Cuyahoga County Board of Health

Site and Soil Evaluation for Sewage Treatment and Dispersal

INSTRUCTIONS

The form for ***Site and Soil Evaluation for Sewage Treatment and Dispersal*** *provides a standard format to record detailed information on site conditions, soil characteristics and limitations, and risk factors associated with a site and surrounding area. These instructions inform the soil and site evaluator and other parties of the information to be included the attached form. Appendix 1 includes a list of resources including how to purchase the* **USDA/NRCS Field Book for Describing and Sampling Soils, Version 2.0** *that should be used as a supplement to these instructions. Appendix 2 provides information on loading rate estimates and includes a copy of the* **Tyler Table** *that should be used to determine the approximate size and configuration needed for a soil absorption area given specific site conditions and soil characteristics.*

The sewage treatment system (STS) location and design will be based on the information provided by the site and soil evaluation and, therefore, significant emphasis should be placed on correctly documenting soil characteristics and site conditions. A site and soil evaluator shall be capable of properly conducting site and soil investigations and accurately recording required information. This rule further states that demonstration of competency may include, but is not limited to, certification as a professional soil scientist by the Association of Ohio Pedologists or ARCPACS. Whoever conducts a soil and site evaluation to be used for the purpose of STS siting and design is required to use the attached form and instructions in compliance with all STS rule provisions as applicable.

Location and Applicant: Record the site location including the county, township, road and the nearest crossroad or the property address if available from the applicant. This information is important to assure that the evaluated site location is properly identified. Accurate location details will promote easier identification of the site on soil maps and other mapping resources. The applicant information should be provided by the person requesting the evaluation and recorded on the form. If available, the tax parcel number for an existing lot or the lot number assigned to a proposed subdivision lot should be recorded.

Test Hole Designation: Record the number or other designation used to identify the test hole location on both the form and the site plan or drawing required in accordance with Cuyahoga County Board of Health Sewage Treatment System Rules Section 6(B)(1). Each soil description is recorded on a separate form. At least two forms must be completed per lot with a minimum of one evaluation adjacent to each of the two locations that may be used for the primary and replacement areas. If GPS coordinates are taken for a test hole location, these can be provided as a "Latitude / Longitude" value in the space provided on the form.

Method of gathering soil information is designated as a Pit, Auger, or Probe. In order to observe soil details and variations in the soil profile, at least one excavated test pit should be evaluated adjacent to each absorption area. Auger and/or probe borings or test holes should be made in the proposed absorption areas to verify test pit observations. A professional soil scientist may demonstrate the competency and ability to evaluate and document the soil characteristics and variability of a soil at a particular site using a combination of auger, probe, and experience, but where shallow bedrock and/or a significant volume of rock and other fragments are present a test pit should be used to observe the actual depth to bedrock and/or rock features regardless of the status of the evaluator.

Excavate the test pit adjacent to the soil absorption area avoiding the down slope area. When excavating a test pit with a backhoe or other heavy equipment, do not excavate during wet periods or any time when there is risk of disturbance or compaction of the soil. Do not track equipment across the proposed soil absorption area. Compaction and damage to the soil structure will decrease the capacity for treatment and water

movement in the soil beneath and down slope of the STS. Follow OSHA requirements for excavation dimensions and wall slope. Sands are generally less stable than clays. If there are any concerns over stability do not enter the pit.

Land Use / Vegetation: Record the land use or vegetative cover found at the soil description location using terms such as mature woods, dense immature woods, scattered scrub, pasture, fallow field, most recent crop, lawn, etc. An understanding of the different vegetation types such as those that grow in wet areas versus well drained soils can help in identifying the more suitable areas of the site for sewage treatment and dispersal. For proper observation of the surface drainage patterns on the site, areas with dense vegetation should be bush hogged prior to evaluation when the soil is not subject to compaction.

Landform and Position on Landform: Areas for soil absorption should be selected where the site and soils are expected to be suitable for treatment and dispersal and length along the contour can be maximized. Use applicable terms provided on the back of the form to record landforms and positions or refer to additional descriptions in the **USDA-NRCS Field Book for Describing and Sampling Soils.** The evaluation of landforms and slopes provides an opportunity for consideration of preferred landscape positions as well as discussion with landowners, builders, and/or developers regarding the relative location of the home and other structures.

