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Subchapter 11

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TITLE 252. DEPARTMENT OF ENVIRONMENTAL QUALITY
CHAPTER 656. WATER POLLUTION CONTROL FACILITY CONSTRUCTION STANDARDS

Subchapter

SUBCHAPTER 1. INTRODUCTION

Section
252:656-1-1. Applicability
252:656-1-2. Definitions
252:656-1-3. Permit requirements

252:656-1-1. Applicability

(a) This chapter sets the permit and construction standards for wastewater collection systems and treatment works. It does not apply to innovative technology (see 27A O.S. § 2-6-401), to small public sewage systems as defined in 27A O.S. § 2-6-101 (also see OAC 252:641, Individual and Small Public On-Site Sewage Treatment Systems), nor does it apply to industrial wastewater (see OAC 252:606, Oklahoma Pollutant Discharge Elimination System (OPDES) Standards and OAC 252:616, Industrial Wastewater Systems). There are other rules that also may govern wastewater systems, such as OAC 252:621, Non-Industrial Flow-Through and Public Water Supply Impoundments; OAC 252:619, Operation and Maintenance of Non-Industrial Total Retention Lagoon Systems; OAC 252:627, Operation and Maintenance of Water Reuse Systems; OAC 252:515, Management of Solid Waste; and the federal OSHA standards.

(b) This chapter applies to any person or entity that constructs or modifies a wastewater collection system or treatment works that is not:

(1) a small public sewage treatment system as defined in 27A O.S. § 2-6-101, or

(2) an industrial wastewater system.

252:656-1-2. Definitions

In addition to terms defined in Title 27A of the Oklahoma Statutes, the following words or terms, when used in this Chapter, shall have the following meaning unless the context clearly indicates otherwise:

"25-year flood" means a flood event that has a 4 percent chance of being equaled or exceeded in magnitude in any given year.

"100-year flood" means a flood event that has a 1 percent chance of being equaled or exceeded in magnitude in any given year.

"208 Plan" means an area wide wastewater treatment management plan that states are required to submit to EPA for approval pursuant to section 208 of the Clean Water Act, 33 U.S.C. § 1288.

"ASTM" means the American Standard Testing Method and Material.

"Biosolids" means organically treated wastewater materials from municipal wastewater treatment plants that are suitable for recycling as a soil amendment. This term is within the meaning of "sludge" as defined in 27A O.S. § 2-6-101(11). Biosolids are divided into the following classes:

(A) Class A Biosolids meets the pathogen reduction requirements of 40 CFR § 503.32 (a);

(B) Class B Biosolids meets the pathogen reduction requirements of 40 CFR § 503.32 (b).

"BOD" means total 5-day biochemical oxygen demand.

"Bypass" means the intentional or unintentional diversion of a waste stream from any portion of a wastewater treatment system.

"CBOD" means 5-day carbonaceous biochemical oxygen demand.

"Cell" means an individual basin of a lagoon system.

"cfm" means cubic feet per minute.

"Collection system" means pipelines or conduits, pumping stations, force mains and all other facilities used to collect or conduct wastewater to a treatment works.

"CT" means the product of residual disinfectant concentration, (C) in (mg/l), and the corresponding disinfectant contact time (T) in minutes, i.e., C x T. CT requirements for a variety of disinfectants and conditions are in the EPA Guidance Manual to the Surface Water Treatment Rule.

"DEQ" means the Oklahoma Department of Environmental Quality.

"Discharge point" means the point at which wastewater enters Waters of the State or become Waters of the State.

"Domestic wastewater" means wastewater from drinking fountains, showers, toilets, lavatories and kitchens.

"End-of-pipe" means the terminal points in all reclaimed water users' distribution systems.

"Engineer" means a person licensed to practice engineering in Oklahoma.

"fps" means feet per second.

"Freeboard" means the vertical distance from the surface water level to the overflow elevation in a treatment unit.

"GPM" means gallons per minute.

"Land application" means the controlled application of treated wastewater onto the land surface for beneficial use.

"MGD" or "mgd" means million gallons per day.

"MLSS" means mixed liquor suspended solids.

"MLVSS" means mixed liquor volatile suspended solids.

"New technology" means any method, process or equipment which is used to treat or convey sewage which is not addressed in this Chapter. This does not refer to innovative technology as defined by 40 CFR Part 35.

"NPDES" means the National Pollution Discharge Elimination System.

"OAC" means Oklahoma Administrative Code.

"OSHA" means the Occupational Health and Safety Administration.

"Open storage basin" means an uncovered basin, below or above ground level, that is designed, maintained and operated to store Category 2 or 3 reclaimed water.

"Person" means any individual, company, corporation, government agency, municipality, or any other entity.

"Population equivalent" and **"PE"** mean the calculated population which would normally contribute the same amount of biochemical oxygen demand (BOD) per day of wastewater. It is computed on the basis of 0.17 lb. of 5-day BOD per capita per day.

"PSRP" means process to significantly reduce pathogens.

"PVC" means polyvinyl chloride.

"Reclaimed water" means wastewater that has gone through various treatment processes to meet specific water quality criteria with the intent of being used in a beneficial manner.

"Retention time" means the theoretical time required to displace the contents of a tank or treatment unit at a given rate of flow (volume divided by rate of flow).

"Riprap" means a permanent, erosion resistant ground cover that consists of hard, sound durable stones that average in weight between thirty to fifty pounds (30-50 lbs), with no more than twenty percent (20%) weighing less than twenty pounds (20 lbs).

"Service line" means a wastewater line that connects an individual home, building or business to a permitted collection system.

"Total Kjeldahl nitrogen (TKN)" means the total of the organic and ammonia nitrogen.

"Treatment works" means any plant, disposal field, lagoon, incinerator or other facility used to treat, stabilize, hold or reclaim non-industrial wastewater.

"UL" means Underwriters Laboratories Inc.

"U.S.C." means United States Code.

"Variation" means change from the adopted or current standards for equipment, material or process.

"Wastewater system" means a collection system and treatment works.

"Water reuse system" means a treatment and distribution system designed to treat and supply reclaimed water.

252:656-1-3. Permit requirements

(a) **Permit to construct.** No one shall construct, modify or put into operation a wastewater system or a water reuse system without first obtaining a permit to construct from DEQ. Permits to construct will not be issued for new Category 4 restricted golf course irrigation systems pending further research and evaluation of performance data collected from existing systems.

(b) **Permit to supply.** No one shall supply reclaimed water without first obtaining a permit to supply from DEQ, except when using reclaimed water within the wastewater treatment plant boundaries pursuant to Category 6.

SUBCHAPTER 3. PERMIT PROCEDURES

Section

252:656-3-1. Permitting process

(a) This Subchapter implements the permitting process of Part 4, Wastewater and Wastewater Treatment Systems, 27A O.S. § 2-6-401 et seq., and the Oklahoma Uniform Environmental Permitting Act, 27A O.S. § 2-14-101 et seq.

(b) Permits are required for the construction or modification of non-industrial wastewater and water reuse systems.

(c) The permit application is a two-step process:

(1) The first step is the submission of an engineering report (as described in 252:656-3-4); and

(2) The second step is the submission of the final design report along with the required application forms and fees. The final design report shall:

(A) include 2 sets of plans and specifications, with at least one set of plans printed on 11" x 17" paper and at least one set of specifications loosely bound and suitable for scanning, and

(B) reflect any changes from the approved engineering report.

(d) Unless an extension is granted, a construction permit expires if construction does not begin within one year from the date the permit is issued.

(e) Permits to construct or modify non-industrial wastewater and water reuse systems shall only be issued to public entities unless all components of the proposed systems, including all service lines, are located on property:

(1) owned by the applicant, or

(2) dedicated to the applicant through a recorded easement for the installation and operation of the system.

252:656-3-2. Applications

(a) **Permit application requirements.** Applicants seeking permits to construct either a non-industrial wastewater or water reuse system shall submit the following to DEQ:

(1) an application;

(2) the appropriate fee;

(3) two (2) copies of an engineering report in compliance with OAC 252:656-3-4;

(4) two (2) sets of plans and specifications; and

(5) documentation of adequate financial accountability.

(b) **Application.** The application shall be complete and legible and include:

(1) the type of entity that is applying for the permit,

(2) the legal description of the property where the system will be located,

(3) a final design analysis and

(4) a list of all applicable ASTM standards required for construction, installation and testing of the processes and equipment listed in the plans and specifications.

(c) **Governing body and authority of public entity.** Public entities other than municipalities shall provide certified copies of the results of the last election or appointment of the members of the governing body. Public entities must also provide citations to their legal authority to own and operate the proposed facility.

(d) **Notice to political subdivision.** If the proposed facility is to be located within a political subdivision, the applicant must notify the political subdivision.

(e) **Financial accountability.** All applicants must demonstrate they have adequate financial accountability, and technical and managerial capacity to comply with the requirements of this Chapter and to continuously maintain the facility.

(1) If the applicant is not a city, town or other public entity, the applicant must demonstrate to the satisfaction of the DEQ:

(A) that the applicant can cover the expected costs for operation and maintenance, replacement and closure;

(B) that the applicant can provide for the continued existence and financial accountability of the facility;

(C) that provisions have been made for continued existence of the operating entity for the expected life of the facility; and

(D) that all components of the non-industrial wastewater or water reuse system, including service lines, are located on property under the control of the applicant through a recorded easement or ownership of the property. [See 27A O.S. § 2-6-401(A)].

(2) Financial accountability may be demonstrated in one of the following fashions:

(A) The applicant must provide proof of a sufficient amount on deposit to the credit of a trust, the powers of which are to operate and maintain the wastewater system for the expected life of the facility; or

(B) Other proof of financial viability, such as the issuance of a bond or insurance contract covering the operation and maintenance of the wastewater system may be submitted to DEQ for approval; and

(3) Costs for closure of the wastewater system as required by law must be included in any funding plan.

(f) **Transferring applications.** Applications and unexpired permits may be transferred upon showing the transferee has legal authority and financial accountability, and that both parties agree to the transfer.

(g) **Compliance with permit.** Applicants shall:

(1) construct wastewater and water reuse systems according to the plans and specifications approved by DEQ;

(2) comply with the terms of the permits that are issued by DEQ. Permits may contain provisions more stringent than these rules in order to meet water quality standards;

(3) not proceed with construction before the permit is issued by DEQ; and

(4) not deviate from the approved plans and specifications.

252:656-3-3. Municipal exemptions

(a) Municipalities may be exempted from construction permits for gravity wastewater collection lines no larger than 12 inches in diameter if they:

(1) Adopt and enforce an ordinance requiring all wastewater systems within their corporate limits to comply with applicable DEQ rules.

(2) Adopt and enforce an ordinance withholding approval of sewer line extensions to wastewater treatment works, lift stations, and interceptor lines which have reached treatment or hydraulic capacities.

(3) Retain an adequate number of competent full-time staff to review and approve plans and specifications for sewage collection systems. Such staff must include at least one engineer, in responsible charge, who must approve and then sign plans authorizing construction to proceed according to the approved plans.

(4) Have adequate inspection and enforcement staff and procedures to assure construction does not proceed before approval of or deviate from approved plans and specifications.

(5) Submit a quarterly status report to the DEQ that describes the current design capacity, additional loading capacity, effluent quality and the extent of sewage bypasses.

(b) To obtain the exemption, municipalities must apply on DEQ forms.

(c) There are no exemptions for permits funded by the State Revolving Fund..

252:656-3-4. Engineering report

(a) Applicants shall submit to DEQ two (2) copies of the engineering report for proposed new construction or modifications to sewage collection systems, or treatment works at least thirty (30) days prior to the submittal of plans and specifications. Applicants shall also submit a letter in which the applicant endorses the contents of each engineering report submitted to DEQ. For line extension and lift station construction, the submission of an Engineering Report Form, developed by DEQ, signed and sealed by an engineer licensed by the State of Oklahoma, may be submitted to meet the requirements of the necessary engineering report, unless a full engineering report is required by DEQ. Engineering reports shall include:

(1) **Volume and strength of sewage flow.** Establish the existing and anticipated design average and design peak flows and waste load for the existing and ultimate conditions. Include the basis for projecting initial current and/or future dry and wet weather flows and waste load for the existing, or initial, service area, and the anticipated future service area. For discharging facilities, the report must demonstrate that the proposed project complies with the design flow in the 208 Plan and other applicable OPDES permit limits.

