INDIVIDUAL SEWAGE DISPOSAL RULES AND REGULATIONS

FOR

CLAY COUNTY, MISSOURI

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CLAY COUNTY PUBLIC HEALTH CENTER
Environmental Health Protection Division
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INDIVIDUAL SEWAGE DISPOSAL RULES AND REGULATIONS FOR CLAY COUNTY, MISSOURI

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Minimum Construction Standards for On-Site Sewage Disposal Systems

PURPOSE: This rule establishes minimum construction standards for on-site sewage disposal systems. In accordance with the authority granted in G.O. 89-113, this rule establishes the minimum standards and criteria for the design, location, installation and repair of individual on-site sewage disposal systems to promote the public health and general welfare and to protect the surface and ground waters of the county.

(1) General.

(A) Definitions. For the purposes of these standards, certain terms or words used here shall be interpreted as follows. The word shall is mandatory and the words should and may are permissive. All distances, unless otherwise specified, shall be measured horizontally:

1. **Administrative authority**– the administrative authority shall mean the Health Officer;

2. **Aeration unit**–A sewage tank which utilizes the principle of oxidation in the decomposition of sewage by the introduction of air into the sewage. All aeration units shall comply with NSF Standard 40 Class I;

3. **Alluvium**–Soil parent material which was transported and deposited in a running water setting;

4. **Alternative**–An individual sewage disposal system employing methods and devices as presented in section (9) of this rule. Also known as advanced systems;

5. **Approved**–Considered acceptable by the Health Officer;

6. **Baffle**–A device installed in a septic tank for proper operation of the tank and to provide maximum retention of solids. This includes vented sanitary tees and submerged pipes in addition to those devices normally called baffles;

7. **Bedrock**–That layer of geologic material which is consolidated;

8. **Bedroom**–Any room within a dwelling that might reasonably be used as a sleeping room. The number of bedrooms in a residence as given by an appraiser will be used in determining volumes in the sizing of on-site sewage disposal systems;

9. **Black water**–Liquid-carried waste from a dwelling or other establishment, which contains organic wastes, including excreta or other body wastes, blood or other body fluids, and garbage;

10. **Building sewer**–That part of the drainage system which extends from the end of the building drain and conveys its discharge to an on-site sewage disposal system;

11. **Capacity**–The liquid volume of a sewage tank using inside dimensions below the outlet;

12. **Color**–The moist color of the soil based on the Munsell soil color system;

13. **Distribution pipes**–Perforated rigid pipes that are used to distribute sewage tank effluent in a soil treatment system;

14. **Dosing chamber** (or pump pit or wet well)–A tank or separate compartment following the sewage tank which serves as a reservoir for the dosing device;

15. **Dosing device**–A pump, siphon or other device that discharges sewage tank effluent from the dosing chamber to the soil treatment system;

16. **Dwelling**–Any building or place used or intended to be used by human occupants as a residential unit(s);

17. **Environmental Health Specialist**–A person employed as a sanitarian or environmental health professional by the Health Officer

18. **Effluent**–The liquid discharge of a septic tank or other sewage treatment device;

19. **Effluent filter**-Easily removable, cleanable device installed on the outlet piping of a septic tank for the purpose of retaining solids of a specific size within the tank.

20. **Evaporation Pond (Lagoon) System**-An onsite wastewater treatment system incorporating an approved pretreatment component and a lagoon used to treat and contain effluent.

21. **Exfiltration**-Undesirable exiting of effluent from an onsite water treatment system component into the environment.

22. **Fixed media treatment system (biofilter)**–A system configured wherein the microorganisms responsible for treatment are attached to a fixed medium.

23. **Gravelless** system–An absorption system recognized by the Health Officer as an acceptable method of subsurface disposal of sewage without the required use of gravel. The following are examples:

A. Large diameter, eight inch (8") and ten inch (10") corrugated, perforated plastic pipe, wrapped in a sheath of spun-bonded filter wrap;

B. Chamber system;

C. Drip irrigation;

D. Polystyrene aggregate bundle;

24. **Gray water**–Liquid waste, specifically excluding toilet, hazardous, culinary and oily wastes, from a dwelling or other establishment which is produced by bathing, laundry, or discharges from floor drains;

25. **Grease trap**–A device designed and installed so as to separate and retain oils and fats from normal wastes while permitting normal sewage or wastes to discharge into the drainage system by gravity;

26. **Ground absorption sewage treatment and disposal system**–A system that utilizes the soil for the subsurface disposal of partially treated or treated sewage effluent. The following are examples:

A. Conventional soil absorption system–A system that distributes effluent by gravity flow from the septic or other treatment tank and applies effluent to the soil through the use of a seepage trench or bed;

B. Dosing soil absorption system–A system that distributes effluent by a pump or automatic siphon to elevate or distribute effluent to the soil through the use of a seepage trench or bed.

C. Drip soil absorption system–A system that distributes effluent through drip lines in a grid pattern (also known as trickle irrigation);

D. Low pressure distribution system–A soil absorption system that distributes effluent by a pump and smaller diameter distribution piping with small diameter perforations in a specially designed shallow placement absorption field; and

E. Pressure dosed manifold distribution system – A soil absorption system that distributes effluent by a pump and small diameter distribution piping to conventional gravity laterals

27. **Hazardous waste**–Any waste or combination of wastes, as determined by the Hazardous Waste Commission by rules, which, because of its quantity, concentration, or physical, chemical or infectious characteristics, may cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness, or pose a present or potential threat to the health of humans or the environment;

28. **Health Officer**– the Clay County Public Health Center Director of Public Health or his/her representative;

29. **High ground water**–Zones of soil saturation which include: perched water tables, shallow regional ground water tables or aquifers, or zones that are seasonally, periodically or permanently saturated;

30. **High-water level**–The highest known flood water elevation of any lake, stream, pond or flowage or the regional flood elevation established by a state or federal agency;

31. **Holding tank**–A watertight tank for temporary storage of sewage until it can be transported to a point of approved treatment and disposal;

32. **Horizon**–A layer of soil, approximately parallel to the surface, that has distinct characteristics relative to adjacent layers;

33. **Individual sewage disposal system**–A sewage disposal system, or part of a system, serving a dwelling or other establishment, which utilizes subsurface soil treatment and dispersal, or an approved pretreatment component and evaporation pond;

34. **Intermittent sand filters**–Intermittent sand filters are beds of granular materials twenty-four to thirty-six inches (24-36") thick underlain by graded gravel and collecting pipe. Waste water is applied intermittently to the surface of the bed through distribution pipes and the bed is under- drained to collect and discharge the final effluent Filters may be designed to provide free access (open filters) or may be buried in the ground (buried filters or subsurface sand filters);

35. **Lagoon**-A sealed earthen basin used to hold wastewater effluent.

36. **Matrix color**–The dominant color of a soil material;

37. **Mottling**–Spots or splotches of color interspersed in the dominant (or matrix color) of a soil material. Mottles may be of a wide variety of colors;

38. **Mound system**–A system where the soil treatment area is built above the ground to overcome limits imposed by proximity to water table or bedrock or by rapidly or slowly permeable soils;

39. **Non-ground absorption sewage disposal system**–A facility for waste treatment designed not to discharge to the soil, land surface, or surface waters such as waterless toilets;

40. **Onsite Soil Evaluator (OSE)**–An individual who registered with the State of Missouri and approved by the Health Officer;

41. **Other establishment**–Any public or private structure other than a dwelling which generates sewage;

42. **Perched water table**–A saturated zone above and separated from the water table by a horizon which is unsaturated;

43. **Permeability**–The ease with which liquids and gases move within the soil or rock;

44. **Plastic limit**–A soil moisture content below which the soil may be manipulated for purposes of installing a soil treatment system and above which manipulation will cause compaction, puddling and smearing, as determined by the Health Officer. This is not to be confused with plastic limit as used or defined in the Unified Soil Classification System;

45. **Privy**–An outhouse or structure used for receiving human excrement in a container or vault beneath the structure;

46. **Registered geologist**–A person who meets the requirements of Chapter 256, RSMo;

47. **Restrictive horizon**–A soil horizon that is capable of perching ground water or sewage effluent and that is brittle and strongly compacted or strongly cemented with iron, aluminum, silica, organic matter or other compounds. Restrictive horizons may occur as claypans, fragipans, iron pans or organic pans and are recognized by their resistance in excavation or in use of a soil auger. These horizons are compacted, hard, or very high in clay content and usually very slowly permeable;

48. **Rock fragments**–The percentage by volume of rock fragments in a soil that are greater than two millimeters (2 mm) in diameter or retained on a No. 10 sieve which may include, but is not restricted to, chert, sandstone, shale, limestone or dolomite;

49. **Seepage bed**–An excavated area larger than three feet (3') in width which contains a bedding of aggregate or gravelless product and has more than one (1) distribution line;

50. **Seepage (lateral) trench**–An area excavated one to three feet (1–3') in width which contains a bedding of aggregate or gravelless product and a single distribution line;

51. **Septage**–Those solids and liquids removed during periodic maintenance of a septic or aeration unit tank or those solids and liquids removed from a holding tank;

52. **Septic tank**–Any watertight, covered receptacle designed and constructed to receive the discharge of sewage from a building sewer, separate solids from liquid, digest organic matter, store liquids through a period of detention and allow the clarified liquids to discharge to a soil treatment system;

53. **Setback–A** separation distance measured horizontally;

54. **Severe geological limitations**–Site-specific geologic conditions which are indicative of rapid recharge of an aquifer and likely groundwater contamination. Locations with significant groundwater contamination potential should be investigated by a registered geologist to determine if the site has severe geological limitations. Standardized criteria for determination of severe geological limitations are available in the form *Assessment of Individual On-Site Waste Disposal Geological Limitations* from the Department of Natural Resources, Division of Geology and Land Survey;

55. **Sewage**–Any water-carried domestic waste, exclusive of footings and roof drainage. Domestic waste includes, but is not limited to; liquid waste produced by bathing, laundry, culinary operations, liquid wastes from toilets and floor drains and specifically excludes animal waste and commercial process water. Also known as wastewater;

56. **Sewage flow**–Flow as determined by measurement of actual water use or, if actual measurements are unavailable, as estimated by the best available data provided by Table 2 in subsection (1)(E) of this rule;

57. **Sewage tank**–A watertight tank used in the treatment of sewage which includes, but is not limited to, septic tanks and aeration units;

58. **Sewage tank effluent**–That liquid which flows from a septic tank or aeration unit under normal operation;

59. **Significant groundwater contamination potential**–Any condition which would cause or indicate rapid recharge of an aquifer. This includes, but is not limited to, the following conditions or parameters: a water sample from an on-site well which exceeds drinking water standards with respect to fecal coliform; a hydrologic connection is established between the on-site waste disposal system and any well; a disposal field to be placed in Class V soils; a disposal field within one hundred feet (100') of the topographic drainage of a sinkhole; or a sewage tank within fifty feet (50') of the topographic drainage of a sinkhole;

60. **Simple drip**- Simple drip is a form of design and installation of subsurface drip irrigation allowing the system to be pressurized with the use of a ball valve on the return manifold just past the last drip line. It also allows for forward flushing of the system during each pump cycle. Simple drip shall have a time dose control panel but is not required to have a "head works" box with solenoid valves for control panel operated flushing of the system;

61. **Sinkhole**–A land surface depression that is hydraulically connected with a subterranean passage developed by a solution or collapse into the underlying bedrock, or both;

62. **Site**–The area bounded by the dimensions required for the proper location of the soil treatment system;

63. **Slope**–The ratio of vertical rise or fall to horizontal distance;

64. **Soil**–The naturally occurring, unconsolidated mineral or organic material of the land surface developed from rock or other parent material and consisting of sand, silt and clay-sized particles and variable amount of organic materials;

65. **Soil characteristics, limiting** –Those soil characteristics which preclude the installation of a standard system, including, but not limited to, evidence of water table, restrictive horizon, or bedrock closer than three feet (3') to the ground surface;

66. **Soil saturation**–The condition that occurs when all the pores in a soil are filled with water;

67. **Soil textural classification**–Soil particle sizes or textures specified in this rule refer to the soil textural classification in the *Soil Survey Manual Handbook No. 18*, U.S. Department of Agriculture, 1993;

68. **Soil treatment area**–That area of trench or bed bottom which is directly used for calculation of system size;

69. **Soil treatment system**–A system where sewage tank effluent is treated and disposed of below ground surface by filtration and percolation through the soil. It includes those systems commonly known as seepage bed, trench, drainfield, disposal field, and systems known as alternative and advanced treatment systems;

70. **Standard(Conventional)system**–An individual sewage disposal system employing a building sewer, sewage tank and the soil treatment system commonly known as seepage bed or trenches, drainfield or leach field; or an approved pretreatment component and evaporation pond;

71. **Toilet waste**–Fecal matter, urine, toilet paper and any water used for flushing;

72. **Trench rock**–Clean rock, washed creek gravel or similar insoluble, durable and decay-resistant material free from dust, sand, silt or clay (as approved by Clay County Public Health Center). The size shall range from one inch to three inches (1"–3"). If limestone, dolomite or other crushed white rock is used, it shall be washed and be a minimum size of one and one-half inches (1 1/2");

73. **Valve** - device which can stop sewage tank effluent from flowing to a portion of the soil treatment area. This includes, but is not limited to, caps or plugs on distribution or drop box outlets, divider boards, butterfly valves, gate valves or other mechanisms;

74. **Valve box**–Enclosure that houses a valve;

75. **Wastewater**–see sewage;

76. **Wastewater stabilization pond**–A sealed earthen basin which uses the natural unaided biological processes to stabilize wastewater (also known as a sewage lagoon); and

77. **Water table**–The highest elevation in the soil or rock where all voids are filled with water, as evidenced by presence of water or soil mottling or other information. This includes perched water tables, seasonal or apparent water tables.

(B) Applicability. For this rule, on-site wastewater treatment and disposal system means all equipment and devices necessary for proper conduction, collection, storage, treatment and disposal of wastewater from a dwelling or other facility producing sewage of three thousand gallons (3000 gals.) or less per day. Included within the scope of this rule are building sewers, septic tanks, subsurface absorption systems, mound systems, intermittent sand filters, gravelless systems, aeration unit wastewater treatment systems and single family evaporation ponds. Lot sizes shall be a minimum of three (3) acres except smaller lots may be considered contingent upon a satisfactory engineer's report as required in Section 14, A of the Missouri Department of Natural Resources Rule 10 CSR 20-8.020 Design of Small Sewage Works. Commercial or industrial facilities and developers of subdivisions must first contact the Department of Natural Resources concerning compliance with the Missouri Clean Water Law and Regulations before applying for any approvals or permits under this rule.

(C) Responsibilities.

1. The design, construction, operation and maintenance of sewage treatment and disposal systems, whether septic tank systems, privies or alternative systems, shall be the responsibility of the designer, owner, developer, installer or user of the system.

2. Actions of representatives of the Health Officer engaged in the evaluation and determination of measures required to effect compliance with the provisions of this rule shall in no way be taken as a guarantee or warranty that sewage treatment and disposal systems approved and permitted will function in a satisfactory manner for any given period of time. Due to the development of clogging mats, which adversely impact the life expectancy of normally functioning ground absorption sewage treatment and disposal systems and variables influencing system function which are beyond the scope of this rule, no guarantee or warranty is implied or given that a sewage treatment and disposal system will function in a satisfactory manner for any specific period of time.