Percent Slope and Shape of Slope: Record slope as a percentage. Slope is important in estimating a linear loading rate and the percent slope will influence system and component selection. The shape of the slope is recorded using the standard terms provided on the back of the form. Ideally the shape of the slope should be described in two directions, first the up-and-down slope (perpendicular to the contour) and the across slope (parallel to the contour); e.g. Linear, Convex. The shape of the slope, particularly concave and complex slopes, should alert a system designer to potential challenges at the site.

Date and Evaluator Information: Record the date the evaluation was conducted at the site. If the site investigation was conducted over a period of days, each date that the evaluator was at the site should be recorded. The name of the person conducting the site evaluation should be legibly printed with the signature and a contact phone number provided. If the work conducted by the evaluator is associated with a private business, company information can be provided in the space provided below the evaluator line. Room is also provided for designation of certification if applicable. Additional contact information including a mailing address, fax number, and e-mail address may be provided.

Soil Description

Provide at least one detailed soil description for each soil absorption area and more as needed to record the variation at the site. If only one soil description is provided for a soil absorption area and variation was found in related test holes for that area, record the most limiting factors in the soil description for that area. Use the terms provided on the back of the form to report soil description information on horizons, texture, structure and consistence. Other standard terms for describing soils can be found in the **USDA-NRCS Field Book for Describing and Sampling Soils**.

Soil Profile: At a minimum, record the master horizon designations in the first column. The common horizon suffixes and modifiers denoted on the back of the form should be used when the evaluator can properly apply these terms. Use the second column to record the top and bottom depth in inches from the ground surface for each described layer of the soil profile.

Estimating Soil Saturation: Record descriptions of the soil matrix color and any concentrations or depletions as observed from moist broken soil surfaces using the Munsell color notations for hue, value and chroma. Redoximorphic features resulting from the reduction, movement, and oxidation of iron can be observed as the

characteristic red (concentrations) and gray (depletions) common in many of Ohio soils. Reduction depletions are soil features that show evidence of loss of iron as recognized by gray colors in the matrix, or gray clay films, or both. For most soils, gray colors have value ≥4 and chroma ≤2, but for sandy *(sands and loamy sands textures)* soils chroma may be ≤3.

Caution must be taken in soils with dark surface underlain by a gray horizon. Because the organic matter in the surface is the dominant pigmenting agent the reduced iron is not visible. Generally oxidized root channels occur and are visible and should be used as indicators of oxidation/reduction.

Some low chroma colors are concentrations. Colors in the value/chroma range of 2/1 and 3/2 are manganese oxides and iron-manganese oxides. Since manganese accepts electrons prior to iron the manganese oxides need to be documented in the concentrations column.

To discern the kind of water table, it is important to identify the matrix color and/or concentrations and depletions in combination with the presence or absence of a layer in the soil above which effluent in saturated flow is expected to move laterally:

Apparent water table (Endo-saturation) - soil is saturated in all layers. Endo-saturated soils have a water table that rises as the ground water rises during the winter and early spring. No separation can be made between the water table in the soil and the ground water.

Perched water table (Epi-saturation) - soil is saturated with water in one or more layers within ~80 inches of the soil surface and also has one or more unsaturated zones with an upper boundary above that depth. The perched saturated zone is separated and disconnected from underlying ground water.

Estimating Soil Permeability: Record the specified information for texture, structure and consistence.

Texture – classifies the amount of sand, silt and clay particles in the soil (and any fragments).

Class - Record the textural class using the USDA textural triangle. An abbreviation list is on the back of the form. All sands, loamy sands, and sandy loam textures must have a sand modifier as indicated on the **Tyler Table** (see Appendix 2). When the coarse fragment content is ≥15% then a coarse fragment modifier must be used as provided on the back of the form.

Approximate % Clay - Estimate and record the clay percentage. Clay percentages can be used to assess the need to adjust loading rates or to assess if a high clay content layer should be addressed as a restrictive layer for design purposes. A professional soil scientist can generally estimate clay percentages within 5%. Others should at least be able to determine when a soil horizon has greater than 45% clay (see section below on Depth to Restrictive Layer).

