Virginia Department of Health (VDH)
Sewage Handling and Disposal Regulations
Site and Soils – Revisions Subgroup

Date: June 15, 2022
Time: 10:00
Location: 109 Governor Street, 5th Floor Conference Room, Richmond, VA
(with WebEx virtual option)

Attendees:

Lance Gregory	Anne Powell	Dr. Phillip Brown	Steve Thomas
Danna Revis	Tom Ashton	Josh Anderson	Josh Hepner
Curtis Moore			

1. Review previous meeting summary.

Mr. Gregory welcomed the subgroup to the meeting and asked if there were any edits to the previous meeting summary. There were not comments on the previous summary.

2. Continued discussion on suggested site and soil changes.

The subgroup then walked through a document that Mr. Moore shared with the group previously. The document was created in 2006 at the direction of VDH with assist from Mr. Moore and others to layout the general process for conducting site and soils evaluations. Feedback from the subgroup is document in the attachment as track changes.

DON ALEEXANDER WROTE:

III. Site Evaluation Methodologies
This will be a how to section on site evaluation aimed at EHSs, AOSEs and individuals interested in how a site evaluation is conducted. Very likely this section will be similar to what we have now but expanded to include what it takes to determine site suitability or unsuitability for a particular effluent quality. It will include how to describe soils, how to measure permeability, water tables, and other relevant soil features. It is not envisioned as a pass-fail section but rather as a description of *methods*.

VDH Regulation Revision
Part III
General Criteria for Conducting Site Evaluations

A) General

The purpose of a site evaluation is to understand the soil system and the hydrology of the site, to predict wastewater flow through the soil and into subsurface materials, and to preliminarily design a subsurface absorption system that compliments the soil system and the hydrology of the site. The evaluation process is intended to allow the collection and documentation of sufficient information to determine the potential for a site to support a subsurface absorption system. A site evaluation shall follow a systematic approach that includes the description of surface characteristics, the description of subsurface characteristics, the interpretation of these characteristics for use in a subsurface absorption system, and the documentation of all results. The process of data collection, evaluation, and design is often repeated several times for each system. During each repetition, new information is obtained and a new design is tried until a design is developed that provides the best match with the site conditions. The comprehensive site evaluation requires considerable expertise by the evaluator. The evaluator must have substantial knowledge about soil science, geology, subsurface absorption system design, and environmental health.

B) Preliminary Documentation

All readily available information about the site should be obtained and reviewed prior to visiting the site. This information may include the following.

1) A survey or other documentation showing the boundaries of the site;
2) A topographic map or topographic survey;
3) Planned or existing location and size of the house or structure;
4) Planned or existing location of wells, water lines, buried utilities, and easements; Danna Revis– make it clear you need to call 811.
5) Information required for determining wastewater characteristics such as number of bedrooms, number of employees, and biological oxygen demand of wastewater;

6) A soil survey such as those prepared by the U.S.D.A. Natural Resource Conservation Service;
7) Geology maps;
8) Adjacent or previous subsurface soil absorption system evaluations, designs, or permits; (web accessible would be great) OEHS needs to notify LHDs that we are encouraging the private sector to request previous permits for all of their work.
9) Adjacent or previous well permits;
10) Location and type of regulatory buffer zones (e.g RPAs) that may impact soil absorption systems.

C) Surface Characterization

Surface characterization shall include the identification and documentation of all existing and proposed features that may impact the ability of a site, or portion thereof, to support a subsurface soil absorption system with the exclusion of those items covered in the Subsurface Characterization section (VAC XXXX_XXXX) of this Chapter. These features shall be documented over the entire area available for evaluation unless a specific system or area is proposed or identified. Where a specific system or area is proposed or identified, the documented area can be modified as noted below for each feature. The features required to be identified and the documented area for specific systems are as follows.

1) Water supply sources within 200 feet of a proposed system and structure it serves.
   a) Water lines
   b) Wells
   c) Cisterns
   d) Springs
   e) Reservoirs
   f) Other water sources used for animal or human consumption
2) Water bodies within 200 feet of a proposed system and structure it serves.
   a) Marshes
   b) Swamps
   c) Streams (intermittent and perennial)
   d) Lakes
   e) Rivers
   f) Shellfish waters
   g) Storm water management facilities
   h) Other water bodies
3) Probable wetlands within 200 feet of a proposed system and structure it serves.
4) Evidence of surface ponding within 200 feet of the proposed system and structure it serves. Steve Thomas – Identification of the cause of the surface ponding.
5) Rock outcrops within 50 feet of a proposed system and structure it serves.
6) Physical improvements within 100 feet of the proposed system and structure it serves.
   a) Structures
   b) Building foundations
   c) Utility lines (underground and overhead)
   d) Agricultural drainage tile
   e) Drainage ditches

f) Cuts or embankments – Curtis Moore - Treat embankments like a basement. Also take into account the depth of the installation. Loudoun has local code. Tom Ashton – 20 feet is the standard of practice for most people. Danna Revis – May add swimming pool to standoff list.
g) Disturbed, compacted, or filled soil areas
h) Existing subsurface soil absorption systems and associated components
i) Other physical improvements identified in VAC XX…XXX as limiting factors for design or placement of subsurface soil absorption

