CHAPTER

4 SITE EVALUATION AND REQUIREMENTS

General Comments

A private sewage disposal system has effluent that cannot be directly discharged into waterways or open ponds. Soil of the right consistency and water content provides natural filtering and treatment of this discharge. Because soil conditions vary widely, even on the same building site, tests and inspections of the soils must be performed to evaluate the degree to which the soil can accept these liquids. The results of the tests provide necessary information to design an adequate private sewage disposal system. Chapter 4 provides the methods for evaluating the building site.

Purpose

A site evaluation, whether performed by the code official, their designee, an engineer or contractor, is a vital part of the permitting process and will ultimately determine if the design of the septic system will meet the requirements of the code and perform properly for years into the future. Ensuring that the soil type and resulting absorption rate are appropriate for the placement of a septic system is foundational. Consideration of site elements is also extremely important. The placement of structure, well location, distance to surface water, and the slope of the property are just some of the important factors to consider during a site evaluation. While it seems counterintuitive, the development of a property should start with septic system design and location. This is especially important on smaller lots with larger homes.

SECTION 401—GENERAL

401.1 Scope. Evaluation of *private sewage disposal systems* and requirements for sites shall comply with this chapter.

C The following information will inform and advise the code official on the required or necessary considerations that must be evaluated in order to permit and install a private sewage disposal system.

401.2 Site evaluation. Site evaluation shall include soil conditions, properties and permeability, depth to zones of soil saturation, depth to bedrock, slope, landscape position, all setback requirements and the presence of *flood hazard areas*, including special *flood hazard areas* and 500-year floodplains. Soil test data shall relate to the undisturbed elevations, and a vertical elevation reference point or benchmark shall be established. Evaluation data shall be reported on approved forms. Reports shall be filed within 30 days of the completion of testing for all sites investigated.

C Site evaluations should consider soil conditions including color, size/structure and hydraulic loading of the soil located in the tank and drain field area. It is important to ensure proper separation between the bottom of the drain field and the perched or seasonal high water table or unsuitable soil such as hardpan or rock. Additional factors such as setbacks to surface water or flood hazard areas, drinking water or irrigation wells, property lines, ditches or swales, and significant sloping areas should also be considered as part of the site evaluation process. The soil data collected should apply to natural soil conditions that have not been disturbed. Often, systems are planned to be installed in areas where the natural soil has been removed and the area has been filled in with soil taken from another location. This is often referred to as fill material. The code official should be very cautious with soil evaluations in these cases as there are no natural indicators of permeability or the seasonal high water table. It is a good idea to consult with an engineer or soil scientist in these cases to ensure the system will perform well and avoid a sanitary nuisance situation.

401.3 Replacement system area. On each parcel of land being initially developed, sufficient area of suitable soils based on the soil tests and system location and site requirements of this code for one replacement system shall be established. Where bore hole test data in the replacement system area are equivalent to data in the proposed system area, the percolation test is not required.

C Drain fields do not last forever. Suitable areas with favorable soil conditions are required for future drain field locations. While it is possible to dig up a failing drain field, perform a soil replacement and install a new drain field in the same location, it is very expensive and labor intensive, and the fill material is not as desirable as natural soil material. While evaluating the site, scrutiny should be given to the drain field replacement area to make sure that it will meet code when the replacement drain field needs to be installed.

401.3.1 Nonconforming site conditions. Where site conditions do not permit replacement systems in accordance with this code and an alternative system is used, the alternative system shall be approved in accordance with Section 105.

C When a conventional drain field cannot be installed in the replacement area, an alternative system can be considered, and it will have to meet all code requirements.

401.3.2 Undisturbed site. The replacement system shall not be disturbed to the extent that the site area is no longer suitable. The replacement system area shall not be used for construction of buildings, parking lots or parking areas, below-ground swimming pools or any other use that will adversely affect the replacement area.

C It is important that property owners understand that the replacement area should not be used for other purposes such as structure expansions, swimming pools or parking areas. In the cases where this does occur, it may be required to remove said structures and other property improvements to use the replacement area for its original purpose.

