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~~OFFICE WEST VIRGINIA~~
SECRETARY OF STATE

Form #3 ☐

AGENCY: Department of Health and Human Resources TITLE NUMBER: 64

CITE AUTHORITY: WV Code §§16-1-4 and -9

AMENDMENT TO AN EXISTING RULE: YES___ NO X

IF YES, SERIES NUMBER OF RULE BEING AMENDED: _____

TITLE OF RULE BEING AMENDED: _____

IF NO, SERIES NUMBER OF RULE BEING PROPOSED: 47

TITLE OF RULE BEING PROPOSED: Sewage Treatment and Collection System Design Standards

THE ABOVE PROPOSED LEGISLATIVE RULE HAVING GONE TO A PUBLIC HEARING OR A PUBLIC COMMENT PERIOD IS HEREBY APPROVED BY THE PROMULGATING AGENCY FOR FILING WITH THE SECRETARY OF STATE AND THE LEGISLATIVE RULE-MAKING REVIEW COMMITTEE FOR THEIR REVIEW.

Philip A. Lynch
Authorized Signature

SCANNED

Brief Summary of the Rule
64 CSR 47
Sewage Treatment & Collection System Design Standards

The amended rule will bring the on-site wastewater design standards into compliance with legislative Rule 64 CSR 9 (Sewage Systems, Sewage Treatment Systems and Septic Tank Cleaners) which was approved by the Legislative in 1998.

This rule incorporates new technology for both on-site wastewater systems and public sewage treatment and collection systems.

**Statement of Circumstances
Which Require the Proposed Rule
64 CSR 47
Sewage Treatment & Collection System Design Standards**

The Sewage Treatment and Collection Systems Design Standards (64 CSR 16) have not been updated since 1983. Since that time, the design and technology of both public and on-site wastewater treatment and collection systems has changed and been improved. Also, the design standards need to be brought into compliance with Legislative Rule 64 CSR 9, Sewage System, Sewage Treatment Systems and Sewage Tank Cleaning, that was approved by the Legislature in 1998.

This design standard will also require assistance in requiring new and modified on-site wastewater systems be in compliance with the state's Groundwater protection Act.

FISCAL NOTE FOR PROPOSED RULES

Rule Title: 64 CSR 47 Sewage Treatment & Collection System Design Standards

Type of Rule: X Legislative Interpretive Procedural

Agency: Bureau for Public Health
Department of Health and Human Resources

Address: Building 3, Capitol Complex
Charleston, W. Va. 25305

1. Effect of the Proposed Rule	ANNUAL		FISCAL YEAR		
	Increase	Decrease	Current	Next	Thereafter
Estimated Total Cost	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Personal Services	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Current Expense	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Repairs & Alterations	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Equipment	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Other	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Revenue	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

2. Explanation of above estimates.

This proposed rule does not require additional funds.

3. Objectives of this rule:

To amend and update the current rule (64 CSR 47).

Rule Title: 64 CSR 47 Sewage Treatment & Collection System Design Standards

4. Explanation of Overall Economic Impact of Proposed Rule.

A. Economic Impact on State Government.

None.

B. Economic Impact on Political Subdivisions; Specific Industries; Specific Groups of Citizens.

None.

C. Economic Impact on Citizens/Public at Large.

None.

Date: July 25, 2002

Signature of Agency Head or Authorized Representative

A handwritten signature in black ink, appearing to read "Philip A. Lynch, for", is written over a horizontal line.

**Paul L. Nisbaum, Secretary
Department of Health and Human Resources**

QUESTIONNAIRE

(Please include a copy of this form with each filing of your rule: Notice of Public Hearing or Comment Period, Proposed Rule, and if needed, Emergency and Modified Rule.)

DATE: June 14, 2002

TO: LEGISLATIVE RULE-MAKING REVIEW COMMITTEE

FROM: (Agency name, Address & Phone No.) Martha Barnitt

Department of Health and Human Resources

State Capitol Complex, Building 3, Room 206; Charleston, WV 25305

Telephone: (304) 558-5598

LEGISLATIVE RULE TITLE: Sewage Treatment and Collection System Design
Standards

1. Authorizing statute(s) citation: WV Code §§ 16-1-4 and -9.

2. a. Date filed in State Register with Notice of Hearing or Public Comment Period:
June 14, 2002
- b. What other notice, including advertising, did you give of the hearing?
Notice of the proposed rule will be sent to local county health departments,
Public health associations, and others interested industry associations.

- c. Date of Public Hearing(s) or Public Comment Period ended:
July 15, 2002

- d. Attach list of persons who appeared at hearing, comments received, amendments, reasons for amendments.

Attached X No comments received

- e. Date you filed in State Register the agency approved proposed Legislative Rule following public hearing (be exact):

July 26, 2002

- f. Name, title, address and phone/fax/e-mail numbers of agency person(s) to receive all written correspondence regarding this rule (please type):

Martha Barnitt

Office of the Secretary - - DHHR

Building 3 - Room 206

Charleston, West Virginia 25305

Tel: 558-5598 Fax: 558-7075

- g. IF DIFFERENT FROM ITEM 'f', please give Name, title, address and phone number(s) of agency person(s) who wrote and/or has responsibility for the contents of this rule (please type):

Ron Forren, Director - Public Health Sanitation

Office of Environmental Health Services - DHHR

815 Quarrier Street, Suite 418

Charleston, West Virginia 25305

Tel: 558-2981

3. If the statute under which you promulgated the submitted rules requires certain findings and determinations to be made as a condition precedent to their promulgation:

- a. Give the date upon which you filed in the State Register a notice of the time and place a hearing for the taking of evidence and a general description of the issues to be decided.

N/A

b. Date of hearing or comment period:

N/A

c. On what date did you file in the State Register the findings and determinations required together with the reasons therefore?

N/A

d. Attach findings and determinations and reasons:

Attached N/A

**TITLE 64
LEGISLATIVE RULES
BUREAU FOR PUBLIC HEALTH**

**SERIES 47
SEWAGE TREATMENT AND COLLECTION SYSTEM DESIGN STANDARDS**

**TITLE 64
LEGISLATIVE RULES
BUREAU FOR PUBLIC HEALTH**

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**SERIES 47
SEWAGE TREATMENT AND COLLECTION SYSTEM DESIGN STANDARDS**

OFFICE OF THE SECRETARY OF STATE
COMMONWEALTH OF VIRGINIA

§64-47-1. General.

1.1. Scope.- This legislative rule establishes the design standards for sewage treatment or collection system construction and operation. This rule should be read in conjunction with W. Va. Code §§16-1-6 and -9. The W. Va. Code is available in public libraries and on the Legislature's web page: <http://www.legis.state.wv.us/>.

1.2. Authority.- W. Va. Code §16-1-4 and -9.

1.3. Filing Date.

1.4. Effective Date.-

1.5. Repeal and Replacement of Former Rules. - This legislative rule repeals and replaces Interpretive rule, 64CSR47, "Sewage Treatment and Collection System Design Standards," effective December 1, 1983.

1.6. Applicability. - This rule applies to any person involved in the construction or operation of sewage treatment or collection systems requiring approval by the Bureau for Public Health.

1.7. Enforcement. - This rule is enforced by the Commissioner of the Bureau for Public Health or his or her designee.

§64-47-2. Definitions.

2.1. Acceptable Application. - The completed forms, plans, specifications, fee, if required, and other data as specified by this rule or by instructions issued by the commissioner of the Bureau for Public Health.

2.2. Accessible. - When the location of a public sewer system is adjacent to, or available by right-of-way to, a particular lot, and sewage can discharge by gravity.

2.3. Approved. - A procedure of operation or construction that is in accordance with design standards, specifications and instructions established by the Department.

- 2.4. BOD. - Biochemical oxygen demand.
- 2.5. Bureau. - The Bureau for Public Health.
- 2.6. Chief. - The chief of the Office of Water Resources of the department of environmental protection, or his or her designee.
- 2.7. Commissioner. - The Commissioner of the Bureau for Public Health, or his or her designee.
- 2.8. Department. - The West Virginia Department of Health and Human Resources.
- 2.9. Design Standards. - Application procedures, design requirements, specifications and construction standards promulgated by the Bureau for Public Health.
- 2.10. Effluent. - Liquid discharge from a sewage treatment or disposal system.
- 2.11. Establishment. - A building, structure or place used or intended to be used for multiple dwelling units, or for manufacturing, commercial, religious, institutional, educational or recreational purposes.
- 2.12. Individual Sewer System. - A system with a daily design flow not to exceed one thousand (1,000) gallons per day with subsurface discharge or not to exceed six hundred (600) gallons per day design flow with surface discharge. A single entity owns and performs maintenance of the system.
- 2.13. Municipal Sewer System. - A system or group of systems that receives sewage from more than one (1) dwelling or establishment that is operated and maintained by an incorporated municipality, public service district, or sanitary board.
- 2.14. Percolation Test. - A method described in this rule for evaluating soils in a particular area for subsurface effluent disposal.
- 2.15. Permit. - A written document issued by the Commissioner that gives permission to construct, install, extend, alter or operate an approved sewer system, use a method of sewage disposal, or to collect, remove, transport or dispose of sewage.
- 2.16. Person. - Individual, partnership, association, syndicate, company, firm, trust, corporation, government corporation, institution, department, division, bureau, agency, or any other entity recognized by law.
- 2.17. Public Sewer System. - A sewage collection system or systems, including municipal sewer systems. with or without treatment facilities, with a daily design flow greater than one thousand (1000) gallons per day with subsurface discharge or greater than six hundred

(600) gallons per day with surface discharge, serving one (1) or more dwellings or establishments. A single entity owns and performs maintenance on the system.

2.18. Sewage. - Excreta or liquid waste containing animal or vegetable matter in suspension or solution including, but not limited to, waste from commodes, urinals, lavatories, bathtubs, laundry tubs, washing machines, drinking fountains, sinks, kitchen equipment, and other sanitary fixtures or facilities.

2.19. Sewer System. - A publicly or privately owned system that receives and treats sewage and provides for the disposal of effluent and sludge that comes from it. This definition includes individual sewer systems and public sewer systems.

2.20. Sewage Tank. - A watertight receptacle designed and constructed to receive and retain sewage solids. Sewage tanks include, but are not limited to, septic tanks, aeration type sewage treatment systems, privy vaults, holding tanks or receptacles and self-contained excreta disposal facilities.

2.21. Sewage Tank Cleaner. - A person engaged in the collection, removal, transportation or disposal of sewage.

2.22. Standard Soil Absorption System - A system designed to receive effluent from a septic tank and dispose of it at depths ranging from eighteen (18) to thirty-six (36) inches from the original ground surface.

2.23. Subdivision. - The result of the division of a tract of land into two (2) or more lots, tracts, parcels, plats, sites, areas, units, interests, or other division for the purpose of dwelling or establishment development and including the division of land by deed, metes and bounds description, lease, map, plat or other instrument, or by act of construction.

2.24. Wastewater. - Water containing human, animal or domestic waste.

2.25. Water Well. - Any excavation or penetration in the ground, that enters or passes through an aquifer for purposes that may include, but are not limited to, a water supply, exploration for water, dewatering, or heat pump wells. This definition does not include ground water monitoring activities and all activities for the exploration, development, production, storage and recovery of coal, oil, and gas and other mineral resources regulated under W.Va. Code §§22-1-1 et seq., 22A-1-1 et seq., or 22B-1-1 et seq.

§64-47-3. Sewage Permit Applications.

3.1. Application for Permits.

3.1.a. An applicant shall submit a completed application for a permit in

accordance with "Sewage System Rules," 64CSR9, this rule and the instructions of the Commissioner.

3.1.b. Several application packages are available for the various methods of sewage collection, treatment, disposal and types of facilities served. To determine which application package to request, an applicant shall refer to Table 64-47-A. at the end of this rule.

3.1.c. An applicant may obtain an application package from the environmental engineering division, office of environmental health services, Bureau.

3.1.d. An applicant shall determine minimum design loadings for various types of sewage treatment facilities by referring to Table 64-47-B. at the end of this rule.

3.2. Revisions to Approved Plans and Specifications. - The Commissioner shall approve in writing any deviations from approved plans or specifications affecting capacity, flow or operation of units before the applicant makes any changes. The applicant shall submit revised plans or specifications to the Commissioner well in advance of any change he or she is planning in construction work to give the Commissioner sufficient time for review and approval. Structural revisions or other minor changes during construction that do not affect capacities, flows or operation may be made without approval by the Commissioner. At the Commissioner's request, the applicant shall submit final drawings to the bureau and the municipality at the completion of the work, clearly showing the completed alteration.

3.3. Operation During Construction. - The applicant shall provide specifications to the Commissioner that details a program for keeping existing treatment plant units in operation during construction of plant additions. The applicant shall submit to the bureau and the chief the shutdown schedule agreed to by the bureau and the chief, should it be necessary to take plant units out of operation.

§64-47-4. Sewage Collection Systems.

4.1. General.

4.1.a. Design. The design of new systems or extensions to existing systems shall carry sanitary sewage flows plus contain an allowance for non-excessive infiltration.

4.1.b. Modifications. Modifications to the design on existing systems shall be to carry sanitary sewage flows plus contain an allowance for non-excessive infiltration and inflow.

4.1.c. Overflows. The Commissioner shall review on a case by case basis, overflows from new interceptor sewers.

4.1.d. Combined Sewers. The Commissioner shall not approve new combined

systems.

4.1.e. Design Factors. In determining the required capacities of sanitary sewers, an applicant shall consider the following factors:

4.1.e.1. Maximum hourly quantity of sewage;

4.1.e.2. Additional maximum wastewater flow from industrial plants; and

4.1.e.3. Groundwater infiltration.

4.1.f. Design Basis Per Capita Flow. To arrive at average dry weather flows from combined residential, commercial and institutional sources, an applicant shall design a new system on the basis of one (1) of the following two (2) methods:

4.1.f.1. Using estimates based on a one (1) year record of a fully documented analysis of water use adjusted for consumption and losses; or

4.1.f.2. Using state developed per capita wastewater flows using seventy (70) GPCD or existing water usage records for various sizes and types of municipalities.

4.2. Gravity.

4.2.a. Design Period. The maximum allowable design period for sewers is fifty (50) years for the estimated tributary area. This rule shall allow phasing of collection system.

4.2.b. Infiltration Allowance and Industrial Flows. The Commissioner may add an infiltration allowance to the per capita design flows of two hundred (200) gallons per inch diameter per mile per day and a reasonable allowance for future industries to arrive at the average daily flow (ADF).

4.2.c. Peak Flows.

4.2.c.1. When flowing full, an applicant shall make sewer designs to carry a peak flow of:

4.2.c.1.A. Lateral Sewers - 4 x ADF; and

4.2.c.1.B. Trunk and Interceptor and Outfall Sewers - 2.5 x ADF.

4.2.d. When deviating from the above stated peak design flows, an applicant shall provide in the design engineering report a brief justification and description of the procedure he or she used for sewer design.

4.2.e. Calculation. An applicant shall present computations and other design data for proposed sewage collection and treatment facilities of greater than one hundred thousand (100,000) gallons per day, in an appropriate form to the Commissioner. The computations shall include:

4.2.e.1. Average daily flow and peak daily flow at critical points such as the change in size of sewers; and

4.2.e.2. The velocity at minimum, average and peak flows in sewers, as required.

4.2.f. Minimum Size.

4.2.f.1. No gravity sewer shall be less than eight (8) inches in diameter except for using six (6) inch diameter sewer pipe for lateral sewers when:

4.2.f.1.A. No possibility of future extension exists; and

4.2.f.2.B. The sewer cannot service more than either thirty (30) mobile homes or twenty-three (23) residences.

4.2.f.2. There shall be no allowance for a four (4) inch sewer pipe for the gravity collection system.

4.2.g. Small Diameter-Gravity Sewers.

4.2.g.1. On a case by case basis the Commissioner may allow these sewers for sanitary sewage collection.

4.2.g.2. Pretreatment is a requirement prior to discharge into these small diameter-gravity sewers.

4.2.g.3. The minimum pipe size is four (4) inches.

4.2.g.4. An applicant may use cleanouts instead of manholes and shall install them:

4.2.g.4.A. At all changes in direction; and

4.2.g.4.B. At all connections.

4.2.h. Cover. The minimum allowable earth cover on sewers is three (3) feet unless otherwise approved by the Commissioner. Generally, sewers shall be sufficiently deep enough to drain basement fixtures, to protect the sewers from surface loadings and to prevent

freezing.

4.2.i. Slope.

4.2.i.1. For new sewers the design and construction shall be to give velocities, when flowing full, of not less than two (2) feet per second based on Kutter's or Manning's formula using an "n" value of 0.013.

4.2.i.2. For existing sewers, the Commissioner recommends a value of "n" as 0.015 to determine existing capacities. The Commissioner shall grant permission to use other practical "n" values if he or she considers it justifiable on the basis of research or field data an applicant presents.

4.2.i.3. The Commissioner recommends slopes greater than the ones in Table 64-47-C. at the end of this rule that contains minimum required slopes.

4.2.i.4. Under special conditions, if detailed data given are justifiable, the Commissioner may grant an applicant permission to use slopes slightly less than those required for the two (2) feet per second velocity when flowing full. When selecting decreased slopes, the engineer shall provide the Commissioner a report and the computations of the depth of flow in the pipes at minimum, average, and peak rates of flow. This rule recognizes that the decreased slopes may cause additional sewer maintenance.

4.2.i.5. Sewers shall lay in a straight line with uniform slope between manholes. Concrete anchors, or approved equal, shall anchor sewers laid on a twenty percent (20%) slope or greater and spaced as follows:

4.2.i.5.A. Not over thirty-six (36) feet center to center on slopes between twenty percent (20%) to thirty-five percent (35%).

4.2.i.5.B. Not over twenty-four (24) feet center to center on slopes between thirty-five percent (35%) to fifty percent (50%).

4.2.i.5.C. Not over sixteen (16) feet center to center on slopes fifty percent (50%) and over.

4.2.j. Alignment. Sewers twenty-four (24) inches in diameter or less shall lay with straight alignment between manholes.

4.2.k. Increasing Size. When a sewer joins a larger one, the invert of the larger sewer shall be sufficiently lower to maintain the same energy gradient. An approximate method for securing these results is to place the 0.8 depth of both sewers at the same elevation.

4.2.l. High Velocity Protection. An applicant shall make special provisions to

protect against displacement by erosion and shock when velocities are greater than fifteen (15) feet per second.

4.2.m. Materials. The material selected for the pipe shall be adaptable to local conditions, such as character of industrial wastes, possibility of septicity, soil characteristics, exceptionally heavy external loadings, abrasion and similar problems.

4.2.n. Types of Gravity Pipe. Design of all sewers shall be to prevent damage from superimposed loads. Proper allowance for loads on the sewer shall be according to the width and depth of trench. Construction of gravity sewer lines shall be of clay, plastic, ductile iron or concrete sewer pipe meeting the following minimum specifications:

4.2.n.1. House Connection to Collector Sewers:

Clay - ASTM C 700

Plastic - ASTM D 2729, D 2751, D 2836, D 2852

Ductile Iron - AWWA C-110, C-151, Cement lined

Concrete - ASTM C 14

4.2.n.2. Collector and Interceptor Sewers:

Clay - ASTM C 700 - Joints meet the requirements of ASTM C 425. This rule does not permit seal joints or cement joints.

Plastic-ASTM D 3033, D 3034, F 789, A 2000

Composite - ASTM D 2680

Ductile Iron - AWWA C-110, C-151, Cement lined

Concrete - ASTM C-76

4.2.o. Bedding. In accordance with ASCE Manual & Report on Engineering Practice No. 37, bedding shall be Class "A", "B", "C". To provide the strength necessary for future soil and load conditions, the engineer shall determine the class of bedding.

4.2.p. Inverted Siphons. Inverted siphons shall have not less than two (2) barrels, with a minimum pipe size of six (6) inches, and be provided with necessary appurtenances for convenient flushing and maintenance. The manholes shall have adequate clearances for rodding; and in general, provide sufficient head and pipe sizes selected to secure velocities of at least three (3) feet per second for average flows. Arrangement of the inlet and outlet details shall be to divert the normal flow to one (1) barrel in order to take either barrel out of service for cleaning. Use of ductile iron pipe or equal is a requirement.

4.2.q. Stream Crossing. When sewers must cross under a stream or watercourse, there shall be a minimum separation of three (3) feet between the stream bed and the top of the sewer pipe. However, the Commissioner may approve other methods provided there is equivalent protection and performance. Use of ductile iron pipe or equal is a requirement.

4.2.r. Aerial Sewers. Aerial sewers require the Commissioner's prior approval.

4.2.s. Protection of Drinking Water Supplies.

4.2.s.1. Water Supply Interconnections. There shall be no physical connection between a public or private drinking water supply system and a sewer or appurtenance.

4.2.s.2. Relation to Public Water Systems. A general guideline is that gravity or pressure sanitary sewers, or both, shall be at least ten (10) feet horizontally from a drinking water supply.

4.2.s.3. Relation to Wells. No gravity or pressure sanitary sewer line shall be located within fifty (50) feet of a public, private or individual homeowner's drinking water well. However, if physical limitations prevent a fifty (50) foot separation, the Commissioner may give written approval for variance from these requirements. Under no conditions shall the construction of any gravity or pressure sanitary sewer be closer than ten (10) feet to a private homeowner's well.

4.2.s.4. Relation to Water Lines.

4.2.s.4.A. Horizontal Separation. Gravity or pressure sanitary sewers shall be at a minimum of ten (10) feet horizontally away from any existing or proposed water lines. However, if maintaining the ten (10) foot horizontal separation is not possible, the construction of the sewer and testing shall be as prescribed in Paragraph 4.2.s.5. of this rule. A sewer shall not be constructed closer than three (3) feet edge to edge to a water line.

4.2.s.4.B. Vertical Separation. When a gravity or pressure sanitary sewer must cross water lines, its construction shall be at an elevation so that the top of the sewer line is a minimum of eighteen (18) inches beneath the bottom of the water main. However, if meeting the eighteen (18) inch vertical separation requirement is not possible, then the construction of the sewer and testing shall be as prescribed in Paragraph 4.2.s.5. of this rule.

4.2.s.5. Special Construction Requirements.

4.2.s.5.A. Horizontal. In cases where water and gravity or pressure sanitary sewer lines must lay closer than ten (10) feet apart, the sewer line construction shall be a minimum of eighteen (18) inches lower than the water line and constructed of a pressure type pipe meeting requirements for water lines. The installation shall undergo hydraulic testing for a period of not less than twenty-four (24) hours and considered satisfactory if leakage is not more than 0.25 gallons per inch diameter of pipe per joint. In lieu of hydraulic testing, the sewer line can be air tested. The placement of the water line shall be upon an undisturbed earth shelf or bench. Backfilling to create the bench is not permissible. Maintaining maximum possible horizontal distance between the lines is a requirement. Where meeting these conditions is not possible, an applicant shall obtain written approval for a variance from the Commissioner. When placement of the lines is within five (5) feet of each other, each line shall have a metallic

impregnated, permanent identification tape buried directly above it denoting "sewer line" or "potable water line."

4.2.s.5.B. Vertical. If maintaining a vertical clearance of eighteen (18) inches as specified in Subparagraph 4.2.s.4.B. of this rule is not possible, the location of the gravity or pressure sanitary sewer shall be so that it crosses between joints of the water line. Also, construction of the sewer line shall be so that it crosses under the water line at mid joint. The construction of the sewer shall be of a pressure type pipe meeting the requirements for water lines at the crossing. This rule requires maintaining a minimum vertical clearance of six (6) inches between the sewer and water lines. The construction of a gravity or pressure sanitary sewer line, or both, shall not be over the top of a water line. However, when meeting the standard vertical installation requirements is not possible, encase the sewer line so that the casing extends at least ten (10) feet on each side of the crossing. This rule requires maintaining a minimum vertical separation of eighteen (18) inches between the lines.

4.2.t. Sewer Riser Pipes.

4.2.t.1. All mobile home lots shall have a sewer riser pipe with a minimum diameter of four (4) inches and extend at least four (4) inches above the ground in a vertical position.

4.2.t.2. When not serving a mobile home, all sewer riser pipes shall be tightly capped or plugged to keep them watertight.

4.3. Manholes.

4.3.a. Location. Manholes shall be placed:

4.3.a.1. At the end of each sewer line;

4.3.a.2. At all changes in slope, size, or alignment;

4.3.a.3. At all intersections; and

4.3.a.4. At distances not greater than four hundred (400) feet for sewers fifteen (15) inches in diameter or less, and five hundred (500) feet for sewers eighteen (18) inches to thirty (30) inches in diameter. The Commissioner may waive this requirement and permit greater spacing in larger sewers and in sewers carrying settled effluent.

4.3.a.5. This rule allows for the construction of cleanouts at the upper end of all lines. In some special conditions, cleanouts may replace manholes, but installation of them requires approval by the Commissioner prior to installation.

4.3.b. Materials. Manholes shall be pre-cast concrete, poured-in-place concrete

or concrete manhole block.

4.3.c. Drop Type. A sewer entering a manhole at an elevation of twenty-four (24) inches or more above the manhole invert provides for outside drop pipe. The entire drop connection shall be encased in concrete. If an inside drop is necessary, the manhole and access provided for cleaning shall have a pipe fastened to it.

4.3.d. Diameter. The minimum base diameter of manholes shall be forty-eight (48) inches. Larger diameters are preferable for large diameter sewers with a minimum opening of twenty-four (24) inches.

4.3.e. Steps. There shall be a provision for non-corrosive steps embedded in the walls, offset and spaced twelve (12) to eighteen (18) inches apart vertically.

4.3.f. Flow Channel. The inside base of the manhole shall be filled with concrete to form a bench sloping toward the flow channel. In addition, both the flow channel and the bench shall be troweled to a smooth surface.

4.3.g. Watertightness. Solid manhole covers are required where the manhole covers may flood by street runoff or high water.

4.3.g.1. Manholes of segmented block shall have waterproofing on the exterior with plaster coatings, supplemented by a bituminous waterproof coating;

4.3.g.2. Concrete manholes shall have waterproofing on the exterior where groundwater conditions are unfavorable; and

4.3.g.3. Pipe connections to manholes and joints on manholes shall be watertight.

4.4. Pumping Station.

4.4.a. General.

4.4.a.1. Flooding. The location of stations including electrical equipment shall be at an elevation not subject to the one hundred (100) year flood or otherwise have adequate protection against the one hundred (100) year flood.

4.4.a.2. Location.

4.4.a.2.A. Preferably, the location shall be off the right-of-way of streets and alleys and shall be a suitable structure;

4.4.a.2.B. The station shall be readily accessible, but be as far as

possible from the nearest dwelling; and

4.4.a.2.C. Fencing shall be required to prevent entry of unauthorized persons, unless the Commissioner gives prior approval for an alternative method.

4.4.a.3. Overflows. There shall be no overflows or bypasses from lift stations at new facilities.

4.4.a.4. Pumping Rates and Number of Pumping Units. All lift stations, each capable of providing the maximum design flow, shall have minimum dual pumps. The size of the pumping units shall be to provide the minimum cleaning velocity of two (2) feet per second at the rated capacity, assuming a $C=120$ for plastic pipe and $C=100$ for all other pipe materials in the Hazen-Williams Formula.

4.4.a.5. Type. The Commissioner may approve the wet well or wet well/dry well type, or both.

4.4.b. Design.

4.4.b.1. Long Drive Shaft Pumps. A wet well installation achieved by mounting the pump in the wet well and connecting it by a drive shaft to the motor above the wet well shall not be approved.

4.4.b.2. Separation. There shall be complete separation of the wet well and dry well, including its superstructure.

4.4.b.3. Pump Removal. There shall be provisions to facilitate removing pumps and motors.

4.4.b.4. Access. Dry wells of pumping stations and wet wells containing either bar screens or mechanical equipment requiring inspection or maintenance shall have suitable and safe means of access.

4.4.b.5. Size. The effective capacity of the wet well shall provide a detention time not exceeding thirty (30) minutes for the design average flow.

4.4.b.6. Floor Slope. The wet well floor shall have a minimum slope of one (1) to one (1) towards the hopper bottom. The horizontal area of the hopper bottom shall be no greater than necessary for proper installation and function of the inlet. Bottoms shall have a smooth finish.

4.4.b.7. Protection Against Clogging.

4.4.b.7.A. Readily accessible bar screens with clear openings not

exceeding two and one-half (2½) inches, unless using pneumatic ejectors or installing special devices to protect the pumps from clogging or damage, may precede pumps handling raw sewage;

4.4.b.7.B. Where the size of the installation warrants, this rule recommends a mechanically cleaned bar screen with a grinder or comminution device;

4.4.b.7.C. There shall be convenient facilities for handling screenings where screens are located; and

4.4.b.7.D. It is preferable to use duplicate protection units of proper capacity for the larger or deeper sections.

4.4.b.8. Pump Openings.

4.4.b.8.A. Pumps shall be capable of passing two and one-half (2½) inch solids or be of the grinder pump type when used in residential developments of five hundred (500) persons or less;

4.4.b.8.B. Pumps for all other installations shall be capable of passing three (3) inch solids or be of the grinder pump type; and

4.4.b.8.C. Pumps are to be non-clog type pumps or ejectors.

4.4.b.9. Priming. The placing of the pump shall be so that under normal operating conditions it will operate under a positive suction head, except as specified for suction lift pumps.

4.4.b.10. Electrical Equipment. Electrical systems and components such as motors, lights, cables, conduits, switch boxes, and control circuits, in enclosed or partially enclosed spaces, shall be of materials resistant to the environment when usage takes place.

4.4.b.11. Intake. Each pump shall have an individual intake. Wet well design shall be such as to avoid turbulence near the intake.

4.4.b.12. Dry Well Dewatering.

4.4.b.12.A. The dry wells shall have a separate pump in them to remove leakage or drainage with the discharge above the overflow level of the wet well;

4.4.b.12.B. A connection to pump suction may be used as an auxiliary feature;

4.4.b.12.C. Water ejectors connected to a drinking water supply

shall not be approved; and

4.4.b.12.D. All floor and walkway surfaces shall have an adequate slope to a point of drainage.

4.4.b.13. Controls.

