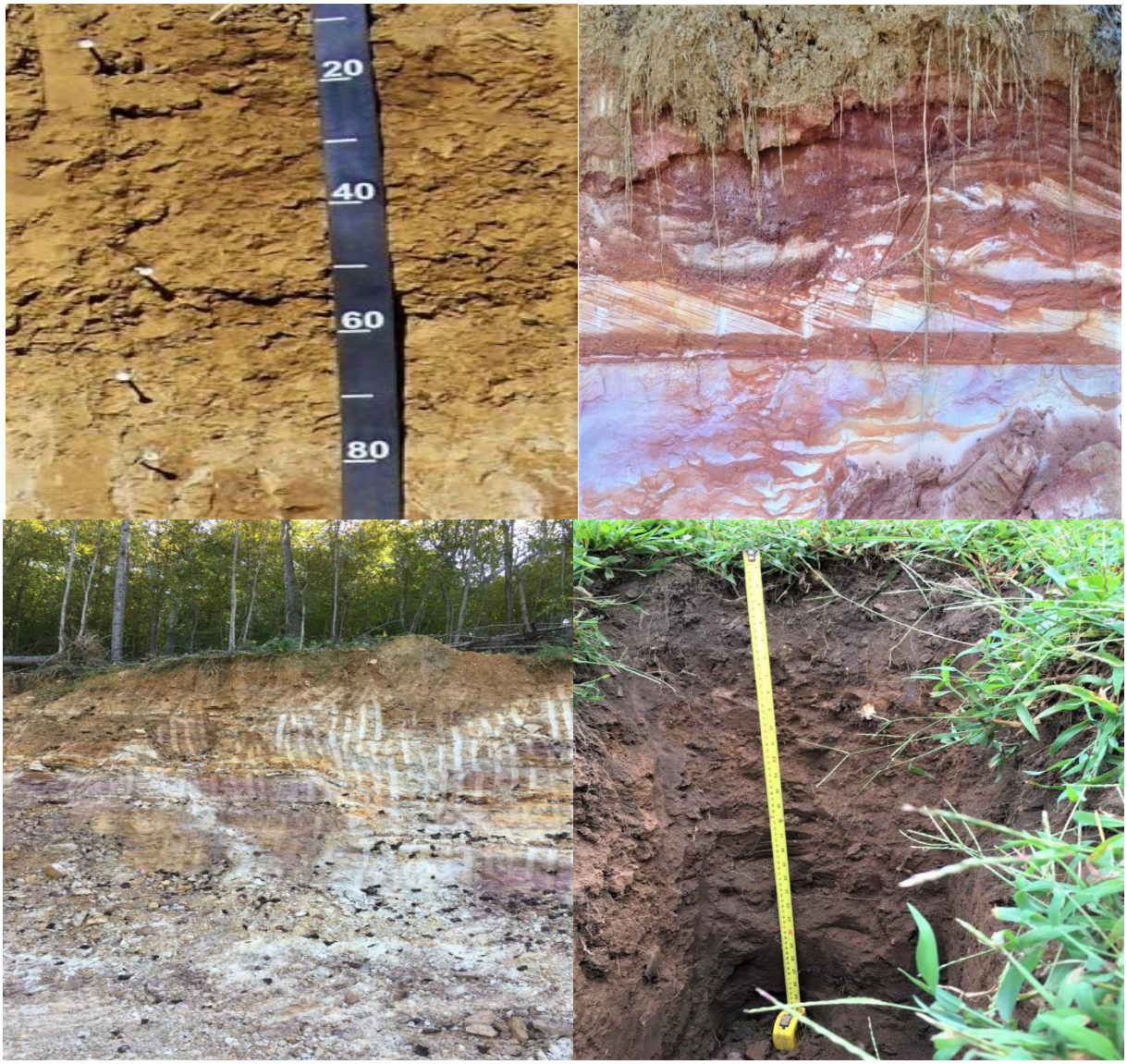
Tennessee Department of Environment and Conservation
Division of Water Resources
Land Based Systems Unit
Soils Handbook of Tennessee



July 15, 2018

Soils Handbook of Tennessee
Effective Date: July 15, 2018
Document No.
DWR-SSD-G-01-Soil Handbook - 071518

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Jennifer Dodd
Director, Division of Water Resources

Brad Harris, Reviewer

Paul Brawley, Drafter/Preparer

Allen Rather, Drafter/Preparer

Terry Henry, Drafter/ Preparer

Billy Roach, Drafter/Preparer

Revision No.	Date	Brief Summary of Change
1	7/15/2018	Update 1989 Soils Handbook

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Division of Water Resources
Soils Handbook

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PREFACE

Tennessee Code Annotated, 68-221-401 mandates that subsurface sewage disposal systems be located, constructed and maintained in a manner that:

1) Do not contaminate any drinking water supply;
2) Are not accessible to rodents, insects or other potential carriers of disease;
3) Do not pollute or contaminate surface or groundwater;
4) Are not a health hazard by being accessible to the general public;
5) Do not cause a nuisance due to odor or unsightly appearance; and
6) Will not violate any other laws or regulations governing water pollution or sewage disposal.

It is the Tennessee Department of Environment and Conservation's Division of Water Resources responsibility to ensure the mandates of this statute are met. In order to accomplish the mandates of the statute, the Division of Water Resources has developed the Regulations to Govern Subsurface Sewage Disposal Systems. These regulations address all aspects of subsurface sewage disposal systems.

Of the factors that influence the performance of a subsurface sewage disposal system, soil suitability is arguably the most critical. The regulations contain soil suitability requirements for subdivision approval and issuance of subsurface sewage disposal system permits. Subdivision approval and subsequent permit issuance, as allowed by the regulations, has evolved from being solely based on percolation tests to being largely based on results of soil maps and interpretations. This evolution has resulted in the ever-increasing role of soils consultants in the day-to-day function of the Division's activities.

Rule 0400-48-01-.18 of the Regulations establishes the process by which an individual can achieve the status of approved soils consultant. And Rule 0400-48-01-.03 (3) allow for the work of private soils consultants to be utilized by the Division for subdivision approval and permit issuance.

This "Soil Handbook" has been prepared as a document that provides instruction and clarification to both new and approved soils consultants in order that they may provide consistent, accurate, and reliable information to be used by Division staff. The base of the Soils Handbook is founded on statute and regulation and as a result, variation of the product produced by private soils consultants should be minimal. This handbook provides a baseline of standard practices for soil maps and interpretations for the Division's purpose. Rule 0400-48-01-.18 (1) (h) states soil maps shall be made to comply with criteria set forth by the most current edition of the "Soils Handbook of Tennessee" prepared by the Division of Water Resources.

The role of the Division with respect to applicants for permits or subdivision evaluations is to ensure that, prior to approval; an appropriate amount of suitable soil has been identified for the purpose of supporting onsite disposal of sewage for each subdivision lot created or for each permit issued. The role of soils consultants with respect to the Division's objectives is to provide an evaluation of the site with respect to its suitability for subsurface sewage disposal systems, and accurately present this evaluation in a format that can be successfully interpreted and applied by Division personnel. When accurate soil maps are applied correctly by Division staff and installations conform to the Regulations to Govern Subsurface Sewage Disposal Systems and the site specific permit for construction, suitable long-term system performance can be expected.

However, when Division staff inadvertently use an inaccurate soil map in support of permit preparation, the consequences may be significant. The system, even if constructed correctly, may not function and the soil intended for repair purposes may not provide an adequate area to replace the system.

Since soil maps and interpretations prepared by soils consultants are ultimately used in support of permit issuance for subsurface sewage disposal systems and permits for these systems pave the way for home construction, it follows that the accuracy of these maps is a critical factor in the economic security of the owner of the property. In other words, the consequences of an inaccurate soil map are far-reaching and expensive. A house with a failing septic system is of little value unless the system can be adequately repaired. In the event there is inadequate suitable soil to facilitate a conventional repair to the system, the only repair option may be an alternative or experimental type of system. If these are not legitimate options, the owner may be left with a system that will never adequately support the home. The value of homes with chronic septic system failures for which there is no long-term repair is significantly depreciated from the value of the same homes with functioning systems.

The success of the Division's program is largely dependent on the accuracy of soil maps and their proper application by Division staff. The intent of this handbook is to provide a document to be used as a guideline through which accurate soil maps and interpretations are generated and the information on the maps is consistently and uniformly presented. Accurate maps that present necessary information in a consistent manner will prepare a solid foundation that, when accompanied with proper application, will ensure homeowners a functional long-term means of onsite sewage disposal.

GLOSSARY

The glossary contains definitions of common terminology used in the discussion of soil science matters as specifically related to the field of subsurface sewage disposal. Not all of the terms listed in the glossary are utilized in this document. Below are sources from which definitions were taken, whole or part, and identified by a code (ex. EPA, NRCS) following the definitions.

EPA = Environmental Protection Agency
NRCS = Natural Resource Conservation Service
NCSS = National Cooperative Soil Survey
SSM = Soil Survey Manual (NRCS)
TDEC = Tennessee Department of Environment and Conservation, Division of Water Resources

Aggregate - a unit of soil structure formed by natural processes as opposed to artificial processes and generally <10mm in diameter.

Alluvial – consists of unconsolidated, sorted, clastic sediment deposited by running water, particularly channel flow or on actively flooded portions of streams (NRCS SSM)

Argillic horizon – normally a subsurface horizon with a significantly higher percentage of phyllosilicate clay than the overlying soil material. It shows evidence of clay illuviation. The argillic horizon forms below the soil surface, but it may be exposed at the surface by erosion. (NRCS)

Association, soil - a group of soils geographically associated with a characteristic repeating pattern, usually defined and delineated as a single map unit. (NRCS)

Bedrock - the solid rock that underlies the soil and other unconsolidated material or that is exposed at the ground surface. Examples of bedrock include shale, limestone, sandstone, dolomite and granite.

Berm, diversion - a ridge of earth, generally a terrace (similar to an agricultural terrace), built to protect downslope areas by diverting surface runoff from its natural course, is sometimes referred to as a diversion drain, compare to vee ditch. (TDEC)

Bottom land - the normal flood plain of a stream, subject to flooding. (TDEC)

Brittleness (Manner of Failure) – the rate of change and the physical condition soil attains when subjected to compression. Soils are moist or wetter. Ruptures abruptly ("pops" or shatters). Categories of manner of failure are brittleness, fluidity, and smeariness. (NRCS Field Book for Describing and Sampling Soils & Soil Survey Manual) (See also fragic properties & fragipan)

Chroma - the relative purity, strength or saturation of a color, it indicates the degree of saturation of neutral gray by the spectral color. (See - Munsell color system, hue, value and chroma) (NRCS SSM)

Clay - as a soil separate, the mineral soil particles less than 0.002 mm in diameter. As a soil texture class, soil material that is 40% or more clay, less than 45% sand and less than 40% silt. (NRCS)

Claypan - a dense, compact layer in the subsoil having a much higher clay content than the overlying material, from which it is separated by a sharply defined boundary; formed by downward movement of particles or may have been formed in alluvial materials. (NRCS)

Closed depression – An enclosed area that has no surface drainage outlet and from which water escapes only by evaporation or subsurface drainage; an area of lower ground indicated on a topographic map by a hachured contour line forming a closed loop (NRCS NCSS) compare to open depression

Coarse fragments - if rounded, mineral or rock particles 2mm to 25cm (10 in) in diameter; if flat, mineral or rock particles (flagstones) 2mm to 38.1cm (6-15 in) long.

Colluvium – poorly sorted slope sediments that have been transported and accumulated along or at the base of slopes, in depressions, or along small streams primarily due to gravity, soil creep, and slope wash processes (NRCS SSM)

Commissioner – the Commissioner of Environment and Conservation, the commissioner's duly authorized representative, and in the event of the commissioner's absence or a vacancy in the Office of Commissioner, the Deputy Commissioner. (TDEC)

Concretions - are cemented bodies of various shapes that can be removed from the soil intact and do not slake in water. Nodules differ from concretions in that concretions possess a crude internal symmetry organized around a point, a line, or a plane. Nodules by contrast, lack evident internal organization. (NRCS SSM)

Consultant – a soils consultant approved by the Department and licensed by the Department of Commerce & Insurance to do soil mapping for on-site sewage disposal systems planninginthe StateofTennessee.

Complex, soil - a map unit of two or more soil series arranged in a complex, intricate pattern or being so small in area that it is not practical to map the individual units separately at the selected scale of mapping.

Concretions - grains, pellets or nodules of various sizes, shapes and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate, manganese or iron oxides are common compounds in concretions.

Consistency - the resistance of a material to deformation or rupture. (ii) The degree of cohesion or adhesion of the soil mass.
Terms used for describing consistency at various soil moisture contents are:

- wet soil - non-sticky, slightly sticky, sticky, non-plastic, slightly plastic, plastic and very plastic.
- moist soil - loose, very friable, friable, firm, very firm and extremely firm.
- dry soil - loose, soft, slightly hard, hard, very hard and extremely hard.
- cementation - weakly cemented, strongly cemented and indurated.

Control section - the part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 and 40 inches.

Cut areas – scraped areas where 4 inches or more of the surface soil has been removed, compare to Graded Land (TDEC)

Cut bank - consists of banks created by the mechanical removal of soil material from the area to expose the soil horizons, must be at least 12 inches in depth on slopes >30% and at least 18 inches in depth on slopes <30%. Also the slope of the cutbank must be >30%. (TDEC)

Cut line - the manual and/or mechanical (typically by hand labor) clearing of the vegetation along the lines of a soil mapping grid. The vegetation is cut down to allow for a clear line of sight along the entire length of all gridlines. (TDEC)

Delineation - a line on a soil map representing changes in soil, slope of land, etc. (TDEC)

Department – Tennessee Department of Environment and Conservation

Dissimilar soil or miscellaneous area components are those that differ enough from the named components to affect major interpretations. The differences for management are large. (See similar soils)

Division – Division of Water Resources

Division Soil Consultant – an approved soil consultant shall be one who meets all of the requirements per Rule 0400-48-01-.18 of the regulations to govern subsurface sewage disposal systems. Refers to Division of Water Resource (DWR) staff who has met these requirements (actual DWR job titles may vary from soil consultant).

Division Staff – staff employed by the Division of Water Resources in subsurface sewage disposal systems

Drain, diversion - See berm, diversion.

Drain, curtain – can be entirely a drawdown drain or a combination of an interceptor drain and drawdown drain. They are constructed to completely encircle the area to be protected. (TDEC)

Drain, drawdown - a subsurface drain designed to lower a water table or saturated zone in the vicinity of the septic field (TDEC).

Drain, interceptor – a subsurface drain constructed to intercept groundwater moving down slope within the soil profile prior to its entrance into the soil area intended for disposal purposes. May wholly or partially encircle the disposal field area. (TDEC)

Drain, subsurface - a drainage system that is designed to shield the designated septic field line area by intercepting subsurface water before it enters the field line area. (Note - subsurface drains include drawdown drains, and interceptor drains) (TDEC)

Drainage, surface - runoff or surface flow of water, from an area.

Drain (as used on soil maps) – (TDEC)

- A **"one-dot"** drain starts and ends where the actual accumulation or collection of water is concentrated in an area (channel) that can easily be identified. This type of drain usually has a maximum depth of 1 foot (12 inches). These drains may or may not have the potential to flood. The standard setback is 25 feet unless the soil consultant recommends a larger or smaller distance. Fifteen feet is the minimum setback to be recommended by a soil consultant.

- A **"two-dot" drain** starts and ends where the actual accumulation or collection of water is concentrated in an area (channel) that is usually more than 1 foot (12 inches) deep. This drain is more visible or defined than the one dot drain. These drains may or may not have the potential to flood the surrounding area. The standard setback is 25 feet unless the soil consultant recommends a larger or smaller distance. Fifteen feet is the minimum setback to be recommended by a soil consultant.

- A **"double-line"** drain is usually big enough to be referred to as a creek, stream or river. These drains may flood the surrounding area and some may flood often. The minimum setback is usually 25 feet along drains of this size. The width of these drains may vary, but most are a minimum of 10 feet wide.

Embankment - a landscape feature, created by natural or man-made erosional influences, which result in an abrupt-cliff-like formation. Embankments can rise positively (upward) or fall negatively (downward) from the horizontal level.

Escarpment - a steep-faced bank or bluff rising abruptly from the land surface.

Fill – areas with less than 24 inches of fill material added to the original soil surface. When less than 24 inches of fill is present over the unit of soil, the word "Fill" and the 6-inch fill increment should be listed after the percent slope. Type of fill material should be explained for that unit of soil. (TDEC)

Filled land – areas to which more than two feet of soil and/or debris have been added (TDEC)

First bottom - the normal flood plain of a stream, subject to flooding.

Flood--An overflow of water onto lands that are used or usable by man and not normally covered by water. Floods have two essential characteristics: The inundation of land is temporary; and the land is adjacent to and inundated by overflow from a river, stream, lake, or ocean. (USGS)

Foot slope - the inclined, generally concave, surface at the base of a hill.

Fragic properties – Fragic properties are the essential properties of a fragipan. They have neither the layer thickness nor volume requirements for the fragipan. Aggregates with fragic properties have a firm or firmer rupture resistance class and a brittle manner of failure when soil water is at or near field capacity. They show evidence of pedogenesis, including one or more of the following: oriented clay within the matrix or on faces of peds, redoximorphic features within the matrix or on faces of peds, strong or moderate soil structure, and coatings of albic materials or uncoated silt and sand grains on faces of peds or in seams. Peds with these properties are considered to have fragic properties regardless of whether or not the density and brittleness are pedogenic. (See soil taxonomy for a more complete definition. (NRCS Soil Taxonomy)

Fragipan is an altered subsurface horizon, 15 cm or thicker, that restricts the entry of water and roots into the soil matrix. It may, but does not necessarily, underlie an argillic, cambic, albic, or spodic horizon. It is commonly within an argillic horizon, but some are within an albic horizon. The fragipan has strongly developed fragic properties (see fragic properties). Commonly, it has relatively low content of organic matter and a high bulk density relative to the horizons above it. It has a hard or harder rupture-resistance class when dry. When moist, it has a brittle manner of failure in 60 percent or more of the volume. Also refer to soil taxonomy for a more complete definition. (NRCS Soil Taxonomy)

Fragmental - 90% or more of the soil mass (by volume) rock fragments coarser than 2 mm, and 10% or less fine earth (clay, loam, sand) to fill interstices larger than 1 mm. (See Soil Taxonomy for specific particle size terms) (Also see Skeletal)

Graded land – areas from which soil has been removed and the remaining soil cannot be classified in any soil series, compare to cut areas (TDEC)

Grid staking - the system developed to provide proper ground control (i.e. field located reference points marked with wood stakes) for soil mapping. The name being derived from the manner in which the field stakes are arranged in a grid pattern spaced at intervals. (TDEC)

Grid-box centers (GBC) - the actual center point of a grid box. (TDEC)

Groundwater (geological) - in the broad sense, all water below the ground surface; Specifically, that part of the subsurface water which is in the zone of saturation (a subsurface zone in which all the interstices are filled with water under pressure greater than that of the atmosphere).

Groundwater (soil science) - the portion of the total precipitation that at any particular time is either passing through or standing in the soil and the underlying strata and is free to move under the influence of gravity.

Gullied land – areas where gullies occupy nearly all of the surface area. Areas in which gullies occur within spatial intervals of less than one hundred feet shall be classified as a soil gullied land complex. Gullies of more than one hundred feet spatial intervals shall be located on the soil maps with the designated symbols. (TDEC)

Horizon, soil - a layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. Soil horizons are a part of a soil profile. (NRCS SSM)

Hue - One of the three variables of color. It is a measure of the chromatic composition of light that reaches the eye. (See - Munsell color system, hue, value and chroma) (NRCS SSM)

Hydric soils – soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part. (NRCS SSM) (Also refer to Field Indicators of Hydric Soils NRCS for most recent and complete guide for identifying and delineating hydric soils)

Hydrophytic plants - plants that grow in and are adapted to an aquatic or very wet environment.

Individual lot – lots that are not a part of a subdivision as defined in the Regulations to Govern Subsurface Sewage Disposal Systems (TDEC)

Karst – topography with sinkholes, caves, and underground drainage that is formed in limestone, gypsum, or other rocks by dissolution (general definition)

Licensed Professional Soil Scientist (LPSS) - means an individual who has met the educational and experience requirements of T.C.A. 62-18-208(a) (1) and has met the requirements of T.C.A. 0780-05-06-.04 and obtained a License from the Department of Commerce & Insurance.