SECTION 402—SLOPE

402.1 General. A *conventional soil absorption system* shall not be located on land with a slope greater than 20 percent. A *conventional soil absorption system* shall be located not less than 20 feet (6096 mm) from the crown of land with a slope greater than 20 percent, except where the top of the aggregate of a system is at or below the bottom of an adjacent roadside ditch. Where a more restrictive land slope is to be observed for a soil absorption system, other than a *conventional soil absorption system*, the more restrictive land slope specified in the design sections of this code shall apply.

C The slope of the property is a very important factor to consider when installing both the tank and drain field. Extreme slope, greater than 20 percent, can cause a tank and drain field system to create a sanitary nuisance. Systems should be located greater than 20 feet away from the crown of the extreme (20 percent or greater) sloping areas of the property, except where the top of the drain field is at or below the bottom of an adjacent roadside ditch or swale.

SECTION 403—SOIL BORINGS AND EVALUATION

403.1 Soil borings and profile descriptions. *Soil borings* shall be conducted on all sites, regardless of the type of private sewage system planned to serve the parcel. Borings shall extend not less than 3 feet (914 mm) below the bottom of the proposed system. Borings shall be of sufficient size and extent to determine the soil characteristics important to an on-site liquid waste disposal system. Borehole data shall be used to determine the suitability of soils at the site with respect to zones of seasonal or permanent soil saturation and the depth to bedrock. Borings shall be conducted prior to percolation tests to determine whether the soils are suitable to warrant such tests and, if suitable, at what depth percolation tests shall be conducted. The use of power augers for *soil borings* is prohibited. *Soil borings* shall be conducted and reported in accordance with Sections 403.1.1 through 403.1.5. Where it is not practical to have borings made with a backhoe, such borings shall be augered or dug by hand.

C Soil borings and pits are necessary and required to ensure proper soil evaluations can occur. Pits dug by a backhoe that are large enough to see the horizontal soil profile to a depth of at least 6 feet are recommended so that soil horizons and the soil textures of those horizons can be easily viewed and evaluated. When using a soil auger, make sure that the correct auger buckets are available for the type of soil worked. Soil should be evaluated (recording color, texture, and depth as you go) to a depth of at least 3 feet below the bottom of the drain field. Power augers must not be used as they do not provide proper evaluation of the soil due to the disturbance of the soil that occurs during their use. They also can create an unsafe situation that results in physical harm to the user.

403.1.1 Number. There shall be not less than three borings per soil absorption site. Where necessary, more *soil borings* shall be made for an accurate evaluation of a site. Borings shall be constructed to a depth of not less than 3 feet (914 mm) below the proposed depth of the system.

Exception: On new parcels, the requirement of six borings (three for initial area and three for replacement area) shall be reduced to five where the initial and replacement system areas are contiguous and one boring is made on each outer corner of the contiguous area and the fifth boring is made between the system areas [see Appendix A, Figure A101.1(1)].

C At least three soil borings should be performed in the drain field area. It is recommended that they be at the beginning, middle and end of the drain field location. Additional soil borings may be needed depending on the system design. It is important not to forget the evaluation of the drain field replacement area.

When evaluating a new site, the requirement is for at least three in the proposed installation area and another three in the replacement area, except when the proposed installation location and the replacement area are right next to each other.

403.1.2 Location. Each borehole shall be accurately located and referenced to the vertical elevation and horizontal reference points. Reports of boring location shall either be drawn to scale or have the horizontal dimensions clearly indicated between the borings and the horizontal reference point.

C The site plan should indicate soil boring or pit locations in relation to both vertical elevation and the horizontal reference point.

403.1.3 Soil description. Soil profile descriptions shall be written for all borings. The thickness in inches (mm) of the different soil horizons observed shall be indicated. Horizons shall be differentiated on the basis of color, texture, *soil mottles* or bedrock. Depths shall be measured from the ground surface.

C The soil boring and pit descriptions must record the depth, color and texture of each soil horizon encountered. The depth must reference how far down from the surface each distinct horizon starts and ends. Other features that should be recorded include mottles, hardpan and bedrock.