4.4.b.13.A. Control float cables location shall not be affected by the flows entering the wet well or by the suction of pumps;

4.4.b.13.B. Float tubes in dry wells shall extend high enough to prevent overflow;

4.4.b.13.C. A means to automatically alternate the pump in use shall be in place; and

4.4.b.13.D. Pump stations with motors or controls below grade shall have a secure external disconnect switch.

4.4.b.14. Valves and Piping.

4.4.b.14.A. Pumps shall have a full closing valve on the suction piping except on submersible and vacuum primed pumps;

4.4.b.14.B. The installation of a check valve followed by a gate valve on the discharge piping is required; and

4.4.b.14.C. The location of the valves shall not be in a wet well.

4.4.b.15. Ventilation. All dry well installations shall have mechanical ventilation.

4.4.b.15.A. Wet Wells. Ventilation shall be either continuous or intermittent.

4.4.b.15.A.1. If continuous, ventilation shall provide at least twelve (12) complete air changes per hour; and

4.4.b.15.A.2. If intermittent, ventilation shall provide at least thirty (30) complete air changes per hour.

4.4.b.15.B. Dry Wells. Ventilation shall be either continuous or intermittent.

4.4.b.15.B.1. If continuous, ventilation shall provide at least six (6) complete air changes per hour; and

4.4.b.15.B.2. If intermittent, ventilation shall provide at least thirty (30) complete air changes per hour.

4.4.b.16. Flow Measurement. There shall be the capability for placing suitable devices for measuring sewage flow at all pumping stations, and the devices shall be placed at critically located pumping stations.

4.4.b.17. Water Supply. There shall be no physical connection between any potable water supply and a sewage pumping station.

4.4.b.18. Alarm Systems. All pump station installations shall equip a high water alarm light at the lift station.

4.4.b.19. Reliability. At the determination of the Commissioner, emergency power may be a requirement under specific circumstances, such as above water intakes, recreational waters, or other situations.

4.4.b.20. Portable Equipment. In some instances portable equipment may furnish service to more than one (1) pumping station. However, when using this equipment it shall have the capability to operate between the wet well and the discharge side of the station. The station shall equip permanent fixtures that will facilitate rapid and easy connection of lines.

4.4.b.21. Emergency Power Generation. All emergency power generation equipment, if required, shall include instructions indicating the essential need of routinely and regularly starting and running the units at full load.

4.4.c. Suction Lift Pumps.

4.4.c.1. Suction lift pumps shall be of the self-priming or vacuum priming type.

4.4.c.1.A. Self-priming Pumps. Self-priming pumps shall be capable of rapid priming and repriming at the "lead pump on" elevation. Accomplishing the self-priming and repriming shall be automatic under design operating conditions. Suction piping shall not exceed the size of the pump suction and shall not exceed twenty-five (25) feet in total length. Priming lift at the "lead pump on" elevation shall include a safety factor of at least four (4) feet from the maximum allowable priming lift for the specific equipment at design operating conditions. The combined total of dynamic suction lift at the "pump off" elevation and required net positive suction head at design operating conditions shall not exceed twenty-two (22) feet.

4.4.c.1.B. Vacuum-priming Pump Stations. Vacuum-priming

pump stations shall equip dual vacuum pumps capable of automatically and completely removing air from the suction lift pump. The vacuum pumps shall have adequate protection from damage due to sewage. The combined total of dynamic suction lift at the "pump off" elevation and required net positive suction head at design operating conditions shall not exceed twenty-two (22) feet.

4.4.c.2. The net positive suction head and specific speed requirements as stated on the manufacturer's pump curve under the most severe operating conditions shall limit the capacity of a suction lift pump.

4.4.c.3. The location of the suction lift pumps shall not be within the wet well.

4.4.c.4. Access to the wet well shall not be through the dry well, and the dry well shall have a gas-tight seal when mounted directly above the wet well.

4.4.d. Submersible Pumps.

4.4.d.1. Pump Removal. Pumps shall be readily removable and replaceable without dewatering the wet well or disconnecting any piping in the wet well.

4.4.d.2. Hoist Provision. The Commissioner may require a submersible pumping facility to have a hoist for removing the pump from the wet well.

4.4.d.3. Electrical Control Location. The location of electrical controls shall be outside the wet well in a suitable housing for protection against weather and vandalism.

4.4.e. Pneumatic Ejectors.

4.4.e.1. Venting. This rule requires the venting of ejector pots to the atmosphere.

4.4.e.2. Duplicate Compressors. There shall be duplicate compressors and consideration shall be given to providing an air storage tank.

4.4.f. Force Mains.

4.4.f.1. Size. Minimum size of force mains to serve facilities having a population of five hundred (500) people or less shall be three (3) inches for solids passing pumps. Minimum size of force mains serving populations of over five hundred (500) people, shall be four (4) inches for solids passing pumps. Applicant may utilize smaller size force mains in conjunction with grinder pumps.

4.4.f.2. Air Relief Valve. Placement of air relief valves shall be at high

points in the force mains.

4.4.f.3. Termination. The force mains shall enter the receiving manhole with its center-line horizontal and with an invert elevation that will insure a smooth laminar flow transition to the gravity flow section, but in no case shall the force main enter the gravity sewer system at a point more than one (1) foot above the flow line of the receiving manhole.

4.4.f.4. Materials of Construction. The construction of force mains shall be of plastic, ductile iron or cement lined steel pipe bearing the pressure class required by the total dynamic head.

4.4.f.5. Anchoring. Anchoring of the force mains shall be sufficient within the pump station and throughout the line length. The number of bends shall be as few as possible. There shall be thrust blocks, restrained joints, or tie rods where there is a need for restraint.

4.5. Vacuum Sewage Collection Systems.

4.5.a. Main Lines.

4.5.a.1. Materials.

21. 4.5.a.1.A. PVC or ABS of schedule 40 DWV, Class 200, or SDR

4.5.a.1.B. Joints may be either solvent welded, "O"-Ring, or heat fusion joints, that have a specific design to seal against vacuum.

4.5.a.2. Piping.

4.5.a.2.A. Minimum diameter pipe size shall be three (3) inches in the collection system.

4.5.a.2.B. There shall be cleanouts at a maximum of every two hundred (200) feet on straight runs and at changes in direction.

4.5.a.2.C. Frost depth or load condition shall dictate how deep to bury the line, but except as allowed on a case-by-case basis by the Commissioner, it shall be no less than three (3) feet deep.

4.5.a.2.D. The system manufacturer shall certify all vacuum system designs.

4.5.a.2.E. The applicant shall utilize the manufacturer's

recommendation for reform pockets and lifts.

4.5.a.2.F. Total available head loss from any input point should not exceed eighteen (18) feet of water. There shall be a reserve of five (5) feet of water for valve operation.

4.5.a.2.G. Installation of the collection system shall meet the following tightness test specification, "the system shall be vacuumed to twenty-four (24) inches of mercury vacuum pressure, allowed fifteen (15) minutes to stabilize, and thereafter shall not lose more than one percent (1%) vacuum pressure per hour over a minimum of a four (4) hour period." There shall be testing prior to the installation of valves.

4.5.b. House Connections.

4.5.b.1. Pneumatic or electric controllers shall actuate valves. This rule prohibits valve systems that are electrically controlled. Minimum valve size shall be three (3) inches.

4.5.b.2. The location of the valve shall be outside the dwelling. The location of the pipe between the dwelling and valve shall be to provide ten (10) to fifteen (15) gallons storage, or the location of a thirty (30) gallon tank shall be between the dwelling and the valve. This rule requires a permanent maintenance easement for the valve and its appurtenances.

4.5.b.3. Valve boxes shall have a solid bottom, and be counter weighted to prevent flotation when located in an area subject to flooding or high ground water. The cover and valve box material shall be of adequate strength to withstand the expected maximum dynamic and static loading conditions. Venting valve boxes will reduce condensation, and shall be constructed of corrosion resistant material.

4.5.b.4. The vent system for the house shall have a diameter of three (3) inches or greater to prevent evacuation of traps during vacuum valve operation. The vent pipe shall extend above the eaves of the house. The commissioner shall consider other methods for venting on a case by case basis.

4.5.b.5. Those systems using a pneumatic controller shall have adequate protection of the sensor controllers, and any portion of the controller apparatus vented to atmosphere shall have protection from flooding, screened from insect entry, and provided with rain covers.

4.5.c. Sewage Collection Tanks.

4.5.c.1. The sewage collection tanks shall be of either coated welded steel or fiber glass and shall be vacuum tight.

4.5.c.2. Each inlet to the tank shall have its own shut-off valve.

4.5.c.3. There shall be liquid level sensors installed to operate the discharge sewage pumps, the high level alarm and to interrupt the electrical power to the vacuum pumps.

4.5.c.4. The size of the collection tank shall be to hold a maximum of ten (10) minutes design flow. The size of the collection tanks shall be at 1.5 x operating volume or a minimum of four hundred (400) gallons.

4.5.d. Vacuum Pumps.

4.5.d.1. There shall be vacuum reserve tanks installed in series between the sewage collection tank and the vacuum pumps.

4.5.d.2. This rule allows for the use of either liquid ring or sliding vane vacuum pumps as long as they are compatible with pumping moist air containing some sewer gases.

4.5.d.3. There shall be a check valve installed between the vacuum reservoir tank and the vacuum pumps.

4.5.d.4. There shall be dual vacuum pumps, each capable of handling the load, and emergency back-up power.

4.5.d.5. Venting the vacuum pump exhaust outside the building is a requirement. If there is a possibility of objectional odors due to proximity of inhabited dwellings, the evacuation line from the vacuum reserve shall have carbon absorption.

4.5.e. Sewage Pumps.

4.5.e.1. There shall be dual pumps, each capable of handling two and one-half ($2\frac{1}{2}$) times the average daily flow.

4.5.e.2. There shall be emergency back-up power to operate the entire system.

4.5.e.3. The sewage pumps shall be capable of meeting the NPSH requirements as dictated by the vacuum conditions in the sewage collection tanks.

4.5.e.4. There shall be shut-off valves so that each pump can be isolated for repairs.

4.5.e.5. The discharge piping shall incorporate a check valve/gate valve

arrangement such as utilized in a conventional pump station.

4.5.e.6. High level alarms and loss of vacuum alarms shall be capable of transmitting to three (3) or more responsible parties.

4.5.f. Design Requirements.

4.5.f.1. It is a requirement to submit hydraulic calculations for the vacuum mains and force mains with the application.

4.5.f.2. It is a requirement to submit plans and profiles of all mains. Profiles shall indicate depth to mains, and plans shall indicate all valves.

4.5.f.3. When these standards are not applicable, it is a requirement to follow the manufacturer's recommendations.

4.5.g. Maintenance and Operation.

4.5.g.1. Factory trained maintenance personnel employed by the entity shall be available twenty-four (24) hours per day.

4.5.g.2. An applicant shall keep an inventory of parts including spare valves, controllers, valve pits, and others.

4.5.g.3. This rule does not allow mixing of equipment such as different makes and models, for a specific project.

4.5.h. Miscellaneous.

4.5.h.1. Collection stations shall equip ventilators and heater dehumidifiers.

4.5.h.2. Branch lines shall have individual cut off valves to allow isolation of the line for repair. Main line sections shall have isolation valves no less than two thousand (2000) feet apart.

4.5.h.3. Consideration to lessen the size of the treatment units in new systems that utilize water saving devices such as vacuum toilets, shall be based upon review and approval by the Commissioner.

4.5.h.4. Retaining spare controllers, valves, and sensors shall be on a basis of one (1) per each fifteen (15) units installed.

4.5.h.5. House vent stacks shall be at least three (3) inches in diameter. If

necessary, there shall be an installation of a three (3) to four (4) inch stack on the gravity sewer lateral adjacent to the house wall.

4.5.i. Relation of vacuum lines to water lines shall be as for gravity lines. See Paragraph 4.2.s.4. of this rule.

4.6. Pressure Sewage Collection System.

4.6.a. General.

4.6.a.1. Simplex units shall serve no more than three (3) residences. Duplex units shall serve no more than ten (10) residences. Other multiple source applications requires approval by the Commissioner. This rule requires spare pumps.

4.6.a.2. Types of Pressure Systems.

4.6.a.2.A. Grinder Pump Pressure System.

4.6.a.2.B. Septic Tank Effluent Pumping Pressure System.

4.6.a.3. Types of Pumps.

4.6.a.3.A. Submersible, Centrifugal Grinder Pumps. Pumps shall be readily removable and replaceable without dewatering the wet well.

4.6.a.3.B. Semi-Positive Displacement Grinder Pumps. Pumps shall be readily removable and replaceable without dewatering the wet well. There shall be pressure relief valves unless the Commissioner approves an other means of pressure relief.

4.6.a.3.C. Non-Clog Submersible Centrifugal Effluent Pumps.

4.6.b. Design Requirements.

4.6.b.1. Hydraulic Calculations. Submitting calculations with the application is a requirement.

4.6.b.1.A. The determination of peak flows shall be from the manufacturers recommendations based upon the pumping equipment the system is using.

4.6.b.1.B. There shall be head losses due to valves and fittings.

4.6.b.1.C. For purposes of calculation, using a C=100 in the Hazen-Williams Formula for all pipe, except for using a C=120 for plastic pipe is a requirement.

4.6.b.1.D. Design velocity shall be in the range of two (2) to five (5) feet per second.

4.6.b.1.E. Computed design life of the pumps shall be on the basis of ten (10) years.

4.6.b.2. Plans. Submitting plans and profiles of all pressure mains is a requirement. Profiles shall indicate depth of pressure mains. The plans shall indicate all valves.

4.6.b.3. Design. The design shall be in accordance with the standards herewith stated, except when not covered by this standard, then following the manufacturer's recommendations is a requirement.

4.6.c. Pressure Mains.

4.6.c.1. Type. Minimum Pressure Rating - PVC SDR 21, Schedule 40, or PVC SDR 26 may be used.

4.6.c.2. Size. The minimum size service line from the grinder pump to the collection main shall be one and one-fourth (1¼) inches.

4.6.c.3. Valves and Cleanouts.

4.6.c.3.A. Valving mains shall occur at junctions in order that segments of the system may be taken out of service for maintenance.

4.6.c.3.B. Cleanouts shall be at junctions so that lines may be cleaned.

4.6.c.3.C. The placement of cleanouts with valves shall be at every four hundred (400) to six hundred (600) feet on straight runs.

4.6.c.3.D. The location of cleanouts and valves shall be at changes in direction of the lines.

4.6.c.3.E. There shall be air release valves at high points in the line.

4.6.c.3.F. There shall be ball or gate valves with cleanouts at the ends of lines.

4.6.c.3.G. There shall be a method of providing continuity of service for main collector lines.

4.6.c.4. Thrust Blocks. There shall be concrete thrust blocks at changes in direction and at "T" junctions.

4.6.c.5. Flushing. This rule requires using one of the following methods:

4.6.c.5.A. Flush tanks of one-thousand (1,000) gallons capacity with pumps at the ends of lines.

4.6.c.5.B. Water hydrants with backflow preventers at the end of lines. The backflow preventer shall be of the reduced pressure type and shall be non-removable.

4.6.c.5.C. Water tank truck with pumps.

4.6.c.6. Relation to water lines shall be as for gravity lines. See Paragraph 4.2.s.4. of this rule.

4.6.d. Grinder Pump Pressure System.

4.6.d.1. Location.

4.6.d.1.A. The location of the pump station shall be outside the residence or commercial building.

4.6.d.1.B. The location of the control box for a single residence unit shall be on the outside of the building, preferably with the pump station.

4.6.d.1.C. For duplex grinder pump stations, the location of the control box shall be with the pump station.

4.6.d.2. Electrical.

4.6.d.2.A. Control panels shall be of the NEMA type 3 or 4 enclosure.

4.6.d.2.B. The pump and float electrical controls shall have provisions for disconnection without entering the main control box.

4.6.d.3. Alarms.

4.6.d.3.A. When using a single unit grinder pump station, there shall be a high water alarm light outside the residence.

4.6.d.3.B. When using a dual grinder pump station, there shall be an alarm light at the control box by the pump station.

4.6.d.4. Emergency Holding.

4.6.d.4.A. An existing septic tank may act an emergency holding tank.

4.6.d.4.B. In areas of frequent power outages of a duration of more than four (4) hours each, the installation of emergency holding tanks of two hundred (200) gallons capacity is a requirement.

4.6.d.5. Sequence of Connections. The sequence of valves, pump, and other appurtenances from the residence to the collection force main shall be as follows: four (4) inch sewer line, gate valve, pump, check valve, gate valve, and connection line with forty-five (45) degree bend in the direction of flow.

4.6.d.6. Check and Gate Valves.

4.6.d.6.A. Check or gate valves shall be either plastic or bronze.

4.6.d.6.B. Check valves may be either swing check or ball type. If using swing type check valves, construction of a one (1) to two (2) foot horizontal run of straight pipe on the downstream side of the check valve is a requirement.

4.6.d.7. Level Controls. Level controls in the pump station shall be either mercury magnetic switches, mercury switches, or pressure switches.

4.6.e. Septic Tank Effluent Pressure Systems.

4.6.e.1. Location. Same as Grinder Pump Pressure Systems. See Paragraph 4.4.d.1. of this rule.

4.6.e.2. Controls.

4.6.e.2.A. Control panels shall be NEMA type 3 or 4 enclosure.

4.6.e.2.B. The pump and float controls shall have provision for disconnection without entering the main control box.

4.6.e.3. Alarms. Same as Grinder Pump Pressure Systems. See Paragraph 4.6.d.3. of this rule.

4.6.e.4. Sequence of Connections. The sequence of valves, pump, and other appurtenances from the residence to the collection force main shall be as follows: four (4) inch sewer line, septic tank, pumping chamber with pump, check valve, gate valve and connection to main collection line with forty-five (45) degree bend in direction of flow.

4.6.e.5. Check and Gate Valves. Same as Paragraph 4.6.d.6. of this rule.

4.6.e.6. Level Controls. Same as Paragraph 4.6.d.7. of this rule.

4.6.e.7. There shall be provisions for the treatment of septage at the plant. There shall be a provision for a septic tank pumping vehicle.

4.6.f. Maintenance and Operation.

4.6.f.1. In the interest of obtaining proper maintenance and operation on a pressure sewer system, the applicant shall be either:

4.6.f.1.A. Under the jurisdiction of a public entity;

4.6.f.1.B. Under the jurisdiction of a private company regulated by the public service commission; or

4.6.f.1.C. Under the jurisdiction of a property owners association.

4.6.f.2. Maintenance personnel employed by an entity operating a pressure system shall attend a factory training course on maintenance and operation of the proposed units.

4.6.f.3. For maintenance needs, this rule recommends a truck provided with a hoist.

4.6.f.4. This rule requires permanent maintenance easements if the location of the pumping equipment and other appurtenances is on private property.

4.6.f.5. An applicant shall keep spare parts, such as air relief valves, gate valves, and relay switches in inventory.

4.6.f.6. This rule does not allow mixing equipment (makes, models) for a specific project.

4.6.f.7. An applicant shall provide spare pumps in the initial design according to Table 64-47-D. at the end of this rule.

§64-47-5. Sewage Treatment Works.

5.1. General.

5.1.a. The design of sewage treatment plants shall be to provide for an estimated population twenty (20) years from the date of this rule. The design of all treatment plants shall

be so that their capacity can readily be increased except when circumstances preclude the probability of expansion.

5.1.b. Plant Location. A sewage treatment plant site shall be as far as practical from any present area being built-up or any area that will probably be built up within a reasonable future period. There shall be a buffer zone as indicated in Table 64-47-E. at the end of this rule, from any surrounding occupied structure to any new plant site. These buffer zone requirements do not apply to existing treatment works that are being upgraded or expanded. The direction of prevailing winds shall be considered when selecting the plant site. The location of the plants operational units shall be at an elevation that is not subject to the one hundred (100) year flood or shall otherwise be adequately protected against one hundred (100) year flood damage. The plant shall remain fully operational during a twenty-five (25) year flood. The plant shall be readily accessible in all seasons. The site shall be of sufficient size to accommodate expansion or addition of facilities to increase the degree of treatment.

5.1.b.1. The Commissioner may wave buffer zone requirements shown in Table 64-47-E. upon receipt of a written request by the applicant and a detailed review by the Commissioner to determine any public health impact. Health, safety and nuisance considerations shall be the basis of establishing a buffer zone.

5.1.b.2. The distances set forth in Table 64-47-E. are distances to sewage treatment units such as aeration basins, clarifiers, sludge holding tanks, chlorination basins, chlorinator rooms, blower houses and other units as stated in Table 64-47-E. Other buildings that may be part of the plant, but are only used for storage or as a laboratory and do not contain chlorine cylinders or blowers, shall not be considered a sewage treatment unit and shall not be subject to buffer zone requirements.

5.1.c. Quality of Effluent.

5.1.c.1. Surface Water Discharge. The stream standards and water quality criteria established by the water resources board and effluent limitations established by the division of water resources shall be the basis of the required degree of wastewater treatment. The Commissioner may establish more stringent requirements if the location of a public water supply intake, a recreational water use area, or an aquaculture is downstream from the discharge point.

5.1.c.2. Land Discharge. See Subsection 5.19 of this rule.

5.1.c.3. New Processes, Methods and Equipment. The policy of the Commissioner is to encourage the development of new processes, methods and equipment for sewage treatment. The Commissioner may require the following:

5.1.c.3.A. Monitoring observations, including test results and engineering evaluations, demonstrating the efficiency of these processes;

5.1.c.3.B. Detailed description of the test methods;

5.1.c.3.C. Testing, including appropriately composited samples, under various ranges of strength and flow rates, including daily variations, and waste temperatures over a sufficient length of time to demonstrate performance under climatic and other conditions that the system may encounter in the area of the proposed installations;

5.1.c.3.D. Testing and evaluations made under the supervision of a competent process engineer other than those employed by the manufacturer or developer; and

5.1.c.3.E. A performance bond.

5.1.d. Design.

5.1.d.1. Industrial Wastes. When treating industrial and institutional wastes in a sewage treatment works, the character of the wastes in the design of the plant shall be considered. In these cases, the Commissioner may require treatability studies on the composite wastewater prior to the plant design.

5.1.d.2. Hydraulic Loading. The design of treatment plant units shall be based on the average rate of sewage flow per twenty-four (24) hours, except where there are notations of significant deviations from the normal daily flow pattern.

5.1.d.3. Existing Sewage Systems. When there are existing sewers, there shall be a determination as to the volume and strength of sewage flow. Obtaining these data shall be from actual flow measurements, preferably for both wet and dry weather periods. There shall be laboratory analysis made on flow proportional composite samples taken over twenty-four (24) hour periods. The design of plans and specifications for sewage works to serve existing sewage systems shall be on the basis of characteristics and strength of sewage as shown by results of composite samples examined and gaugings of the present flow plus allowance for estimated increase in population. In addition, they shall include non-excessive infiltration/inflow.

5.1.d.4. New Sewage Systems. For the construction of new sewers, design plans for sewage treatment works shall be made on the basis of seventy (70) gallons per capita per day or estimates based upon a minimum one (1) years fully documented analysis of water use records adjusted for consumption and losses.

5.1.d.5. Organic Loading. Computation of the design organic loading shall be in the same manner used in determining design flow. Generally, computation of organic loading shall be at 0.17 pounds of five (5) day BOD per person per day. For package sewage treatment plants, recirculating sand filter systems, stabilization ponds, aerated ponds and individual sewer systems, treating fifty thousand (50,000) G.P.D. or less, the organic loading design shall increase if proposing garbage grinders.

5.1.d.6. Conduits. The design of all piping and channels shall be to carry the maximum expected flows. The design of the incoming sewer shall be for free discharge. Filletting bottom corners of the channels is required. Eliminating pockets and corners where solids can accumulate is also required. There shall be suitable gates in channels to seal off unused sections that might accumulate solids. The use of shear gates or stop planks shall receive approval when using them in place of gate valves or sluice gates.

5.1.d.7. Arrangement of Units. Arrangement of component parts of the plant shall be for greatest operating convenience, flexibility, economy, and so as to facilitate installation of future units. There shall be multiple treatment units for plants greater than one hundred thousand (100,000) gallons in size. There shall be a provision for appurtenances in such a manner that it is possible to temporarily take any unit of service. The remainder of the plant shall be operational with the unit or units out of service. In the case of oxidation ditches, if multiple rotors exist, the above requirements shall be met.

5.1.e. Miscellaneous.

5.1.e.1. Provisions for Taking Units Out of Service. Diversion piping and structures shall be properly located and arranged so that it is possible to independently remove either dual or multiple units of the plant from service for inspection, maintenance and repairs.

5.1.e.2. Dewatering. There shall be means to dewater each unit. The possible need for hydrostatic pressure relief devices shall be considered.

5.1.e.3. Construction Materials. Because of the possible presence of hydrogen sulfide and other corrosive gases, greases, oils, and similar constituents frequently present in sewage, the materials selected for use in sewage treatment works shall be considered. This is particularly important in the selection of metals and paints. It is essential to avoid using dissimilar metals to minimize galvanic action. Cathodic protection is a requirement for all steel tanks.

5.1.e.4. Covering Units. The use of properly vented covers shall receive approval.

5.1.e.5. Painting. It is important to avoid the use of paints containing lead or mercury. In order to facilitate identification of piping, this rule suggests that the different lines be color-coded. The contents shall be stenciled on the piping in a contrasting color. The color scheme is only required for plants of over one hundred thousand (100,000) gallons in size. For purposes of standardization, Table 64-47-F. at the end of this rule contains the recommended color scheme.

5.1.e.6. Operating Equipment. The specifications shall include a complete outfit of tools and accessories for the plant operator's use, such as squeegees, wrenches,

valve keys, rakes, shovels, etc. A portable pump is recommended. There shall be readily accessible storage space and work bench facilities and consideration given to provision of a garage area that would also provide space for large equipment, maintenance and repair.

5.1.e.7. Grading and Landscaping. There shall be concrete, asphalt or gravel walkways for access to all units. Where possible, it is important to avoid steep slopes to prevent erosion. Surface water shall not drain into any unit. There shall be particular care taken to protect trickling filter beds, sludge beds, and intermittent sand filters from surface water. There shall be a provision for landscaping, particularly when a plant location must be near residential areas.

5.1.f. Plant Outfalls.

5.1.f.1. Outlet. The outfall sewer, where practical, shall extend to the low water level of the receiving body of water in a manner to insure satisfactory dispersion of the effluent. It shall not have its outlet submerged and there must be provisions for taking samples of the effluent discharge. This rule permits the use of headwalls where adequate dispersion is obtained without carrying the outfall into the stream.

5.1.f.2. Design and Construction. The construction of the outfall sewer shall be as to protect it against the effects of flood water, ice, or other hazards as to reasonably insure its structural stability and freedom from stoppage.

5.1.g. Essential Facilities.

5.1.g.1. Emergency Power.

5.1.g.1.A. General. All sewage treatment facilities greater than one hundred thousand (100,000) gallons in size that require electrical power, shall have an alternate source of electric power to allow continuity of operation during power failures, except as noted below. Methods of providing alternate sources include:

5.1.g.1.A.1. The connection of at least two (2) independent public utility sources, such as substations. This rule recommends a power line from each substation, and it shall be a requirement unless the reviewing agency receives verifying documentation and approves that a duplicate line is not necessary to minimize water quality violations;

5.1.g.1.A.2. Portable or in-place internal combustion engine equipment that will generate electrical or mechanical energy; and

5.1.g.1.A.3. Portable pumping equipment when only emergency pumping is required.

5.1.g.1.B. Power for Aeration. Standby generating capacity is not a requirement for aeration equipment used in the activated sludge process. When power outages of four (4) hours or more are common, auxiliary power for minimum aeration of the activated sludge is a requirement. The reviewing authority may require full power generating capacity on certain critical stream segments.

5.1.g.1.C. Power for Disinfection. There shall be continuous disinfection, when required, during all power outages.

5.1.g.2. Electrical Equipment. The location of all electrical equipment such as motors and local controls, and electrical conduits shall either be at an elevation above the one hundred (100) year flood level or be of waterproof design. There shall be adequate protection for all outdoor equipment from the weather. Motors located indoors, and near liquid handling piping and equipment, shall be of splashproof design. All electrical wires in underground conduits or in conduits that can flood shall have water resistant insulation as identified in the National Electrical Code.

5.1.g.3. Water Supply.

5.1.g.3.A. General. There shall be an adequate supply of drinking water for use in the laboratory and general cleanliness around the plant. No piping or other connections shall exist in any part of the treatment works that, under any condition, might cause the contamination of a drinking water supply. There shall be an examination of the chemical quality for suitability for the intended use in heat exchangers, chlorinators, and other units.

5.1.g.3.B. Direct Connections. The drinking water supply line to each treatment plant shall have, as a minimum, an approved reduced pressure type backflow preventer. The installation of these devices shall be in a location to prevent flooding, corrosion and allow for adequate, quick service and periodic inspections. Installation in below-grade meter type vaults is not acceptable. All water supply take-off points shall follow the devices and, there shall be no allowance for extension of this line to serve the public.

5.1.g.3.C. Indirect Connection. When using a potable water supply for any purpose in a plant, there shall be provisions for a break tank, pressure pump, and pressure tank. Water shall discharge to the break tank through an air-gap at least six (6) inches above the maximum flood line or the spill line of the tank, whichever is higher. There shall be a permanently posted sign at every hose bibb, faucet, or stop clock located on the water system beyond the break tank to indicate that the water is not safe for drinking.

5.1.g.3.D. Separate Drinking Water Supply. When it is not possible to provide drinking water from a public water supply, there shall be a separate well. Location, construction and testing of the well shall comply with requirements of the Bureau. Requirements governing the use of the supply are those contained in Subparagraphs 5.1.g.3.B. and 5.1.g.3.C. of this rule. Prior to construction, an applicant shall obtain approval of the supply

from the Commissioner.

5.1.g.3.E. Separate Non-Drinking Water Supply. When there is a provision for a separate non-drinking water supply, there shall be posting of a permanent sign indicating the water is not safe for drinking to stop cocks, hose bibbs, and other water outlets.

5.1.g.4. Sanitary Facilities. All sewage treatment plants with laboratory facilities shall have a shower, toilet, and lavatory. There shall also be a provision for locker facilities.

5.1.g.5. Sewage Flow Measurement. There shall be facilities for measuring the volume of sewage flows at all treatment works greater than one hundred thousand (100,000) gallons in size. All plants having a capacity of greater than one hundred thousand (100,000) gallons per day shall equip indicating, recording, and totalizing equipment for effluent flow measurement.