7) Percent slope over the proposed system or area. Multiple values and corresponding locations shall be reported for single systems proposed on two or more different slopes.
8) Landscape Features within 100 feet of the proposed system and structure it serves
   a) Type of landforms described per *the glossary of terms in VAC XX-XXXXX*.
   b) Excessively steep slopes and/or abrupt slope changes
   c) Concave slope shapes
   d) Depressions
   e) Sink holes (includes the center and outer boundary)
   f) Flood plains – Expanding to 100 year floodplain could eliminate sites for already platted sites. Could have significant impact on properties in SWVA. Make sure there is an exception if it is expanding. Maybe include increased level of treatment/maintenance if system is located in a flood plain. Also, include protection of the treatment unit itself. Also depends on the definition of "flood plain". Maybe connect it with soil evaluation.
   g) Gullies, rills, and other erosional features
   h) Other landscape features identified in VAC XX…XXX as limiting factors for design or placement of subsurface soil absorption systems
9) Current land use and management within 100 feet of the proposed system and structure it serves
   a) General category of vegetation (forest, agricultural field, etc.) – currently developed property yes or no.
   b) Type of vegetation present (hydrophilic or hydrophobic)
   c) Size of vegetation (i.e., old growth vs. newly planted trees)

D) Subsurface Characterization

Subsurface characterization shall include the identification and documentation of all subsurface features that may impact the ability of a site to support a subsurface soil absorption system.

1) Acceptable equipment for completing the subsurface characterization
   a) An auger or other equipment (e.g. backhoe pits) shall be used to expose the soil profile as long as it does not mask or blend the soil characteristics required to determine suitability.
   b) Devices utilizing the Archimedes screw principle are specifically prohibited
2) Number of sampling points
   a) The number of sampling points evaluated shall be sufficient to accurately characterize the depth(s) and extent of all limiting conditions as well as identify any variability in subsurface conditions that may impact the operation or performance of a subsurface soil absorption system.
   b) A minimum of five sampling points shall be required to determine the design requirements and limitations for placement of a subsurface soil absorption system. 5 borings may be overkill for small areas like an AOSS pad. Steve Thomas – may actually

need more borings for AOSS, make sure we are designing on the worst soil within the area.

c) If more than one area is required to achieve the required square footage for a system, each area shall be evaluated with a minimum of five sampling points. Repair areas that are contiguous with the proposed installation area are not considered separate areas for the purpose of determining the number of sampling points.
d) In situations where a large area is proposed or utilized, additional sampling points are typically required. The number of sampling points to be investigated will be determined on a case-by-case basis. The number of sampling points shall be large enough to provide a reasonable assurance that the full range of variability typically encountered in similar soil and site conditions can be observed and described.

3) Sampling point location
   a) Sampling points should be located in the area or areas foreseen to be the most likely to support the proposed system. This is typically the area or areas determined to be the most favorable for placement of a subsurface soil absorption system based on the information discerned from the preliminary documentation and surface characterization procedures detailed in Sections D and C above, (VAC XX-XXXX….).
   b) Sampling points should be located as close as practical to the probable center and probable corners of the subsurface soil absorption system.
   c) The location of sampling points shall be sufficient to provide a reasonable assurance that the full range of variability typically encountered in similar soil and site conditions can be observed and described.
   d) Additional sampling point locations may be required if subsurface conditions are discovered during the initial subsurface characterization process that negatively impact the planned placement of a subsurface soil absorption system.
   e) When test pits are used to facilitate the evaluation, they shall be constructed in locations and orientations that minimize soil disturbance within the absorption area while still providing an accurate representation of the subsurface conditions within the proposed site.
   f) In situations where a large area is to be characterized, the location of sampling points shall be determined on a case-by-case basis. The location of sampling points shall be sufficiently diverse to provide a reasonable assurance that the full range of variability typically encountered in similar soil and site conditions can be observed and described.
4) Depth of sampling points
   a) All sampling points shall be excavated and described to a depth that is sufficient to determine that the minimum vertical separation distance is achieved between the lower limit of the proposed system and all limiting features in the soil. Evaluations to deeper depths shall be made if supporting information related to site suitability can be obtained from observations through or into a limiting feature.
   b) A minimum evaluation depth of five feet is required in soils that exhibit no limiting features within five feet of the ground surface. (At least one boring, even if you aren't going deep) The minimum observation depth can be reduced when auger refusal makes deeper excavations impractical. If this occurs, the depth of refusal shall be considered a restriction when determining vertical separation distances unless an additional documented sampling point (or points) within a close proximity to the area of refusal verifies that the refusal is not evidence of a limiting feature.

c) Excavating safety standards shall be observed when utilizing test pits for sampling points.

5) Description of sampling points

a) Soil descriptions shall be completed following the guidelines set forth in the ***Soil survey manual, U.S. Department of Agriculture Handbook 18 (most recent version)***

b) All observable soil features that relate to subsurface soil absorption system suitability shall be described and reported.

c) The minimum soil features that shall be described and reported in each sampling point include the following.

i) Master and transitional horizons with appropriate subordinate distinctions

ii) Thickness of horizons

iii) Moist color of matrix using the Munsell color chart designations

iv) Moist color of mottles using the Munsell color chart designations

v) Abundance, size and contrast of mottles

vi) Moist color of redoximorphic features using the Munsell color chart designations

vii) Abundance, size and contrast of redoximorphic features

~~vii)~~viii) Texture

~~viii)~~ix) Consistence

~~ix)~~x) Other observed soil features that may relate to suitability of soils for use in a subsurface soil absorption system

d) Specific soil features shall be described using test pits when they play a paramount role in determining site suitability. These features include the following.

i) Soil structure by grade, size, and type

ii) Volumetric percentage, size, and shape of rock fragments

iii) Roots

iv) Pores

e) The parent material from which the soil was formed shall be documented. If more than one parent material contributed to the soil formation, each one shall be described. In cases where residuum is the parent material, the probable rock type (or types) shall also be described. If the rock type is of a mafic character, it shall be noted as such.

f) Clay mineralogy shall be estimated or measured in soils that have textures described as clay, silty clay, or sandy clay within the sampling depth.

g) The depth to free water.

h) The soil water state for all soil horizons when any portion of the soil profile approaches field capacity.