403.1.4 Soil mottles. Seasonal or periodic soil saturation zones shall be estimated at the highest level of *soil mottles*. The *code official* shall require, where deemed necessary, a detailed description of the soil mottling on a marginal site. The abundance, size, contrast and color of the *soil mottles* shall be described in the following manner:

Abundance shall be described as "few" if the mottled color occupies less than 2 percent of the exposed surface; "common" if the mottled color occupies from 2 to 20 percent of the exposed surface; or "many" if the mottled color occupies more than 20 percent of the exposed surface. Size refers to length of the mottle measured along the longest dimension and shall be described as "fine" if the mottle is less than 0.196 inch (5 mm); medium if the mottle is from 0.196 inch to 1.590 inches (5 mm to 40 mm); or coarse if the mottle is larger than 1.590 inches (40 mm). Contrast refers to the difference in color between the soil mottle and the background color of the soil and is described as "faint" if the mottle is evident but recognizable with close examination; "distinct" if the mottle is readily seen but not striking; or "prominent" if the mottle is obvious and one of the outstanding features of the horizon. The color(s) of the mottle(s) shall be indicated.

C Redoximorphic features or mottles are indicators of the seasonal high water table or perched water tables. These features only present in the soil under extended saturation periods. The mottles should be both prominent and distinct when using them for determining a water table level depth. During soil profile evaluation, the mottles encountered should be documented without mistaking them for soil inclusions (other strips or veins of contrasting soil types). It is important to describe these mottles as best possible to ensure proper documentation and justification in the determination of the seasonal-high or perched water table.

403.1.5 Observed ground water. The depth to ground water, if present, shall be reported. Observed ground water shall be reported at the level that ground water reaches in the soil borehole or the highest level of sidewall seepage into the boring. Measurements shall be made from ground level. Soil located above the water level in the boring shall be checked for the presence of *soil mottles*.

C The highest level of the observed water table must be recorded. It is important to note that the observed water table is often found below the depth of mottling (indicator of seasonal high water table) but it can, in less common cases, be found above the mottling during wet conditions or seasons of the year. In certain soil textures, the ground water may be noticed by increased suction or resistance on the soil auger bucket.

403.2 Color patterns not indicative of soil saturation. The following soil conditions shall be reported, but shall not be interpreted as color patterns caused by wetness or saturation. Soil profiles with an abrupt textural change with finer-textured soils overlying more than 4 feet (1219 mm) of unmottled, loamy sand or coarser soils can have a mottled zone for the finer textured material. Where the mottled zone is less than 12 inches (305 mm) thick and located immediately above the textural change, a soil absorption system shall be permitted in the loamy sand or coarser material below the mottled layer. The site shall be considered to be unsuitable where any *soil mottles* occur within the sandy material. The *code official* shall consider certain coarse sandy loam soils to be included as a coarse material.

C The right color of mottling depends on the soil type you are evaluating. For example, high-chroma or reddish-brown mottles are looked for in sandy soils. In clayey soils, low chroma (white or grey) color depletions in the soil are looked for.

403.2.1 Other soil color patterns. *Soil mottles* occur that are not caused by seasonal or periodic soil saturation zones. Examples of such soil conditions not limited by enumeration are *soil mottles* formed from residual sandstone deposits; *soil mottles* formed from uneven weathering of glacially deposited material or glacially deposited material that is naturally gray in color, including any concretionary material in various stages of decomposition; deposits of lime in a profile derived from highly calcareous parent material; light-colored silt coats deposited on soil bed faces; and *soil mottles* usually vertically oriented along old or decayed root channels with a dark organic stain usually present in the center of the mottled area.

C It is important for the soil evaluator to be trained and experienced to ensure that the right type of mottling is used to call a seasonal high water table. Soil inclusions or deposits of different types of soil with different textures and colors can occur. These are often confused as hydraulic indicators rather than the soil mottles they actually are. Misidentification of these mottles can result in installation requirements that are not necessary and costly for property owners.

403.2.2 Reporting exceptions. The site evaluator shall report any mottled soil condition. The observation of *soil mottles* not caused by soil saturation shall be reported. On request, the *code official* shall make a determination of the acceptability of the site.

C The soil evaluator must record all hydraulic and soil mottles. This important documentation is essential for transparency and justification of the installation requirements.

403.3 Bedrock. The depth of the bedrock, except sandstone, shall be established at the depth in a *soil boring* where more than 50 percent of the weathered-in-place material is consolidated. Sandstone bedrock shall be established at the depth where an increase in resistance to penetration of a knife blade occurs.

C Hardpan or bedrock is determined when 50 percent or more of the soil in the auger bucket or pit is consolidated. This threshold is often reached gradually when encountering larger soil structures, but in some cases can be crossed abruptly.