5.1.g.6. Floor Slope. There shall be adequate floor surface slope to a point of drainage.

5.1.g.7. Stairways. The installation of stairways shall be with a slope of thirty (30) to thirty-five (35) degrees from the horizontal to facilitate carrying samples, tools, and other necessities. All risers in a stairway should be of equal height. All stairways shall have handrails.

5.1.h. Safety. Following are the minimum requirements for all plants:

5.1.h.1. Enclosure of the wastewater treatment works with a minimum six (6) feet high chain link fence with a locked entrance gate designed to discourage the entrance of unauthorized persons and animals. In lieu of a chain link fence, a barbed wire fence with a locked entrance gate can enclose natural systems, such as stabilization ponds, polishing ponds and wetlands.

5.1.h.2. There shall be handrails, grating, and guardrails installed when necessary, such as open basins, screen channels, mechanical equipment and other hazardous places. For all extended aeration plants of fifty thousand (50,000) gallons per day or less grating is a requirement.

5.1.h.3. Provision of first-aid equipment.

5.1.h.4. Posting of "No Smoking" signs in hazardous locations.

5.1.h.5. Provision of protective clothing and equipment such as SCBA's, atmospheric testers and gloves.

5.1.h.6. Provision of portable blower and sufficient hose.

5.1.h.7. There shall be explosion proof electrical equipment and nonsparking tools in work areas where hazardous conditions may exist, such as digester vaults and other locations where potentially explosive atmospheres of flammable gas or vapor accumulate.

5.1.h.8. Proper grounding and insulation of all electrical wiring is a requirement. There shall be no part of the plant piping used for grounding.

5.1.h.9. There shall be a provision for portable lighting equipment.

5.1.h.10. All manhole steps shall have slip-proof rungs and the steps shall be of the railroad type that will help prevent foot slippage off the ends of the rungs.

5.1.h.11. There shall be a provision for separate storage located remotely from the plant for flammable and hazardous material.

5.1.h.12. The location of heating devices with open flames shall be in separate rooms with outside entrances and at grade or above.

5.1.h.13. Installation of particular safety precautions for gas-collection piping is a requirement.

5.1.h.14. There shall be adequate ventilation.

5.1.h.15. Chlorinator rooms and chlorine storage areas shall have heat, light, and a ventilation fan that is capable of being turned on from outside the room. The room shall be at grade or above. There shall be a provision a viewing window from the plant interior; and

5.1.h.16. The treatment works shall comply with the provisions of the Occupational Safety and Health Act (OSHA).

5.1.i. Laboratory Space. All treatment works shall have facilities, either contractual or on-site, for making the necessary analytical determinations and operating control tests. When using an on-site laboratory, isolation shall be done to render the laboratory reasonably free from the adverse effects of noise, heat, vibration, and dust. Minimum laboratory space for facilities not performing BOD and suspended solids testing on-site shall be one hundred (100) square feet floor space with thirty-five (35) square feet bench area. Facilities providing on-site BOD, suspended solids, and fecal coliform analysis shall provide a minimum of four hundred (400) square feet of floor space and one hundred fifty (150) square feet of bench space. If more than two (2) persons will be working in the laboratory at any given time, there shall be a provision of one hundred (100) square feet of additional space for each additional

person. Advanced wastewater treatment plants shall provide a minimum of one hundred (100) additional square feet of floor space with proportionate increase in bench space. Lists of laboratory equipment shall be compiled from USEPA approved latest edition of Standard Methods for the Examination of Water & Wastewater, by APHA - AWWA - WPCF.

5.1.j. Laboratory Equipment. All treatment works shall have laboratory equipment determined by the commissioner based upon type and complexity of the treatment process. However, all extended aeration treatment plants of one hundred thousand (100,000) gallons per day or less shall have the following:

5.1.j.1. A test kit for pH and for chlorine residual. This test kit shall be of the comparator type as manufactured by Hach, Taylor, Hellige or Wyandotte;

5.1.j.2. Two (2) one-liter graduated beakers;

5.1.j.3. A secchi disk; and

5.1.j.4. A squeegee with proper length of handle, five (5) quart bucket and rubber gloves.

5.2. Screening Devices and Comminutors.

5.2.a. Bar Racks and Screens.

5.2.a.1. Either coarse bar racks or bar screens shall provide protection for pumps and other equipment. Coarse bar racks shall provide protection for comminutors.

5.2.a.2. Location.

5.2.a.2.A. Indoors. Screening devices, installed in a building where there is other equipment or offices located, should be accessible only through a separate outside entrance.

5.2.a.2.B. Outdoors. Screening devices installed outside shall have protection from freezing.

5.2.a.2.C. Access. Screening areas shall have stairway access, lighting and ventilation, and a convenient means for removing the screenings.

5.2.a.3. Design and Installation.

5.2.a.3.A. Bar Spacing. Clear openings between bars shall be no less than one (1) inch for manually cleaned screens. Clear openings for mechanically cleaned screens may be as small as one-half ($\frac{1}{2}$) inch. Maximum clear openings shall be one and three-

fourths (1 3/4) inches.

5.2.a.3.B. Slope. The placement of manually cleaned screens, except those for emergency use, shall be on a slope of thirty (30) to forty-five (45) degrees from the horizontal.

5.2.a.3.C. Velocities. At normal operating flow conditions, approach velocities shall be no less than 1.25 feet per second, to prevent settling; and no greater than 3.0 feet per second through the bar screen to prevent forcing material through the openings.

5.2.a.3.D. Channels. For plants of greater than one hundred thousand (100,000) gallons per day, there shall be a provision for dual channels and equipped with the necessary gates to isolate flow from any screening unit. There shall also be provisions to facilitate dewatering each unit. The shape of the channel preceding and following the screen shall be to eliminate stranding and settling of solids. Channels shall be three (3) to six (6) inches below the invert of the incoming sewer.

5.2.a.3.E. Mechanical Devices. A positive means of locking out each mechanical device shall be a provision.

5.2.a.4. Control Systems.

5.2.a.4.A. Timing Devices. All mechanical units without timing devices shall run continuously. All mechanical units operated by timing devices shall have auxiliary control that will set the cleaning mechanism in operation at predetermined high water elevations.

5.2.a.4.B. Electrical Fixtures and Controls. Electrical fixtures and controls in screening areas where explosive gases may accumulate shall meet the requirements of the National Electrical Code for Class 1, Group D, Division 1 locations.

5.2.a.4.C. Manual Override. A manual override shall supplement automatic controls.

5.2.a.5. Auxiliary Screens. When using mechanically operated screening or comminuting devices, there shall be a provision for auxiliary manually cleaned screens. Design shall include provisions for automatic diversion of the entire sewage flow through the auxiliary screens should the regular units fail.

5.2.a.6. Fine Screens. The use of fine screens in lieu of sedimentation is not permitted. In special cases, if demonstrated that the features peculiar to fine screens may be advantageous, the Bureau may approve the proposed installation on a case-by-case basis.

5.2.a.7. Disposal of Screenings. There shall be facilities for removal,

handling, storage, and disposal of screenings in a sanitary manner. Manually cleaned screening facilities shall include an accessible platform from which the operator may rake screenings easily and safely. There shall be a provision for suitable drainage facilities for both the platform and storage areas. This rule prohibits grinding of screenings and return to the sewage flow. This rule prohibits open area disposal. The commissioner shall approve the manner in which applicant buries screens or if permitted, applicant may place them in a landfill.

5.2.b. Comminutors.

5.2.b.1. Location. The location may be a requirement at sewage treatment plants forty thousand (40,000) gallons or greater in size. The location of comminutors shall be downstream of any grit removal equipment.

5.2.b.2. Size. The design of comminutors shall be to handle peak flow.

5.2.b.3. Installation. There shall be a bar screen bypass channel. The use of the bypass channel should be automatic at depths of flow exceeding the design capacity of the comminutor.

5.2.b.4. Servicing. There shall be a provision to facilitate servicing units in place and removing units from their location for servicing.

5.2.b.5. Macerators and Grinder Pumps. In lieu of comminutors, applicant may use macerators and grinder pumps or similar devices upon approval by the Commissioner.

5.3. Grit Removal.

5.3.a. General. There shall be grit removal facilities for all sewage treatment plants serving combined sewer systems. There shall be provision made for future installation of grit removal facilities for all plants of greater than one hundred thousand (100,000) gallons in size serving new sanitary sewer systems. Grit removal facilities may be a requirement for new plants serving existing sewer systems. All sewage treatment plants having anaerobic digesters require grit removal.

5.3.b. Location. The location of grit removal facilities, except in unusual circumstances shall be ahead of pumps and comminuting devices, and coarse bar racks should be placed ahead of mechanically cleaned grit removal facilities.

5.3.c. Type and Number of Units. Grit removal facilities for plants treating wastes from combined sewers shall have at least two (2) manually cleaned units or one (1) mechanically cleaned unit and one (1) manually cleaned unit. Facilities other than channel-types are desirable for plants one hundred thousand (100,000) gallons or greater in size, if provided with flexible controls for agitation or air supply devices and with grit removal

equipment.

5.3.d. Velocity-Controlled Grit Removal.

5.3.d.1. Inlet. Inlet turbulence shall be minimal.

5.3.d.2. Velocity and Detention. Design of channel-type chambers shall be to provide a velocity of one (1) foot per second. The detention time shall be based on the size of particles (0.21 mm) to be removed. The design should take into consideration undesirable turbulence and velocities at inlets and outlets.

5.3.d.3. Grit Washing. The method of final grit disposal should determine the need for grit washing.

5.3.d.4. Drains. There shall be a provision for dewatering each unit.

5.3.d.5. Water. For clean up purposes, there shall be an adequate supply of water under pressure.

5.3.d.6. Grit Removal. Grit removal facilities located in deep pits shall have mechanical equipment for pumping or hoisting grit to ground level. The pits shall have a stairway, elevator or manlift, ventilation, and lighting, and have a means of drainage.

5.3.e. Aerated Grit Removal.

5.3.e.1. Air Diffusers. The location of air diffusers shall be on one (1) side of the tank, two (2) to three (3) feet above the tank bottom.

5.3.e.2. Air Supply Rate. There shall be a detention time of three (3) minutes.

5.3.e.3. Inlet and Outlet. Design of the aerated grit chamber shall be such as to prevent short circuiting at the inlet and outlet. The inlet to the chamber shall introduce the wastewater directly into the circulation pattern caused by the air diffusion. The outlet shall be at a right angle to the inlet and a baffle installed near the outlet.

5.3.e.4. Grit Removal. The aerated grit chambers shall have mechanical grit removal equipment.

5.3.f. Grit Handling. Grit handling areas should have impervious surfaces with drains. If transporting grit, the design of the conveying equipment should be to avoid loss of material and to provide protection from freezing.

5.3.g. Grit Disposal. The Commissioner shall approve in advance the manner in

which an applicant buries grit or if permitted, applicant may place it in a landfill.

5.4. Pre-aeration .

5.4.a. General. Pre-aeration of sewage to reduce septicity may be a requirement in special cases.

5.5. Flow Equalization.

5.5.a. General. There shall be flow equalization when there are expectations of large daily variations in organic or hydraulic loadings.

5.5.b. Location. The location of equalization basins shall be downstream of pretreatment facilities such as bar screens, comminutors, and grit chambers.

5.5.c. Type. There may be a provision for flow equalization by using separate basins or on-line treatment units, such as aeration tanks. The design of equalization basins may be as either in-line or side-line units.

5.5.d. Design.

5.5.d.1. Mixing. Mixing requirements for normal raw domestic wastewaters shall range from 0.02 to 0.04 hp/1000 gallons of maximum storage volume.

5.5.d.2. Aeration. Maintaining a minimum of 1.0 mg/l of dissolved oxygen in the mixing basin at all times is required. Air supply rates shall be a minimum of 1.25 cfm/1000 gallons of storage capacity.

5.5.d.3. Storage. There shall be sufficient storage to allow the sections of the plant that follow the storage to operate at or at less than their rated design capacity.

5.5.d.4. Detention/Equalization. Basins designed for a combination of storage of wet weather flows and equalization shall have compartments to allow utilization of a portion of the basins for dry weather flow equalization.

5.5.d.5. Flow Discharge Control. There shall be multiple pumping units capable of delivering the desired flow rate from the equalization basin with the largest pumping unit out of service. All pumps, ejectors and air lifts shall be easily removable.

5.5.d.6. Aeration Support. When pumps have floating surface aerators, there shall be provisions to protect the units when dewatering the tank.

5.5.d.7. Basin Cleaning. There shall be facilities to flush solids and grease accumulations from the basin walls.

5.5.d.8. Scum Control. For plants greater than one hundred thousand (100,000) gallons in size there shall be a provision for a high-water-level takeoff for withdrawing floating material where using subsurface diffusers.

5.5.d.9. Controls. Controls shall be a provision for plants greater than one hundred thousand (100,000) gallons per day. Inlets and outlets for all basin compartments shall suitably equip accessible external valves, stop plates, weirs, or other devices to permit flow control, level control, and the removal of an individual unit from service. Also, there shall be a provision for facilities to measure and indicate liquid levels and flow rates.

5.6. Settling.

5.6.a. Inlets. The design of inlets should be to dissipate the inlet velocity, to distribute the flow equally, and to prevent short-circuiting. The design of channels should be to maintain a velocity of at least one (1) foot per second at one-half design flow. There shall be provisions for eliminating corner pockets and dead ends and use corner fillets or channeling where necessary. There shall be provisions for elimination or removal of floating materials in inlet structures having submerged ports.

5.6.b. Dimensions. The minimum length of flow from inlet to outlet shall be ten (10) feet unless special provisions are made to prevent short-circuiting. The liquid depth of mechanically cleaned settling tanks shall be as shallow as practicable, but not less than seven (7) feet. Sidewater depth for final clarifiers for activated sludge shall not be less than twelve (12) feet for plants greater than one hundred thousand (100,000) gallons in size.

5.6.c. Scum Removal. There shall be effective scum collection and removal facilities, including baffling, ahead of the outlet weirs on all settling tanks. There may be provisions for discharge of scum with the sludge; other provisions may be necessary to dispose of floating materials that may adversely affect sludge handling and disposal.

5.6.d. Weirs. Overflow weirs shall be adjustable. Weir loadings shall not exceed ten thousand (10,000) gallons per day per linear foot for plants designed for average flows of 1.0 mgd or less. Weir loadings for plants designed for flows in excess of 1.0 mgd shall receive special consideration, but these loadings should not exceed fifteen thousand (15,000) gallons per day per linear foot. If pumping is a requirement, pump capacity shall relate to tank design to avoid excessive weir loading.

5.6.e. Submerged Surfaces. The tops of beams and similar construction features submerged shall have a minimum slope of 1.4 vertical to 1 horizontal. The underside of these features shall have a slope of one (1) to one (1) to prevent the accumulation of scum or solids.

5.6.f. Multiple Units. Multiple units capable of independent operation shall exist at all plants having a capacity greater than one hundred thousand (100,000) gallons per day.

5.6.g. Protective and Servicing Facilities. In plants greater than one hundred thousand (100,000) gallons in size all settling tanks shall have a provision for easy access for maintenance, and protection of operators. These features include stairways, walkways, handrails, etc. If side walls extend some distance above the liquid level to provide flood protection for other purposes, there shall be convenient walkways to facilitate housekeeping and maintenance of weirs.

5.6.h. Surface Settling Rates.

5.6.h.1. Primary Settling Tanks. Surface settling rates for primary tanks shall not exceed one thousand (1000) gallons per day per square foot at design flow or one thousand five hundred (1500) gallons per day per square foot for peak hourly flows, whichever is larger, for plants having a design flow of 1.0 mgd or less. The Commissioner may permit higher surface settling rates for larger plants.

5.6.h.2. Intermediate Settling Tanks. Surface settling rates for intermediate settling tanks, when using following fixed film reactors, shall not exceed one thousand five hundred (1,500) gallons per day per square foot based on their design flow.

5.6.h.3. Final Settling Tanks. Surface settling rates for final settling tanks, based on maximum flow rates, shall be as follows:

5.6.h.3.A. Fixed Film Biological Reactors. Surface settling rates for settling tanks following trickling filters or rotating biological contactors shall not exceed one thousand two hundred (1200) gallons per day per square foot based on peak hourly flow.

5.6.h.3.B. Activated Sludge. The hydraulic design of intermediate and final settling tanks following the activated sludge process shall be based upon the anticipated peak hourly rate for the area downstream of the inlet baffle. The hydraulic loadings shall not exceed: one thousand two hundred (1200) gallons per day per square foot for conventional, step aeration, contact stabilization and the carbonaceous stage of separate-stage nitrification; one thousand (1000) gallons per day per square foot for extended aeration; and eight hundred (800) gallons per day per square foot for the separate nitrification stage. The solids loading, that includes the return activated sludge (RAS) concentration volume, for all activated sludge processes shall not exceed fifty (50) pounds of solids per day per square foot at the peak rate. Package plants equal to or smaller than five thousand (5000) gallons per day shall have a minimum of eight (8) hours detention time in the clarifier and plants between five thousand (5000) and forty thousand (40,000) gallons per day shall have a minimum six (6) hours detention time in the clarifier, excluding the bottom two thirds (2/3) of the hopper.

5.6.i. Freeboard. The walls of settling tanks shall extend at least six (6) inches above the surrounding ground surface and shall provide not less than twelve (12) inches freeboard. Additional freeboard or the use of wind screens is recommended where larger settling tanks are subject to high velocity wind currents that would cause tank surface waves and inhibit

effective scum removal.

5.6.j. Scum Removal. Effective scum collection and removal facilities, including baffling, shall exist for all settling tanks. The design shall recognize unusual characteristics of scum that may adversely affect pumping, piping, sludge handling and disposal. There may be provisions for the discharge of scum with the sludge; however, other special provisions for disposal may be necessary.

5.6.k. Sludge Removal. There shall be provisions to permit continuous sludge removal from settling tanks. Final clarifiers in activated sludge plants greater than 0.25 mgd shall have positive scraping devices except for in-basin clarifiers. Each sludge withdrawal line shall be at least four (4) inches in diameter, if pumped, and, if gravity flow, at least six (6) inches in diameter and individually valved. This does not apply to air lift methods of sludge removal rate. Head available for withdrawal of sludge shall be at least thirty (30) inches. There shall be adequate provisions for rodding or backflushing individual pipe runs. Piping shall also exist to return waste sludge to primary clarifiers.

5.6.l. Sludge Hopper. The minimum slope of the side walls shall be 1.7 vertical to 1 horizontal. Hopper wall surfaces shall be smooth with rounded corners to aid in sludge removal. Hopper bottoms shall have a maximum dimension of two (2) feet.

5.7. Activated Sludge.

5.7.a. General. The use of activated sludge process, and its various modifications, shall be permitted where sewage is amenable to biological treatment.

5.7.b. Settling Tanks. The following requirement is in addition to those set forth in Subsection 5.6 of this rule:

5.7.b.1. Bypass. When using a primary settling tank, there also shall be a provision for discharging raw sewage directly to the aeration tanks to facilitate plant start-up and operation during the initial stages of the plant design life.

5.7.c. Aeration.

5.7.c.1. Aeration Tanks.

5.7.c.1.A. General. There shall be multiple tanks capable of independent operation for all plants rated at greater than one hundred thousand (100,000) gallons per day. The size of the aeration tank for any particular adaptation of the process shall be based on such factors as the size of the plant, degree of treatment desired, sludge age, mixed liquor suspended solids (MLSS) concentration, BOD loading and food to microorganism ratio (F/M). There shall be calculations submitted to justify the basis of the aeration tank capacity and process efficiency. When not submitting process design calculations, it is a requirement to use the

aeration tank capacities and permissible loadings for the several adaptations of the processes shown in Table 64-47-G., found at the end of this rule. These values apply to plants receiving peak to average daily load ratios ranging from about 2:1 to 4:1. Thus, the Commissioner may consider the utilization of flow equalization facilities to reduce the daily peak organic load as justification to approve organic loading rates that exceed those specified in Table 64-47-G.

5.7.c.1.B. Arrangement of Aeration Tanks. The dimensions of each independent mixed liquor aeration tank shall be such as to maintain effective mixing and utilization of air. Liquid depths shall not be less than ten (10) feet for plants greater than one hundred thousand (100,000) gallons per day. For very small tanks or tanks with special configuration, the shape of the tank and the installation of aeration equipment should provide for elimination of short-circuiting through the tank. Table 64-47-G. at the end of this rule contains Permissible Aeration Tank Capacities and Loadings.

5.7.c.2. Inlets and Outlets. Inlets and outlets for each aeration tank unit shall suitably equip valves, gates, stop plates, weirs or other devices to permit control of the flow and to maintain reasonably constant liquid level. The hydraulic properties of the system shall permit any single aeration tank unit out of service to carry the maximum instantaneous hydraulic load.

5.7.c.3. Conduits. Design of channels and pipes carrying liquids with solids in suspension shall be to maintain self-cleaning velocities or shall agitate to keep the solids in suspension at all rates of flow within the design limits.

5.7.c.4. Measuring Devices. For plants designed for greater than one hundred thousand (100,000) gallons per day, there shall be devices installed for indicating flow rates of influent sewage, return sludge and air to each aeration tank. For plants designed for greater than one million (1,000,000) gallons per day, there shall be devices installed for totalizing, indicating and recording influent sewage and returned sludge to each aeration tank. Where the design provides for mixing all returned sludge with the raw sewage, or primary effluent, at one (1) location, then measuring the mixed liquor flow rate to each aeration unit is a requirement.

5.7.c.5. Freeboard and Foam Control.

5.7.c.5.A. Aeration tanks shall have a freeboard of at least eighteen (18) inches.

5.7.c.5.b. Aeration tanks shall have foam control devices on all plants greater than ten thousand (10,000) gallons in size. Suitable spray systems or other appropriate means is acceptable. The spray lines shall have provisions for draining to prevent damage by freezing.

5.7.d. Aeration Equipment.

5.7.d.1. General. Design of aeration equipment shall be to supply sufficient oxygen to maintain a minimum dissolved oxygen concentration of 2 mg/l throughout the mixed liquor at all times. Aeration equipment shall be capable of transferring 1.1 lbs. of oxygen per pound of peak BOD applied to the aeration tank with the exception of the extended aeration process for which the value shall be 1.8. There shall be calculations submitted to justify the oxygen requirements and the aeration equipment capacity for plants greater than one hundred thousand (100,000) gallons in size.

5.7.d.2. Nitrification. In the case of nitrification, the oxygen requirement for oxidizing ammonia shall be added to the above requirement for carbonaceous BOD removal. Taking the nitrogen oxygen demand (NOD) as 4.6 times the daily peak TKN content of the influent is a requirement. In addition, there shall be consideration given to the oxygen demands due to recycle flows, heat treatment supernatant, vacuum filtrate, elutriates, and others due to high concentrations of BOD and TKN associated with the flows.

5.7.d.3. Controls. There shall be variable air controls to aeration basins. There may be time clocks, variable speed devices or variable depth weirs for the blowers or aerators used. All extended aeration plants shall have a twenty-four (24) hour time clock graduated in fifteen (15) minute intervals.

5.7.d.4. Diffused Air Systems.

5.7.d.4.A. The design of aeration equipment shall be to provide oxygen requirements as set forth in Table 64-47-H. at the end of this rule.

5.7.d.4.B. The requirements above shall include air volume standards for channels, pumps or other air-use demands.

5.7.d.4.C. The specified capacity of blowers or air compressors, particularly centrifugal blowers, shall take into account that the air intake temperature may reach forty degrees Celsius (40° C) or one hundred four degrees Fahrenheit (104° F) or higher and the pressure will be less than atmospheric.

5.7.d.4.D. The blowers shall exist in multiple units, for plants of a capacity greater than twenty thousand (20,000) gallons per day in size, so arranged and in such capacities as to meet the maximum air demand with the single largest unit out of service. The design shall also provide for varying the volume of air delivered in proportion to the load demand of the plant.

5.7.d.4.E. The spacing of diffusers shall be in accordance with the oxygenation requirements through the length of the channel or tank and designed to facilitate adjustments of their spacing without major revision to air header piping. The arrangement of diffusers shall also permit their removal for inspection, maintenance and replacement without dewatering the tank and without shutting off the air supply to other diffusers in the tank.

5.7.d.4.F. Individual assembly units of diffusers shall equip control valves, preferably with indicator markings for throttling or for complete shut-off. Diffusers in any single assembly shall have substantially uniform pressure loss.

5.7.d.4.G. There shall be air filters to prevent clogging of the diffuser system used and to protect the blowers.

5.7.d.5. Mechanical Aeration System.

5.7.d.5.A. The design of the mechanism and drive unit shall be for the expected conditions in the aeration tank in terms of the power performance. Certified testing shall verify mechanical aerator performance.

5.7.d.5.B. A mechanical aeration system shall also accomplish the following:

5.7.d.5.B.1. Maintain all biological solids in suspension.

5.7.d.5.B.2. Meet maximum oxygen demand and maintain process performance with the largest unit out of service. When system capacity is greater than twenty thousand (20,000) gallons per day and when proposing single unit installations, there shall be a provision for a spare aeration mechanism; and

5.7.d.5.B.3. Provide for varying the amount of oxygen transferred in proportion to the load demand on the plant.

5.7.e. Return Sludge Equipment.

5.7.e.1. Return Sludge Rate. The rate of sludge return shall vary by means of variable speed motors, drivers, air lifts or timers to pump sludge. The rate of sludge return expressed as a percentage of the average design flow of sewage shall generally be variable between the limits shown in Table 64-47-I at the end of this rule.

5.7.e.2. Return Sludge Pumps. If using motor driven return sludge pumps, the largest pump out of service shall obtain the maximum return sludge capacity. Pump suction shall equip a positive head. Pumps shall have at least three (3) inch suction and discharge openings. If using air lifts for returning sludge from each settling tank hopper, a standby unit is not a requirement provided the design of the air lifts facilitate rapid and easy cleaning and removal and applicant is providing other standby measures. Air lifts shall be at least two and one-half (2 ½) inches in diameter.

5.7.e.3. Return Sludge Piping. Discharge piping shall be at least three (3) inches in diameter and the design shall be to maintain a velocity of not less than two (2) feet per second when return sludge facilities are operating at normal return sludge rates.

5.7.e.4. Waste Sludge Facilities. Waste sludge control facilities shall have a maximum capacity of not less than twenty-five per cent (25%) of the average rate of sewage flow and function satisfactorily at rates of 0.5 percent of average sewage flow or a minimum of ten (10) gallons per minute, whichever is larger, for plants greater than one hundred thousand (100,000) gallons per day in size. Aerated sludge holding tanks shall exist for all extended aeration plants up to one hundred thousand (100,000) gallons per day in size. The design of sludge holding tanks shall be with a minimum capacity of ten percent (10%) of the average daily design flow.

5.8. Trickling Filters.

5.8.a. Design. The design of filters shall be so as to provide the reduction in carbonaceous and nitrogenous oxygen demand required, and to properly condition the sewage for subsequent treatment processes. The hydraulic loading on standard rate trickling filters shall be between two million (2,000,000) and four million (4,000,000) gallons per acre per day with an organic loading equal to or less than four hundred (400) pounds of BOD₅ per acre foot per day.

5.8.b. Dosing Equipment.

5.8.b.1. Distribution. The sewage distribution may be over the filter by rotary distributors or other suitable devices that permit reasonably uniform distribution to the surface area. At design average flow, the deviation from a calculated uniformly distributed volume per square foot of the filter surface shall not exceed plus or minus ten percent (10%) at any point.

5.8.b.2. Dosing. Sewage application to the filters may be by siphons, pumps, or by gravity discharge preceding treatment units when suitable flow characteristics have been developed. Application of sewage shall be practically continuous. A piping system that permits recirculation shall be considered.

5.8.b.3. Hydraulics. There shall be careful calculation of all hydraulic factors involving proper distribution of sewage on the filters. For reaction type distributors, a minimum head of twenty-five (25) inches between low water level in siphon chamber and center of arms is a requirement. There shall be surge relief to prevent damage to distributor seals, where pumping sewage directly to the distributors.

5.8.b.4. Clearance. There shall be a minimum clearance of six (6) inches between media and distributor arms. This rule requires greater clearance where icing occurs.

5.8.c. Media.

5.8.c.1. Quality. The media may be crushed rock, slag, or plastic, or specially manufactured material. The media shall be durable, resistant to spalling or flaking and relatively insoluble in sewage. The top eighteen (18) inches shall have a loss by the 20-cycle,

sodium sulfate soundness test of not more than ten percent (10%), as prescribed by ASCE Manual of Engineering Practice No. 13, "Filtering Materials for Sewage Treatment Plants." The balance to pass a 10-cycle test using the same criteria. Slag media shall be free from iron. Manufactured media shall be structurally stable and chemically and biologically inert.

5.8.c.2. Rock or slag filter media shall have a minimum depth of five (5) feet above the underdrains. Manufactured filter media shall have a minimum depth of ten (10) feet to provide adequate contact time with the wastewater. Rock or slag filter media depths shall not exceed ten (10) feet and manufactured filter media depths shall not exceed thirty (30) feet.

5.8.c.3. Size and Grading.

5.8.c.3.A. Rock, slag and similar media shall not contain more than five percent (5%) by weight of pieces whose longest dimension is three (3) times the least dimension. They shall be free from thin elongated flat pieces, dust, clay, sand or fine material and shall conform to the size and grading when mechanically graded over vibrating screens with square openings according to Table 64-47-J at the end of this rule.

5.8.c.3.B. Hand Picked Field Stone. The maximum dimensions of stone shall be five (5) inches; and minimum dimensions of stone shall be three (3) inches.

5.8.c.3.C. Manufactured Media. On a case-by-case basis, the Commissioner shall evaluate applications of manufactured media.

5.8.c.3.D. Handling and Placing of Media. Storage of material delivered to the filter site shall be on wood planks or other approved clean, hard surfaced areas. Rehandling of all material shall take place at the filter site and there shall be no dumping of material into the filter. Rescreening and forking crushed rock, slag, and similar media at the filter site to remove all fines is required. Placement of these material shall be by hand to a depth of twelve (12) inches above the tile so as not to damage the underdrains. The engineer may place the remainder of the material. The engineer shall approve how applicant handles and places manufactured media. There shall be no trucks, tractors, or other heavy equipment driven over the filter during or after construction.