Approximate % Rock and Other Fragments - Record the percent fragments by volume. Rock fragments or other coarse fragments (anything >2 mm in size) can cause either an increased or decreased permeability rate depending on the method of application to the infiltrative surface, amount of void space, material in void space and kind of fragments.

Structure – describes the naturally occurring arrangement of soil particles. Usually soils with defined structure have better permeability. An exception to this is platy structure, which is indicative of compaction formed through natural or anthropogenic processes. The **USDA-NRCS Field Book for Describing and Sampling Soils** has resources to assist in the determination of size and type designations.

Grade - Use the Arabic numerals listed in the grade table on the back of the form.

Size - Use the abbreviations associated with the terms on the back of the form.

Type (shape) – Use the abbreviations associated with the terms on the back of the form.

Consistence - Soil consistence refers to "attributes of soil material as expressed in degree of cohesion and adhesion or in resistance to deformation on rupture" (Soil Survey Manual). Consistence affects treatment and dispersal including water holding capacity and retention time in the soil. The loading rate table in Appendix 2 considers any layer or horizon with a moist consistence greater than firm to be a restrictive layer. Refer to the **USDA-NRCS Field Book for Describing and Sampling Soils** to determine the force needed to characterize consistence.

Other Soil Features: Record any information that may be relevant to STS design or a determination of risk factors for the site. The evaluator should indicate conditions that are atypical for the soil series and should identify soil characteristics that may be mistaken for redoximorphic features. An evaluator may choose to add more detailed soil information such as effervescence indicating a high carbonate content soil layer that may be only slightly weathered and not conducive to effluent treatment. Information on the % depletions associated with redoximorphic features may also be recorded here to provide some indication of the degree of saturation, particularly if there are "few" depletions with gray colors in $\leq$2% of the matrix color.

Limiting Conditions

Record the depth to each limiting condition in inches from the surface of the ground to the limiting condition. If only one test pit is excavated for an absorption area, at least two additional borings or test holes should be made to confirm the depths to each limiting condition. The shallowest observed depth to a limiting condition should be recorded.

Depth to Saturation (Water Table): Descriptions of saturation include a perched seasonal water table or an apparent water table which includes normal ground water (see the section above for Estimating Soil Saturation). Identification of a gray matrix color or depletions having >2% gray colors in the matrix are considered evidence of saturation as a limiting condition. In the case of a perched water table, the associated perching layer must be recorded by horizon designation or depth in the space provided for descriptive notes.

Depth to Highly Permeable Material: A highly permeable material is designated where effluent is expected to move too quickly to provide the retention time necessary for adequate treatment. A description of the type of highly permeable material is recorded using terms such as gravelly loamy sand (15 to <35 % fragments). Highly permeable material is considered to be a limiting condition for soils with loamy sand or coarser textures (see first row under texture on the **Tyler Table**) having $\geq$15% fragments. For other textures, soil horizons having greater than 50% by volume rock or other fragments are considered to be limiting. This information is included in the soil description details under texture.

Depth to Bedrock: A description of the type of bedrock formation is recorded using terms such as unfractured bedrock, fractured limestone, massive sandstone, flaggy shale, etc. Bedrock may have a solid surface allowing saturated flows to move laterally or may have fractures that allow for rapid vertical movement of effluent. Weathered or soft bedrock is typically designated as a Cr horizon and may or may not be a limiting depending on the amount and type of fines, void space, and type of bedrock.

Depth to Restrictive Layer: A restrictive layer is designated where effluent in saturated flow is expected to move laterally. Referring to Appendix 3, the 0.0 gal/da/ft^2 infiltration loading rates on the **Tyler Table** should be considered as restrictive layers. A description of the type of restrictive layer is recorded using terms such as dense glacial till, soil texture with >45% clay, dense lacustrine sediment, fragipan, compacted material or other restrictive layers such as horizons with consistence stronger than firm.