403.4 Alluvial and colluvial deposits. Subsurface soil absorption systems shall not be placed in alluvial and colluvial deposits with shallow depths, extended periods of saturation or possible flooding.

C A drain field should not be located in areas of frequent or seasonal flooding as the soil is unsuitable. The soil is dynamic and lacks natural structure that needs time to develop and is favorable to hydraulic loading of the soil.

SECTION 404—PERCOLATION OR PERMEABILITY EVALUATION

404.1 General. The permeability of the soil in the proposed absorption system shall be determined by percolation tests or permeability evaluation.

C Permeability of the soil is key to a well-functioning drain field. While percolation tests are still used in some areas, boring holes identifying soil characteristics that are then compared to known hydraulic loading rates are more commonly used to determine drain field sizing.

404.2 Percolation tests and procedures. Not less than three percolation tests in each system area shall be conducted. The holes shall be spaced uniformly in relation to the bottom depth of the proposed absorption system. More percolation tests shall be made where necessary, depending on system design.

C Similar to soil boring holes or pits, the percolation test requires at least three holes in the drain field location. The percolation holes must be dug uniformly to the bottom of the proposed drain field depth. This will help ensure adequate hydraulic soil loading in the entire drain field area.

404.2.1 Percolation test hole. The test hole shall be dug or bored. The test hole shall have vertical sides and a horizontal dimension of 4 inches to 8 inches (102 mm to 203 mm). The bottom and sides of the hole shall be scratched with a sharp-pointed instrument to expose the natural soil. Loose material shall be removed from the hole, and the bottom shall be covered with 2 inches (51 mm) of gravel or coarse sand.

C When using a soil auger, the bucket used must be 4 to 8 inches in diameter. Loose soil must be removed and approximately 2 inches of gravel or coarse sand placed at the bottom of the hole.

404.2.2 Test procedure, sandy soils. The hole shall be filled with clear water to not less than 12 inches (305 mm) above the bottom of the hole for tests in sandy soils. The time for this amount of water to seep away shall be determined and this procedure shall be repeated if the water from the second filling of the hole seeps away in 10 minutes or less. The test shall proceed as follows: Water shall be added to a point not more than 6 inches (152 mm) above the gravel or coarse sand. Thereupon, from a fixed reference point, water levels shall be measured at 10-minute intervals for a period of 1 hour. Where 6 inches (152 mm) of water seeps away in less than 10 minutes, a shorter interval between measurements shall be used, but the water depth shall not exceed 6 inches (152 mm) in any case. Where 6 inches (152 mm) of water seeps away in less than 2 minutes, the test shall be stopped and a rate of less than 3 minutes per inch (7.2 s/mm) shall be reported. The final water level drop shall be used to calculate the percolation rate. Soils not meeting the requirements of this section shall be tested in accordance with Section 404.2.3.

C This section outlines the procedures for conducting a percolation testing sandy soils. It is important to follow and document all steps as closely as possible. These steps will help you determine if the soil is poorly or well drained. This information is important to determine the specific hydraulic loading of the soil that is possible in that location.

404.2.3 Test procedure, other soils. The hole shall be filled with clear water, and a minimum water depth of 12 inches (305 mm) shall be maintained above the bottom of the hole for a 4-hour period by refilling whenever necessary or by use of an automatic siphon. Water remaining in the hole after 4 hours shall not be removed. Thereafter, the soil shall be allowed to swell not less than 16 hours or more than 30 hours. Immediately after the soil swelling period, the measurements for determining the percolation rate shall be made as follows: Any soil sloughed into the hole shall be removed, and the water level shall be adjusted to 6 inches (152 mm) above the gravel or coarse sand. Thereupon, from a fixed reference point, the water level shall be measured at 30-minute intervals for a period of 4 hours, unless two successive water level drops do not vary by more than 1/16 inch (1.59 mm). Not less than three water level drops shall be observed and recorded. The hole shall be filled with clear water to a point not more than 6 inches (152 mm) above the gravel or coarse sand whenever it becomes nearly empty. The water level shall not be adjusted during the three measurement periods except to the limits of the last measured water level drop. Where the first 6 inches (152 mm) of water seeps away in less than 30 minutes, the test shall be performed again for a period of 1 hour with measurements performed every 10 minutes. The water depth shall not exceed 5 inches (127 mm) at any time during the measurement period. The drop that occurs during the final measurement period shall be used in calculating the percolation rate.