Lot – a part of a subdivision or a parcel of land intended for the building of a single house, building or other development where a subsurface sewage disposal systems is to be used. (TDEC)

Manner of Failure – the manner in which specimens fail under increasing pressure. (NRCS SSM)

Mottling, soil – refers to repetitive color changes that cannot be associated with compositional properties of the soil (NRCS SSM) (See – redoximorphic features)

Munsell® color system – used for describing soil color (using the elements of hue, value, chroma). An example is 10YR 5/3 (NRCS SSM).

Nodule – are cemented bodies of various shapes that can be removed from the soil intact and do not slake in water. Nodules differ from concretions in that concretions possess a crude internal symmetry organized around a point, a line, or a plane. Nodules by contrast, lack evident internal organization. (NRCS SSM)

Official Soil Series Descriptions – records definitions and descriptive information with specific information about individual soil series (NRCS)

Open depression – any enclosed or low area that has a surface drainage outlet whereby surface water can leave the enclosure; an area of lower ground indicated on a topographic map by contour lines forming an incomplete loop or basin indicating at least one surface exit. Compare – closed depression. (NRCS NCSS)

Open throat/open sink hole – see sinkhole throat

Pan - a compact, dense layer in a soil that impedes the movement of water and the growth of roots.

Parent material - the unconsolidated organic and mineral material in which soil forms. (NRCS SSM)

Percolation, soil water – describes the process by which fluid moves through the soil profile, also refers to the ability of soil to absorb water. (TDEC) (Also see Sections 2.2.4 and 2.2.5)

Percolation test – a method of determining the usability of an area for SSDS disposal by testing for the rate at which the undisturbed soil in a series of test holes of standard size will absorb water per unit of surface area. (Also see Sections 2.2.4 and 2.2.5).

Permeability - the quality of soil that enables it to transmit water or air. Permeability is measured as the number of inches per hour that water moves through saturated soil. (TDEC)

Phase, soil - a subdivision of a series based on features that effect its use and management. For example, slope, stoniness and thickness. (NRCS & TDEC)

Ponding – standing water in a depression that is removed only by percolation, evaporation, and/or transpiration.

Profile, soil - a soil profile is a two-dimensional vertical cut through a soil. The profile has soil horizons within the profile. (NRCS SSM)

Redoximorphic features – features formed by the processes of reduction, translocation, and/or oxidation of Fe and Mn oxides; formerly called mottles and low-chroma colors. (NRCS Field Indicators of Hydric Soils) (below taken from Redoximorphic Features for Identifying Aquic Conditions Technical Bulletin 301 North Carolina State University Agricultural Research Service August 2015)

1. Redoximorphic concentrations – nodules and concretions, masses, pore linings
2. Redoximorphic depletions – bodies of low chroma (<2) having values of 4 or more where Fe-Mn oxides alone have been stripped out or where both Fe-Mn oxides and clay have been stripped out
3. Reduced matrices – soil matrices that have a low chroma color in situ because of Fe (II), but whose color changes in hue or chroma when exposed to air as the Fe (II) is oxidized to Fe (III). The change in color occurs within 30 minutes or less after the sample is exposed to air.
4. Depleted matrices – a depleted matrix refers to the volume of a soil horizon or subhorizon in which the processes of reduction and translocation have removed or transformed iron, creating colors of low chroma and high value. A, E, and calcic horizons may have low chromas and high values and be mistaken for a depleted matrix.

Regolith - a general term for the entire layer or mantle of fragmented and loose, incoherent or unconsolidated rock material, of whatever origin (residual or transported) and of every character that nearly everywhere forms the surface of the land and overlies or covers the more coherent bedrock.

Regulations – The Regulations to Govern Subsurface Sewage Disposal Systems (TDEC)

Residuum- a term used if the properties of the soil indicate that it has been derived from rock, similar to that which underlies it and if there is no overt evidence that it has been modified by movement. (NRCS SSM)

Restrictive horizon - a horizon in the soil (bedrock or fragipan) that impedes or stops the downward movement of liquids through the soil.

Rock, shallow – any occurrence of rock at a depth that prohibits installation of a SSDS or that compromises the buffer (distance between disposal media and rock) required by statute/regulation. (TDEC)

Rockiness - refers to the relative proportion of bedrock exposure, either rock outcrop or patches of soil too thin over bedrock for use in a soil area. Rocky is used for soils having "fixed" rock (bedrock) and "stony" for soils having loose detached fragments of rock. (TDEC)

1. map units with 0.1 to <2% rock outcrop are named Rocky, i.e. Talbott Rocky or Talbott Stony
2. map units with 2 to 10% rock outcrop are named Very Rocky i.e. Talbott Very Rocky or Talbott Very Stony
3. map units with >10% or more of rock outcrop are normally named complexes or associations of soil and rock outcrop. These units are not used for SSDS. i.e. Talbott Rock Outcrop

Sand – as a soil separate, individual rock or mineral fragments from 0.05 mm to 2.0 mm in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85% or more sand and not more than 10% clay. (NRCS)

Series, soil – a group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness and arrangement. (NRCS) (Also see Official Soil Series Description)

Silt – as soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 mm) to the lower limit of very fine sand (0.05 mm). As a soil textural class, soil that is 80 % or more silt and less than 12 % clay. (NRCS)

Similar soil or miscellaneous area components are those that differ so little from the named components that their soil interpretation for most uses is very similar. The differences for management are small. (See dissimilar soils)

Sinkhole – a cavity in the ground, especially in limestone bedrock, caused by water erosion and providing a route for surface water to disappear underground. (General definition)

Sinkhole karst – A landscape dominated by subsurface drainage and sinkholes that range widely in sizes and density; the most common type of karst in upland areas of temperate regions (e.g., Highland Rim of TN, northern FL, southwestern MO, etc.) (NRCS NCSS)

Sinkhole throat – an opening within a closed depression that allows for the passage of water from the surface to the subsurface. (TDEC)

Skeletal-35% or more but less than 90%, (by volume) rock fragments coarser than 2 mm, with enough fine earth (clay, loam or sand) to fill interstices larger than 1 mm. (see Soil Taxonomy for specific particle size terms) (Also see Fragmental)

Soil – a natural, three-dimensional body at the earth's surface capable of supporting plants. It has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil absorption rate – the rate, in minutes per inch (mpi), that clean water is absorbed by or drains through a soil during least favorable climatic conditions when soil are at or near field capacity. Estimated absorption rates are established in Appendix I of the Regulations to Govern Subsurface Sewage Systems for soil series and phases of soil series that have been recognized in Tennessee. For soil series and phases that have been recognized but not listed in Appendix I, the Department shall establish the absorption rate. Estimated soil absorption rates for variants of soil series and miscellaneous land types may be proposed by an approved soil consultant; however, those rates will be evaluated by the Department.

Soil classification – classification includes soil taxonomy, but it also includes the grouping of soils according to limitations that affect specific practical purposes, such as the soil limitations affecting SSDS (NRCS)

Soil collapse (soil pipe) – a feature (roughly circular) formed when soil collapses into an underlying void. Typical in karst areas where water table fluctuations involving the soil/bedrock interface mine soil from the base of the soil profile. When the void becomes too large to support the overburden of soil, the ground surface will collapse into the void.

Soil delineation line – a delineation line on a soil map separating map units with similar soils from dissimilar soils. (TDEC)

Soil drainage classes – (NRCS)

- Excessively drained – water is removed rapidly, the soils are commonly coarse textured
- Somewhat excessively drained – water is removed from the soil rapidly, the soils are commonly coarse textured
- Well drained – water is removed from the soil readily but not rapidly, the soils are mainly free of, or are deep or very deep to, redoximorphic features related to wetness
- Moderately well drained – water is removed from the soil somewhat slowly during some periods of the year
- Somewhat poorly drained – water is removed slowly that the soil is wet at a shallow depth for significant periods during the growing season
- Poorly drained – water is removed so slowly that the soil is wet at shallow depths periodically during the growing season or remains wet for long periods
- Very poorly drained – water is removed from the soil so slowly that free water remains at or very near the surface during much of the growing season

Soil Grade, Size and Type/Shape Abbreviations (see also soil texture abbreviations) (NRCS Field Book for Describing and Sampling Soils) (see also Appendix E)

Grade		Size		Type/Shape	
Structureless =	0	Very Fine =	vf	Granular =	gr
Weak =	1	Fine =	f	Angular blocky =	abk
Moderate =	2	Medium =	m	Subangular blocky =	sbk
Strong =	3	Coarse =	co	Platy=	pl
		Very coarse=	vc	Prismatic =	pr
		Extra coarse =	ec	Columnar =	cpr
				Structureless (single grain) =	sg
				Structureless (massive) =	m

Soil hydrology – the science dealing with the distribution and movement of the soil solution in the soil profile.

Soil map – a record on a map showing soil series, drains and other pertinent information for the use of SSDS evaluations. (TDEC) (See sections 2.2.1, 2.2.2, 2.2.3 for general, high and extra-high intensity soil maps and 3.1.2 for individual lot soil map)

Soil map notes – a format used that organizes soil information on a soil map in a fashion that makes the necessary information easy to find and use (TDEC).

Soil observation – each individual auger boring or pit utilized, typically at the grid stakes and grid-box center, by the Soil Scientist to see and identify the soil characteristics at one location. (TDEC)

Soil phase – terms added to map unit component names to convey important information about a map unit. Common phases are slope, surface texture, flooding, ponding, surface fragments, degree of erosion, i.e., filled, graded. (NRCS SSM)

Soil pit – used for soil mapping purposes, can be hand or mechanically excavated, is generally expected to be large enough for the evaluator(s) (soil scientist and/or TDEC staff) to enter and observe a representative soil profile that is to be evaluated for SSDS. The soil pit should be dug to 36 inches or to a restrictive layer. (Waste stabilization lagoons and filled land or steep slope special investigations are examples where soil pits should be greater in depth) (TDEC)

Soil profile – description of a soil profile including soil properties that is used for information for SSDS evaluations. Typically these are soil pits with a large enough area excavated to expose a representative soil profile of the surrounding area(s). (TDEC)

SSDS – Subsurface Sewage Disposal System; in this document this term will include all septic systems. (TDEC)

SSD – Subsurface Drip Dispersal System (TDEC)

Soil shape – (NRCS SSM) (see also Appendix E)

1. Platy – the units are flat and platelike, they are generally oriented horizontally.
2. Prismatic – the individual units are bounded by flat to rounded vertical faces. Units are distinctly longer vertically, and the faces are typically casts or molds of adjoining units.

Vertices are angular or subrounded; the tops of the prisms are somewhat indistinct and normally flat.
3. Columnar – the units are similar to prisms and bounded by flat or slightly rounded vertical faces. The tops of columns, in contrast to those of prisms, are very distinct and normally rounded.
4. Blocky – the units are blocklike or polyhedral. They are bounded by flat or slightly rounded surfaces that are casts of the faces of surrounding peds. Typically, blocky structural units are nearly equidimensional but grade to prisms and plates.
5. Granular- the units are approximately spherical or polyhedral. They are bounded by curved or very irregular faces that are not casts of adjoining peds.
6. Structureless- either single grain or massive

Soil size – six soil size classes are very fine, fine, medium, coarse, very coarse, and extremely coarse (see also Appendix E) (NRCS SSM)

Soil structure – refers to units composed of primary particles. The soil mass under stress tends to rupture along predetermined planes or zones. These planes or zones form the boundary of the structural units. (NRCS SSM) (See also Appendix E)

Soil structure grades – (NRCS SSM) a grouping or classification of soil structure on the basis of inter- and intra-aggregate adhesion, cohesion, or stability. Four grades of structure are recognized as follows: (see also Appendix E)

1. Massive, if coherent; single-grain, if noncoherent.

2. Weak –the units are barely observable in place. When they are gently disturbed, the disturbed soil material parts into a mixture of whole and broken units.

3. Moderate –well-formed and evident in undisturbed soil. When disturbed, the soil material parts into a mixture of mostly whole units, some broken units, and material that is not in units.

4. Strong – the units are distinct in undisturbed soil. They separate cleanly when the soil is disturbed. When removed, the soil material separates mainly into whole units. Peds have distinctive surface properties.

Soil taxonomy – a basic system of soil classification for making and interpreting soil surveys. *Agricultural Document No. 436. Soil Conservation Service, US Department of Agriculture.*

Soil texture – the relative proportions of the vario**us** soils separates in a soil as described by the classes of soil texture NRCS SSM). The following are soil texture abbreviations (NRCS Field Book for Describing and Sampling Soils); see also Soil Grade, Size and Type/Shape abbreviations. (See also Appendix E)

Soil Texture abbreviations -

- Coarse sand = cos
- Sand = s
- Fine sand = fs
- Very fine sand = vfs

- Loamy coarse sand = lcos
- Loamy sand = ls
- Loamy fine sand = lfs
- Loamy very fine sand = lvfs
- Coarse sandy loam = cosl
- Sandy loam = sl
- Fine sandy loam = fsl
- Very fine sandy loam = vfsl
- Loam = l
- Silt loam = sil
- Silt = si
- Sandy clay loam = scl
- Clay loam = cl
- Silty clay loam = sicl
- Sandy clay = sc
- Silty clay = sic
- Clay = c

Subsoil – technically, the B horizon; roughly part of the solum below plow depth.

Surface layer – The soil ordinarily moved in tillage or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 cm), frequently designated as the plow layer or the AP horizon.

Surface runoff – water that travels over the soil surface to the nearest surface stream.

Symbols – all special features (natural and cultural) that influence the performance of a subsurface sewage disposal system that are shown on a soil map (TDEC)

System – the term commonly used for any type of subsurface sewage disposal (i.e., septic) system, conventional or alternative.

Taxadjuncts – are polypedons that have properties outside the range in characteristics of any recognized series and are outside higher category class limits by one or more differentiating characteristics of the series. A taxadjunct is given the name of an established series that is most similar in characteristics. These components classify differently taxonomically but have the same interpretations for use and management as the named series. Because the differences in properties between the named series and its taxadjunct are small and do not affect major interpretations, a new series is not established. Ex. Soil texture varies but is not significant to the use or management or predicted behavior of that soil, color chip variation on Munsell Color system, depth to a fragipan where depth is outside the range of characteristics for that soil but is <40 inches (NRCS SSM & TDEC)

Terrace (geological) – an old alluvial plain (no longer the active floodplain or first bottom) ordinarily flat or undulating, bordering a stream, lake or the sea.

Terrace – (agricultural) a raised, generally horizontal strip of earth constructed along a hill on or nearly on a contour to make land suitable for tillage and to prevent accelerated erosion.

Undisturbed soil – a soil that has no cutting, compaction, filling or other disturbance that has changed the soil profile (TDEC)

Vee ditch – a broad trench, similar to an agricultural grassed waterway, with a V-shaped cross-section. The V-ditch is constructed to collect and channel surface water. (TDEC)

Value, color – the relative lightness or intensity of color and approximately a function of the square root of the total amount of light. One of the three variables of color. (See – Munsell color system, hue, chroma and value) (NRCS)

Variant, soil – a soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified. Soil variants will generally require a different and/or specific interpretation for subsurface sewage disposal use. Use of soil variants will require additional data, soil profile description, with soil color, redoximorphic features, soil texture, soil structure, clay films, or any other soil characteristics important to the classification of that soil. The use of soil variants may delay the evaluation of a site, because an on-site evaluation by a division soil consultant may be required. (TDEC)

Water problem – (Percolation testing) (see Section 2.2.4 & 2.2.5) (Referenced in Regulations Rule 0400-48-01-.03 (b)).

Soils that have morphological, physical, or landscape related attributes concerning saturated hydraulic conductivity, water table, flooding, surface drainage, subsurface drainage, shrink-swell or landscape position that render soils unsuitable for percolation testing.

Examples include:

1. Redoximorphic features –depletions, concentrations, etc.,
2. Drainage classes of moderately well, somewhat poorly, poorly, very poorly
3. Aquic moisture regimes, fragipan soils, modifiers of aquic, glossic, fragic or vertic
4. Areas subject to flooding
5. Areas that occupy the bottoms of sinkholes
6. Areas in a water receiving (discharge) position from (surface and/or groundwater)

Water table – the upper surface of the zone of saturation or that level in the ground where the water is at atmospheric pressure. The level below which the soil or rock is saturated with water. (TDEC)

Water table, perched – the water table of a saturated layer of soil, which is separated from an underlying saturated layer by a restrictive horizon/aquitard. (TDEC)

Wetland – are areas where water covers the soil, or is present either at or near the surface of the soil all year or for varying periods of time during the year, including during the growing season. Water saturation (hydrology) largely determines how the soil develops and the types of plant and animal communities living in and on the soil. Wetlands may support both aquatic and terrestrial species. The prolonged presence of water creates conditions that favor the growth of specially adapted plants (hydrophytes) and promote the development of characteristic wetland (hydric) soils. (EPA)

Tennessee Department of Environment and Conservation
Division of Water Resources
Soils Handbook of Tennessee

1.0 Soil Consultant Approval

Rule 0400-48-01-.18 of the Tennessee Department of Environment and Conservation (Department), Division of Water Resources (Division) (DWR) Regulations to Govern Subsurface Sewage Disposal Systems (Regulations), identifies the requirements for approved soil consultants in the State of Tennessee.

Professional Soil Scientists Licensed through the Department of Commerce and Insurance and approved by the DWR are entitled to submit soil maps, soil evaluations, and site investigations in support of the statutory and regulatory objectives of the Division. Licensed Professional Soil Scientists are also among those whose percolation test results are acceptable.

1.1 Education Requirements for Soil Consultant Approval

Graduation from an accredited college or university with a bachelor's degree in soil science, agronomy, and/or agriculture with emphasis in plant and soil science or agronomy; or, graduation from an accredited college or university with a minimum of thirty (30) quarter hours biological, physical and earth sciences and an additional twenty-two and one-half (22.5) quarter hours or equivalent semester hours in soil science is required.

Experience shall not be substituted in lieu of educational requirements.

1.2 Experience Requirements for Soil Consultant Approval

A minimum of two (2) years full time or equivalent of soil evaluation experience in accordance with the United States Department of Agriculture system is required. Experience must include studies of soil physical characteristics, geology and soil relationships, soil-landscape relationships, soil identification; landscape features, mapping techniques, interpretive ranges, sewage systems, and soil improvement design variations.

The experience shall be full time or equivalent experience totaling four hundred ninety four (494) days. There shall be no more than one (1) day credit gained in any one (1) calendar day. One day shall consist of seven and one-half (7.5) hours. A calendar day shall be a 24-hour period that begins at 12:01 A.M. and expires at 12:00 P.M. on that day. One year's experience shall be considered as 1850 hours, and two

years' experience shall be 3700 hours. Experience gained during or before educational requirements are met will be considered on a case-by-case basis, not to exceed one-fourth of the total experience requirement.

The experience shall be documented through a notarized affidavit by a soil consultant approved by the Division or by a NRCS soil scientist who is GS-11 grade or higher, In the notarized affidavit, the soil consultant who provided the training shall attest to the fact that the candidate for approval was trained under the guidelines established by the Soils Handbook of Tennessee. However, completion of a training plan based on the Soils Handbook may not be required for NRCS soil scientists who were trained by the NRCS under the supervision of a soil scientist in grade level GS-11 or higher, employed by the NRCS. An affidavit, along with documentation of type of training, signed by the NRCS soil scientist who supervised the soil consultant candidate shall be submitted for consideration.

1.3 Soil Consultant Testing Procedure

The testing procedure for soil consultants consists of three (3) phases that shall be administered in sequence, beginning with Phase 1. Phase 1 is the written examination; Phase 2 is the field soil-mapping test; and Phase 3 is the satisfactory completion of five (5) high intensity soil maps.

Prior to beginning Phase 1 of the testing procedure, the soil consultant candidate must provide appropriate documentation attesting to education and experience achievements to the Division (academic transcripts, affidavits, payroll records…). This information is to be submitted to the Division of Water Resources Land Based Systems Unit.

1.3.1 Phase 1 – Written Exam

Phase 1 of the testing procedure is a written exam from the Division. This test is in addition to the required Commerce and Insurance licensing requirements to practice soil science in Tennessee. All candidates to become approved soil consultants must pass the written examination. This exam is to demonstrate that the candidate has adequate knowledge of the Regulations and the Soils Handbook as they apply to soil mapping and soil map interpretations. A test score of eighty (80) percent is required. The Division's Central Office will provide notification of test scores to the soil consultant.

1.3.2 Phase 2 – Field-Mapping Test (also used for Section 5.0)

Phase 2 of the testing procedure is a field-mapping test. The candidate must pass a field soil-mapping test to demonstrate mastery in soil classification, soil mapping, and soil map interpretations as they apply to subsurface sewage disposal. In addition, Phase 2 shall demonstrate that the candidate has adequate cartographic skills. A score of eighty (80) % or more is

required. Upon the successful completion of the field mapping test the candidate receives interim soil consultant approval to complete high intensity soil maps.