E)Testing Procedures for Specific Subsurface Properties

Additional testing beyond field observations shall be conducted when the nature of certain soil properties needs further clarification. The recognized methodologies for collecting additional information on each of these properties are as follows.

1) **Permeability**. Permeability is considered one of the most variable of all soil characteristics. The test results should be considered an index number to aid in narrowing the range of variability and not an absolute number for purposes of design.

a) Number of test points

i) The number of testing points shall be sufficient to accurately characterize the variability in subsurface conditions that may impact the operation or performance of a subsurface soil absorption system.

ii) A minimum of five testing points shall be required.

iii) If more than one area is required to achieve the square footage for a system, each area shall be tested with a minimum of five testing points. Repair areas that are contiguous with the proposed installation area are not considered separate areas for the purpose of determining the number of testing points unless the installation depths vary. In cases where installation depths vary, the repair and installation areas shall each be tested with a minimum of five points.

iv) In situations where a large area is proposed or utilized, additional testing points are typically required. The number of sampling points to be investigated will be determined on a case-by-case basis. The number of testing points shall be large enough to provide a reasonable assurance that the full range of variability typically encountered in similar soil and site conditions can be observed.

b) Test point location

i) Test points should be located as close as practical to the probable center and probable corners of the subsurface soil absorption system.

ii) The location of test points shall be sufficient to provide a reasonable assurance that the full range of variability typically encountered in similar soil and site conditions can be observed and described.

iii) When test pits are used to facilitate the evaluation, they shall be constructed in locations and orientations that minimize soil disturbance within the absorption area while still providing an accurate representation of the subsurface conditions within the proposed site.

iv) In situations where a large area is to be characterized, the location of test points shall be determined on a case-by-case basis. The location of test points shall be sufficiently diverse to provide a reasonable assurance that the full range of variability typically encountered in similar soil and site conditions can be observed.

c) Depth of testing.

i) Test depths shall be the deeper of 12 inches below ground surface or six inches below the proposed installation depth when no restrictive features are suspected within the vertical separation distance.

ii) In cases where a restrictive feature is suspected within the vertical separation distance, the test depth may be modified to test the restrictive layer. The test hole shall penetrate the restrictive feature such that the column of water is a minimum of one (1) inch below the upper boundary of the restriction. The test hole shall not penetrate the lower boundary of the restrictive feature. For restrictions that are less than seven (7) inches in thickness, testing apparatus such as the double ring infiltrometer shall be used.

d) Percolation test

i) Test Hole Construction

(1) The diameter of the test holes shall be 5 to 6 inches.

(2) The auger being used to construct the test holes shall not cause smearing of the sidewalls.

(3) The test hole may be scarified as necessary but the diameter shall not exceed 6 inches.

(4) Two inches of pea gravel or coarse sand shall be added to the test hole.

(5) A four (4) inch ID slotted or perforated thin walled pipe shall be centered in the test hole. The annular space shall be stabilized with pea gravel or coarse sand. The pipe should extend 6 to 18 inches above the test hole surface. A fixed reference point shall be made for recording water levels. All readings shall be made from this same reference point.

ii) Presaturation. Twelve (12) inches of clean water shall be added to the test hole. The duration of the presaturation period is 4 hours. The depth of water shall be measured from the fixed reference point established in _section i_ above. At each succeeding 15 to 30 minute interval, water shall be added to achieve a level of 12 inches.

(1) If the test hole is dry at the conclusion of the presaturation period, proceed directly to the percolation test.

(2) If the test hole is not dry at the conclusion of the presaturation period, add water to achieve a depth of 12 inches. Allow the water to remain for a minimum of 18 hours, but no more than 24 hours, and proceed to the percolation test.

(3) When high shrink swell soils are suspected, an additional 4 hour presaturation period is required prior to conducting the percolation test. This testing period shall start between 20 and 24 hours after conclusion of the initial presaturation period.

(4) The presaturation shall be documented on forms approved by the division. Documentation should include, at a minimum, the periodic water level readings and any additions of water to the test hole. All measurements are made to the nearest 1/8 inch.

iii) Test procedure

(1) All measurements are made to the nearest 1/8 inch.

(2) If the test hole is dry at the end of 4 hours of presaturation add 6 inches of water and record the fall after 10 minutes.

(3) If the test hole is not dry after the presaturation period, the following procedures shall be followed.

(a) If the test hole has more than 6 inches of water remaining at the beginning of the testing period, record the level and take a one (1) hour reading. Calculate the percolation rate.

(b) If the test hole has less than 6 inches of water remaining, but is not dry, at the beginning of the testing period, carefully adjust the water level to 6 inches and take a one (1) hour reading. Calculate the percolation rate.