C This section outlines the procedures for conducting percolation testing for all soils other than sandy soils. It is important to follow and document all steps as closely as possible. These steps will help determine if the soil is poorly or well drained. This information is important to determine the specific hydraulic loading of the soil that is possible in that location.

404.2.4 Mechanical test equipment. Mechanical percolation test equipment shall be of an approved type.

C Mechanical percolation test equipment and procedures must be reviewed and validated in order to be utilized as an alternative to traditional percolation tests.

404.3 Permeability evaluation. Soil shall be evaluated for estimated percolation based on structure and texture in accordance with accepted soil evaluation practices. Borings shall be made in accordance with Section 404.2 for evaluating the soil.

C Soil borings in accordance with Section 404.2 are made so that percolation estimates can be based on the soil's specific structure and texture.

SECTION 405—SOIL VERIFICATION

405.1 Verification. Where required by the *code official*, depth to *soil mottles*, depth to high ground water, soil textures, depth to bedrock and land slope shall be verified by the *code official*. The *code official* shall require, where necessary, backhoe pits to be provided for verification of *soil boring* data. Where required by the *code official*, the results of percolation tests or permeability evaluation shall be subject to verification. The *code official* shall require, where necessary, that percolation tests be conducted under supervision. Where the natural soil condition has been altered by filling or other methods used to improve wet areas, the *code official* shall require, where necessary, observation of high ground water levels under saturated soil conditions. Detailed soil maps, or other adequate information, shall be used for determining estimated percolation rates and other soil characteristics.

C Important soil boring or pit characteristics must be validated by the code official prior to the issuance of a construction permit. The code official should use a number of resources as appropriate to ensure the system is being permitted and installed properly.

405.2 Monitoring ground water levels. A property owner or developer shall have the option to provide documentation that soil mottling or other color patterns at a particular site are not an indication of seasonally saturated soil conditions of high ground water levels. Direct observation shall be used to document ground water levels. Monitoring shall be in accordance with the procedures cited in Sections 405.2.1 through 405.2.6.

C If a property owner questions that seasonal high water table determination of the soil evaluation, the owner has the right to provide documentation of their findings. Ultimately, it is the responsibility of the code official to make the final determination. The code official must consider all evidence before making a final determination.

405.2.1 Precipitation. Monitoring shall be performed at a time of the year when maximum ground water elevation occurs. In determining whether a near-normal season has occurred where sites are subject to broad regional water tables, such as large areas of sandy soils, the fluctuation over the several-year cycle shall be considered. In such cases, data obtained from the United States Geological Survey (USGS) shall be used to determine if a regional water table was at or near its normal level.

C Recent or seasonal perceptions must be considered when conducting a soil evaluation and the determination of the seasonal high water table. Determinations made during wet conditions are often argued to be unfair by property owners; however, it is the best time to make observations as drain fields must be able to perform properly during wet and dry periods of the year. USGS soil surveys and maps are helpful tools to help explain observations made in the field.

405.2.2 Artificial drainage. Areas to be monitored shall be checked for drainage tile and open ditches that alter natural high ground water levels. Where such factors are involved, information on the location, design, ownership and maintenance responsibilities for such drainage shall be provided. Documentation shall be provided to show that the drainage network has an adequate outlet and will be maintained. Sites affected by agricultural drain tile shall not be acceptable for system installation.

C Site factors such as improved drainage systems can alter the hydrology of the drain field location. When such improvements are present on the property or adjacent property, it is important to gather more information so that the code official can consider this information during the permitting process. Monitoring wells may be installed and used to observe hydraulic conditions.

405.2.3 Procedures. The owner or the owner's agent shall notify the *code official* in writing of the intent to monitor. Where necessary, the *code official* shall field check the monitoring once or more during the time of expected saturated soil conditions.

Not less than three wells shall be monitored at a site for a proposed system and replacement. Where necessary, the *code official* shall require more than three monitoring sites, and the site evaluator shall be so advised in writing.