3. Prior to the issuance of a permit to install or affect major repair of an on-site sewage disposal system, plans and specifications shall be required for review. Approval by the Health Officer shall be required for–

A. Plans for absorption field showing the following:

(I) Field locations with slope(s) indicated or with contour lines based on field measurement. If field areas are essentially flat or of uniform grade, spot elevations will be required for alternate systems.

(II) Field layout, length, spacing, connection, pipe sizes and cleanout details, invert elevations of flow distribution devices and laterals, valves and appurtenances;

(III) Trench plan and profile drawings and flow distribution device details;

(IV) Location and design of associated surface and groundwater drainage systems;

(V) Name, address and telephone number of the person(s) drafting the plans; and

(VI) Any other information required by the Health Officer; and

B. Alternative systems whether or not specifically described in this rule.

4. The entire sanitary sewage system shall be on property owned or controlled by the person owning or controlling the system. The Health Officer may require the property boundaries to be established by a professional land surveyor registered in the State of Missouri. Necessary easements shall be obtained permitting the use and unlimited access for inspection and maintenance of all portions of the system to which the owner and operator do not hold undisputed title. Easements shall remain valid as long as the system is required and shall be recorded with the county recorder of deeds.

(D) Minimum Set-Back Distances. All on-site wastewater treatment and disposal systems shall be located in accordance with the distances shown in Table 1.

(E) Sewage Flow Rates. Table 2 shall be used to determine the minimum design daily flow of sewage required in calculating the design volume of sanitary sewage systems to serve selected types of establishments. The minimum design volume of sewage from any establishment shall be one hundred gallons (100 gals.) per day. Design of sewage treatment and disposal systems for establishments not identified in this rule shall be determined using available flow data, water-using fixtures, occupancy or operation patterns and other measured data.

1. Volume determination. In determining the volume of sewage from single family dwellings, the minimum flow rate shall be one hundred fifty gallons (150 gals.) per day per bedroom. The minimum volume of sewage from each single family dwelling shall be three hundred gallons (300 gals.) per day. When the occupancy of a single family dwelling exceeds two (2) persons per bedroom, the volume of sewage shall be determined by the maximum occupancy at a rate of seventy five gallons (75 gals.) per person per day.

Table 1–Minimum Set-Back Distances

Minimum Distance From	Sewage Tank[1]	Disposal Area [2]	Lagoons
Private water supply well [3]	(feet) 50	(feet) 100	(feet) 100
Public water supply well	300	300	300
Cistern	25	25	25
Spring	50	100	100
Classified stream, lake or impoundment*	50	50	50
Stream or open ditch [4]	25	25	25
Property lines	10	10**	75
Residence served with basement	15	25	100
Residence served without basement	5	15	100
Nearest existing residence	-	-	200
Building foundation/Accessory building ***	5	15	25
Swimming pool	15	15	15
Water line under pressure	10	10	10
Suction water line	50	100	100
Upslope interceptor drains	-	10	10
Down slope interceptor drains	-	25	25
Top of slope of embankments or cuts of two feet (2') or more vertical height	-	20	20
Edge of surficial sink holes	50	100	500
Other soil absorption system except repair area	-	20	20

*A classified stream is any stream that maintains permanent flow or permanent pools during drought periods and supports aquatic life.

**Recommend twenty-five feet (25') of down slope property line initially, but repair may be allowed to ten feet (10') of down slope property line.

***Accessory building set-back may be reduced to fifteen feet (15') if necessary as approved by Health Officer.

[1] Includes sewage tanks, intermittent sand filters and dosing chambers.

[2] Includes all systems (sand filter, wetland and the like) except evaporation ponds.

[3] Unplugged abandoned wells or wells with less than eighty feet (< 80') of casing depth shall have one-hundred-fifty feet (150') minimum distance from all above.

[4] Sewage tanks and soil absorption systems should never be located in the drainage area of a sinkhole.

Note: System components cannot encroach into a public easement without permission of the authority having jurisdiction (ahj).

TABLE 2–Quantities of Domestic Sewage Flows

Type of Establishment[1]	Flow
	(gallons per day per unit unless
Residential Units	otherwise indicated)
Single Family Dwelling	150/bedroom
Multiple Family Dwelling (with laundry capabilities)	150/bedroom
Multiple Family Dwelling (without laundry	120/bedroom
capabilities cottages)	75/person
	(in excess of 2 persons/bedroom)
Mobile Home Parks	300/home*
Commercial Facilities	
Transportation terminals (airports, bus stops, railroad stations and the like)	5/passengers
Laundromats	580/machine
Beauty Shops (Style Shops)	125/chair
Bowling Lanes	50/lane
Business (other than those listed elsewhere in this table)	25/employee
Factories (exclusive of industrial waste)	25/person/shift
add for showers	10/person/shift
Marinas	10/boat slip
with bathhouse	30/boat slip
Motels/Hotels	120/room
with cooking facilities	175/room
Offices (per shift)	25/person
Service Stations	250/water closet or urinal
24-hour Service Stations	325/water closet
Theaters: Movies	5/seat
Drive-in	15/vehicle space
Warehouses	30/employee
Public parks (toilets only)	5/user
Public parks with bath house	15–25/user
Camps	
Construction or Work Camps	60/person
	40/person (with chemical toilets)
Summer Camps	60/person
Campgrounds–with Comfort Station (without water and sewer hookups)	100/campsites
Travel Trailer/Recreational Vehicle Park (with water and sewer hookups)	120/space
Assembly & Mercantile	
Retail Stores	120/ 1000 sq. ft. of retail sales area
Stadium, Auditorium, Theater, Drive-in	5/seat or space
Swimming Pools, Spas, and Bathhouses	10/person
Churches (Not including a Kitchen, Food Service Facility, Day Care or Camp)	3/seat
Churches (With a Kitchen but not including a Food Service Facility, Day Care or Camp)	5/seat
Country Club	20/member

TABLE 2–Quantities of Domestic Sewage Flows (continued)

Type of Establishment[1]	Flow
Food or Drink Establishment**	
Bar (not serving food)	20/seat
Restaurants	40/seat or 40/15 sq. ft. of dining area, whichever is greater
24-hour Restaurant	75/seat
Food Stands	
1) per 100 square feet of food stand floor space	50 gal.
2) add per food employee	25 gal.
Other food service facilities	5/meal
Meat Markets	
1) per 100 square feet of market floor space	50 gal.
2) add per market employee	25 gal.
Institutional**	
Hospitals	300/bed
Day Care Facilities	15/person
Residential Care Facilities	60/person
Rest Homes and Nursing Homes	
with laundry	120/bed
without laundry	60/bed
Day Schools	
with cafeteria, gym, and showers	15/student
with cafeteria only	12/student
with neither cafeteria nor showers	10/student
Boarding Schools	60/person

[1] Establishments with flows greater than three thousand gallons per day (3,000 gpd) shall be regulated under Chapter 644, RSMo, administered by the Department of Natural Resources.

* Must consider flow into the soil absorption system from mobile homes where taps are allowed to run to prevent freezing.

** Establishments processing food may be required to provide grease interceptors in an accessible location prior to the sewage treatment system.

Note: Gallons per person per unit includes normal infiltration for residential systems.

2. Other establishments. For establishments or housing developments other than a single family residence, either Table 2 shall be used to estimate the sewage flow rate or actual measured flow rate for existing systems may be used. Values for estimated sewage flow for establishments having food service operations shall be increased by a factor of one and one-half (1.5) to compensate for the high organic strength.

3. Grease traps shall be required at food service facilities, meat markets and other places of business where the accumulation of grease or oils can cause premature failure of a soil absorption system. The following design criteria shall be met:

A. The grease trap shall conform to Plumbing & Drainage Institute Standard PDI-G101 or equivalent;

B. The grease trap shall be plumbed to receive all wastes associated with food handling and no toilet wastes;

C. The grease trap liquid capacity shall be sufficient to provide for at least five gallons (5 gals.) of storage per meal served per day, at least two-thirds (2/3) of the required septic tank liquid capacity, or a capacity as determined in accordance with the following:

$$LC = D \times GL \times ST \times HR/2 \times LF$$

where LC = grease trap liquid capacity (gallons)
D = number of seats in dining area
GL = gallons of wastewater per meal
(1.5 single-service; 2.5 full-service)
ST = storage capacity factor = 2.5
HR = number of hours open
LF = loading factor = (1.25 interstate highway
= 1.0 other highways and
recreational areas
= 0.8 secondary roads);

D. Two (2) or more chambers must be provided, with total length-to-width ratio at least two to one (2:1). Chamber opening and outlet sanitary tee must extend down at least fifty percent (50%) of the liquid depth;

E. Access manholes, with a minimum diameter of twenty-four inches (24"), shall be provided over each chamber and sanitary tee. The access manholes shall extend at least to finished grade and be designed and maintained to prevent surface water infiltration. The manholes shall also have readily removable covers to facilitate inspection and grease removal; and

F. Where it has been demonstrated that specially designed grease interceptors will provide improved performance, the grease trap liquid capacity may be reduced by up to fifty percent (50%).

4. Reduction in sewage flow. Reductions in design sewage flow rates may be allowed by the Health Officer on a case-by-case basis depending upon water conservation plans. Sewage flow rates may be reduced up to forty percent (40%) for gray water systems where the toilet wastes are discharged to a holding tank and disposed of off site or where waterless toilets are utilized.

(2) Site Evaluation.

(A) All proposed sites for on-site sewage treatment and disposal systems shall be evaluated for the following:

1. Soil conditions, properties and permeability as determined by a soil morphology examination; a profile pit shall be required for all new installations in order to conduct soil morphology examination;

2. Slope;

3. The existence of lowlands, local surface depressions, rock outcrops and sinkholes;

4. All required setback distances as required in subsection (1)(D) of this rule;

5. Surface water flooding probability and depth to water table;

6. Location of easements and underground utilities;

7. Amount of available area for the installation of the system and an area for replacement;

8. Location of home site or dwelling as well as management of surface runoff water from those buildings;

9. Any other cultural feature, such as roads, streets and the like in the surrounding areas which influences surface and subterranean flow of water on or near the proposed site; and

10. Any significant groundwater contamination potential.

(B) Preliminary Soils Information. During a site evaluation reference may be made of county soil survey reports which are available from the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) for Clay County. NRCS soil survey reports should not be used as sole final determination for a specific site, but only as a guide to which soils are expected in a given area.

(C) Soil Morphology. This evaluation shall be conducted by an Onsite Soil Evaluator (OSE) registered with the State of Missouri and approved by the Health Officer. This type of evaluation is required for all sites. All soil morphologies should be recorded on a state form or an equivalent form containing all of the required information.

(3) Building Sewers.

Building sewers used to conduct wastewater from a building to an on-site wastewater treatment and disposal system shall be constructed of material meeting the minimum requirements of American Society for Testing and Materials (ASTM) Standards and listed by that agency for such use. Suitable materials meeting ASTM standards include: Acrylonitrile, butadiene styrene (ABS), cast iron pipe, concrete pipe, copper or copper-alloy tubing, polyvinyl chloride (PVC) or vitrified clay pipe. Although listed by ASTM, asbestos cement pipe will not be accepted due to potential health hazards to installers. Building sewer specifications are as follows:

(A) Size. Building sewers shall not be less than four inches (4") in diameter;

(B) Slope. Building sewers shall be laid to the following minimum slope:

1. Four-inch (4") sewer–twelve inches (12") per one hundred feet (100'); and

2. Six-inch (6") sewer–eight inches (8") per one hundred feet (100');

(C) Cleanouts. A cleanout shall be provided at least every one hundred feet (100') and at every change in direction or slope if the change exceeds forty-five degrees (45°). A cleanout should be provided between house and tank; and

(D) Connection to sewage tank. The pipe going into and out of the sewage tank shall be schedule 40 PVC or cast iron and shall extend a minimum of two feet (2') beyond the hole of excavation for the sewage tank.

(4) Sewage Tanks.

(A) General. All liquid waste and wash water with the following exceptions shall discharge into the sewage tank. Roof, garage, footing, surface water, drainage, cooling water discharges and hazardous wastes shall be excluded from the sewage tank. Backwash from water softeners and swimming pool filtration systems may be excluded from the sewage tank. In such event of excluding swimming pool filter backwash, the Department of Natural Resources shall be contacted for applicability of a discharge permit. All sewage tank effluent shall be discharged to a soil absorption system or evaporation pond that is designed to retain the effluent upon the property from which it originated. All tanks regardless of material or method of construction shall-

1. Be watertight and designed and constructed to withstand all lateral earth pressures under saturated soil conditions with the tank empty;

2. Be designed and constructed to withstand a minimum of two feet (2') of saturated earth cover above the tank top; and

3. Not be subject to excessive corrosion or decay.

(B) Septic Tanks. Septic tanks, regardless of material or method of construction, shall conform to the following criteria:

1. The liquid depth of any septic tank or its compartment shall be not less than thirty-six inches (36"). A liquid depth greater than six and one-half feet (6 1/2') shall not be considered in determining tank capacity;

2. No tank or compartment shall have an inside horizontal dimension less than twenty-four inches (24");

3. Inlet and outlet connections of the tank shall be protected by baffles or sanitary tees as defined in paragraph (4)(B)6 of this rule;

4. The space in the tank between the liquid surface and the top of the inlet and outlet baffles shall not be less than twenty percent (20%) of the total required capacity, except that in horizontal cylindrical tanks, this space shall be not less than fifteen percent (15%) of the total required liquid capacity;

5. Inlet and outlet baffles shall be constructed of acid-resistant concrete, acid-resistant fiberglass or plastic;

6. Sanitary tees shall be affixed to the inlet or outlet pipes with a permanent waterproof adhesive. Baffles shall be integrally cast with the tank, affixed with a permanent waterproof adhesive or with stainless steel connectors top and bottom;

7. The inlet baffle shall extend at least six inches (6") but no more than twenty percent (20%) of the total liquid depth below the liquid surface and at least one inch (1") above the crown of the inlet sewer;

8. The outlet baffle and the baffles between compartments shall extend below the liquid surface a distance equal to forty percent (40%) of the liquid depth, except that the penetration of the indicated baffles or sanitary tees for horizontal cylindrical tanks shall be thirty-five percent (35%) of the total liquid depth. They also shall extend above the liquid surface as required in paragraph (4)(B)4 of this rule. In no case shall they extend less than six inches (6") above the liquid surface;

9. There shall be at least one inch (1") between the underside of the top of the tank and the highest point of the inlet and outlet devices;

10. The inlet shall be not less than three inches (3") above the outlet;

11. The inlet and outlet shall be located opposite each other along the axis of maximum dimension. The horizontal distance between the nearest points of the inlet and outlet devices shall be at least four feet (4');

12. Sanitary tees shall be at least four inches (4") in diameter. Inlet baffles shall be no less than six inches (6") or no more than twelve inches (12") measured from the end of the inlet pipe to the nearest point on the baffle. Outlet baffles shall be six inches (6") measured from beginning of the outlet pipe to the nearest point on the baffle;

13. **Access to the septic tank shall be as follows**:

A. Manholes. Access shall be provided over both the inlet and outlet devices and to each tank compartment by means of either a removable cover or a manhole at or above grade. The extension can be made using riser of approved material and fitted with tight covers. Proper attention must be given to the accident hazard involved when manholes are extended close to the ground surface. Manhole covers which terminate at or above grade shall have either an effective locking device or otherwise be adequately constructed in a manner to prevent accidental access; and

B. A six-inch (6") inspection port shall be provided over the inlet and outlet baffles of each tank and terminate at or above grade. An inspection port shall not be used as a pump out access. A manhole cover at or above grade may also serve in place of inspection ports;

14. **Compartmentation of single tanks shall be in accordance with the following**:

A. Septic tanks larger than fifteen hundred gallons (1500 gals.) and fabricated as a single unit shall be divided into two (2) or more compartments;

B. When a septic tank is divided into two (2) compartments, not less than one-half (1/2), nor more than two-thirds (2/3), of the total volume shall be in the first compartment;

C. When a septic tank is divided into three (3) or more compartments, one-half (1/2) of the total volume shall be in the first compartment and the other half equally divided in the other compartments;

D. Connections between compartments shall be baffled so as to obtain effective retention of scum and sludge. The submergence of the inlet and outlet baffles of each compartment shall be as specified in paragraphs (4)(B)7 and 8 of this rule;

E. Adequate venting shall be provided between compartments by baffles or by an opening of at least fifty (50) square inches near the top of the compartment wall; and

F. Adequate access to each compartment shall be provided by one (1) or more manholes with a minimum opening twenty inches (20") square or in diameter and located within six feet (6') of all walls of the tank;

15. The use of multiple tanks shall conform to the following:

A. Where more than one (1) tank is used to obtain the required liquid volume, the tanks shall be connected in series;

B. Each tank shall comply with all other provisions of this section;

C. No more than three (3) tanks in series can be used to obtain the required liquid volume; and

D. The first tank shall be no smaller than any subsequent tanks in series;

16. The liquid capacity of a septic tank serving a dwelling shall be based upon the number of bedrooms permitted in the dwelling served and shall be at least as large as the capacities given in Table 3.