(2) **Existing system.** Describe the existing system, including the need for the project related to health and safety, system operations and maintenance, and population growth. Issues that

must be addressed include, but are not limited to, suitability of existing facilities for continued use, adequacy of water supply, history of compliance with state and federal requirements, and comparison of existing treatment units with state and federal design requirements.

(3) **Project description and alternatives**. The report must contain a description of the alternatives that were considered to meet the identified need. Provide a service area and project site maps showing the existing and proposed systems. The information must describe legal and natural boundaries, major obstacles, elevations, and any other information necessary to properly evaluate the project. Describe the proposed project and, where two or more solutions exist, discuss the alternatives including cost analysis and discuss the reasons for selecting the one recommended. For each alternative considered, the report must provide the following:

(A) **Description.** A description of the collection system, pumping systems, treatment, and discharge facilities associated with each alternative as applicable.

(B) **Design criteria.** The design parameters used for evaluation purposes.

(C) **Schematic.** A schematic diagram(s) of all existing and proposed treatment processes.

(D) **Land requirements.** The identification of sites and easements that will be used and whether the sites:

(i) are currently owned or leased by the applicant, or

(ii) will be acquired or leased by the applicant.

(E) **Construction problems.** A discussion of concerns such as subsurface rock, high water table, limited access, or other conditions that may affect the cost of construction or the operation of the facility.

(F) **Advantages and disadvantages.** A description of the ability of each alternative to meet the owner's needs, address violations cited in any enforcement orders, satisfy public and environmental concerns, and comply with regulatory requirements. The report must demonstrate the compatibility of each alternative with existing, comprehensive, and area-wide development plans. Provide a short description of environmental impacts that may preclude any alternatives.

(G) **Selected alternative.** A complete description of the proposed project based on the general description presented in the evaluation of alternatives. The report must show that the proposed project will comply with all the requirements of this Chapter. At a minimum, the following information must be included:

(i) **Treatment**. A description of the processes, including biosolids management, in detail and the identification of the location of the plant and the site of any discharges; a status of compliance with the 208 Plan, and if applicable, include current revisions with copy of DEQ approval letter, if approved in the current 208 Plan.

(ii) **Pumping stations**. The size, type, location and any special power requirements, including provisions for emergency operations, of all pumping stations.

(iii) **Collection system layout**. Identify general location of line improvements, including: lengths, sizes and key components.

(iv) **Calculations**. Provide supporting calculations in sufficient detail to demonstrate compliance with DEQ design requirements to assure adequate capacity for the collection and treatment system as a whole to transport and treat the wastewater or reclaimed water. For collection system projects, the submittal must include a map with a list of manholes and pipes and the associated characteristics, such as elevation of inverts, pipe diameter, pipe segment length, and other information necessary to evaluate the project. The report must provide assurance that

the receiving collection and treatment systems have adequate capacity.

(4) **Construction sequence.** A description of the sequence of construction and steps needed to maintain compliance during construction. If the project is not to be completed in one sequence, then provide details of the phases.

(5) **Site.** Describe the topography, soils, geologic conditions, depth to bedrock, groundwater level, floodway or floodplain considerations, and other pertinent site information. The project must be constructed on the site consistent with approved plans. Include 6 months of data on the groundwater level. Provide soil boring information pursuant to OAC 252:656-11-3 (a) for projects that include lagoons or other non-industrial impoundments.

(6) **Water supply.** Identify surface water intakes within five (5) miles of the discharge and known public and private water wells within three hundred feet (300').

(7) **Receiving stream.** Identify the receiving stream and its wasteload requirements according to the Water Quality sections of OAC 252:606 and Oklahoma's Water Quality Management Plan (208 Plan).

(8) **Disposition of biosolids.** Discuss the available alternatives for biosolids reuse and/or disposal (OAC 252:606 and OAC 252:515). Submit a sludge management or sludge disposition plan to DEQ for approval. All biosolids that will be land applied and/or disposed in a landfill must comply, at a minimum, with the Class B pathogen reduction requirements contained at 40 CFR, Part 503, adopted by reference at OAC 252:606.

(9) **Industrial wastes.** Discuss the characteristics and volume of anticipated industrial wastes.

(10) **Collection system.** Describe the area to be served by existing and proposed sewers. Sewer capacities must be designed for the estimated ultimate population that will be served. Similarly, consideration must be given to the maximum anticipated loadings from institutions, industrial parks and other similarly situated facilities.

(11) **Financing.** Provide itemized cost estimates to build, operate and maintain the proposed project including, but not limited to:

(A) development, construction, land and rights-of-way, legal services, engineering services, contingencies, refinancing, and any other factors associated with the proposed project;

(B) discuss financing methods;

(C) provide information regarding rate structures, annual operating and maintenance (O&M) cost, tabulation of users by monthly usage categories and revenue received for the last three fiscal years; and

(D) give status of existing debts and required reserve accounts. Include a schedule of short-lived assets and a recommended annual reserve deposit to fund replacement of short-lived assets such as pumps, paint and small equipment.

(12) **Enforcement orders.** Discuss all applicable enforcement orders, including the violations cited in the orders and how the project will eliminate said violations.

(13) **Conclusions and Recommendations.** Provide any additional findings and recommendations that must be considered in development of the project. This must include:

(A) recommendations for a specific course of action to be undertaken;

(B) any special studies to be developed;

(C) highlight the need for special coordination, include a recommended plan of action to expedite project development, etc.

(14) **Project Schedule**. The report must propose a schedule to:

(A) obtain funds to complete the proposed project;

(B) submit construction plans, specifications, and permit application(s);

(C) start construction;

(D) complete construction, and

(E) attain compliance with applicable OPDES discharge permits.

(b) **Water reuse treatment and reclaimed water distribution systems.** Applicants shall submit to DEQ two (2) copies of the engineering report for proposed new construction or modifications to water reuse treatment and reclaimed water distribution systems. Engineering reports shall be submitted at least thirty (30) days prior to the submission of plans and specifications and all engineering reports submitted to DEQ shall be signed and sealed by an engineer licensed by the State of Oklahoma. Applicants shall also submit a letter in which the applicant endorses the contents of each engineering report submitted to DEQ. For line extension and lift station construction, the submission of an Engineering Report Form, developed by DEQ, signed and sealed by an engineer licensed by the State of Oklahoma, may be submitted to meet the requirements of the necessary engineering report, unless a full engineering report is required by DEQ. Engineering reports shall include the following, as applicable:

(1) **Volume and quality of reclaimed water flow.** Describe anticipated flow from wastewater treatment works to the water reuse treatment facility. For discharging facilities, the report must demonstrate how the proposed project impacts the design flow in the 208 Plan and other applicable OPDES permit limits.

(2) **Existing system.** Describe existing wastewater treatment and water reuse systems. Descriptions shall include: the suitability of existing facilities for continued use, adequacy of water supply and the facility's history of compliance with state and federal requirements.

(3) **Project description.** Provide service area and project site maps showing the existing and proposed systems. The information shall describe legal and natural boundaries, elevations, major obstacles and any other information necessary to properly evaluate the project. Project descriptions shall include the following:

(A) **Description.** A description of the wastewater treatment system preceding the water reuse treatment facility.

(B) **Design criteria.** The design parameters used for evaluation purposes.

(C) **Schematic.** Schematic diagrams of all existing and proposed treatment processes.

(D) **Land requirements.** Identification of the sites and easements that will be used and whether the sites:

(i) are currently owned or leased by the applicant, or

(ii) will be acquired or leased by the applicant.

(E) **Treatment**. A detailed description of the treatment processes, including biosolids management, identification of the location of the plant and the site of any discharges:

(i) **Pumping stations**. Identify the size, type, location, any special power requirements and provisions for emergency operations of all pumping stations.

(ii) **Reclaimed water distribution system layout**. Identify the general locations of line improvements, including lengths, sizes and key components.

(iii) **Calculations**. Provide supporting calculations in sufficient detail to demonstrate compliance with DEQ design requirements.

(4) **Construction sequence.** A description of the sequence of construction and steps needed to maintain compliance during construction. If the project is not to be completed in one sequence, then provide details of the phases.

(5) **Site.** Describe the topography, soils, geologic conditions, depth to bedrock, groundwater level, floodway or floodplain considerations, and other pertinent site information. The project must be constructed on the site consistent with approved plans. Include 6 months of data on the groundwater level. Provide soil boring information pursuant to OAC 252:656-11-3 (a) for projects that include lagoons or other non-industrial impoundments.

(6) **Biosolids handling**. If the proposed project will increase the production of biosolids and/or residuals, provide a description of any modifications necessary to properly treat and dispose of biosolids. All biosolids that will be land applied and/or disposed in a landfill must comply, at a minimum, with the Class B pathogen reduction requirements contained at 40 CFR, Part 503, adopted by reference at OAC 252:606. Submit a sludge management or sludge disposition plan as appropriate to the DEQ for approval.

(7) **Reclaimed water distribution system.** A description of the following:

(A) The location, size, and direction of flow of all existing and proposed reclaimed water distribution lines from the point of connection with the existing or proposed treatment works or storage locations to the end user.

(B) A summary of quantities that includes, at a minimum, pipe size, materials and linear feet of piping, types of testing and number and size of pumps.

(C) The disinfection system design based on one of the following criteria:

(i) maintaining a chlorine residual to end-of-pipe pursuant to Appendix A of OAC 252:627; or

(ii) a DEQ approved calibrated model of chlorine decay rate in the distribution system to demonstrate that adequate chlorine residual will be maintained to prevent slime growth and regrowth of pathogens to end-of-pipe.

(8) **Financing.** Itemized cost estimates to build, operate and maintain the proposed project including, but not limited to:

(A) development, construction, land and rights-of-way, legal services, engineering services, contingencies, refinancing, and any other factors associated with the proposed project;

(B) financing methods;

(C) information regarding rate structures, annual operating and maintenance (O&M) cost, tabulation of users by monthly usage categories and revenue received for the last three fiscal years; and

(D) the status of existing debts and required reserve accounts. Include a schedule of short-lived assets and a recommended annual reserve deposit to fund replacement of short-lived assets such as pumps, paint and small equipment.

(9) **Enforcement orders.** A discussion of all enforcement orders, identifying the violations cited in orders and explaining how the project will eliminate those violations.

(10) **Conclusions and Recommendations.** All engineering reports shall include a recommendation for a specific course of action to be undertaken. The conclusions and recommendations shall also include any additional findings, identify any special studies to be developed, and any other recommendations that must be considered in development of the project.

(11) **Project Schedule**. A proposed schedule to obtain funds to:

(A) complete the proposed project;

(B) submit construction plans, specifications, and permit application(s);

(C) start construction;

(D) complete construction; and

(E) attain compliance with applicable OPDES discharge permits.

252:656-3-5. Plans and specifications

(a) **General plans.** Applicants shall submit to DEQ two (2) copies of general plans that include the following:

(1) **Plan view.** Include a plan view of the plant and any discharge points, using at least 10-

foot contours.

(2) **Flood elevations.** Show both the 25-year and 100-year flood elevations and their boundaries.

(3) **Existing and proposed treatment works.** Show the physical arrangement of all treatment units on a project site plat.

(4) **Existing collection systems.** Show the location, size and direction of flow of all existing sanitary sewers at the point of connection with proposed new sanitary sewers. Show the elevations of all sewer inverts close to the manholes.

(5) **Proposed collection systems.** Show the location of all proposed sewers, sewer easements and direction of flow. Number all manholes on the layout and correspondingly on the profile. Provide a summary of quantities that includes, at a minimum, linear feet of trenching, number of manholes, size, materials and linear feet of piping, types of testing and number and size of pumps (if applicable).