5.8.d. Underdrainage System.

5.8.d.1. Arrangement. Underdrains with semi-circular inverts shall exist and the underdrainage system shall cover the entire floor of the filter. Inlet openings into the underdrains shall have an unsubmerged gross combined area equal to at least fifteen percent (15%) of surface area of the filter.

5.8.d.2. Slope. The underdrains shall have a minimum slope of one percent (1%). The design of effluent channels shall be to produce a minimum velocity of two (2) feet per second at average daily rate of application to the filter.

5.8.d.3. Flushing. There shall be a provision for flushing the underdrains. The use of a peripheral head channel with vertical vents is acceptable for flushing purposes. There shall be inspection facilities.

5.8.d.4. Ventilation. The design of the underdrainage system, effluent channels and effluent pipe shall be to permit free passage of air. The size of drains, channels, and pipe shall be such that not more than fifty percent (50%) of their cross-sectional area will be submerged under the design hydraulic loading. There shall be a provision in the design of the effluent channels to allow the possibility of increased hydraulic loading.

5.8.e. Special Features.

5.8.e.1. Flooding. There shall be provisions in the design of filter structures so that they may flood.

5.8.e.2. Maintenance. The installation of all distribution devices, underdrains, channels and pipes shall be so that an applicant may properly maintain, flush, or drain them.

5.8.e.3. Freeboard. There shall be a freeboard of four (4) feet or more for tall, manufactured media filters to minimize windblown spray.

5.8.e.4. Flow Measurement. There shall be devices to permit measurement of flow to filter, including recirculated flows.

5.8.e.5. Recirculation. The merits of recirculation for various purposes; for example, to prevent drying of a standard rate filter between dosings shall be considered.

5.8.f. Two-Stage Filters. The use of two-stage filters when single stage filters may not accomplish the required removals shall be considered.

5.8.g. Efficiencies. Calculating and documenting expected efficiencies is required. The effect of climatic conditions on the overall filter performance shall be considered.

5.8.h. Rotary Distributor Seals. This rule shall not permit the use of mercury seals. Ease of seal replacement shall be a consideration in design.

5.9. Rotating Biological Contactors (RBC's).

5.9.a. Winter Protection. Year round operation requires covering of rotating contactors to protect the biological growth from cold temperatures and the excessive loss of heat from the wastewater with the resulting loss of performance. Construction of enclosures shall be of a suitable corrosion resistant material. There shall be installation of windows or simple louvered mechanisms that can be opened in the summer and closed in the winter to provide

ventilation. To minimize condensation, the enclosure shall have insulation or heat.

5.9.b. Required Pretreatment. Primary settling tanks equipped with scum and grease collecting devices shall precede RBC's. Bar screening or comminution are not suitable as the sole means of pretreatment.

5.9.c. Unit Sizing. Unit sizing shall be based on experience at similar full-scale installations or thoroughly documented pilot testing with the particular wastewater. In determining design loading rates, expressed in units of volume per day per unit area of media covered by biological growth, the following parameters shall be considered:

5.9.c.1. Design flow rate and influent waste strength;

5.9.c.2. Percentage of BOD to be removed;

5.9.c.3. Media arrangement, including number of stages and unit area in each stage;

5.9.c.4. Rotational velocity of the media;

5.9.c.5. Retention time within the tank containing the media;

5.9.c.6. Wastewater temperature;

5.9.c.7. Percentage of influent BOD that is soluble; and

5.9.c.8. In addition to the above parameters, loading rates for nitrification shall depend upon influent total Kjeldahl nitrogen (TKN), influent ammonia nitrogen concentration, pH, and the allowable effluent ammonia nitrogen concentration.

5.9.d. Design Safety Factor. Daily load variations affect effluent concentrations of ammonia nitrogen from the RBC process designed for nitrification. Therefore, it may be necessary to increase the design surface area proportional to the ammonia nitrogen daily peaking rates to meet effluent limitations. An alternative is to provide flow equalization sufficient to insure process performance within the required effluent limitations.

5.9.e. Air Driven Units. This rule shall not permit air driven units.

5.10. Sequential Batch Reactor (SBR) and Intermittent Wastewater Treatment Systems.

5.10.a. Batch Reactor. Batch reactor and intermittent treatment technologies shall use an alternating multiple-tank system for new installations. Tank applications for renovating existing treatment works or for facilities with flows equal to or less than fifty thousand (50,000) gallons per day shall be considered on a case-by-case basis, by the Commissioner.

5.10.b. Aeration Devices. Blowers or other aeration devices shall exist in multiple units for treatment works that have a capacity of greater than twenty thousand (20,000) gallons per day. The arrangement and capacity of blowers or other aeration devices shall be as to meet the maximum air demand with the largest single unit out of service.

5.10.c. Diffusers. Individual assembly units of diffusers shall have control valves, preferably with indicator markings for throttling or for complete shutoff.

5.10.d. Design Loadings. Five-day biochemical oxygen demand loading and aeration requirements shall be no less than the requirements specified by the manufacturer for each particular proprietary sequencing batch reactor (SBR) process. An applicant shall obtain written concurrence with the proposed design and specifications for a particular installation from the manufacturer of a proprietary system or technology and shall provide it with the project plans. Generally, an applicant should use an average hydraulic detention time of twenty-four (24) hours as a basis for design.

5.10.e. Operation. Each unit shall be capable of independent operation during low, average, peak, and storm flow.

5.10.f. Decanting. There shall be provisions to insure that decanting cannot in any way occur during any phase of operation except at the end of the "settle" or the "idle" phase or period.

5.10.g. Pre-treatment. A mechanically cleaned bar screen having maximum clear openings between the bars of $\frac{1}{2}$ " (closer spacings are encouraged) shall precede SBR treatment plants. Comminutors or other sewage grinders are not acceptable substitutes for this requirement.

5.10.h. Scum Removal. Each unit shall have a means of excluding scum and other floatables from entering the decanter.

5.10.i. Design Flow Rate. The design of downstream units and piping shall be based upon the decanter flow rate, not the design flow of the treatment facilities.

5.11. Recirculating Sand Filters (RSF). The design of RSF systems can be to treat flows as small as those generated by the individual home, up to any size for which engineering considerations and economics would indicate the RSF system to be the optimum choice, when comparing the RSF technology to other candidate technologies.

5.11.a. Design Considerations. All piping used in RSF systems shall comply with collection system piping standards. Appropriate cleanouts or access ports shall be available in all piping, to allow operator access for inspection and maintenance purposes.

5.11.b. General Description. The recirculating sand filter treatment system

consists of a septic tank, or Imhoff tank, followed by a recirculation tank, and then an open sand filter. An applicant shall provide a pumping system with time clock control mechanisms to provide a recirculation rate that results in fresh liquid being dosed onto the surface of the sand filter. An applicant shall provide float controls to override the time clocks, if flows increase to the point where overflow is imminent but the time clock is not yet ready to provide power to the pumps.

5.11.c. Septic Tank/Imhoff Tank Design. The design of septic tanks or Imhoff tanks are to be in accordance with established design standards.

5.11.d. Recirculation Tank. Septic tank or Imhoff tank effluents are directed, by gravity if possible to a recirculation tank. Normally, the tank size is to be equal to the incoming twenty-four (24) hour flow, assuming that the organic concentrations are within the range of normal domestic sewage (i.e.: 150 350 mg/l BOD₅). The primary purpose of the recirculation tank is to receive underdrain flows from the sand filter(s), to mix with the septic tank or Imhoff tank effluent. This maintains a positive dissolved oxygen concentration in the recirculation tank, thus eliminating any septic odors from being released when dosing the filters. There shall be a provision for pumps in the recirculation tank to dose the filter(s) on an intermittent basis.

5.11.e. Dosing. A means of dosing the filters can be dosing troughs, spray nozzles, or a central splash pad in the middle of the filter, or a dosing grid system. This rule recommends spray nozzles to optimize distribution onto the filter. All exposed dosing lines shall be self draining to prevent freezing during cold weather periods.

5.11.e.1. Filter dosing normally lasts for several minutes each hour, or half-hour periods. Dosing less frequently than once every two (2) hours is not a recommendation, although applicant may vary the dose interval and dose volume. Dosing shall not occur for more than fifty percent (50%) of a dosing cycle to allow aeration to occur between cycles. This rule recommends a recirculation ratio of at least 12:1 (i.e., recirculation ratio equals daily flow dosed onto the filter(s) divided by the average daily flow of sanitary wastes entering the treatment facility). Recirculation ratios up to 25:1 may be appropriate, depending on the nature of the wastes being treated.

5.11.e.2. The activation of the recirculation pump(s) shall be by means of a time clock with not greater than fifteen (15) minute increment settings. An applicant shall use a ninety-six (96) pin, twenty-four (24) hour clock, or other timer approved by the Commissioner.

5.11.e.3. A single recirculation pump is acceptable for a single family home or smaller RSF system. An RSF system serving a greater design load than a single family home shall have duplex pumps.

5.11.e.4. This rule recommends volumes equal to one (1) to four (4) inches of depth over the filter during each dosing cycle.

5.11.e.5. Piping between the recirculation tank and filters shall allow dosing of any filter by either duplex pump, via actuation of appropriate valves.

5.11.f. Electrical Controls. All electrical wiring shall be in compliance with the National Electrical Code. This rule recommends a control panel in a NEMA IV housing to preclude damage due to inclement weather conditions unless the location of the controls is inside a secure building.

5.11.f.1. There shall be high and low liquid level control switches (i.e., mercury float switches, or similar) installed in the recirculation tank. The high level switch shall activate at least one (1) pump by overriding the timer control. The low level switch shall override the timer control to turn all pumps off. Placement of the high level switch should be several inches above the normal operating level in the recirculation tank. Placement of the low level switch should be several inches above the pump intake. Actuation of either the high or low level switches shall also cause activation of a visual or audible, or both, alarm indicator to notify the operator of a potential operational problem.

5.11.f.2. Removing pumps and electrical controls (i.e., high and low level switches, etc.) located in the recirculation tank, shall be easy via "quick disconnect" piping and electrical connections.

5.11.g. Discharge Valving. The dischargment of treated sewage is only from the filter underdrain piping. All underdrain piping is directed back into the recirculation tank. There shall be a floating ball valve installed inside the recirculation tank. At the maximum operating liquid level in the recirculation tank, the ball valve shall close and filter effluents shall bypass the tank to disinfection. At lower operating liquid levels, filter effluents shall re-enter the recirculation tank for further treatment.

5.11.h. Filter. Except for a single-family home, all RSF systems shall include at least two (2) filters, with filter alternation accomplished manually. The overall filter area shall be based on a design of ≤ 4 gallons per day per square foot, based on the average daily sewage flow entering the treatment facility.

5.11.h.1. The filter media shall be silica sand, Black Beauty, graded bottom ash from coal-fired power plants, or other media approved by the Commissioner. Filter media shall have a uniformity coefficient of ≤ 2.5 with an effective particle size of 0.5 to 1.5 mm.

5.11.h.2. The filter media depth shall be ≥ 24 inches, with three (3) layers of support gravel in the underdrain. Support gravel layers shall be ≥ 3 inches for each layer, with support gravel sizes as follows: bottom layer, one and one-half ($1 \frac{1}{2}$) inches to three-fourths ($\frac{3}{4}$) inch; middle layer, three-fourths ($\frac{3}{4}$) inch to one-fourth ($\frac{1}{4}$) inch; top layer one-fourth ($\frac{1}{4}$) inch to one-eighth ($\frac{1}{8}$) inch.

5.11.h.3. This rule does not recommend the use of a filter fabric between the filter

media and support gravel. A filter fabric placed on top of the filter media may reduce maintenance requirements.

5.11.h.4. Placement of perforated underdrain piping shall be at the bottom of the filter prior to placement of the gravel support material. Underdrain piping shall be ≥ 4 inches in diameter, or sized based on system hydraulics. Underdrain piping shall lay on a one percent (1%) slope, at a spacing of no greater than ten (10) feet apart. The upper ends of all underdrain piping shall contain an elbow and non-perforated riser pipe that shall terminate halfway between the top of the filter media and the top of the filter sidewalls. The riser pipe shall be available for inspection and maintenance to the underdrain without necessitating excavation of the filter.

5.11.h.5. There shall be a filter sidewall freeboard of twelve (12) inches above the filter media. Filter sidewalls and bottoms shall be impermeable. The slope of the filter bottoms shall be toward the perforated underdrain piping at a grade of one (1) inch vertical to one (1) foot horizontal.

5.11.h.6. Normal operation of a multiple filter RSF system would allow one (1) or more filters to be "at rest" while the filter-in-use operates until "ponding" occurs; after that the applicant manually alternates the filter-in-use. If ponding of a filter does not occur within a one (1) to two (2) month period, this rule recommends manual alternation. After ponding occurs on a filter, there shall be an allowance for the filter to rest, the removal of clogging material from the top of the filter, raking the media, and then releveling it as necessary.

5.11.i. Disinfection. Disinfection of the RSF system effluent is required.

5.12. Constructed Wetlands Wastewater Treatment Systems.

5.12.a. The Commissioner shall review constructed wetlands wastewater treatment systems on a case by case basis. Recommended design shall be on the basis of the latest edition of the Tennessee Valley Authority's "General Design, Construction, and Operation Guidelines Constructed Wetlands Wastewater Treatment Systems for Small Users Including Individual Residences." Other acceptable designs are the USEPA and NASA wetlands designs.

5.13. Other Biological & Mechanical Systems.

5.13.a. New Biological & Mechanical Treatment Schemes. New biological and mechanical treatment schemes with promising applicability in wastewater treatment may be considered if the applicant provides the required engineering data for new process evaluation in accordance with Paragraph 5.1.c.3. of this rule.

5.14. Sewage Stabilization Ponds, Anaerobic Lagoons, and Aerated Lagoons. This rule shall permit the use of stabilization ponds, anaerobic lagoons and aerated lagoons for treatment of raw sewage, primary sewage effluent or secondary sewage effluent.

5.14.a. Stabilization Ponds.

5.14.a.1. Sizing. Stabilization ponds shall have a minimum capacity of sixty-five thousand (65,000) gallons.

5.14.a.2. Wind Sweep. The location of stabilization ponds shall be to permit an unobstructed wind sweep across the ponds.

5.14.a.3. Water Supply. The location of stabilization ponds shall be a minimum of three hundred (300) feet from public water supplies using wells or springs. Maintaining a minimum distance of six hundred (600) feet if the public water supply well is down gradient from or lower in elevation than the bottom of the sewage pond is required.

5.14.a.4. Geology and Soils. An applicant shall obtain borings to determine surface and subsurface characteristics of the pond site for all ponds greater than 2.5 acres in size or where required by the commissioner. The soil conservation service, the U.S. Department of Agriculture, requires a soil report for all pond sites.

5.14.a.5. Pond Shape. The shape of all ponds should be such as to produce a uniform perimeter with no coves, islands or peninsulas permitted. Corners of ponds are required to be round. The most desirable shape of ponds is round, square or rectangular with the length not exceeding three (3) times the width.

5.14.a.6. Design.

5.14.a.6.A. Loading. The design of stabilization ponds shall be on the basis of thirty-four (34) pounds per day of five (5) day BOD per acre.

5.14.a.6.B. Ponds in Series. If one (1) or more ponds are added in series with the primary pond, the primary pond shall have a surface area equal to that required in Part 5.14.a.1.F.1. of this rule.

5.14.a.6.C. Pretreatment. Where stabilization ponds follow some type of conventional treatment facility, reduction of the pond loading as set forth in Part 5.14.a.1.F.1. of this rule may be considered on a case-by-case basis.

5.14.a.6.D. Depth. Liquid depth of ponds shall be no less than three and one-half (3½) feet or greater than five (5) feet. There shall be a three (3) foot minimum freeboard.

5.14.a.7. Influent Lines.

5.14.a.7.A. Location of Discharge. Influent lines shall extend ten (10) feet beyond the maximum pond depth and in no case, more than one-fourth (1/4) the length

of the primary stabilization pond. Ponds following the primary pond or secondary treatment facilities in multiple unit systems shall be edge discharging.

5.14.a.7.B. Gravity. Influent lines from gravity collection systems shall discharge at a point twelve (12) to eighteen (18) inches above the pond surface.

5.14.a.7.C. Pressure. Pressure influent lines may discharge either above the pond surface or at a point one (1) foot above the pond bottom. When discharging below the pond surface, the end of the pressure line shall rest upon a concrete apron of two (2) square feet minimum size.

5.14.a.7.D. Pipe Support. Piers or other open structures shall support influent lines. This rule shall not permit dikes for pipe support.

5.14.a.8. Pond Details.

5.14.a.8.A. Embankments. The construction of embankments shall be of compacted impervious materials with a minimum top width of eight (8) feet. This rule requires the removal of all vegetation from the area upon which the embankment is to be placed.

5.14.a.8.B. Slope. Embankment slopes shall not be steeper than two (2) feet horizontal to one (1) foot vertical. Minimum slopes shall not be flatter than four (4) feet horizontal to one (1) foot vertical.

5.14.a.8.C. Pond Bottom. Pond bottoms shall be level and cleared of all vegetation and debris.

5.14.a.8.D. Watertightness. If soil characteristics are such that seepage will take place, ponds shall be watertight through use of a pond liner of man-made materials with a minimum thickness of sixty (60) mil required, or clay or through use of a soil additive, approved by the Commissioner.

5.14.a.9. Effluent Lines.

5.14.a.9.A. Discharge. The design of the effluent line shall be to discharge from a point eighteen (18) inches below the surface of the pond. There may be a provision to vent the effluent line to prevent siphoning. The effluent line shall discharge on a concrete slab or rip-rap apron. The placement of effluent lines shall be at the furthest point from the influent line discharge.

5.14.a.9.B. Discharge Structure. For ponds greater than 2.5 acres in size, there shall be discharge structures capable of variable depth control. Depth shall be adjustable between 3.5 and five (5) feet in increments of 0.5 foot or less. Spacing of withdrawal

points shall be from eighteen (18) inches below the surface to twelve (12) inches above the pond bottom discharge structures. Placement of these structures shall be at a point farthest from the influent line discharge and be readily accessible from the embankment.

5.14.a.9.C. Recirculation. Recirculation should be a consideration for multiple pond facilities. When proposing recirculation, thereby reducing pond size, applicant shall submit calculations justifying the proposed reduction to the commissioner for approval.

5.14.a.10. Drain Lines. This rule shall not permit drain lines.

5.14.a.11. Miscellaneous.

5.14.a.11.A. Surface Runoff. There shall be a provision to divert storm and surface water around stabilization ponds.

5.14.a.11.B. Fencing. Enclosing ponds with a stock-tight fence a minimum of six (6) feet in height with a locked entrance gate is a requirement.

5.14.a.11.C. Signs. There shall be several signs stating the nature of the facility installed on the fence.

5.14.a.11.D. Prefilling. This rule requires prefilling stabilization ponds with water to a minimum depth of two (2) feet prior to use.

5.14.a.11.E. Access Road. There shall be an all-weather access road to the pond site.

5.14.b. Anaerobic Lagoons.

5.14.b.1. General. Anaerobic lagoons shall generally be used for animal waste treatment.

5.14.b.2. Location. The location of anaerobic lagoons shall be a minimum of one thousand five hundred (1500) feet from the nearest occupied structure.

5.14.b.3. Water Supply. Distance from a drinking water supply shall comply with Paragraph 5.14.a.3. of this rule.

5.14.b.4. Geology and Soils. These shall comply with Paragraph 5.14.a.4. of this rule.

5.14.b.5. Lagoon Shape. Shall comply with Paragraph 5.14.a.5. of this rule.

5.14.b.6. Design. Design shall comply with the West Virginia Standard for Disposal Lagoon (359), published October, 1972 by the Soil Conservation Service USDA.

5.14.c. Aerated Lagoons.

5.14.c.1. General. Aerated lagoon sewage treatment facility shall consist of the following:

5.14.c.1.A. Pretreatment;

5.14.c.1.B. Aeration basin;

5.14.c.1.C. Settling basin, if required; and

5.14.c.1.D. Supplementary treatment, if required.

5.14.c.2. Water Supply. Distance from a drinking water supply shall comply with Paragraph 5.14.a.3. of this rule.

5.14.c.3. Geology and Soils. These shall comply with Paragraph 5.14.a.4. of this rule.

5.14.c.4. Shape. The shape shall comply with Paragraph 5.14.a.5. of this rule.

5.14.c.5. Design.

5.14.c.5.A. Method. The design of aeration basins is normally based upon the aerated lagoon theory using a K_e of 0.5 (at 20°C). Formulas to be used are:

$$t = \% \text{ removal} / (100 - \% \text{ removed}) K_T = \text{days detention}$$

$$\text{where: } K_T = 0.5 (1.075)^{T-20}$$

T = average year-round air temperature at the site in °C.

The dissolved oxygen level should be a minimum of 2 ppm and assumed that ratio of oxygen transfer should be at (0.9). The oxygen requirement should be based upon the removal of 1.5 pounds/pound of BOD₅.

5.14.c.5.B. Depth. The aeration basin shall be of a depth ranging from six (6) to fifteen (15) feet. Supplying air to the aeration basin shall be by means of surface aerators or subsurface air diffusers. A 96 pin time clock shall operate each surface aerator. The design of basins shall be to distribute oxygen throughout, but not to keep solids in suspension.

5.14.c.5.C. Settling. A settling pond shall follow the aeration basin. The size of the settling pond shall be based upon BOD₅ remaining after aeration at the loading rate of thirty-four (34) pounds of BOD₅ per surface acre per day.

5.14.c.6. Lagoon Details. Lagoon shape, dikes, embankments, construction and effluent lines shall comply with Paragraphs 5.14.b.6. through 5.14.b.10. of this rule.

5.15. Disinfection.

5.15.a. General. There shall be adequate disinfection of all sewage treatment plant effluents prior to discharge. All wastewater treatment works using gas chlorination shall have a Chlorine Institute chlorine repair kit.

5.15.b. Chlorination.

5.15.b.1. Chlorine Terminology. The word "chlorine" whenever used in this section refers to dry chlorine unless otherwise indicated.

5.15.c. Equipment.

5.15.c.1. Feed Equipment Type. This rule generally prefers solution-feed vacuum-type chlorinators for plants greater than one hundred thousand (100,000) gallons per day in size. There shall be consideration given to the use of hypochlorite solution feeders of the positive displacement type. For plants of one hundred thousand (100,000) gallons per day or less in size, using tablet type chlorinators shall receive approval.

5.15.c.2. Feed Equipment Capacity. Chlorinator capacities required may vary, depending on the use and point of application of the chlorine. For disinfection, the capacity shall be such to produce a residual of 0.5 ppm maximum in the final effluent at peak flow rates.

5.15.c.3. Chlorination Equipment and Spare Parts. It is a requirement to maintain an inventory of parts subject to wear and breakage at all times. This rule requires dual chlorinators for plants over one hundred thousand (100,000) gallons per day in size. Each chlorinator shall be able to provide the required chlorination at peak flow rates. If the discharge is within a five (5) mile distance up-stream from a public water supply, chlorination of the sewage effluent shall be a requirement unless a written waiver is granted by the Commissioner.

5.15.c.3.A. Water Supply. A supply of water shall be available for operating the chlorinators. When a booster pump is required, there shall be duplicate pumping equipment. When a connection is made from the domestic water supplies, there shall be a provision for equipment for backflow prevention. There shall be pressure gauges on chlorinator water supply lines.

5.15.c.3.B. Measurement Equipment. There shall be equipment for measuring the amount of chlorine use.

5.15.c.4. Evaporators. When manifolding of several cylinders is required to feed sufficient chlorine, there shall be consideration given to the installation of evaporators.

5.15.c.5. Leak Detection and Controls. A bottle of ammonium hydroxide solution shall be available for detecting chlorine leaks. Also, there shall be consideration given to the provision of caustic soda solution reaction tanks for absorbing the contents of leaking one (1) ton cylinders where the cylinders are in use. There shall be installation of automatic leak detectors wherever using gas chlorination.

5.15.d. Piping and Connections.

5.16.d.1. General. Piping systems shall be well supported, adequately sloped to allow drainage and protection from mechanical damage. Due to changes in temperature, there shall be allowance for pipe expansion.

5.15.d.2. Condensation. When a vaporizer does not provide adequate superheat, a pressure reducing valve shall be used to prevent condensation.

5.15.d.3. The arrangement of chlorine solution piping shall be such that any or all chlorinators may pre-chlorinate and post-chlorinate.

5.15.e. Housing.

5.15.e.1. Building. The design and construction of any building to house chlorine equipment or containers shall be to protect all elements of the chlorine system from fire hazards. If storing or processing flammable materials in the same building with chlorination equipment other than that using hypochlorite solutions, there shall be a fire wall erected to separate the two (2) areas.

5.15.e.1.A. If gas chlorination equipment and chlorine cylinders are to be in a building used for other purposes, a gas-tight partition shall separate this room from any other portion of the building. Doors to this room shall equip panic hardware and applicant shall install a chlorine detector/alert system. The rooms shall be at ground level and shall permit easy access to all equipment. Storage area shall be separated from the feed area. This rule shall not permit a basement.

5.15.e.1.B. There shall be a means of exit to the outside of the building from each separate room or building in which applicant is storing, handling or using chlorine, other than hypochlorite.

5.15.e.1.C. There shall be installation of a clear glass, gas-tight

window in an exterior door or interior wall of the chlorinator room to permit viewing of the chlorinator without entering the room.

5.15.e.2. Heat. There shall be chlorinator rooms with a means of heating and maintaining a temperature of at least sixty degrees Fahrenheit (60°F). The room shall also have protection from excess heat.

5.15.e.3. Ventilation. There shall be installation of forced, mechanical ventilation that provides one (1) complete air change per minute in all chlorine feed rooms and rooms where storing chlorine cylinders. The entrance to the air exhaust duct from the room shall be near the floor and the location of the point of discharge shall be so as not to contaminate the air inlets to any building or inhabited areas. The location of air inlets shall be so as to provide cross ventilation with air and at such a temperature that will not adversely affect the chlorination equipment. The vent hose shall run without traps from the chlorinator and shall discharge to the outside atmosphere above grade.

5.15.e.4. Electrical Controls. The controls for the fans and lights shall be such that they will automatically operate when the door is opened and manually operated from the outside without opening the door.

5.15.e.5. Respiratory Protection. Respiratory air-pac protection equipment, meeting the requirements of the National Institute for Occupational Safety and Health (NIOSH), shall be available where the handling of chlorine gas takes place, and stored at a convenient location, but not inside any room where using or storing chlorine. There shall be instructions posted for using the equipment. The units shall use compressed air, have at least a thirty (30) minute capacity, and be compatible with the units used by the fire department responsible for the plant. This rule requires a minimum of two (2) air-pacs.

5.15.f. Application of Chlorine.

5.15.f.1. Mixing With Flow. There shall be provisions to ensure uniform mixing of the chlorine solution with the wastewater flow near the point of application.

5.15.f.2. Contact Period. There shall be a minimum contact period of forty (40) minutes at average daily flow or fifteen (15) minutes at maximum daily flow. Additional contact time may be a requirement if the discharge point is in proximity to a water supply intake, recreational area or some other similar area.

5.15.f.3. Contact Tank. Design of chlorine contact tanks shall be to minimize "short-circuiting" of flow. There shall be over and under, or end-around, baffling provided. This rule requires air lift sludge returns from the contact tank for all extended aeration sewage treatment plants unless preceded by a filter or polishing pond. This rule requires multiple units for plants over one hundred thousand (100,000) gallons in size.

5.15.g. Dechlorination. The removal of all or part of the chlorine residual may be a requirement prior to final discharge, to meet the adopted stream standards or other requirements for particular streams.

5.15.g.1. Other Methods. The Commissioner shall evaluate the use of other methods for disinfection on a case-by-case basis. As a minimum, there shall be an investigation when intending to use other disinfection methods.

5.15.g.2. Minimum effluent conditions, such as clarity, soluble organics and pH are required for adequate disinfection.

5.15.g.3. Methods for dispersion and mixing with the waste stream are required.

5.15.g.4. Other factors, including but not limited to, equipment reliability, safety and application rates are required for varying waste flows.

5.15.g.5. Refer to Paragraph 5.1.c.3. of this rule.

5.15.h. Evaluation of Effectiveness.

5.15.h.1. Sampling. There shall be facilities included for securing a sample prior to discharge to determine the effectiveness of the disinfection method.

5.15.h.2. Residual Chlorine Testing and Control. When using chlorine for disinfection, there shall be equipment for measuring chlorine residual. When the discharge occurs in critical areas, the installation of facilities for continuous automatic chlorine residual analysis, recording and proportioning systems may be a requirement.

5.16. Supplementary Treatment.

5.16.a. General. Supplementary treatment shall be a requirement when health considerations or waste load allocations and effluent limitations require treatment more stringent than secondary.

5.16.b. Alternating Surface Sand Filters.

5.16.b.1. General. Normally, an applicant shall use alternating surface sand filters for plants of one hundred thousand (100,000) gallons per day or less in size. The commissioner may permit alternating surface sand filters for plants of over one hundred thousand (100,000) gallons per day in size on a case-by-case basis. No individual surface sand filter shall exceed five hundred (500) square feet.

5.16.b.2. Filter Rate. The design of an alternating sand filter shall be for a

filter rate of not more than twenty (20) gallons per square foot per day.

5.16.b.3. Application. The effluent application shall be with either a pump or siphon chamber designed to dose all sections of the filter equally with three (3) to four (4) inches of liquid in twenty (20) minutes or, where elevation differences permit, the Commissioner may permit gravity application of effluent to the filter, if the distribution of the effluent is uniform.

5.16.b.4. Location. The location of alternating surface sand filters shall not be within one hundred (100) feet of the nearest occupied residence or habitation. The commissioner may waive this distance requirement in the event applicant obtains a release from the neighboring property owner or owners.

5.16.b.5. Media. The sand used in alternating surface sand filters shall be coarse, clean sand of uniform size. Effective size of 0.5 to 1.5 mm in diameter with a uniformity coefficient of no greater than 3.0 and less than one percent (0.15%) fines passing a one hundred (200) sieve. The Commissioner may waive this requirement if finding the media is to perform in an adequate manner.

5.16.b.6. Construction. The side walls, dividing partitions and bottom of the sand filters shall be impermeable. General construction shall be as shown in the Portfolio of Drawings.