The field-mapping test shall be compared to an approved Division of Water Resources high intensity soil map completed by an approved Soil Consultant. The following criteria as outlined in Table 1.1 shall determine the score of Phase 2 of the testing procedure:

A. Soil Classification

A1. Accordance with Soil Taxonomy and Official Soil Series Descriptions

Soil shall be classified according to the Soil Taxonomy, the Official Soil Series Description (OSD), and the Regulations. However, where a soil is misclassified but that error does not affect the use and management of that soil or the design of a subsurface sewage disposal system (SSDS), that error is not critical; and, typically, no points shall be deducted from the test score.

Where a soil is misclassified and that error affects the use and management of that soil or the design of a SSDS, that error is critical and up to twenty-five (25) points shall be deducted from the test score.

A2. Soil Absorption Rate in Concordance with Appendix I

The soil absorption rates for soil series shall be those listed in Appendix I of the Regulations except for those conditions that require less favorable rates based on Additional Site Requirements and Limitations for Subdivision Approval and Individual Lots and Issuance of Construction Permit (Rule 0400-48-01-.04 in the Regulations) and Section 2.11 of The Soils Handbook.

Where a soil series is rated more favorable than the absorption rate established in Appendix I of the Regulations, up to twenty-five (25) points shall be deducted from the test score

A3. Appropriate Depth Associated with Absorption Rate

Where soil absorption rates for soil series or phases of soil series are given to depths greater than the soil conditions warrant, up to twenty-five (25) points shall be deducted from the test score.

A4. >75 MPI Soils Identified Correctly

If the rate designated by the approved soil consultant is >75 MPI, no lesser rate will be considered accurate; also, if the soil consultant candidate designates a soil to be >75 MPI and the Division soil consultant rates the soil as 75 MPI or <75 MPI, the soil consultant candidate's designated rate will be considered inaccurate. Rating inaccuracies of the above-mentioned type will receive up to a twenty-five (25) point deduction.

A5. Appropriate Designation of Soil Improvement Practices

The need for soil improvement practices is determined on the site by an approved soil consultant. Where soil improvement practices are needed but not identified on a soil map, up to twenty-five (25) points shall be deducted from the test score. Where soil improvement practices are identified as requirements on the soil map but are not necessary, up to twenty-five (25) points shall be deducted from the test score.

B. Soil Map Unit Line Placement

Soil lines between similar soils (soils with similar physical and chemical characteristics) that have the same use and management requirements, the same expected performance and the same estimated absorption rates need not be separated on the soil map. Line placement between these soils is not critical.

Soil line placement between dissimilar soils is critical. Dissimilar soils are soils that have one or more soil characteristics that are different from the adjacent soils. The difference in soil characteristics requires different use and management, or under the same management different results are nearly certain. Some examples are soils that have different soil absorption rates, different physical or chemical soil characteristics, and different depths to restrictive horizon, and soils that require different management practices.

Soil lines between dissimilar soils that are misplaced by twenty (20) feet or more are significant and each occurrence shall reduce the test score by up to twenty-five (25) points.

Soil lines that have been misplaced between dissimilar soils by more than ten (10) feet but less than twenty (20) feet shall result in a reduction of up to fifteen (15) points for each occurrence on the soil map.

Soil lines that have been misplaced by ten (10) feet or less shall result in no deductions from the score.

C. Significant Features

C1. All Identified

Where cut banks, drains, drainage ways, gullies, streams, sinkholes, wells or other significant natural or constructed features are omitted, up to twenty-five (25) points shall be deducted for each occurrence on the soil map. Features identified outside the mapped area, which affect the use of the mapped area, should also be located.

C2. Correctly Located

Where one or more of these natural or constructed landscape features is misplaced by more than ten (10) feet, up to twenty-five (25) points shall be deducted for each occurrence on each soil map.

Where one or more of these natural or constructed landscape features is misplaced by less than ten (10) feet, no deduction shall be made from the score.

D. Soil Notes

D1. Formatting and Legibility

Accurate soil notes that are specific, complete and legible are crucial to the use of a soil map. The format presented in Section 3.5 is required on the soil map.

Where the soil notes are inaccurate, incomplete, illegible, or not in the proper format, up to twenty-five (25) points shall be deducted from the test score.

D2. Statement Omission

The statement “Any cutting, filling or compaction will void this soil map.” and the statement that names the kind of soil map completed, the soil consultant who completed that soil map, and the date of completion is required. Where any of the required statements is omitted or is incomplete, up to twenty-five (25) points shall be deducted from the test score.

The following statements should also appear on the map:

> “This soil map is to evaluate the site for a subsurface sewage disposal system only. This soil map complies with the standards established

in the Regulations to Govern Subsurface Sewage Disposal Systems, the Soils Handbook, and the Soil Taxonomy. No other warranties are made or implied."

"Signature of Soil Consultant does not constitute approval of this map by the Division of Water Resources."

D3. Inappropriate Statements

Where inappropriate statements, especially statements that specify the design or installation of a SSDS, specify how the soil map may or may not be used, leaves any doubt about the accuracy of the soil map, or serves as a disclaimer to the accuracy of the map, are used, 25 points shall be deducted from the test score.

D4. Legend and Symbols

Both conventional and ad-hoc symbols that appear on a soil map shall be defined in a map symbol legend printed on the front of each soil map. Where one or more of these symbols is omitted or is inaccurately shown in the legend, up to twenty-five (25) points shall be deducted from the test score. Appendix A provides an index of acceptable map symbols.

TABLE 1.1
FIELD MAPPING SCORING PROCEDURE

Primary Map Category	Primary Map Subcategory	Point Value
A. Soil Classification	A1. Accordance with Soil Taxonomy and Official Soil Series Descriptions	25
	A2. Absorption Rate in Accordance with Appendix I	
	A3. Appropriate Depth Associated with Absorption Rate	
	A4. >75 MPI Soils Identified Correctly	
	A5. Appropriate Designation of Soil Improvement Practices	
B. Soil Map Unit Line Placement		25
C. Significant Features	C1. All Identified	25
	C2. Correctly Located	
D. Soil Notes	D1. Formatting and Legibility	25
	D2. Statement Omission	
	D3. Inappropriate Statements	
	D4. Legend and Symbols	
Total Points		100

The field mapping test score shall be determined using the method outlined in Table 1.1 by a Division Soil Consultant. A failing map score for the field-mapping test will be confirmed by a consensus of Division Soil Consultants.

The maximum number of points is one hundred (100), which is a perfect score. Each error or omission will result in a deduction of all or a portion of the points assigned to that category. A score of eighty (80) % is considered satisfactory.

The portion of points deducted from the total points for a category will be determined by the severity of the error. Minor errors or omissions shall be errors or omissions that: would not change whether a site was permitted or not; and, would not be expected to cause system failure due to under sizing. These types of errors or omissions (individually) would not typically result in a total loss of points for that category. However, multiple minor errors or omissions in a category may result in the loss of all points associated with a category. Minor errors or omissions are not limited to the above-listed examples. Major errors or omissions that would typically result in a total loss of points for that category, and result in a failing score for the map, would be those errors or omissions that: caused a system to be undersized to the degree that failure would be expected; caused a system to permitted in unsuitable soil; presented a suitable soil as unsuitable; did not adequately identify soil improvement practices; and, misuse of variant label. Major errors or omissions are not limited to the above-listed examples.

After the field-mapping test has been successfully completed, the candidate for approval shall become a tentatively approved soil consultant, approved to complete high intensity soil maps only. The Division's Central Office will provide notification of tentatively approved status to the soil consultant.

1.3.3 Phase 3 – Five High-Intensity Soil Maps

Phase 3 of the testing procedure consists of successfully completing the first five (5) high intensity soil maps. The tentatively approved soil consultant shall submit the first five high intensity soil maps for evaluation to the Division of Water Resources Land Based Systems Unit.

Each of the first five (5) high intensity soil maps shall be evaluated using the same criteria and values used for the soil mapping field test. A score of eighty (80) percent is required on each of the maps. Each of the first five soil maps shall be submitted to the Division as soon as it is completed. Each of the five (5) high intensity soil maps shall be made to comply with the criteria set forth in the most current edition of the Soils Handbook, the Regulations, and the Soil Taxonomy. All five of the maps will be reviewed by Division of Water Resources Land Based Systems Unit.

After successful completion of all phases of the approval process the tentatively approved soil consultant becomes a soil consultant approved to make general and high intensity soil maps. Notification of approved status will be made to the Division's Central Office by the

Division Soil Consultant The Division's Central Office will provide notification of approved status to the soil consultant. In addition, before a soils consultant is included on the approved list and before any of the soils consultant's maps are used in support of subdivision approval or permit issuance the soils consultant must comply with T.C.A. 0780-05-06-.04 Licensing.

1.4 Results of Failing Examination

The Regulations in Rule 0400-48-01-.18 (1)(f) state: "If the candidate fails the written examination, the field test or any of the first five (5) soil maps, the testing procedure may begin again after a six (6) month period. The second time, if the candidate fails the written test, the field mapping test or any of the first five (5) high intensity soil maps, the testing procedure may begin after a twelve (12) month waiting period. The testing procedure may be repeated only one time."

1.5 Extra High Intensity Soil Maps

Extra high intensity soil maps are accepted by the Division by those approved soil consultants who have demonstrated that they have the knowledge and skills to complete these soil maps.

The Regulations state under Rule 0400-48-01-.18 (1)(g) "After a period of one (1) year and the completion of a minimum of twenty-five (25) high intensity soil maps with a total of one hundred (100) acres, an approved soil consultant who has not been reprimanded or suspended may apply to become approved to make all intensity soil maps." This application should be made to the Division Central Office Land Based Systems Unit.

The one (1) year period shall consist of three hundred sixty-five (365) consecutive days. The one (1) year period shall begin on the date after the candidate officially became an approved soil consultant.

The twenty-five (25) high intensity soil maps shall be soil maps of any size that have been completed without errors or omissions (but that total at least 100 acres). The five (5) high intensity soil maps completed, as part of the soil consultant's testing procedure, shall be excluded.

After the twenty-five (25) high intensity soil maps have been completed, the candidate shall be required to participate in a training workshop for completing extra high intensity soil maps.

After completion of the above-listed requirements, the candidate shall receive tentative approval to complete all intensity soil maps.

Each of the first five (5) extra high intensity soil maps shall be submitted to the Division Soil Consultant for evaluation.

The five extra high intensity soil maps shall be evaluated by the appropriate Division Soil Consultant. The criteria to evaluate the high intensity soil maps shall be used; keeping in

mind the increased degree of accuracy associated with extra-high intensity maps as defined by the Rule 0400-48-01-.02

After the first five (5) extra high intensity soil maps have been evaluated and accepted by the Division, that candidate shall be approved to make all intensity soil maps. The Division's Central Office will provide notification of approved status to the soil consultant.

2.0 Soil Classification – Soil Mapping and Soil Interpretations

Soil mapping consists of: (1) accurately classifying the soil or miscellaneous land type, (2) accurately delineating the boundaries of the soil or miscellaneous land type on a suitable base map, and (3) accurately predicting the performance of each kind of soil for subsurface sewage disposal purposes. High intensity and extra-high intensity mapping efforts must encompass the entire subdivision, the entire lot, or at least 20,000 square feet per lot.

2.1 Units Of Soil Classification

Soils are classified as soil series, phases of soil series, and taxadjuncts to soil series or variants of soil series.

Soil series is the lowest category in the Soil Taxonomy. Each soil series has a set of physical and chemical characteristics specific to that soil series, and those characteristics set that series apart from all other soil series. Each soil series named must be within the range of soil characteristics that have been established for that soil series.

Phases of soil series may be established to more accurately predict the behavior of that soil under a specified use and management. (Examples are slope classes, depths to rock, fragipan, etc.)

Variants of soil series are used to identify soils for which there are no established soil series, and for established soil series that have not been recognized by the National Cooperative Soil Survey (NCSS) in Tennessee. Variants have not been recognized by the NCSS since 1988. In this Soils Handbook, the definition of a variant differs slightly from the definition used by the NCSS.

A soil variant is a soil that has one or more characteristics preventing that soil from being classified in any soil series recognized by the NCSS in Tennessee. Some examples that justify the use of a variant are: depth to rock where the depth to rock is outside the range in characteristics for the named series; depth to a fragipan where the depth is more than 40 inches; or difference in soil texture that would change the classification of the named series, and the use, management and interpretations of that soil.

Soil variants are rare. The use of a soil variant requires documentation that contains, but is not limited to, a soil profile description that describes the soil color (as compared to the Munsell soil color chart), including mottles; soil texture; soil structure; clay films; redoximorphic features, or any other soil characteristic important to the classification of that

soil. The use of a soil variant may delay the evaluation of that site, because an on-site evaluation by a Division Soil Consultant may be required.

Soil taxadjuncts to a soil series consist of soils that have one or more soil characteristics that prevents that soil from being classified in any recognized soil series, but does not change the use and management or predicted behavior of that soil. One example of soil taxadjuncts is some soil colors that vary one or two color chips on the Munsell system from the range allowed for the named soil. Other examples are a soil that varies in soil texture enough to change the classification but are not significant to the use and management or predicted behavior of that soil (e.g. fine loamy versus fine silty), or depth to a fragipan where the depth is outside the range of characteristics for that soil series but is less than 40 inches.

Miscellaneous land types consist of areas of non-soil, and areas of soil that lack diagnostic horizons necessary to classify that soil. Non-soil miscellaneous land types consist of, but are not limited to, consolidated rock, water bodies, paved areas, etc. Miscellaneous land types of soil also consist of gullied land, graded land, filled land, etc. that can be classified only in higher categories in the Soil Taxonomy.

2.2 Kinds of Soil Maps and Requirements

2.2.1 General Soil Maps

A general soil map is a Second Order survey as defined in the Soil Survey Manual, United States Department of Agriculture, October 1993. These surveys are made for intensive land use that requires detailed information. Field procedures permit plotting of soil boundaries by observations and interpretation of other available data. Boundaries are verified at closely spaced intervals and the soils in each delineation are identified by transecting or traversing. Map units shall be named at a categorical level above the series, miscellaneous areas, or interpretive groups of soils such as those in which percolation tests are allowed or not allowed. Map scale shall be one (1) inch equals one hundred (100) feet. The minimum size delineation shall be two thousand five hundred (2500) square feet.

This kind of soil map is necessary to meet the requirements of T.C.A. 68-221-403(c)(7) effective July 1, 1990. The only purpose of these soil maps is to determine whether the soils on a site meet the requirements to be evaluated for subsurface sewage disposal systems by utilizing percolation tests.

Regulation Rule 0400-48-01-.03 (b) sets forth conditions under which percolation tests may be conducted. Criteria to use for evaluating soils or sites for suitability for percolation shall be depth to rock, slope and wetness or water problems. Soils shall not qualify for percolation tests if they meet one or more of the following:

1. Soils that are classified in The Soil Taxonomy great group that have fragipan properties.
2. Soils that are classified in The Soil Taxonomy subgroups that have the modifier aquic, glossic, fragic, or vertic in the name.

3. Soils that have insufficient depth to rock. (Karst <36 inches, Non-karst <30 inches)
4. Slopes of more than 30 percent shall be considered unsuitable unless determined to be suitable following a special investigation by an approved soil consultant and Division Staff. Slopes exceeding 50 percent shall be considered unsuitable.
5. Soils with drainage classes of moderately well, somewhat poorly, poorly, very poorly drained that have at least 10% by volume redoximorphic depletions in any soil horizon within 30 inches of the soil surface.
6. Areas subject to flooding and do not have a surface drainage outlet
7. Areas that occupy bottoms of sinkholes
8. Areas shall not be in a water receiving position when the inflow of water (both surface and/or subsurface) is to such an extent that it will be detrimental to the performance of a SSDS.

The requirements of general soil maps were established by a memorandum issued by the Division of Water Resources on July 18, 1990 in response to Tennessee Code Annotated 68-221-403. This memorandum specified the mapping legend that is to be used. General soil maps shall be completed according to the following specifications:

1. A closed legend shall be used. Only the mapping units and symbols in the established legend are allowed. Any other mapping units must have prior approval from the Division's Central Office.
2. All requirements applicable to base maps for high intensity soil maps apply.
3. All requirements relative to map finishing and completion for a high intensity soil map shall apply except as noted in the above mentioned memo.
4. There shall be no color coding
5. No soil names (series, types, phases or miscellaneous land types) shall be on the map or in the legend.
6. There shall be no soil notes on the map or attached to the map. Only the legend with a definitive name for the mapping symbol shall be on the map. This can be a copy of the established legend, but preferably is a legend with only the applicable mapping units for that particular map.
7. No recommendations relative to soil improvement practices shall be made.
8. All features such as roads, wells, streams, sinks, springs, rock outcrops, escarpments, gullies, buildings and other features shall be accurately located on the general soil map.
9. All areas with limestone bedrock at or near the surface shall be considered karst.

MAPPING LEGEND FOR GENERAL SOIL MAPS

SYMBOL	NAME
KP	Karst, percable, well drained, 36 inches or more to hard rock, 0 to 30 percent slopes
KP_R	Karst, percable, well drained, 24 to 36 inches to hard rock, 0 to 30 percent slopes
P	Non-karst, percable, well drained, 30 inches or more to hard rock, 0 to 30 percent slopes
P_R	Non-karst, percable, well drained, 24 to 30 inches to hard rock, 0-30 percent slopes
NP_S	Karst and non-karst, non-percable, more than 50 percent slopes
NP_W	Karst and non-karst, non-percable, water problem (wetness), 0 to 30 percent slopes
NP_{R1}	Karst and non-karst, non-percable, due to less than 24 inches to hard rock, 0 to 30 percent slopes
SI_S	Karst and non-karst, 30 to 50 percent slopes, requires special investigation.

If a mapping unit has more than one limitation, then more than one subscript (S- slope, W- water problem, R – depth to rock) should be used. For example, if NP has limitations of wetness and insufficient depth to rock, then both should be noted $NP_{W,R1}$.

2.2.2 High Intensity Soil Maps

A high intensity soil map is a First Order survey as defined in the Soil Survey Manual, United States Department of Agriculture, March 2017. These surveys are made for very intensive land use that requires very detailed soils information that requires very precise knowledge of soils and their variability such as individual building sites. Field procedures require observation of soil boundaries throughout their length. Map units are mostly soil series, phases of soil series with some complexes and miscellaneous land areas. Some map units named at a categorical level above the series are allowed. Map scale shall be one (1) inch equals one hundred (100) feet with a minimum size delineation of six hundred and twenty-five (625) square feet.

High intensity soil maps may be on a 100-foot master grid system with surveyed control stakes numbered at not more than 500-foot intervals with the location of same shown on the plat. The intermediate grid stakes may be set by rough chaining or other methods to a lesser degree of accuracy; however, intermediate stakes shall be within two (2) feet of the distance shown.

The ratio of precision of the unadjusted survey shall be a minimum of 1:1000. The plat shall show: (1) the seal and signature of the surveyor and (2) a bar scale. Excessive vegetative growth such as weeds, vines, briars or other growth shall be

removed to provide access to the area to be soil mapped. Wooded areas shall have adequately cut and flagged lines to identify the lot lines.

High intensity soil maps may also be based on a staked lot method. Staked lots must have a numbered surveyed stake at each corner. The ratio of precision of the unadjusted survey shall be a minimum of 1:1000. The plat shall show the seal and signature of the surveyor and a bar scale. Intermediate ground control stakes shall be numbered and set in areas where lot corners are not visible from any point on the lot. The intermediate stakes must be set no more than 200 feet apart, and rough chaining or other methods may set said intermediate stakes to a lesser degree of accuracy; however, said stakes shall be within two (2) feet of the distance shown on the plat. The removal of vegetative growth such as weeds, vines and briars to permit access to all parts of the property may be required. In wooded areas, cut/flagged lines shall be in place at the time the soil mapping is done.

2.2.3 Extra High Intensity Soil Maps

An extra-high intensity soil map shall be the same as a high intensity map except the map scale may be one (1) inch equals one hundred (100) feet or one (1) inch equals fifty (50) feet. In addition, the minimum size delineation shall be one hundred (100) square feet. These maps show more taxonomic detail and more cartographic detail than high intensity soil maps. A base map with grid points at 50-foot intervals is required on most sites. However, in some cases (disturbed, fill…) a base map with grid points at 25-foot intervals may be required.

These soil maps are made to provide very detailed soil information that is required to make land use decisions on small areas where soils and landscapes are variable and complicated. They may be most useful to provide soils information about soils that occur in very complicated patterns on very complex landscapes. An extra-high intensity soil map is required for all alternative methods for sewage disposal.