Table 3—Dwelling Septic Tank Capacity*

Number of Bedrooms	Minimum Liquid Capacity
	(gallons)
1–2	1000
3	1200
4-5	1500

* These figures provide for use of garbage grinders, automatic clothes washers and other household appliances. Garbage grinders are not recommended due to introduction of fats.

A. For six (6) or more bedrooms, the septic tank shall be sized on the basis similar to an establishment. See paragraph (4)(B)17 of this rule.

B. No tank shall be designed to retain less than two (2) days flow; and

17. For individual residences with more than five (5) bedrooms, multiple-family residences, individual septic tank systems serving two (2) or more residences or any place of business or public assembly, the liquid capacity of the septic tank shall be designed in accordance with the following:

$$V = 1.5Q + 500$$

where V = the liquid capacity of the septic tank
and Q = the design daily sewage flow.

(C) Location. Location of the sewage tank shall include the following:

1. The sewage tank shall be placed so that it is accessible for the removal of liquids and accumulated solids;

2. The sewage tank shall be placed on firm and settled soil capable of bearing the weight of the tank and its contents; and

3. The sewage tanks shall be set back as specified in subsection (1)(D) of this rule.

(D) Solids Removal. The owner of any septic tank or his/her agent should regularly inspect and arrange for the removal and sanitary disposal of septage from the tank whenever the top of the sludge layer is less than twelve inches (12") below the bottom of the outlet baffle or whenever the bottom of the scum layer is less than three inches (3") above the bottom of the outlet baffle.

(E) Aeration Units. An aeration unit wastewater treatment plant utilizes the principle of oxidation in the decomposition of sewage by the introduction of air into the sewage. An aeration unit may be used as the primary treatment unit instead of a septic tank except where special local conditions may limit their use. All aeration unit type treatment systems shall comply with the general requirements for sewage tanks set forth in subsection (4)(A) of this rule and with the following:

1. Limitations. Special conditions where aeration units should not be used may include, but not be limited to, the following:

A. Where intermittent use (interruptions allowing more than five (5) days without continuous flow) will adversely affect the functioning of the plant; and

B. Where local ordinances restrict their use;

2. General. The aeration unit shall be located where it is readily accessible for inspection and maintenance. Set-back distances for aeration units shall be in accordance with subsection (1)(D) of this rule;

3. Design. All aeration units shall comply with National Sanitation Foundation Standard No. 40 or as required by the Health Officer. In addition, all aeration unit treatment plants shall comply with the requirements stipulated in this section. The aeration unit shall have a minimum treatment capacity of one hundred fifty gallons per bedroom per day (150 gals/pbd) or five hundred gallons (500 gals.), whichever is greater;

4. Effluent disposal. Effluent from an aeration unit shall be discharged into a soil absorption system or other final treatment system in accordance with section (5) and (9) of this rule. No reductions in the area of soil absorption systems or other final treatment systems shall be permitted because of the use of an aeration unit instead of a septic tank unless approved by the Health Officer. Direct surface discharge of any effluent shall not be permitted except for evaporation pond overflow as required in subsection (6)(A); and

5. Operation and maintenance. Where aeration units are used, operation and maintenance are recommended. Aeration units should be inspected at least one (1) time each year and pumped when mixed liquor solids concentrations result in excessive clarifier loading.

(5) Absorption Systems.

The common design of absorption systems is the use of absorption trenches, each separate from the other and each containing a distribution pipe. This type system should be used whenever practical. Other types of absorption systems may be used as alternatives where the site conditions meet the specific design requirements of the alternative systems. Installation shall not be made while the soil is wet or moist. This is to prevent smearing and destroying the structure of the soil. All absorption systems should have curtain drains, terraces or use of other flow diversion methods to minimize surface or ground water from loading the absorption field.

(A) Absorption Trenches. The absorption trench gives additional treatment to the sewage from the treatment tank. Regardless of its appearance of clarity or transparency, the outflow or effluent from a sewage tank is a dangerous source of contamination. The satisfactory operation of the sewage disposal system is largely dependent upon the proper site selection, design and construction of the absorption trench.

1. Absorption trenches should not be constructed in rapidly percolating soils which may result in contamination of water-bearing formations or surface waters. An area that is at least equal in size to the distribution field area and which meets all other site and soil criteria shall be set aside for a replacement field.

2. The absorption trench shall be located on the property to maximize the vertical separation distance from the bottom of the absorption trench to the seasonal high groundwater level, as determined by the presence of mottling, bedrock or other limiting layer. The vertical separation between the bottom of the absorption trench and limiting layer or seasonal high water table shall be no less than two foot (2') for standard systems, unless otherwise approved by the Health Officer. Greater vertical separation may be required where water-bearing formations are in danger of contamination.

3. Absorption trenches shall not be constructed in un-stabilized fill or ground which has become severely compacted.

4. In calculating the minimum trench bottom area for any absorption trench system, the design flow shall be divided by the application rate. Absorption trenches in highly permeable soils (group I soil) shall have four feet (4') of separation between the trench bottom and seasonal high groundwater table or bedrock. Cherty clay soils located in areas of severe geological limitations shall have less than fifty percent (50%) rock fragments and a vertical separation distance of four feet (4') or more between the absorption trench bottom and bedrock. Unlined absorption trenches shall not be installed in cherty clays when the field evaluation indicated the presence of large voids. Absorption trenches installed in areas of severe geological limitations with cherty clays should be designed for a maximum loading rate of forty-five hundredths gallons per square foot per day (0.45 gals/sq. ft. per day). If the loading rate is three tenths gallons per square foot per day (0.3 gals/sq. ft. per day) or less the Health Officer may require backfill above the infiltration barrier to be sand, loamy sand, or sandy loam when available.

5. The minimum area in any absorption trench system shall be four hundred (400) square feet Each absorption trench system shall have a minimum of two (2) trenches with no one (1) trench longer than one hundred feet (100') unless approved by the Health Officer on a case-by-case basis. The absorption trenches shall be located not less than three (3) times the trench width on centers with a minimum spacing of five feet (5') on centers.

6. Absorption trenches shall be at least eighteen inches (18") wide and no more than thirty-six inches (36") wide. Thirty-six inch (36") wide trenches shall not be utilized in soils with a loading rate of less than forty-five hundredths gallons per square foot per day (0.45 gals/sq. ft. per day) unless approved by the Health Officer. The bottom of standard absorption trenches shall be at least eighteen inches (18") and no more than thirty inches (30") below the finished grade except as approved by the Health Officer.

7. The pipe used between the sewage tank and the absorption system shall be a minimum of four-inch (4") inside diameter equivalent to the pipe used for the building sewer as set forth in section (3) of this rule. The pipe shall have a minimum fall of not less than one-eighth inch (1/8") per foot. All joints shall be of watertight construction.

8. Gravity-fed absorption field distribution lines should be at least four inches (4") in diameter. Perforated distribution line shall have holes at least one-half inch

(1/2") and no more than three-fourths inch (3/4") in diameter.

A. Pipe used for distribution lines shall meet the appropriate ASTM standard or those of an equivalent testing laboratory. Fittings used in the absorption field shall be compatible with the materials used in the distribution lines.

B. When four inch (4") or six inch (6") diameter corrugated plastic tubing is used for distribution lines, it shall be certified as complying with applicable ASTM standards. The corrugated tubing shall have either two (2) or three (3) rows of holes, each hole between one-half inch (1/2") and three-fourths inch (3/4") in diameter and spaced longitudinally approximately four inches (4") on centers. ***Coiled tubing shall not be used.***

9. The absorption trenches shall be constructed as level as possible, but in no case should the fall in a single trench bottom exceed one-fourth inch (1/4") in ten feet (10'). The ends of distribution lines should be capped or plugged, or when they are at equal elevations, they shall be connected.

10. Rock used in soil absorption systems shall be clean gravel or crushed stone, and graded or sized between one and three inches (1-3") with no more than ten percent (10%) material to pass through a one-half inch (1/2") screen. The rock shall be placed a minimum of twelve inches (12") deep with at least six inches (6") below the pipe and two inches (2") over the pipe and distributed uniformly across the trench bottom and over the pipe. Limestone and dolomite shall be avoided when possible. Before placing soil backfill over the trenches, the gravel shall be covered with one (1) of the following:

A. Un-faced, rolled, three and one-half inch (3-1/2") thick fiberglass insulation;

B. Untreated building paper;

C. Synthetic drainage fabric; or

D. Other material approved by the Health Officer laid as to separate the gravel from the backfill.

11. Complex slope patterns and slopes dissected by gullies shall not be considered for installation of absorption trenches. Uniform slopes under fifteen percent (15%) shall be considered suitable slope for installation of absorption trenches. When slopes are less than two percent (2%), provisions shall be made to insure adequate surface drainage. When slopes are greater than four percent (4%), the absorption trenches shall follow the contour of the ground. Uniform slopes between fifteen percent (15%) and thirty percent (30%) should not be used for installation of absorption trenches unless the soils are three feet (3') or more below the trench bottom. Slopes within this range may require installation of interceptor drains upslope from the soil absorption system to remove all excess water that might be moving laterally through the soil during wet periods. Usable areas larger than minimum are ordinarily required in this slope range. Slopes greater than thirty percent (30%) shall not be utilized for installation of absorption trenches unless the following requirements can be met and approval is obtained from the Health Officer:

A. The slope can be terraced or otherwise graded or the absorption trenches can be located in naturally occurring soil so as to maintain a minimum ten foot (10') horizontal distance from the absorption trench and the top edge of the fill embankment;

B. The soil is permeable and no restrictive layers or water tables occur at a depth within two feet (2') of the trench bottom;

C. Surface water runoff is diverted around the absorption trench field so that there will be no scouring or erosion of the soil over the field or to allow surface runoff onto the field;

D. If necessary, groundwater flow from heavy rainfall is intercepted and diverted to prevent that water from running into or saturating the soil absorption system; and

E. There is sufficient ground area available to install the absorption trench system with these modifications.

12. Effluent distribution devices, including distribution boxes, flow dividers, flow splitters, and flow diversion devices, shall be of sound construction, watertight, not subject to excessive corrosion and of adequate design as approved by the Health Officer. Effluent distribution devices shall be separated from the sewage tank by a minimum of two feet (2') of undisturbed or compacted soil and shall be placed level on a solid foundation of soil, gravel or concrete to prevent differential settlement of the device. Distribution boxes provided with flow equalizers are recommended.

A. Each distribution line shall connect individually to the distribution box and shall be watertight.

B. The pipe connecting the distribution box to the distribution line shall be of a watertight construction laid on undisturbed earth.

C. Unless approved by the Health Officer, no more than four (4) distribution lines should be connected to a distribution box receiving gravity flow unless the ground surface elevation of the lowest trench is above the flow line elevation of the distribution box.

D. Distribution devices should be accessible to surface grade.

13. Step-downs or drop boxes may be used where topography prohibits the placement of absorption trenches on level grade. Serial distribution systems should be limited to a separation of at least three feet (3') between the bottom of the absorption trenches and the limiting condition such as slow permeability or zone of seasonal saturation as evidenced by mottling. Whenever the design sewage flow rate requires more than seven hundred and fifty lineal feet (750 lin. ft.) of distribution line in a step-down or drop-box type system, the absorption field shall be divided into two (2) or more equal portions. Step-downs shall be constructed of two feet (2') of undisturbed soil and constructed to a height level with the top of the upper distribution line. The

inlet to a trench should be placed either in the center or as far as practical from the outlet (overflow) from the same trench. Drop boxes shall be constructed so that the inlet supply pipe is one inch (1") above the invert of the outlet supply pipe which is connected to the next lower drop box. The top of the trench outlet laterals, which allow effluent to move to the distribution lines, shall be two inches (2") below the invert of the outlet supply line. It is recommended that drop boxes be designed to close off the trench outlets to provide for periods of resting when the absorption trench becomes saturated.

14. Dosing is recommended for all systems except serial distribution systems and shall be provided when the design sewage flow requires more than five hundred lineal feet (500 lin. ft.) of distribution line. When the design sewage flow requires more than one thousand lineal feet (1000 lin. ft.) of distribution line, the absorption field shall be divided into two (2) equal portions and each half dosed alternatively, not more than four (4) times per day. Dosing may be accomplished by the use of a pump or other dosing device approved by the Health Officer. Each side of the system shall be dosed not more than four (4) times per day. The volume of each dose shall be the greater of the daily sewage volume divided by the daily dosing frequency, or an amount equal to approximately three-fourths (3/4) of the internal volume of the distribution lines being dosed (approximately one-half gallon per lineal foot (1/2 gal./lin. ft.) of four-inch (4") pipe). Whenever dosed distribution box systems are utilized, the separation distance between the absorption trench bottom and limiting condition should be at least two feet (2').

15. Gravelless subsurface absorption systems may be used as an alternative to conventional four-inch (4") pipe placed in gravel filled trenches; however they cannot be used in areas where conventional systems would not be allowed due to poor permeability, high groundwater or insufficient depth to bedrock. Design approval for these systems may be required from the Health Officer prior to installation and all manufacturing specifications and installation procedures shall be closely adhered to. Gravelless trench systems using fabric wrapped tubing shall not be used where wastes contain high amounts of grease and oil, such as in restaurants.