(6) **Existing and proposed reclaimed water distribution systems.** Show the location, size, and direction of flow of all existing and proposed reclaimed water distribution lines from the point of connection with the existing or proposed treatment works or storage locations to the end user. Provide a summary of quantities for proposed reclaimed water distribution lines that includes, at a minimum, pipe size, materials and linear feet of piping, types of testing and the number and size of pumps. Testing specifications shall include requirements for flushing mains to remove any construction debris before placing the system into service. Construction of reclaimed water distribution systems shall be in accordance with OAC 252:626-19-2, except as follows:

(A) locate reclaimed waterlines at least 5 feet horizontally from any existing or proposed potable waterlines;

(B) locate reclaimed waterlines at least 5 feet horizontally from any existing or proposed sewer lines;

(C) locate reclaimed waterlines crossing any existing or proposed potable waterlines at least 2 feet vertically below the potable waterlines; and

(D) locate reclaimed waterlines crossing any existing or proposed sewer lines at least 2 feet vertically above the sewer lines.

(7) **Drawings.** Show the name of the municipality, sewer district, or institution; scale in feet; north point; date; and name, telephone number, address, signature of engineer and/or imprint of engineer's seal on the drawings. In the case of bound documents, engineers must affix their seal, signature and date to the cover sheet or index page, which identifies all documents bound together for which the registrant has responsible charge. In the absence of a cover sheet or index page each sheet must have the seal, and dated signature of the registrant who has responsible charge. For bound documents involving multiple registrants, either each document in the bound set must be sealed, signed and dated by the registrant in responsible charge for that portion of the work, or the cover sheet or index page must be sealed, signed and dated by each registrant with a breakdown of responsibility for each document clearly identified. Draw general plans to a scale of 100 feet per inch. Establish and reference a permanent benchmark. The minimum plan size must be 11" x 17", one-sided and of adequate contrast sufficient for electronic imaging and storage.

(b) **Detailed plans.** The applicant shall submit to DEQ two (2) copies of detailed plans drawn to a suitable scale. Plans to modify or extend existing wastewater treatment systems or water reuse systems shall clearly indicate the changes.

(1) **Non-industrial wastewater systems.** Detailed plans for non-industrial wastewater systems shall include the following:

(A) **Sewer plan and profile.** Include a plan and profile of all sewers to be constructed showing all special features, such as inverted siphons, extra strength pipe, concrete encasements, outfall structures and sewer bridges. Show all stream crossings on the profile with stream bed elevations, normal flow elevation and extreme high and low water levels. Scale the profiles to not more than 100 feet per inch horizontal and 10 feet per inch vertical. Show the scale on the profiles. Show all known existing structures both above and below ground that might interfere with the proposed construction; including water mains, gas mains, storm drains, and nature of street surfacing. Show wyes on the plan view and dimensions from the nearest down-stream manhole recorded on maps.

(B) **Sewer details.** Include profiles showing manhole stationing, size of sewers, top of rim and sewer invert elevations at each manhole and the grade and length of sewers between adjacent manholes. Show ground elevations at the house line or at approximately 50 to 75 feet from the centerline of the sewer in each direction except in the case of out-fall and/or relief sewers, where no wyes for house connections are needed.

(C) **Sewer appurtenances.** Include the details of all ordinary sewer appurtenances such as manholes, drop manholes, inverted siphons and pumping stations. A sufficiently detailed drawing of each structure must show dimensions, equipment, elevations, capacities, and any explanatory notes necessary to make them easily interpreted.

(D) **Sewer cross sections.** Include cross sections for manholes, outfall structures, headwalls, pipe cradling and encasement, and similar structures.

(E) **Sewage pumping station details.** Include complete construction details showing number and size of pumps, isolation valves, check valves, alarm system and emergency operation provisions.

(F) **Treatment works hydraulic profile.** Show hydraulic profiles with sewage, supernatant liquor and sludge flow through the plant.

(G) **Schematic diagrams.** Label schematic piping diagrams with all lines, appurtenances and direction of flow.

(H) **Treatment units.** Provide complete construction details of all treatment units including high and low water levels of receiving stream.

(I) **Fillets.** Eliminate dead spots in all tanks by designing fillets and otherwise rounding edges.

(2) **Water reuse systems.** Detailed plans for water reuse systems shall include the following information:

(A) **Treatment works hydraulic profile.** Show hydraulic profiles with sewage, supernatant liquor and sludge flow through the system.

(B) **Schematic diagrams.** Label schematic piping diagrams with all lines, appurtenances and direction of flow.

(C) **Treatment units.** Provide complete construction details of all treatment units including high and low water levels of receiving stream.

(D) **Distribution system.** Provide complete construction details of the distribution system, which shall be designed in compliance with Subchapter 27.

(c) **Specifications.** Applicants shall submit to DEQ complete detailed specifications for the proposed project with the plans and shall include a detailed summary of equipment and design data, with references to the specific applicable standards (e.g., ASTM, UL, etc.) for construction, installation and testing of said equipment.

(d) **Construction materials.** Applicants are responsible for complying with any occupational, safety and building codes. Reference in the plans or specifications where these codes require special construction materials, such as the National Electrical Code requirement for explosion-proof wiring where gases may accumulate. The DEQ will not, however, determine whether the

proposed construction will meet such codes.
(e) **Redundant equipment.** Provide redundant treatment units and equipment for maintenance and repair.
(f) **Maintenance and cleaning.** For maintenance and operational controls, all units must be equipped with means for cleaning. Direct discharge of untreated sewage is prohibited.
(g) **Weather protection.** Protect the structures and all electrical and mechanical equipment and controls from elements and a 100-year flood. Protect mechanical units, pumps, valves and piping from freezing.
(h) **Construction sequence.** Include a program for keeping existing wastewater facilities in compliance with all applicable water quality permit conditions during construction of additional facilities in accordance with OAC 252:656-3-4(a)(4) and/or OAC 252:656-3-4(b)(4).

252:656-3-6. Revisions
(a) **Approved plans.**
(1) **Before contract is awarded.** Any changes from approved plans or specifications affecting capacity, flow or operation of units must be submitted to the DEQ as an addendum for review and approval. The DEQ must review and approve the submission before construction can commence based on the addendum.
(2) **After contract is awarded.** After a contract has been awarded, submit proposed changes from approved plans or specifications in the form of a Change Order, signed and sealed by an engineer, licensed by the State of Oklahoma. The permittee and the contractor must sign Change Orders. The DEQ must review and approve the submission of the proposed changes before construction can commence based on the Change Order.
(b) **As-built plans.** File as-built plans (plans of record) for wastewater treatment works and water reuse systems with DEQ within six months after the project is completed, unless the engineer certifies that construction was completed according to the approved plans.
(c) **DEQ Inspection.** The applicant must notify the DEQ of construction completed pursuant to an Addendum or Change Order, a minimum of ten (10) days prior to the commencement of operations.

252:656-3-7. Variances from construction standards
(a) The policy of DEQ is to encourage better wastewater treatment methods and equipment, including the use of new technology. DEQ may approve processes or equipment not specifically covered by the standards in this Chapter provided the permittee requests a variance. A variance from the standards in this Chapter may be allowed, upon request of the applicant, if the DEQ finds the variance will not increase the likelihood of a system failure. No variance will be allowed unless it is noted on the construction permit.
(b) The consulting engineer shall justify the requested variance by submitting data showing the proposed processes or equipment will equal or exceed the performance of processes or equipment known to perform the same function according to the standards contained in this Chapter. Variance requests shall include the following:
(1) monitoring observations including:
(A) test results, and engineering evaluations, and
(B) data from existing installations that demonstrate the efficiency of the proposed processes or equipment;
(2) a detailed description of the test methods;
(3) other information as requested by DEQ. The DEQ may require that pilot studies and appropriate testing be conducted and evaluations be made under the supervision of a competent process engineer other than one employed by the manufacturer or developer;

(4) if required under (c) of this Section, a copy of the supplier's bond or warranty/guarantee; and

(5) if required under (d) of this Section, a copy of the supplier's bond or warranty/guarantee.

(c) **Suppliers' bonds and warranties/guarantees.** Suppliers of processes or equipment not covered by the standards in this Chapter shall be required to post a performance bond or provide a warranty or guarantee in the event that the processes or equipment fail.

(1) **Performance bonds.** Performance bonds shall:

(A) be made payable to the permittee in an amount equal to the contract price for the installed processes or equipment plus ten percent (10%); and

(B) remain in effect for at least one (1) year after the processes or equipment are placed into operation.

(2) **Warranties/guarantees.** Warranties and guarantees shall:

(A) be made payable to the permittee in an amount equal to the contract price for the installed processes or equipment plus ten percent (10%); and

(B) remain in effect for at least one (1) year after the processes or equipment are placed into operation.

(d) **Engineers' bond or contractual agreement.** Engineers proposing processes or equipment not covered by the standards in this Chapter will be required to either:

(1) post a performance bond made payable to the permittee in an amount sufficient to cover the cost of any engineering services necessary to replace the installed processes or equipment with processes or equipment that conform with the requirements of this Chapter; or

(2) enter into a contractual agreement with the permittee wherein the engineer agrees to provide engineering services necessary to replace any failed processes or equipment with processes or equipment that conform with the requirements of this Chapter.

252:656-3-8. Financial responsibility [REVOKED]

252:656-3-9. Fees

(a) Permits will not be issued until all fees are paid unless a monthly billing agreement with the DEQ and the permittee is current.

(b) Fees for treatment works construction are based on design flow and are as follows:

(1) New facilities and major modifications that alter the original design or the design capacity:

(A) 1.0 MGD and greater $5,440.00

(B) 0.50 MGD - 0.99 MGD $4,080.00

(C) 0.10 MGD - 0.49 MGD $2,720.00

(D) 0.01 MGD - 0.09 MGD $1,360.00

(E) less than 0.01 MGD $680.00

(2) Minor modifications that will not alter the design capacity of the facility such as flow measurement, discharge structures and equalization basins:

(A) 1.0 MGD and greater $1,360.00

(B) 0.50 MGD - 0.99 MGD $1,090.00

(C) 0.10 MGD - 0.49 MGD $814.00

(D) 0.01 MGD - 0.09 MGD $540.00

(E) less than 0.01 MGD $270.00

(c) Collection system and reclaimed water distribution system improvement fees are:

(1) Line extensions (rounded to the nearest one hundred feet (100'): $150.00 for the initial one to five hundred feet (1-500') plus $28.50 for each additional one hundred feet (100').

(2) Lift stations:$140.00 per 100 GPM for the peak capacity rating rounded to the nearest 100 GPM.

(3) Municipalities that are exempted from obtaining construction permits under OAC 252:656-3-3 shall submit payment to DEQ for twenty percent (20%) of the total fee calculated in this Subsection. This fee may be paid upon submission of plans, or on a monthly or quarterly basis.

(d) To assist in meeting rising costs to the Department for the non-industrial wastewater systems program and water reuse systems program, the fees set out in paragraphs (b) and (c) above shall be automatically adjusted on July 1st every year to correspond to the percentage, if any, by which the Consumer Price Index (CPI) for the most recent calendar year exceeds the CPI for the previous calendar year. The Department may round the adjusted fees up to the nearest dollar. The Department may waive collection of an automatic increase in a given year if it determines other revenues, including appropriated state general revenue funds, have increased sufficiently to make the funds generated by the automatic adjustment unnecessary in that year. A waiver does not affect future automatic adjustments.

(1) Any automatic fee adjustment under this subsection may be averted or eliminated, or the adjustment percentage may be modified, by rule promulgated pursuant to the Oklahoma Administrative Procedures Act. The rulemaking process may be initiated in any manner provided by law, including a petition for rulemaking pursuant to 75 O.S. § 305 and OAC 252:4-5-3 by any person affected by the automatic fee adjustment.

(2) If the United States Department of Labor ceases to publish the CPI or revises the methodology or base years, no further automatic fee adjustments must occur until a new automatic fee adjustment rule is promulgated pursuant to the Oklahoma Administrative Procedures Act.

(3) For purposes of this subsection, "Consumer Price Index" or "CPI" means the Consumer Price Index - All Urban Consumers (U.S. All Items, Current Series, 1982-1984=100, CUUR0000SA0) published by the United States Department of Labor. The CPI for a calendar year is the figure denoted by the Department of Labor as the "Annual" index figure for that calendar year.

(e) Emergency grant projects are exempt from construction permit fees (wastewater systems funded in part or in whole by grant monies made available through the Oklahoma Water Resources Board as authorized by Title 82, § 1085.39).

(f) REAP (Rural Economic Assistance Program) Grant Projects are exempt from permit fees.