Prior to General, High or Extra High Intensity soil mapping the area must have:

1. All lot corners marked and numbered (visible at time of mapping) when mapping is done on lot layouts or area(s) grid staked
2. A numbered line stake shall be visible from any point on a particular lot.
3. On plats corner staked, long lines over 300’ in length are to be staked on 200’ intervals along the line
4. Heavy vegetation removed if it interferes with soil mapping, cleared areas to be mowed shall be maintained until soil map is completed
5. Wooded lines cleared for line of sight on lot lines and shall be maintained until soil map is completed.

2.2.4 Percolation Tests

Rule 0400-48-01-.03(b) states - Under authority of T.C.A. 69-221-403(c), after a general or high intensity soil evaluation (See Sections 2.2.1 and 2.2.2) has been conducted by an approved soil consultant and the soils are found to have the following characteristics, then a percolation test may be conducted pursuant to Rule 0400-48-01-.05.

(i) There shall be a minimum depth of twenty-four (24) inches of undisturbed soil. (No compaction, cutting, filling, etc.) (Does not refer to percolation test hole depth, - see Section 2.2.5)
(ii) Slopes of more than thirty (30) percent do not qualify for percolation tests unless provisions of subparagraph (4)(d) of Rule 0400-48-01-.04 are met.
(iii) No water problem shall exist. A water problem shall be considered to exist if any of the conditions are present as listed in the "Soils Handbook of Tennessee". (See following).

Regulation Rule 0400-48-01-.03 (b) also sets forth conditions under which percolation tests may be conducted. Criteria to use for evaluating soils or sites for suitability for percolation shall be depth to rock, slope and wetness or water problems (See below). Soils shall not qualify for percolation tests if they meet one or more of the following (Also see Section 2.2.1, General Soil Maps):

1. Soils that are classified in Soil Taxonomy great group that have fragipan properties.
2. Soils that are classified in Soil Taxonomy subgroups that have the modifier Aquic, Glossic, Fragic, or Vertic.
3. Soils that have insufficient depth to rock. (Karst <36 inches, Non-Karst <30 inches).
4. Slopes of more than 30 percent shall be considered unsuitable unless determined to be suitable following a special investigation by an approved soil consultant and Division Staff. Slopes exceeding 50 percent shall be considered unsuitable.
5. Soils with drainage classes of moderately well, somewhat poorly, poorly, very poorly drained that have at least 10% by volume redoximorphic depletion in any soil horizon within 30 inches of the soil surface.
6. Areas subject to flooding and do not have a surface drainage outlet.
7. Areas that occupy bottoms of sinkholes.
8. Areas in a water receiving positions (discharge) when the flow of water (both surface and/or subsurface) such an extent that it will be detrimental to the performance of a SSDS.

Where a percolation test is required to determine the percolation rate for a conventional system, the percolation holes used to determine this rate must be located at the intersection of lines in a grid pattern with maximum perpendicular

distances of fifty (50) feet between the lines of the grid. Each hole shall be considered reasonably representative of a square area of two thousand five hundred (2,500) square feet which includes that hole in the approximate center of the square; or

Where a percolation test is required to determine the percolation rate for an alternative system, the percolation holes used to determine this rate must be located at the intersection lines in a grid pattern with maximum perpendicular distances of twenty-five (25) feet between the lines of the grid. Each hole shall be considered reasonably representative of a square are of six hundred twenty-five (625) square feet, which includes that hole in the approximate center of the square.

Where percolation tests are used to determine the percolation rate at which water moves through the soil, the minimum lot size shall be twenty thousand (20,000) square feet where a public water supply is used or a minimum of twenty-five thousand (25,000) square feet where a private water supply is used. The Department shall be notified at least three (3) days prior to the day that the percolation test will be conducted. Percolation test procedures may be monitored when deemed necessary.

(i) Two (2) copies of the subdivision plat at a scale of one (1) inch equal on hundred (100) feet shall be submitted to the Commissioner. Such plat shall show percolation test holes identified by number and plotted to scale, subdivision boundaries and other pertinent topographic features. All lot and grid lines shall be drawn with appropriated numbers shown on the plat corresponding with survey stakes on the ground.

(ii) Tabulated results of percolation test holes shall be reported on a form provided by the Department.

(iii) The actual average percolation rate shall be determined by averaging only the test results from the area actually to be covered by the permit, which includes both initial and duplicate area. Areas in which percolation test results were unfavorable shall be excluded. The average percolation rate shall be calculated on a weighted basis.

(iv) Percolation test results shall not be conclusive evidence as to the suitability of an area. Such tests shall be considered and analyzed as one of many criteria in determining site suitability.

All percolation tests shall adhere to the requirements of paragraph (1) of Rule 0400-48-01-.11 Location of Septic Tanks, Dosing Chambers and Absorption Fields.

2.2.5 Percolation Test Procedures

Rule 0400-48-01-.05 sets forth the procedures for percolation testing.

1. Types of Test Holes – The holes shall be dug or bored, with horizontal dimensions from six (6) to twelve (12) inches and vertical sides to the depth as appropriate for the type of system to be installed and the house that is to be constructed.
    - All types of SSDS - minimum vertical depth of twenty-six (26) inches in undisturbed soil.
    - Under Tennessee Code Annotated 68-221-403(i) where rock is encountered at a lesser depth, two (2) inches of undisturbed soil shall be left between the bottom of the test hole and rock with a minimum vertical depth of twenty-two (22) inches.
    - Site being evaluated for a modified mound or drip dispersal systems - minimum vertical depth test hole of eighteen (18) inches.
    - Sites where depth of SSDS will be greater than twenty-four (24) inches - the vertical depth of the percolation test holes shall reflect the intended depth of the SSDS.

2. Preparation of Test Holes – Carefully scratch the bottom and sides of the holes with a knife blade or sharp pointed instrument in order to remove any smeared soil surfaces, and to provide a natural soil interface into which water may percolate. Remove all loose material from the holes. Add two (2) inches of coarse sand or fine gravel to protect the bottom from scouring and sediment.
3. Conducting the Test – Carefully fill the holes with clear water to a minimum depth of twelve (12) inches over the gravel. No additives shall be used at any time during the percolation test procedures. In most soils, it is necessary to refill the holes by supplying a surplus reservoir of water, possibly by means of an automatic siphon, to keep water in the holes at least four (4) hours and preferably overnight. The measurement period of the test shall begin twenty-four (24) to thirty (30) hours after initial filling.
4. Percolation Rate Measurement – Percolation rate measurement shall be made on the day following the procedure described under item (3) of the percolation test form and calculations of area required for disposal fields shall be based on Appendix II of Regulations to Govern Subsurface Sewage Disposal Systems.
5. If greater than six (6) inches of water remains in the test holes after the overnight presoaking period, adjust the depth to approximately six (6) inches

over the gravel. From a fixed reference point, measure the drop in water level over a thirty (30) minute period. This drop is used to calculate the percolation data.

6. If six (6) inches or less, of water remains in the holes after the overnight presoaking period, add clear water to bring the depth of water in the holes to approximately six (6) inches over the gravel. From a fixed reference point measure the drop in the water level at approximately thirty (30 minute intervals for four (4) hours, refilling to approximately six (6) inches over the gravel after each reading. The drop that occurs during the final thirty (30) minute period is used to calculate the percolation rate, the drop that occurs during prior periods provides information for possible modification of that procedure to suit local circumstances.
7. Only percolation rates generated as that result of the complete four (4) hour measurement period will be considered valid for plat approval or permit issuance.
8. Test shall be conducted by an engineer or surveyor licensed in the State of Tennessee. An approved soil consultant or a registered professional environmentalist registered in the State of Tennessee may conduct percolation tests if they are not employed by a State, Regional, District, County or Municipal Department of Environment and Conservation.

Although percolation tests are not as reliable as soil mapping, they are necessary in some instances (where soils are rated >75 minutes per inch) and allowed under State statutes in other instances. Therefore it is the person(s), performing the percolation test, responsibility to monitor and follow procedures and that the results are accurate and meaningful. By doing this, the results of the percolation test will help assure the proper design and size of a SSDS or document the necessity to deny a SSDS permit for that lot or tract of land.

2.3 Soil Map Unit Design

Soil map units represent a collection of soils that have similar soil characteristics and similar soil properties. Soils in a soil map unit must have similar and predictable response to a specified use and management. A soil map unit delineation is one specific delineated area on a soil map that represents one specific area of similar soils on the earth's surface.

2.4 Soil Map Unit Names

Soil series and phases of soil series are the most common and useful kind of soil map units used because:

1. They have a strong scientific basis;
2. Many soil characteristics, soil properties, and soil qualities can be expressed with a single name;

3. The physical and chemical properties and performance of similar soils can be extrapolated from laboratory data and the results of on-site experiments from similar soils.
4. The behavior of a soil can be predicted from extrapolations of data collected by observations and measurements taken from similar soils.

Soil map unit names should be determined in consideration of the entire upper 48 inches of the soil profile.

Map units consisting of 0.1 % to 10 % rock outcrop can be named either as “Rocky” or “Very Rocky” phases or as complexes or associations of soil and rock outcrop. Commonly, map units with less than 2 % rock outcrop are named “Rocky” and those with 2 % to 10 % rock outcrop are named “Very Rocky”. Map units consisting of 10 % or more rock outcrop are normally named complexes or associations of soil and rock outcrop. These map units cannot be used for sewage disposal systems.

Where soil variants not previously approved by the Division are proposed, a brief soil profile description (a minimum of matrix color, redox depletions, redox accumulations, texture, structure, consistence and all other important soil characteristics) shall be attached to the soil map. The probable classification of the variant (subgroup and family) shall be provided, along with the soil profile description. Use of variants will necessitate review by a Division Soil Consultant.

The use of soil variants to vary the estimated absorption rate of soil series is not acceptable.

Miscellaneous land types include, but are not limited to, filled land, graded land, gullied land, parking lots, and bogs, low lying areas or marshes.

Filled land consists of areas to which more than 24 inches of soil, rock or debris have been added. Where less than 24 inches (fill) of soil, rock or debris have been added, the buried soil shall be classified and evaluated to a depth of 48 inches from the original surface, or to rock (lithic contact) or any restrictive layer.

Graded land consists of areas that have been graded or otherwise manipulated to the extent that the remaining soil cannot be classified in any soil series. Where grading has been less severe, and diagnostic horizons remain, the remaining soil shall be classified as a graded phase of the appropriate soil series.

Gullied land consists of areas where gullies more than one (1) foot in depth occupy more than fifty (50) percent of the area. Where gullies more than one (1) foot in depth occupy from fifteen (15) percent to fifty (50) percent of an area, that area shall be classified as a complex of the remaining named soil series and gullied land. Boundaries of “Gullied Land” soil map units should not be positioned to encompass the necessary buffer for sewage disposal purposes. The boundary should be positioned at the edge of the feature closest to the edge of the “Gullied Land” soil map unit. Further investigations with an extra high intensity soil map may or may not reveal areas, within these units, of suitable soils for subsurface sewage disposal systems.

Bogs, low lying areas, or marshes are defined as those areas inundated or saturated by surface water or groundwater 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. These areas are low-lying land that is flooded in wet seasons.

2.5 Kinds of Soil Map Units

Single taxon soil map units (consociations) are soil map units in which each soil map unit delineation is comprised of eighty-five (85) percent or more of the named soil. No areas of the fifteen (15) percent inclusions shall exceed the acceptable maximum size for each kind of soil map. However, shallow rock inclusions should represent no more than 10 percent of the soil map unit. Shallow rock inclusions are defined as those areas where depth to rock is shallower than the depth to rock identified on the soil map for that area. These areas, if encountered during construction would affect system construction (less than adequate buffer). Dissimilar soil inclusions shall not exceed 2500 square feet on general soil maps, 625 square feet on high intensity soil maps and 100 square feet on extra high intensity soil maps.

Inclusions of similar soils (soils with the same estimated absorption rates and the same management requirements) need not be mentioned in the soil notes.

Where dissimilar soils occupy more than fifteen (15) percent of a map unit, the entire area shall be classified and delineated as a soil complex. The most limiting soil in a complex shall determine the use and management of that soil map unit. On many landscapes, dissimilar soils occur together in areas larger than the acceptable sizes or occupy more total area than is acceptable for inclusions, but are too small to be used separately. Generally, there is no need to separate these soils on a soil map. On these landscapes, soil complexes may be used to depict these areas on a soil map. The soil interpretations (absorption rates, etc.) of the most limiting soil in the complex shall apply.

2.6 Slope Classes

Slope classes are different for each kind of soil map because of the different amount of detail required for each kind of soil map.

Slope classes for general soil maps are established in the legend. The slope classes are 0 to 30 percent, 30 to 50 percent, and greater than 50 percent.

Where slopes are between 30 and 50 percent a special investigation shall be conducted to evaluate those soils and/or to determine whether the site may be evaluated using percolation tests.

Slope classes for high intensity soil maps shall be adequate to evaluate sites for all conventional subsurface sewage disposal systems and some other systems, and to design such systems.

These slope classes should provide adequate data to design soil and site improvement practices. The slope classes for high intensity soil maps are:

0 to 5 percent
5 to 15 percent
15 to 30 percent
30 to 50 percent
Greater than 50 percent.

Where slope classes of 0 to 3 percent and 3 to 5 percent are useful to design subsurface drains, those classes should be used. On undulating ridgetops where the slopes are complex, a 2-8% slope class may be useful.

Where slopes are extremely complex and are mostly steep or very steep, slope classes of 0 to 30 percent, and greater than 50 percent may be used.

Slope classes for extra high intensity soil maps shall be those slope classes required to design all conventional subsurface sewage disposal systems, all alternative subsurface sewage disposal systems, and experimental systems. The slope classes for extra high intensity soil maps are:

0 to 3 percent
3 to 6 percent
6 to 12 percent
12 to 30 percent
30 to 50 percent
Greater than 50 percent

Slope classes for subsurface drip dispersal extra high intensity soil maps are:

0-9%
10-20%
20-30%
30-40%
40-50%
>50%

Slope classes shall distinguish the main parts of simple hilly landscapes by delineating the ridge (hill) tops, the hillsides (back slopes) and valley floors (toe/foot slopes). Generally, soil differences will separate these main parts of most landscapes.

2.7 Drain and Cutbank Identification

Drainageways have no visible or defined channel and, as a result, it is usually hard to determine the point where surface water starts to accumulate or collect. A drainageway landscape is usually concave or u-shape and does not physically limit the installation of septic system field lines. Surface water spreads out and dissipates across the surrounding

landscape. Due to the lack of a channel, these drains may flood the surrounding area and some may flood often. Potential for flooding is directly associated with the drainageway catchment area and volume and intensity of rainfall. No symbol is proposed for identification of these features on a soil map if the feature(s) meet the above definition. However, soil improvement in the form of a surface berm or interceptor drain with surface berm may be necessary to adequately protect the area from groundwater and surface water interference.

A “one-dot” drain starts and ends where the actual accumulation or collection of water is concentrated in an area (channel) that can easily be identified. This type of drain usually has a maximum depth of 1 foot (12 inches). These drains may or may not have the potential to flood. The standard setback is 25 feet unless the soil consultant recommends a larger or smaller distance. Fifteen feet is the minimum setback to be recommended by a soil consultant.

A “two-dot” drain starts and ends where the actual accumulation or collection of water is concentrated in an area (channel) that is usually more than 1 foot (12 inches) deep. This drain is more visible or defined than the one dot drain. These drains may or may not have the potential to flood the surrounding area. The standard setback is 25 feet unless the soil consultant recommends a larger or smaller distance. Fifteen feet is the minimum setback to be recommended by a soil consultant.

A “double-line” drain is usually big enough to be referred to as a creek, stream or river. These drains may flood the surrounding area and some may flood often. The minimum setback is usually 25 feet along drains of this size. The width of these drains may vary, but most are a minimum of 10 feet wide.

Cutbank consist of banks, commonly but not exclusively, along sides of roads, borrow areas, mines, pits, construction excavation areas, and basements created by the mechanical removal of soil material from the area to expose the soil horizons or rock.

To be considered a cutbank the bank must be at least 12 inches in depth on slopes greater than 30 percent and at least 18 inches in depth on slopes less than 30 percent. In addition, the slope of the cutbank must be greater than 30 percent.

2.8 Depth to Rock Classes

Statute 68-221-403 (f) requires 12 inches of undisturbed soil between trench bottom and top of bedrock in the areas of karst geology. However, the department may specify a lesser distance in a non-karst area. The Division’s technical manual Letter of Explanation regarding this statute subsection identifies the minimum depth in non-karst areas as being an average of 6 inches. Given standard construction practices of 12 inches of gravel media and 12 inches of cover, 36“ inches would be the minimum depth of soil over rock for permitting purposes in karst areas, and 30 inches in non-karst areas.

Karst area(s) is defined as "a type of topography that is formed over limestone, dolomite, or gypsum by dissolving or solution, and that is characterized by closed depressions or sinkholes, caves, and underground drainage" by the Glossary of Geology.

Statute 68-221-403 (i) allows for modifications to several standard construction practices allowing for depths of soil shallower than 36 inches (karst) or 30 inches (non-karst) to be permitted.

When evaluating an area of soil for sewage disposal purposes it is critical that depth to rock be observed closely as this depth determines whether an area can be used and how it can be used. In fact, units of similar soil should be further divided if there are areas within the unit of soil that have limiting depths to rock.

Subsection "i" allows the most flexibility for permitting shallow soils; however, utilizing depths between and including 24 inches and 30 inches has consequences with respect to additional area required for permitting purposes and additional expense associated with system construction.

The following depths to rock classes are recommended for mapping purposes (high intensity).

36 inches or greater -	allows for standard system construction without respect to karst or non-karst
31 inches or greater -	allows for systems to be permitted in karst areas under Subsection "i" without the addition of field line footage and/or compatible fill material
30 inches or greater -	allows for standard system construction in non-karst areas
24 inches to 30 inches -	allows for systems to be permitted under Subsection "i" with the addition of field line footage and/or compatible fill material

These same depths to rock classes, with the addition of a 20 inch depth to rock class, also apply to extra-high intensity soil maps. Areas of suitable soil with only 20 inches to rock may be considered for a modified mound permit and subsurface drip dispersal systems.

2.9 Soil Drainage Classes

The following are general guidelines to be used in determining soil drainage classes. Some soils are classified as well and/or moderately well drained; these soils should be examined closely to determine the drainage class that is most appropriate for that site. Any soil that is near a depth to the next drainage class should also be examined closely. These are general guidelines and depths given do not consider all the information a soil scientist will observe on a specific site.

Excessively drained soils are those soils that exhibit a rapid loss of water, either by percolation or by surface flow. The occurrence of free water is very rare or very deep (>60 inches). These soils are unsuitable for use if their absorption rate is less than 10 minutes per inch.

Well-drained soils have no redoximorphic features within the upper 40 inches of the soil profile and do not typically require the application of soil improvement practices for sewage disposal purposes. However, well-drained soils may need protection if they are bordered by less well-drained soils.

Moderately well drained soils have no redoximorphic features within the upper 16 inches of the soil surface and have few redoximorphic features within the 16-20 inch depth from the soil surface. These soils require soil improvement practices with few exceptions.

Somewhat poorly drained and poorly drained soils have redoximorphic features shallower than 16 inches (10 to <20 inches), and dominant redoximorphic features within the 16 inch to 20 inch depth from the soil surface. These soils are unfavorable for sewage disposal purposes due to high water levels that may occur for significant periods.

Some soils that are poorly or somewhat poorly drained are rated favorably in Appendix I. This rating is based on textural consideration only. Based on drainage class (<10 inches to redoximorphic features) these soils are considered unsuitable. Footnote “4” of Appendix I suggests that these soils may be suitable if artificially drained. Permitting these soils for use with drainage will only be considered following review by a Division Soil Consultant.

2.10 Soil Absorption Rates

Soil absorption rates are the rate that clean (potable) water can be absorbed into a soil or percolate through a soil during the period of time when conditions are least favorable. Least favorable rates generally are during the winter and spring seasons, while soils are near and above field capacity.

Soil absorption rates have been established for many soil series and some phases of soil series that have been recognized in Tennessee. The established soil absorption rates in minutes per inch (MPI) are listed by soil series and phases of some soil series in Appendix I of the Regulations to Govern Subsurface Sewage Disposal Systems. The estimated absorption rate for a soil series or a phase that has been recognized in Tennessee but has not been listed in Appendix I shall be established by the Division.