A. The eight (8) and ten (10)-inch(inner diameter) corrugated polyethylene tubing used in gravelless systems shall meet the requirements of ASTM F667, Standard Specification for Large Diameter Corrugated Polyethylene Tubing. For purpose of calculation, the eight-inch (8") pipe may be considered equal to eighteen inches (18") in width of a standard absorption trench. The ten-inch (10") pipe may be considered equal to twenty-five inches (25") in width of a standard absorption trench.

B. Two (2) rows of perforations shall be provided located one hundred twenty degrees (120°) apart along the bottom half of the tubing, each sixty degrees (60°) from the bottom centerline. The tubing shall be marked with a visible top location indicator one hundred twenty degrees (120°) away from each row of holes. Perforations shall be cleanly cut and uniformly spaced along the length of the tubing and should be staggered so that there is only one (1) hole in each corrugation. All gravelless drainfield pipe shall be encased at the point of manufacture with a filter wrap of spun-bonded nylon, spun-bonded polypropylene or other substantially equivalent material approved by the Health Officer.

C. Rigid corrugated tubing shall be covered with filter wrap at the factory and each joint shall be immediately encased in a protective wrap that will prevent ultraviolet light penetration which shall continue to encase the large diameter pipe and wrap until just prior to installation in the trench. Filter wrap encasing the tubing shall not be exposed to sunlight (ultraviolet radiation) for extended periods. Rocks and large soil clumps shall be removed from backfill material prior to being used. Clayey soils (soil group IV) shall not be used for backfill. The near end of the large diameter pipe shall have an offset adapter (small end opening at top) suitable for receiving the pipe from the septic tank or distribution device and making a mechanical joint in the trench.

D. The trench for the gravelless system shall be dug with a level bottom. On sloping ground, the trench should follow the contour of the ground to maintain a level trench bottom and to ensure a minimum backfill of six inches (6"). It is recommended that the minimum trench width for the gravelless system be eighteen inches (18") in friable soils to ensure proper backfill around the bottom half of the pipe. In cohesive soils, the minimum width of excavation should be twenty-four inches (24"). In clay soils, it is recommended that the trench be backfilled with sandy material, sandy loam, loam, clay loam, silt loam or silty clay loam. The gravelless system may be installed at a trench bottom depth of eighteen inches (18") minimum to thirty inches (30") maximum, but a more shallow trench bottom depth of eighteen to twenty-four inches (18-24") is recommended. To promote equal effluent and suspended solids distribution, the slope of the drain pipe should be from zero to one-half inch per one hundred feet (0–1/2 in./100 ft.).

E. A fifteen inch (15") gravelless chamber may be considered equal to twenty-four inches (24") in width of a standard absorption trench. The twenty-two inch (22") chamber may be considered equal to twenty-eight inches (28") in width of a standard absorption trench. The thirty-four inch (34") chamber may be considered equal to forty-two inches (42") in width of a standard absorption trench.

F. Installation of the chamber system shall be in accordance with this rule except:

(I) Istallation shall be made in accordance with the manufacturer’s specifications;

(II) The side walls of trenches placed in Group IVa soils shall be raked to open pores which were damaged or sealed during excavation; and

(III) Chambers utilizing maximum sidewall absorption features shall be installed per the manufacturer’s

recommendations to maximize the use of upper soil horizons; and

G. A 12 inch (12”) polystyrene aggregate bundle absorption field product may be considered equal to twenty-four inches (24”) in width of a standard absorption trench. The two bundle polystyrene aggregate absorption product may be considered equal to twenty-eight inches (28”) in width of a standard absorption trench. The three bundle polystyrene aggregate absorption product may be considered equal to forty-two inches (42”) in width of a standard absorption trench. Installation of the polystyrene aggregate bundle absorption field products shall be in accordance with this rule.

16. Dosing/alternating systems are encouraged, especially in slowly permeable soil conditions.

17. The Health Officer may permit the use of a bed system on sites where soils have a minimum loading rate of forty-five hundredths gallons per square foot (0.45 gals/sq.ft.) and essentially meeting the other requirements of this section, and only on lots which are limited by topography, space or other site planning considerations. In such cases the number of square feet of bottom area needed shall be increased by fifty percent (50%) over what would be required for a trench system. When the design volume of sewage exceeds four hundred fifty gallons (450 gals.) per day, adequate space shall be provided to accommodate a trench system for the absorption field unless otherwise approved by the Health Officer. There shall be no less than a two-foot (2') separation between the bed bottom and the limiting layer or seasonal high water table.

(B) Possible modifications to standard absorption systems which may be utilized to overcome selected soil and site limitations and must be approved by the Health Officer include the following:

1. Shallow placement of absorption trenches shall be utilized where insufficient depth to seasonally high or perched water table or where insufficient soil thickness prevents the placement of conventional distribution lines in accordance with this section. Shallow trenches shall be designed and constructed to provide a minimum of two feet (2') of natural soil separation between the trench bottom and the uppermost elevation of the seasonally high or perched water table and rock. Shallow trenches may be constructed by placing the top of the gravel at original ground level and covering the absorption field with loamy soil, (sandy loam, loam, clay loam, silt loam or silty clay loam) to a depth of eight to twelve inches (8-12") at the center. The cover over the absorption field shall extend at least five feet (5') beyond the edge of any trench and have a turf grass cover established immediately after construction. If an area is to be filled and the trenches constructed in the fill with the bottom of the trenches in at least six inches (6") of natural soil, the following procedures must be followed:

A. The fill material should be of a sandy texture with a maximum clay content of twenty percent (20%). The fill material should not be hauled or worked wet. The area to be filled must be protected from traffic and small brush and trees removed prior to placement;

B. The soil surface must be loosened with a cultivator or garden plow. This work must be done when the soil is dry;

C. The fill is moved onto the site without driving on the loosened soil. The fill material is then tilled into the natural soil to create a gradual boundary between the two (2). The remaining fill is then added in layers until the desired height is obtained with each layer being tilled into the preceding layer; and

D. The site is then shaped to shed water and fill all low spots before the absorption system is installed. After installation of the absorption system, the site must have a turf grass cover established as soon as possible;

2. Alternating dual field absorption systems may be utilized where soils are limited by high clogging potentials, high shrink/swell potential soils and where the potential for malfunction and need for immediate repair is required. Alternating dual field absorption systems shall be designed with two (2) complete absorption fields, each sized a minimum of seventy-five percent (75%) of the total area required for a single field and separated by an effluent flow diversion valve. The diversion valve shall be constructed to resist five hundred pounds (500 lbs.) crushing strength, structurally sound and shall be resistant to corrosion. A valve placed below ground level shall be constructed so that it may be operated from the ground surface; and

3. Sand-lined trenches may be used in areas where the soil has greater than fifty percent (50%) rock fragments and there are severe geological limitations. For a maximum loading rate of forty-five hundredths gallons per day per square foot (.45 gpd/sq. ft.), the sand is not required to meet the requirements for intermittent sand filters. The material must be natural or manufactured sand and have no more than fifteen percent (15%) clay content. Manufactured sand shall be chat, fines manufactured from igneous rocks or chert gravel, shredded rubber tires or manufactured from crushed glass. **Crushed limestone is not acceptable.** For higher loading rates, the sand must meet the requirements for an intermittent sand filter.

A. In standard four-inch (4") pipe and gravel trenches, the depth of liner material must be twelve inches (12") below the gravel and at least six inches (6") on the sides of the gravel up to the top of the gravel. To place sand on the sides of the trenches, the trench walls must be excavated on a slope instead of vertically. The side slopes should be two horizontal to one vertical (2:1) and in no case steeper than one horizontal to one vertical (1:1).

B. In gravelless pipe systems the minimum thickness of liner material is six inches (6") around the pipe.

C. The effluent to sand-lined systems in areas of potential groundwater contamination should be equally distributed as much as practically possible. Serial and drop-box systems shall not be used. As a minimum, a

distribution box shall be used to evenly distribute the effluent to the trenches. Dosing is recommended in order to more positively assure even distribution.

D. The sand-lined trenches may be used, with the approval of the Health Officer, where the percentage of rock fragments is less than seventy percent (70%) for at least four feet (4') below the trench bottom. For sand-lined trenches to function properly, the permeability of the natural material should be similar to the permeability of the liner material. Sand-lined trenches must not be used over fragipans or other restrictive layers which have potential to perch water tables and could cause saturation of the liner material.

(6) Evaporation Pond (Lagoon) Systems.

(A) An evaporation pond system can provide satisfactory sewage disposal in rural areas where soils are not suited for absorption systems. Evaporation pond systems should only be installed if no other approved system can be installed on the property. Single residence evaporation ponds are not generally suitable in subdivisions with lots less than three (3) acres in size. No more than one (1) single family residence will be allowed on one (1) evaporation pond.

1. The following minimum separation distances may be modified as necessary to accommodate site requirements or local codes:

A. The pond shall be located a minimum of seventy-five feet (75') from property lines as measured from the adjoining pond shoreline. However, this distance must be increased where necessary to be sure that all effluent is disposed upon the property from which it originated;

B. The pond shall be located a minimum of two hundred feet (200') from the nearest existing residence and a minimum of one hundred feet (100') from the residence that it serves;

C. The pond shall be located at least one hundred feet (100') from a potable water supply or pump suction line; and

D. The pond shall be located at least fifty feet (50') from a stream, water course, lake or impoundment.

2. Ponds may be utilized when there are no significant limitations related to groundwater from their use and the soils have been demonstrated to be very slowly permeable. There shall be either a minimum separation distance between the pond bottom and creviced bedrock of three feet (3') or installation of a clay liner with a minimum thickness of one foot (1') or a synthetic liner, either of which must be acceptable to the Health Officer.

3. Steeply sloping areas should be avoided.

4. Selection of the pond site should consider a clear sweep of the surrounding area by prevailing winds. Heavy timber should be removed for a distance of fifty feet (50') from the water's edge to enhance wind action and prevent shading.

5. A properly sized, constructed, and functioning NSF Class 1 aeration tank as approved under NSF Standard 40, or other approved pretreatment component which provides equivalent effluent quality, shall precede the pond. The use of an aeration tank should not be used as a basis for reduction of set-back distances.

6. The minimum pond size shall be calculated on the basis of four hundred square feet per bedroom (400 sq. ft. per bedroom) of water surface area at the three-foot (3') operating level. The minimum water surface area at the three-foot (3') level shall be twelve hundred square feet (1200 sq. ft.).

7. A single cell is generally acceptable for single residence pond systems. If multiple cells are used for further polishing or storing of the effluent, the secondary cell should be one-half (1/2) the size of the primary cell.

8. The minimum embankment top width shall be four feet (4'). The embankment slopes shall not be steeper than three to one (3:1) on the inner and outer slopes. Inner embankment slopes shall not be flatter than four to one (4:1). Outer embankment slopes shall be sufficient to prevent the entrance of surface water into the pond. Freeboard shall be at least eighteen inches (18") and preferably twenty-four inches (24"). Additional freeboard may be provided.

9. To minimize erosion and facilitate weed control, embankments shall be seeded with a locally hardy grass from the outside toe to one foot (1') above the water line. Alfalfa or similar long-rooted crops which might interfere with the structure of the embankment shall not be used. Rip rap may be necessary under unusual conditions to provide protection of embankments from erosion.

10. The influent line shall be of a sound, durable material of watertight construction of SDR 35 or greater. The line shall have a minimum diameter of four inches (4") and be laid on a firm foundation at a minimum grade of one-eighth inch (1/8") per foot from the point of entry into the pond. The influent line shall discharge as far as practical from the possible outlet side of the pond. A cleanout or manhole should be provided in the influent line near the pond embankment. From this point the line shall either be laid to the inner toe of the embankment and then on the bottom of the pond to the terminus point or the line shall be supported and secured every five feet (5'). A concrete splash pad three feet (3') square should be placed under the terminus of the pipe. The elevation of the cleanout or manhole bottom should be a minimum of six inches (6") above the high water level in the pond.

11. The pond shall be shaped so there are no narrow or elongated portions. Round, square or rectangular cells are considered most desirable. Rectangular cells shall have a length not exceeding three (3) times the width. No islands, peninsulas or coves shall be permitted. Embankments should be rounded at corners to minimize accumulation of floating materials.

12. The floor of the pond shall be stripped of vegetation and leveled to the proper elevation. Organic

material removed from the pond area shall not be used in embankment construction. The wetted area of the pond must be sealed to prevent excessive exfiltration. Seals consisting of soils must be adequately compacted by the construction equipment.

13. Embankments shall be constructed of impervious materials and compacted sufficiently to form a stable structure with very little settlement.

14. Any effluent should be withdrawn from six inches (6") below the water surface. This can be accomplished by placing a tee on the inlet end of the pipe or by placing the outlet pipe eight to ten inches (8-10") lower on the inlet end than the outlet end of the pipe.

15. The pond area shall be enclosed with a fence conforming to the following conditions:

A. The fence shall be at least four feet (4') in height;

B. The fence shall be welded, woven or chain link material with no smaller than fourteen gauge (14 ga.) wire. Cattle or hog panels can be substituted with a tee post being used for a line post;

C. Fence posts shall be pressure-treated wood, galvanized and/or painted steel. Fence posts shall be driven, tamped or set in concrete. Line posts should be at least eighteen inches (18") deep and shall be spaced no more than ten feet (10') apart. Corner posts should be at least twenty-four inches (24") deep and shall be properly braced;

D. The fence shall be of sound construction with no gaps or openings along the bottom;

E. The fence shall be no closer than the center of the berm to the water's edge at the three-foot (3') deep operating level. Fence set-backs should not exceed thirty feet (30') from the water's edge;

F. A properly hinged four foot (4') high gate or comparable materials shall be installed and provided with an effective latching device. The gate should be thirty-six to forty-eight inches (36-48") in width to accommodate maintenance and mowing equipment; and

G. The fence must be completed prior to occupancy of the dwelling unless otherwise approved by the Health Officer.

16. Effluent from a pond must be disposed of on the property from which it originated. This may be accomplished by locating the outlet as far as practical from the property line and out of any natural drainage ditches or swales. The minimum distance from the outlet to a property line shall be one hundred feet (100'). Another method is to construct a terraced swale with a minimum length of one hundred fifty feet (150'). If these methods are unsuccessful, or whenever there is less than twelve inches (12") of permeable soil over a restrictive layer, controlled surface irrigation must be used. To utilize controlled surface irrigation, the pond must be capable of operating up to five feet (5') deep with one foot (1') of freeboard or have a second cell for storage. The Health Officer shall approve the method of effluent disposal.

17. There shall be no permanent connection of any roof drain, footing drain or any source of rainwater to the evaporation pond.

18. Odor problems caused by spring turnover of water, temporary overloading, ice cover, atmospheric conditions or anaerobic conditions may be controlled by broadcasting sodium or ammonium nitrate over the surface of the pond. In general, the amount of sodium or ammonium nitrate should not exceed two pounds (2 lbs.) per day until the odor dissipates.

(7) Privy.