(c) If the test hole is dry at the beginning of the testing period, carefully add 6 inches of water and take a one (1) hour reading. Carefully adjust the water level to 6 inches and take a second one (1) hour reading. Calculate the percolation rate.

iv) Test results

(1) The percolation rate for each hole is determined by dividing the time interval by the water level difference in inches (time in minutes / fall in inches).

(2) The result is reported in minutes per inch.

(3) The percolation rate of the test area is determined by averaging the last reading from each test point.

e) Saturated Hydraulic Conductivity Tests**.** Saturated hydraulic conductivity is an in situ qualitative measurement of the ability of a saturated soil to transmit water through a volume of soil in the unsaturated zone. The recognized methodology for determining saturated hydraulic conductivity is through the use of a constant-head permeameter test. Specific testing apparatus shall be approved by the division. The specific testing procedures provided in the manufacturer's manual shall be strictly followed notwithstanding any modifications that follow. The testing methodologies, when performed, shall be used in conjunction with information collected in the surface and subsurface characterization procedures to aid in determining the loading rate or aid in identifying restrictive features. Specific testing parameters include the following.

i) Testing apparatus that is located in the test hole shall terminate no more than 1 inch above the bottom of the test hole.
ii) Reading intervals are established by the rate of water movement from the instrument into the soil. The time between readings is normally reduced with faster rates of water movement. The reading interval shall be sufficient to establish a pattern of water movement. Water level readings and time intervals for all readings shall be documented. Common reading intervals are as follows.
   (1) One (1) to two (2) minute intervals for rapid rates of water movement
   (2) Five (5) to ten (10) minute intervals for moderate rates of water movement
   (3) Fifteen (15) to thirty (30) minute intervals for slow rates of water movement
iii) Number of readings
   (1) Readings shall be recorded from the beginning of the test through completion.
   (2) The number of readings shall be sufficient to establish a pattern of water movement.
iv) Testing period. Test completion occurs when at least three consecutive water level drops per period of time are identical or very similar. The testing period may vary with the moisture state of the soil. Minimum testing periods are as follows.
   (1) Thirty (30) minutes for soils with rapid rates of water movement
   (2) One (1) hour for moderate rates of water movement
   (3) Two (2) hours for slow rates of water movement
v) Test results
   (1) The Glover solution (Zangar, C. N. 1953. Theory and Problems of Water Percolation. U.S. Department of the Interior, Bureau of Reclamation, Engineering Monograph No. 8, Denver, Colorado.) shall be used to calculate the saturated hydraulic conductivity. The equation is $Ksat=Q[\sinh^{-1}(H/r) - (r^2/H^2+1)^{.5} + r/H] / (2pH^2)$.
   (2) Ksat calculations for the last three reading intervals shall be documented for each test point.
   (3) The saturated hydraulic conductivity of the test area shall be determined by averaging the last Ksat calculation from each test point.
   (4) The value shall be reported in centimeters per day.

f) Double Ring Infiltrometer. The double ring infiltrometer may be used in specific situations where infiltration rate is of concern or when suspected restrictions less than seven inches thick are to be tested. ASTM standard D-3385 shall be used as the test procedure.
g) Other procedures approved on a case-by-case basis by the division may be utilized. Justification for not using the recognized methodologies detailed in this section shall be included with the request to use alternative procedures.

2) **Depth of seasonal water table.**
   a) Water Table Study
      i) A detailed plan for conducting a water table study shall be developed by the applicant, submitted to the local or district health department, and approved by the local or district health department in order for the results to be considered valid. A preliminary conference with the local or district health department is required to initiate the submittal process. Submission of the water table study plan shall be a minimum of 45 calendar days prior to the planned initiation of the study. The water table study plan shall include, at a minimum, the following.
         (1) Justification for conducting the study.
         (2) Construction and installation methods for observation devices.
         (3) A diagram showing well construction components, materials, sizes, dimensions, and installation depths.
         (4) Proposed criteria for evaluating the results of the observations.
         (5) Provisions that allow department personnel to enter the monitoring site for the purpose of making independent observations throughout the study period, including written permission from the property owner.
         (6) The general location of the study site identified on a USGS topographic map at a scale of 1:24,000.
         (7) Property corners and property lines with dimensions shown on a survey plat.
         (8) When practical, a survey plat of the study site at a scale of one inch equals 60 feet or more detailed. The plat shall include the following.
            (a) Field verified topographic contours at intervals of no greater than two feet.
            (b) Horizontal distances from proposed well locations to.
            (c) Relative elevations of the monitoring wells referenced to a semi-permanent or permanent reference points.
            (d) Existing and proposed drainage features including the location of the drain outfall(s).
            (e) Location of sampling points used to describe the subsurface site conditions.
            (f) Location of proposed monitoring wells to be used in the study.
         (9) Results of the surface characterization (Section B; VAC XX-XXX) and the subsurface characterizations (Section C; VAC XX-XXX) completed on the site(s) proposed for testing.
         (10) Soil types classified to the series level using existing soil survey information or rough field classifications.
         (11) The reference source for long term precipitation data that will be used to determine the percentage of average precipitation during the observation period and prior to the observation period.
      ii) Location and number of monitoring wells
         (1) General
            (a) At a minimum, the locations that represent the portion of the proposed area(s) most likely to exhibit the wettest conditions shall be tested.
            (b) Determination of the wettest locations shall be based on landforms and soil morphologic features.
         (2) Number and location of monitoring wells

(a) Individual small flow systems
  (i) A minimum of three monitoring wells shall be located within each soil absorption area.
  (ii) A minimum of one well shall be located in the reserve area for those sites where the reserve is contiguous to the proposed soil absorption area.