The estimated soil absorption rates listed in Appendix I or those established by the Division shall be the estimated soil absorption rate for those soils on both high intensity and extra high intensity soil maps, and for all kinds of subsurface sewage disposal systems. These rates are considered “optimum” rates. However, if a higher (slower) rate is more appropriate

for a given unit of soil based on site-specific conditions (eroded phases, variable depth to restrictive layer…) the higher rate should be assigned to the unit. For example: the Mountview soils in Appendix I have an assigned rate of 45 minutes per inch. However, these soils increase in clay with depth. The typical pedon (TP) in the official series description (OSD) describes the soil as having brittle properties in 30 to 40 percent of the soil mass between depths of 25 and 28 inches. Between depths of 28 and 33 inches, 30 to 50 percent of the soil mass is described as brittle. Below a depth of 33 inches, the soil is described as gravelly clay. Furthermore, the Mountview soils are classified in an Oxyaquic subgroup and are described as being well drained or moderately well drained.

Therefore, in places, the Mountview soils could be rated 60 or maybe 75 mpi between depths of 0 to 30 inches or 0 to 24 inches, respectively, as the site conditions dictate. Below a depth of 30 inches, a greater than 75 mpi rating may be appropriate. Some sites may require subsurface drains. Guidelines presented in Section 2.11 should be considered when site-specific conditions necessitate assigning a higher rate than what is in Appendix I.

Typically, the lowest (fastest) soil absorption rate assigned to a soil unit will be associated with a specific depth within the upper 48 inches of the soil profile. If the depth associated with the lowest rate is less than 48 inches, a higher (slower) soil absorption rate may be associated with interim depths. In the above-mentioned example of Mountview soil, a rate of 60 MPI was assigned to a depth of 30 inches. The lower horizon in the soil profile to a depth of 48 inches shall also be assigned a rate in the soil notes as appropriate (i.e., 60 MPI to 30 inches, and >75 MPI from 31 inches to >48 inches).

The shallowest depth for which a rate should be applied to a given soil unit is 24 inches except for those soils that are to be considered for a modified Wisconsin mound system or subsurface drip dispersal. A modified mound or subsurface drip dispersal may utilize soils as shallow as 20 inches. Alternative systems require an extra-high intensity soil map.

Some soils that are poorly or somewhat poorly drained are rated favorably in Appendix I. This rating is based on textural consideration only. Based on drainage class these soils are considered unsuitable. Footnote “4” of Appendix I suggests that these soils may be suitable if artificially drained. Permitting these soils for use with drainage will only be considered following review by a Division Soil Consultant

Where soil complexes or other multitaxa soil map units of two or more soils are used, the interpretations shall be for the most limiting soil in that soil map unit. Soil consultants have the authority to raise the estimated absorption rate for the lower subsoil layers in some soils in which there is evidence of groundwater interference, fragipan, clay, rock or other soil conditions likely to interfere with the installation or performance of a subsurface sewage disposal system. Soil consultants do have the responsibility and authority to recommend and require soil improvement practices where necessary to accomplish some soil absorption rates.

The authority to vary from the established soil absorption rates is Rule 0400-48-01-.04 (5) Additional Site Requirements and Limitations for Subdivision Approval and Individual Lots and Issuance of Construction Permit in the Regulations to Govern Subsurface Sewage

Disposal Systems. This authority requires that soil consultants recognize the need for drains and to require the appropriate kind and depth of installation of the subsurface drains. This authority does not allow soil consultants to establish absorption rates more favorable than the rates assigned in Appendix I of these Regulations.

Soil consultants shall use the following guidelines to establish soil absorption rates for soil variants and for miscellaneous land types.

2.11 Estimated Absorption Rates for Soil Variants and Miscellaneous Land Types

Soil variants are soils that cannot be classified in any recognized soil series by the NCSS in Tennessee, but generally are so limited in extent that establishing new soil series is not practical. Soil consultants have the authority and the responsibility to determine the estimated soil absorption rates for soil variants. However, a Division Soil Consultant will confirm these rates.

Some miscellaneous land types (for example gullied land and rock land) have been declared by regulation to be excluded from consideration for subsurface sewage disposal systems. Other miscellaneous land types may be considered for subsurface sewage disposal systems after they have been properly evaluated and demonstrated to have favorable properties for subsurface sewage disposal.

Filled land as defined in this Soils Handbook and the Regulations require a special investigation, which in part requires an extra high intensity soil map that is further defined in Section 4.5 of the Soil Handbook.

Graded land, as defined in this Soils Handbook, means areas from which the soil has been removed and the remaining soil cannot be classified in any soil series. That area may be evaluated with percolation tests if all the requirements to evaluate a site with percolation tests have been met per Rule 0400-48-01-.03 (b)

2.12 Factors That Affect Soil Absorption Rates

Extrinsic Factors and Site/Soil Properties

Extrinsic factors and site/soil properties that affect the development and performance of a soil are slope, configuration of the landscape and position on the landscape. The slope affects the rate of runoff and infiltration rates for that soil. It affects the rate that soil and water are lost from the higher places, and the rate that soil (particles, material, or deposits) and water accumulate on other places. Slope, along with intrinsic soil properties, determines the rate and direction that water moves in the soil.

Intrinsic Factors

Intrinsic soil properties that affects the soil absorption rates are; size, shape, and distribution of macro pores. The soil texture, structure and consistence determine the size, shape, number and distribution of the pores in a soil.

Soil Color

Soil color is an important soil characteristic and is extremely useful in determining many soil qualities including drainage and permeability. The Munsell soil color system is used for describing soil color (using the elements of hue, value, and chroma, Example 10YR 5/4).

Uniformly red or brown soil colors in the upper thirty inches or more indicate that a soil is well drained. Reduced soils have chromas that are all or dominantly 2 or less. Uniformly gray, black, or white soils or dominantly gray, black, or white soils because of wetness are poorly drained. These soils are wet (saturated or nearly saturated) for several days to several weeks in duration, several times each wet season.

In between uniformly red or brown soil colors and gray soil colors are soils that are mostly red or brown but have gray mottles (redox depletions) with or without concretions, nodules, or soft black accumulations (redox accumulations) are intermediate in drainage. They have been described as moderately well drained or somewhat poorly drained.

Soil Texture

Soil texture is the relative proportion of sand, silt and clay in a soil. It affects the quantity, size, shape and continuity of all pores. Generally, the total pore quantity is greatest in the clayey soils, but the quantity of macro pores is greatest in coarser textured soils.

Soil Structure

Soil structure is the aggregation of individual soil particles in an orderly fashion. It determines the quantity of macro pores and the permeability of many soils. However, the soil permeability determines the type, grade and size of structural aggregates in many soils, especially those in medium and fine textural classes.

Soil Consistence

Soil consistence is the resistance of a soil mass of peds or clods to deformation. Generally, the loose consistence has the most macro pores and is most permeable; the friable and very friable consistence classes have moderate permeability. The macro pores and permeability decrease as the firm quality increases.

2.12.1 General Rating Guideline

The following descriptions are general in scope and applicability. They are intended to reflect the characteristics that are "typical" to the MPI rating categories. These characteristics are not all inclusive nor are they definitive. Consultation with the appropriate Division soil consultant is encouraged when questions arise concerning the appropriate rate to be assigned to a particular soil profile.

2.12.2 Characteristics of a < 10 MPI soil

These soils consist of thick layers of gravel, sand, and loamy sand. Layers of fine textured soil, if present, are thin. On a weighted average basis, these have less than 70 percent of soil finer than very fine sand. These soils have textures of coarse sand, sand, fine sand, loamy coarse sand, loamy sand, or loamy fine sand in the particle control section. These soils are excessively drained, somewhat excessively drained, and well drained. They are classified as Entisols and Ultisols in the sandy particle size class.

2.12.3 Characteristics of a 10 MPI soil

These soils consists of layers of sand, loamy sand, and gravel. Gravelly layers, if present are less than 3 inches in thickness and total gravel in the upper 30 inches is less than 35 per cent by volume. The total sand content, excluding very fine sand, is less than 70 per cent on a weighted basis. These soils are somewhat excessively drained or well drained. They are classified as Paleudults in the loamy-skeletal particle size class and Eutrudepts in the coarse-loamy particle size class.

2.12.4 Characteristics of a 15 MPI Soil

These soils are very young with no development, and are coarse in texture with very rapid permeability. These soils are well drained, deep and found along streams, flood plains, and on toe slopes of coarse textured materials. These soils are borderline on being excessively well drained**.** These soils have in the upper 30 inches or more, soil textures of loamy skeletal family particle size class as determined on a weighted basis. Layers of fragmental or sandy skeletal family particle size classes are not allowed. There may be thin layers of loamy textural family classes; loamy, coarse loamy, fine loamy, coarse silty, and fine silty may be present. These soils shall have 15 mpi estimated absorption rates depending on the thickness and number of loamy layers present. The majority of these soils is classified as Entisols, Inceptisols, and Ultisols and is in the fine-loamy, coarse-loamy, and loamy-skeletal particle size classes.

2.12.5 Characteristics of a 30 MPI Soil

Well-drained 30 mpi soils have loamy, coarse loamy, fine loamy, coarse silty or fine silty family soil textural classes in the upper 30 inches or more of the soil as

determined on a weighted basis. There shall be no evidence of redoximorphic features in the upper 40 inches of these soils. They may have depths to rock of 40 inches or more and are not underlain by depths to clay or fragipans within the upper 40 inches. These soils shall have an estimated absorption rate of 30 mpi in the upper 30 inches or more, depending on the soil textures. Loamy, coarse loamy and coarse silty soil textures shall have 30 mpi estimated adsorption rates.

Moderately well-drained 30 mpi soils (with soil improvement practices) have coarse loamy, coarse silty, fine loamy or fine silty soil textures and are friable to a depth of 30 inches or deeper. These soils have no redoximorphic features within the upper 16 inches of the soil profile and have few redoximorphic features within the 16-20 inch depth from the soil surface.

The majority of these soils are classified as Entisols and Inceptisols with the remainder in the Alfisol, Molliisol, and Ultisol orders.

2.12.6 Characteristics of a 45 MPI Soil

Well-drained 45 mpi soils have coarse loamy, coarse silty, fine loamy or fine silty soil textures and are friable to a depth of 30 inches or deeper. There shall be no restrictive or blocking layers such as fragipan, clay, rock, etc. in the upper 40 inches. In addition, in this group are red (5 Y/R or redder) soils with high clay content but having friable consistence when moist. There are no redoximorphic features within 40 inches of the soil surface.

Moderately well drained 45 mpi soils (with soil improvement practices) have depths to excess wetness ranging from less than 20 inches to 30 inches. Depth to redoximorphic features ranges from less than 20 inches to 30 inches. There are no dominantly gray layers within 20 inches of the soil surface. These soils are predominantly very deep, well drained and moderately well drained Ultisols and Alfisols on uplands, residual and colluvial, and on stream terraces. The majority of these soils are in the fine, fine-loamy, and fine-silty particle class sizes.

2.12.7 Characteristics of a 60 MPI Soil

These soils are generally well developed and permeable in the upper 30 inches of the soil surface. These soils should not have clays with high shrink/swell potential in the upper 30 inches of the soil surface. These soils cannot have a fragipan or fragic properties within the upper 48 inches of the soil surface. They are usually well drained but may be moderately well drained. These soils are predominantly very deep, well drained and moderately well drained Ultisols and Alfisols on uplands.

2.12.8 Characteristics of a 75 MPI Soil

These soils have moderate to slow permeability in the upper 24 inches and generally have well developed profiles. They should not have clays with high shrink/swell potential in the upper 24 inches of the soil profile. These soils cannot have a fragipan or fragic properties within the upper 24 inches of the soil surface. These soils include soils that have had special exemptions that allow for 20 inches to clay (Bradyville). These soils may be well drained or moderately well drained but must include soil improvement practices if moderately well drained. These soils are predominantly very deep, well drained, moderately well drained, or somewhat poorly drained Ultisols and Alfisols on uplands, foot slopes, toe slopes, and stream terraces. Most of these soils have a fragipan or have fragic properties deeper than 24 inches from the soil surface. Some of these soils have a restrictive clayey or shaley horizon deeper than 24 inches.

2.12.9 Characteristics of a >75 MPI Soil

These soils have limiting properties in the upper 24 inches of the soil profile. Specifically, these soils have rock depths less than 24 inches from ground surface; fragipans or fragic properties less than 24 inches from ground surface; high (>35%) clay content less than 24 inches from ground surface; or, redoximorphic features less than 16 inches from ground surface or very firm or firmer rupture resistance classes or is plastic and sticky when wet. These soils have restrictive horizons or layers at depths less than 24 inches from the soil surface. Restrictive horizons or layers include fragipans, fragic properties, restrictive clayey layers, dense layers, and lithic or paralithic bedrock. Many of these soils have seasonal water tables and cannot be drained by subsurface drainage soil improvement practices. All soils that are classified as Vertisols or soils in a Vertic or Lithic subgroup are included with this group. Additionally soils in the “shallow” family are in this group. Other soil orders in this group are Alfisols, Entisols, Inceptisols, Mollisols, and Ultisols.

These soils may or may not be suitable for percolation tests per Rule 0400-48-01-.03 (b)

3.0 Soil Map Compilation

Soil map compilation consists of accurately showing the kind, size, slope, extent and location of each soil map unit delineation on an acceptable base map to represent area on the earth’s surface. It shows the spatial relation of each soil map unit delineation to other soil map unit delineations, other landscape characteristics, and to natural and cultural features.

Soil maps are of little or no use without soil notes that characterize each kind of soil map unit. In addition, the soil notes, to be useful, must present interpretations that accurately predict the expected performance for sewage disposal purposes for each soil map unit.

3.1 Base Map Requirements for Soil Maps

3.1.1 Base Map Requirements for Soil Maps of Subdivisions

The base map requirements for preparing soil maps are specified in the Rule 0400-48-01-.02 and Rule 0400-48-01-.03 (3) for general, high intensity and extra high intensity soil maps. These criteria are discussed in Chapter 2.

3.1.2 Base Map Requirements for Individual Lots

The Regulations under Rule 0400-48-01-.04 state in part: "For lots which are not a part of a subdivision herein, where the services of a soil consultant are utilized, then the requirements established in Rule 0400-48-01-.04 (1) of the Regulations may apply as deemed necessary by the Department either on an area basis or site specific basis." Through this regulation, soil consultants are allowed to complete general and high intensity soil maps on sketches. Neither the seal nor the signature of a registered land surveyor is required on a sketch map. However, adequate information should be available on each sketch map to relocate the identified soil area in the event the stakes have been moved, removed or destroyed. In the event adequate information to locate a soil area is not presented on the map and relocation of the soil area is not possible, permit issuance based on the soil map will be delayed until that area has been re-staked by an approved soil consultant or another suitable area has been located and mapped. In the event the original area is re-staked, the soil consultant will be responsible for attesting to the accuracy of the re-staked area. GPS coordinates may be provided in lieu of staking. However, the unit must have sub-meter accuracy.

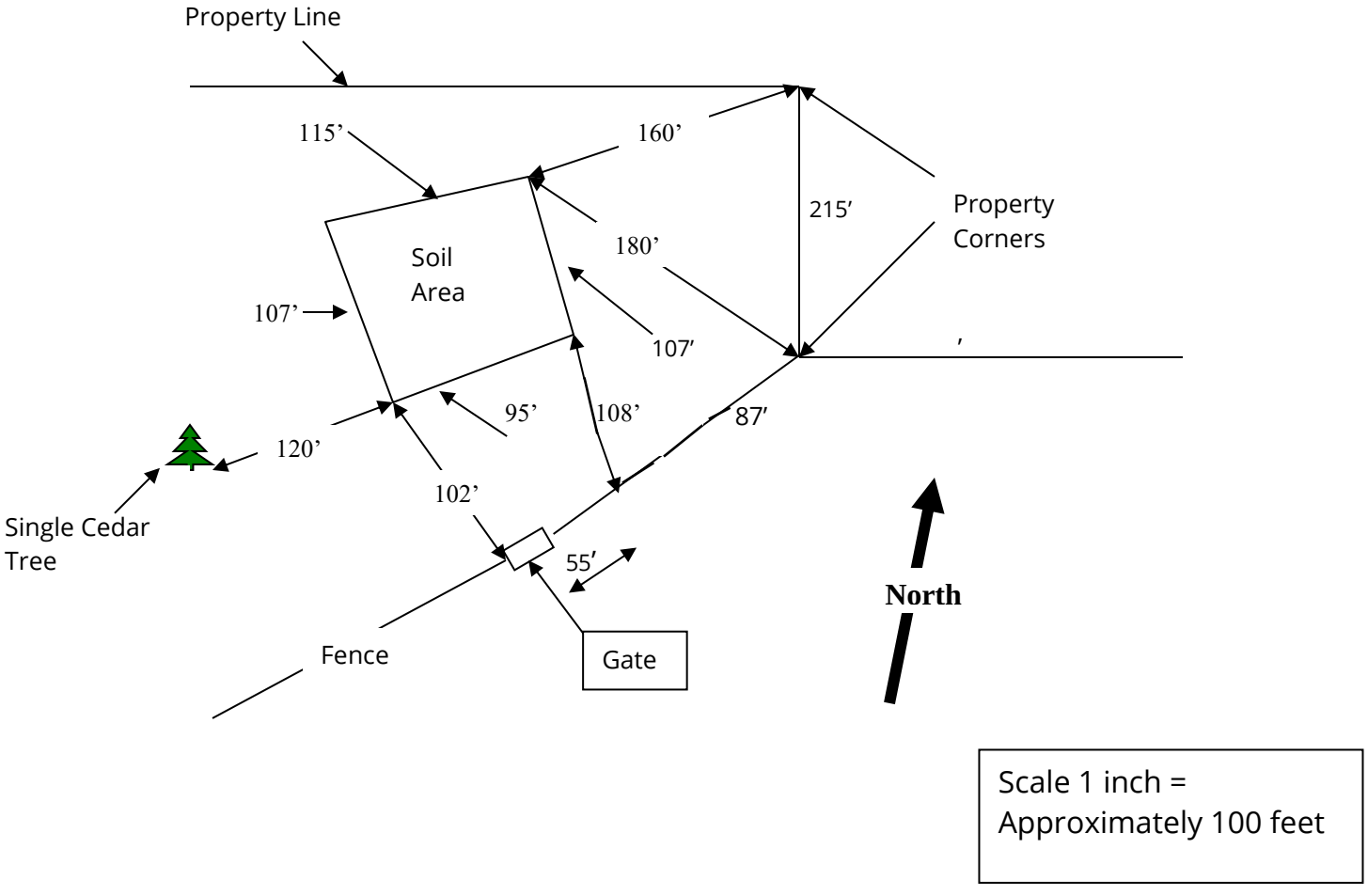
Adequate information would include, but not be limited to, taped distances for the purpose of triangulating at least three of the soil stakes for each soil area mapped. See Figure 3.1 for guidance relative to providing information used to triangulate points. Triangulated soil stakes should be roughly opposite each other within the pattern of stakes. In addition, taped distances between the soil stakes should be provided on the soil map. Three triangulated soil stakes taped from permanent or semi-permanent points along with stake-to-stake distances will allow for adequate reconstruction of a soil area. Use of metal "T" fence posts is recommended when formally staking the soil area.

In the event a sketch map is prepared, the north arrow and scale should be designated as approximate on the soil map. An approximate scale of 1"=100' is required for mapped soil areas on sketch maps. The absence of signature and seal of a registered land surveyor implies that all distances are approximate. All other base map requirements remain the same as the requirements specified in Rule 0400-48-01-.02 and Rule 0400-48-01-.03 (3)

In some instances a scale of 1"=50' may be beneficial due to a small lot or a complex site. If a scale of 1"=50' is used it should be displayed prominently on the soil map as the 1"=50' scale can be misinterpreted for a scale of 1"=100'. This scale may be

practical on sketch maps to determine areas for extra-high intensity soil mapping, small lots, lots with complex details, etc.

Figure 3.1 Generalized Recommendation for Information Required for Soil Area Location on Sketch Maps, Minimum of Three Distances To Triangulate Required



All Distances are Approximate (by taping).

Corners of Soil Area Marked with (flags, "T" posts, wooden stakes) on (Date).

3.2 Soil Map Unit Delineations

Each soil map unit shall be drawn and clearly plotted on the base map of each soil map that is being completed. Line size should be no greater than 1 millimeter in width if hand drawn. The map scale shall be the scale specified for the kind of soil map being completed.

Each soil map unit delineation shall be identified with an appropriate symbol or the name of the soils or miscellaneous land type printed in (or leadered into) the appropriate soil map delineation. The appropriate percent slope category should be included with each soil map unit label. If less than 24 inches of fill are present over the unit of soil, the word "Fill" and the 6-inch fill increment should be listed after the percent slope. Type of fill material should be explained for that unit of soil.