(A) A privy will be allowed only under limited conditions and will not be recognized as a method of sewage disposal for a continuously occupied dwelling, business or other structure. A privy will only be considered for intermittent use in areas not served by a piped water source. Plans and construction of a privy will be considered on a case by case basis and will need to meet the approval of the Health Officer.

1. The privy shall be used to receive only human excreta and toilet paper. The privy shall not be used as a depository for other wastes.

2. A pit shall be provided for the privy. The sides of the pit shall be curbed to prevent cave-in. If the pit has an earth bottom, the bottom shall be at least three feet (3') above saturated soil conditions. If this separation distance cannot be achieved in the location of the privy, then the pit shall be liquid tight.

3. The pit shall be periodically pumped out by someone who services septic tank systems. At no time shall the pit contents be allowed to accumulate to within one foot (1') of the pit top. The pit contents shall then be transported and disposed into a community sewer system that is in compliance with Chapter 644, RSMo.

4. Both the pit and the privy shall be vented. Insect-proof openings shall be placed in the walls, below the seat. A vent shall extend from the underside of the seat board through the roof or up to a horizontal vent open to the sides of the toilet. This vent must be flush with the underside of the seat board and shall not extend down into the pit. All vent openings to the outside shall be properly screened to keep out insects. The top of the privy shall have a screened opening on each side. It is preferable the opening be all the way around the top of the privy in order to allow air to pass through and to carry away any odors which may seep into the upper part of the structure. If a crescent-shaped opening is cut into the door or wall of the privy, it shall also be screened.

5. The inside of the privy shall be of durable, smooth, non-absorbent material. If wood is used, the inside of the structure shall be coated with a polyurethane-type coating so as to minimize the penetration of liquids and odors into the wood.

6. A tight-fitting door, preferably with a self-closing feature, such as a door spring, shall be used.

7. A privy shall be set back from surface waters, buildings, property lines and water supply wells the same distance as required for soil treatment areas. This information may be found in subsection (1)(D), Table 1 of this rule.

8. The privy shall be of sufficient capacity for the facility it serves, but shall have at least fifty cubic feet (50 cu. ft.) of capacity.

9. Abandoned pits shall have the contents removed, transported and disposed into a community sewer system that is in compliance with Chapter 644, RSMo. This activity shall be performed by someone who services septic tank systems. The pit shall then be filled with clean earth and slightly mounded to allow for settling.

(8) Holding Tanks.

(A) The use of holding tanks is generally discouraged and their interim use should be limited to situations where construction of satisfactory sewage treatment and disposal systems will occur within one (1) year. Use of a holding tank must be specifically approved by the Health Officer on a case-by-case basis which may require stipulations in a signed agreement regarding the use and the length of time for use of the holding tank.

1. A holding tank shall be constructed of the materials and by the same procedures as those specified for watertight septic tanks.

2. An inspection port over the inlet of at least six inches (6") diameter and a manhole of at least twenty inches (20") diameter providing access to all compartments of the tank shall extend to the finish grade and be provided with seals to prevent odor and exclude insects and vermin. The ground shall be sloped away from the manhole to provide surface runoff. The lid of the manhole shall have an effective locking device or other means of securing the led to prevent accidental access.

3. The tank shall be protected against flotation under high water table conditions. This shall be achieved by weight of the tank, earth anchors or shallow bury depths.

4. The minimum size shall be one thousand gallons (1000 gals.) or four hundred gallons (400 gals.) times the number of bedrooms, whichever is greater. For permanent structures, other than residences, the capacity shall be based on measured flow rates or estimated flow rates. The tank capacity shall be at least five (5) times the daily flow rate.

5. Holding tanks shall be located as follows:

A. In an area readily accessible to the pump truck under all weather conditions;

B. As specified for septic tanks in Table 1 set forth in subsection (1)(D) of this rule; and

C. Where accidental spillage during pumping will not create a nuisance.

6. A contract for disposal and treatment of the sewage wastes shall be maintained by the owner with a pumper, municipality, agency or firm which possesses a current and valid permit issued by the Department of Natural Resources for such activity.

7. Holding tanks shall be monitored to minimize the chance of accidental sewage overflows. Techniques such as warning lights or bells, or regularly scheduled pumping shall be used. A positive warning system shall be installed which allows twenty-five percent (25%) reserve capacity after actuation.

8. Holding tanks used in conjunction with permanent black water/gray water systems must conform to the requirements of this section except that the minimum size tank is one thousand gallons (1000 gals.). In these situations, the holding tank is to receive toilet wastes only.

(9) Advanced (Alternative) Systems.

(A) General. The intent of this section is to provide minimum standards for the design, location, installation, use and maintenance of alternative sewage disposal systems in areas of limiting soil characteristics, where a standard system cannot be installed or a standard system is not the most suitable treatment. Where these systems are employed, they shall comply with all local and Clay County codes and ordinances and should be subject to timely inspections to assure adherence to specifications. These systems shall be designed and stamped by a professional engineer licensed in the state of Missouri or state approved designer. All absorption systems should have curtain drains, terraces or use of other flow diversion methods to minimize surface or ground water from loading the absorption field.

(B) Low Pressure Pipe (LPP) System. A low pressure, two- to four-foot (2–4') pressure head, pipe system may be utilized where soil and site conditions prohibit the installation of a conventional or modified septic tank system due to the presence of shallow soil conditions, seasonally high water table conditions and slow soil permeability. The Health Officer may permit the use of a LPP system where there are cherty clay soils, severe geological limitations or both. The separation distance in these areas of concern for groundwater between the trench bottoms and bedrock shall be at least four feet (4') or more. The Health Officer may require that the hydraulic design of LPP systems be designed by a professional engineer licensed in the state of Missouri or state approved designer. The Health Officer may also require the LPP trenches to be sand-lined if the soils have severely diminished treatment capability due to excessive rock content. The amount of rock fragments shall be less than fifty percent (50%) and in no case more than seventy percent (70%), unless the trenches are lined with sand.

1. The LPP shall consist of the following basic components:

A. A network of one- to two-inch (1–2") diameter perforated PVC, one hundred sixty pounds per square inch (160 lbs. /sq. in.) pipe or equivalent placed in natural soil at shallow depths, generally no more than twelve inches

(12"), in narrow trenches not less than eight inches (8") in width and spaced not less than five feet (5') on center. Trenches shall include at least five inches (5") of pea gravel, if available; or if necessary, no less than three-quarter inch (3/4") crushed stone below the pipe and two inches (2") above the pipe; and four inches (4") of soil cover. The holes in the perforated pipe should be spaced from two feet (2') to no more than eight feet (8'). The minimum hole size is five thirty-seconds inch (5/32"); or

B. Other approved gravelless products as designed by a Missouri licensed engineer and approved by the Health Officer. The holes in the perforated pipe should be spaced from two feet (2') to no more than eight feet (8'). The minimum hole size is five thirty-seconds inch (5/32"): and

C. A properly designed, two (2)-compartment septic tank or other approved pretreatment system and a pumping or dosing tank. The pumping or dosing tank shall be a minimum of five hundred gallons (500 gals.) or have the capacity to store one (1) day's flow above the pump on level, whichever is greater. A filter or screen capable of preventing the passage of suspended solids to the soil absorption system shall be provided;

D. A submersible sewage effluent pump (*not* a sump pump) with appropriate on/off controls for controlled dosing and a high water alarm or other approved pressure dosing and distribution system; and

E. A watertight supply manifold pipe for conveying effluent from the pump to the low pressure network.

2. The soil and site criteria for low pressure pipe systems shall meet the following minimum requirements:

A. LPP absorption fields shall not be installed on slopes in excess of ten percent (10%). LPP absorption fields may be installed on slopes greater than ten percent (10%), but require special design procedures to assure proper distribution of effluent over the absorption field;

B. There shall be at least twenty-four inches (24") of separation between the naturally occurring soil surface and bedrock, water-impeding formation, seasonally high water table or evidence of chroma 2 mottles. This twenty-four-inch (24") depth shall consist of permeable soils or be classified as SUITABLE or PROVISIONALLY SUITABLE in accordance with section (10) of this rule. The bottom of the proposed trenches must be located a minimum of one foot (1') above rock, water-impeding formation, seasonally high water table or where there is evidence of chroma 2 mottles. In areas where there are severe geological limitations and the soils have a high chert content, the bottom of the proposed trenches shall be at least four feet (4') above bedrock unless an evaluation by a registered geologist determines that the separation distance may be reduced;

C. Components of the LPP shall not be located in depressions or areas subject to frequent flooding. Surface water, perched ground water and other subsurface lateral water movement shall be intercepted or diverted away from all components of the LPP. Final shape of the LPP distribution field shall be such that rainwater or runoff is shed;

D. Location of the septic tank, pumping or dosing chamber and LPP absorption field is subject to the same horizontal setbacks specified in subsection (1)(D) of this rule. Horizontal setback distances in Table 1 shall be measured in the LPP absorption field from a margin of two and one-half feet (2 1/2') beyond the lateral and manifold pipes;

E. An area that is at least equal in size to the LPP distribution field area plus a two and one-half foot (2 1/2') margin beyond the lateral and manifold pipes and which meets all other site and soil criteria shall be set aside for a replacement field; and

F. There shall be no soil disturbance to an approved site for an LPP system except the minimum required for installation.

3. The following application rates shall be used in determining the maximum application rate for low pressure pipe systems:

A. In calculating the number of square feet for the absorption field (not square footage of trench bottom), the design sewage flow (Table 2) shall be divided by the application rate (Table 9). The lateral lines shall have a minimum spacing of five feet (5') on centers within the areas calculated for the absorption field area; and

B. The systems shall be designed so that the discharge from any one (1) lateral line does not vary more than ten percent (10%) from the other laterals. All gravel laterals shall have an envelope of trench rock surrounding the pipe. The trench rock shall be placed to a minimum depth of five inches (5") below the pipe and two inches (2") above the pipe.

4. Design of the LPP shall comply with accepted practices and be specifically approved by the Health Officer. The system shall be designed and bear the seal of a Missouri registered engineer.

(D) Elevated Sand Mounds. Elevated sand mounds may be considered whenever site conditions preclude the use of absorption trenches. The construction of a mound shall be initiated only after a site evaluation has been made and landscaping, dwelling placement, effect on surface drainage and general topography have been considered. Due to the nature of this alternative system, actual selection of mound location, size of mound and construction techniques must be carefully considered and the criteria established in this rule implicitly followed. A set-back distance of fifty feet (50') from the down slope property line is recommended.

1. Elevated sand mounds shall not be utilized on soils where the high ground water level as evidenced by mottling, bedrock or other strata occurs within twenty-four inches (24") of natural grade. Up to four feet (4') of soil thickness over bedrock may be required in areas where there is a significant potential for groundwater

contamination. Mounds shall be constructed only upon undisturbed naturally occurring soils.

2. Elevated sand mounds are subject to the setback distances required in subsection (1)(D) of this rule.

3. The fill material from the natural soil plowed surface to the top of the rock-filled bed shall be sand, loamy sand or sandy loam. Loading rates on the sand fill shall not exceed the values in Table 4.

Table 4–Recommended Loading Rates For Soil Textures Suited to Use as Fill in a Mound System

Texture	Loading Rate
	(gal./sq. ft./day)
Medium to coarse sand	1.2
Fine sand	1.0
Loamy sand	0.8
Sandy loam	0.6

Note: Rock fragments larger than one-sixteenth inch (1/16") shall not exceed fifteen percent (15%) by volume of the material used for sandy fill.

4. There shall be a minimum of one foot (1') of fill material and two feet (2') of naturally occurring soils between the bottom of the trench rock and the highest elevation of the limiting conditions as defined in paragraph (9)(D)1 of this rule.

5. Whenever possible, mounds should be located on flat areas or crests of slopes. Mounds should not be located on natural slopes of more than six percent (6%) unless approved by the Health Officer.

6. In no case shall the width of the trench rock in a single bed exceed ten feet (10').

Table 5–Loading Rate

Soil Group	Loading Rate of Basal Area
	(gpd/sq. ft.)
I	1.0 - 1.2
II	0.7 - 0.8
III	0.5 - 0.6
IVa	0.3 - 0.4
IVb	.05 - 0.1
V	0.4 - 0.6

7. The required bottom area of the trenches or bed and the effective basal area of the mound shall be based on one hundred fifty gallons per bedroom per day (150 gals. /pbd).

8. The area of sand fill shall extend beyond the basal area and the sides shaped to a three to one (3:1) or four to one (4:1) slope. The sand fill shall be covered with six inches (6") of fine textured soil and a final cap of six inches (6") of good topsoil applied. Also the mound shall be seeded with a hardy grass to establish a turf grass cover as soon as possible. No shrubs shall be planted on the top of the mound. Shrubs may be placed at the foot and side slopes of the mound.

9. The land area fifty feet (50') down slope of the elevated sand mound is the effluent dispersal area and the soil in this area may not be removed or disturbed.

10. Dosing shall be required for all elevated sand mounds. The mound shall be dosed not more than two (2) times per day. The size of the dosing pump shall be selected to maintain a minimum pressure of one pound per square inch (1 psi), two and three-tenths feet (2.3') of head, at the end of each distribution line.

A. Perforation holes and hole spacing shall be determined to insure equal distribution of the effluent throughout the bed or trenches.

B. The perforated pipe laterals shall be connected to a two-inch (2") diameter manifold pipe with the ends capped. The laterals shall be spaced no farther than forty inches (40") on center and no farther than twenty inches (20") from the edge of the trench rock. The perforated pipe laterals shall be installed level with the perforations downward. There shall be a minimum of nine inches (9") of trench rock below the laterals and two inches (2") above the laterals. The material used to cover the trench rock shall be untreated building paper, six inches (6") of compacted straw, three and one-half inch (3 1/2") unbacked fiberglass insulation, or a geotextile.

C. The manifold pipe shall be connected to the supply pipe from the pump. The manifold shall be sloped toward the supply pipe from the pump. Antibackflow valves are prohibited in the pump discharge line. The pump discharge line shall be graded to permit gravity flow to the absorption area or back to the dosing tank. Proper air relief and anti-siphon devices shall be installed in the piping to prevent siphoning of effluent from the dosing tank or from the mound.

11. Prior to preparing the area selected for the mound, above ground vegetation must be closely cut and removed from the ground surface. Prior to plowing, the dosing pump discharge line shall be installed from the pump chamber to the point of connection with the distribution manifold. The area shall then be plowed to a depth of seven to eight inches (7–8") parallel to the land contour with the plow throwing the soil upslope to provide a proper interface between the fill and natural soils. A rubber-tired tractor may be used for plowing but in no case shall a rubber-tired tractor be used after the surface

preparation is completed. Tree stumps should be cut flush with the surface and the roots should not be pulled. The soil shall be plowed only when the moisture content of a fragment eight inches (8") below the surface is below the plastic limit.

12. Mound construction shall proceed immediately after surface preparation is completed.

A. A minimum of twelve inches (12") of sand fill shall be placed where the trench rock is to be located. A crawler tractor with a blade shall be used to move the sand into place. At least six inches (6") of sand shall be kept beneath equipment to minimize compaction of the plowed layer. The sand layer upon which the trench rock is to be placed shall be level.