(b) Multiple individual small flow sites and large flow systems.
  (i) The applicant must request a specific number and location of monitoring wells.
  (ii) The applicant shall provide justification for the number and location of wells requested in the water table study plan.
  (iii) At a minimum, the number and location of wells shall be sufficient to provide a reasonable degree of confidence that the shallowest occurrence of a water table within a proposed area(s) will be identified.
  (iv) The local or district health department shall work with the applicant to determine the final number and location of monitoring wells if the original request is deemed to be inadequate.
  (v) Testing of only the wettest areas within a group of small flow sites or within a large flow area is permitted upon approval by the local or district health department.

iii) Depth of monitoring wells.
  (1) The bottom of the well shall be placed a minimum of eighteen inches below the proposed installation depth of the soil absorption system except as noted in items 2 and 3 below.
  (2) When a restrictive layer is present within 36 inches of the proposed installation depth the well shall be anchored into the top of the restriction.
  (3) When the system is proposed to be placed below a restrictive layer, the well shall be placed a minimum of 24 inches below the proposed depth of installation.

iv) Construction standard for manual monitoring wells
  (1) Construct a bore hole with a soil auger taking care to limit smearing and compaction of the sidewalls and bottom of the hole.
  (2) Construct the bore hole when the soil is slightly moist or dry.
  (3) The bore hole shall be of sufficient diameter to allow an annular space of 1 to 3 inches to remain between the pipe and bore hole sidewall.
  (4) Case the bore hole with schedule 40 PVC pipe with an inside diameter of 1.5 to 3 inches.
    (a) The lower 12 inches of the pipe shall have 1/8 inch to ¼ inch slits or 1/8 to ¼ inch diameter holes placed in it.
    (b) The pipe should be covered with a threaded cap that can be tightened to minimize vandalism.
  (5) Backfill the annular space around the pipe with clean pea gravel to a depth of 1 to 2 inches above the uppermost slit or drilled hole.
  (6) Fill the annular space to within 2 to 4 inches of the surface with bentonite or neat cement.
  (7) Backfill to the surface with a fine textured soil making a collar at the surface to minimize surface water entering the well.

(8) If the wells are to be read manually, establish a reference point that allows measurements to be made to the surface of the water with an accuracy of $\pm$ 0.5 inches.

v) Construction standard for automated monitoring wells. If the wells are to have automated data recorders, follow the manufacturer's installation procedures. Periodic inspection of automated wells is highly recommended to ensure that data is being recorded. Incomplete data may, at the discretion of the local or district health department, invalidate the test.

vi) The yearly observation period for water table studies shall be December 1 through May 31, inclusive.

vii) The normal rainfall determination period shall be January 1 to October 31 immediately prior to the beginning of the study.

viii) Frequency of observations

(1) Automated wells shall be configured to collect data a minimum of two times in every 24 hour period.

(2) Manual wells

(a) Observations shall be made a minimum of two times in any seven day period.

(b) No more than three consecutive days without a recorded observation is permitted.

(c) In soils suspected to have rapidly fluctuating water tables, consideration should be given to increasing the frequency of observations.

(d) The frequency of observations may be modified upon mutual agreement between the district health department and the applicant if circumstances warrant more or less frequent observations

ix) Length of study

(1) The length of the study shall encompass a minimum of one yearly observation period when the cumulative precipitation is 80 percent or greater during the normal rainfall determination period.

(2) The length of the study shall encompass a minimum two yearly observation periods when the cumulative precipitation is less than 80 percent during the normal rainfall determination period.

~~(2)~~(3) The study may be ended at the request of the applicant at any time. Premature test termination renders all test data invalid.

x) Not withstanding the provisions in item xi, the cumulative precipitation shall be between 80 and 120 percent of the long term precipitation average during the observation period for the observation period to be considered valid.

xi) The applicant shall have the option of accepting the results of the observation period when the cumulative precipitation exceeds 120 percent of the long term precipitation average.

xii) Observation period precipitation information shall be referenced from the closest NOAA approved weather station that appears to reflect the general climatic conditions as those at the study site. Alternative sources of study period precipitation data may be approved by the district health department on a case by case basis.

xiii) Recording of observations in manual wells. Record the depth to the water from the reference point to the nearest ½ inch.

xiv) Calibration of data for manual wells

(1) Water level measurements shall be converted to indicate the depth below ground surface that water was observed.
(2) Assigning water levels to days without recorded observations. A water level shall be assigned for all days where an observation was not made. The previously recorded observation and the subsequently recorded observation shall be averaged. This average shall be assigned as the water level for the day or days between the recorded observations

xv) Criteria for determination of the seasonal water table. The seasonal water table shall be the shallower of the following.
(1) The shallowest depth at which water is observed for 30 cumulative days during any one yearly observation period; or
(2) The shallowest depth at which water is observed for 20 consecutive days.

xvi) Site modifications that may impact the water table study are prohibited during the study period. The prohibited activities include construction of a soil drainage system, cutting or filling of soil, timber harvesting, or any other activity deemed by the local or district health department to potentially impact the validity of the study. Site modifications performed after the beginning of the test shall invalidate all observations made prior to the site modifications.