5.16.b.7. Disinfection. This rule requires disinfection after the filters and before discharge to a stream.

5.16.c. High Rate Effluent Filtration.

5.16.c.1. General. High rate filters may be either gravity or pressure.

5.16.c.1.A. Pressure. This rule limits the use of pressure high rate filters to plants of greater than one hundred thousand (100,000) gallons per day in size.

5.16.c.2. Filtration Rates. Allowable rates for gravity filters shall not be greater than one (1) gallon per minute per square foot per day. Filtration rates for pressure filters shall not be greater than five (5) gallons per minute per square foot per day. Rates are based upon the maximum flow rate applied.

5.16.c.3. Number of Units. There shall be total filter area in two (2) or more units, and calculation of the filtration rate shall be on the total available filter area with one (1) unit out of service, for plants of forty thousand and one (40,001) gallons per day or more in size.

5.16.c.4. Backwash. Backwash shall include either or both air scouring

and positive surface wash. There shall be a provision for using filtered effluent for backwash and waste filter backwash water. It shall return to the head of the plant.

5.16.c.4.A. Backwash Water Storage. Total backwash water storage capacity required shall equal or exceed one (1) complete backwash cycle.

5.16.c.4.B. Backwash Rate. The backwash rate shall not exceed twenty (20) gallons per minute per square foot with a minimum backwash period of ten (10) minutes.

5.16.c.4.C. Pumps. An applicant shall size and interconnect pumps for backwashing filter units to provide the required rate to any filter with the largest pump out of service.

5.16.c.5. Proprietary Equipment. Where proposing proprietary filtration equipment not conforming to the preceding requirements, an applicant shall provide data that supports the capability of the equipment to meet effluent requirements under design conditions. The Commissioner shall consider the equipment on a case-by-case basis.

5.16.c.6. Equipment Serving Plants with Design Flows of Forty Thousand (40,000) Gallons Per Day or Less. When proposing filtration equipment serving plants with design flows of forty thousand (40,000) gallons per day or less not conforming to the preceding requirements, an applicant shall provide data that supports the capability of the equipment to meet effluent requirements under design conditions. The Commissioner shall consider the equipment on a case-by-case basis.

5.16.d. TKN Removal.

5.16.d.1. General. Consideration shall be given to TKN removal when the total Kjeldahl nitrogen limit as stated in the discharge load allocation is less than eighteen (18) mg/l.

5.16.d.2. Methods. Methods used to achieve TKN removal may include, but not be limited to: additional aeration in extended aeration plants; separate stage nitrification; break-point chlorination; nitrification column; and alternating surface sand filters.

5.16.e. Microscreening.

5.16.e.1. General. An applicant may use microscreening units following a biological treatment process for the removal of residual suspended solids.

5.16.e.2. Materials. Microscreen shall be either a specially woven polyester or stainless steel with aperture size of twenty (20) to thirty (30) microns.

5.16.e.3. Design. The hydraulic loading shall not be greater than ten (10) gallons per minute per square foot of submerged drum surface. Maximum head loss shall be twelve (12) to eighteen (18) inches. There shall be an overflow weir to bypass part of the flow when head exceeds six (6) to eight (8) inches. It is recommended that drums be not less than ten (10) feet in diameter.

5.16.e.4. Backwash. Application of continuous pressurized (60 psig) backwash shall be at a minimum rate of eight (8) gallons per minute per square foot of screen. There shall be dual backwash pumps, with each pump being capable of supplying one hundred percent (100%) of the required flow. Backwash water shall return to the head of the plant at a rate not to exceed fifteen percent (15%) of the average daily design flow.

5.16.e.5. Reliability. There shall be dual microscreen units with each unit being capable of providing one hundred percent (100%) of the design microscreen capacity. There shall be automatic drum speed controls with provision for manual override for each screen. It is a requirement to enclose all units in a heated and ventilated structure.

5.16.f. Polishing Ponds.

5.16.f.1. General. The design of polishing ponds shall be in accordance with Section 5.14.b. of this rule. Polishing ponds shall have a capacity of at least sixty-five thousand (65,000) gallons or capacity for a detention time of ten (10) days plant design flow, whichever is greater.

5.16.f.2. Distance Requirements. The location of polishing ponds shall be at least one hundred (100) feet from the nearest occupied structure.

5.16.g. Post Aeration. Meeting a discharge load allocation of 6.0 milligrams per liter dissolved oxygen shall be by means of one (1) of the following:

5.16.g.1. Post aeration tank with air added by diffusion or mechanical means;

5.16.g.2. Cascade aeration; or

5.16.g.3. Polishing ponds shall provide the dissolved oxygen requirements.

5.17. Sludge Handling and Disposal.

5.17.a. Anaerobic Sludge Digestion.

5.17.a.1. Multiple Units. This rule recommends multiple tanks. When using a single digestion tank, there shall be an alternate method of sludge processing or

emergency storage to maintain continuity of service.

5.17.a.2. Depth. For those units proposed to serve as supernatant separation tanks, the depth shall be sufficient to allow for the formation of a reasonable depth of supernatant liquor. This rule recommends a minimum sidewater depth of ten (10) feet.

5.17.a.3. Maintenance Provisions. To facilitate draining, cleaning, and maintenance, the following features are desirable:

5.17.a.3.A. Slope. The tank bottom should slope to drain toward the withdrawal pipe. For tanks equipped with a suction mechanism for withdrawal of sludge, this rule recommends a bottom slope not less than 1:12. When the sludge removal is to be by gravity alone, this rule recommends 1:4 slope.

5.17.a.3.B. Access Manholes. In addition to the gas dome, there shall be at least two (2) thirty-six (36) inch diameter access manholes in the top of the tank. There shall be stairways to reach the access manholes. There shall be a separate sidewall manhole. The opening should be large enough to permit the use of mechanical equipment to remove grit and sand.

5.17.a.3.C. Safety. There shall be nonsparking tools, safety lights, rubber-soled shoes, safety harness, gas detectors for inflammable and toxic gases and at least two (2) self-contained breathing units for emergency use.

5.17.a.4. Sludge Inlets and Outlets.

5.17.a.4.A. Recirculation. There shall be multiple recirculation withdrawal and return points, unless incorporating mixing facilities within the digester. The return shall discharge above the liquid level and the location shall be near the center of the tank.

5.17.a.4.B. Raw Sludge Discharge. Raw sludge discharge to the digester shall be through the sludge heater and recirculation return piping, or directly to the tank if there are internal mixing facilities.

5.17.a.4.C. Withdrawal. Sludge withdrawal to disposal shall be from the bottom of the tank. This pipe shall interconnect with the recirculation piping.

5.17.a.5. Tank Capacity. The determination of the total digestion tank capacity shall be by rational calculations based upon such factors as volume of sludge added, its percent solids and character, the temperature to maintain in the digesters, the degree or extent of mixing to obtain and the degree of volatile solids reduction required. An applicant shall submit calculations to the Commissioner, to justify the basis of design.

When the calculations are not based on the above factors, the minimum combined

digestion tank capacity design shall be based on: the assumption that a raw sludge evolves from ordinary domestic wastewater, that a maintained digestion temperature is to be in the range of ninety degrees Fahrenheit (90° F) to one hundred degrees Fahrenheit (100°F) or (32°C and 38°C), that the digested sludge will maintain forty percent (40%) to fifty percent (50%) volatile matter, and that there will be frequent removal of the digested sludge from the system.

5.17.a.5.A. Completely-Mixed Systems. Completely-mixed systems shall provide for effective mixing. Loading the system may be at a rate up to eighty (80) pounds of volatile solids per one thousand (1,000) cubic feet of volume per day in the active digestion units. When there are no grit removal facilities, reducing the digester volume due to grit accumulation shall be considered.

5.17.a.5.B. Moderately-Mixed Systems. For digestion systems where accomplishing mixing is only by circulating sludge through an external heat exchanger, loading the system may be at a rate up to forty (40) pounds of volatile solids per one thousand (1,000) cubic feet of volume per day in the active digestion units. Modification to this loading may be upward or downward depending upon the degree of mixing provided.

5.17.a.6. Gas Collection, Piping, and Appurtenances.

5.17.a.6.A. General. The design of all portions of the gas system, including the space above the tank liquor, the storage facilities and the piping, shall be so that under all normal operating conditions, including sludge withdrawal, the gas will be maintained under positive pressure. All enclosed areas where any gas leakage might occur shall have adequate ventilation.

5.17.a.6.B. Safety. When producing gas all safety facilities shall be used. There shall be pressure and vacuum relief valves and flame traps, along with automatic safety shutoff valves. This rule shall not permit water seal equipment. Housing gas safety equipment and gas compressors shall be in a separate room with an exterior entrance.

5.17.a.6.C. Gas Piping and Condensate. Gas piping shall be of adequate diameter and shall slope to condensate traps at low points. This rule shall not permit the use of float-controlled condensate traps.

5.17.a.6.D. Gas Utilization Equipment. The location of gas-fired boilers for heating digesters shall be in a separate room not connected to the digester gallery.

5.17.a.6.E. Electrical Fixtures. Electrical fixtures and controls in places enclosing anaerobic digestion appurtenances, when the tanks and piping normally contain hazardous gases, shall comply with the National Electrical Code for Class 1, Group D, Division 2 locations. An applicant shall isolate digester galleries from normal operating areas to avoid an extension of the hazardous location.

5.17.a.6.F. Waste Gas. Waste gas burners shall be readily accessible and located at least twenty-five (25) feet away from any plant structure if placed at ground level, or located on the roof of the control building if sufficiently removed from the tank. All waste gas burners shall equip an automatic ignition, such as a pilot light or a device using a photoelectrical cell sensor. The use of natural or propane gas to insure reliability of the pilot light shall be considered. Discharging the gas to the atmosphere through a return-bend screened vent terminating at least ten (10) feet above the ground surface, provided that the assembly incorporates a flame trap, may be permissible in remote locations.

5.17.a.6.G. Ventilation. Any underground enclosures connecting with digestion tanks, or containing sludge, gas piping or equipment shall be equipped with forced ventilation. The piping gallery for digesters shall not connect to other passages. If self-closing doors are used at connecting passageways and tunnels to minimize the spread of gas, they shall be tightly fitting.

5.17.a.6.H. Meter. There shall be a gas meter with a bypass to meter total gas production.

5.17.a.7. Digester Heating.

5.17.a.7.A. Insulation. Wherever possible, the construction of tanks shall be above ground water level and suitably insulated to minimize heat loss.

5.17.a.7.B. Heating Facilities. Sludge may be heated by circulating it through external heaters or using heating units located inside the digestion tank.

5.17.a.7.B.1. The design of piping for external heating shall be to provide for the preheating of feed sludge before introduction to the digesters. There shall be provisions in the layout of the piping and valving to facilitate cleaning of these lines. The sizing of heat exchanger sludge piping should be for heat transfer requirements.

5.17.a.7.B.2. Other Heating Methods. The Commissioner shall consider other types of heating facilities on their own merits.

5.17.a.7.C. Heating Capacity. There shall be heating capacity sufficient to consistently maintain the design sludge temperature. When using a digester tank gas for sludge heating, an auxiliary fuel supply is required.

5.17.a.7.D. Hot Water Internal Heating Controls.

5.17.a.7.D.1. There shall be an automatic mixing valve to temper the boiler water with return water so that the inlet water to the heat jacket can be held below a temperature at which caking will be accentuated. In addition, there shall be manual control provided by bypass valves.

5.17.a.7.D.2. The boiler shall equip automatic controls to maintain the boiler temperature at approximately one hundred eighty degrees Fahrenheit (180°F) to shut off the main gas supply in the event of pilot burner or electrical failure, low boiler water level, or excessive temperature.

5.17.a.7.D.3. There shall be thermometers to show temperatures of the sludge, hot water feed, hot water return, and boiler water.

5.17.a.8. Supernatant Withdrawal.

5.17.a.8.A. Piping Size. Supernatant piping shall not be less than six (6) inches in diameter.

5.17.a.8.B. Withdrawal.

5.17.a.8.B.1. Arrangement of piping shall be so that withdrawal can be made from three (3) or more levels in the digester. There shall be a positive unvalved vented overflow.

5.17.a.8.B.2. If providing a supernatant selector, provisions shall be made for at least one (1) other drawoff level located in the supernatant zone of the tank in addition to the unvalved emergency supernatant drawoff pipe. There shall be high pressure backwash facilities.

5.17.a.8.C. Sampling. There shall be provisions for sampling at each supernatant drawoff level. Sampling pipes shall be at least one and one-half (1-½) inches in diameter, and shall terminate at a suitably-sized sampling sink or basin.

5.17.a.8.D. Alternate Supernatant Disposal. An applicant shall give consideration to supernatant conditioning, when appropriate, in relation to its effect on plant performance and effluent quality.

5.17.b. Aerobic Sludge Digestion.

5.17.b.1. General. Using aerobic digestion may stabilize secondary sludge. There shall be digestion in single or multiple tanks, designed to provide effective air mixing, reduction of the organic matter, supernatant separation, and sludge concentration under controlled conditions.

5.17.b.2. Digestion Tanks. This rule recommends multiple tanks. An applicant may use a single sludge digestion tank in the cases of small treatment plants, when making provisions for sludge handling, or when a single unit will not adversely affect normal plant operations.

5.17.b.3. Mixing and Air Requirements. Design of aerobic sludge digestion tanks shall be for effective mixing by aeration equipment. There shall be sufficient air to keep the solids in suspension and maintain dissolved oxygen between one (1) and two (2) milligrams per liter. There shall be a minimum mixing and oxygen requirement of thirty (30) cfm per one thousand (1,000) cubic feet of tank volume with the largest blower out of service. If using diffusers, the nonclog type is a requirement, and their design shall be to permit continuity of service. If using mechanical aerators, there shall be a minimum of 1.0 horsepower per one thousand (1,000) cubic feet. This rule discourages the use of mechanical equipment in areas where freezing temperatures are typical.

5.17.b.4. Tank Capacity. The determination of tank capacities shall be based on rational calculations, including such factors as quantity of sludge produced, sludge characteristics, time of aeration, and sludge temperature.

5.17.b.4.A. Volatile Solids Loading. The volatile suspended solids loading shall not exceed one hundred (100) pounds per one thousand (1,000) cubic feet of volume per day in the digestion units. Lower loading rates may be necessary depending on temperature, type of sludge, and other factors.

5.17.b.4.B. Solids Retention Time. Required minimum solids retention time for stabilization of biological sludges varies depending on type of sludge. Normally, there shall be a minimum of fifteen (15) days retention for waste activated sludge and twenty (20) days for combination of primary and waste activated sludge, or primary sludge alone. In areas where sludge temperature is lower than fifty degrees Fahrenheit (50°F), additional detention time shall be considered.

5.17.b.5. Supernatant Separation. There shall be facilities for separation and withdrawal of supernatant and for collection and removal of scum and grease.

5.17.b.6. Sludge Thickening. Prior to placement on sludge drying beds, all sludge produced by the activated sludge process shall condition to a minimum solids content of two percent (2%) by weight.

5.17.c. Sludge Pumps and Piping.

5.17.c.1. Sludge Pumps.

5.17.c.1.A. Duplicate Units. There shall be duplicate units.

5.17.c.1.B. Type. There shall be plunger pumps, screw feed pumps, recessed impeller type centrifugal pumps, progressive cavity pumps, or other types of pumps capable of solids handling for handling raw sludge.

5.17.c.1.C. Minimum Head. There shall be a minimum positive

head of twenty-four (24) inches at the suction side of centrifugal-type pumps and that minimum is desirable for all types of sludge pumps. Maximum suction lifts shall not exceed ten (10) feet for plunger pumps.

5.17.c.1.D. Sampling Facilities. Unless sludge sampling valves are installed at the sludge pumps, the size of valve and piping shall be at least one and one-half (1-½) inches.

5.17.c.2. Sludge Piping.

5.17.c.2.A. Size and Head. Sludge withdrawal piping shall have a minimum diameter of six (6) inches for gravity withdrawal and three (3) inches for pump suction and discharge lines. When withdrawal is by gravity, the available head on the discharge pipe shall be adequate to provide at least 3.0 feet per second velocity.

5.17.c.2.B. Slope. Gravity piping shall be laid on uniform grade and alignment. The slope of gravity discharge piping shall not be less than three percent (3%). There shall be provisions for cleaning, draining and flushing discharge lines.

5.17.c.2.C. Supports. The corrosion resistance and continuing stability of supporting systems located inside the digestion tank shall receive special consideration.

5.17.d. Sludge Dewatering.

5.17.d.1. Sludge Drying Beds. Estimating the sizing of the drying bed shall be on the basis of 4.0 square foot capita when the drying bed is the primary method of dewatering, and 1.0 square foot capita if using it as a back-up dewatering unit. Under no circumstances shall surface water enter the bed areas.

5.17.d.2. Design.

5.17.d.2.A. Gravel. An applicant shall grade the lower course of gravel around the underdrains and it shall be twelve (12) inches in depth, extending at least six (6) inches above the top of the underdrains. It is desirable to place this in two (2) or more layers. The top layer of at least three (3) inches shall consist of gravel one eighth (1/8) inch to one-fourth (1/4) inch in size.

5.17.d.2.B. Sand. The top course shall consist of six (6) to nine (9) inches of clean washed coarse sand with an effective size of 0.3 to 0.6 mm in diameter with a uniformity coefficient of no greater than 4.0 and less than one percent (0.1%) fines passing number one hundred (100) sieve. The Commissioner may waive this requirement if this media performs adequately. The finished sand surface shall be level.

5.17.d.2.C. Underdrains. Underdrains shall be at least four (4) inches in diameter and the spacing of them shall be not more than twenty (20) feet apart.

5.17.d.2.D. Partially Paved Type. The design of the partially paved drying bed shall be with consideration for space requirement to operate mechanical equipment for removing the dried sludge.

5.17.d.2.E. Walls. Walls shall be watertight and extend fifteen (15) to eighteen (18) inches above and at least six (6) inches below the surface. There shall be curbing of outer walls to prevent soil from washing onto the beds.

5.17.d.2.F. Sludge Removal. There shall be not less than two (2) beds and their arrangement shall be to facilitate sludge removal. There shall be concrete truck tracks for all percolation-type sludge beds.

5.17.d.2.G. Sludge Influent. The sludge pipe to the drying beds shall terminate at least twelve (12) inches above the surface and be arranged so that it will drain. There shall be concrete splash plates for percolation-type beds at sludge discharge points.

5.17.d.2.H. Protective Enclosure. A protective enclosure shall be considered if winter operation is required..

5.17.d.3. Mechanical Dewatering Facilities. There shall be a provision to maintain continuity of service so that an applicant may dewater sludge without accumulation beyond storage capacity. The number of vacuum filters, vacuum beds, centrifuges, filter presses, belt filters, and other mechanical dewatering facilities shall be sufficient to dewater the sludge produced with the largest unit out of service. Unless other standby facilities are available, there shall be adequate storage facilities. The storage capacity shall be sufficient to handle at least a three (3) month sludge production.

5.17.d.3.A. Auxiliary Facilities for Vacuum Filters. There shall be back-up vacuum pumps and filtrate pumps. It is permissible to have an uninstalled back-up vacuum pump or filtrate pump for every three (3) or less vacuum filters, provided that the removal or replacement of the installed unit requires little effort.

5.17.d.3.B. Ventilation. There shall be facilities for ventilation of dewatering area. The condition of the exhaust air shall be to avoid odor nuisance.

5.17.d.3.C. Chemical Handling Enclosures. There shall be lime-mixing facilities of lime dust.

5.17.d.4. Drainage and Filtrate Disposal. Drainage from beds or filtrate from dewatering units shall return to the sewage treatment process at appropriate points.

5.17.d.5. Other Dewatering Facilities. If proposing to dewater or dispose of sludge by other methods, a detailed description of the process and design data shall accompany the plans.

5.18. Sewage Sludge, Disposal Methods. When considering sewage sludge disposal methods, such as incineration and landfill, an applicant shall follow appropriate requirements of the solid waste regulations.

5.19. Land Application of Sewage Effluent.

5.19.a. General. Land application shall not be considered as a treatment process, but only a means of disposing of sewage effluent that received secondary treatment. For public health reasons, this rule shall not permit land disposal of effluent that received primary treatment.

5.19.b. Preliminary Considerations.

5.19.b.1. Land application installations are normally used where the waste contains pollutants that can successfully be removed through distribution to the soil mantle. Removal of these pollutants may be through organic decomposition in the vegetation-soil complex and by absorptive, physical, and chemical reactions with earth materials. Preliminary considerations of a site for land application shall be the compatibility of the waste with the organic and earth materials and the percolation rates and exchange capacity of the soils. The land application of wastewater will eventually recharge the local groundwater. Therefore, the quality, direction and rate of movement, and local use of the groundwater, present and potential, are prime considerations in evaluating a proposed site.

5.19.b.2. It is essential to maintain an aerated zone of at least five (5) feet and preferably more, to provide good vegetation growth conditions and removal of nutrients. A groundwater mound will develop below a disposal site after it is in use. The major factors in design of ground disposal fields are topography, soils, geology, hydrology, weather, agriculture practice, adjacent land use and equipment selection and installation.

5.19.c. Site Plan and Report. The following shall be considerations and included in a site plan and report:

5.19.c.1. Location Maps. USGS topographic map of the area, a seven and one-half (7½) minute series where published, showing the location of the total property and proposed land application site; and West Virginia Division of Highways County Maps showing location of the total property.

5.19.c.2. Plan. A topographic map of the entire property at a workable scale showing all buildings, land application area, area of possible expansion, roads, direction of groundwater flow, active and abandoned wells, public water supplies, groundwater monitoring wells, streams, wooded areas, fences or other barriers, visible geologic formations such as

sinkholes and rock outcrops, ponds, and all structures, wells and ponds on adjacent property within two thousand (2000) feet of the boundaries of proposed disposal area.

5.19.c.3. Soil Map. A soil map shall be furnished showing soil types within the land application site. An applicant may incorporate this information on the plan.

5.19.c.4. Report.

5.19.c.4.A. Geology of Site. This includes formations, rock types, degree of weathering of bedrock, local bedrock structure, character and thickness of surficial deposits, solution openings and sinkholes or limestone areas.

5.19.c.4.B. Hydrology of Site. This means the depth to seasonal high water table and test well data including chemical and bacterial analysis for groundwater quality and depth of well.

5.19.c.4.C. Soils at Site. Cation exchange capacity of the soils, soil types and characteristics, detailed chemical analysis of the soils and thickness of the soils.

5.19.c.4.D. Climatological Data at Site. This includes daily rainfall and daily temperature.

5.19.c.4.E. Agricultural Practices at Site. This includes the present and intended soil-crop management practices, kinds of crops to be grown, harvesting frequency and ultimate use of crop.

5.19.c.4.F. Effluent Characteristics. This is the detailed chemical analysis of effluent to dispose.

5.19.c.4.G. Rate and Frequency of Application. This includes all calculations relating to nitrogen, cadmium and heavy metals and calculations for winter storage.

5.19.c.4.H. Management Practices. These include types of equipment for transport and application; supervision of site; contracts, land easements, land leases, land purchases, monitoring procedures, and emergency procedures in the event of plant or equipment breakdown.

5.19.d. Design.

5.19.d.1. Effluent Requirements. Secondary treatment shall be a requirement (30 mg/1 of BOD₅ and 30 mg/1 of suspended solids). Disinfection shall be a requirement with disinfection occurring after secondary treatment.

5.19.d.2. Holding Pond. There shall be a minimum ninety (90) day

storage to store all flow during periods when disposal cannot occur. All storage shall be above a fixed water level to prevent complete draining of the pond. A two (2) foot residual water depth is a requirement to prevent growth of vegetation.

5.19.d.3. Application Rates. The maximum application rates in terms of depth of effluent are: one-fourth ($1/4$) inch per hour; one-half ($1/2$) inch per day; two (2) inches per week. The above are maximum rates and lower application rates may be necessary in some areas due to soil characteristics.

5.19.d.4. Slopes. There shall be a limit on cultivated fields to four percent (4%) or less. The limit of slope on sodded fields shall be to eight percent (8%) or less. The limit on forested slopes shall be eight percent (8%) for year-round operation but for seasonal operation fourteen percent (14%) slopes may be acceptable.

5.19.d.5. Runoff. The design of the system shall be to prevent surface runoff from entering or leaving the project site.

5.19.d.6. Fencing. A fence at least six (6) feet high or a locked entrance gate shall enclose the irrigated area to keep out children and domestic animals.

5.19.d.7. Warning Signs. Appropriate signs shall be posted along the fence around the project boundaries to designate the nature of the facility and advise against trespassing.

5.19.e. Spray Irrigation.

5.19.e.1. Piping to Sprinklers. The arrangement of the piping shall be to allow the irrigation pattern to be varied easily. For a permanent system, facilities shall be designed to allow complete drainage of the pipes to prevent pollution and freezing, and to provide an even distribution over the entire field.

5.19.e.2. Pump Station. There shall be duplicate pumps for delivery to the spray field, with the capacity of each pump sized to handle maximum rate of flow, plus an allowance to deplete stored volumes. The pump station shall have a metering device that will show the total flow and rates to the irrigation field. The top of the disinfection facility and the wet well of the pumping station shall be at least as high as the maximum holding pond surface elevation, to prevent flooding of the units when the spray irrigation equipment is not in operation. A control valve between the holding pond and the spray irrigation pump station is required.

5.19.e.3. Buffer Zone. Sprinklers shall be located to give a non-irrigated buffer zone around the irrigated area, and the design of the buffer zone shall consider wind transport of the wastewaters. A fence shall be placed at least fifty (50) feet beyond the normal projected spray area. A minimum of three hundred fifty (350) feet from the fence of the enclosed irrigated area to the property lines of adjacent areas or highways is required, unless there are:

5.19.e.3.A. Low sprays to reduce wind transport of the effluent; or

5.19.e.3.B. Physical buffers, such as trees, along with low sprays.

5.19.f. Ridge and Furrow.

5.19.f.1. Slopes. The construction of furrows may be down slope on sites up to one percent (1%). The construction of furrows shall be at right angles to the slope on sites up to eight percent (8%).

5.19.f.2. Construction. Furrows shall be no more than one thousand (1,000) feet in length and spaced from twenty (20) to forty (40) inches apart.

5.19.g. Overland Flow.

5.19.g.1. Slopes. Slopes shall range from two percent (2%) to eight percent (8%). Lengths of slopes shall range from one hundred and fifty (150) to three hundred (300) feet.

5.19.g.2. Construction. Slopes may be flooded or application made by gated pipe or spray.

5.19.h. Monitoring and Reporting. A minimum of one (1) drilled groundwater monitoring well shall be in each dominant direction of groundwater movement, and between the project site and public well(s) or high capacity private wells, there shall be a provision for sampling at the surface of the water table and at five (5) feet below the water table at each monitoring site. The Commissioner shall approve the location and construction of the monitoring well(s) before construction. These may include one (1) or more of the test wells where appropriate. If crops are used for animal or human consumption, analysis of the crop shall be required at harvest. The Commissioner shall determine frequency of reporting on a case-by-case basis, based on site characteristics.

§64-47-6. Individual Sewage Systems.

6.1. General. The design standards apply to the site requirements, design, construction, and maintenance of individual sewage treatment systems including septic tank soil absorption systems with standard soil absorption fields; serial distribution soil absorption fields; soil absorption beds; shallow soil absorption fields; mound systems; home aeration units; effluent disposal ponds; composting toilets; grey water disposal systems; holding tanks; privies; recycle systems; and any other systems that provide waste treatment and disposal for individual dwellings and commercial establishments.

6.1.a. When applying for approval for systems using soil absorption or on-site ef-

fluent disposal, an applicant shall submit to the Commissioner one (1) copy of the completed application, the design data sheet, and the plan.

6.1.b. When applying for approval for systems using other methods of effluent disposal, an applicant shall submit to the Commissioner four (4) copies of the completed application, the design data sheet, and the plan.

6.2. General Site Requirements.

6.2.a. The location of an individual sewage system shall not be in a poorly drained or filled area, or in any area where seasonal flooding occurs, without the prior written approval of the Commissioner. There may be exceptions if the construction of the fill area has been in accordance with directions of the Commissioner, or if an applicant provided evidence to the Commissioner that the fill area is suitable and of acceptable composition.

6.2.b. No part of an individual sewage system location shall be within ten (10) feet of a building, foundation or property line.

6.2.c. No part of an individual sewage system location shall be within twenty-five (25) feet of a public water supply line, or within ten (10) feet of a private water supply line.

6.2.d. The Commissioner shall determine the distance between a septic tank, home aeration unit, vault privy, or other sewage tank, and a public water system well or water supply.

6.2.e. The location of a septic tank, home aeration unit, vault privy, or other sewage tank shall be at least fifty (50) feet from a private water well or groundwater supply.

6.2.f. The location of absorption fields, serial distribution systems, absorption beds, mound systems, and other soil absorption systems shall comply with the distances contained in Table 64-47-K. at the end of this rule.

6.2.g. Roof drains, foundation drains, sump pumps, surface drains, or similar drains shall not connect to an individual sewage system.

6.2.h. The location of a septic tank or other treatment unit or disposal field shall not be under area to be paved, parking lots, driving surfaces, or any type of structure.

6.2.i. There shall be a minimum of three (3) feet between any portion of a standard soil absorption system and seasonal groundwater bedrock, and any other impermeable layer.

6.2.j. There shall be no standard septic tank soil absorption system installed in soils where percolation test results show an average percolation time of less than five (5) minutes per inch.

6.3. Site Evaluation.

6.3.a. The evaluation of a site for the installation of a soil absorption system, including absorption fields, serial systems, absorption beds, and others, shall include but not be limited to, percolation test results and evaluation of soils in a six (6) foot excavation. Percolation tests shall be performed according to the following:

6.3.a.1. A minimum of four (4) test holes shall be placed at equal distances over the entire absorption field site. If the results of the tests are reasonably close, it shall be considered an average test result. If the tests results show extreme variations, it may be considered necessary to relocate the field in a more suitable area;

6.3.a.2. Holes shall be bored to the depth of the proposed soil absorption field from six (6) to eight (8) inches in diameter at the site where the installation of the soil-absorption field is to take place;

6.3.a.3. The bottom and sides of the hole shall be scratched with a sharp pointed instrument or wire brush to remove any smeared soil surfaces that interfere with the absorption of water into the soil;

6.3.a.4. The loose dirt shall be removed from the bottom of the test holes and two (2) inches of gravel shall be placed into the holes to prevent sealing;

6.3.a.5. A nail or a marked measuring device shall be placed in the wall of each hole exactly six (6) inches above the level of the gravel;

6.3.a.6. The test hole shall be completely filled with water to ground level and maintained to a depth of at least twelve (12) inches for a minimum period of four (4) hours before beginning the percolation rate measurement.