Remarks / Risk Factors

The evaluator is responsible for assessing and documenting risk factors associated with the site. Any additional soil or site features that may influence treatment or dispersal are documented here. Record on the form and indicate on the site plan or site drawing the location of any visible or known surface and subsurface drainage features such as water impoundments, ravines, swales, eroded areas, drainage tiles, sink holes, karst, springs, or seeps that are present within 100 feet of a described soil absorption area. Designate on the site plan or site drawing the areas for which each soil profile description is representative (see **Designation of Absorption Areas on Site Plan or Site Drawing** below) and designate any areas with conditions that would prohibit or impact the siting of an STS such as the drainage features described above.

In most cases, the primary health risk associated with STS is the potential for pathogen contamination. In some areas there could be both a health and environmental concern related to nutrient contamination, primarily associated with nitrogen, and possibly phosphorus. The assessment of risk factors should receive increased attention when a site and soil evaluation process involves multiple lots or larger subdivision proposals. Identifying risk factors is very important in areas of high STS density, particularly where there is also a high density of private water systems or the site location is within a source water protection area.

Resources that may be useful for considering risk factors include the county soil surveys, USGS topographic maps, aerial photographs, well logs, source water protection assessments, wetland inventories, state and USGS geologic and hydrologic maps such as DRASTIC maps showing groundwater pollution potentials, and the DCMS 24 map of known and probable karst in Ohio. Many of these resources are now available in digital form and are accessible on the web. These resources are general and cannot be substituted for a site investigation and should be used to provide the evaluator with an understanding of what might be encountered at the site.

Designation of Absorption Areas on Site Plan or Site Drawing

The dimensions (length and width) of at least two soil absorption area locations should be shown on the plan or drawing accompanying the site and soil evaluation forms. If the representative area for a soil profile description is large enough to accommodate multiple locations for siting a soil absorption area, this can be noted, but the dimensions must still be provided. The evaluator designates the dimensions of the soil absorption area locations as follows:

1. To calculate an absorption area, the evaluator must designate a minimum anticipated daily design flow. Unless specified by the owner for a planned home or provided by a local health district as a minimum default value for proposed lots or subdivisions, use a conservative daily design flow value of at least 480 gallons per day (gpd) for a four bedroom home based on 120 gpd/bedroom.

2. Applying soil characteristic from the evaluation to the **Tyler Table**, determine the soil absorption area using the most conservative applicable value for an infiltration loading rate. To calculate the area, divide the daily design flow by the infiltration loading rate.

3. Applying percent slope and the most conservative infiltration distance from the evaluation to the **Tyler Table,** determine the minimum length parallel to the land contour using the applicable linear loading rate. To calculate the length, divide the daily design flow by the linear loading rate.

4. Calculate a width by dividing the area by the length. Additional width must be available to accommodate the area needed for multiple design options including the spacing between leaching trenches, 3:1 side slopes on mounded systems, and/or down slope or perimeter areas needed to address horizontal subsurface flow due to shallow limiting conditions in the soil profile. To accommodate multiple system options, use a designated soil absorption area width of at least five times the calculated width.

This process of determining dimensions will enlarge the designated locations beyond the calculated absorption area in step 2. As noted in step 4, this is necessary to assure that there will be adequate area available to allow for consideration of multiple design options.

Appendix 1 Resources

USDA/NRCS Field Book for Describing and Sampling Soils, Version 2.0
ftp://ftp-fc.sc.egov.usda.gov/NSSC/Field_Book/FieldBookVer2.pdf
Order information
http://soils.usda.gov/technical/fieldbook/

Soil and Site Evaluation for Onsite Wastewater Treatment
The Ohio State University Extension Bulletin 905
http://ohioline.osu.edu/b905/index.html
Order information
http://www.ag.ohio-state.edu/~buckpubs/foagbe.htm

ASTM Standards
http://www.astm.org/cgi-bin/SoftCart.exe/index.shtml?E+mystore
Standard Practice for Surface Soil Characterization for On-Site Septic Systems, D 5879-95
Standard Practice for Subsurface Site Characterization of Test Pits for On-Site Septic Systems

Glossary of Soil Science Terms
http://www.soils.org/sssagloss/

Association of Ohio Pedologists homepage
http://www.ohiopedologist.org/index.htm
Association of Ohio Pedologists consultants list
http://www.ohiopedologist.org/Information/ConsultantBrochure.pdf
Association of Ohio Pedologists Certified Soil Scientists
http://www.ohiopedologist.org/Cert.htm