xvii) Reporting and Notification
(1) Copies of the water table observation data and precipitation data shall be submitted to the local health department within fourteen days of the end of each observation month.
(2) A report shall be submitted to the local health department within thirty days of the end of each annual observation period that includes the following.
  (a) Discernable relationships between the observation data and the precipitation data.
  (b) The seasonal water table level based on cumulative days.
  (c) The seasonal water table based on consecutive days.
  (d) The percent of normal precipitation that occurred during the annual observation period.
(3) A final report shall be submitted to the local health department within sixty days of completion of the study. The report shall include the following.
  (a) All water table data, precipitation data, and appropriate data summaries.
  (b) A discussion of the overall results of the study including the minimum depth to seasonal water table, percent of normal precipitation, cumulative days observed, and consecutive days observed.
(4) Water table studies will only be considered valid if performed by authorized individuals. A list of authorized individuals is as follows.
  (a) VDH staff
  (b) Virginia Certified Professional Soil Scientists
  (c) Authorized Onsite Soil Evaluators
  (d) Professional Engineers
(5) With the exception of VDH staff, parties responsible for conducting the water table study shall certify, through signing a department approved statement and affixing their professional seal, that the information submitted is accurate, complete, and represents an analysis of all available data for the site. When two

separate parties work together to complete the study, both individuals shall sign and seal the certification statement.

b) Other procedures approved on a case-by-case basis by the division.

F) Interpretation of Information and Design Recommendations

The observations and testing completed in the previous sections of this chapter (VAC XXX-XXXX, VAC XXX-XXXX) must be interpreted in order to recommend a set of design parameters and characterize the limitations for subsurface soil absorption systems. These interpretations are based on the surface characterization process, the subsurface characterization process, the results of additional testing, as well as the limitations that may exist with specific types of treatment or dispersal technology. The initial results of this process may lead the evaluator to the conclusion that additional testing or more investigations are required before a final set of recommendations can be developed. Any additional tests and investigations that are deemed necessary shall be completed prior to developing the final set of recommendations. The major factors that need to be interpreted and the guidance pertaining to each are as follows**.**

1) **Restrictive layers.** The depth that restrictive layers are encountered is important because these layers retard or stop water flow. The degree of restriction within various types of restrictive layers may vary. Therefore, the evaluator should not only understand that a restrictive layer is present, but should also determine the impact that the layer may have on the functioning of a proposed soil absorption system. The procedures outlined in the permeability subsection of Section E of this chapter (VAC XX-XXXX) for testing restrictions should be used when the existence of a restrictive layer is in question. Once the existence of a restriction is determined, the evaluator shall use the guidance offered in Item 2 of this section (soil depth) to make design recommendations. Guidance for determining the presence of specific types of restrictions through subsurface observations is as follows.
   a) Bedrock. Bedrock shall be defined as the soil horizon that meets the qualifications for designation as R or Cr in the subsurface characterization section of this chapter (VAC XX-XXX). Bedrock is always considered a restriction with respect to subsurface soil absorption systems.
   b) Pans and other cemented layers. Pans and cemented layers are always considered a restriction with respect to subsurface soil absorption systems. One or more of the following items typically indicates the presence of a pan or cemented layer.
      i) Meets the qualifications for subordinate soil horizon designation of *d*, *m*, or *x*
      ii) A combination of firmness, brittleness, and a higher bulk density than adjacent layers
      iii) Vesicular pores
      iv) Platy or prismatic structure
      v) Massive structure when not associated with saprolite
      vi) Restricted or altered root penetration
   c) Lithologic discontinuities. All discontinuities are not considered a restriction with respect to subsurface soil absorption systems. The presence of one or more of the following items may indicate the presence of a restriction due to a discontinuity.
      i) A stone line associated with a horizon boundary
      ii) Redoximorphic features or mottles associated with the contact between two soil horizons
      iii) Significant differences in soil moisture content observed in adjacent soil horizons

iv) Significant differences in soil texture observed in adjacent soil horizons
v) Significant differences in soil structure or matrix color observed in adjacent soil horizons when textures are similar

d) Strongly contrasting soil textures. Strongly contrasting textures are not always considered a restriction with respect to subsurface soil absorption systems. The presence of one or more of the following items may indicate the presence of a restriction.
i) Adjacent soil horizons with textures that are not adjacent to each other on the U.S.D.A. textural triangle
ii) Horizon boundary described as abrupt
iii) Redoximorphic features or mottles associated with the contact between two soil horizons
iv) Significant differences in soil moisture content observed in adjacent soil horizons

e) High or very high shrink swell soils. Very high shrink swell soils shall be considered a restriction with respect to subsurface soil absorption systems. High shrink swell soils may be considered a restriction with respect to subsurface soil absorption systems. One or more of the following items may indicate the presence of high or very high shrink swell soils.
i) Presence of slickensides
ii) High clay content with unusually long ribbons when texturing
iii) Estimated clay mineralogy class dominated by 2:1 clays
iv) Mafic or mixed mineralogy rock types as the probable parent material
v) Saprolite with mafic mineral or color indicators (shades of black, green, or olive)
vi) Presence of pressure faces
vii) Presence of sand coated ped faces in a Bt soil horizon