C When monitoring wells are proposed to help inform the determination of the water table, the owner or agent must notify the code official. The code official must monitor the wells once or more during wet conditions. A minimum of three monitoring wells in the drain field location is required. More wells may be required by the code official if deemed necessary.

405.2.4 Monitoring well design. Not less than two wells shall extend to a depth of not less than 6 feet (1829 mm) below the ground surface and shall be not less than 3 feet (914 mm) below the designed system depth. However, with layered mottled soil over permeable unmottled soil, not less than one well shall terminate within the mottled layer. Monitoring at greater depths shall be required, where necessary, due to site conditions. The site evaluator shall determine the depth of the monitoring wells for each specific site. Depths shall be approved. The monitoring well shall be a solid pipe installed in a bore hole. The pipe size shall be not less than 1 inch (25 mm) and not greater than 4 inches (102 mm). The bore hole shall be not less than 4 inches (102 mm) and not greater than 8 inches (203 mm) larger than the pipe [see Appendix A, Figure A101.1(2)].

C This section outlines the design requirements for the use of monitoring wells. This information and requirements should be listed on the monitoring plan submitted for review by the code official.

405.2.5 Observations. The first observation shall be made on or before **[DATE]**. Observations shall be made thereafter every 7 days or less until **[DATE]** or until the site is determined to be unacceptable, whichever occurs first. Where water is observed above the critical depth at any time, an observation shall be made 1 week later. Where water is present above the critical depth at both observations,

monitoring shall cease and the site shall be considered unacceptable. Where water is not present above the critical depth at the second observation, monitoring shall continue until **[DATE]**. Where any two observations 7 days apart show the presence of water above the critical depth, the site shall be considered unacceptable and the *code official* shall be notified in writing. When rainfall of 0.5 inch (12.7 mm) or more occurs in a 24-hour period during monitoring, observations shall be made at more frequent intervals, where necessary.

C This section outlines the procedure requirements for the use of monitoring wells. This information and requirements should be listed on the monitoring plan submitted for review by the code official.

405.2.6 Reporting data. Where monitoring shows saturated conditions, the following data shall be submitted in writing: test locations; ground elevations at the wells; soil profile descriptions; soil series, if available from soil maps; dates observed; depths to observed water; and local precipitation data—monthly from **[DATE]** and daily during monitoring.

Where monitoring discloses that the site is acceptable, the following data shall be submitted in writing: location and depth of test holes, ground elevations at the wells and soil profile descriptions; soil series, if available from soil maps; dates observed; results of observations; information on artificial drainage; and local precipitation data—monthly from **[DATE]** and daily during monitoring. A request to install a soil absorption system shall be made in accordance with Section 105.

C The data collected by way of the approved monitoring procedures must be used by the code official to determine if the site location is suitable for the proposed system.

SECTION 406—SITE REQUIREMENTS

406.1 Soil absorption site location. The surface grade of all soil absorption systems shall be located at a point lower than the surface grade of any nearby water well or reservoir on the same or adjoining property. Where this is not possible, the site shall be located so surface water drainage from the site is not directed toward a well or reservoir. The soil absorption system shall be located with a minimum horizontal distance between various elements as indicated in Table 406.1. *Private sewage disposal systems* in compacted areas, such as parking lots and driveways, are prohibited. Surface water shall be diverted away from any soil absorption site on the same or neighboring lots.

C Where feasible, the elevation of the top of the drain field location shall be below any wells, ditches, swales or surface water bodies on the property or adjacent properties. When this is not possible, the site grading in the drain field area must direct drainage away from the wells, ditches, swales or surface water bodies. Drainage from one drain field area must not be directed to another drain field area on the same or adjacent lot.

Using Table 406.1, the minimum setback, or minimum horizontal separation, to each element to any part of the septic system must be maintained in order to achieve compliance.

TABLE 406.1—MINIMUM HORIZONTAL SEPARATION DISTANCES FOR SOIL ABSORPTION SYSTEMS

ELEMENT	DISTANCE (feet)
Cistern	50
Habitable building, below-grade foundation	25
Habitable building, slab-on-grade	15
Lake, high-water mark	50
Lot line	5
Reservoir	50
Roadway ditches	10
Spring	100
Streams or watercourse	50
Swimming pool	15
Uninhabited building	10
Water main	50
Water service	10
Water well	50

For SI: 1 foot = 304.8 mm.