ODNR Division of Soil & Water Conservation soils information
http://ohiodnr.com/soilandwater/inv+eval.htm
Soil Regions of Ohio
http://ohiodnr.com/soilandwater/soils/soilreg1.htm

USDA Natural Resources Conservation Service soils information (Ohio site)
http://www.oh.nrcs.usda.gov/technical/soils/index.html

USDA/NRCS Web Soil Survey
http://websoilsurvey.nrcs.usda.gov/app/

USDA/NRCS Soil Data Mart
http://soildatamart.nrcs.usda.gov/

USDA/NRCS Soil Taxonomy
http://soils.usda.gov/technical/classification/taxonomy/

Official Soil Series Descriptions
http://soils.usda.gov/technical/classification/osd/index.html

Guide for estimating saturated hydraulic conductivity from texture and bulk density
http://soils.usda.gov/technical/handbook/contents/part618p5a.html.

Guide for estimating infiltration rates from texture, structure and consistence
http://www.soils.wisc.edu/sswmp/SSWMP_4.42.pdf

Appendix 2 Tyler Table

The loading rate table provided at the end of this appendix should be of interest in understanding the relationship between site evaluation information and STS design considerations. Table 1 is reprinted from the following published documents available through the Small Scale Waste Management Project (SSWMP) at University of Wisconsin, Madison. The papers provide a detailed explanation of the development and use of this loading rate table in Ohio.

Hydraulic Wastewater Loading Rates to Soil. E. J. Tyler. 2001. Proceedings of the 9th International Symposium on Individual and Small Community Sewage Systems. ASAE. Saint Joseph, MI. P.80-86. http://www.soils.wisc.edu/sswmp/SSWMP_4.43.pdf

Designing with Soil: Development and Use of a Wastewater Hydraulic Linear and Infiltration Loading rate Table. E. Jerry Tyler and Laura Kramer Kuns. 2000. Conference Proceedings. NOWRA. Grand Rapids, MI. http://www.soils.wisc.edu/sswmp/SSWMP_4.42.pdf

The selection of a soil loading rate or basal loading rate (referred to as infiltration loading rate in Table 1) and a linear loading rate (referred to as hydraulic linear loading rate in Table 1) shall be justified in an HSTS layout plan or an STS design plan. The following shall be considered when utilizing the values provided in the references cited in this appendix:

1. Table 1 values assume a higher daily design flow than that established in this chapter. Daily design flows generally include a margin of safety and usually are specified as peak flows. Selected loading rate values may differ depending on the incorporation of other safety factors. Some designs may include a means to attenuate peak flows and limit the actual daily flow to a volume significantly less than the peak daily design flow.

2. Table 1 values are estimates. Many factors should be considered when selecting loading rates, starting with close attention to the information from the site and soil evaluation for the specific site selected for the soil absorption component. Other factors include but are not limited to the type of soil absorption component and its configuration and landscape position.

3. Some of the spaces in Table 1 have values of 0.0 for the infiltrative loading rate or are blank for hydraulic loading rate values. Table 1 also does not account for depths of less than eight inches to a limiting condition. This indicates that the site conditions that relate to these circumstances could be unsuitable or very challenging for STS performance. Very conservative loading rates should be selected for such site conditions when an STS is not otherwise prohibited.

   When there is a Table 1 designation of 0.0 gal/da/ft^2 for the infiltration loading rate, the soil should be considered as a limiting condition. The blank spaces on Table 1 in the columns for hydraulic linear loading rate correspond to the designations of 0.0 gal/da/ft^2 for the infiltration loading rate.

   Under conditions of infiltration distances of less than eight inches to a perched seasonal high water table where a STS may be sited in accordance with the variance provisions of OAC 3701-29-13(D), a very conservative hydraulic linear loading rate should be selected in the context of the loading rates presented in Table 1.