2) **Soil Depth**. Soils must have sufficient depth to properly treat the wastewater introduced by the soil absorption system. Soils must also have enough depth to allow for the assimilation of wastewater into the natural soil system without creating an excessive degree of hydraulic loading. The minimum soil depth for treatment is more dependent on the level of treatment that the wastewater has undergone prior to introduction into the soil system (pretreatment) and less dependent on soil permeability. The minimum soil depth required to prevent excessive hydraulic loading is less dependent on the level of pretreatment and more dependent on the permeability of the soil. The minimum soil depth for all sites shall be sufficient to achieve both adequate treatment and adequate assimilation of the wastewater into the soil system. Soil depth is differentiated from soil wetness as an interpretive factor due to the common need to characterize barriers to water movement separately from seasonal water tables.

a) **Methodology.** Soil depth is the vertical distance from the soil surface to the shallowest occurrence of bedrock, partially weathered bedrock (soil horizons with the Cr designation), and restrictive soil features as defined in Item 1 above (VAC XX-XXXX).

b) **General guidance**. Soils with deeper depths have a greater ability to properly treat and assimilate wastewater into the natural soil system than soils with shallow depths. Therefore, deeper soils are more suitable than shallow soils for soil absorption systems. All other factors being equal, a system proposed in deeper soils typically is assigned a higher loading rate relative to a system proposed in shallow soils. The evaluator must also understand that soil depth can be highly variable within a very small area. The evaluator should strive to describe the full range of soil depth that is likely to occur on a site during the subsurface characterization process and recommend design parameters based on the most limiting depth. Correlations can often be made to other factors such as landscape position and slope when variable depths are encountered. The evaluator should consider evaluating additional sampling points when higher degrees of variability are observed or suspected. When highly variable conditions are suspected, the evaluator should be more conservative when recommending design parameters. This would likely include modifications to the recommended installation depth and the recommended dispersal technology.

c) **System Considerations.** Soil depth plays an integral role in determining the type and size of system recommended for installation. Where soils with extremely shallow depths are proposed for use, consideration should be given to the logistics of system installation and larger areas to aid in dispersal. In some cases, soil depth may dictate that a specific type of dispersal system not be utilized. It may also dictate that a specific level of pretreatment must be utilized. The practicality of installing trenches at extremely shallow depths should be given specific attention. The evaluator must understand the construction techniques and specific limitations of all approved dispersal and pretreatment systems in order to determine which system or systems should be recommended for a particular site.

3) **Soil wetness**. Well aerated soils must be present in order to facilitate the treatment of effluent in a subsurface soil absorption system. The vertical distance from the ground surface to the occurrence of the water table is used to quantify the degree of soil wetness that is likely to exist on a site.

a) **Methodology**. The presence of redoximorphic features is typically used to determine water table depth. The shallowest occurrence of redoximorphic features shall be the water table depth unless a water table study proves otherwise. A water table study shall be performed when depth to a water table is in question. A water table study may be performed when the evaluator desires confirmation of a water table based on redoximorphic features. All water table studies shall be performed in accordance with Section E above (VAC XX-XXXX).

b) **General guidance**. Soils with deeper water tables have a greater ability to properly treat and assimilate wastewater into the natural soil system than soils with shallow water tables. Therefore, soils with deeper water tables are more suitable than those with shallow water tables for soil absorption systems. All other factors being equal, a system proposed in soils with deeper water table conditions typically is assigned a higher loading rate than a system proposed in soils with shallow water tables. The evaluator must also understand that some soils have a seasonal water table at depths that are shallower than the occurrence of redoximorphic features. Correlations can often be made to other factors such as landscape position, slope, or permeability when this occurs. The evaluator should consider conducting a water table study when free water is observed for extended periods at depths shallower than redoximorphic features. If water table studies are not performed, the evaluator should be more conservative with the recommended design parameters. This would likely include modifications to the recommended installation depth, the recommended level of treatment, and the recommended dispersal technology.

c) **System Considerations.** Soil wetness plays an integral role in determining the type of system recommended for installation. Where soils with extremely shallow water tables are proposed for use, consideration should be given to the logistics of system installation, the dispersal technology, and the level of pretreatment. In some cases, the depth to water table may dictate that a specific type of dispersal system not be utilized. It may also dictate that a specific level of pretreatment must be utilized. The practicality of installing trenches at extremely shallow depths should be given specific attention. The evaluator must understand the construction techniques and specific limitations of all approved dispersal and pretreatment systems in order to determine which system or systems can be supported on the site.

4) **Landform and slope**. The combination of these two factors determine whether water tends to collect at a site or flow away from a site. They are extremely important because they influence how wet the site is. Slope and landscape position are combined due to their interrelationship and cumulative impact on subsurface absorption area suitability. The evaluator must integrate both of these items into a single factor in order to properly assess the subsurface absorption system potential. Interpretation of this factor is arguably the most subjective of any factor that must be interpreted, but it is critical to the proper functioning of subsurface soil absorption systems.
   a) **Methodology.** The particular landform and slope of a proposed area should be rated relative to an average landscape position with a moderate degree of slope. This should give the evaluator a qualitative index of where the proposed area lies on a scale ranging from well suited to poorly suited. Once this exercise is completed, the base loading rate shall be modified to reflect the relative suitability of the proposed area.
   b) **General Guidance.** Concave landforms are more likely to accumulate water and result in wetter soil conditions than convex landforms. Convex landforms tend to encourage water to flow away and are typically drier than concave landforms. Flatter slopes tend to accumulate or hold more water than sloping sites. Therefore, convex landforms with steeper slopes are more suitable than flatter concave landforms for soil absorption systems. All other factors being equal, a system proposed on a convex steep slope typically is assigned a higher loading rate than a system proposed on a flat concave slope.
   c) **System Considerations.** Landforms and slope can play an integral role in determining the type of system recommended for installation. Where extremely flat or extremely steep slopes are proposed for use, consideration should be given to the logistics of system installation. In some cases, slope may dictate that a specific type of system not be utilized. The practicality of installing trenches at shallow depths on extremely steep slopes and extremely flat slopes should be given specific attention. Landform configuration can also limit the ability of a site to support certain systems. The evaluator must understand the construction techniques and specific limitations of all approved systems in order to determine which systems can be supported on a particular landform. The practicality of installing trenches on very narrow landforms and in concave landforms should be given specific attention.