6.3.b. Percolation Rate Measurement. After completing the requirements in Paragraph 6.3.a.1. - 6.3.a.6., the water depth shall be adjusted in the holes to the six (6) inch level. Determine how many minutes it takes for all of the water to absorb into the soil. The resulting time in minutes, divided by six (6), will be the rate of fall or absorption per inch.

6.3.b.1. The average rate of fall for all test holes will be determined by adding the rate of fall for each test hole together and dividing by the number of test holes. This figure is the average rate of fall per inch. See Table 64-47-L at the end of this rule.

6.3.b.2. If desired, an applicant may use an alternate test, if approved by the local health department.

6.3.b.3. Observation Hole. A hole shall be excavated six (6) feet deep in

the center of the proposed soil absorption system area to evaluate the soil depth to bedrock and the seasonal water table. If slopes at the proposed site exceed fifteen percent (15%), the excavated observation hole shall be placed at the location of the lowest proposed trench of the system. Additional observation holes may be required when there are extreme variations in soil or geology in the test area.

6.3.b.4. Six (6) feet deep slit trenches of a specified length may be required in limestone geology to determine depth to bedrock.

6.4. Septic Tanks.

6.4.a. Liquid capacities for tanks serving single-family dwellings shall be in accordance with the following:

Number of Bedrooms	Minimum Tank Capacity (gallons)
4 or less	1000
Each additional bedroom	250 gallons each

6.4.b. When using a dual compartment tank or dual tanks, the volume ratio of the first compartment or tank to the second compartment or tank shall approximate two (2) to one (1). In a dual compartment tank, the connection between compartments shall be an elbow with a minimum diameter of four (4) inches, placed so that the invert at the partition is approximately sixteen (16) inches below the liquid level.

6.4.c. The construction of septic tanks may be of reinforced concrete, fiberglass or other watertight and durable materials approved by the Commissioner. All tanks shall meet the general requirements of Subdivision 6.4.g. of this rule, regardless of construction material. Septic tank construction shall comply with the following:

6.4.c.1. Precast Concrete Septic Tanks. Concrete used shall consist of at least six (6) bags of cement per yard of concrete mix or the equivalent, with a minimum compressive strength of four thousand (4000) pounds per square inch based on a twenty-eight (28) day compression test. Reinforcement shall be at least six (6) inch by six (6) inch mesh number ten (10) welded wire fabric or the equivalent. Aggregate used in the concrete shall be no larger than one (1) inch in size. There shall be vibrated concrete to minimize honey-combing. The sidewalls of the tanks shall be at least two and one-half (2½) inches in thickness. The top and bottom shall have a minimum thickness of four (4) inches.

6.4.d. The manufacturers of concrete septic tanks shall obtain approval from the Commissioner for the construction of and compliance with the Design Standards.

6.4.e. Metal Septic Tanks. Metal septic tanks shall not be approved due to their potential to leak into ground water.

6.4.f. Plastic and Fiberglass Tanks. The Commissioner shall approve plastic and fiberglass tanks.

6.4.g. General requirements for tanks shall be as follows:

6.4.g.1. The invert of the inlet pipe shall be a minimum of two (2) inches above the invert of the outlet pipe.

6.4.g.2. Inlets and outlets shall be a minimum of four (4) inches in diameter and equipped with a flexible watertight seal.

6.4.g.3. The inlet shall equip a cast-in-place or inserted baffle or a sanitary tee. The inlet baffle or sanitary tee shall extend to a minimum depth of six (6) inches, but to no more than twenty percent (20%) of the liquid depth.

6.4.g.4. The outlet shall equip a cast-in-place or inserted baffle or sanitary tee. The effluent baffle shall extend to at least thirty-five percent (35%) of the liquid depth, but to no more than forty percent (40%) of the liquid depth.

6.4.g.5. The top of the inlet and outlet baffles or tees shall extend at least six (6) inches above the flow line.

6.4.g.6. Minimum liquid depth shall be thirty (30) inches.

6.4.g.7 There shall be a minimum of nine (9) inches clearance above the liquid level.

6.4.g.8. The top of the tank, above the outlet, shall have embossing, imprinting, stenciling or other form of marking in an indelible and legible manner with the manufacturer's name, the liquid capacity and date of manufacture.

6.4.g.9. Access. There shall be adequate access to each compartment of the tank for inspection and cleaning. Both the inlet and outlet devices shall be accessible. When installing a septic tank at a depth greater than twelve (12) inches below grade, it shall be required to install an extended manhole riser to within twelve (12) inches of final grade.

6.4.g.10. All septic tanks shall have a four (4) inch gas tight inspection port that extends to the surface of the ground to measure sludge and scum accumulations.

6.5. The Standard Soil Absorption System.

6.5.a. The pipe for gravity distribution systems shall have a minimum diameter of four (4) inches. Pressure distribution systems may use smaller size pipe.

6.5.b. Pipe used in the construction of soil absorption fields shall conform to the ASTM Standards for wastewater piping. This includes, but is not limited to:

6.5.c. Plastic pipe ASTM - D 2729, D 2852, D 3350, D 2751, D 2836, D 3033, D 3034, D 3298, F 789.

6.5.d. The septic tank inlet and outlet piping shall be schedule forty (40) or the equivalent. This pipe shall span the tank hole excavation and rest on a minimum of two (2) feet of undisturbed soil.

6.5.e. Perforated pipe used in the construction of soil absorption systems shall have a minimum of two (2) rows of downward facing holes approximately ninety (90) degrees apart.

6.5.f. Aggregate used in the construction of a soil absorption field shall be washed gravel, crushed stone, or slag, one-half ($\frac{1}{2}$) to two and one-half ($2\frac{1}{2}$) inches in size, with a hardness of three (3) on the Moh scale of hardness. The field test for hardness is that the aggregate shall scratch a copper penny without leaving a residue.

6.5.g. The installation of graveless soil absorption systems shall be in accordance with manufacturers' specifications as approved by the Commissioner.

6.5.h. The construction of the standard soil absorption field with either level or sloping topography shall be in accordance with the following specifications:

6.5.h.1. The trenches shall be one (1) to three (3) feet wide with a maximum depth of thirty-six (36) inches and a minimum depth of eighteen (18) inches.

6.5.h.2. If distribution lines of greater than one hundred (100) feet are necessary, the connection of the inlet line shall be so that the lengths on either side of the connection shall not exceed one hundred (100) feet each. Absorption fields dosed by a pump or dosing siphon may utilize trenches of greater length, if reviewed and approved by the Commissioner.

6.5.h.3. There shall be a minimum of six (6) inches of aggregate placed in the bottom of the trench beneath the pipe, and a minimum of two (2) inches placed above the pipe.

6.5.h.4. The construction of the bottom of each trench and its distribution line shall be level. The construction of trenches shall be consistent with the topography and in such a manner so as to minimize the compaction or smearing of the sides and bottoms. Construction of the trenches shall not take place if the soil is so wet that it forms a "wire" instead of breaking apart when rolled between the hands. Construction shall not take place during rain or inclement weather that may interfere with or preclude correct construction procedures.

6.5.h.5. The surface of the aggregate shall have a cover of a minimum of three (3) inches of straw or hay, or one (1) layer of untreated building paper or filter fabric prior to backfilling.

6.5.h.6. There shall be a minimum of six (6) feet of undisturbed earth between the sidewalls of each trench. Additional separation may be a requirement in areas of severe topography and poor soil characteristics to avoid interaction between the trenches.

6.5.h.7. The design of soil absorption fields constructed in flat areas shall be to provide a closed continuous system or closed circuit design.

6.5.h.8. Performing the backfilling of the absorption field shall be in such a manner as to minimize compaction. There shall be a mound of backfill over the system to allow for settling and to promote run-off from the system. There shall be no grading to the absorption field construction area after backfilling. There shall be no backfilling if the ground is frozen.

6.5.h.9. The sewer line from the structure to the septic tank shall lay on a grade of not less than one-eighth ($1/8$) of an inch per foot (1%).

6.5.h.10. The installation of the absorption field shall be so that the invert of the absorption field piping is a minimum of eight (8) inches lower than the invert of the sewage tank outlet.

6.5.h.11. The construction of the standard soil absorption field in areas of sloping topography shall be in accordance with the following specifications:

6.5.h.11.A. Soil absorption fields constructed on sloping ground shall use a serial distribution system. This rule recommends the use of drop boxes;

6.5.h.11.B. The construction of soil absorption systems shall not be on ground with a slope in excess of twenty-five percent (25%);

6.5.h.11.C. The bottom of each trench and its distribution line shall be level;

6.5.h.11.D. There shall be a minimum of six (6) inches of ground cover over the gravel fill in each trench; and

6.5.h.11.E. The absorption trenches shall follow the approximate ground surface contours to minimize variation in trench depth.

6.5.h.12. Adjacent trenches shall connect with a relief line, cross over, or drop box arrangement in such a manner that each trench is completely filled with septic tank

effluent to the full depth of the gravel before effluent flows to succeeding trenches. The construction of the relief line, cross-over, or drop box arrangement shall incorporate the following requirements:

6.5.h.12.A. The relief line or crossover shall be a solid four (4) inch sewer line with tight joints and with direct connection to the distribution lines or a drop box installation.

6.5.h.12.B. The construction of relief lines, cross-overs, and drop boxes shall not be in any location or manner where they will be subject to damage during or following construction. An applicant shall mark the location of these relief lines, cross-overs, or drop boxes prior to backfilling to avoid damage from heavy equipment. The line shall rest on undisturbed earth with care given to carefully tamping the backfill.

6.5.h.12.C. The trench for the relief pipe or cross-over shall be no deeper than the top of the gravel of the trenches being connected. The line shall rest on undisturbed earth with care given to carefully tamping the backfill. An applicant shall exercise care in construction of the relief or cross-over line to insure that an undisturbed block of earth remains between the trenches.

6.5.h.12.D. The invert of the overflow pipe in the first relief or cross-over line should be at least two (2) inches lower than the invert of the septic tank outlet.

6.5.i. When servicing a structure other than a single-family dwelling, there shall be a reservation of land for the construction of two (2) standard soil-absorptions fields, each of adequate size to serve the proposed structure.

6.5.j. If the soil absorption field is greater than one thousand five hundred (1500) square feet in area, a siphon chamber or pump chamber may be required by the Commissioner to ensure even distribution of effluent.

6.5.k. Absorption fields over three thousand (3,000) square feet in total area shall include some form of dosing.

6.5.l. When a total field area over five thousand (5,000) square feet is necessary, the field shall be split into two (2) or more fields of approximately equal size.

6.6. Absorption Beds.

6.6.a. The construction of absorption beds shall only be when topography or space limitations prevent installation of a standard absorption field.

6.6.b. The size of absorption beds shall be to provide an area thirty percent (30%) greater than that calculated for a standard absorption field to make up for sidewall loss.

6.6.c. The installation of the piping distribution network within the bed shall be in such a manner that the location of the pipes are eighteen (18) to thirty-six (36) inches from the sides of the bed with a minimum of three (3) feet between pipes and a maximum of six (6) feet between pipes in a continuous or closed circuit design. Construction of the bed shall be in accordance with the general design and construction requirements of the standard absorption field.

6.6.d. Maximum depth of an absorption bed shall be thirty-six (36) inches, minimum depth shall be eighteen (18) inches.

6.7. Dual Soil Absorption Fields.

6.7.a. Use of dual absorption fields may receive approval if percolation rates are between sixty (60) minutes and ninety (90) minutes per inch.

6.7.b. Area reserved for absorption shall provide sufficient area for the replacement of dual soil absorption fields.

6.7.c. Construction of the dual absorption fields shall be in accordance with the dosing requirements of the standard soil absorption system, with a junction box or valving arrangement to provide for alternation of the fields. The size of each of the fields shall be in accordance with the percolation test results. Both fields shall be of the maximum sizing required for a sixty (60) minutes per inch rate.

6.8. Shallow and Elevated Soil Absorption Systems.

6.8.a. Due to the shallowness of many West Virginia soils, a soil absorption system will often have to be shallow or the elevation shall be above the original ground surface to maintain the minimum distance above the seasonal high water table, rock table, or impermeable soil layer. The construction of a shallow or elevated system is permissible where there is a suitable layer of soil, sufficient room, and the natural slope is not excessive. Shallow and elevated soil absorption systems presently approved for use are: shallow fields, shallow beds, elevated fields and unique systems designed for specific situations. Shallow systems are similar to the standard absorption field and they may receive consideration for new residences.

6.8.b. Use of shallow and elevated systems using gravity distribution may receive approval under conditions where pervious rock table, an impermeable layer of any type, or seasonal water table is less than four and one-half (4½) feet of the ground surface, on either level topography or sites of up to approximately fifteen percent (15%) slope. When additional treatment precedes shallow or elevated fields, or designed as low pressure distribution systems, the Commissioner may waive the separation distance to an impermeable layer, or seasonal water table from three (3) feet to two (2) feet. Due to a potential for groundwater contamination, the depth to pervious rock table shall not be less than three (3) feet from any portion of the soil absorption system. Slope limitations of fifteen percent (15%) do not apply to low pressure

systems.

6.9. Shallow Field..

6.9.a. The construction of shallow systems shall in general be in accordance with the procedures and requirements for standard absorption fields. However, the depth of the trenches in natural ground may vary from twelve (12) to eighteen (18) inches. The space between trenches may vary from six (6) to twelve (12) feet, and the depth of cover material may vary from six (6) to twelve (12) inches, depending on the trench depth.

6.9.b. There shall be cover material placed prior to the construction of the trench system.

6.9.c. Topography of the site may be level, less than three percent (3%) slope, or up to fifteen (15) percent slope if using a serial type distribution system.

6.9.d. The percolation rate for design considerations shall be the rate recorded for the natural soil at installation depth.

6.9.e. Elevated Systems are systems installed at a depth of six (6) inches into the original ground and have a portion of the gravel or distribution piping in select fill above the original ground. All applicable provisions of Subsection 6.2 of this rule apply to elevated systems.

6.10. Individual Sewage Systems with Surface Water Discharge.

6.10.a. Individual systems with surface water discharge may receive consideration for approval under the following conditions:

6.10.a.1. To correct existing failures when other means of treatment and disposal have proven ineffective; and

6.10.a.2. On lots greater than two (2) acres in size that cannot qualify for standard or shallow soil absorption systems. All mechanical systems with surface water discharge shall have a perpetual maintenance agreement as approved by the Commissioner.

6.11. Individual Home Aeration Units.

6.11.a. Individual home aeration units shall be used only when there is a provision for additional treatment, such as soil absorption or other means of effluent disposal approved by the Commissioner. The Commissioner may require ownership, operation, and maintenance of a home aeration unit to be under the control of a public or private utility regulated by the Public Service Commission.

6.11.b. Individual home aeration units shall bear the NSF seal demonstrating conformance with NSF Standard 40 or other recognized testing agency approved by the Commissioner.

6.11.c. Individual home aeration units may receive approval providing an applicant meets the following criteria:

6.11.c.1. Shall have a perpetual maintenance agreement approved by the Commissioner;

6.11.c.2. May use Class I NSF plants or equivalent where there is surface water discharge; and

6.11.c.3. May use Class II NSF plants or equivalent where there is a provision for additional treatment.

6.12 Intermittent Surface Sand Filters.

6.12.a. Effluent from a home aeration unit may discharge to intermittent surface sand filters.

6.12.b. Effluent from a surface sand filter may discharge to a stream after disinfection in accordance with the regulations and requirements pertaining to surface discharge of waste water.

6.12.c. The design of intermittent surface sand filters preceded by a home aeration unit shall be on a filtration rate of ten (10) gallons per day per square foot. There shall be two (2) filters of design size to provide for alternation of operation.

6.12.d. Intermittent surface sand filters serving individual sewage systems shall have an insulated cover.

6.12.e. The intermittent surface sand filter shall receive dosing by either a pump or sewage siphon.

6.13. Composting Toilets.

6.13.a. Utilization of composting toilets may be only in conjunction with an approved grey water treatment and disposal system.

6.13.b. The design and construction of a composting toilet shall meet the requirements of NSF Standard 41.

6.14. Incinerating and Chemical Toilets.

6.14.a. Use of incinerating and chemical toilets may be only in conjunction with an approved grey water disposal system.

6.14.b. The design, construction, and application of incinerating or chemical toilets shall receive approval by the Commissioner. The use of chemical or incinerating toilets may receive approval by the Commissioner in emergency situations, temporary usage situations, or for recreational residences, or isolated residences.

6.15. Grey Water Disposal Systems.

6.15.a. Those houses served by a grey water disposal system shall have a house sewer of not more than two (2) inches in diameter.

6.15.b. Houses served by grey water disposal systems shall not have garbage disposal units connected to the grey water disposal system.

6.15.c. Manufactured grey water disposal systems shall receive approval by the Commissioner.

6.15.d. Non-commercial grey water disposal systems shall consist of the following:

6.15.d.1. A soil absorption field designed on the basis of a thirty percent (30%) reduction in water usage, and constructed in accordance with the design requirements for the standard soil absorption fields; and

6.15.d.2. A septic tank sized according to the following:

Number of Bedrooms	Minimum Capacity
4 or less	1000 gallons
5 or more	Add 250 gallons for each additional bedroom

6.16. Privies.

6.16.a. Every privy shall equip:

6.16.a.1. An earthen bottom pit or a watertight vault or other watertight receptacle with walls extending at least six (6) inches above ground level.

6.16.a.2. A crowned curb constructed of compacted earth or other suitable material, at least six (6) inches thick, extending from the top of the walls of the pit, vault, or receptacle, in all directions over the surface of the ground for a distance of eighteen (18) inches.

6.16.a.3. A riser that is fly tight when not in use.

6.16.a.4. There shall be an enclosed superstructure constructed with a vent pipe extending from the pit, vault, or receptacle to a point at least twenty-four (24) inches above the roof of the of the superstructure or through the wall of the superstructure. The vent shall have a screen to prevent the entrance of flies and other insects.

6.16.a.5. Privy pits may have an earthen bottom if:

6.16.a.5.A. The location of the privy is below and one hundred (100) feet or more from a groundwater supply or individual well, and its location is so that the disposal of any leaching from there is in a manner that does not create a nuisance or insanitary condition.

6.16.a.5.B. The pit is four (4) feet or less in depth and determined by the excavation of a seven (7) foot hole that rock or water table does not exist within three (3) feet of the bottom of the pit.

6.16.a.6. There shall be no privy located within twenty (20) feet of any dwelling, roadside cut, stream, establishment, or within ten (10) feet of any property line.

6.16.a.7. The construction and design of the privy superstructure, vault, pit or other type receptacle shall be such as to prevent access to the vault or receptacle and the contents thereof, by flies, rats, and wild or domestic animals.

6.16.a.8. Privy vaults, pits or receptacles shall have the contents removed as often as necessary to prevent creating a nuisance or unsanitary condition.

6.16.a.9. There shall be an approved grey water disposal system installed to serve those residences with indoor plumbing or running water for sinks and showers. For those residences without indoor plumbing, there shall be a shallow leach trench installed for disposal of grey water as approved by the Commissioner.

6.17. Recirculating Toilets.

6.17.a. Recirculating toilets and the piping for the toilets shall be separate from and not connected to the potable water system of any residence or other structure under any circumstances. There shall be color coded pipe used to facilitate inspection and maintenance of the installations.

6.17.b. Recirculating toilets shall:

6.17.b.1. Be installed and operated in accordance with the manufacturer's instructions; and

6.17.b.2. Be approved by the Commissioner before installation.

6.18. Self-Contained Excreta Disposal Systems.

6.18.a. The design of self-contained excreta disposal systems shall be so as to prevent flies, rats, and wild or domestic animals from having access to the contents thereof.

6.18.b. The construction of all fixtures, tanks, or receptacles shall be of impervious, easily cleanable material.

6.18.c. Tanks and receptacles shall:

6.18.c.1. Be watertight and vented to the outside air;

6.18.c.2. Be constantly supplied with sufficient amounts of an approved chemical agent to process and deodorize the contents thereof; and

6.18.c.3. Have the contents removed and the tank or receptacle thoroughly cleaned as often as necessary to prevent creating a nuisance, or an unsanitary condition.

6.19. Sewage Holding Tanks.

6.19.a. The approval of sewage holding tanks shall only be for new construction after a contract awarded for the development of a public or private sewage collection system or treatment facility, or both, to serve the proposed new construction.

6.19.b. A holding tank shall be watertight and constructed of the same materials and by the same procedures as a watertight septic tank.

6.19.c. The liquid capacity of the holding tank shall be sufficient to contain a one (1) week design flow from the facility it is to service.

6.19.d. The location of holding tanks shall be in an area readily accessible for pumping under all weather conditions and where accidental spillage during pumping presents the least hazard to public health.

6.19.e. The location of holding tanks shall be in accordance with the distance requirements established for septic tanks in Subsection 6.3 of this rule.

6.19.f. Construction and installation of the holding tank shall provide adequate access to the tank for pumping, cleaning and maintenance through manhole and cleanouts.

6.19.g. A holding tank installation shall equip an audiovisual high level alarm when the tank is approximately two-thirds (2/3) full and will require pumping shortly. The

location of the alarm shall be inside the facility served.

6.19.h. A contract with a licensed sewage tank cleaner with a valid permit for pumping and maintenance of the tank on a regular schedule shall be required.

6.19.i. A letter from a wastewater treatment plant owner accepting the pumpings shall be a requirement. This facility shall be approved by the Commissioner. There shall be an examination of the receiving wastewater treatment plant to ensure there will be adequate treatment, and there will be no effect on the normal operation of the wastewater treatment plant.

6.19.j. When it is necessary to protect the public health, the Commissioner reserves the right to require additional assurances before approving holding tanks.

6.20. Alternative and Experimental Sewer Systems.

6.20.a. The construction of alternative and experimental sewer systems may be where there is a suitable layer of soil, sufficient area and the natural slope is not excessive.

6.20.b. Alternative soil absorption systems presently approved for use are: shallow fields, soil absorption mounds, shallow beds, low pressure pipe systems, elevated fields, evapotranspiration systems and unique systems designed for specific situations.

6.20.c. Alternative soil absorption systems may receive consideration for new construction on lots two(2) acres and over providing soil and site limitations can be met.

6.21. Effluent Pumping for Individual Sewer Systems.

6.21.a. Pump type shall be non-clog submersible centrifugal effluent pumps or progressing cavity positive displacement pumps.

6.21.b. Pumps shall be readily removable and replaceable without dewatering the wet well.

6.21.c. The pump size should be to dose a soil absorption system two (2) to four (4) times a day. The recommended dosing cycle is twice a day, however, the dose shall be no more than seventy-five percent (75%) of the distribution pipe volume for all soil absorption systems using four (4) inch pipe.

6.21.d. The location of the pump shall be six (6) to eight (8) inches off the tank bottom to provide additional volume for sludge settlement.

6.21.e. The location of relays and electrical plug-ins or sockets shall not be inside the wet well or access manhole. The location of the devices must be above-ground in a weatherproof box or in the residence.

6.21.f. There shall be a high water alarm placed within the residence.

6.21.g. Pipe used for the distribution system, the force main, shall be PVC SDR 21, PVC SDR 26, or Schedule 40 1 1/4" to 2" diameter.

6.21.h. All parts of the distribution system, the manifold and laterals, shall slope slightly toward the inlet to avoid freezing and ponding of water in the system between dosing.

6.21.i. The installation of piping shall be below the frost line.

6.21.j. The wet well shall be watertight and constructed of materials that will not corrode.

6.21.k. The wet well shall have an access manhole of twenty four (24) inches or greater in diameter. The installation of the manhole shall be level with or above the ground surface and the cover secured.

6.21.l. The size of a wet well shall be to provide adequate volume not only for one day reserve capacity, but also for single dose capacity plus additional capacity to maintain minimum depth for operation.

6.21.m. The wet well tank shall be set lower than the septic tank to provide usage of maximum capacity of the wet well.

§64-47-7. Septage Treatment And Disposal.

7.1. Public Sewage Treatment Plant.

7.1.a. The owner and operator of the public sewage treatment plant shall grant written permission for disposal of septage to the septage hauler.

7.1.b. The disposal of septage shall not be in a public sewage treatment plant treating less than one hundred thousand (100,000) gallons per day, unless providing pre-treatment.

7.2. Lagoons.

7.2.a. The soil conditions shall be such that a minimum of four (4) feet of soil exists between the bottom of the lagoon and the high groundwater table and rock table for permeable soils and a minimum of two (2) feet of soil exists between the bottom of the lagoon and the high groundwater table and rock table for impermeable clay soils.

7.2.b. The lagoon site shall be free of rock outcroppings and shall be out of the

twenty-five (25) year flood plain.

7.2.c. All surface water shall be diverted from the lagoon and there is to be no discharge from the lagoon.

7.2.d. Maximum depth of the lagoon shall be no greater than six (6) feet with one (1) foot freeboard.

7.2.e. Inside and outside slopes shall be no greater than three (3) to one (1) unless proposing some type of side reinforcement, for example: rip-rap.

7.2.f. A six (6) foot high fence with a locked entrance gate shall enclose the lagoon or made inaccessible to the public through location or other means.

7.2.g. The location of the lagoon shall not be within one thousand (1,000) feet of any existing occupied buildings.

7.2.h. Disposal lagoons require placement of septage in small incremental lifts six (6) to twelve (12) inches and sequential loading of another lagoon or lagoons for optimum drying. Therefore, this rule requires a minimum of two (2) lagoons.

7.2.i. Two (2) feet of soil shall be placed as a final cover when septage fills the lagoon, and it is no longer usable.

7.2.j. If re-using the lagoon is an option, it is required to retain the septage for a minimum of ninety (90) days after discharging the last load.

7.2.k. After the minimum ninety (90) day storage in the lagoons, an applicant may land dispose the septage either by landfilling or land spreading.

7.2.l. There shall be immediate covering of lagoon contents after landfilling or land spreading.

7.2.m. Land spreading of lagoon contents on fields used for growing crops for human or animal consumption is generally not recommended due to the potentially highly infectious nature of the waste. However, fields used for land spreading may be useful for animal forage crops provided the fields are fallow for a minimum of six (6) months after the last application and prior to the first plantings of the forage crops.

7.3. Lime Stabilization.

7.3.a. The addition of lime in sufficient quantities will stabilize septage and destroy pathogenic organisms. There is no destruction of organic matter or solids reduction during the lime stabilization process.

7.3.b. The mixing together of the septage and lime shall take place until reaching a pH greater than twelve (12).

7.3.c. The mixture shall maintain a pH greater than twelve (12) for a minimum of two (2) hours.

7.3.d. Achieving the mixing process shall be through diffused air mixing or by mechanical mixers.

7.3.e. When land disposing the mixture, an applicant shall follow the requirements outlined in Subsections 7.2.l. and 7.2.m. of this rule.

7.4. Other Methods.

7.4.a. Other methods of septage treatment and disposal are composting, pressure chlorination, electron treatment, incineration and conventional waste treatment. The Commissioner shall review these methods of septage treatment and disposal on a case by case basis.

§64-47-8. Animal Waste Handling Facilities.

8.1. General. The design and construction of animal waste handling facilities shall be in accordance with the current issue of the US Department of Agriculture Soil Conservation Service, Agriculture Waste Management Field Manual.

§64-47-9. Grease Traps.

9.1. There shall be grease traps for all restaurants and similar establishments where a large quantity of grease and fats in liquid wastes will occur.

9.2. The location of the external grease trap shall be within thirty (30) feet from the fixtures served. If meeting this distance requirement is not possible and thus, external grease traps are not possible due to existing conditions or physical limitations, the Commissioner may allow internal grease traps.

9.3. Only those plumbing fixtures into which the grease and fats are discharging shall connect to the grease trap.

9.4. The external grease trap shall be a minimum one hundred fifty (150) gallons capacity. Larger grease traps may be a requirement depending upon the loading.

9.5. The external grease trap shall be in an easily accessible place outside the building served.

§64-47-10. Administrative Due Process.

Those persons adversely affected by the enforcement of this rule desiring a contested case hearing to determine any rights, duties, interests or privileges shall do so in a manner prescribed in the Rules of Procedure for Contested Case Hearings and Declaratory Rulings, 64 CSR 1.

§64-47-11. Enforcement.

This rule is enforced under W. Va. Code §§ 16-1-6, -9, -17, -18 and other applicable Code provisions.