(g) The maximum fee for any one application will not exceed $5,825.00. Any person or entity that constructs or modifies a wastewater collection system or treatment works subject to these rules, prior to the issuance of a permit, is subject to the doubling of all fees required by this chapter, as deemed necessary to offset additional administrative costs of such reviews. Further, the submission of appropriate fees and/or the issuance of a permit does not preclude any person or entity from further enforcement and/or fines as set out by State statutes and rules, for constructing or modifying a wastewater collection system or treatment works prior to the issuance of all appropriate permits as required by this chapter.

252:656-3-10. Operation and Maintenance (O & M) Manual

Within ninety (90) days of the completion of the construction, the applicant must submit to the DEQ an O & M Manual for the operation and maintenance of the wastewater treatment system or the water reuse system. The O & M Manual must include at a minimum:

(1) System Treatment Requirements;

(2) Current NPDES Permit wasteload requirements to water quality sections of OAC 252:606 including 208 Plan requirements;

(3) Description, Operation and Control of the Treatment Works;
(4) Control of Unit Processes;
(5) Laboratory Testing;
(6) Common Operating Problems;
(7) Start-Up Testing and Procedures;
(8) Normal Operating Procedures;
(9) Alternative and Emergency Operations;
(10) Emergency Shutdown Operations and Emergency Response;
(11) Records Control and Retention;
(12) Safety;
(13) Wastewater Treatment System Maintenance Requirements and/or Water Reuse System Maintenance Requirements;
(14) Spare Parts and Chemical Inventory;
(15) Reclaimed water storage and distribution system flushing plan to prevent slime growth, regrowth of pathogens and water age; and
(16) Best Management Practices for Category 6 uses within a wastewater treatment plant.

SUBCHAPTER 5. SANITARY SEWER STANDARDS

Section

252:656-5-1. Design capacity

Design sewers for the ultimate future population that may be served.
(1) Consider the maximum hourly domestic flow, industrial flow, inflow and infiltration and the topography regarding the slope and pumping needs.
(2) Design for an average daily per capita flow of 100 gpd, which includes normal infiltration. Peak design flow must be based on an acceptable infiltration/inflow (I/I) study or, for new sewer extensions, the ratio of peak to average daily flow from a widely recognized engineering standard.
(3) Exclude storm water from roof drains, streets and other areas.

252:656-5-2. Design standards

(a) **Standard.** Design and construct sewers with hydraulic slopes sufficient for obtaining a velocity of 2 fps (feet per second) or greater. Base the design on Manning's formula using an "n" value of 0.013. Gravity sewers shall not be smaller than 8-inch diameter, except those sewer lines meeting the requirements in Subchapter (c) below.
(b) **Slope.** The depth of flow and the slope of the conduit affects the velocity of a liquid flowing under gravity conditions. The following table gives minimum slopes for different sizes of pipe to meet the required flow velocity.
(1) 4" sewer: 1.00 feet/100 feet
(2) 6" sewer: 0.50 feet/100 feet
(3) 8" sewer: 0.40 feet/100 feet
(4) 10" sewer: 0.29 feet/100 feet
(5) 12" sewer: 0.22 feet/100 feet
(6) 14" sewer: 0.17 feet/100 feet

(7) 15" sewer: 0.15 feet/100 feet
(8) 16" sewer: 0.14 feet/100 feet
(9) 18" sewer: 0.12 feet/100 feet
(10) 21" sewer: 0.10 feet/100 feet
(11) 24" sewer: 0.08 feet/100 feet

(c) **Exceptions.** The following may be approved where the proper slope cannot be achieved.

(1) **Pipe Diameter**. Under the following conditions, DEQ may approve a smaller pipe diameter than stated in (b) above (but not less than 8 inches) if:

(A) The available ground slope or an obstruction dictates a different pipe diameter to meet the slope/velocity criteria.

(B) A smaller diameter pipe (but not smaller than 8-inch) will provide better hydraulic flow characteristics than the larger pipe (i.e., greater depth of flow, higher velocity, etc.). The applicant must furnish computations and compare the hydraulic conditions in the pipe at average, high and low flow conditions. Computations shall show capacity in the pipe at projected peak flow conditions.

(2) **No future expansion.** Up to 400 feet of 6-inch pipe may be installed at the end of a line that is isolated from future expansion.

(3) **Privately-owned collection lines.** Under the following conditions four- and six-inch diameter lines may be installed in privately-owned developments such as mobile home parks, recreational vehicle parks and similar establishments:

(A) Individual lots or units within the development are not intended for sale or transfer of ownership or where the collection system will not be dedicated to a public entity.

(B) No more than 10 mobile homes or 180 fixture units shall be connected to a four-inch line, and no more than 40 mobile homes or 700 fixture units shall be connected to a six-inch line.

(C) The minimum slope for a four-inch line shall be 1/8 inch per foot and for a six inch line 1/16 inch per foot.

(4) **Small diameter gravity sewers.** A small diameter gravity sewer system is acceptable where only settled sewage will be transported and consist of septic tanks and small diameter collection mains. They may only be considered for small municipalities or rural sewer districts with less than 100 connections or a population equivalent less than 250 with no or low potential for population growth. Locate septic tanks so all sewage is settled before the connection to small diameter sewers. Grinder pumps shall not be used in lieu of a septic tank.

(A) **Hydraulic design.** The design flow shall be at least 0.3 gpm per connection. The velocity in lines carrying only settled effluent may be reduced to not less than 1.0 fps based on Manning's open channel flow formula using a "n" value of not less than 0.013 and depth of flow at one half the pipe diameter.

(B) **Collector mains.** The horizontal alignment may bend so long as the radius of a bend does not exceed the manufacturer's recommendations. Use a positive gradient. The pipe diameter shall be at least 4 inches, and determined through hydraulic analysis. Determine burial depth by the elevation of the interceptor tank outlet invert elevation, frost depth and anticipated trench loadings.

(C) **Service laterals.** Lines between septic tanks and collector lines shall be 3-inch PVC or larger.

(D) **Tanks, pumps and service lines.** Septic tanks shall meet the design requirements of OAC 252:641 with routine maintenance. Septic tanks, pumps and service lines from them must be regarded as integral components of the wastewater system and

not part of the individual home plumbing.

(E) **Manholes and cleanouts.** Cleanouts may be used instead of manholes, except at major junctions of mains. Cleanouts are required at the upstream ends of mains, at minor main junctions, at changes in main diameter and at least every 400 feet. Cleanouts shall be flush with the ground and designed to prevent damage from vehicular traffic.

(F) **Corrosion.** Use corrosion resistant materials in lift stations.

(G) **Vents.** Vents are necessary to maintain free-flowing conditions in the main and are commonly used in combination with cleanouts.

(H) **Testing.** In addition to leak testing the small diameter system, conduct vacuum or hydrostatic tests on interceptor tanks. Typical acceptance criteria are less than 1.0 inch loss of Hg vacuum after five minutes with initial vacuum of 4.0 inches of Hg or a drop in water level of 1.0 inch after 24 hours in an overfilled tank.

(5) **Pressure sewers.** Pumping units, septic tanks and holding tanks shall be regarded as integral components of the wastewater system and not part of individual home plumbing. There must be at least one pump per housing unit and a minimum of an audio/visual alarm for malfunctions.

(A) **Sewer design.** Flow velocities must be in the range of 2 to 5 feet per second for grinder pump installations. Lower velocities may be approved only for pipes carrying settled effluent from septic tanks. Systems must have air relief valves, a means to flush all lines, cleanouts and rerouting procedure in the event of maintenance. Each line without a grinder pump must have a septic tank meeting OAC 252:641, Individual and Small Public On-Site Sewage Treatment Systems, to separate solids.

(B) **Pumps.** Pump size must meet the volume and head conditions. Grinder pumps must be at least two-horsepower unless the applicant can show that the manufacturer of the complete pump system has a minimum of 5 successful installations permitted by the DEQ serving ten (10) or more homes. Systems will be designed to provide back-flow prevention. Pumps shall be housed in a tank separate from the septic tank with at least 12 hours holding capacity to allow for power outages and equipment failures.

(C) **Equipment Inventory.** A minimum number of pumps shall be purchased by the system to provide back up for maintenance of the system. The system is required to provide one pump for the first 1-10 homes, one (1) additional pump for the next fifteen (15) homes and one (1) additional pump for each additional twenty-five (25) homes thereafter.

252:656-5-3. Materials

(a) **ASTM.** All pipe, materials and construction must meet ASTM standards. List the standard for all materials and methods in the detailed specifications.

(b) **Bedding.** Specify the applicable ASTM material class of bedding, which must be matched to the proper strength pipe to support the anticipated loads.

(c) **Backfill.** Specify the applicable ASTM standard for the backfill material and its placement.

(d) **Manholes.** Specify the applicable ASTM standards for the manhole material, manhole installation and manhole testing to be used in the construction of the manholes. Bricks and/or concrete blocks will not be approved for manhole construction.

252:656-5-4. Construction standards

(a) **Sewer.** Lay sewers in straight alignment with uniform grade between manholes. Protect all pipe from traffic load damage. Install metal tracer wire on all non-ferrous piping.

(b) **Trench.** The width of the trench shall be ample to allow the pipe to be laid and joined

properly and to allow the backfill to be placed and compacted as needed.

(1) Trench sides shall be kept as nearly vertical as possible. When wider trenches are dug, appropriate bedding class and pipe strength shall be used.

(2) Provide a minimum clearance of 4 inches between all pipe and any large stones, ledge rock, or boulders.

(3) Except for ductile iron pipe, provide 30 inches of soil cover as protection from traffic load damage to the pipe. Specify the applicable ASTM standards for ductile iron pipe.

(c) **Separation.** Sanitary sewers located in the street right-of-way shall be located on opposite sides of the streets from potable water lines and shall comply with the following:

(1) **Horizontal separation.** Sanitary sewers shall be at least:

(A) 50 feet from petroleum product tanks unless constructed of ductile iron pipe which shall be no closer than 10 feet (joint material shall be resistant to petroleum products);

(B) 300 feet from a public water supply well;

(C) 50 feet from a private water well;

(D) 10 feet from any existing or proposed water main; and

(E) 5 feet from electrical lines and petroleum lines.

(2) **Vertical separation (crossings).** Sanitary sewers and sewer service lines shall cross at least 24 inches above or below water mains, and the crossing section centered so that the joints will be as far as possible from the water mains.

(3) **Special conditions.** When it is impossible to obtain proper horizontal and vertical separation as stipulated in (1) and (2) of this subsection, design and construct the sanitary sewer equal to water pipe, and pressure test it to assure water tightness of joints adjacent to the water line prior to backfilling. [See OAC 252:626-19-2(h)(3) (relating to vertical separation of water mains and sewer lines).]

(4) **Prohibition against sewer and water lines in same trench.** Sanitary sewer and sewer service lines shall not be laid in the same trench as water mains and/or water service lines.

(d) **Stream crossings - aerial.** Support all joints in aerial crossings. Design crossing supports to prevent frost heave, overturning and settlement. Use concrete encasement (except around PVC pipe) or riprap where the pipe enters stream banks. Use expansion joints between above-ground and below-ground sewers and force mains, and protect them from freezing. Protect pipes that cross streams from the impact of flood waters and debris.

(e) **Stream crossings - below-grade.** The top(s) of all sewers entering or crossing stream beds shall be at least 3 feet below the natural bottom of the stream bed. Construct or encase the crossing with ductile iron pipe using mechanical joints. Sewers shall remain watertight and free from changes in alignment or grade. Trench backfill shall be stone, coarse aggregate, washed gravel or other material that will not cause siltation. Specify construction methods to minimize siltation and bank erosion.

(f) **Flood plain structures.** Protect sewer outfalls, headwalls, manholes, gate boxes and other structures located in flood plains from stream erosion. Locate structures so they do not interfere with the free discharge of flood flows.

(g) **Manholes.** Manholes shall be installed at the end of each line; at all changes in grade, size, or alignment; at all intersections; and at distances not greater than 400 feet apart for sewers 15 inches in diameter or less, and 500 feet for sewers 18 to 30 inches in diameter. Greater spacing may be permitted in larger lines, those carrying a settled effluent or where adequate modern cleaning equipment for such spacing is provided. Lampholes and cleanouts shall not be substituted for manholes nor installed at the end of laterals longer than 250 feet. [See 252:656-27-2(b) (relating to separation distance requirements).]