5) **Hydraulic conductivity.** Hydraulic conductivity is the velocity at which water moves through soils. This factor can help the designer determine the volume of wastewater that a site can transmit in a specific time. When restrictive layers are excluded, the combination of soil texture, soil structure, porosity, and clay mineralogy determine the hydraulic conductivity of a soil. Soil texture influences the porosity and the structure of the soil. Clay mineralogy is determined by the parent material and can influence soil structure.

a) **Methodology.** The starting point for evaluating hydraulic conductivity should be soil texture and structure immediately below the infiltrative surface. This should give the evaluator a qualitative index of where the proposed site lies on a scale ranging from better suited to poorly suited for subsurface absorption systems. If a significant percentage of 2:1 clays are suspected or mafic parent materials are described, permeability tests shall be conducted per Section E of this chapter (VAC XX-XXXX). Once these exercises are completed, the recommended loading rate shall be modified to reflect the relative suitability of the specific soil.
b) **General guidance.** Sandy soils typically have a higher hydraulic conductivity than clayey soils if all other things are equal. A soil with strong structure has a higher hydraulic conductivity than soils with weak structure if all other things are equal. Regardless of structure, soils with a significant amount of 2:1 clays have lower hydraulic conductivities than soils dominated by 1:1 clays. In summary, a system proposed in clayey soils with weak structure typically are assigned a much lower loading rate than those proposed in sandier soils or soils with stronger structure.
c) **System Considerations.** Hydraulic conductivity should play an integral role in determining the type of system recommended for installation. Where extremely high rates of water movement and extremely slow rates of water movement are proposed for use, special consideration should be given to the dispersal method recommended. In some cases, the rate of water movement may dictate that a specific type of system be utilized. The evaluator must understand the capabilities of different types of dispersal systems in order to determine which system should be recommended. The use of systems with pressure dosing in soils with low hydraulic conductivities should be given specific attention.

6) **Recommended installation depth of system.** The recommended installation depth should be based on the cumulative information discerned in items one through five above. The installation depth shall meet all minimum requirements contained in other chapters of this regulation. The installation depth should strike a balance between maximizing the vertical separation distance to limiting features (restrictions, water tables, etc.) and the most suitable hydraulic conductivity rate. Economic considerations may play a role in recommending the installation depth, but it should be a secondary consideration to the proper functioning of the system. Consideration must be given to the recommended system type to ensure that the installation depth is appropriate for the recommended system type.
7) **Recommended system type.** The recommended system type should be based on the cumulative information discerned in items one through six above and the limitations surrounding installation and operation of all available systems. The recommended system shall meet all minimum requirements contained in other chapters of this regulation. The evaluator should specifically consider the benefits of pressure distribution, pretreatment, and installation logistics when recommending a system type. Economic considerations may play a role in recommending the system type, but it should be a secondary consideration to the proper functioning of the system.
8) **Recommended loading rate.** The loading rate is the amount of wastewater applied to an area of soil per day. The loading rate must be assigned correctly so that the size of the soil absorption system is adequate. Overestimation of the loading rate can invite premature failure of the system.

a) **Methodology.** The recommended loading rate should be based on the cumulative information discerned in items one through seven above and the interpretation of permeability tests that may have been conducted under the provisions outlined in Section E above (VAC XX-XXXX).
   i) The starting point for determining the recommended loading rate shall be the value obtained in Item 5 in this section, hydraulic conductivity (VAC XX-XXXX). Modifiers shall be made to this value based on the methodologies outlined in Items 1 through 4 above. Not withstanding the provisions in item ii) below, the result shall be the maximum recommended loading rate.
   ii) When a permeability test is completed per Section E of this chapter (VAC XX-XXXX), it should only be used to verify the recommended loading rate determined in item i) above or to create a more conservative loading rate. The recommended loading rate shall not exceed, regardless of the results of permeability tests, the maximum loading rate assigned through the procedure in item i) above.
b) **General guidance.** The evaluator is encouraged to be more conservative in assigning the recommended loading rate than the procedure detailed in *item a* above. The recommended loading rate can be decreased when available area is not limited and the evaluator believes that the life expectancy of the system would be significantly increased by installing a larger system.

G) Reporting Results

The design recommendations formulated in Section F (VAC XX-XXXX) shall be reported with the results of the subsurface site characterization, the results of the surface characterization, and additional testing procedures. Department approved forms shall be used as a basis for the report. The report shall include, at a minimum, the following.

1) Site sketch prepared during the surface characterization with the sampling points located and identified.
2) A completed profile description sheet from each sampling point evaluated.
3) A copy of all results from additional testing procedures.
4) A narrative of the subsurface characterization describing the major features and limitations
5) A design recommendations summary that addresses each of the items outlined in the Section F (VAC XX-XXX). This summary shall specifically address reasons for modifications to any prescriptive loading rates when modifications are recommended as a basis for the design.