TABLE 16-47-A.- APPLICATION PACKAGES

Package	Type of System
A	Collection System Only
B	Collection and Treatment System (100,000 gallons per day or less
C	Collection and Treatment System (100,000 gallons per day or greater
D	Individual on-site Sewage Collection and Treatment System
E	Subdivision Using Individual Sewage Disposal Systems
F	Mobile Home Parks

TABLE 64-47-B.- MINIMUM DESIGN LOADINGS FOR SEWAGE TREATMENT FACILITIES

Facility Description	Unit Sewage Design Flow (gpd)	Unit Five-Day BOD (lbs/day)
Airports		
Each employee	15	.05
Each passenger	5	.02
Assembly Halls		
Per seat	2	.02
Bowling Alleys (No Food Service)		
Per Alley	75	.13
Per Alley with Bar	225	
Churches		
Per Member with Kitchen	5	.02
Per Member without Kitchen	2	.01
Clinics		
Per Staff	20	.03
Per Patient	5	.02
Country Clubs		
Per Member (non-resident)	25	.05
Per Member (resident)	70	.17
Domestic Sewage		
Residences (per resident -a-)		
New Collection System	70	.17*
Summer Cottages, etc., per resident	50	.17
Apartment Houses--one bedroom	140	.34
--two	210	.51
--three	280	.60
Factories (per worker)		
Heavy with cafe and shower	35	.04
Light with cafe	25	.02
Light with shower	25	.02
Light	20	.02

Facility Description	Unit Sewage Design Flow (gpd)	Unit Five-Day BOD (lbs/day)
Hospitals		
Each patient (bedside)	300	.34
Each resident staff	100	.17
Each non-resident staff	20	.02
Hotels, Boarding Houses (Exclusive of restaurants, bars) per guest	50	.15
Industrial Park (Sanitary Waste Only) Per developable acre	500	.84
Institutions Per resident	70	.17
Laundry (coin operated) Per machine	400	1.34
Labor Camps Per person	50	
Mine Bath Houses Per worker	15	.03
Mobile Homes Per mobile home	280	.68
Motels (Exclusive or restaurant or bar) Per unit	80	.15
Nursing and Rest Homes		
Per resident	150	.26
Per resident staff	70	.17
Offices and Warehouses		
Per workers, no food service	20	.03
Add for food service, per worker	5	.01

Facility Description	Unit Sewage Design Flow (gpd)	Unit Five-Day BOD (lbs/day)
Recreation		
Parks, picnic areas, and beach areas	10	.02
Campground, per person	25	.05
Amphitheater, per person	5	.01
Historical site, per person	5	.01
Lodges, per person	70	.17
Park Residences, per person	70	.17
Park Washhouse, per person	30	.05
Restaurants		
24 hour service, per seat	50	.17
Ordinary, not 24 hour service, per seat	30	.10
Curb service (drive-in), per car space	50	.17
Fast food (single service), per seat	25	.06
Schools		
Elementary, each staff or student	8	.02
High school, each staff or student	10	.03
Boarding school	70	.17
Service stations		
Ordinary, not 24 hour service	500	.80
24 hour service	1000	1.60
Shopping mall per 100 sq.ft.	15	.03
Shopping Center Based on individual store occupancy		
Swimming Pools		
Per swimmer	5	.01
Add for shower facilities, per swimmer	2	.01
Taverns and Bars, Little or no food service		
Per seat	20	.04
Theaters		
Drive-in, per car space	4	.008
Movie, per seat	2	.004
Travel Trailer Park (b)		
No water to site, per person	35	.075
Water to site, per person	50	.10

Facility Description	Unit Sewage Design Flow (gpd)	Unit Five-Day BOD (lbs/day)
Disco/Dance Halls, per seat	5	.01
Beauty Parlors/Barber Shops		
Per chair	150	.50
Per operator	20	.02
Dentist		
Per chair	200	.10
Per staff	20	.02
Doctor		
Per patient	5	.01
Per staff	20	.02
(a) Assume four persons per residence (b) Assume three persons per travel trailer site *See Subsections 5.1.d.3., 5.1.d.4., 5.1.d.5. (NOTE 1: These factors do not apply to the design of municipal sewage systems. Refer to Subsection 6.1. for design loadings for municipal sewage systems.) (NOTE 2: If proposed facilities are not listed in the table above, and average daily water usage data is available, a <u>peaking</u> factor of 2.5 will be required.)		

TABLE 64-47-C.- MINIMUM SLOPES FOR SANITARY SEWERS

Sewer Size	Minimum Slope in feet per 100 feet
6"	0.62
8"	0.40
10"	0.28
12"	0.22
14"	0.17
15"	0.15
16"	0.14
18"	0.12
21"	0.10
24"	0.08
27" and larger	0.07

TABLE 64-47-D.- SPARE PUMPS FOR PRESSURE SEWER SYSTEMS

Installed Units	Spare Units
1 to 10	1
11 to 20	2
21 to 30	3
31 to 40	4
41 to 50	5
51 to 75	6
76 to 100	7
101 to 150	8
151 to 200	9
201 to 300	10
301 to 400	11
401 to 500	12
501 - up	As approved by the Commissioner.

TABLE 64-47-E.- BUFFER ZONE REQUIREMENTS FOR SEWAGE TREATMENT WORKS

Treatment Facilities	Buffer Zone Requirements (feet)
Sewage Treatments Plants:	
40,000 GPD or less	100
40,001 - 100,000 GPD	200
greater than 100,000 GPD	300
Other Treatment Facilities:	
Polishing Ponds	100
Package Sand Filters	100
Alternating Surface Sand Filters	100
TKN Removal Equipment	100
Aerated Lagoons	100
Constructed Wetlands	100
Recirculating Sand Filter Systems	100
Stabilization Ponds	300
Trickling Filters	300
Land Treatment Systems	300
These requirements DO NOT APPLY to existing treatment works that are being upgraded or expanded.	

TABLE 64-47-F.- WASTEWATER TREATMENT PLANT LINE COLOR CODE

Type of Line	Color
Sludge line	Brown
Gas line	Orange
Potable water line	Blue
Chlorine line	Yellow
Sewage line	Gray
Compressed air line	Green
Water lines for heating digesters or buildings	Blue with 6 inch red bands spaced 30 inches apart

TABLE 64-47-G.- PERMISSIBLE AERATION TANK CAPACITIES AND LOADINGS

Process	Aeration Tank Organic Loading--lb.BOD5/day per 1000 cu. ft.	F/M Ratio lb.BOD5/day per lb.MLVSS	MLSS* mg/litter
Conventional Step Aeration Complete Mix	40	0.2-0.5	1000-3000
Contact Stabilization	50**	0.2-0.6	1000-3000
Extended Aeration 3000-5000 Oxidation Ditch	15	0.05-0.1	
*MLSS values are dependent upon the surface area provided for sedimentation and the rate of sludge return as well as the aeration process.			
**Total aeration capacity, includes both contact and reaeration capacities. Normally the contact zone equals 30 to 35% of the total aeration capacity.			

TABLE 64-47-H.- WASTEWATER TREATMENT PLANT MINIMUM AIR REQUIREMENTS

Process	Cubic Feet of Air Available Per lb. of BOD5 Load in Aeration Tank
Conventional	1500
Step Aeration	1500
Contact Stabilization	1500
Modified or "High-Rate"	400 to 1500 (depending on BOD5 removal expected)
Extended Aeration	2600

TABLE 64-47-I.- RETURN SLUDGE RATE

	Minimum	Maximum
Standard Rate	15	75
Carbonaceous State of Separate Stage Nitrification	15	75
Step Aeration	15	75
Contact Stabilization	50	150
Extended Aeration	50	150
Nitrification Stage of Separate Stage Nitrification	50	200

TABLE 64-47-J.- MEDIA SIZE/GRADING

Passing 4½-inch screen	100% by weight
Retained on 3-inch screen	95-100% by weight
Passing 2-inch screen	0-2% by weight
Passing 1-inch screen	0-1% by weight

TABLE 64-47-K.- MINIMUM HORIZONTAL SEPARATION DISTANCES BETWEEN SOIL ABSORPTION SYSTEMS AND NATURAL AND MANMADE FEATURES

Distance	Feature
10 feet	Foundation drain upslope from disposal area.
20 feet	Stream banks and open drainage features, whether manmade or natural.
20 feet	Manmade cuts in soil and curtain drains.
20 feet	Foundation drains downslope from disposal area.
50 feet	Manmade cuts that intersect rock or shale.
100 feet	Water supply springs and water supply wells.
50 feet	Water Supply Cistern

TABLE 64-47-L.- STANDARD SEPTIC TANK SOIL ABSORPTION SYSTEM SIZING FOR SINGLE-FAMILY DWELLINGS

Percolation Test Results (Average Time in Minutes Required for Water to Fall One Inch)	Minimum Area of Soil Absorption System (Square Feet per Bedroom)
Less than 5 minutes	Consult with local health department
5 - 30 minutes	300
31 - 60 minutes	400
over 60 minutes	Consult with local health department

TABLE 64-47-M.- SINGLE ABSORPTION SYSTEM SIZING FOR ESTABLISHMENT OTHER THAN SINGLE-FAMILY DWELLING

Percolation Test Results	Square Feet Per 1000 Gallons Sewage Per Day
Less than 5 minutes	Consult with your local health department
5 - 10 minutes	1650
11 - 30 minutes	2500
31 - 45 minutes	2950
46 - 60 minutes	3300
over 60 minutes	Consult with your local health department

PUBLIC COMMENTS AND DEPARTMENT RESPONSES

SEWAGE TREATMENT AND COLLECTION SYSTEM DESIGN STANDARDS 64 CSR 47

5.9.d.4 **Comment:** No reference to this section in the document.

5.19.d.3 **Comment:** Application Rates: so long as there are "average" design rates I have no problem with this. However, in actual operation significant variation upwards (during dry periods) and downwards (during wet periods) should be allowed within these regulations as long as the average values are not exceeded.

Response: Variations in rates are going to occur. That is why these application rates are variable by design. It is already understood that variations are imminent. No recommended change to the section.

6.2 **Comment:** Heading to a Section.

Response: No response needed.

6.2.1 **Comment:** Suggested language: New proprietary treatment technology for onsite systems shall be verified by unbiased third parties through field performance testing on a minimum of three pilot test sites, utilizing field testing criteria established and/or approved by the Commissioner.

Response: It is strongly believed that this is a good suggestion. However, it is also felt that this field testing performance entity cannot be established prior to the implementation of these design standards. Consequently, we do not suggest entering this at this time.

6.2.a **Comment:** This is too vague. What directions would I give and/or what is suitable and acceptable composition? What is the definition of suitable fill? Why not allow discharge into a filled area regardless of the composition as long as it percs and the effluent is pretreated?

Response: The standard is written in this manner to give the sanitarian the opportunity, through experience and evaluation expertise, the ability to make sound field assessments on each situation. No recommended change to this section.

6.2.d **Comment:** Distance requirements need to be established so that there will consistency throughout the state. The Commissioner shall determine the distance between a septic tank, home aeration unit, vault privy, or other sewage tank, and a public water supply well or water supply.

Response to Comments 64CSR47

Response: The distance is not stated here because it is covered in the public water supply regulations. Also, section 6.2.e covers private water supplies and not public as is mentioned in 6.2.d. No recommended change to this section.

6.2.h **Comment:** Numerous comments from the Water Quality association. Where should the discharge from the softener go if it can't go in the septic system? People will want to know.

Response: New information received through scientific testing seems to indicate that water softener backwash does not appear to be significant to the detriment of a septic system. Section 6.2.h has been deleted.

6.2.k **Comment:** Why not an Eljen system in this type of situation?

Response: Even with an Eljen system, the possibility of contamination of groundwater is greatly enhanced with the installation of any subsurface discharge systems. No recommended change to this section.

6.3.a.2 **Comment:** Need to add no deeper than 36 inches in depth.

Response: The use of 36 inches is not added to give the sanitarian the latitude to allow for percolation rates at different depths for alternative systems as well. There could be a possibility that getting below a filled area to get to original soil may be deeper than 36 inches. No recommended changes to this section.

6.3.a.4 **Comment:** Is sand no longer allowed for percolation tests?

Response: Some problems have surfaced in the past with the use of limestone sand, etc., instead of clean brown river sand. The committee felt that it was best to eliminate the use of sand for the tests. No recommended change to this section.

6.3.a.8 **Comment:** What is an alternate test for measuring percolation? What alternate tests? There is apparently a measuring stick batter board method? How does it work?

Response: There are other tests on the horizon that are currently being developed. This provision in the design standards gives the health department the chance to look at all technologies and evaluate them for possible use in the future. The batter board is an alternate method that has been used as a measuring device instead of time. In my 25 years with the department, I have never seen it used in the field. No recommended change to this section.

6.3.b.1 **Comment:** "The average the rate of fall." Remove the second "the."

Response to Comments 64CSR47

Response: Strike the second "the" from the phrase. "The average the rate of fall" has been changed to "The average rate of fall."

6.4.c **Comment:** Can individuals still construct their own septic tanks?

Response: No, they cannot. No recommended change to this section.

6.4.c.1 **Comment:** Are these facilities to be inspected for compliance?

Response: Yes, on a complaint basis and by the onsite sewage coordinator as time permits. No recommended change to this section.

6.4.g.2 **Comment:** I think that this requirement should be made to cover all designs of tanks, even previously approved, with a six month time frame for the manufacturer to get any needed changes done to their forms.

Response: All concrete manufacturers should already be using 4 inch in diameter outlets and inlets. This requirement makes it mandatory to have flexible water tight seals at the inlet and outlet. These will likely be the rubberized ring seals. (No more asphalt coating or Quikcrete.) No recommended changes to this section.

6.4.g.10 **Comments:** The suggestion has been made that we should take this pipe to six inches. This would allow for pumping of the tank without the need for digging up the manhole or cleanout ports. This pumping would achieve almost as good a result as pumping via the cleanout ports or manhole. This requirement should be made to cover all designs of tanks, even those previously approved with a six month time frame for the manufacturers to get any needed changes done to their forms.

While we can appreciate the utility of observation ports, I'm afraid that the average homeowners do not want a pipe sticking up out of their yard, or, if installed, it is a prime candidate for being broken off, dirt introduced, mischief, etc. I always try to broach the subject of ports if appropriate, but it might be better not to insist. If a homeowner does not care to pump his tank, 10 ports will not help.

Where on the tank should this be located? Inlet or outlet side?

Response: Pumping of the tank requires more than sticking a hose into the inspection port. An inspection of the inlet and outlet baffles is also required by the pumper. This would not be possible with the use of just the inspection port.

The inspection was a compromise of the committee members. The original idea was to have manhole risers on both the inlet and outlet sides of the tank that would extend to the

Response to Comments 64CSR47

surface of the ground. You are right that the homeowner will not necessarily pump the tank even if the inspection port is in place. However, they will at least know the location of the tank and maybe think about pumping it on a more routine basis.

The location of the port can be on the inlet side, the outlet side, or even in the middle of the tank. A north central WV tank manufacturer has already been installing the 4 inch portal in the center of the tank for about 4 years now. The reference does not make it known exactly where the portal can be installed in the tank. No recommended changes to this section.

6.5.d **Comments:** All of my installers use SDR 35 presently and we have not had any problems that I know of with this level of pipe. SDR 35 pipe is heavy enough to use going into or coming out of the tank. Schedule 40 is fine too, but SDR 35 is plenty heavy enough and is much easier to plumb up to.

Response: Schedule 40 is a little heavier and seems to be more readily available in most parts of the state. There is only a small area in which 40 would be required. The committee was pretty well sold on 40. No recommended change to this section.

6.5.g **Comments:** Many installers are going to the 10" pipe and chambers since the labor costs associated with gravel systems are higher. (Also, in our area, which is blessed with limestone, Fairfax has bought up all the quarries in anticipation of making a killing on Corridor H. Consequently, gravel costs have increased significantly.) However, I think that gravel should be run down the sides and over the top of chambers and 10' pipe installations if the percolation rate is greater than 40 minutes/inch.

Response: There is merit to your argument. The committee discussed this and determined that any type of requirement that is above what is in the design standards should be promulgated on a local basis. I suspect that you are probably already enforcing this requirement on a local level. No recommended change in this section.

6.5.h.1 **Comment:** Remove the one foot width allowance.

Response: The one foot width allowance has always been in effect and the committee sees no reason to change that. No recommended change to this section.

6.5.h.5 **Comments:** Does this mean that both straw/hay and the building paper would be used or should this have the word "or" instead of "and" in the statement?

Response: A good observation. Section 6.5.h.5 has been changed to read: "The surface of the aggregate shall have a cover of a minimum of three (3) inches of straw or hay, or one (1) layer of untreated building paper or filter fabric prior to backfilling."

Response to Comments 64CSR47

6.5.h.10 **Comment:** Why 8 inches for level systems? This will make it difficult to put a system in without a pump on a level lot.

Response: The tanks have 9 inches of freeboard space on top of them. If the invert of the outlet is at that level, and the minimum depth for a drainfield line is 18 inches, that gives a difference of nine inches from the invert of the tank to the bottom of the drainfield. Tanks installed for level systems are going to have to be installed very shallow. No recommended changes in this section.

6.5.h.11.a **Comment:** If there is one provision I disagree with the most strongly in these regulations, it is the use of serial distribution. These systems slowly fail over time around the location of the crossover due to the eroding effects of the ponded wastewater in the trench. Just last week I visited a site where the first trench in a failed serial distribution drainfield was spewing wastewater on the ground due to the failure around the location of the pipe crossover. They also make no sense from a soil treatment perspective because nearly all the wastewater loading is occurring in a limited soil infiltration area in the first trench driving wastewater towards the groundwater. This leaves less contact time for soil based microorganisms to consume the waste material. Rather than spreading the wastewater evenly to the other trenches and allowing more time for this natural treatment process to occur, serial distribution loads most of this wastewater all in one trench. There is no way to solve this problem other than banning serial distribution and requiring distribution boxes (with dial a flow devices) to provide some assurance that the wastewater is divided equally among all the trenches in the soil absorption system. Finally, your own regulations 6.5.12.a and 6.5.h.12.b recognize this problem with "carefully tamping the backfill" and the emphasis on "tight joints" on the crossover as a requirement. Frost heave makes careful tamping meaningless over time and the crossover is sure to at some point create a surfacing wastewater health hazard.

Response: The committee battled with the idea to eliminate crossovers as well. After much discussion, it was decided to allow them to stay, but to keep the recommendation that drop boxes be used. More and more systems are being installed with the use of drop boxes. The advent of non gravel drainfield technology has also eliminated the use of crossovers as well. No recommended change to this section.

6.5.h.12.d **Comment:** The former reference specifies that the drainfield piping be 8" lower than the tank outlet piping; the latter says that the crossover piping be at least 2" lower than the tank outlet. Is there a conflict here?

Response: No, there is no conflict. 6.5.h.10 said that the invert of the drainfield piping had to be 8" lower than the invert of the tank. This section is saying that the invert of the first crossover has to be two inches lower than the outlet of the tank. No recommended changes to this section.

Response to Comments 64CSR47

6.8.b **Comments:** What is considered additional treatment?

Response: Additional treatment would be the use of a home aeration unit or a like technology that would produce a good quality effluent to be subsurface discharged. No recommended changes to this section.

6.11.c.2 **Comment:** Should say "may use Class I NSF plants or equivalent where there is surface water discharge."

Response: If third party testing is ever in place, this will be a good idea. Section changed to read: "May use Class I NSF plants or equivalent where there is surface water discharge: and."

6.11.c.3 **Comment:** Should say "May use Class II NSF plants where there is a provision for additional treatment." Should read: "May use Class II NSF plants or equivalent where there is a provision for additional treatment."

Response: Again, if third party testing is ever in place, this will be a good idea. Section changed to read: "May use Class II NSF plants or equivalent where there is a provision for additional treatment."

6.12.d **Comment:** This should say: "intermittent surface sand filters serving individual sewage systems shall have an insulated cover."

Response: Agree. Section changed to read: "Intermittent surface sand filters serving individual sewage systems shall have an insulated cover."

6.16.a.1 **Comment:** I don't believe the DEP will allow earthen privies anymore.

Response: DEP will not allow earthen privies if they serve 20 OR MORE people per day. No recommended change to this section.

6.16.a.5.a **Comment:** On line three, "there from"?

Response: "Therefrom" is an adverb meaning from that or it. No change to this section.

6.16.a.10 **Comment:** Add, pit privies are prohibited from serving 20 or more people a day.

Response: Not needed. The 20 or more per day is a DEP provision, not the health department. No recommended change.

Response to Comments 64CSR47

6.17 **Comment:** What is a recirculating toilet?

Response: Toilets that are recirculating water (usually graywater) for reuse. No change to this section.

6.19.a **Comment:** Is there a time limit for using holding tanks?

Response: Certain time limits are referred to permit policies already intact. No recommended changes to this section.

6.21 **Comment:** Check valve requirement and location.

Response: Check valve locations vary from system to system. No recommended change in this section.

7.1 **Comment:** Is this section about septage pumpers? It is labeled public sewage treatment plants.

Response: No, it is about septage disposal. No recommended changes to this section.

7.1.a **Comment:** This section says that the plant must accept the waste of septage haulers. Is that what it is supposed to mean? Some plants may violate their DEP requirements by doing so.

Response: This is not saying the plant must accept the waste. It is saying that, if it does, it must grant written permission to the hauler saying they can use the facility. No recommended changes to this section.

8.1 **Comment:** "shallo"?

Response: "shallo" has been changed to "shall."

Table B **Comment:** 25 not in line.

Response: Agree. Number 25 moved to correspond with fast food (single service), per seat.

Other comments not referred to by section

Comment: In design flows, it looks like they are the same as current EG 9. There is nothing I can find for food services that are exclusively take out. How do we size these?

Response to Comments 64CSR47

Response: The sizing figure used in the loading design for take-out only food service facilities is 50 gallons per day parking space.

Comment: Should the horizontal distance from a drainfield and a water supply be increased to more than 100 feet if the drainfield is higher in elevation?

Response: The committee did not change the horizontal distance separation for a well being downhill from a drainfield.

Comment: Earthen bottom privies are still allowed. However, the part requiring a percolation test to be done and a percolation slower than 60 minutes per inch was removed (at least I didn't see it). Rationale?

Response: The 60 minute percolation requirement for the earthen privy was taken out because the committee felt that the low volume use of the privy and the low introduction of water to the privy pit did not justify the performance of the percolation test.

Comment: I just scanned these, so I did not see the distance requirements for septic tanks. Has this distance been increased to 100 feet for water supplies if the water supply is downhill (to be in sync with water well design standards)?

Response: The distance requirements for septic tanks is in Section 6.2 of the document. The distance for septic tanks to separated from a downhill water supply has remained the same. No recommended changes.

Comment: The drainfield size that you have eliminates the 200 feet per bedroom for less than a 10 minute percolation. I feel that this should be left in the rules as soil that is very sandy does not need 300 feet per bedroom and is only a waste of time and money because only a small portion of the drainfield will be used in sandy soil.

Response: It has been shown that more failures occur in small systems regardless of soil type. After 5 or so years, the biomat of a system tends to choke off the percolation for the soil. No recommended changes.

Response to Comments 64CSR47

SUMMARY OF CHANGES MADE IN RESPONSE TO COMMENTS

6.2.h	Deleted Section 6.2.h.
6.3.b.1	Changed "The average the rate of fall" to "The average rate of fall."
6.5.h.5	Changed to read: "The surface of the aggregate shall have a cover of a minimum of three (3) inches of straw or hay, or one (1) layer of untreated building paper or filter fabric prior to backfilling."
6.11.c.2	Changed to read: "May use Class I NSF plants or equivalent where there is surface water discharge; and"
6.11.c.3	Changed to read: "May use Class II NSF plants or equivalent where there is a provision for additional treatment."
6.12.d	Changed to read: "Intermittent surface sand filters serving individual sewage systems shall have an insulated cover."
8.1	Change "shallo" to "shall." Now reads: "General. The design and construction of animal waste handling facilities shall be in accordance with the current issue of the US Department of Agriculture Soil Conservation Service, Agricultural Waste Management Field Manual."
Table B	Moved the number 25 to correspond with fast food (single service), per seat.



Water Quality Association
International Headquarters & Laboratory

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Lisle, Illinois 60532-1088 USA
Phone 630 505 0160
Fax 630 505 9637
www.wqa.org

A not-for-profit organization

June 25, 2002

Ronald K. Forren
R.S. Director
Public Health Sanitation Division
WV Bureau for Public Health
815 Quarrier Street, Suite 418
Charleston, WV 26301

Dear Mr. Forren:

A Water Quality Association (WQA) member has mentioned to us a possibility of proposed West Virginia restrictions against home water softener regeneration discharges to on-site sewage facilities. This would be an unjustified and terrible disservice to homeowners who have installed the products of WQA member companies or are considering the purchase of water softener equipment.

It is not true that water softener regeneration discharges pose a problem to on-site sewage treatment facilities or to septic system leach fields. Proposals to regulate such water treatment discharges are not supported by scientific documentation and shortsightedly deny consumers the right to improve their own water supplies.

Important scientific studies, including two I have enclosed with this letter by scientists at the University of Wisconsin and the National Sanitation Foundation, International ("NSF"), address very directly the impact water softener regeneration discharges may have on on-site sewage facilities. The highlights of this evidence may be summarized as follows:

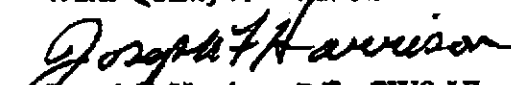
1. Tests confirm that water softener waste effluents cause no operational problems in the typical anaerobic or aerobic home wastewater treatment plants.
2. The volume of wastes from properly installed water softeners (about 50 gallons per regeneration) are added to the septic tank slowly and are not of sufficient volume or intensity to cause any deleterious hydraulic load problems in septic or aerobic tank systems. In fact, the data shows that back flush from water softeners are lower in volume and rate of addition than wastes from many automatic clothes washers.
3. Studies have determined that water softener regeneration wastes not only do not interfere with septic or aerobic tank system drain field soil percolation, but actually could, under some circumstances, improve soil percolation particularly in fine-textured soils.

4. An important and beneficial difference is that septic and aerobic tank contents containing water softener effluents include significant amounts of calcium and magnesium, which counteract the effects of sodium on both the biological action and soil in drain fields. Dehydration, such as plasmolysis of cells and high sodium adsorption ratio ("SAR") or impermeability in soils, can be prevented when a balance of the different electrolytes is maintained. This is why milk with 8,000 milligrams of dissolved salts per liter, for example, is not difficult to drink or for bacteria to live in, whereas water with 8,000 mg/L solely of sodium chloride would be very dehydrating and virtually impossible to drink.

Groundwater quality and household water supplies in most parts of the United States can present formidable challenges for many homeowners. These residents have an absolute need to correct untenable water quality problems in their homes. Indeed, in many cases, residential water treatment solutions, including in-home water softeners and reverse osmosis drinking water treatment units, are indispensable to protecting the health and safety of drinking water and/or to making the water aesthetically useable and palatable.

A rule against water softener waste discharges to septic tanks would unfairly and unnecessarily deprive West Virginia homeowners of their only method to treat hard water and West Virginia businesses and manufacturers of water treatment equipment - lost sales and confusion in the marketplace.

Sincerely,
Water Quality Association


Joseph F. Harrison, P.E., CWS-VI
Technical Director

enclosure

cc: Craig Blair
Carlyn Meyer
Jack Ferguson

LINCOLN COUNTY HEALTH DEPARTMENT

ENVIRONMENTAL HEALTH SERVICES
P.O. BOX 527 HAMLIN, WV 25523-0527 PHONE 824-3330 FAX 824-3334

July 10, 2002

COMMENTS ON NEW SEWAGE RULES

6.2.d. The Commissioner shall determine the distance between a septic tank, home aeration unit, vault privy, or other sewage tank, and a public water system well or water supply.

6.2.e. The location of a septic tank, home aeration unit, vault privy, or other sewage tank shall be at least fifty (50) feet from a private water well or groundwater supply.

I don't understand the need for 6.2.d if we are going state the distances in 6.2.e?

6.4.g.2. Inlets and outlets shall be a minimum of four (4) inches in diameter and equipped with a flexible watertight seal.

I think that this requirement should be made to cover all designs of tanks, even previously approved with a 6 month timeframe for the manufacturer to get any needed changes done to their forms.

6.4.g.8. The top of the tank, above the outlet, shall have embossing, imprinting, stenciling or other form of marking in an indelible and legible manner with the manufacturer's name, the liquid capacity and date of manufacture.

I think that this requirement should be made to cover all designs of tanks, even previously approved with a 6 month timeframe for the manufacturer to get any needed changes done to their forms.

6.4.g.10. All septic tanks shall have a four (4) inch gas tight inspection port that extends to the surface of the ground to measure sludge and scum accumulations.

The suggestion has been made to that we should take this pipe to 6 inches. This would allow for pumping of the tank without the need for digging up the manhole or cleanout ports. This pumping would achieve almost as good a result as pumping via the cleanout ports or manhole. This requirement should be made to cover all designs of tanks, even previously approved with a 6 month timeframe for the manufacturer to get any needed changes done to their forms.

6.5.d. The septic tank inlet and outlet piping shall be schedule forty (40) or the equivalent. This pipe shall span the tank hole excavation and rest on a minimum of two (2) feet of undisturbed soil.

All of my installers use SDR 35 presently and we have not had any problems that I know of with this level of pipe.

6.5.h.5. The surface of the aggregate shall have a cover of a minimum of three (3) inches of straw or hay, and one (1) layer of untreated building paper or filter fabric prior to backfilling.

Do this mean that both the straw /hay and the building paper would be used or should this have the word "or" instead of "and" in the statement?

6.5.h.8. Performing the backfilling of the absorption field shall be in such a manner as to minimize compaction. There shall be a mound of backfill over the system to allow for settling and to promote run-off from the system. There shall be no grading to the absorption field construction area after backfilling. There shall be no backfilling if the ground is frozen.

Does this also mean that absorption fields should not be installed when the ground is frozen?

If you have any questions concerning this matter please feel free to contact me in my office at 824-3330.

Sincerely,
Francis W. Holton, R.S.

07/12/02

11:07

ENVIRON. HEALTH SRV.-FAIRMONT WV → DEHS/PUB HEALTH

NO.130

009

07/10/2002

10:26

WV ENV. HEALTH-CERT. & TRAINING → FAIRMONT DO

NO.585

002

Page 1

Sus Latorre - New Regs.

From: <TDavis3800@aol.com>
To: <RonaldForre@WVDEHHR.ORG>
Date: 7/3/02 8:26AM
Subject: New Regs.

Ren,

In response to the new regs. I would like to offer my thinking on 2 of the new laws.

SDR 35 pipe is heavy enough to use going in or coming out of a tank. SCH 40 is fine too but SDR 35 is plenty heavy enough and much easier to plumb up to. Also the drainfield size you have eliminates the 200' per bedroom for less than 10 mpi perc test. I feel this size should be left in the rules as soil that is very sandy does not need 300' per bed room and is only a waste of time and money because only a very small portion of the drainfield will be used in sandy soil. If you have any questions feel free to call at 304-778-2337.

Thanks

Tim

7/1/02

Ron,

Following are some of my comments and observations concerning revisions to the sewage design standards. Since I am not too familiar with the issues involving public and central sewer, my comments are primarily on 64-47-6, Individual Sewage Systems, and the sections following:

6.2—I feel that this introductory section needs to have some sort of language that requires, for new construction, soil absorption systems to go into the original ground surface. I don't think we should encourage fills as a substitute for proper planning.

6.2.a—This is too vague—what directions would I give and/or what is suitable and acceptable composition?

6.3.a.8—What alternate tests? There is apparently a measuring stick-batter board method. How does it work?