(1) **Drop manhole.** A drop pipe is required for all sewer lines entering a manhole at an elevation of 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches, the invert shall be filleted to prevent solids deposition. For drop pipes constructed outside the manhole, the entire outside drop connection shall be encased in concrete. Drop pipes constructed inside the manhole, shall be secured to the interior wall of the manhole and provide access for cleaning.

(2) **Diameter.** The minimum inside diameter of manholes shall be 48 inches with a conical section at top to receive a standard manhole ring and cover.

(3) **Flow channels.** The flow channels through manholes shall conform in shape and slope to that of the sewer lines.

(4) **Inlet and outlet pipes.** Join inlet and outlet pipes to the manhole with a gasket or other flexible watertight connection that allows for differential settlement of the pipe and manhole wall.

(5) **Watertight covers.** Use watertight covers on manholes that may become submerged.

(6) **Bases.** Manhole bases shall be at least 8 inches thick, with a diameter 8 inches more than the largest outside diameter of the manhole. Construct with leakproof joints between the base and manhole.

(7) **Leakage Testing.** Specify the applicable ASTM standard for the test to be used.

(h) **Inverted siphons.** Inverted siphons shall have at least two barrels with a pipe size at least 6 inches in diameter. Provide necessary appurtenances for convenient flushing and maintenance. Construct manholes with adequate clearance for rodding the pipes. Provide sufficient head and select a pipe size for a velocity of at least 3.0 fps for average flows. Arrange the inlet and outlet details so normal flow is diverted to one barrel and either barrel may be taken out of service for cleaning. The vertical alignment shall permit cleaning and maintenance.

252:656-5-5. Tests

(a) **Deflection test.** Perform deflection tests on all flexible pipe after the final backfill has been in place at least 30 days. Deflection must not exceed 5%. Tests must be run using a rigid ball or mandrel with a diameter equal to 95% of the inside diameter of the pipe taking into account manufacturing tolerances. Tests must be performed without mechanical pulling devices. Specify the applicable ASTM standard for the test to be used.

(b) **Leakage test.** Leakage tests are required for all gravity lines. Hydrostatic tests must use a 2-foot test head and leakage inward or outward must not exceed 10 gallons per inch of pipe diameter per mile per day. Specify the applicable ASTM standard for the test to be used. The procedures listed in the *Handbook of PVC Pipe,* Uni-Bell PVC Pipe Association, 2001 may be used for PVC pipe. An air test result must assure a leakage limit equivalent to the hydrostatic test limit.

SUBCHAPTER 7. PUMP STATION STANDARDS

Section

252:656-7-1. Pump station design

(a) Required design factors for pumping stations are:

(1) **Emergency plan.** Provide an emergency plan for handling sewage should the lift station

completely fail. Required emergency operations are in 252:656-7-4.

(2) **Separate wells.** Wet and dry wells must be completely separated, each with its own entrance.

(3) **Equipment accessibility and safety.** Provide a suitable stairway or ladder for dry wells and for wet wells with bar screens or mechanical equipment. Adequate provision must be made to effectively protect maintenance personnel from hazards. Equipment for confined space entry in accordance with OSHA and regulatory agency requirements must be provided for all wastewater pumping stations. The design of the system must protect the pump station controls and appurtenances from unauthorized access and vandalism. Provide a building or other form of protection such as fencing or access hatches with locks. The design of the system must prevent unauthorized access or vandalism to control system and equipment.

(4) **Equipment removal.** Provide for removal of pumps, motors, and other mechanical and electrical equipment during all weather conditions.

(5) **Dry well dewatering.** Provide a sump pump in dry wells to remove leakage or drainage. The discharge pipe shall terminate above the overflow level of the wet well and include a check valve located near the pump. Do not connect water ejectors to a potable water supply. Slope all floor and walkway surfaces to the sump. Pump seal water shall be piped to the sump.

(6) **Flood Protection.** Wastewater pumping stations structures and electrical and mechanical equipment shall be protected from physical damage by the 100 year flood and shall not be located in a flood way. Wastewater pumping stations shall remain fully operational and accessible during the 25 year flood. Regulations of state and federal agencies regarding flood plain obstructions shall be followed.

(7) **Buoyancy.** Where high groundwater conditions are anticipated, buoyancy of the wastewater pumping station structures shall be considered and, if necessary, adequate provisions shall be made for protection.

(8) **Pump station accessibility and security.** The pumping station must be readily accessible by maintenance vehicles during all weather conditions and must be located off the traffic ways of streets and alleys.

(b) Pump requirements are:

(1) **Multiple units.** Provide at least two pumps. With any pump out of service, the remaining pump(s) must have the capacity to handle maximum sewage flows.

(2) **Protect against clogging.** Pump stations with screening devices shall provide for the storage and disposal of the collected material. Provide a suitable bypass where screening is installed.

(3) **Pump openings.** Pumps, other than grinder type pumps, shall be capable of passing a 3-inch sphere. Suction piping shall be at least 4 inches in diameter. Suction lines to dry wells shall include suitable shut-off valves to allow pump removal.

(4) **Priming.** Locate pumps so they will operate under a positive suction head under normal conditions.

(5) **Intake.** Each pump shall have an individual intake and be designed to avoid turbulence near the intakes.

(6) **Pumping rates.** Size pumps to prevent hydraulic surges.

(c) Force main requirements are:

(1) **Diameter.** Force mains shall be at least 4 inches in diameter and provide at least 2 fps velocity.

(2) **Air relief valve.** Install air relief valves at high points in force mains.

(3) **Termination.** Terminate force mains not more than 2 feet above the flow line of the

receiving manhole, and design them to reduce splashing and erosion.

(4) **Design pressure.** Design the force main and fittings, including reaction blocking, to withstand normal pressure and pressure surges (water hammer).

(5) **Stream crossings.** Force main construction used for stream crossings must meet applicable requirements of OAC 252:656-5-4.

(6) **Design friction losses.** Calculate friction losses through force mains with the Hazen and Williams formula (or equivalent), using these C values:

(A) Unlined iron or steel - 100

(B) All other lined ductile iron - 120

(C) PVC - 140

(7) **Separation from water mains.** Refer to OAC 252:656-5-4(c).

(8) **Controls.** Locate the control system so it is not affected by turbulence of incoming flow or pump suction. Provide automatic alternation of constant speed pumps at each cycle.

(9) **Valves.** Place suitable shutoff valves on suction and discharge lines of each pump. Place a check valve or equivalent on each discharge line, between the shut-off valve and the pump. Shut-off valves are not required on the suction side of pumps that can be removed from service without discharging.

(10) **Wet wells.** Wet well size and control settings shall be appropriate to meet the chosen manufacturer's recommended cycling times and to avoid heat buildup in the pump motor due to frequent starting and not to exceed 30 minutes between pump off to pump on to avoid septic conditions due to excessive retention time. The effective volume of the wet well shall be based on design average flow and a filling time not to exceed 30 minutes unless the facility is designed to provide flow equalization. Slope wet well floors to the pump intake at least 1 to 1 (1:1). Covered wet wells shall have provisions for air displacement to the atmosphere.

(11) **Ventilation.** Adequate ventilation shall be provided for all pump stations. Where the pump room is located below ground surface, mechanical ventilation is required. There shall be no interconnection between wet well and dry well ventilation systems. If the wet well must be entered to service mechanical equipment, forced ventilation is required, independent of dry well ventilation. Ventilation equipment switches shall be well marked and located at the entrance to the dry well. Intermittent operation ventilation systems shall be interconnected with the lighting system. The fan wheel(s) shall be fabricated from non-sparking material.

(A) **Wet wells.** Ventilation may be either continuous or intermittent. Mechanical ventilation is required if screens or mechanical equipment requiring maintenance and/or inspection are located in a wet well. Continuous ventilation shall provide at least 12 complete air changes per hour. Intermittent ventilation shall provide at least 30 complete air changes per hour. Air shall be forced into, rather than exhausted from, the wet well. Wet wells not designed for access shall have provision for air displacement to the atmosphere. The top of the pumping station shall be located higher than the 100-year flood.

(B) **Dry wells.** Provide adequate ventilation for all dry wells. Ventilation may be either continuous or intermittent. Continuous ventilation shall provide at least six complete air changes per hour; intermittent ventilation shall provide at least 30 complete air changes per hour. Ventilation equipment switches shall be marked and located at the entrance to the dry well.

(12) **Water supply interconnection.** There shall be no direct connection between any potable water supply and sewage pumps or piping.

(13) **Pressure testing/leakage testing.** Test the installed pipe for leakage in accordance

with the applicable ASTM standard specifications. The design working pressure of the pipe must not exceed 2/3 of the rated pressure of the pipe. Specify the applicable ASTM standard to be used.

252:656-7-2. Suction lift pumps

The pump equipment compartment shall be above grade or offset and effectively isolated from the wet well. Wet well access shall not be through the equipment compartment. Valving shall not be located in the wet well. 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 22 feet.

(1) Self-priming pumps shall be capable of rapid priming and repriming at the "lead pump on" elevation. Suction piping should not exceed the size of the pump suction and shall not exceed 25 feet in total length. Priming lift at the "lead pump on" elevation shall include a safety factor of at least 4 feet from the maximum allowable priming lift for the specific equipment at design operating conditions.

(2) Vacuum-priming pump stations shall be equipped with dual vacuum pumps capable of automatically and completely removing air from the suction lift pump. The vacuum pumps shall be adequately protected from damage due to sewage.

252:656-7-3. Submersible pump stations

Submersible pump stations shall meet the applicable requirements under OAC 252:656-7-1 (design), except as provided in this section.

(1) **Construction.** Submersible pumps and motors must be designed specifically for raw sewage use, including totally submerged operation during a portion of each pumping cycle. Provide an effective method to detect shaft seal failure or potential seal failure. The motor shall be of squirrel-cage type design without brushes or other arc-producing mechanisms.

(2) **Pump removal.** Submersible pumps shall be readily removable and replaceable without dewatering the wet well or manually disconnecting any piping in the wet well.

(3) **Electrical.**

(A) **Power supply and control.** Electrical supply, control and alarm circuits shall be designed to provide strain relief and to allow disconnection from outside the wet well. Terminals and connectors shall be protected from corrosion by location outside the wet well or through use of watertight seals. If the location is not sheltered, use weatherproof equipment.

(B) **Controls.** Locate the motor center outside the wet well. Protect it by a conduit seal or other appropriate measures meeting National Electrical Code requirements to prevent the atmosphere of the wet well from gaining access to the control center. The seal shall be so located that the motor may be removed and electrically disconnected without disturbing the seal.

(C) **Power cord.** Pump motor power cords shall be designed for flexibility and serviceability under conditions of extra hard usage and shall meet the requirements of the National Electrical Code standards for flexible cords in wastewater pump stations. Power cord terminal fittings shall be corrosion-resistant and constructed in a manner to prevent the entry of moisture into the cable, provided with strain relief appurtenances and designed to facilitate field connection.

(4) **Valves.** Valves for force mains shall be located outside the wet well in a separate enclosure. Provide drain systems for below-ground enclosures. If the valve enclosure is drained to the wet well, include a method to prevent sewage from entering the enclosure

during surcharged wet well conditions.

252:656-7-4. Emergency operation

(a) **Design.** Design pumping stations to prevent bypassing of raw sewage during periods of power outage or mechanical failure. The pumping station must meet one of the following design conditions:

(1) an on-site standby generator with automatic means of activation in the event of a power failure;

(2) a portable engine-driven pump with a quick connection to the force main; four hours of emergency storage at the average design flow above the alarm level; and telemetry to the city office during working hours and to the home of the person(s) in responsible charge of the lift station during off-duty hours;

(3) 24 hours of emergency storage at the average design flow above the alarm level with an audio/visual alarm system;

(4) an on-site engine-driven pump with one hour of emergency storage at design flow above the alarm level and an automatic means of activation; or

(5) a portable engine-driven generator with four (4) hours of emergency storage at the design flow above the alarm level, a telemetry alarm system that communicates to the person in charge of the lift station, and a transfer switch with electrical system components that comply with the National Electrical Code requirements that is pre-wired to allow for a ready connection between the lift station and the portable generator.