B. After hand leveling of the trench rock, the distribution system shall be placed and the pipes covered with two inches (2") of rock. After installation of the distribution system, the entire mound is to be covered with topsoil native to the area. The entire mound shall be crowned by providing twelve inches (12") of topsoil on the side slopes with a minimum of eighteen inches (18") over the center of the mound. The entire mound shall then have a turf grass cover established to assure stability of the installation.

C. The area surrounding the elevated sand mound shall be graded to provide diversion of surface runoff waters.

(E) Sand Filters. Septic tanks or aeration units and sand filters may be used along with soil absorption systems as specifically approved by the Health Officer.

1. The septic tank and aeration units must be in accordance with section (4) of this rule. Setback distances as shown in Table 1 and as specified in subsection (1)(D) of this rule shall apply.

2. **The following shall apply to pressure dosed sand filter systems:**

A. Conventional pressure dosed sand filters use an intermittent filter with two feet (2') or more of medium sand designed to filter and biologically treat sewage tank effluent from a pressure distribution system at an application rate not to exceed one and twenty-five hundredths gallons per square foot (1.25 gals. /sq. ft.) sand surface area per day, applied at a dose not to exceed one-half gallon (1/2 gal.) per orifice per dose. These sand filters may be buried or open.

B. Re-circulating pressure dosed sand filters use a re-circulating filter with two feet (2') or more of medium filter media designed to filter and biologically treat sewage tank effluent from a pressure distribution system at an application rate not to exceed five gallons per square foot (5 gals./sq. ft.) filter surface per day, applied at a dose not to exceed two gallons (2 gals.) per orifice per dose. These sand filters shall be uncovered and open to the surface.

C. Minimum filter area for these filters shall be as follows:

(I) Conventional pressure dosed sand filters for single family residences shall be a minimum of three hundred and sixty square feet (360 sq. ft.) in surface area with a design sewage flow not to exceed six hundred gallons (600 gals.). If sand filter design flows exceed an average of four hundred and fifty gallons per day (450 gpd), the minimum sand surface will be based on one and twenty-five hundredths gallons per day per square foot (1.25 gpd/sq. ft.); and

(II) Pressure dosed sand filters for commercial facilities shall be sized on the basis of projected daily sewage flow. If the waste strength is proposed to be greater than residential strength waste, pretreatment shall be required which will reduce the biological oxygen demand to levels not to exceed three hundred (300), total suspended solids to levels not to exceed one hundred-fifty (150), and oil and grease to levels not to exceed twenty-five (25). The minimum sand surface will be based on two to five gallons per day per square foot (2-5 gpd/sq. ft.).

D. Design criteria shall include the following:

(I) Sewage tanks shall be in accordance with section (4) of this rule. Set-back distances as shown in Table 1 of subsection (1)(D) and as specified in subsection (1)(E) of this rule shall apply, unless a variance has been allowed by the Health Officer. Tanks shall be watertight and tested in the field. The test shall be performed by filling the tank two inches (2") above the riser inlet. At the end of the first twenty-four (24)-hour period, the tank water level should be refilled. After another twenty-four (24)-hour period, no more than one inch (1") of water should have dropped from the original reading. All sewage and pump tanks will be supplied with vandal-proof access risers to grade over the pump units. Risers should have a waterproof epoxy seal between the tank and riser;

(II) Pumping systems for a pressure dosed sand filter system should provide pumping apparatus that is capable of filtering gross solids larger than one-eighth inch (1/8") and draw from the clear zone near the outlet side of the sewage tank. This zone is described as the layer of effluent between the sludge and scum layers of the sewage tank. Pumps should be able to deliver adequate head pressure to control orifice plugging. Pumps should be made of a corrosive resistant material such as Type 316 stainless steel, suitable plastic, or 85-5-5-5 bronze. Screens should have at least ten square feet (10 sq. ft.) of surface area, with one-eighth inch (1/8") openings;

(III) Operation controls should be on a timer dose that distributes the average daily flow over an eighteen (18)-hour period. Re-circulating filters will be set to re-circulate five (5) times the average daily flow over a twenty-four (24)-hour period. Systems should be designed with a high water alarm and light signal. Control panels should be located on an exterior location. Control operations should be located in an area available for maintenance;

(IV) Intermittent filter media shall be a mixture of sand or durable inert particles with one hundred

percent (100%) passing the three-eighths inch (3/8") sieve; ninety to one hundred percent (90-100%) passing the No. 4 sieve; sixty-two to one hundred percent (62-100%) passing the No. 10 sieve; forty-five to eighty-two percent (45-82%) passing the No. 16 sieve; twenty-five to fifty-five percent (25-55%) passing the No. 30 sieve; ten percent (10%) or less passing the No. 60 sieve; four percent (4%) or less passing the No. 100 sieve; or sand meeting the ASTM-C 33 concrete sand specification minus four percent (4%) or less passing the No. 100 sieve. All drainage rock should be a river washed, hardened and weathered rock. The treatment media will be two feet (2') deep and of a media with an effective size of three tenths to one and twenty-two one hundredths millimeters (0.3-1.22 mm) and a uniformity coefficient of less than two (2). Limestone or dolomite is not acceptable for drainage rock;

(V) Re-circulating filter media shall be a mixture of sand or durable inert particles with one hundred percent (100%) passing the three-eighths inch (3/8") sieve; seventy-nine to one hundred percent (79-100%) passing the No. 4 sieve; eight to ninety-two percent (8-92%) passing the No. 8 sieve; zero to fifteen percent (0-15%) passing the No. 30 sieve; zero to one percent (0-1%) passing the No. 50 sieve. All drainage rock should be a river washed, hardened and weathered rock. The treatment media will be two feet (2') deep and of a media with an effective size of one and one-half to three millimeters (1 1/2-3 mm) and a uniformity coefficient of less than two (2). Limestone or dolomite is not acceptable for drainage rock; and

(VI) Container designs may be concrete containers consisting of watertight walls and floors to prevent groundwater from infiltrating or effluent from exfiltrating from the filter. All penetrations through the walls shall be water-tight. Containers may also consist of a thirty (30) mil polyvinyl chloride liner covering the sand filter bottom and side wall areas. Polyvinyl chloride liners should be supplied with repair kits and boots for passage through the liner wall. The bottom area of the liner should be bedded in two inches (2") of leveling sand. The liner should be constructed to form a waterproof membrane between the trench bottom and trench walls. The polyvinyl liner should incorporate all seams to be a chemically or heat bonded waterproof seam.

E. The filter design criteria shall include the following:

(I) The interior base of the filter container shall be level or constructed at a grade of one percent (1%) or less to the under drain pipe elevation;

(II) The underdrain piping shall consist of a pipe with one-fourth inch (1/4") grooves cut every four inches (4") along the pipe length to a depth of one-half (1/2) of the pipe diameter. The bottom of the filter container shall be covered with a minimum of six inches (6") of drain media. The under drain pipe shall be enveloped in an amount and depth of drainage rock to prevent migration of the under drain media into the pipe perforations;

(III) A minimum of twenty-four inches (24") of approved filter media shall be installed over the under drain media. The media shall be damp at the time of installation to insure compaction of the media. The top surface of the media shall be level;

(IV) There shall be a minimum of three inches (3") of clean drain media below the distribution laterals, and sufficient media above the laterals equal to or covering the orifice shields and/or pipe;

(V) Distribution laterals shall be evenly spaced on minimum, thirty inch (30") centers. Orifices shall be placed such that there is one (1) orifice or more on average per six square feet (6 sq. ft.) of sand surface. Orifice holes shall be one-eighth inch (1/8") in diameter. The diameter of the piping manifold and lateral shall be no less than one-half inch (1/2"). The ends of the distribution laterals should be constructed with a means to perform flushing of the piping, collectively or individually, through the operation of a flushing valve. The flushed effluent may be discharged to the sand filter;

(VI) The top of the intermittent media in which the pressure distribution system is installed shall be covered with a breathable nylon or polypropylene spun filter fabric rated at eighty-five hundredths ounce per square yard (0.85 oz. /sq. yd.) to eliminate soil intrusion into the filter media. Re-circulating filters shall be open-topped;

(VII) The top of the intermittent sand filter area shall be backfilled with a soil cover, free of rocks, vegetation, wood waste, etc. The soil cover shall have a textural class of loamy sand. The soil cover shall have a minimum depth of six inches (6") and a maximum depth of twelve inches (12"). Intermittent sand filters designs may delete soil cover and incorporate three to six inches (3-6") of a quality cypress or cedar mulch over the entire filter area;

(VIII) Where the effluent from a sand filter is to be discharged via a pump, the pump and related apparatus shall be housed in a vandal resistant vault designed to withstand the stresses placed upon it and not allow the migration of drain media, sand or under drain media to its interior. The vault shall have a durable, affixed floor. The vault shall provide watertight access to the finished grade with a diameter equal to that of a gravity discharge sand filter. The depth of the under drain and the operational level of the pump cycle and alarm shall not allow effluent to come within two inches (2") of the bottom of the sand filter media. The pump off level shall be no lower than the invert of the perforations of the under drain piping. The internal sand filter pump shall be electrically linked to the sand filter dosing apparatus in such a manner as to prevent effluent from entering the sand filter in event the internal sand filter pump fails; and

(IX) Other sand filters which vary in design from those described in this rule may be authorized by the Health Officer if they can be demonstrated to produce a comparable effluent quality.

F. Effluent from sand filters must be disposed of into a soil absorption system. The required footage of the soil absorption system may be reduced by up to one-third (1/3) of that required for a conventional soil absorption system if approved by the Health Officer The soil absorption system shall be in accordance with section (5) or (9C) or (9F) of this rule. Setback distances as shown in Table 1 and as specified in subsection 1D of this rule shall apply. Shallow bury designs should be utilized whenever possible to achieve the best absorption rates.

(F) Drip Soil Absorption. Drip soil absorption, also known as subsurface wastewater drip irrigation, may be utilized where soil and site conditions prohibit the installation of conventional or other advanced (alternative) disposal systems. Drip systems must be designed by a Missouri licensed professional engineer. Any changes from the permitted design shall be approved by the engineer and the department of health. If design changes are made, an "as built" drawing must be provided before final approval is granted.

1. Site Specifications. Site limitation and modifications include but are not limited to the following:

A. Drip distribution shall be oriented parallel to natural surface contours and shall be sited to avoid natural drainage features and depressions that may hold surface water.

B. Designs shall address surface water diversion as needed. An interceptor drain may be used upslope of the drip distribution components to intercept the horizontal flow of subsurface water to reduce its impact on the down gradient drip distribution absorption area.

C. Drip distribution may be installed on a slope greater than 25 % with special safety consideration and installation criteria as needed. When non-pressure compensating emitters are used, there shall be no greater than 6 feet of vertical difference between the bottom drip line and the top drip line without zoning.

2. Design criteria.

A. The application rate shall not exceed the values as shown in Table 9 for low pressure pipe systems in subparagraph (10)(M) of this rule.

B. Drip lines shall be placed two feet (2') apart in a parallel arrangement. Emitters shall be placed in the drip lines every two feet (2') so there will be a two-foot by two-foot (2'x2') grid pattern. Other configurations and spacing of the drip line and emitters may be used with approval of the Health Officer; however, each emitter will be considered to cover four square feet (4 sq. ft.) of absorption area.

C. Drip soil absorption systems may be allowed at sites where the soil is classified as being in group IVb. A minimum separation distance of twelve inches (12") shall be maintained between the drip lines and emitters and a high ground water table or other limiting condition. The maximum application rate for IVb soils shall be from five-hundredths to one-tenth gallons per day per square foot (0.05–0.10 gpd /sq. ft.) of absorption field as approved by the Health Officer.

D. The methods and calculations for sizing the soil absorption area shall be included in the design plan and not be less than that determined in accordance with the site and soil evaluation. A future replacement soil absorption area shall be required in the design plan unless otherwise approved by the Health Officer.

E. Systems shall be sized based on at least 150 gallons/day per bedroom or as otherwise justified for daily peak flow.

F. Any selected pretreatment component shall meet NSF Standard 40, Class 1 effluent standards unless approved by the Health Officer.

G. Only pressure compensating emitters shall be used for drip distribution unless approved by the Health Officer. The design plan shall specify the flow rate of the emitters.

H. Time dosing is required and the reserve capacity of the dosing tank shall be a minimum of one and one half times the daily design flow. Controls shall provide a means to record pump cycles and pump run times to allow troubleshooting system malfunctions.

I. Unless otherwise approved by the Health Officer, the drip system shall be designed using the "simple drip" method with a manual flushing valve in the return line which shall be routed to the dosing tank.

3. Installation and Operation & Maintenance.

A. Areas designated for absorption area installation and future replacement shall be undisturbed and be protected from damage or disturbance. If any disturbance or damage has occurred, installation shall not proceed and the registered installer shall contact the owner, the designer, and the Health Officer. Installation of subsurface drip tubing shall not proceed when there is a risk of smearing or compaction

B. The tank and manifold shall be guaranteed watertight by the supplier, installer or both. No pipe shall penetrate a concrete tank except through a cast-in rubber grommet. No pipe shall penetrate a fiberglass or plastic tank or riser except through a watertight rubber grommet.

C. Following installation, the installer and/or maintenance contractor shall conduct a start-up procedure to ensure operational and design specifications and document baseline measurements needed for future monitoring.

D. The installing contractor shall provide information to the homeowner including but not limited to; operation and maintenance for the treatment system, a design as provided by the engineer, and any "as built" information if needed.

E. The service provider shall report to the Health Officer any service contract allowed to lapse.

(G) Wetlands. Constructed wetlands provide secondary levels of treatment, which means that some form of pretreatment (septic tank, aeration tank, lagoon, etc.) must

be used prior to the wetland, as wetlands cannot withstand large influxes of suspended solids. The pretreatment used must be capable of removing a large portion of these solids. Effluent from wetlands must be disposed into an approved soil absorption system with the setback distances required in Table 1, located in subsection (1)(D) of this rule.

1. Free water surface wetlands are shallow beds or channels with a depth less than twenty-four inches (24") and filled with emergent aquatic plants. This type of wetland shall not be allowed.

2. Submerged flow wetlands are similar to free water surface wetlands except that the channels are filled with shallow depths of rock, gravel or sand. The depth of the porous media is usually less than eighteen inches (18"). The porous media supports the root systems of the emergent aquatic vegetation. The water level is to be maintained below the top of the porous media so that there is no open water surface.

3. The surface area of wetlands shall be determined by using the following equation:

$$A_S = [Q(\ln C_o - \ln C_e)]/(k_T \times f \times d)$$

where: A_S = wetland surface area, sq. ft.
Q = daily flow rate to wetland, cu. ft./day ([gallons/day] ÷ 7.5);
C_o = influent BOD_5 concentration, mg/L;
C_e = effluent BOD_5 concentration, mg/L;
k_T = temperature dependent rate constant, per day;
d = water depth in wetland, ft; and
f = void fraction of rock media, decimal.

4. After a surface area has been determined, a cross-sectional area shall be calculated against hydraulic loading by using the following equation:

$$A_h = Q/(K_h \times S)$$

where: A_h = cross-sectional area (hydraulic loading), sq. ft.;
K_h = hydraulic conductivity of rock media, ft./day*; and
S = slope of wetland bottom, decimal.**

* A value of eight hundred feet per day (800 ft./day) may be used for the hydraulic conductivity for rock of one inch (1") diameter.