6.4.g.10—While we can appreciate the utility of observation ports, I'm afraid the average homeowners do not want a pipe sticking up out of their yard. Or, if installed, it is a prime candidate for being broken off, dirt introduced, mischief, etc. I always try to broach the subject of ports if appropriate, but it might be better not to insist. If a homeowner doesn't care enough to pump his tank, 10 ports won't help.

6.5.g—Many installers are going to 10" pipe and chambers since labor costs associated with gravel systems are higher. (also, in our area, which is blessed with limestone, Fairfax has bought up all the quarries in anticipation of making a killing on Corridor H. Consequently, gravel costs have increased significantly.) However, I think that gravel should be run down the sides and over the top of chambers and 10" pipe installations if the perc rate is greater than 40 min/in.

6.5.h.10

6.5.h.12.D—The former reference specifies that the drainfield piping be 8" lower than the tank outlet piping; the latter says the crossover piping be at least 2" lower than the tank outlet. Is there a conflict here?

6.16.a.1

6.16.a.5—I believe that DEP does not allow open bottom privies anymore.

6.17—What is a recirculating toilet?

pervious to water, but I believe that it is still a good filter medium for sewage. I assume that this section was meant for the limestone-type areas where there are large cracks? Is there a way to word this so that we can be 2 feet from the permeable sandstone if preceded by additional treatment? The sandstone that I am referring to is hard, but diggable with a backhoe, and you can usually break it apart with your hands.

6.11.c.3. Should say "May use Class II NSF plants when there is a provision for additional treatment."

6.12.8. I think this should say "Intermittent surface sand filters serving individual sewage systems shall have an insulated cover."

7.1. Is this section about seepage pumps? It is labelled public sewage treatment plant.

7.1.a. This section says that the plant must accept the waste of seepage haulers...Is that what it is supposed to mean? Some plants may violate their DEP requirements by doing so.

Ron

Lee Thompson called in and requested
to add one more comment to his
comments on the Sewage Design Standards.
He would like to add into the section
on percolation tests that a percolation test
is valid indefinitely unless there is a
physical change to the pore of the
property when the test is run.

Dave

Effects Of

BACKWASH WATER *And* REGENERATION WASTES

From HOUSEHOLD WATER CONDITIONING EQUIPMENT

On PRIVATE SEWAGE DISPOSAL SYSTEMS

Introduction

Household water conditioning equipment is commonly installed with drain lines discharging into household sewage disposal systems. This is an economical practice, and experience to date has shown that the waste waters and brines from filters and water softeners have no significant effects on private or public sewage disposal systems.

This is supported by the literature which shows that:

1. The volumes of liquids is less than that from automatic clothes washers, and does not add a significant load to the system;
2. The waste brines from water softeners are mixtures of calcium, magnesium and sodium chlorides; the calcium and magnesium counteract the effects of sodium on both biological action and soil in drain fields;
3. The low concentrations of mixed salts are far below the levels which would have measurable effects on either anaerobic or aerobic biological actions.

Volume of Wastes from Household Water Softeners

Table I is a tabulation of data on a series of twenty recently tested water softeners, on which flow rate and time figures were available, from the records of the Water Quality Association Laboratory. This table is believed to be a representative sample of the water softeners in current production in the United States.

The peak flow rates and times shown in this table represent the backwash step, and the fast rinse, where

it is used, in the total regeneration cycle. The backwash is to flush accumulated suspended solids from the softener bed, and the fast rinse is used in some designs following the regular brine and rinse to insure complete removal of salt from the softener and valve system. The peak flow gallons is the product of the time and flow rate. The total gallons is the sum of the peak flow gallons, and the volume of brine and fresh slow rinse water discharged to drain during the complete regeneration cycle.

This data shows that the typical softener discharges about 30 gallons of water during its peak flow period(s), and a little more than 50 gallons during its total regeneration cycle. Typical regeneration frequency would be once or possibly twice per week.

For comparison purposes, a Consumer Reports article (1) tabulated data on 19 automatic clothes washers. Analysis of this data shows that water use per cycle ranges from 31 to 59 gallons, with an average of 44.7 gallons, and a median of 45 gallons. Time per cycle ranges from 31 to 46 minutes, with an average of 39.3 minutes and a median of 38 minutes. This data is in general agreement with 50 gallons per cycle for self-service laundries given in Table I of the Illinois Private Sewage Disposal Code. (2)

The U. S. Dept. of H.E.W. publication "Studies on Household Sewage Disposal Systems, Part III", (3) shows that an automatic clothes washer increases water use an average of 25 gallons per bedroom per day, but the 95 percentile increase is 91 gallons per bedroom per day. The study also showed a range of 1 to 15 loads, and an average of 5.5 loads per week. Further, in the systems studied, no correlation could be found between water consumption and solids retention.

Table I
HOUSEHOLD WATER SOFTENER REGENERATION WASTES

Resin Cu. Ft.	Max. Salt Lbs.	Peak Flow gpm.	Peak Flow Min.	Peak Flow gal.	Total gal.	Total Time Min.
0.75	10.7	1.0	10	10	50	55
1.25	22	3.0	15	45	80	85
0.75	12	3.2	16	51	75	76
0.96	4	1.0	20	20	30	101
0.75	10	1.5	12	18	36	65
2.0	30	3.5	14	49	83	44
0.75	14	2.0	12	24	60	100
1.50	12	1.4	20	28	42	101
1.0	15	1.75	21	37	67	89
0.75	14	2.6	21	55	88	111
1.0	15	2.25	21	47	70	81
0.75	6	1.3	17	22	37	96
0.45	4	1.2	17	20	36	96
0.75	6	1.85	18	33	58	97
0.36	4	0.9	18	16	30	97
0.75	6.2	1.5	18	27	42	97
1.5	12	1.85	18	33	54	97
0.75	10	0.75	20	15	39	70
0.50	8.7	2.5	10	25	48	67
0.60	9	1.6	20	32	52	96
Range	0.36-2.0	4-30	0.75-3.5	10-55	30-88	44-111
Average	0.86	11.2	1.83	30.3	53.8	86.0
Median	0.75	10.7	1.85	28	52	96

A study by the Ohio Agricultural Experiment Station (4) showed that the amount of water used in hard and softened water homes is approximately the same. In this study of 19 homes, 39.5 gallons per person per day was used during a hard water period, and in the same homes with softened water, water usage was 40.4 gallons per person per day. This indicates that the additional water used for the regeneration of the water softeners was largely offset by the reduction in water required for cleaning in the home.

Thus the data in Table I on water softeners shows that the volume of liquids from even the largest water softener will have little effect on a properly sized septic tank, and that the volume of wastes from the typical softener will be less than that from an automatic clothes washer. Further, the regenerations of modern fully automatic softeners take place at night when flows from other sources are unusual, thus reducing the effect of the regeneration volumes.

The common types of household water filters use less water than water softeners for servicing. They do require water for backwashing, sometimes somewhat more than softeners, but do not have the brine and rinse volumes of wastes as do softeners. Thus the total volumes of water discharged would be less than softeners. Modern filters, like softeners, are normally backwashed at night when flows from other sources are usually zero.

The larger softeners and filters are, of course, used where the volumes of water to be treated are the highest. Such cases are normally found where the numbers of persons and bedrooms are also highest,

and the waste treatment system is sized in proportion. Therefore, even the large water conditioning units do not add a significant load to the waste system.

Thus the evidence available to us in the technical literature, plus the results of many years of practical observations, indicates that the volumes of water from backwashing and/or regenerating household water conditioning equipment do not place a significant load on a properly sized household sewage disposal system.

Chemical Characteristics of Water Softener Regeneration Wastes

Household water softeners use an ion exchange process to remove hardness from water. In the process, hard water is passed through a tank containing a permanent bed of ion exchange material, usually beads of an organic compound called resin. This resin has an affinity for calcium and magnesium, the minerals in water which cause hardness. Thus as the water passes through the bed of resin, the calcium and magnesium in the water are held by the resin, and a chemically equivalent amount of sodium is released into the water. This ion exchange process is repeated literally millions of times during the softening process.

Ultimately so much hardness is removed that the initial supply of sodium in the resin nears depletion, and water passing through the unit will no longer be completely softened. The softener is then considered exhausted, and must be recharged or regenerated. In this process, a relatively strong solution of

common salt, sodium chloride, is flushed through the bed of resin. Because of the relatively high concentration of sodium in the solution, the softening reactions are reversed, the calcium and magnesium are forced out of the resin, and the resin recharged with sodium. The mixture of calcium, magnesium and excess sodium chlorides are rinsed to drain with fresh water, and the unit is ready for another softening cycle.

Water softeners do serve as fairly efficient filters, and will remove suspended solid particles from water. Thus virtually all softeners have a backwash, or reverse flow flush, to wash the accumulated solid particles from the bed and down the drain. The water used in this backwashing is a major portion of the regeneration waste volume.

Softeners may be regenerated with varying amounts of salt, usually ranging from 5 to 15 pounds per cubic foot of resin, as indicated in the following Table:

Salt Level Pounds	Typical Capacity in Well Designed Unit Kilograms
5	20
10	26
15	30

The lower salt levels clearly produce the most efficient use of salt, but may allow hardness leakage at high flow rates, with very cold water, or with high hardness waters. The high salt levels are least efficient, but produce the best softening under adverse conditions.

Modern fully automatic water softeners are rarely regenerated with the high salt dosages, since more frequent regenerations present no problems in operation. The figures in Table I are the highest salt dosages recommended for the units by their manufacturers, and therefore represent the most severe conditions which would be found in actual practice.

For evaluation purposes, we have selected the regeneration of a 1.0 cubic foot softener with 15 pounds of salt to represent relatively severe operating conditions. Such a regeneration would produce waste brine containing a total of 10.0 pounds of sodium chloride, 3.2 pounds of calcium chloride, and 1.4 pounds of magnesium chloride. These figures will be used in the following sections dealing with both aerobic and anaerobic waste treatment systems.

Effect of Softener Wastes on Septic Tank Biological Action

Studies made more than forty years ago by Rudolfs (5) showed that concentrations of common salt (sodium chloride) up to approximately 0.2% had no effect upon the rate of digestion of septic tank sludge. Concentrations in the range of 0.3 to 0.4% produced a slight stimulation of the bacterial action, and a concentration of 0.5% had a slight retarding effect. Tests with a solution of 0.525% sodium chloride plus 0.115% calcium and magnesium salts showed that at a total concentration of 0.64% the sludge digestion was stimulated. Thus it was concluded that significantly higher concentrations of common salt can be tolerated when mixtures of calcium and magnesium are also present.

As shown previously, a softener regeneration with 15 pounds of salt would produce a mixture of 10.0 pounds of sodium chloride, 3.2 pounds of calcium chloride, and 1.4 pounds of magnesium chloride. In the minimum septic tank size of 750 gallons, these weights are equivalent to 0.16% sodium chloride,

0.051% calcium chloride, and 0.022% magnesium chloride. These values are clearly far below the levels at which biological action would be retarded.

The lack of adverse effects on septic tank action was noted in a letter dated 1946, from C. W. Classen of the Illinois Department of Public Health (6). U.S. Public Health Service Publication No. 526, "Manual of Septic Tank Practice" (7) states: "Waste brines from household water softener units have no adverse effect on the action of the septic tank, but may cause a slight shortening of the life of a disposal field installed in a structured clay type soil." This latter point will be discussed in a separate section.

The most exhaustive tests known to us were conducted at the Robert A. Taft Sanitary Engineering Center in Cincinnati. (8) In these tests, solutions containing 16.0 pounds of sodium chloride, 4.3 pounds of calcium chloride and 1.9 pounds of magnesium chloride were added to an operating 455 gallon septic tank once a week. These amounts of salts are equivalent to 0.42% sodium chloride, 0.11% calcium chloride and 0.05% magnesium chloride, more than twice the levels we believe to be severe conditions. Yet the tests at the Taft Center produced no adverse effects on the test tank over a period of 28 weeks.

These reports parallel the experience of the water conditioning industry, which has no evidence that softener regeneration wastes have interfered with the biological action of properly sized and installed septic tanks.

Effect of Softener Wastes on Aerobic Biological Action

We know of no articles which deal specifically with the effects of water softener wastes on aerobic waste treatment processes. However, a number of studies have been conducted which show that such treatment processes can be used even when high salt concentrations, such as in sea water, are present. An article by Ludzack and Noran (9) includes a considerable amount of information which can be applied to small aerobic waste treatment systems.

Ludzack and Noran point out that aerobic sewage digestion does continue even in sea water, although the rates are considerably decreased. Further, they state that "high-chloride notation refers to the sea-water chloride range of 18,000 to 20,000 mg/l." In terms of sodium chloride concentrations, these values are 29,600 to 33,000 mg/l, or about 3% by weight. These factors must be kept in mind when the conclusions of the article are considered.

Significant conclusions concerning activated-sludge operations include:

- "1. Detectable changes in sustained performance of activated sludge were not observed below chloride concentrations of 5,000 to 8,000 mg/l." (Equal to 8,200 to 13,200 mg/l as sodium chloride.)

This is several times higher than the probable maximum chloride concentration which would be produced in the unit by water softener regeneration waste brine.

- "3. A given change in activated-sludge chlorides resulted in a better overall performance when the change was made abruptly rather than incrementally."

The chloride changes in an aerobic system due to softener regeneration would be considered abrupt in the time reference referred to in the paper. The chloride increases would be fairly sharp immediately

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after a regeneration, but the concentration would then taper off with dilution by fresh water.

"5. Initial respiratory activity after a chloride change was equal to or greater than that of a reference sludge. Significant population variety and activity changes occurred later. Sustained high chlorides generally depressed respiration."

The chloride change due to a softener regeneration clearly would not affect respiration both because of low concentration, and the fairly rapid decrease with dilution. Softener regenerations would not produce consistently high chloride concentrations in the terms used in the paper.

"6. Periodic operation at low chlorides improved the tolerance of activated sludge to high chlorides."

The periodic softener regenerations would be followed by periods of much lower concentrations, with even the "high" values much lower than the levels referred to in the paper.

The paper also includes some pertinent conclusions regarding anaerobic digestion:

"1. Anaerobic digesters were much more sensitive to chlorides than activated sludge units were."

This statement shows that aerobic treatment systems would be less affected by softener regeneration wastes than anaerobic units such as septic tanks. It has been established that softener wastes will not have an adverse effect on septic tank biological action.

"6. Aerobic digestion is likely to be more effective than anaerobic digestion for excess sludge stabilization when operating on high or varying salinities."

This reaffirms the fact that softener wastes would produce less effect on aerobic than anaerobic digestion systems. Again, it must be noted that the chlorides from a softener would be far below the "high" range as used by the authors of the paper.

Effect of Softener Wastes on Drain Field Systems

The literature on soils and irrigation contains a number of references to the adverse effects that high sodium waters have on soil structure and permeability. When taken by itself, this information may be a source of concern over the effects of the sodium concentrations in water softener waste brines on drain field systems.

Further reading, however, reveals that calcium and magnesium, also present in water softener waste brines, counteract the effects of sodium on soil. Lime (calcium oxide) and gypsum (calcium sulfate) have long been used in the treatment of saline and alkaline soils. In his book on "The Nature and Properties of Soils," Brady states (10):

"... when sodium is a prominent adsorbed ion, the particles are dispersed and a very undesirable soil structure results. By contrast, the adsorption of calcium may encourage granulation by a phenomenon called flocculation. This occurs when the colloidal matter is brought together in flocules and encourages a type of structure which is quite desirable."

The U. S. Department of Agriculture Handbook No. 60 states (11):

"From a practical viewpoint, it is fortunate that

the calcium and magnesium cations in the soil solution are more strongly adsorbed by the exchange complex than sodium. At equivalent solution concentrations, the amounts of calcium and magnesium adsorbed are several times that of sodium. In general, half or more of the soluble cations must be sodium before significant amounts are adsorbed by the exchange complex."

Although the sodium in waste water softener brines may be more than half of the total cations, it does not appear to affect soil. In actual tests at the Taft Sanitary Engineering Center (8), water softener waste brine was applied to Brookston silt loam, specifically selected because of its known susceptibility to damage by high sodium concentrations. The results show that the salt effluent in every case caused less clogging of the test soil cores than the normal effluent throughout the tests, which were continued until the cores became essentially clogged.

The authors did point out that there may have been long-term damage to the soil structure from the salt, which might have affected sustained permeability, but presented no evidence that the reduction in percolation rate due to salt actually did occur. Thus even tests on soil known to be damaged by sodium have failed to show that the mixture of salts in the water softener regeneration wastes had an adverse effect on percolation rates. The tests only showed that other factors, possibly physical or biological, caused clogging before any possible effects of the mixed salts could be noted.

We know of no evidence of later tests by these or other investigators which would reverse these findings. In fact, the water conditioning industry knows of no case where it has been shown that the wastes from water softeners have caused excessive deterioration of a drain field, even in earlier years when septic systems were smaller and softener salt usage was higher than today.

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6. Classen, C. W. Private communication, 1946.
7. "Manual of Septic-Tank Practice, U. S. P. H. S. Publication 526, 1957, 1967, Page 39.
8. Reference (3), Pages 82-92.
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RESEARCH REPORT | EXECUTIVE SUMMARY



Washers Pose No Risk to Septic Tanks

RESEARCH REPORT

Septic Tank / Water Softener

"Potential Effects of Water Softener Use on Septic Tanks Soil Absorption On-Site Wastewater Systems"

University of Wisconsin - Madison

"The Effect of Home Water Softener Waste Regeneration Brines on Individual Aerobic Wastewater Treatment Plants."

The National Sanitation Foundation

PURPOSE

The purpose of these studies was to provide documented answers to the following questions:

1. Is the salt-brine discharge from water softener regeneration toxic to the bacteria in the treatment system?
2. Does the flow rate and volume of backwash and regeneration water discharged from a water softener have an effect on the settling and flocculation process causing carryover of solids into the drain field?
3. Does water softener regeneration discharge reduce the percolation of water through the soil in seepage fields by causing swelling of soil particles?

FINDINGS

The studies conducted by scientists at the University of Wisconsin - Madison, small scale waste management project and the National Sanitation Foundation confirmed the results earlier but less definitive studies; and were in complete agreement with earlier assumptions and industry conclusions.

1. Water softener waste effluents actually exert a beneficial influence on a septic tank system operation by stimulating biological action in the septic tank and cause no operational problems in the typical anaerobic or aerobic septic tanks.

2. The volume of softener wastes are added to the septic tank slowly and are not of sufficient volume to cause any deleterious hydraulic load problems in septic tank systems. In fact, they are lower in volume and rate of addition than waste from many automatic washers.

3. Water softener regenerational wastes not only should not interfere with septic tank system drain field soil percolation but actually might improve soil percolation, particularly in fine textured soils.

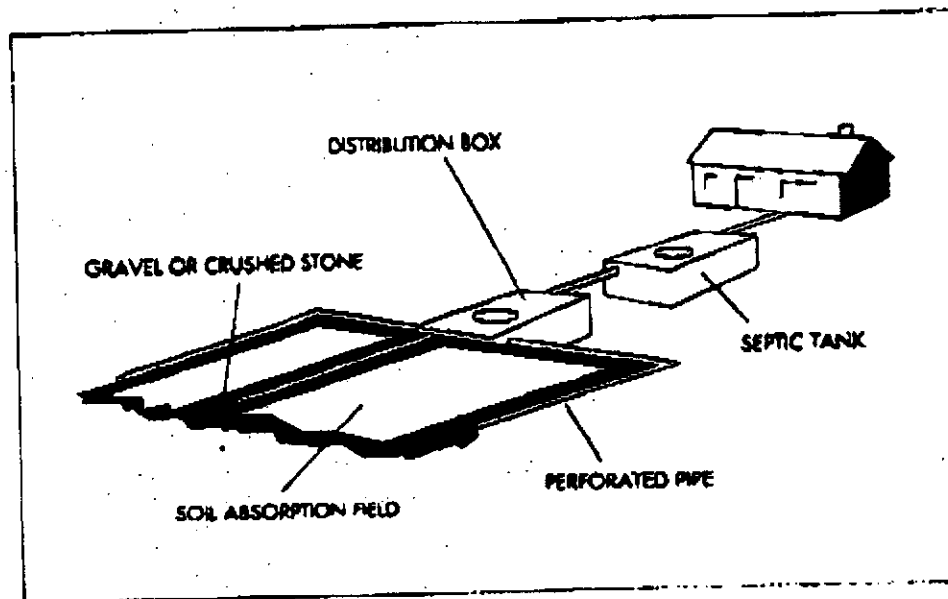
The results confirmed earlier government tests which had reached the same

conclusions, but were questioned because they were interpreted to be in contradiction to the scientific literature on irrigation which demonstrates adverse effects of high sodium water on soil structure and permeability, especially in clay-type soils. It is known that when fresh water was used on irrigated soils with a high proportion of exchangeable sodium, reduced conductivity occurred as the high total salt levels were diluted with the irrigation waters.

The important and beneficial difference is that water softener effluents contain significant amounts of calcium and magnesium, which counteract the effect of sodium and help maintain and sustain soil permeability.

The studies concluded that it is better to discharge water softener wastes to septic tank systems than to separate dry wells or ditches.

FIGURE 1



BACKGROUND

An estimated 20 million on-site household sewage disposal systems are in place in the United States. Many of these systems have operating problems from time to time. It is natural that homeowners, local contractors, installers, and regulatory personnel should look for the reasons for these problems and, perhaps inevitable, that some may blame water conditioning equipment.

The supposition that could be used to eliminate water softeners might be as follows: "Everyone knows that lack of or excessive amounts of salt will kill bacteria, and if a home with a softener has a problem, it could be caused by the softener. Anyways, it is better to advise against softeners, which might cause a problem, than to take a chance."

No matter what the reasoning, the questions concerning the effects of water softener regeneration wastes on these private sewage disposal systems are not new, and the industry has collected a good deal of information on the subject over the years. This information served the industry well, and there were no major restrictions on the use of water softeners for over 25 years.

However, in the mid 1970s, first a county in one state, and then another jurisdiction

in another state, and then later, entire states enacted regulations prohibiting the discharge from softeners to private sewage disposal systems.

SEPTIC TANKS

The most widely used septic tank system is shown in Figure 1 (front page). The sewage is received from the home into the septic tank where the organic matter present is partially digested and solids are collected. Relatively clear water is discharged from the tank to the soil through a suitable distribution system.

An example of a typical single compartment septic tank is shown in Figure 2. The sewage enters at one end which is properly baffled to prevent bypass flow and reduce turbulence. In the main part of the tank, less buoyant solids settle to the bottom of the

*Water softener waste effluents actually cause
...no operational problems in the typical
anaerobic or aerobic home treatment plants.*

tank, and the lighter than water oils, greases, and solids rise to the top as shown in Figure 2. Under ideal conditions, much of the soluble organic matter, heavy solids, and floating greases are digested by the bacteria normally present in the sewage. Since these bacteria operate in the absence of air, this digestive process is called "anaerobic."

Ideally, by the time the wastewater passes through the baffled outlet of the septic tank, through the distribution box, and into the disposal field, most of the suspended solids and organic matter have been removed. The water then is passed into the drain field in which perforated pipe or tile with open joints allow the water to trickle out into the trenches. These trenches are commonly bedded with gravel or crushed stone which further distributes the water as it is applied to the soil absorption field.

FIGURE 3

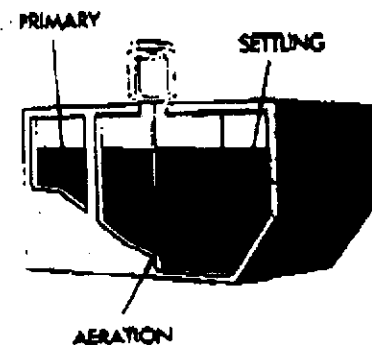
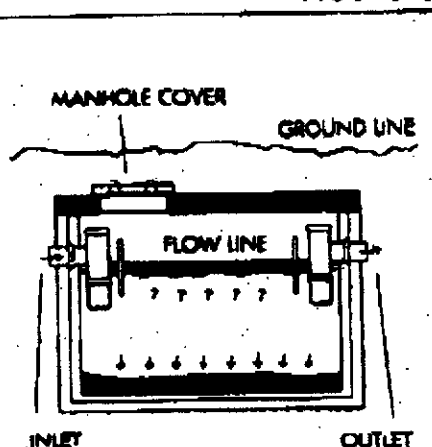


Figure 3 is an example of a concrete home aeration plant with no effluent filtration. These plants can be characterized as utilizing preliminary sedimentation, mechanical aeration, and final sedimentation with surface skimming.

FIGURE 2



The NSF study operated two aerobic plants for approximately six months with simulated use being a family of five persons at a rate of 50 gallons per person per day. The NSF test demonstrated no adverse plant performance, even when stressed by loading at a rate simulating 10 persons (twice the average use rate).

FOR MORE INFORMATION

The complete 70-page Research Report, Order No. R12 may be purchased from:
Water Quality Association
4151 Naperville Road
Lisle, Illinois 60532

Order No. R12s

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TO: RON FORREN, DIRECTOR
PUBLIC HEALTH SANITATION

FROM: MICHAEL L. SALE, SUPERVISOR
ENVIRONMENTAL HEALTH PROGRAM *MMS*

RE: PROPOSED SEWAGE SYSTEM DESIGN STANDARDS

DATE: 7-12-2002

RON, HERE ARE A FEW QUESTIONS AND SUGGESTIONS FROM MY STAFF.

6.2.a. WHAT IS THE DEFINITION OF SUITABLE/ACCEPTABLE FILL?

WHY NOT ALLOW DISCHARGE INTO A FILLED AREA REGARDLESS OF THE COMPOSITION AS LONG AS IT PERCS AND THE EFFLUENT IS PRETREATED?

6.2.d. DISTANCE REQUIREMENT NEEDS TO BE ESTABLISHED SO THAT THERE WILL BE CONSISTENCY THROUGHOUT THE STATE.

6.2.l. WHY NOT INCLUDE GARGAGE DISPOSALS?

6.2.k. WHY NOT AN ELIEN SYSTEM IN THIS TYPE OF SITUATION?

6.3.a.2. NEED TO ADD NO DEEPER THAN 36 INCHES IN DEPTH.

6.3.a.4. IS SAND NO LONGER ALLOWED FOR PERCOLATION TESTS?

6.3.a.8. WHAT IS AN ALTERNATE TEST FOR MEASURING PERCOLATION?

6.4.c. CAN INDIVIDUALS STILL CONSTRUCT THEIR OWN TANKS?

6.4.c.1. ARE THESE FACILITIES TO BE INSPECTED FOR COMPLIANCE?

6.4.g.10. WHERE ON THE TANK SHOULD THIS BE LOCATED? INLET OR OUTLET SIDE

6.5.h.1. REMOVE THE ONE FOOT WIDTH ALLOWANCE.

6.8.b. WHAT IS CONSIDERED ADDITIONAL TREATMENT?

6.16.a.10. ADD PIT PRIVIES ARE PROHIBITED FROM SERVING (20) OR MORE PEOPLE/DAY.

6.19.a. IS THERE A TIME LIMIT FOR USING HOLDING TANKS?

6.21. CHECK VALVE REQUIREMENT AND LOCATION?

Mark Whittaker - new sewer regs

From: Patty Rodgers
To: Mark Whittaker
Date: 5/17/02 10:35AM
Subject: new sewer regs

I had some ideas for the new sewer regs if it is not too late:

On the back of our permit forms it has some statements that conflict with the advise I have gotten from the state in the past. I was wondering which way I should go, and I would like it to be clarified in the new regs.

The first statement says that any system installed shallower than 18 inches must be installed by a class II installer, but Ron Forren told me that an Eljen installed at 12" could be considered a class I system as long as it was guaranteed that way by the Eljen. Also it says that for it to be class I it has to rely on gravity flow, but the regs say that class I installers can install pumps. It also excludes Eljen as a conventional system.

Statement # 6 says that a min drop of 6 in to a level system and 10 in to a sloping system from the tank...I can't find this statement in the regs, should it be stated in the new regs?

Are screws still required in chambers installations? I haven't been requiring them because I was told (probably by an installer) that they were no longer needed due to improvements in the product.

Another thing for the new regs, we have had a few requests to put in greywater systems for just 1 fixture (like a washer in the basement or a sink that is difficult to connect to the main system). The 30% reduction is too small for this kind of application. Is there any way we can include something in the new regs for this kind of thing?

Will there be anything in the new regs regarding garbage disposals?

There was also the issue of section 3.4 "When, upon investigation, the director finds a person is constructing, installing, extending, altering, maintaining or operating a toilet facility or sewer system which does not comply..." The way this reads, we can still put a person on notice who illegally installed a sewer system 5 years ago for "operating" an unapproved system. However, Charleston has been reluctant to enforce it that way. Will this be changed in the future regulations? How do you feel about this particular issue? I believe that it is unfair to not enforce it this way because of all of the people who do it the right way. Just because someone did not get caught within 1 year of illegally installing a system, they should not be "scott-free." On the other hand, what if someone puts it in illegally and then sells the house? That would make the new owner in violation.

I know you have a lot going on right now with the floods. I was just thinking about this stuff and wanted to bring it to your attention before I forgot about it :).

Thanks,

Patty Rodgers, R.S.
Nicholas County Health Department
1 Stevens Road
Summersville, WV 26651
304-872-5329
fax 304-872-5362

Linda Whaley, AR

6.16.a.5.a, line 3: **there from?**

6.3.b.1.: **The average the rate of fall?**

8.1: **Shallo**

pg. 95 **25 not in line**

Mark Whittaker - Sewage Design Standards

From: Tom Felton
To: ms#694b.PO24.DHHR
Date: 6/27/02 11:33AM
Subject: Sewage Design Standards

Mark:

I had a couple of question re. proposed design standards:

1. In design flows it looks like they are the same as current EG-9. There is nothing I can find for food service establishments that are exclusively take-out. How do we size these.
2. Should the horizontal distance from a drainfield and a water supply be increased to more than 100' if the drainfield is higher in elevation?
3. Earthen bottom privies are still allowed. However, the part requiring a perc. test to be done and a perc slower than 60 mins. per inch was removed (at least I didn't see it). Rationale?
4. I just scanned these so I did not see the distance requirements for septic tanks. Has this distance been increased to 100' for water supplies if the water supply is downhill (to be in sync with water well design standards)?

Thanks. See you tomorrow.

Tom

P.S.- Ask woody tomorrow why he has outdistance me as the "Silver Tongue" Devil!