(b) **Equipment requirements**.

(1) **General.** The following general requirements shall apply to all internal combustion engines used to drive auxiliary pumps, service pumps and electrical generating equipment:

(A) **Engine protection.** The engine must be protected from operating conditions that would result in damage to equipment. Unless continuous manual supervision is planned, protective equipment shall be capable of shutting down the engine and activating an alarm.

(B) **Size.** The engine shall have adequate rated power to start and continuously operate all connected loads. The engines shall be capable of handling the peak capacity of the station.

(C) **Routine start-up.** All emergency equipment shall be provided with instructions indicating the need for regular starting and running of such units at full loads.

(D) **Equipment protection.** Emergency equipment shall be protected from damage due to restoration of regular electrical power.

(E) **Instructions, tools and parts.** Post a complete set of operational instructions, emergency procedures and maintenance schedules at the station. Provide any special tools and spare parts.

(2) **Engine-driven pumping equipment.** Where permanently installed or portable engine-driven pumps are used, the following requirements shall also apply:

(A) **Pumping capacity.** Engine-driven pump(s) shall meet the design pumping requirements unless storage capacity is available for flows beyond pump capacity. Pumps shall be designed for anticipated operating conditions, including suction lift if applicable.

(B) **Operation.** The engine and pump shall be equipped for automatic start-up and operation, and for manual start-up.

(C) **Portable pumping equipment.** Where part or all of the engine-driven pumping equipment is portable, a riser from the force main with quick-connect coupling and appropriate valving shall be provided to hook up portable pumps.

(D) **Telemetry.** Connect a telemetry alarm system from the engine-driven pump to the city office or cell phone during working hours and to the home or cell phone of the person(s) in responsible charge of the lift station during off-duty hours.

(3) **Engine-driven generating equipment.** Where permanently installed or portable engine-driven generating equipment is used, the following requirements shall also apply:

(A) **Generating capacity.** Generating unit size shall be adequate to provide power for pump motor starting current and for lighting, ventilation, and other auxiliary equipment necessary for safety and proper operation of the lift station. Provide sequencing controls to start pump motors unless the generating equipment has capacity to start all pumps simultaneously with auxiliary equipment operating.

(B) **Operation.** Provide for automatic and manual start-up and load transfer. Protect the generator from damaging operating conditions. The engine must start and stabilize at operation speed before assuming the load.

(C) **Portable generating equipment.** If portable generating equipment will be used, include special electrical connections.

(c) **Overflow basins.** General construction of overflow basins shall be in accordance with 252:656-11-3.

(d) **Alarm systems.** Pumping stations shall have an automatic alarm system capable of alerting responsible maintenance personnel of an equipment failure before an overflow occurs, even during a power failure. If telemetry is not provided to an office manned 24 hours per day, then show an equivalent alerting capability.

SUBCHAPTER 9. GENERAL STANDARDS

Section

252:656-9-1. Plant location and design life

(a) **Minimum separation distances.** Local ordinances and zoning requirements may establish separation distances greater than those required by this Chapter. The minimum separation distance from any public water supply well is 300 feet. The minimum distance requirements from any public water supply intake structure will be determined on a case by case basis. No part of any wastewater treatment or conveyance unit shall be constructed or extended within 100 feet of a plant site property line. Measurement for lagoons shall be from the centerline of the nearest dike.

(b) **Flood protection.** Protect the treatment works structures, electrical and mechanical equipment from physical damage by a 100-year flood. Treatment works must remain operational and be accessible during a 25-year flood. Flood protection applies to new construction and to existing facilities undergoing major modification.

(c) **Design life.** Design sewage treatment plants for an estimated 20-year population projection. Construction may occur in phases to reduce initial cost.

(d) **Phased.** For facilities to be built in phases, the engineer shall furnish design data for ultimate plant capacity. The data shall include size, type, loading and location of all units. Use dashed lines to show units that are to be constructed as a later phase. Furnish a hydraulic profile showing the water elevations of all units and the flood elevation of streams that can affect the plant site. Detailed design data are required for all units to be constructed as Phase I.

(e) **Access Restriction.**

All facilities must be fenced to prevent unauthorized entry. Fencing must be posted with warning signs to indicate the nature of the facility, listing emergency contact information. Post at least one sign on each side of the site.

252:656-9-2. Essential facilities

(a) **Emergency power facilities.** All plants shall provide standby equipment which will generate electric power to allow continuity of operation, including but not limited to pumping, aeration and disinfection, during power failures.

(b) **Water supply.**

(1) **General.** Provide potable water under pressure to laboratories, restrooms, offices, drinking fountains and showers. Cross-connections between potable and non-potable water lines is prohibited.

(2) **Direct connections.** Potable water from a municipal or separate supply may be used directly at points above grade. Hot water shall not be taken directly from a boiler used for supplying hot water to a sludge heat exchanger or digester heating unit.

(3) **Indirect connections.** Where a potable water supply is to be used for any purpose in a plant other than those listed in paragraph (1), above, provide a break tank, pressure pump, and pressure tank. Discharge water to the break tank through an air gap at least six inches above the maximum flood line or the spill line of the tank, whichever is higher. Post a permanent sign at every hose bib, faucet, hydrant, or sill cock located on the water system beyond the break tank to indicate that the water is not safe for drinking. The installation of a reduced pressure zone backflow prevention device will be considered in lieu of the break tank. To allow maintenance on the backflow prevention device, the design shall include a bypass line with equal backflow prevention. Do not locate back-flow devices in a pit or vault where they may become submerged; they must be easily accessible for routine testing for proper operation.

(4) **Non-potable water outlets.** Post a permanent sign at non-potable water outlets indicating the water is not safe for drinking.

(5) **Prevention of cross-connections.** Do not allow a physical connection between potable water lines, sanitary sewer lines and/or reclaimed water lines unless a break tank is provided. All water discharged to a break tank shall be discharged through an air gap at least six inches (6") above the maximum flood line or the spill line of the tank, whichever is higher.

(c) **Laboratory equipment.** All treatment works shall have access to a laboratory for making analytical determinations and operation control tests.

(d) **Sewage flow measurement.** Flow measurement devices shall be selected for reliability and accuracy. All flow measurement equipment must be sized to function effectively over the full range of flows expected and shall be protected against freezing. Every primary flow measurement device must conform to the standard guidelines in the *Water Measurement Manual,* 3rd Edition, published by the United States Department of the Interior, Bureau of Reclamation. An equivalent set of standard guidelines may be used, if approved by the DEQ. Every primary measurement device, sharp crested weir or flume, must be equipped with an affixed staff gauge to measure the liquid level and placed at the proper head measurement location. For continuous flow measurement, the level sensor must be placed at the proper head measurement location equivalent to the location of the staff gauge so that the head measured using the staff gauge and that measured by the sensor are the same.

(1) **Influent flow.** Provide for the measurement of incoming flow at all non-industrial wastewater treatment plants. Where all incoming flow to a plant having a design flow of less than 0.5 mgd is through a single pump station, flow measurements may be satisfied by the calibration of pumps and the installation of run-time meters. Weirs must not be used to measure influent flow.

(2) **Effluent flow.** For discharging systems, provide for the measurement of wastewater effluent flow in accordance with the system's OPDES permit and OAC 252:606. For lagoon effluent, a baffle shall be provided to prevent the discharge of surface debris and algae to a depth of at least one foot (1') below the weir crest.

(3) **Land application.** For land application systems, effluent flow measurement shall be in accordance with OAC 252:656-25-2(h).

(4) **Closed channel flow measurement.** Provide the complete design information and calculations for all closed channel flow measurement devices.

(e) **Housed facilities.** Where treatment units are in a housed facility, introduce fresh air continuously at a rate of 12 air changes per hour, or intermittently at a rate of 30 air changes per hour. Provide adequate stairway access to above or below ground installations. All electrical installation in enclosed grit removal areas where hazardous gases may accumulate shall meet the requirements of the National Electrical Code.

252:656-9-3. Plant outfalls

(a) **Entrance impact control.** All wastewater treatment facilities designed to discharge treated wastewater shall provide an outfall sewer pipe to a defined water course. Provide the following when designing outfall lines:

(1) Dispersion of the effluent across the stream as needed to protect aquatic life; and

(2) Access for effluent sampling.

(b) **Protection and maintenance.** Protect the outfall sewer from the effects of floodwater, ice, or other hazards to reasonably assure its structural stability and freedom from stoppage. Provide a manhole at the shore end of all gravity sewers extending into the receiving waters. Provide at least a 12-inch diameter pipe or appropriate screening for submerged discharges to prevent blockage by aquatic animals.

(c) **Discharge to reservoirs.** Proposed discharges within 600 feet of the maximum conservation pool elevation shall extend the line into the reservoir. Anchor the lines to the bottom in such a fashion as to be at least 10 feet below the surface and 100 feet from the water line at the conservation pool elevation.

(d) **Sampling provisions.** Design all outfalls with easy access for obtaining effluent samples during all weather conditions at a point after the final treatment process and before it reaches the receiving waters.

SUBCHAPTER 11. LAGOON STANDARDS

Section

252:656-11-1. Lagoon siting

(a) **Winds.** Locate lagoons to minimize wind obstructions.

(b) **Surface runoff.** Do not locate lagoons in floodways. Divert storm water runoff around lagoons and protect embankments from erosion.

(c) **Hydrology.** Use sound sanitary and engineering practices to protect groundwater aquifers and public water supplies from pollution from lagoons. Maintain a 4-foot separation between the lagoon bottom and the highest known groundwater elevation.

(d) **Geology.** Lagoons shall not be located in areas that are subject to karstification (i.e., sink

holes or underground streams generally occurring in areas underlain by limestone, gypsum or dolomite). There shall be a 4-foot separation between the lagoon bottom and any bedrock formation.

252:656-11-2. Basis of design

(a) **Facultative Lagoons.** Facultative lagoons depend on the relationship between organic loading and surface area (algal photosynthesis) or on surface area and supplemental mechanical aeration to provide an aerobic layer of water at the surface. Facultative lagoons may be either total retention or flow-through (discharge) to waters of the state.

(b) **Flow-through lagoons.**

(1) **Organic loading.** Limit the organic load to 35 pounds BOD per acre (water surface area) per day for any cell depending solely on algal photosynthesis for oxygen. The total water surface area requirement based on organic loading is calculated at the average water depth. Flow-through lagoon systems will not consistently provide ammonia removal through the nitrification process so the effluent from these facilities may be toxic to aquatic life and thus cause whole effluent toxicity test failures.

(2) **Flow Control.** Provide at least two primary cells on new systems. Design the primary cells so they may be operated in either series or in parallel, with at least 60 days retention time. Provide at least two secondary cells operating in series with the primary cells and in series with each other. Provide a bypass line around any secondary cell in a series to the next cell. The secondary cells shall have at least 60 days detention for a total of at least 120 days detention in the system.

(3) **Depth.** The maximum water depth shall not exceed 6 feet in primary cells and 10 feet in secondary cells. Provide structures to allow the primary cells to operate between four foot depth and the maximum design depth plus three feet of freeboard. The operating depth for a flow-through lagoon shall be between 4 and 6 feet.

(c) **Total Retention.** Size the primary cell(s) for the expected organic loading and additional evaporation cells designed for the hydraulic load. Base the design of all cells receiving raw wastewater on an organic loading of 35 lbs BOD per surface acre per day at the average operating depth. Design the primary cells so they may be operated in either series or in parallel.

(1) **Surface evaporation.** Where more than one acre of surface area is needed, provide at least two cells. For those systems greater than five (5) acres surface area provide at least two primary cells.

(A) Provide sufficient area to evaporate the annual influent flow based on the average daily design flow with allowances for infiltration and inflow to the sewage collection system.

(B) Base the evaporation rates on the annual average pan evaporation minus the 90th percentile annual precipitation for the geographical location, as contained in Appendix E.

(C) The system shall be designed with a five (5) foot operating depth, with three (3) feet of freeboard.

(2) **Land Application.** Design two (2) primary cells and one storage cell. Follow design guidelines stated in Subchapter 25 of this Chapter.