** Values for slope should range between twenty-five hundredths and one percent (0.25–1%).

5. After the hydraulic loading has been determined, an organic loading shall be calculated using the following equation:

$$A_o = OGL/0.05$$

where: A_o = cross-sectional area (organic loading), sq. ft.; and
OGL = organic loading, lbs BOD_5/day.

6. The larger of the two (2) calculations, the hydraulic loading or the organic loading, shall be used to determine the wetland dimensions. Wetlands should not be long and narrow.

7. The width of the wetland shall be calculated by dividing the larger cross-sectional area by the water depth. The calculated width should not be less than one-third (1/3) of the length (a length:width ratio of three to one (3:1)). Should it be necessary to construct a wetland with a ratio greater than three to one (3:1), step-loading along the length of the wetland shall be considered.

8. The configuration of a wetland for an individual home can be a one (1) cell or two (2) cells in series, depending upon the soil properties at the site. Larger systems may consist of multiple cells in parallel or series in order to provide more management options.

A. Single cells may be used where there will be no percolation of water through the bottom of the wetland. Water movement properties of the soil at the wetland construction site must be determined through a soil profile analysis performed by an Onsite Soil Evaluator (OSE).

B. Where geological limitations are not severe, a two (2)-cell wetland may be used. The first cell shall be lined, allowing no percolation. The second cell may be unlined and filled with sand (not rock) to promote some percolation from the bottom of the wetland. The second cell shall not be larger than the first cell.

9. Crushed limestone or other rock with sharp edges shall not be used for a porous media as this type of rock will compact with time. Rock with rounded edges, such as creek gravel, shall be used. Rock must be thoroughly washed to remove fines which may cause plugging. Rock substrate size should be one inch (1") diameter, while rock to be used around inlet and outlet pipes may be two to four inches (2-4") diameter to reduce potential clogging. A three to four inch (3-4") layer of washed pea gravel may be used on top of the one inch (1") substrate for decorative purposes.

10. All piping shall be SDR 35 sewer pipe, Schedule 40 polyvinyl chloride (PVC) DWV pipe, or material of equivalent or stronger construction. Piping shall be a four inch (4") diameter.

11. Influent shall be distributed and effluent collected by header pipes running the width of the wetland. Perforated sewer pipe can be used for the headers. For un-perforated pipe, a one and one-half inch (1 1/2") hole shall be drilled every twelve inches (12") along the header. Headers shall be placed at the bottom of the wetland on a bed of rock and covered with two to four inch (2-4") rock. A cleanout shall be placed before the influent header.

A. If effluent from the septic tank flows to the wetland by gravity and there are parallel cells in the wetland, a distribution box shall be placed ahead of the wetland so that flow can be controlled to individual cells.

B. If effluent is pumped, the pumping rate shall not exceed twenty-five gallons per minute (25 gpm) and no more than one-third (1/3) of the daily design flow shall be pumped at one (1) time.

12. Water level in a wetland shall be controllable. The range of control shall be from two inches (2") above the surface of the rock to complete draining of the wetland. Maximum water level in the wetland shall be a minimum of twelve inches (12") below the outlet of the septic tank so that water does not back up into the septic tank.

A. To conveniently check the water level relative to the gravel surface, a four inch (4") diameter perforated pipe may be placed in the bottom of the wetland, through the channel embankment, and then elbowed up to the elevation of the top of the channel.

B. Water level control may be obtained by use of swivel standpipes or collapsible tubing.

13. Surface water shall be kept out of the wetland. This may be accomplished by diverting runoff away from the wetland or constructing an earthen berm around the wetland. Berms shall be a minimum of six inches (6") above the surface of the porous media.

14. Emergent plants shall be selected by the ability of the plants to: root and grow in the wastewater-rock environment, treat wastewater to acceptable levels, produce biomass in amounts that can be controlled and aesthetics. Reference may be made to Tables 6 and 7 in selecting desired plants.

Table 6 - Plant Growth Data after one growing season

Plant Species	Wet Weight	Dry Weight	Top Dry	Root Dry	Top/Root	Root Depth
Softstem Bulrush (*Scirpus validus)*	(lbs./sq. ft.) 9.74	(lbs./sq. ft.) 4.20	3.20	1.00	3.20	(inches) 7.0
Horsetail *(Equisetum hyemale)*	1.90	0.55	0.20	0.35	0.57	11.0
Water Iris *(Iris pseudacorus)*	3.28	0.66	0.31	0.35	0.90	8.0
Pickerel Rush *(Pontederia cordata)*	6.24	1.30	0.50	0.80	0.63	15.0
Arrowhead *(Sagittaria latifolia)*	2.25	0.35	0.17	0.18	0.94	10.0
Cattails *(Typha latifolia)*	7.89	3.00	1.90	1.10	1.73	8.0
Soft Rush *(Juncus effusus)*	3.00	1.05	0.65	0.40	1.62	18.0
Flowering Rush *(Butomus umbellatus)*	0.30	0.07	0.01	0.06	0.18	12.0

Table 7 - Characteristics of Emergent Aquatic Plants

Plant Species	Bloom Date	Type of Bloom	Bloom Color	Plant Height	Growth Pattern	Initial Spacing
Softstem Bulrush *(Scirpus validus)*	June–July	Oblong Spikelets	Gray	(inches) 40–60	Spreading	(feet) 3
Horsetail *(Equisetum hyemale)*	July–Aug.	Oblong Spikelets	Brown	30–40	Spreading	3
Water Iris *(Iris pseudacorus)*	May–Aug.	Flower	White-Lt. Blue	10–18	Bunches	2–3
Pickerel Rush *(Pontederia cordata)*	July–Sept.	Flower	Purple	10–18	Bunches	2
Arrowhead *(Sagittaria latifolia)*	June–July	Hanging Bulbs	Green-White	6–10	Spreading	2–3
Cattails *(Typha latifolia)*	May–June	Oblong Spike	Brown	48–72	Spreading	3
Soft Rush *(Juncus effusus)*	June–July	Flower	Brown	18–30	Bunches	2

(H) Other Systems. Where unusual conditions exist, special systems of treatment and disposal, other than those specifically mentioned in this rule, may be employed provided–

1. Reasonable assurance of performance of the system is presented to the Health Officer;

2. The engineering design of the system is first approved by the Health Officer;

3. Adequate substantiating data indicate that the effluent will not contaminate any drinking water supply, groundwater used for drinking water or any surface water;

4. Treatment and disposal of the wastes will not deteriorate the public health and general welfare;

5. These systems comply with all applicable requirements of this rule, with all local codes and ordinances, and all applicable requirements of sections 701.025-701.059 and Chapter 644, RSMo.

(I) Variances. If circumstances exist which makes compliance with the requirements impractical or impossible, a person may request the Health Officer to review a proposal for modification of the requirements. Such a request shall be made in writing on forms provided by the Health Officer and be accompanied by a plan and shall include pertinent data to support the request. Where variances have been allowed from the standards, the Health Officer may require that a higher level of pretreatment than that of a septic tank be provided. Variances will be considered at the discretion of the Health Officer with relative assurance for protection of the public health and preservation of the quality of surface and ground waters.

(10) Detailed Soils Evaluation.

(A) General. The intent of this section is to provide minimum standards for site evaluations based upon evaluation of the soil characteristics, namely texture, color, structure, drainage and depth. Criteria are also given for sizing standard systems and some alternative systems.

(B) Adoption and Use. A soil evaluation should be conducted by an Onsite Soil Evaluator (OSE) registered with the State of Missouri and approved by the Health Officer.

(C) Site Evaluation. An investigation of a proposed soil absorption site shall consider the following factors:

1. Topography and landscape position;

2. Soil characteristics (morphology) which includes texture, structure, porosity, consistence, color and other physical, mineral and biological properties of various horizons, and the thickness and arrangement of the horizons in the soil profile;

3. Soil drainage, which includes both external (surface) and internal (soil);

4. Soil depth;

5. Restrictive horizons; and

6. Available space that is consistent with the soil profile.

(D) Site evaluations shall be made in accordance with subsections (10)(E)–(M) of this rule. Based on this evaluation, each of the factors listed in subsection (10)(C) of this rule shall be classified as Suitable, Provisionally Suitable or Unsuitable.

(E) Topography and Landscape Position. Uniform slopes under fifteen percent (15%) shall be considered suitable with respect to topography. When slopes are less than two percent (2%), provisions shall be made to insure adequate surface drainage. When slopes are greater than four percent (4%), the absorption lines shall follow the contour of the ground.

1. Uniform slopes between fifteen percent (15%) and thirty percent (30%) shall be considered provisionally suitable with respect to topography, if the soils are thirty-six inches (36") or more thick. Slopes within this range may require installation of interceptor drains upslope from the soil absorption system to remove all excess water that might be moving laterally through the soil during wet period. Usable areas larger than minimum are ordinarily required in this slope range.

2. Slopes greater than thirty percent (30%) shall be considered unsuitable except when a thorough study of the soil characteristics indicates that a soil absorption system will function satisfactorily and sufficient ground area is available to properly install such a system. Slopes greater than thirty percent (30%) may be classified as provisionally suitable when all of the following conditions are met:

A. The slope can be terraced or otherwise graded or the absorption lines located in naturally occurring soil to maintain a minimum ten-foot (10') horizontal distance from the absorption trench and the top edge of the fill embankment;

B. The soil characteristics can be classified as suitable or provisionally suitable to a depth of at least one foot (1') below the bottom of the absorption trench;

C. Surface water runoff is diverted around the absorption field so that there will be no scouring or erosion of the soil over the field;

D. If necessary, groundwater flow is intercepted and diverted to prevent the water from running into or saturating the soil absorption system; and

E. There is sufficient ground area available to install the septic tank system with these modifications.

3. Complex slope patterns and slopes dissected by gullies and ravines shall be considered unsuitable to topography.

4. Areas subject to frequent flooding shall be considered unsuitable to landscape positions.

5. Depressions shall be considered unsuitable with respect to landscape positions except when the site complies essentially with the requirements of this section and is specifically approved by the Health Officer.

6. If directed by the Health Officer, the surface area on or around a ground absorption system sewage treatment and disposal system shall be landscaped to provide adequate drainage. The interception of perched or lateral groundwater movement shall be provided where necessary to prevent soil saturation on or around the ground absorption sewage treatment and disposal system.

(F) Soil Characteristics (Morphology). Soil borings or pits shall be taken at the site to be used for soil absorption systems. Soil borings shall only be used with the approval of the Health Officer. These borings shall be taken to a depth of forty-eight inches (48") or as required to determine the soil characteristics. Soil borings or pits and core samples shall be evaluated and a determination made on the suitability of the soil to treat and absorb septic tank effluent. The important soil characteristics which shall be reviewed by the Health Officer are as follows:

1. The relative amounts of the different sizes of mineral particles in a soil are referred to as soil texture. All mineral soils are composed of sand, two to five hundredths millimeters (2–.05 mm) in size; silt, which includes intermediate-sized particles that cannot be seen with the naked eye but feel like flour when pressed between the fingers, five hundredths to two thousandths millimeter (0.05-0.002 mm) in size; or clay, which is extremely small in size and is the mineral particle that gives cohesion to a soil, less than two thousandths millimeters (0.002 mm) in size or a combination of these. The soil texture and structure of the different horizons of soils may be classified into five (5) general groups and shall be used for determining the application rates.

A. Soil Group I. Sandy texture soils contain more than seventy percent (70%) sand-sized particles in the soil mass. These soils do not have enough clay to be cohesive. Sandy soils have favorable sewage application rates, but may have a low filtering capacity leading to malfunction due to contamination of groundwater. The sandy group includes the sand and loamy sand soil textural classes and shall generally be considered suitable in texture.

(I) Sand. Sand has a gritty feel, does not stain the fingers and does not form a ribbon or ball when wet or moist.

(II) Loamy sand. Loamy sand has a gritty feel, stains the fingers (silt and clay), forms a weak ball and cannot be handled without breaking.

B. Soil group II. Coarse loamy texture soils contain more than thirty percent (30%) sand-sized particles and fewer than twenty percent (20%) clay-sized particles in the soil mass. They exhibit slight or no stickiness. The coarse loamy group includes sandy loam and loam soil textural classes and shall generally be considered suitable in texture.

(I) Sandy loam. Sandy loam feels gritty and forms a ball that can be picked up with the fingers and handled with care without breaking.

(II) Loam. Loam may feel slightly gritty but does not show a fingerprint and forms only short ribbons ranging from twenty-five hundredths to fifty hundredths inch (.25-.50") in length. Loam will form a ball that can be handled without breaking.

C. Soil group III. These fine loamy texture soils contain fewer than forty percent (40%) clay-sized particles and not more than thirty percent (30%) sand-sized particles in a soil mass. Also this group is limited to less than thirty-five percent (35%) clay when the clay minerals exhibit high shrink/swell characteristic and exhibit slight to moderate stickiness. The fine loamy group includes sandy clay loam, silt loam, clay loam and silty clay loam textural classes and shall generally be considered provisionally suitable in texture.

(I) Silt loam. Silt loam feels floury when moist and will show a fingerprint but will not ribbon and forms only a weak ball.

(II) Silt. Silt has a floury feel when moist and sticky when wet but will not ribbon and forms a ball that will tolerate some handling.

(III) Sandy clay loam. Sandy clay loam feels gritty but contains enough clay to form a firm ball and may ribbon to form seventy-five hundredths to one-inch (.75-1") pieces.

(IV) Silty clay loam. Silty clay loam is sticky when moist and will ribbon from one to two inches (1-2"). Rubbing silty clay loam with the thumbnail produces a moderate sheen. Silty clay loam produces a distinct fingerprint.

(V) Clay loam. Clay loam is sticky when moist. Clay loam forms a thin ribbon of one to two inches (1-2") in length and produces a slight sheen when rubbed with the thumbnail. Clay loam produces a non-distinct fingerprint.

D. Soil group IV. These clayey texture soils contain forty percent (40%) or more clay-sized particles and include sandy clay, silty clay and clay. This group may also include clay loam and silty clay loam when the clay fraction is greater than thirty-five percent (35%) and of a high shrink/swell nature. There are two (2) major types of clays–non-expandable and expandable. The non-expandable clays, when wet, are slightly sticky to sticky; when moist, are friable to firm; and when dry, they are slightly hard to hard. The non-expandable clays (Group IVa) shall generally be considered provisionally suitable in texture. The expandable clays, when wet, are very sticky and very plastic and when moist, these clays are very firm to extremely firm and when dry, are very hard to extremely hard. The expandable clays (Group IVb) shall be considered unsuitable in texture.

(I) Sandy clay. Sandy clay is plastic, gritty and sticky when moist and forms a firm ball and produces a thin ribbon to over two inches (2") in length.

(II) Silty clay. Silty clay is both plastic and sticky when moist and lacks any gritty feeling. Silty clay forms a firm ball and readily ribbons to over two inches (2") in length.

(III) Clay. Clay is both sticky and plastic when moist, produces a thin ribbon over two inches (2") in length, produces a high sheen when rubbed with the thumbnail and forms a strong ball resistant to breaking.