No other information (absorption rates, soil improvement requirements or subsurface sewage system design criteria) shall appear in any soil map unit delineation. This information will be in the soil map notes.

3.3 Soil Map Symbols

All observed significant cultural and natural landscape features such as buildings, cemeteries, pipelines, cut banks, drains, streams, wells, sinks, closed depressions, etc., shall be accurately located on the soil map with the appropriate conventional symbols that are provided as Appendix A. Ad hoc symbols may be used for cultural and natural features for which conventional symbols have not been established. Each ad hoc symbol shall be defined in the map symbol legend. Only those symbols used on the soil map shall appear in the legend.

3.4 Soil Map Notes

Soil notes for each soil map unit shall be printed on the soil map. Soil notes shall be in a uniform and consistent format which makes the information easier to find and easier to interpret. Notes should not be stapled or taped to the soil map.

Only the soil notes that apply to the soils or miscellaneous land types that have been classified and delineated on a soil map shall appear on that soil map. Notes prepared mechanically or electronically are preferred. However, notes that are printed manually are acceptable if they are neat, legible and easy to use.

3.5 Format for Soil Notes

A standard format is necessary to ensure that the soil notes are organized in a fashion that makes the necessary information easy to find and use. The format consists of a form on which the county and site/subdivision name, map and parcel numbers, are identified at the top of the map and the name of the soil consultant, date of completion, and type of soil map are recorded at the bottom. In the middle,

there are four (4) sections that are required. Each map unit should have a corresponding section.

Soil map notes will be required to have:
1. Soil name/Symbol and slope %
2. Rate
3. Depth
4. Additional soil or site information:
   Setbacks/depths of improvement practices, setbacks of cutbank, gullies etc.

1. Lists the soil map symbol (if used on the soil map), the name of the soil, and the depths to which the assigned absorption rates (2) apply. Variable slope categories for an otherwise undifferentiated soil unit do not require multiple rows. The order of listing in 1 should be from the most prominent soil on the map to the least prominent soil on the map. If the map contains numerous units of soil and prominence is not obvious, list the units alphabetically. If less than 24 inches of fill are present over the unit of soil, the word "Fill" and the 6-inch fill increment should be listed after the percent slope.

2. Presents the estimated absorption rate for the corresponding depth in 1. The rate should be the same as what is listed in Appendix I or higher (slower) as site-specific conditions dictate. Successively lower horizons should also be assigned a rate down to a depth of 48 inches. Rates for lower horizons shall be higher (slower) than the rate assigned to the uppermost-identified horizon. For example: a map prepared in Dickson County may identify a unit of Mountview soil. In 1 for that soil unit would be the name Mountview (and symbol if appropriate) and the % slope for that unit. Appropriate soil depth ranges should also be listed in 1. For example, 0 inches – 30 inches and 31 – >48 inches would be listed if the distinguishable profile change is located at 30 inches. 2 may read 60 MPI and >75 MPI if these rates apply to the depths listed in 1. Most importantly, the lowest (fastest) rate assigned to the soil unit is not lower than the rate identified in Appendix I. If a soil improvement practice is required to obtain a rate presented in this column, the appropriate indication should be made following the rate (i.e., 75 MPI (WID))

3. Consists of the depths (in inches) to the upper level of bedrock or fragipan that is within a depth of 48 inches. Whether the depth is to bedrock or fragipan should be noted. Where no restrictive layer is within 48 inches, the symbol ">48 inches" shall be in this column for that soil or miscellaneous land type. Section 2.8 provides appropriate depth to rock classes to be used in this column when depth to rock is a limiting factor of the soil unit.

4. Consists of additional soil or site information that is needed to consider each kind of soil on the soil map for sewage disposal purposes. Notes to be included in 4 include, but are not necessarily limited to: type of soil improvement required and the depth at which the improvement practice is to be applied; suitability of the soil for percolation tests; horizontal separation between subsurface drains, cut banks, and drainageways if different from the specified distances in the Regulations; properties of soil to be added as compatible soil; or, the presence and duration of excess surface and subsurface water. Not all of these notes may apply to all soil units.

A general map note stating "control surface water" is not appropriate and shall not be placed on any soil map or in the soil notes. Any soil rate identified in the map notes that is dependent on a soil improvement practice should identify the practice within the notes for that soil type.

The following signature block and statements should conclude the soil note portion of the map:

(Type of Soil Map) Soil Map Completed by:

Signature Date
John Doe, Soil Scientist

The following statement shall be printed conspicuously near the soil notes:

ANY CUTTING, FILLING OR COMPACTION
WILL VOID THIS SOIL MAP

The following statements should also appear on the map:

"I, (Soil consultant's Name) affirm that this soil map meets the standards established in the Regulations to Govern Subsurface Sewage Disposal, the Soils Handbook, and the Soil Taxonomy. No other warranties are made or implied."

"Signature of Soil consultant does not constitute approval of this map by the Division of Water Resources."

Any disclaimer or statement that creates doubt about the nature and properties of a soil is not acceptable. No statements relative to the permitting of a soil or site for SSDS. This kind of determination is the responsibility of DWR.

3.6 Vicinity Maps

Each soil map shall have a vicinity map printed on its front. It shall be accurate enough and legible to ensure that the soil map users can locate the site. The vicinity map need not be to scale.

3.7 Miscellaneous

Two copies of each soil map shall be submitted to the Commissioner on a plat that meets the requirements specified in the Rule 0400-48-01-.03 (3) (2) with the exception for the exemption allowed for individual lots in the Rule 0400-48-01-.04 (1).

All soil maps with the exception of sketch maps shall require signature and seal of a registered surveyor, bar scale, and certificate of accuracy. All soil maps shall display: soil map name, county, date, map/parcel and stamp, a north arrow, bar scale, vicinity map, All

information will be in ink with the statement of "Any cutting, filling, compaction will void this soil map".

The boundary of the mapped area should be clearly delineated and identified on each soil map.

For the purpose of authenticating soil maps, it will be necessary for each of the soil maps submitted to the Commissioner to display a stamp over the soil consultant's signature and date of completion. Any other copy of the map to be considered original will also require the same authenticating process.

Stamps associated with professional license are required to represent an individual's approved status as a soils consultant in the State of Tennessee. The stamp should be signed and dated in blue, indelible ink.

4.0 Site Investigations

This chapter provides guidance for conducting site investigations or special investigations as required by Division personnel. These site investigations include evaluations conducted in support of a modified mound permit, waste stabilization lagoon permit, drip dispersal, steep slopes, fill material, compatible fill, soil improvement/protection practices, closed depressions, and depth to rock maps for previously approved subdivision lots.

4.1 Modified Mound System

Characterization of a site for mound suitability will be assessed following completion of an extra-high intensity soil map for those soils with a depth of 24 inches or greater to a restrictive horizon. Rule 0400-48-01-.15 (4) (1-4)

For soils intended for modified mound systems that have 20 inches to 24 inches to a restrictive horizon, an extra-high intensity soil map must also be completed.

4.2 Waste Stabilization Lagoons

Soil investigations conducted in support of a waste stabilization lagoon permit are to be in accordance with Rule 0400-48-01-.15 (5) (a) (2 -6) as printed below.

(a) Site and Soil Requirements

2. The soil characteristics shall be determined by the following:

(i) An extra-high intensity soil map shall establish the soil rate. The absorption rate may be estimated by an approved soil consultant but may require approval by the department.

(ii) A pit profile description to a depth of six (6) feet below ground surface shall be generated for each lagoon cell (primary and duplicate). Each description shall

identify: soil structure, soil color, including mottles, texture including coarse fragments, plasticity and consistency for each distinct horizon in the soil profile.

(iii) The depth of the seasonal high water table shall be noted if it is located within six (6) feet of the soil surface.

3. The soil absorption rate must be a minimum of one hundred twenty (120) minutes per inch as estimated by an approved soil consultant.

4. An area of suitable soil must be available to install the initial system and maintain a suitable area of adequate size for one hundred (100) percent duplication.

5. The lagoon shall be located in soils where the vertical separation from the bottom of the lagoon and bedrock and rock formations, or more permeable material, are a minimum of one (1) foot.

6. Predominant redoximorphic features shall not be located within six (6) inches of the ground surface. The lagoon shall not be located in areas subject to flooding as determined by the department. The soil profile shall not be hydric in classification. (The term hydric as used does not imply a Certified Wetland Delineation was made, the term hydric is used in referring to soil series classified by the NRCS with hydric designations).

4.3 Drip Dispersal

Drip Dispersal Mapping Requirements

Investigations conducted in support of a subsurface drip dispersal (SDD) system permit are to be in accordance with Rule 0400-48-01-.15 (6) (a)

Subsurface Drip Disposal (SDD) System is a subsurface sewage disposal system, which utilizes pressurized drip irrigation line for the uniform application of treated wastewater throughout the disposal field. SDD systems shall be designed and installed to utilize the upper profiles of a suitable soils area through the uniform distribution of effluent, dosing and resting cycles, and shallow installation of the disposal line.

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An extra-high intensity soil map, provided by a soil consultant listed by the department, shall establish the soil properties for use to design a SDD system. The extra-high intensity soil map shall provide site-specific profile descriptions establishing the texture and structure (shape and grade) for each suitable soil unit mapped. Acceptable soil textural and structural properties are shown in Table VII in the Division Regulations.

Percolation tests shall not be allowed to establish soil properties for the design of SDD systems.

Profile descriptions require the excavation of soil pits in order to allow for site-specific pedon descriptions. The soil column shall be described to a depth of thirty-six (36) inches or to rock or fragipan whichever is shallower. There shall be a minimum of two (2) pits per acre with at

least one pit in any suitable soil unit intended for use, unless a different frequency is specified by the Commissioner.

Slope classes for extra-high intensity soil maps used for Subsurface Drip Disposal systems shall be delineated as follows:

Slope Classes
0 - 9 %
10 - 20 %
20 - 30 %
30 - 40 %
40 - 50 %
> 50 %

Slopes of more than fifty (50) percent shall be considered unsuitable.

For sites with slopes between thirty (30) to fifty (50) percent a special investigation shall be conducted to evaluate those soils to determine: depth to rock, kind of rock and particle size class designation to a depth of six (6) feet or to hard rock, whichever is shallower.

*Areas of coarse sand, loamy coarse sand, and sand require special investigations

4.4 Steep Slopes

Rule 0400-48-01-.04 (4) (d) identifies slopes of more than 30% as unsuitable unless soil conditions will prevent lateral movement of sewage effluent to the ground surface. Slopes greater than 50% are considered unsuitable and not eligible for consideration.

The mapping unit in delineation with slopes greater than 50 percent may contain only the name of the soil series or variant, and the slope designation of greater than 50 percent. Do not rate the soil for estimated absorption rates or indicate any other soil property or characteristics in the delineation or in the notes.

The Division's policy SSD-011-8 addresses the use of steep slopes. This policy states that the investigation shall be conducted by Division Staff and an approved soil consultant and specifies that consideration be given to presence, depth, and orientation of restrictive layers; depth of soil; limitations on the depth of the disposal field trenches; steepness of slope; and, any other conditions, which would influence the lateral movement of effluent. Observations made in support of steep slope investigations should be made to a depth of 6 feet or bedrock, if shallower than 6 feet. Pits are required to assess these characteristics. The location and number of pits required to evaluate a site will vary based on site-specific conditions. A Division Soil Consultant will determine the location and number of pits required.

The limitations of a steeply sloping site for a subsurface sewage disposal system depend in large part on the depth of suitable soil on the site and rock outcrops or cutbank downslope

of the site. Setbacks from these features will be determined on a site-specific basis. As the slope increases, the depth of suitable soil required increases.

The bottom of any planned or designed disposal field trench shall be at least six feet horizontal distance from the ground surface. Site-specific conditions may allow for variations in this distance.

4.5 Fill Material

Filled land is defined in the regulations Rule 0400-48-01-.02 as "areas to which more than two feet of soil and/or debris have been added." Rule 0400-48-01-.04 (4)(a) states: "Areas consisting of fill shall be excluded from the area considered for the installation of the disposal fields unless soil conditions provide for adequate filtration and will prevent outcropping of sewage effluent."

Division Policy No. SSD-011-8 (also steep slopes policy) states, "When application is made to utilize a site for subsurface sewage disposal which has fill material, an investigation shall be conducted by a Division Staff and an approved soil consultant prior to determining the site for suitability."

There are several clues that are helpful in identifying fill. These clues include but are not limited to:

1. Randomly distributed masses of variable texture and colors
2. Buried modern artifacts such as cans, bottles, bottle caps, dish fragments, metal fragments, and waste building materials
3. Buried former surface layers that can be identified by properties such as organic matter content and gleyed organic matter that emits the odor of hydrogen sulfide
4. Masses or fragments of buried grass, tree leaves, and tree limbs
5. Layers and soil masses that remain from the filling process
6. Layers and masses of soil material with variable degrees of compaction
7. Anomalies in the landscape configuration such as banks and depressions
8. Photographs and contour maps that reveal landscape changes.

A high or extra-high intensity soil map should be prepared to identify and delineate the filled area. Where less than 24 inches of fill is present, fill depth shall also be noted on the map unit delineation and type of fill material specified. Less than 24 inches of fill shall be identified as either 0 inches to 6 inches, 6 inches to 12 inches, 12 inches to 18 inches, or 18 to 24 inches as appropriate. Soil units overlain with variable fill depth should be further delineated based on these depths of fill ranges. Smaller depth intervals may also be used if appropriate.

4.5.1 Filled Land Special Investigation

If more than 24 inches of fill material is identified, a special extra-high intensity soil map of the filled area is required. Fill land shall be considered unsuitable for SSDS; however, if a special investigation is required the procedure below shall be followed. All map units designated filled land (>24 inches of fill material) will require a variance from DWR Central Office to be considered for SSDS. This map shall be one inch equals fifty feet or larger. Grid points should be staked and located on the base map at intervals of no more than twenty-five feet.

Observations shall be made to a minimum depth of four feet at each grid point. Observations can be made by auger borings or excavated pits. Additional observations may be necessary to ensure homogeneity of each identified map unit. No map unit should contain dissimilar bodies larger than 100 square feet. No more than 15 percent of the total area of any map unit delineation may contain dissimilar fill material or other soils.

A detailed profile description shall be completed at each grid point. Additional detailed profile descriptions shall be completed for each additional observation point. Each description shall reveal the significant characteristics and qualities of each significant layer in the profile at each grid point. Significant characteristics include but are not limited to the following:

1. Color
2. Texture
3. Consistence and Compaction
4. Structure
5. Debris

After observations have been made at each grid point and the profile for each observation location have been completed the map shall be completed. Map units shall be designed to provide homogeneity in each map unit and to provide the data needed to evaluate the site and design the appropriate subsurface sewage disposal system.

A variance from the Division's Central Office is required prior to permit issuance if the depth of fill over the area proposed for system installation is greater than 2 feet. The special investigation map with associated profile descriptions should accompany the variance request. In support of the variance request a pit may be required within each map unit and a detailed profile description shall be completed for each pit. The Division Central Office shall be notified prior to pit excavation and a time suitable for all parties shall be established.

4.6 Compatible Fill Material

Several kinds of modified subsurface sewage disposal systems allow or require the addition of compatible soil material to the existing soil surface to make a site suitable.

Compatible soil material shall be a soil that is in the same USDA soil textural class as the existing surface soil layer on the site, or that is no more than one USDA soil textural class different from the existing surface soil layer. However, the textural class of "clay" is not considered acceptable as compatible fill material for any textural class of existing soil.

4.7 Soil Improvement/Protection Practices

Regulatory Justification - Limitations for use of certain soils (for sewage disposal purposes), due to groundwater interference, are provided within the regulations. Rule 0400-48—1-.04(1) identifies additional site requirements and limitations for subdivision approval and individual lots and issuance of construction permits. Paragraph 1 of this section states that "the suitability of a site must be demonstrated through…freedom of groundwater interference…" Therefore, soils that exhibit interference from groundwater are considered unsuitable for subsurface sewage disposal. However, there are soils within this group that may be made usable by implementing soil improvement/protection practices (see Section 2.0)

Soil improvement/protection practices (SIP) are designed to collect, remove, and discharge interfering surface and/or subsurface water associated with subsurface sewage disposal systems (SSDS) while not collecting effluent from a SSDS. These practices include, but are not limited to interceptor drains, drawdown drains, surface berms, and "V" ditches. The drainage system may include one or any combination of these types of drains to accomplish the protection of the sewage disposal area.

Correct function of the SIP is critical in the overall performance of the SSDS. Correct function is influenced primarily by SIP construction and location of the SIP relative to the SSDS and to adjacent soil types.

It is the responsibility of the attending soil consultant to determine:

1. Whether or not a SIP is required
2. The type (drawdown, interceptor, surface, or combination) of SIP that is required
3. The minimum depth at which the SIP shall be installed
4. The position on the landscape where the SIP shall be installed.
5. Distance of separation between SIP and disposal area (generally 15-25 feet).

It is also the responsibility of the soil consultant to state that a suitable outlet is required. It is not the responsibility of the soil consultant to determine whether a suitable outlet is available.

Soil improvement practices are used on sites with an installation depth relative to the depth of the fragipan, high clay layer in the soil, bedrock, redoximorphic features, etc.

Soil improvement practices should generally be installed 15-25 feet from a SSDS, Rule 0400-48-01-04(5)(b)(1). Subsurface drains must be installed far enough away from the septic tank and the disposal field to prevent septic tank effluent from entering those features. The exact distance will vary with the slope and the soil permeability.

Soil improvement practices must be installed deep enough to intercept interfering water and discharge it, while also diverting as much surface water as possible. The depth needed will be determined by the depth of the soil restriction (SSDS depth) or the depth needed to lower the high water table.

In soils with a restrictive layer under a permeable soil layer, the bottom of the drain should extend four (4) to six (6) inches into the restrictive layer to effectively block water from moving past the drain. In cases where the restrictive layer is rock, the drain should extend down to the rock surface. In those cases where the drain extends down to the top of rock, the gradient of the bottom of the ditch must be continuous. Obtaining continuous flow on top of rock may necessitate removal of bedrock (rock sawing or blasting). In no case can the bottom of the drain have any swags, depressions, or isolated features that would restrict the flow of water. The gradient of the bottom of the ditch must be continuous to insure flow of water.

Where the purpose of the drain is to lower a high water table in a permeable soil with no restrictive layer, the drain should extend at least twelve (12) inches below the grade of subsurface sewage disposal system trench bottom. In some cases the depth of the drain may exceed forty-eight (48) inches.

Subsurface drains must be installed within the unit of soil they are intended to improve. Placement of a subsurface drain outside the unit of soil it is intended to protect is only permissible following review by a Division Soil Consultant. Soil improvement practices outside the intended drain area will only be permissible if the soils outside have similar properties to the inside soils. Subsurface drains should not be installed further than 25 feet from the area of soil they are intended to protect.

Design

Subsurface Drains- Subsurface drains can be divided into two general categories and are intended to intercept and successfully remove groundwater from soil areas designated for disposal field use:

A. Interceptor Drains – Interceptor drains are constructed to intercept groundwater moving down slope within the soil profile prior to its entrance into the soil area intended for disposal purposes. When the direction of groundwater movement in the soil is apparent, the drain should be positioned up gradient of the soil area. These drains are typically installed in areas that have a three (3) percent slope or more. Soils in which an interceptor drain would be used would typically have a restrictive layer along which lateral movement of water is occurring. These drains may be designed in a 1, 2 or 3 sided design upslope of the disposal field.

B. Drawdown Drains – Drawdown drains are constructed to lower the water table in the vicinity of the soil intended for disposal field use. These drains are typically installed in areas that have less than three (3) percent slope. These soils may or may not have a restrictive layer. These drains can be between the soil area and the local controlling feature for water table level (stream, lake, etc.).

*Curtain Drains are not a category of subsurface drains. It can be entirely a drawdown drain or a combination of an interceptor and drawdown drain. They are constructed to completely encircle the soil area.

Degree of slope will typically determine whether a drain is to be positioned around all or a part of the disposal field area. The type of drain for a particular soil unit should be identified in 4 of the note format. If the drain is to be positioned up gradient of the disposal field area, the soil rate in 2 for that soil unit should be followed by "(WID)" With Interceptor Drain. "WID" indicates that the rate listed for that soil unit is dependent on the installation of an interceptor drain. If the drain is to be positioned around the entire disposal field area, the soil rate in 2 of the soil format for that soil unit should be followed by "(WDD)" With Drawdown Drain. "WDD" indicates that the rate listed for that soil unit is dependent on the installation of an interceptor drain that surrounds, or curtains, the entire disposal field area. Use of "WPD" to indicate that "planned" or "possible" soil improvement practices are suggested is not acceptable. Any indication that Division Staff should "plan" for a drawdown drain but not require a drawdown drain on the permit will not be acceptable.