(A) Primary cells shall have sixty (60) days of retention time.

(B) Secondary cells shall have ninety (90) days of storage with the operating depth not to exceed ten (10) feet.

(d) **Aerated lagoon systems.** The following apply to all new aerated lagoon systems. Only partial-mix systems will be considered for systems with 30 day average concentration limits for BOD and TSS of 30 mg/l and 90 mg/l, respectively, as their basic permit requirement. Aerated

lagoon systems will not consistently provide ammonia removal through the nitrification process so the effluent from these facilities may be toxic to aquatic life and thus cause whole effluent toxicity test failures.

(1) **Number of cells.** At least two aerated cells, in series, followed by one settling lagoon and provide a hydraulic retention time of at least two days.

(2) **Depth.** The design water depth shall be 10 to 15 feet.

(3) **Design Requirements.** Submit design calculations to the DEQ for review, and justify the use of any constants not listed.

(4) **Aeration requirements.** Oxygen requirements will depend on organic loading, required treatment, and concentration of suspended solids to be maintained in the aerated cells. Aeration equipment shall be capable of maintaining a minimum dissolved oxygen level of 2 mg/l in the lagoons at all times. In the absence of experimentally determined values, the design oxygen requirements shall be 1.8 lb O_2/lb BOD applied at maximum loading.

(5) **Additional information.** For a more detailed discussion of aerated lagoon design see *Design Manual Municipal Wastewater Stabilization Ponds*, U.S. Environmental Protection Agency, EPA-625/1-83-015 (1983). Also use *Wastewater Engineering: Treatment, Disposal & Reuse*, Metcalf & Eddy, Inc., 4th Edition, (2003).

(6) **Disinfection.** Disinfection shall be required for all lagoon systems proposed to discharge to "waters of the state" where the beneficial use of the receiving water body is designated in Oklahoma's Water Quality Standards (OAC 252:73045) as either "Primary Body Contact Recreational" or "Public or Private Water Supply".

252:656-11-3. Lagoon construction details

(a) **Soil borings.** Provide soil boring data conducted by an independent soil-testing laboratory. Borings shall extend at least 5 feet below the proposed lagoon bottom and at least one boring shall be at least 25 feet deep or into bedrock. Borings shall be conducted during the time of highest groundwater level. Provide enough borings to accurately represent the soil characteristics of the entire lagoon site. If bedrock is encountered, describe its general characteristics and identification, and the corresponding geological formation(s). Include a map showing the location of each boring, a log of soil types encountered at each boring, the elevation of the water table where encountered and the permeability of soil samples taken from the same elevation as the proposed lagoon bottom. Fill and seal all borings after testing.

(b) **Dikes.**

(1) **Material.** Construct dikes of relatively impervious material and compact them to at least 90% Standard Proctor Density to form a stable structure. Remove vegetation and other unsuitable materials before construction.

(2) **Top width.** The top of the dike shall be at least 8 feet wide for maintenance vehicles.

(3) **Slope.** Inner and outer dike slopes shall not be steeper than 1 vertical to 3 horizontal (1:3). Steeper slopes will only be considered where surface construction is of soil cement or other material that will prohibit vegetation growth. Inner dikes shall not be flatter than 1 vertical to 4 horizontal (1:4).

(4) **Freeboard.** Design the lagoon to maintain at least 3 feet of freeboard above the design maximum water depth at all times.

(5) **Lagoon shape.** Round, square or rectangular lagoons with rounded corners, with a length not more than three times the width constructed without islands, peninsulas or coves.

(6) **Erosion control.** Protect inner dikes from wave action and outer dikes from runoff and floodwaters.

(A) **Seeding.** Where riprap is not used, apply at least 4 inches of fertile top soil to

dikes to establish an adequate vegetative cover. Before prefilling, establish vegetation on dikes from the outside toe to 2 feet above the lagoon bottom on the interior as measured on the slope. Specify perennial, low-growing grasses that spread rapidly. Do not use alfalfa or other long-rooted vegetation for seeding since the roots of this type are apt to impair the water holding efficiency of the dikes.

(B) **Additional protection.** Provide extra protection where inner dikes may be subjected to severe wind action, such as lagoons larger than 5 acres and where the lagoon surface will often be exposed to strong winds. Also, protect areas of turbulence in aerated cells and all pipe penetrations. Install riprap, soil cement or other recognized material. Protect the inner dikes from 1 foot vertically above the high water elevation to 2 feet vertically below the minimum operating elevation. Place riprap on a filter bed at least 6 inches thick, and use material that will stay in place and resist erosion.

(c) **Lagoon seal.** Construct a soil seal as specified below. If native soils exceed this seepage rate, then a bentonite seal or synthetic liner shall be specified. Use ASTM Method 5084. Analysis of soil shall include how soil will be applied. The seepage rate through the lagoon bottom and inside dike shall not exceed 500 gal/day/acre (5.4×10^{-7} cm/s) at a hydraulic head of 6 feet for soil and bentonite seal. Synthetic seals shall have no measurable leakage.

(1) **Soil seal.**

(A) The soil used for sealing shall have a high, uniform content of fine material (clay and silt). Soil containing rock or a high gravel content is not acceptable for a soil seal or for mixing with bentonite.

(B) Soil used to construct the lagoon seal and dike cores shall be relatively incompressible and compacted at a water content up to 4% above the optimum to at least 90% Standard Proctor Density.

(C) The soil used for sealing shall be at least 12 inches thick with the coefficient of permeability (K) no greater than 10^{-7} cm/s. The soil seal shall be applied in lifts no greater than 6 inches.

(D) Written certification to the effect that the seal was provided and applied in accordance with specifications and that the coefficient of permeability is equal to or less than 10^{-7} cm/s shall be furnished by the project engineer and independent soils laboratory. The written certification shall include:

(i) the number of samples taken;

(ii) a map of the location of the samples taken; and

(iii) a demonstration that the location and number of samples taken are representative of the seal of the lagoon, for both the bottom of the lagoon and all sides of the lagoon dike walls.

(2) **Bentonite seal.**

(A) The application rate shall be at least 125% of the minimum rate that is determined to be adequate by laboratory tests.

(B) The water content of the soil-bentonite mixture shall be up to 4% above the optimum for maximum compaction. Bentonite shall be applied to soil that is free of all vegetation, trash, roots, frozen soil, snow or ice, stones over 2 inches in diameter or other objectionable material.

(C) Split the material in half and apply in 2 perpendicular 3-inch lifts for a finished compacted blanket thickness of at least 6 inches.

(D) After mixing and compacting, analyze a sample of the soil/bentonite mixture for permeability. If the coefficient of permeability exceeds 10^{-7} cm/s, the depth of the mixture or content of bentonite shall be increased as necessary to obtain the required seal.

(E) Compact the mixture at the proper water content to at least 90% Standard Proctor Density (specifically excluding use of a sheepsfoot roller).

(F) Cover the completed seal with at least 4 inches of soil in addition to necessary erosion control.

(G) Hydrate with fresh water and keep at or above the optimum water content until the pond is prefilled.

(H) Written certification to the effect that the seal was provided an applied in accordance with specifications and that the coefficient of permeability is equal to or less than 10^{-7} cm/s shall be furnished by the project engineer and independent soils laboratory. The written certification shall include:

(i) the number of samples taken;

(ii) a map of the location of the samples taken; and

(iii) a demonstration that the location and number of samples taken are representative of the seal of the lagoon, for both the bottom of the lagoon and all sides of the lagoon dike walls.

(3) **Synthetic liner.**

(A) The synthetic liner shall be at least 30 mils (0.030 inch) thick, unless the lagoon is subject to heavy traffic, in which case the liner shall be at least 60 mils (0.060 inch) thick.

(B) Remove or cover sharp objects in the subsoil with a bedding of 4 inches of clean soil or sand.

(C) Use 4-inch perforated pipe to allow venting and draining of the soil to reduce gas and hydrostatic pressures and facilitate monitoring for leakage.

(D) The synthetic liner panels shall be laid out in a longitudinal direction and sealed with an overlap of 4 to 6 inches.

(E) The anchor trench shall be a 6-inch minimum depth and placed at least 9 to 12 inches beyond the slope break of the dike.

(F) Take adequate measures to protect the integrity of the liner including UV protection.

(4) **Uniformity.** The bottom shall be as level as possible. Finished elevations shall not deviate more than 3 inches from the average elevation.

(5) **Prefilling.** Protect the integrity of the liner by hydrating with fresh water until the lagoon is used.

(d) **Influent lines.** Influent lines shall terminate in a flow distribution manhole or control structure with the invert at least 6 inches above the maximum design high water elevation of the lagoon. Design the control structure to proportionally split the flow to the primary cells.

(1) **Placement.** Raw sewage distribution lines may be placed on the surface of the lagoon bottom. Anchor pipe to prevent floating or settling. Soil shall not be mounded over the distribution lines. The method of construction shall not alter the integrity of the lagoon seal.

(2) **Point of discharge.** To minimize short-circuiting in primary cells, terminate influent lines at the lesser of either the center of the cell or a point at least 100 feet from the inside toe of any dike. Install multiple inlets when the distance from any inlet to the toe of an adjacent dike exceeds 250 feet. Terminate influent lines for aerated cells within the mixing zone of the aeration equipment.

(3) **Discharge apron.** To control erosion of the lagoon bottom, influent lines shall discharge horizontally into shallow, saucer-shaped depressions and terminate on a concrete apron. The apron shall be at least 2 feet square or 2 feet in diameter. Provide additional energy dissipating devices where influent will enter the lagoon at a high velocity.

(e) **Miscellaneous construction standards**. All pipes entering and exiting the seal shall be constructed with a seepage collar.

(f) **Control structures and interconnecting piping.**

(1) **Structure.** Provide structures to control water depth in cells, route water through the system, and measure flow at discharging facilities. Control structures in primary cells shall be capable of controlling the operating depth between a minimum of 3 feet and the maximum design operating depth. For suspended solids control, the discharge structure should allow the withdrawal point to vary below the surface to obtain the best quality effluent. Valves, slide tubes, dual slide gates or removable interlocking boards are recommended, and they shall:

(A) be accessible for maintenance and adjustment of controls;
(B) control water level and flow rate, and complete shutoff;
(C) be constructed of non-corrosive materials; and
(D) be located to minimize short-circuiting within the cell.

(2) **Discharge piping.** Pipe meeting ASTM standards for sanitary sewers shall be adequately anchored but not interrupt the integrity of the seal.

(A) **Hydraulic capacity.** The hydraulic capacity for continuous discharge structures and piping shall allow for a minimum of 250% of the design flow of the system.

(B) **Minimum pipe size.** All piping within the lagoon shall be at least 12 inches in diameter for facilities serving 100 PE or more and at least 8 inches for facilities serving less than 100 PE. Design influent pipe for rodding. Protect all piping between the lagoon cells from the entrance of turtles.

252:656-11-4. Other lagoon construction

(a) **Fence.** Enclose the lagoon area within a fence to discourage livestock and trespassers. Fences must have a lockable gate and not obstruct maintenance vehicles and equipment. Lagoons located within 350 feet of existing or platted residential or recreational areas shall be enclosed with a 6-foot high woven wire fence. Decorative fences around facilities located in recreational areas will be considered on a case-by-case basis.

(b) **Access.** Provide an all-weather access road to the lagoon site.

(c) **Warning signs.** Provide appropriate permanent signs along the fence around the lagoon site that designate the nature of the facility and advise against trespassing. Place at least one sign on each side of the site. The warning sign shall include the name of the owner and a contact number for the owner.

(d) **Flow measurement.** Flow measurement requirements are presented in 252:656-9-2(d). Provide effective weather protection for recording equipment.

(e) **Pond level gauges.** A pond level gauge to measure the water level in a lagoon shall be installed.

SUBCHAPTER 13. PRELIMINARY TREATMENT STANDARDS

Section

252:656-13-1. Screening devices

(a) **Required.** Screening devices are required at all mechanical treatment plants.