E. Soil group V. This soil group may be of any texture with greater than thirty five percent (35%) rock fragments, however, the most predominant are cherty and very cherty clays, silt loams and silty clay loams. The amount of rock fragments in these soils is of a concern in areas of residual soils overlying highly permeable bedrock where groundwater could become contaminated. In general, soils with less than fifty percent (50%) rock fragments will be considered suitable. In general, soils with greater than fifty percent (50%) rock fragments over highly permeable bedrock will be considered unsuitable. Soils with greater than fifty percent (50%) rock fragments will be considered provisionally suitable if geological limitations are not severe.

F. The soil texture shall be estimated by field testing; and

2. Soil consistency. Soil consistency is comprised of the attributes of soil material, typically clay, that are expressed by the degree and kind of cohesion and adhesion or by the resistance to deformation or rupture.

A. Soil consistency when wet shall be considered as follows:

(I) Stickiness. Stickiness is the quality of adhesion to other objects. For field evaluation of stickiness, wet soil material is pressed between thumb and finger and its adherence noted. Degrees of stickiness are described as follows:

(a) Slightly sticky. After pressure, soil material adheres to both thumb and finger but comes off one or the other cleanly. It is not appreciably stretched when the digits are separated;

(b) Sticky. After pressure, soil material adheres to both thumb and finger and tends to stretch somewhat and pull apart rather than pulling free from either digit; and

(c) Very sticky. After pressure, soil material adheres to both thumb and finger and is decidedly stretched when they are separated; and

(II) Plasticity. Plasticity is the ability to change shape continuously under the influence of an applied stress and to retain the impressed shape on removal of the stress. For field determination of plasticity, the soil material shall be rolled between the thumb and finger to observe whether or not a wire or thin rod of soil can be formed. Degree of resistance to deformation at or slightly above field capacity is as follows:

(a) Slightly plastic. Wire formable but soil mass easily deformable;

(b) Plastic. Wire formable and moderate pressure required for deformation of the soil mass; and

(c) Very plastic. Wire formable and much pressure required for deformation of the soil mass.

B. Soil consistency when moist. Consistence when moist is determined at a moisture content approximately midway between air dry and field capacity. At this moisture content, most soil materials exhibit a form of consistency characterized by– tendency to break into smaller masses rather than into powder; some deformation prior to rupture; absence of brittleness; and ability of the material after disturbance to cohere again when pressed together. To evaluate this consistency, a mass that appears slightly moist shall be selected and attempt made to crush in the hand.

(I) Friable. Soil material crushes easily under gentle to moderate pressure between thumb and finger, and coheres when pressed together.

(II) Firm. Soil material crushes under moderate pressure between thumb and finger but resistance is distinctly noticeable.

(III) Very firm. Soil material crushes under strong pressure; barely crushable between thumb and finger.

(IV) Extremely firm. Soil material crushes only under very strong pressure; cannot be crushed between thumb and finger and must be broken apart bit by bit.

C. Soil consistency when dry. The consistency of soil materials when dry is characterized by rigidity, brittleness, maximum resistance to pressure, more or less tendency to crush to a powder or to fragments with rather sharp edges, and inability of crushed material to cohere again when pressed together. For evaluation, the air-dry mass shall be selected and broken in the hand.

(I) Slightly hard. Weakly resistant to pressure, easily broken between thumb and finger.

(II) Hard. Moderately resistant to pressure; can be broken in the hands without difficulty but is barely breakable between thumb and finger.

(III) Very hard. Very resistant to pressure; can be broken in the hands only with difficulty; not breakable between thumb and finger.

(IV) Extremely hard. Extremely resistant to pressure; cannot be broken in the hands.

3. Soil structure. In many soils, the sand, silt and clay particles tend to cling or stick to one another to form a ped or a clump of soil. This is known as soil structure. Soil structure may have a significant effect on the movement of effluent through a soil. Structure is usually not important in soil groups I and II, and these types of soils shall generally be considered suitable as to structure. The three (3) kinds of soil structure that are most significant in movement of sewage effluent through groups III and IV soils are block-like, platy and the absence of soil structure or massive conditions. These kinds of soil structure are described as follows:

A. Block-like soil structure. In groups III and IV soils, if the soil exhibits many peds of angular and subangular peds, then the soils have block-like structure. The sewage effluent may move between the cracks of these

types of peds. Block-like structure in groups III and IV soils is frequently destroyed by mechanical excavating equipment manipulating the soil when it is too wet. Trenches for absorption lines being placed in groups III and IV soils with block-like structure should only be dug when the soils are moist or dry. Block-like soil structure in groups III and IV soils shall be considered provisionally suitable;

B. Platy soil structure. If groups III and IV soils fall out into plate-like sheets, then the soil would have platy structure. Water or effluent movement through these soils would be extremely slow, and the structure shall be considered unsuitable; and

C. Absence of soil structure. Some groups II, III and IV soils are massive and exhibit no structural aggregates. In these kinds of soils, water or effluent movement would be negligible. This structure shall be considered unsuitable.

(G) Soil Drainage. Soils with seasonally high water tables are of major concern in evaluating sites for sewage effluent disposal. These are the soil areas that give good sewage absorption rates during dry seasons of the year but force sewage effluent to the surface during the wetter seasons.

1. The depth of the seasonal high water table can commonly be recognized by those examining soil profiles. The criterion for recognition of high water tables is that of soil color. Subsurface horizons that are in colors of reds, yellows and browns generally indicate good soil aeration and drainage throughout the year. Subsurface horizons that are in colors of gray, olive or bluish colors indicate poor aeration and poor soil drainage. These dull or grayish colors may occur as a solid mass of soil or may be in mottles of localized spots. The volume of grayish color is indicative of the length of time that free water stands in that soil profile. There are soils that have light-colored mottles which are relic from the light-colored rock from which the soils have weathered. These soils would not have high water tables, so one must distinguish between a true soil composed of sand, silts and clays, or the rock material that may still exist in the soil profile. Similarly, there are also some soils with surface or subsurface alluvial horizons with light colors which can be unrelated to drainage conditions.

2. Any soil profile that has the grayish colors of chroma 2 or less (Munsell color chart) indicative of high water tables, or is either subject to periodic high water, within twenty-four inches (24") of the surface, or is less than twelve inches (12") between the proposed trench bottom and the high water table, shall be considered unsuitable as to drainage. Soils where the seasonally high water table is less than forty-eight inches (48") and more than twenty-four inches (24") below the naturally occurring surface shall be considered provisionally suitable for soil drainage, provided there remains at least twelve inches (12") of soil between the proposed trench bottom and the seasonally high water table. Soils where the seasonally high water table is greater than forty-eight inches (48") below the naturally occurring surface shall be considered suitable for soil drainage. Drainage systems installed for groundwater lowering shall be maintained so that a minimum separation of one foot (1') occurs between the absorption trench bottom and the seasonally high water table. For extensive drainage systems, such as groundwater lowering in subdivisions, easements shall be recorded and shall have adequate width for reasonable egress and ingress for maintenance.

(H) Soil Thickness. The thickness of soils to rock which are classified as suitable or provisionally suitable in texture and structure shall be at least forty-eight inches (48") when conventional soil absorption systems at conventional depths are to be utilized. Soil thickness greater than forty-eight inches (48") shall be considered as suitable as to soil thickness. Soil thickness less than forty-eight inches (48") and greater than thirty-six inches (36") shall be considered provisionally suitable. Where special design and installation modifications can be made to provide at least two feet (2') of naturally occurring soil below the bottom of the absorption trench, these soils may be reclassified as provisionally suitable in thickness.

(I) Restrictive Horizons. Restrictive horizons in soils are recognized by their apparent resistance in excavation or in the use of a soil auger. Restrictive horizons may occur as fragipans or claypans. The fragipan is a layer that owes its hardness mainly to extreme density or compactness as opposed to high clay content or cementation. The layer is typically dense and brittle. Although fragments are friable when removed, when in place the material is so dense that water moves through it very slowly. Unlike fragipans, the claypan is a compact, slowly permeable layer in the subsoil having a much higher clay content than the overlying material. A sharply defined boundary exists between the claypan and the overlying material. Claypans are typically hard when dry and plastic and sticky when wet.

1. Restrictive horizons that are greater than six inches (6") thick severely restrict the movement of water and sewage effluent and do not adequately respond to groundwater lowering drainage systems. Where these horizons are less than six inches (6") thick, they do not severely restrict the movement of water and sewage effluent, but rather indicate the presence of a seasonally high water table and may be modified after special investigation.

2. Soils in which restrictive horizons are six inches (6") or more in thickness and at depths greater than forty-eight inches (48") below the ground surface shall be considered suitable as to depth to restrictive horizons. Restrictive horizons six inches (6") or more in thickness and at depths between forty-eight inches and twenty-four inches (48–24") shall be considered provisionally suitable as to depth to restrictive horizons. Restrictive horizons six inches (6") or more in thickness encountered at depths less than twenty-four inches (24") below the ground surface

shall be considered unsuitable as to depth to restrictive horizons.

(J) Other Applicable Factors. The site evaluation should include consideration of any other applicable factors involving environmental principles including:

1. The potential environmental hazard of possible failures of soil absorption systems involving large quantities of sewage, which would dictate larger separation distances than the minimums specified in subsection (1)(D) of this rule; and

2. The potential environmental and health hazard of possible massive failures of soil absorption systems proposed to serve large numbers of residences, as in residential subdivisions or mobile home parks.

3. The available space that is consistent with the soil profile description must be noted on the soil evaluation report site map.

(K) Determination of Overall Site Suitability. All of the criteria in subsections (10)(E)-(J) of this rule shall be determined to be suitable, provisionally suitable or unsuitable as indicated. If all criteria are classified the same, that classification shall prevail. Where there is a variation in classification of the several criteria, the following shall be used in making the overall site classification. The lowest of the uncorrectable characteristics will determine the overall site classification. The Health Officer shall make this determination–

1. If the topography is classified as unsuitable, it may be reclassified provisionally suitable under the conditions outlined in subsection (10)(E) of this rule;

2. If the soil texture is classified as unsuitable, the overall classification will be unsuitable regardless of the other criteria unless the provisions of subsection (9)(H) of this rule are met;

3. If the soil structure is classified as unsuitable, the overall classification will be unsuitable regardless of the other criteria unless the provisions of subsection (9)(H) of this rule are met;

4. When soil thickness is classified as unsuitable, it may be reclassified as provisionally suitable under the conditions outlined in subsection (10)(H) of this rule;

5. When the restrictive horizon is classified unsuitable, it may be reclassified as provisionally suitable under the conditions outlined in subsection (9)(H) of this rule; and

6. When drainage (groundwater level) is unsuitable, it may be reclassified as provisionally suitable under the conditions outlined in subsection (10)(G) of this rule.

(L) Site Classification. Sites classified as suitable may be utilized for a ground absorption sewage treatment and disposal system consistent with this rule. A suitable classification generally indicates soil and site conditions favorable for the operation of a ground absorption sewage treatment and disposal system or have slight limitations that are readily overcome by proper design and installation.

1. Sites classified as provisionally suitable may be utilized for a ground absorption sewage treatment and disposal system consistent with this rule but with moderate limitations. Sites classified provisionally suitable require some modifications and careful planning, design and installation for a ground absorption sewage treatment and disposal system to function satisfactorily.

2. Sites originally classified as unsuitable may be used for soil absorption disposal systems, provided engineering, hydrogeologic and soil studies indicate to the Health Officer that a suitable septic tank system or a suitable alternate system can reasonably be expected to function satisfactorily. These sites may be reclassified as provisionally suitable upon submission to the Health Officer and meeting the department's requirements in subsection (9)(H) of this rule.

(M) Design Criteria. Tables 8 and 9 shall be used when determining application rates for the appropriate sewage disposal system design.

1. Table 8 shall be used when determining the application rate for septic tank systems of conventional design when using the site evaluation criteria in this rule.

2. The construction of any conventional or LPP system must meet the other applicable requirements as set forth in section (6) of this rule. Soils for LPP systems must be classified as suitable or provisionally suitable to a depth of two feet (2') from the original ground surface. Table 9 shall be used when determining the application rate when using the site evaluation criteria in this rule.

(11) Inspection and Notification Requirements

(A) General. **No part of any system may be covered or backfilled until inspected and approved by the Health Officer**. A minimum of twenty four (24) hours notice is required when requesting an inspection.

(B) Property lines. It is the responsibility of the property owner or developer to properly mark all property lines and corners according to legal description of the property. The Health Officer assumes no responsibility if minimum setback requirements are not met because property lines are marked erroneously.

Table 8 - Application Rates by Soil Groups for Conventional Systems

Soil Group	Soil Texture	Soil Structure/Color	Application Rate
			(gpd./sq.ft.) (conventional)
I	Sand, Loamy sand	Any striation/Brown (No gray)	1.2 - 0.8
II	Sandy loam, Loam	Granular, fine and medium subangular blocky	0.9 - 0.7
	Sandy loam, Loam	Prismatic; coarse, subangular, and angular blocky	0.7 - 0.5
III	Silt loam, Clay loam, Sandy clay loam, Silty clay loam	Granular, fine, and medium subangular blocky	0.6 - 0.4
	Silt loam, Clay loam, Sandy clay loam, Silty clay loam	Prismatic, coarse subangular and angular blocky	0.4 - 0.3
IVa	Sandy clay, Silty clay, Clay (low to moderate shrink/swell)	Granular, fine, and medium subangular blocky	0.4 - 0.2
	Sandy clay, Clay, Silty clay (low-moderate shrink/swell)	Prismatic; coarse subangular or angular blocky	0.3 - 0.1
IVb	Sandy clay, Clay, Silty clay loam, Silty clay (high shrink/swell potential)	Subangular, Angular blocky, or Prismatic	Not suitable
V	Skeletal (less than 50% coarse fragments), Silt loam, Silty clay loam, Clay, Silty clay	Anything but platy or massive	0.4 - 0.2

Table 9 - Application Rates by Soil Group

Soil Group	Soil Texture	Classes	Application Rate (Advanced Systems)
			(gpd/sq. ft.)
I	Sand, Loamy Sand	No structure (Brown colors)	0.5–0.4
II	Sandy loam, Loam	Granular; fine and medium subangular blocky	0.4–0.35
	Sandy loam, Loam	Prismatic; coarse subangular and angular blocky	0.3–0.2
III	Silt loam, Clay loam Sandy clay loam, Silty clay loam	Granular; fine and medium subangular blocky	0.3–0.2
	Silt loam, Clay loam, Sandy clay loam, Silty clay loam	Prismatic; coarse subangular and angular blocky	0.20–0.15
IVa	Sandy clay, Silty clay, Clay (low to moderate shrink/swell)	Granular; fine and medium subangular blocky	0.2–0.1
	Sandy clay, Clay, Silty clay	Prismatic; coarse subangular or angular blocky	0.1–0.05
IVb	Clay, Sandy clay, Silty clay loam, Clay loam, Silty clay (high shrink/ swell potential)	Subangular, Angular blocky, or Prismatic	Not suitable
V	Skeletal (less than 50%), Silt loam, Silty clay loam, Clay, Silty clay	Anything but platy or massive	0.3–0.15