Surface Drains

Surface drains can be divided into two categories and are intended to intercept and successfully remove interfering surface water from soil areas designated for disposal field use:

a. Diversion Ditch – A diversion ditch can be successfully used to intercept and divert surface water flow if maintained. Diversion ditches may be constructed to intercept isolated features that are directing surface water onto the soil intended for disposal field use or they may be constructed to completely shield a soil area from interfering surface water flow as might be encountered at the base of a slope. These ditches require maintenance (cleaning) to allow for filling ("silting in").

b. Vee Ditch – A vee ditch may be used in place of a subsurface drain if the ditch can be dug and maintained deep enough to intercept the restrictive layer or water table and facilitate flow of interfering water away from the disposal field area.

4.8 Closed Depressions

Soil series within a closed depression may have properties similar to soils outside of a closed depression and are to be mapped/evaluated in the same manner. In many instances, it is impractical to discern whether a site is within a closed depression. If it is determined that all or a portion of the soils being mapped/evaluated are within a closed depression, more intensive standards apply for their use as areas for installation of SSDS systems.

Soil units shall be delineated, as they exist according to series description, whether or not they are in a closed depression. When soil units are in a closed depression, the following guidelines apply:

1. The only additional note that must be added is that "the soil unit may be in a closed depression". The size and location of the closed depression in relation to the overall landscape may make this difficult to discern in some cases. The depths of restrictive layers, depth of soil improvement practices, soil rate, etc., as required in other applications, must be noted on the map and in the appropriate notes, as necessary.

2. If the closed depression has one or more open holes (throats), these features must be accurately located on the soil map. If the feature has any dimension greater than 5 feet, the perimeter of the opening shall be shown on the map as a solid line with inward-facing hachure marks. The feature should be shown to scale.

3. The minimum setback from physical features within an apparent closed depression such as throats and drains shall be in accordance with Rule 0400-48-01-.11

4. Subdivision approvals may be granted and/or SSDS permits may be issued for suitable soils areas within closed depressions the same as outside closed depressions with the exception of the following more stringent criteria as specified by Rule 0400-48-01-.04 (4)(c)

    i. Depth to rock formations shall be a minimum of four (4) feet from the surface of the ground.

    ii. Trench depth shall not exceed 30 inches.

    iii. Slopes must be 30% or less.

iv. The area must not be subject to flooding. The term "subject to flooding" as used in the regulations shall refer to those soils that have redoximorphic features developed from saturated soil conditions over prolonged periods and would not otherwise be usable even with the application of soil improvement practices. Some areas of closed depressions may also exhibit indicators of periodic ponding of water or seasonal flooding other than soil wetness characteristics. These indicators may be hydrophytic vegetation or the absence of vegetation. The term "subject to flooding" shall not be interpreted to indicate that all areas within a closed depression are unsuitable for the issuance of a SSDS permit.

v. Soil units that require soil improvement practices shall be considered unsuitable if the positive outlet is within 25 feet of a throat or if the positive outlet is below the elevation of any area determined to be subject to periodic ponding of water.

The soil consultant will not in any way, other than the suitability of the soils, indicate the suitability of the site for construction of a SSDS or as a building site.

4.9 Depth to Rock Maps for Previously Approved Subdivision Lots

This subsection outlines the process for preparing depth to rock studies associated with permit issuance on previously approved subdivisions or lots.

Frequently, the need for depth to rock information on previously approved subdivision lots arises during a Division Staff's evaluation for permit issuance. Subdivision lots approved prior to 1990 (when removal of rock during field line installation was an accepted practice) often have a portion or all of the intended sewage disposal area underlain by shallow rock. When considering these lots for permit issuance, it is critical that areas with appropriate depths to rock are delineated.

Current soil mapping efforts should refer to Section 2.8 for rock depth classes and this section for rock depth data presentation.

Data Collection

The grid should be field-staked at a minimum of 50-foot intervals. Field stakes should be established by survey. Data collection within the field stakes should be based on an alpha/numeric grid pattern with a minimum grid line separation of 10 feet. X-axis should be numerated. Y-axis should be lettered. X and Y coordinates should be clearly marked on each field stake. Field stakes should remain in place until the system is installed and approved.

Depth to rock datum in inches, as determined by rock probe refusal, should be determined for every grid point. A Division Soil Consultant, on a site-by-site basis

prior to data collection, may approve data collection methods other than rock probe refusal.

Persons qualified to collect depth to rock data are the same as those for performing percolation tests Rule 0400-48-01-.05(8)

Data Presentation

Depth to rock in inches for each data point shall be recorded in table format. All rock outcrops on the surface of the ground, including those between grid points, shall be shown on the depth to rock map. This table should be presented on the same document as the property configuration with grid staking. The property boundary map with associated grid lines should have a minimum ratio of precision of 1:7,500 and shall bear the seal and signature of a Registered Land Surveyor. The scale of the map should be 1 inch equals 100 feet or larger (i.e., 1 inch equals 50 feet). Grid lines should be tied to a property corner or other permanent feature. Grid lines should be oriented parallel/perpendicular to property lines or in a north/south, east/west fashion if there are no adjacent property lines.

5.0 Quality Control

Quality control is necessary to ensure that all soil classification, soil mapping and soil interpretations by all soil consultants meet the standards established for all soil maps and for all site investigations.

The established standards are the criteria established by the Soil Taxonomy, the Regulations, and the Soils Handbook of Tennessee by the Division. Ideally, quality control events will serve mainly as a learning experience to develop concepts, skills, and techniques to enable all soil consultants to perform adequately and in a similar fashion that yields similar results. However, these reviews must also serve to emphasize to those soil consultants who cannot or will not perform adequately, that soil maps and site investigations must meet the established standards.

5.1 Kinds of Quality Control Events

The two kinds of quality control events are Routine Quality Control Reviews and Non-Routine Quality Control Reviews. These reviews shall be made to evaluate soil maps and site investigations. These reviews are conducted by DWR staff and/or Division Soil Consultant(s).

Routine Quality Control Events

Routine quality control reviews shall occur without reason to believe that either errors or omissions have been committed. These reviews shall be scheduled as time and resources allow. Priority in scheduling routine quality control events for individual soil consultants shall be commensurate with the volume of work done by each soil consultant in the area where soil maps are being reviewed.

Routine quality control events will involve local and regional Division Staff. Division Staff will review each set of maps (at least 2) submitted to the respective county office based on the checklist included as Appendix B. Errors or omissions identified during this review will be communicated to the person supplying the map to our office. The map will not be accepted nor will it be used in support of subdivision evaluation or permit issuance until the errors or omissions have been addressed.

One of the maps in each set of maps submitted will be forwarded to the appropriate regional office. As each map is received in the regional office, an entry will be made to a login sheet identifying date of receipt, date of completion, soil consultant, and name of map, county, and type of map.

Division Soil Consultants responsible for reviewing soil maps will identify an appropriate percentage of maps from each contributing private soil consultant and conduct a field review to evaluate compliance with standards identified in Section 2.0, Soil Classification – Soil Mapping and Soil Interpretations. Division Soil Consultants will also give consideration to compliance with Section 3.0, Soil Map Compilation, during the field review of the map. The quantity and location of maps selected for routine quality control reviews will be based on the soil map log maintained at the regional office.

Non-Routine Quality Control Reviews

Non-routine quality control reviews are scheduled to resolve problems with soil maps or site investigations as the need dictates.

Division Staff see all soil maps submitted to the Division. They also are involved in all site investigations. Therefore, most non-routine quality control events will begin at the county office level.

Non-routine quality control reviews will likely be initiated due to problems identified during system construction, or system failure subsequent to being loaded. Apparent problems may also be identified during subdivision evaluation and/or the site evaluation for permit issuance.

The Division Staff shall refer any soil map on which there appears to be errors and/or omissions pertaining to soil classification or soil mapping to the appropriate Division Soil Consultant. The Division Soil Consultant shall make a cursory evaluation

of the soil map or site investigation and shall initiate the appropriate activities. The soil consultant will be notified of the date and time of the review by Division Soil Consultants.

5.2 Results of Quality Control Events

Errors or omissions identified during the local Division Staff review will be communicated to the person supplying the map to our office. The map will not be accepted nor will it be used in support of subdivision evaluation or permit issuance until the errors or omissions have been addressed. This communication will be informal as most errors identified at this stage are likely to be soil consultant oversights (i.e., no north arrow, no vicinity map, illegible notes, etc.). However, if a particular soil consultant makes such errors repeatedly, the problem will be forwarded to the appropriate Division Soil Consultant.

Problems identified as the result of regional office soil map review, if minor, will be communicated to the responsible soil consultant and the appropriate local Division Staff. If the problems are not considered minor and/or are committed repeatedly, the appropriate Division Soil Consultant shall be contacted.

Each Division Soil Consultant review of a soil map, whether a routine or non-routine quality control event, will result in a score based on the scoring process identified in Section 1.3.2, Field-Mapping Test. A goal of 10% of each individual soil consultant's soil map submittals will be targeted for a routine quality control review annually.

If the review results in a score of 100% (no loss of points), no notification will be made to the responsible soil consultant.

If the review results in a score of less than 100% but not less than 80% the responsible soil consultant will be made aware of the score by certified letter from the DWR Central Office. This letter will identify the deficiencies associated with the map and offer the responsible soil consultant the opportunity to discuss the score if desired. However, the score (if passing) is not subject to review. A copy of this letter will be forwarded to the regional office file and county office file.

If the review of a map results in a failing score (less than 80%) a certified letter will be sent to the private soil consultant who prepared the map. The letter will identify:

1. Type of Quality Control Event
2. Date of Quality Control Event
3. Participants in the Quality Control Event
4. Map Score with Respect to Each of the Four Categories
5. Primary Reason(s) for Failing Score
6. Location of Property

If the review is a non-routine quality control event, the letter will also identify the reason the map was identified for review.

The soil consultant will have 30 days from the date of issuance of the letter to contest the score of the map. If the score is contested, the soil consultant will be responsible for requesting and coordinating an on-site meeting with the Division Soil Consultant conducting the review and the DWR Central Office. The application for which the map was submitted in support of will not proceed until the issues are resolved.

Based on the results of this meeting the map score will either be changed or remain the same. This will be communicated to the soil consultant in a certified letter. The soil consultant will have 30 days following receipt of the letter in which to contest the score resulting from this meeting. The Division Central Office will coordinate a review by multiple members of the Division Soil Consultant staff, if the score continues to be contested. The score resulting from this review will be considered final for the purposes of this quality control process.

When laboratory data are generated in the course of the review, these data will be considered definitive. When the soil consultant whose soil map is being reviewed chooses to have soil samples analyzed, any costs associated with collection and analysis of these samples will be borne by the soil consultant. For this data to be considered in the score of the map a Division Soil Consultant shall oversee sample collection and the analysis should be conducted at a laboratory acceptable to the Division. Sampling protocol to be used should be discussed with the Division Soil Consultant and agreed upon prior to sample collection.

Map scores will be considered final if:

1. The score is not contested within 30 days
2. After contesting, the score is accepted
3. Score is based on review by multiple Division Soil Consultants

Scores for all maps (passing and failing) will be maintained in each regional office. Failing scores, when finalized, will be forwarded to the Division's Central Office for appropriate disciplinary action.

5.3 Disciplinary Action

Upon notification of a finalized failing score for a soil map, the responsible soil consultant shall be notified of any disciplinary action(s) taken. See Appendix C for reference.

Action taken as the result of failing maps will take into consideration the date of completion of the map and the date of receipt for the first certified letter associated with the first failing map.

The disciplinary process will be specific to the type of deficiency(s) associated with the map. Similar and dissimilar types of deficiencies shall be defined by primary

map categories identified in Table 1.1. There are four primary map categories. Within most of the categories, there are multiple subcategories. Any mapping deficiency identified within the subcategories of a category will be considered to be the same type. For example: If the deficiency associated with the first failing map was associated with an inappropriate depth assigned for an absorption rate (subcategory A3), and the deficiency associated with the second failing map was an inappropriate designation of a soil improvement practice (subcategory A5), the deficiencies would be considered the same type (Category A); and the second failing map would result in a step forward in the disciplinary process. Considering the same example for the first letter, but the second letter was the result of a deficiency associated with an inappropriate statement printed on the map (subcategory D4), the deficiencies would not be considered the same type; and the second failing map would actually be the first failing map for Category D.

TABLE 1.1
FIELD MAPPING SCORING PROCEDURE

Primary Map Category	Primary Map Subcategory	Point Value
A. Soil Classification	A1. Accordance with Soil Taxonomy and Official Soil Series Descriptions	25
	A2. Absorption Rate in Accordance with Appendix I	
	A3. Appropriate Depth Associated with Absorption Rate	
	A4. >75 MPI Soils Identified Correctly	
	A5. Appropriate Designation of Soil Improvement Practices	
B. Soil Map Unit Line Placement		25
C. Significant Features	C1. All Identified	25
	C2. Correctly Located	
D. Soil Notes	D1. Formatting and Legibility	25
	D2. Statement Omission	
	D3. Inappropriate Statements	
	D4. Legend and Symbols	
Total Points		100

The portion of points deducted from the total points for a category will be determined by the severity of the error. Minor errors or omissions shall be errors or omissions that: would not change whether a site was permitted or not; and, would not be expected to cause system failure due to under sizing. These types of errors or omissions (individually) would not typically result in a total loss of points for that category. However, multiple minor errors or omissions in a category may result in the loss of all points associated with a category. Minor errors or omissions are not limited to the above-listed examples. Major errors or omissions that would typically result in a total loss of points for that category, and result in a failing score for the map, would be those errors or omissions that: caused a system to be undersized to the degree that failure would be expected; caused a system to permitted in unsuitable soil; presented a soil as unsuitable when it was actually suitable; did not adequately identify soil improvement practices; and, misuse of variant label. Major errors or omissions are not limited to the above-listed examples.

It is possible for one map to be significantly deficient in more than one category. If this is the case, the deficiency that is furthest along in the disciplinary process will determine the disciplinary action.

Example letter types are included as Appendix C.

First Failing Map

The first failing map will result in a certified letter to the soil consultant. This letter will identify the notable deficiency(s) with the map and serve as a warning with respect to continued disregard for Soil Handbook mapping standards (Letter Type A).

Second Failing Map

If the date of the second failing map is earlier than the date of receipt for the letter associated with the first failing map a letter (Letter Type B) will be sent to the soil consultant. This letter will announce to the soil consultant that all soil maps (old and new) prepared by the soil consultant will be subject to review for that type of deficiency. Division Staff and Division Soil Consultants will conduct these reviews. Potential problems identified by Division Staff review will be forwarded to the appropriate Division Soil Consultant for consideration. All Division Soil Consultant reviews will result in a soil map score.

If the date of completion for the second failing map is after the date of receipt for the letter associated with the first failing map, the following disciplinary action will be taken. A certified letter (Letter Type C) will be sent to the soil consultant identifying the notable deficiency(s) of the soil map and its similarity to the deficiency(s) noted in the first letter. The soil consultant will be made aware that all new soil map submittals considered for permit issuance or subdivision approval will be reviewed for a period of one year. These soil maps must be submitted directly to a Division Soil Consultant who will conduct these reviews. All reviews will result in a soil map score.

Third Failing Map

If the third failing map was generated before the date of the letter identifying the first failing map, a certified letter (Letter Type B) will be sent to the soil consultant identifying the notable deficiency(s) of the soil map and its similarity to the deficiency(s) noted in the first letter. This letter will announce to the soil consultant that all soil maps (old and new) prepared by the soil consultant will be subject to review for that type of deficiency. Division Staff and Division Soil Consultants will conduct these reviews. Potential problems identified by Division Staff review will be forwarded to the appropriate Division Soil Consultant for consideration. All Division Soil Consultant reviews will result in a soil map score.

If the third failing map was generated after the date of the letter identifying the first failing map, but before the date of the letter identifying the second failing map, the following disciplinary action will be taken.

A certified letter (Letter Type C) will be sent to the soil consultant identifying the notable deficiency(s) of the soil map and its similarity to the deficiency(s) noted in the first and second letter. The soil consultant will be made aware that all new soil map submittals considered for permit issuance or subdivision approval will be reviewed for a period of one year. These soil maps must be submitted directly to a Division Soil Consultant. Division Soil Consultants will conduct these reviews. All reviews will result in a soil map score.

If three failing map scores of the same type are accrued by a soil consultant and the third failing map was generated following receipt of the letter identifying the second failing map, the soil consultant will be summoned for a show-cause meeting at the Division's Central Office. Notification of this meeting, and the circumstances necessitating the meeting, will be communicated to the responsible soil consultant by certified letter (Letter Type D). The results of this meeting will determine whether the soil consultant's approval remains intact, is suspended, or revoked.

All soil maps prepared prior to the date of receipt for the Letter D Type will be reviewed and used at the discretion of a Division Soil Consultant and DWR Central Office.

5.4 Suspension or Revocation

Division has the authority to confer upon the qualified candidates the status of approved soil consultants. Likewise, the Division, for the protection of the people and environment of the State of Tennessee, has not only the authority but also the responsibility of revoking the approval of recalcitrant approved soil consultants.

The Regulations state in Rule 0400-48-01-.18 (2) "The Department may revoke or suspend the approval of any soil consultant for the practice of any fraud or deceit in obtaining the approval or any gross negligence, incompetence or misconduct in the practice of soil evaluation or any continued disregard of evaluation criteria as

required by the Soils Handbook of Tennessee prepared by the Division of Water Resources. Any person whose approval as a soil consultant has been denied, suspended, or revoked may request a hearing before the Commissioner by making such request in writing within thirty (30) days of the date of his denial, suspension, or revocation. Any hearing granted under this section shall be conducted in accordance with the Uniform Administrative Procedures Act, compiled in Title 4, Chapter 5, Part 3 of Tennessee Code Annotated."

Any person whose approval has been suspended shall have the status of approved soil consultant reinstated on the first day after the suspension expires.

5.5 Reinstatement

If, after a period of one calendar year from the date of revocation from the list of approved soil consultants, the individual seeks to be considered for reinstatement the process, outlined in Section 1.0, (1.1-1.5) shall apply in its entirety.

If subsequent mapping products are found to be deficient, the above-described disciplinary process (Section 5.3) will be followed with the following exception: only two failing soil maps with the same type deficiency(s) are necessary to result in a Letter Type D.

Appendix A

List of Standard Symbols

Streams, Drainways and Water Features -

- Intermittent Streams or Drainways - the lines are to be in the centerline of the feature and the arrowheads are to point in the direction of water flow. On level sites, arrowheads may be placed on each end of the line if the flow direction cannot be accurately determined.

One Dot Drain:

This category includes areas having a more visible or defined drainway. The area of channelization is typically characterized as having a more distinct v-shaped cross-section and may or may not show any direct evidence of scouring on the ground surface. The contour of the landscape *will not allow* for the placement of SSDS field lines across the course of the drainway.

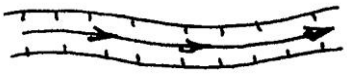
Two Dot Drain:

This category includes areas having distinctly visible drainways, 1 foot or greater in depth, with an obvious stream channel. The contour of the landscape will not allow for the placement of any SSDS lines across the course of the drainway due to the steepness of the slopes or the depth of the drainway.

- Perennial Streams - the lines with arrowheads are to be in the centerline of the feature and the arrowheads are to point in the direction of water flow.

Stream, less than 10 feet wide

Stream, 10 feet wide or wider



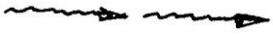
Stream, 10 feet wide or wider

The stream symbol would be shown in the centerline of the feature and the stream banks may be represented with an embankment symbol plotted according to the crest of the bank.

Miscellaneous Stream, Drainway and Water Features -

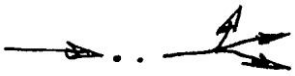
Change in Size of Drainway

The drainway changes in size, for example from a one dot drain to a three-dot drain, at the location of the short vertical cross line.



Erosional Drain

This category of drain describes a small, shallow drains (typically from 6 to 10 inches in depth) caused by activities of man.

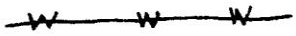


Drainway Ends, Water Flow Dissipates

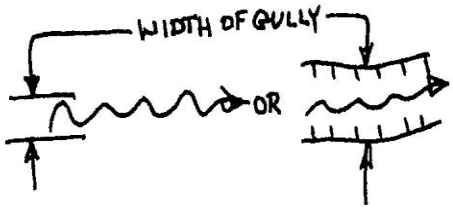
A plotted drainway, of any type and any obvious channel that the water was following along is no longer present, thus the water flow spreads out and dissipates.