Table 1. Infiltration rates in gal/da/ft^2 for wastewater of >30 mg/L * or wastewater of <30 mg/L * and hydraulic linear loading rates in gal/da/ft for soil characteristics of texture and structure and site conditions of slope and infiltration distance. Values assume wastewater volume of >150 gal/da/bedroom. If horizon consistence is stronger than firm or any cemented class or the clay mineralogy is smectitic, the horizon is limiting regardless of other soil characteristics

					Hydraulic Linear Loading Rate, gal/da/ft									
					Slope									
					0-4%			5-9%			>10%			
Soil Characteristics			Infiltration Loading Rate, gal/da/ft^2		Infiltration Distance, in.			Infiltration Distance, in.			Infiltration Distance, in.			
Texture	Structure													
	Shape	Grade	>30 mg/L *	<30 mg/L *	8-12	12-24	24-48	8-12	12-24	24-48	8-12	12-24	24-48	Row
COS, S, LCOS, LS	--	0SG	0.8	1.6	4.0	5.0	6.0	5.0	6.0	7.0	6.0	7.0	8.0	1
FS, VFS,LFS,LVFS	--	0SG	0.4	1.0	3.5	4.5	5.5	4.0	5.0	6.0	5.0	6.0	7.0	2
CSL **, SL	--	0M	0.2	0.6	3.0	3.5	4.0	3.6	4.1	4.6	5.0	6.0	7.0	3
	PL	1	0.2	0.5	3.0	3.5	4.0	3.6	4.1	4.6	4.0	5.0	6.0	4
		2, 3	0.0	0.0	-	-	-	-	-	-	-	-	-	5
	PR/BK /GR	1	0.4	0.7	3.5	4.5	5.5	4.0	5.0	6.0	5.0	6.0	7.0	6
		2,3	0.6	1.0	3.5	4.5	5.5	4.0	5.0	6.0	5.0	6.0	7.0	7
FSL, VFSL	--	0M	0.2	0.5	2.0	2.3	2.6	2.4	2.7	3.0	2.7	3.2	3.7	8
	PL	1,2,3	0.0	0.0	-	-	-	-	-	-	-	-	-	9
	PR/BK /GR	1	0.2	0.6	3.0	3.5	4.0	3.3	3.8	4.3	3.6	4.1	4.6	10
		2,3	0.4	0.8	3.3	3.8	4.3	3.6	4.1	4.6	3.9	4.4	4.9	11
L	--	0M	0.2	0.5	2.0	2.3	2.6	2.4	2.7	3.0	2.7	3.2	3.7	12
	PL	1,2, 3	0.0	0.0	-	-	-	-	-	-	-	-	-	13
	PR/BK /GR	1	0.4	0.6	3.0	3.5	4.0	3.3	3.8	4.3	3.6	4.1	4.6	14
		2, 3	0.6	0.8	3.3	3.8	4.3	3.6	4.1	4.6	3.9	4.4	4.9	15
SIL	--	0M	0.0	0.2	2.0	2.5	3.0	2.2	2.7	3.2	2.4	2.9	3.4	16
	PL	1,2,3	0.0	0.0	-	-	-	-	-	-	-	-	-	17
	PR/BK /GR	1	0.4	0.6	2.4	2.7	3.0	2.7	3.0	3.3	3.0	3.5	4.0	18
		2,3	0.6	0.8	2.7	3.0	3.3	3.0	3.5	4.0	3.3	3.8	4.3	19
SCL,CL SICL	--	0M	0.0	0.0	-	-	-	-	-	-	-	-	-	20
	PL	1,2,3	0.0	0.0	-	-	-	-	-	-	-	-	-	21
	PR/BK /GR	1	0.2	0.3	2.0	2.5	3.0	2.2	2.7	3.2	2.4	2.9	3.4	22
		2,3	0.4	0.6	2.4	2.9	3.4	2.7	3.0	3.3	3.0	3.5	4.0	23
SC, C, SIC	--	0M	0.0	0.0	-	-	-	-	-	-	-	-	-	24
	PL	1,2,3	0.0	0.0	-	-	-	-	-	-	-	-	-	25
	PR/BK /GR	1	0.0	0.0	-	-	-	-	-	-	-	-	-	26
		2,3	0.2	0.3	2.0	2.5	3.0	2.2	2.7	3.2	2.4	2.9	3.4	27
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O

 * 30 mg/L applies to BOD_5 ** CSL is actually COSL – coarse sandy loam