Pond, Lake or Any Other Body of Water

The solid line denotes the water's edge.



Waterline (if known to be actual waterline)



Gully

The width of the symbol on the map shall be scaled to represent the width of the feature on the landscape or embankment symbols shall be plotted on the map to represent the actual edges of the feature on the landscape.

Spring

Well

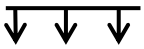
Wet Spot

Topographic Features -

Bedrock Escarpments
Arrows point down slope

Escarpments other than Bedrock
Arrows point down slope

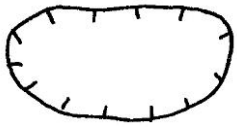
Short Steep Slope



Cutbank

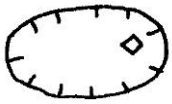
Agricultural Terrace

The solid line is to be plotted as the crest of the feature and the tick marks are to show the downslope side of the berm. The arrow lines are to be plotted to represent the bottom of the trough.



Closed Depression

This type of feature has no obvious surface outlet and typically shows evidence of ponding water, either after heavy rain events or seasonally.



Closed Depression with Throat

Small Sinkhole, Soil Pipe or Dropout

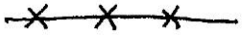
This symbol is to be used on these types of features where the diameter of the feature is 10 feet or less.

Miscellaneous Features, Natural and Cultural -

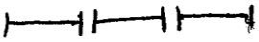
Rock Outcrops

Pile of Material

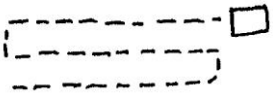
This symbol is to be plotted showing the limits of material piled on a mapping site, typically by a dozer clearing land. The material may consist of rock, fill material, vegetative debris, etc.



Fence (any type)

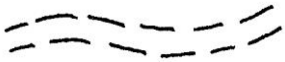


Buried Pipe (any type other than waterline)



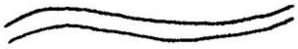
Septic Tank and Field Lines

If this feature cannot be accurately plotted, simply delineate the general area and show as a map unit.



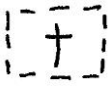
Vehicular Path

This symbol is to be utilized to show paths of vehicular traffic, such as a farm road, found on the land surface.



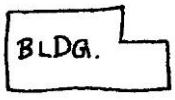
Ground Surface Road

This type of road may be paved or gravel (e.g.) driveways or roads).



Cemetery

The perimeter of the cemetery is to be plotted as accurately as possible.



Building or Structure (any type)

The perimeter of the building or structure is to be plotted as accurately as possible

Appendix B

Division Staff Soil Map Checklist

Soil Map Name: _____

Soil Map Location: _____

County: _____ Date of Completion: _____

Soil Consultant: _____

Type of Soil Map: General High Intensity Extra-High Intensity

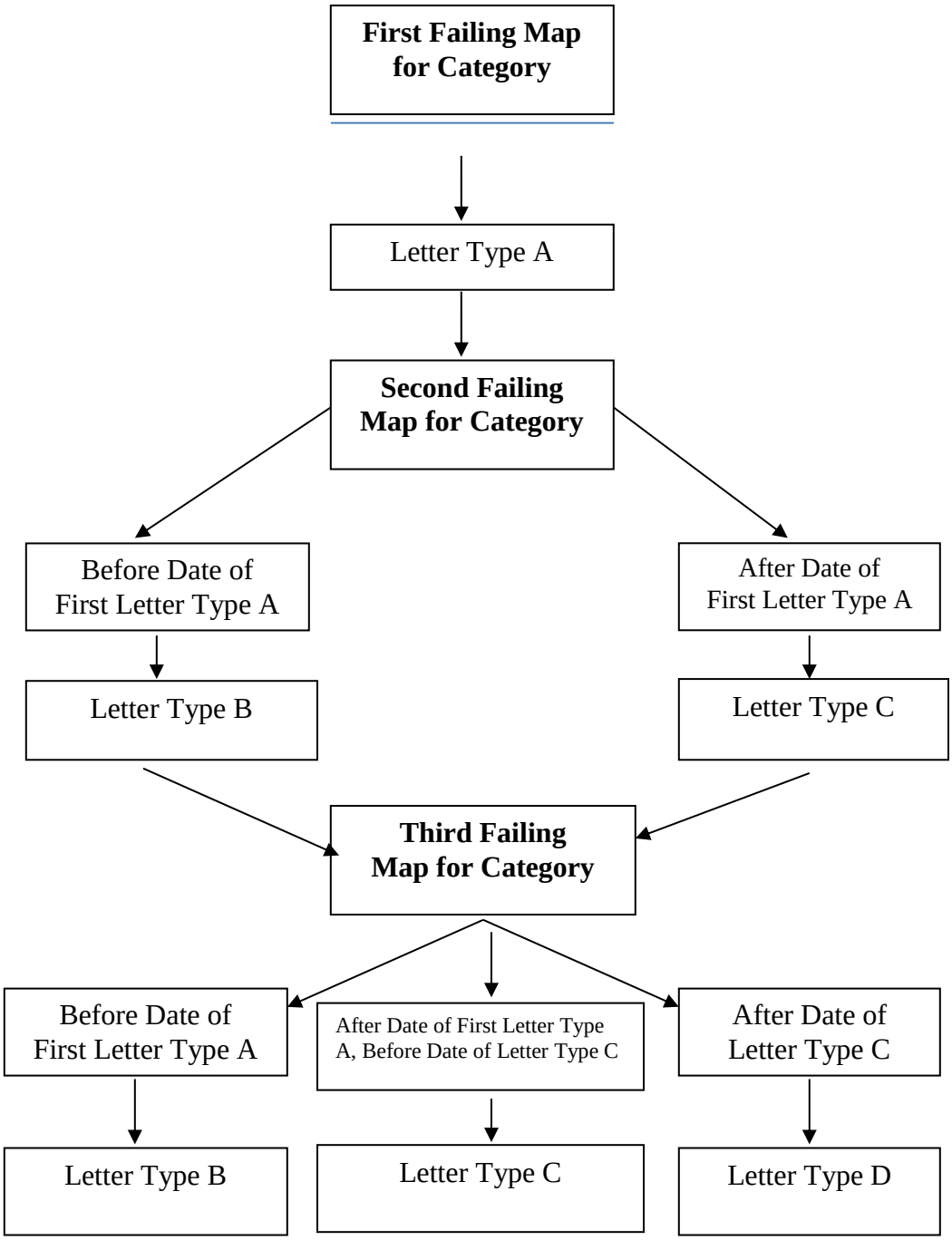
Base Map Criteria	Yes	No
North Arrow	☐	☐
Vicinity Map	☐	☐
Signature and Seal of Surveyor (Except on Sketch Maps)	☐	☐
Certificate of Accuracy (Except on Sketch Maps)	☐	☐
Two Original Copies Submitted	☐	☐
Appropriate Scale	☐	☐
No Inappropriate Statements or Disclaimers on Map	☐	☐

Soil Map Criteria		
Soil Notes on Map	☐	☐
Appropriate Note Format	☐	☐
Legible Notes	☐	☐
Appropriate Statements on Soil Map	☐	☐
No Inappropriate Statements or Disclaimers on Soil Map	☐	☐
Assigned Absorption Rates Meet or Exceed (Slower) Rates In Appendix I	☐	☐
Boundary of Mapped Area Adequately Defined	☐	☐
Appropriate Map Unit Labels	☐	☐
Symbols Used On Soil Map Are Defined In Legend	☐	☐
Symbols Not Used On Soil Map Are Not Included In Legend	☐	☐
Appropriate Slope Class Identified In Soil Notes	☐	☐
Appropriate Line Size for Soil Boundaries	☐	☐
Only Soil Notes Appropriate For That Map Are To Be Presented On the Map	☐	☐
Profile Description for Soil Variants	☐	☐

Greater Than 75 MPI Soils Identified As To Suitability for Percolation Tests	☐	☐
Soil Improvement Practices Explained	☐	☐
Each Map Displays Stamp over Soil Consultant Signature and Completion Date	☐	☐
Adequate Soil Area Relocation Information (Sketch Map)	☐	☐
Minimum of 20,000 square feet of soil Area mapped for each lot	☐	☐
Soils Consultant on Approved List	☐	☐
Signature of Soil Consultant and Completion Date in Blue Indelible Ink	☐	☐

Appendix C

Figure 5.1
Disciplinary Flow Chart



Letter Type A - Identify deficiency(s) and warn soil consultant regarding continued disregard.

Letter Type B - Identify deficiency(s), announce that all work (old and new) is subject to review and warn soil consultant regarding continued disregard.

Letter Type C - Identify deficiency(s), announce that all new submittals will be reviewed for a period of one calendar year and subject to review after one year, warn soil consultant regarding continued disregard.

Letter Type D - Identify deficiency(s), request show cause meeting to determine status of approval.

RE: *SOIL CONSULTANT*
MAP NAME
MAP *DATE*
LOCATION
COUNTY

Dear *SOIL CONSULTANT*,

On *DATE,* a quality control review event was conducted involving the above-described soil map. Participants in this event were *ALL PARTICIPANTS*, and I.

This review was conducted as a *non-routine or routine* quality control event. If non-routine, the reason for this review was due to *PROBLEMS IDENTIFIED AT THE TIME OF PERMIT ISSUANCE, PROBLEMS ENCOUNTERED DURING SYSTEM CONSTRUCTION, FAILING SYSTEM ….*.

The score resulting from this review (*SCORE*) was passing however, some deficiencies were identified:

1.
2.

If you would like to arrange a time to meet with me on site to discuss these deficiencies, please contact me at *PHONE NUMBER*. The above-listed score is not subject to contest.

While the identified deficiencies did not result in a failing map score, continued disregard of the mapping standards associated with these map attributes may result in failing map scores.

OR

The score resulting from this event was failing (*SCORE*). The primary deficiencies resulting in this score were:

1.
2.

If you wish to contest the score of this map, please contact me in writing within 30 calendar days of your receipt of this letter. If you decide not to contest the map score, it will be deemed final following the 30-day period. If finalized, you will be notified by letter. The Central Office will be copied on this letter and disciplinary action will be initiated.

Sincerely,

Division Soil Consultant
DWR Central Office

Copy: Regional Office

RE: *SOIL CONSULTANT*
MAP NAME
MAP *DATE*
LOCATION
COUNTY

Dear *SOIL CONSULTANT*,

On *DATE*, we received your letter of contest for the map score associated with the above-described soil map. On *DATE,* we met at the property to provide you the opportunity to defend the map. Because of the meeting, the (*map score was modified to a passing score*) or (*the map score remained the same*).

If you wish to continue contesting the score of this map, please contact me in writing within 30 calendar days of your receipt of this letter. If you decide not to contest the map score, it will be deemed final following the 30-day period. If finalized you will be notified by letter, and the Central Office will be copied. The Central Office will initiate disciplinary action.

Sincerely,

Division Soil Consultant
DWR Central Office

Copy: Regional Office

RE: *SOIL CONSULTANT*
MAP NAME
MAP *DATE*
LOCATION
COUNTY

Dear *SOIL CONSULTANT*,

On *DATE*, we received your second letter of contest for the map score associated with the above-described soil map.

On *DATE and TIME*, Division Soil Consultant, *PARTICIPANTS* will meet with me at the site. You are welcome to attend this meeting. The score resulting from this meeting will be considered final and not subject to further state review. If you intend to submit laboratory data to support your continued contest of the map score, it will be necessary for you to arrange to have the data available at the time of this meeting.

If, following consideration by multiple state soil consultant supervisors, the score for the map continues to be a failing score you will be notified by letter, and the Central Office will be copied. The Central Office will initiate disciplinary action.

Sincerely,

Division Soil Consultant
DWR Central Office

Copy: Regional Office

RE: *SOIL CONSULTANT*
MAP NAME
MAP *DATE*
LOCATION
COUNTY

Dear *SOIL CONSULTANT*,

On *DATE*, Division Soil Consultant, *PARTICIPANTS*, and I visited the above-described location to assess the failing score earlier assigned to your soil map. Based on our review the failing score was upheld. This letter is to inform you of this finalized failing map score (*SCORE*). A copy of this letter will be forwarded to the Central Office for disciplinary action.

The category type(s) for this failing map is Category *A, B, C, D*.

Sincerely,

Division Soil Consultant
DWR Central Office

Copy: Regional Office
Central Office

RE: *SOIL CONSULTANT*
MAP NAME
MAP *DATE*
LOCATION
COUNTY

Dear *SOIL CONSULTANT*,

On *DATE,* a quality control review event was conducted involving the above-described soil map. Participants in this event were *ALL PARTICIPANTS*, and I.

This review was conducted as a *non-routine or routine* quality control event. If non-routine, the reason for this review was due to *PROBLEMS IDENTIFIED AT THE TIME OF PERMIT ISSUANCE, PROBLEMS ENCOUNTERED DURING SYSTEM CONSTRUCTION, FAILING SYSTEM ….*.

The score resulting from this review (*SCORE*) was passing however, some deficiencies were identified:

1.
2.

If you would like to arrange a time to meet with me on site to discuss these deficiencies, please contact me at *PHONE NUMBER*. The above-listed score is not subject to contest.

While the identified deficiencies did not result in a failing map score, continued disregard of the mapping standards associated with these map attributes may result in failing map scores.

OR

The score resulting from this event was failing (*SCORE*). The primary deficiencies resulting in this score were:

1.
2.

If you wish to contest the score of this map, please contact me in writing within 30 calendar days of your receipt of this letter. If you decide not to contest the map score, it will be deemed final following the 30-day period. If finalized, you will be notified by letter. The Central Office will be copied on this letter and disciplinary action will be initiated.

Sincerely,

Division Soil Consultant
DWR Central Office

Copy: Regional Office

RE: *SOIL CONSULTANT*
MAP NAME
MAP *DATE*
LOCATION
COUNTY

Dear *SOIL CONSULTANT*,

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If you wish to continue contesting the score of this map, please contact me in writing within 30 calendar days of your receipt of this letter. If you decide not to contest the map score, it will be deemed final following the 30-day period. If finalized you will be notified by letter, and the Central Office will be copied. The Central Office will initiate disciplinary action.

Sincerely,

Division Soil Consultant
DWR Central Office

Copy: Regional Office

RE: *SOIL CONSULTANT*
MAP NAME
MAP *DATE*
LOCATION
COUNTY

Dear *SOIL CONSULTANT*,

On *DATE*, we received your second letter of contest for the map score associated with the above-described soil map.

On *DATE and TIME*, Division Soil Consultant, *PARTICIPANTS* will meet with me at the site. You are welcome to attend this meeting. The score resulting from this meeting will be considered final and not subject to further state review. If you intend to submit laboratory data to support your continued contest of the map score, it will be necessary for you to arrange to have the data available at the time of this meeting.

If, following consideration by multiple Division Soil Consultants, the score for the map continues to be a failing score you will be notified by letter, and the Central Office will be copied. The Central Office will initiate disciplinary action.

Sincerely,

Division Soil Consultant
DWR Central Office

Copy: Regional Office

RE: *SOIL CONSULTANT*
MAP NAME
MAP *DATE*
LOCATION
COUNTY

Dear *SOIL CONSULTANT*,

On *DATE*, Division Soil Consultant, *PARTICIPANTS*, and I visited the above-described location to assess the failing score earlier assigned to your soil map. Based on our review the failing score was upheld. This letter is to inform you of this finalized failing map score (*SCORE*). A copy of this letter will be forwarded to the Central Office for disciplinary action.

The category type(s) for this failing map is Category *A, B, C, D*.

Sincerely,

Division Soil Consultant
DWR Central Office

Copy: Regional Office
Central Office

TDEC - DWR Soil Pedon Description Form

Described By: Date:

Site Name & Location: County:

Stop or Pit #: SOP # (office use only):

Soil Series: Drainage Class:

Soil Control Section: Ground Water or Water Table:

Parent Material: Erosion:

Climate: Land Cover:

Slope of Map Unit: Slope of Pit:

Geomorphic Description: Latitude/Longitude (Center of soil area):

Physiographic Location:

Additional Notes:

Soil Pedon Description

Horizon	Depths	Matrix Color	Depletions/Concentrations Redox/Mottles, etc.	Depth to Low Chroma Mottles	Soil Texture	Soil Structure			Soil Horizon Notes
						Grade	Size	Type	

Appendix E

(SOIL) STRUCTURE - GRADE

Grade	Code	Criteria
Structureless	0	No discrete units observable in place or in hand sample.
Weak	1	Units are barely observable in place or in a hand sample.
Moderate	2	Units well-formed and evident in place or in a hand sample.
Strong	3	Units are distinct in place (undisturbed soil), and separate cleanly when disturbed.

(SOIL) STRUCTURE - SIZE

Size Class	Code Conv.	Code NASIS	Criteria: structural unit size [1] (mm) Granular Platy [2] Thickness	Columnar, Prismatic, Wedge [3]	Angular & Subangular Blocky
Very Fine (Very Thin)[2]	vf (vn)	VF (VN)	< 1	< 10	< 5
Fine (Thin) [2]	f (tn)	F (TN)	1 to < 2	10 to < 20	5 to < 10
Medium	m	M	2 to < 5	20 to < 50	10 to < 20
Coarse (Thick) [2]	co (tk)	CO (TK)	5 to < 10	50 to < 100	20 to < 50
Very Coarse (Very Thick) [2]	vc (vk)	VC (VK)	≥ 10	100 to < 500	≥ 50
Extr. Coarse	ec	EC	—	≥ 500	—

[1] Size limits always denote the smallest dimension of the structural units.
[2] For platy structure only, substitute *thin* for *fine* and *thick* for *coarse* in the size class names.
[3] Wedge structure is generally associated with Vertisols (for which it is a requirement) or related soils with high amounts of smectitic clays.

(SOIL) STRUCTURE

(Soil) Structure is the naturally occurring arrangement of soil particles into aggregates that results from pedogenic processes. Record **Grade**, **Size**, and **Type**. For compound structure, list each **Size** and **Type**; e.g., *medium and coarse SBK parting to fine GR*. Lack of structure (structureless) has two end members: *massive (MA)* or *single grain (SG)*. A complete example is: *weak, fine, subangular blocky* or *1, f, sbk*.

(SOIL) STRUCTURE - TYPE (formerly **Shape**) -

Type	Code Conv.	Code NASIS	Criteria: (definition)
NATURAL SOIL STRUCTURAL UNITS (pedogenic structure)			
Granular	gr	GR	Small polyhedrals, with curved or very irregular faces.
Angular Blocky	abk	ABK	Polyhedrals with faces that intersect at sharp angles (planes).
Subangular Blocky	sbk	SBK	Polyhedrals with sub-rounded and planar faces, lack sharp angles.
Platy	pl	PL	Flat and tabular-like units.
Wedge	—	WEG	Elliptical, interlocking lenses that terminate in acute angles, bounded by slickensides; not limited to vertic materials.
Prismatic	pr	PR	Vertically elongated units with flat tops.
Columnar	cpr	COL	Vertically elongated units with rounded tops which commonly are "bleached".
STRUCTURELESS			
Single Grain	sg	SGR	No structural units; entirely noncoherent; e.g., loose sand.
Massive	m	MA	No structural units; material is a coherent mass (not necessarily cemented).
ARTIFICIAL EARTHY FRAGMENTS OR CLODS [1] (non-pedogenic structure)			
Cloddy [1]	—	CDY	Irregular blocks created by artificial distur bance; e.g., tillage or compaction.

[1] Used only to describe oversized, "artificial" earthy units that are not pedogenically derived soil structural units; e.g., the direct result of mechanical alteration; use **Blocky Structure Size** criteria.

(Field Book for Describing and Sampling Soils Version 2.0 NRCS)

1.

Presoaking Data	
Date	Time

DEPARTMENT OF ENVIRON[illegible] AND CONSERVATION
DIVISION OF GROUND WATER PROTECTION

REPORT OF SOIL ABSORPTION TEST

2. Sheet _____ of _____

3. Date _____

4. _____
Location (Subdivision Name or Number, Lot Number or Street Numbers, County and/or Town)

5. _____
Owner/Developer

6. _____
Address

Lot and Hole No.	Hole Depth In.	Depth to Gravel In.	Depth Pre-Soak Water In.	Initial Water In.	Initial Time	PERIODIC CHECK TIMES																Final Period		Min. Per In.
						FIRST		SECOND		THIRD		FOURTH		FIFTH		SIXTH		SEVENTH		FINAL				
						DB / DA	T	DB / DA	T	DB / DA	T	DB / DA	T	DB / DA	T	DB / DA	T	DB / DA	T	DB / DA	T	Fall In.	Time Min.	
7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

Remarks _____

_____ _____
Engineer/Architect/Surveyor/Soil Scientist

CN-0774 (Rev. 7-94)

RDA Pending