(b) **Bar screens.** Bar screens shall comply with the following:

(1) **Flow measurement.** Locate screening devices so that changes in backwater elevations due to intermittent cleaning of screens will not interfere with flow measuring equipment.
(2) **Size.** Clear openings between bars shall not be greater than 1 3/4 inches. Screens shall be designed to be easily raked.
(3) **Slope.** Hand-cleaned screens, except those for emergency use, shall slope 30 to 45 degrees from horizontal.
(4) **Channels.** Shape the channels before and after screens to prevent sedimentation of solids. The channel entrance to the screens must evenly distribute the flow to minimize turbulence.
(5) **Controls.** All mechanical units operated by timing devices shall have auxiliary controls to start operation at predetermined high water elevations. Automatic controls shall have a manual override.
(6) **Screenings.** Hand-cleaned screens must have a platform with suitable drainage and ample facilities for removal, handling, storage and disposal of screenings.

252:656-13-2. Grit chambers

(a) **Where required.** Grit chambers are required at all mechanical sewage treatment plants, ahead of pumps and other equipment that may be damaged by grit.
(b) **Outside facilities.** Protect grit removal facilities located outside from freezing.
(c) **Chamber design.**
(1) Rectangular horizontal-flow grit chambers shall be designed to regulate velocity to minimize organic matter deposition. Channels shall be designed for velocities of 0.8 to 1.3 fps, with a total detention time of 20 seconds to one minute.
(2) Aerated grit chambers shall be designed for a detention time of two (2) to five (5) minutes. Aerated grit chambers shall be sized in accordance with Appendix A.
(d) **Grit washing.** Provide grit washing devices to further separate organic and inorganic materials in all chambers not equipped with positive velocity control. Include provisions for draining each unit.
(e) **Grit removal.** Provide facilities for hoisting grit to ground level from equipment located in deep pits, provide access by stairways, and provide adequate ventilation and lighting.
(f) **Grit disposal.** Provide for the removal, handling, storage and disposal of grit.
(g) **Vortex-type grit chambers.**
(1) The flow into the grit chamber shall be through a straight and smooth channel. The length of the inlet channel must be at least seven (7) times the width or fifteen (15) feet, whichever is greater.
(2) Total detention time in the chamber at design flow is thirty (30) seconds.
(3) The equipment specifications shall identify the required grit removal rates. Removal rates shall be based on the equipment manufacturer's specifications for downstream processes and meet the following minimum criteria:
(i) 95% removal rate for 50-mesh grit.
(ii) 85% removal rate for 70-mesh grit.
(iii) 65% removal rate for 100-mesh grit.
(4) Provide a propeller with a variable speed drive to operate the unit based on the plant flow.
(5) Provide air or water scour to loosen compacted grit and facilitate the grit lifting and removal from the chamber.
(6) Provide inclined screws, conveyors, chain elevators or pumps, including top mounted self-priming suction lift pumps to lift the grit from the chamber and transfer the grit to the washing and separating facilities. Air lift pumps shall not be used for this purpose.
(7) Automatically controlled grit lifting, washing and separating equipment with the ability to manually override.

252:656-13-3. Diurnal flow equalization

(a) **General.** Provide flow equalization basins to equalize variations in organic and hydraulic loadings where large diurnal organic or hydraulic variations of organic or hydraulic loading are expected, where peak to average is greater than 2:1. Wet weather (excess flow) basins are covered in 252:656-13-4.

(b) **Location.** Locate basins downstream of pretreatment facilities such as bar screens and grit chambers.

(c) **Size.** Capacity must be sufficient to reduce expected flow and load variations to less than or equal to 2:1. The volume required to achieve the desired degree of equalization can be determined from a cumulative flow plot over a representative 24-hour period.

(d) **Operation.**

(1) **Mixing.** Provide air or mechanical equipment to maintain adequate mixing. Design corner fillets and hopper bottoms with draw-offs to alleviate the accumulation of sludge and grit.

(2) **Aeration.** Aeration equipment shall be sufficient to maintain a minimum of 1.0 mg/l of dissolved oxygen in the basin at all times. Air supply rates shall be at least 1.25 cfm/1,000 gallons of storage capacity. Isolate the air supply from other treatment plant aeration requirements to facilitate process aeration control.

(3) **Controls.** Equip inlets and outlets for all basin compartments with flow control devices. Provide facilities to measure and indicate liquid levels and flow rates leaving the basin(s).

252:656-13-4. Wet weather flow equalization basins

(a) **Basin type.** For gravity inlet systems, provide flow splitting or automated flow diversion devices to divert excess flows to the flow equalization basin(s). Design shall include a method to return contents to primary basins. For pumped systems, installation of control valves or dedicated pumps to handle wet weather flow shall be used to divert wet weather flow to the basin. Depending on the elevation of the basin, it may be possible to return the flow to the plant's primary units by gravity. If not, a pump return system will be necessary.

(b) **Design criteria.** The design of basins requires a thorough evaluation of flow patterns and volumes. Items to be considered are basin geometry, construction materials, storage capacity and operational controls.

(c) **Basin layout.** Basins designed for storage of five million gallons or more require a minimum of two compartments designed to operate in series. All flow must be diverted to a lined basin where solids can settle and, at a predetermined elevation, overflow to additional basins. A single basin equipped with an impervious liner is acceptable where the required storage capacity is less than five million gallons. Provisions are required for returning the contents of the basins to the treatment plant and for removal of settled solids.

(d) **Basin construction.** Basin construction must be in accordance with OAC 252:656-11-3 and OAC 252:656-11-4 with the following exceptions:

(1) Top of dikes may be reduced to a width of 6 feet.

(2) Bottoms of lagoon cells shall be adequately sloped to allow drainage to waste return structure(s).

(3) For basins with two compartments, the first basin must be lined below the maximum design water elevation with concrete, asphalt, or equivalent material. Single compartment basins must be lined as above.

(e) **Storage capacity.** Design minimum storage to contain the anticipated excess flow during the largest seven-day wet weather period in 10 years, with the capability to be emptied in a timely

manner. Actual flow data shall be used to develop flow balance or mass diagrams for determining basin capacity. Base the frequency and duration of storms on field data and weather service records.

(f) **Aeration requirements.** Where oxygen is required to prevent the wastewater from becoming anaerobic provide air at the rate of 1.25 to 2.0 cfm per 1,000 gallons basin volume. Where mechanical aerators are used, 7.5 horsepower per million gallons of basin capacity is required.

(g) **Pumps and flow control methods.** Controls are required to regulate flow to the basin and return flow to the plant. Adequate controls with measuring devices are required to divert all flow in excess of the plant hydraulic capacity to the basin. Provisions and controls are required to return the basin contents to the plant after the wet weather event has passed and influent flow returned to normal. Return flow may be manual or automatic, but sufficient flow measurement and instrumentation devices must be included to determine the actual flow to the first treatment unit. Where basin return flow is automatic, control equipment must limit the combination of plant influent plus the basin return flow to the hydraulic capacity of the plant.

SUBCHAPTER 15. BIOLOGICAL TREATMENT STANDARDS [REVOKED]

Section

252:656-15-1. Suspended growth systems [REVOKED]

252:656-15-2. Attached growth systems [REVOKED]

252:656-15-3. Biological nutrient removal [REVOKED]

SUBCHAPTER 16. BIOLOGICAL TREATMENT STANDARDS

Section

252:656-16-1. Suspended growth systems

(a) **General.** Suspended growth wastewater treatment systems generally consist of one or more basins where incoming wastewater is mixed with mixed liquor suspended solids and aerated for a period of time. The mixed liquor suspended solids are then separated from the mixture where a portion is returned to the mixing basin and the remainder diverted to other units for additional treatment before beneficial re-use by land application or landfill disposal. The liquid after separation from the solid is discharged or diverted to other units for additional treatment before discharge. Suspended growth systems covered by these standards are commonly know as the Activated Sludge process including the Sequencing Batch Reactor ("SBR") process. The activated sludge process includes several modifications. The most common is the extended aeration process which includes the oxidation ditch and SBR variations. Submit a complete design analysis for all suspended growth systems to DEQ for review. Contact stabilization is not recommended as the only secondary treatment process, but may be considered where equalization of flow is provided or where other treatment units follow.

(b) **Primary treatment.** The conventional activated sludge process must be preceded by primary

treatment in the form of a primary clarifer(s) in accordance with 252:656-17. Provide equipment necessary to adequately remove sludge as it accumulates and transport it to sludge treatment facilities.

(c) **System Design.** Submit a comprehensive discussion of all functional design calculations used to size activated sludge treatment facilities. Include the following:

(1) influent wastewater characteristics,
(2) temperature range of wastewater,
(3) primary treatment of the waste,
(4) hydraulic and organic loading applied to the aeration basin,
(5) anticipated mixed liquor suspended solids level to be maintained in the aeration basin,
(6) aeration time,
(7) oxygen and mixing requirements for average and peak flows,
(8) recirculation and sludge wasting,
(9) degree of treatment anticipated, and
(10) equation(s) used to compute treatment efficiency.

(d) **Aeration basins.**

(1) **Capacities and permissible loadings.** The minimum design criteria for activated sludge systems are listed in Appendix A, Design Tables.

(2) **Arrangement of aeration basins.**

(A) **Basin dimensions.** Design each unit to:

(i) Maintain effective mixture and use of air.
(ii) Prevent unaerated sections and noticeable channeling.
(iii) Maintain velocities sufficient to prevent deposition of solids.
(iv) Restrict short-circuiting through the tank.

(B) **Basin lining.** Line earthen aeration basins with concrete, asphalt or equivalent material below the maximum water elevation. Do not use plastic liners in aeration tanks.

(C) **Number of units.** Divide the total aeration basin volume into at least two units, capable of independent operation.

(D) **Inlets and outlets.**

(i) **Controls.** Provide inlet and outlet devices to control flow and maintain constant water level in all aeration basins. Design the system to allow for the maximum instantaneous hydraulic load with any single unit out of service.

(ii) **Channels.** Design channels and pipes to maintain a velocity sufficient to hold solids in suspension or provide a mechanical means for suspending the solids. Provide for draining each channel when it is not being used.

(E) **Freeboard.** Provide at least 18 inches of freeboard.

(e) **Aeration equipment.**

(1) **Common elements.** Aeration equipment must be capable of maintaining at least 2.0 mg/l of dissolved oxygen in the mixed liquor at all times and provide thorough mixing.

(A) **CBOD removal.** Where data is not available, the design oxygen requirement for the activated sludge process is 1.1 lb O_2/lb peak BOD applied to the aeration basins. For the extended aeration process, the requirement is 1.8 lb O_2/lb peak BOD.

(B) **Nitrification.** For nitrification the oxygen requirement for oxidizing ammonia must be added to the requirement for carbonaceous BOD removal. The nitrogen oxygen demand (NOD) shall be taken as 4.6 lb O_2/lb NH_3 at peak diurnal flow. Assure sufficient alkalinity to maintain pH as required by 252:656-16-3 (b)(3). If the alkalinity is not sufficient, then chemical addition must be required.

(2) **Diffused air systems.**

(A) **Common elements.** Normal air requirements for all activated sludge processes, except extended aeration, is 1,500 ft^3/lb peak BOD for aeration basin loading. For the extended aeration process the value is 2,000 ft^3/lb peak BOD loading.

(B) **Blowers.** Design the blower system to account for temperature extremes ranging from 4 degrees F to 104 degrees F.

(C) **Multiple units.** Provide multiple units with enough capacity to meet the maximum air demand with the largest unit out of service. The design must also allow the volume of air delivered to be varied in proportion to the load demand of the plant.

(D) **Diffusers.** Systems must be capable of providing the diurnal peak oxygen demand or 200% of the design average oxygen demand, whichever is larger. Design air piping systems where the total head loss from blower outlet (or silencer outlet where used) to the diffuser inlet does not exceed 0.5 psi at average operating conditions. The spacing of diffusers must be in accordance with the oxygen requirements through the length of the channel or basin, and designed to allow spacing adjustment without major revisions to the air header piping. All plants using less than four aeration basins must be designed to incorporate removable diffusers that can be serviced and/or replaced without dewatering the basin.

(E) **Filters.** Provide all blowers with air filters.

(3) **Mechanical aeration systems.** The design requirements of a mechanical aeration system shall meet the following:

(A) Maintain all mixed liquor suspended solids in suspension;

(B) Meet maximum oxygen demand and maintain process performance with the largest unit out of service. A minimum of two units shall be provided;

(C) Provide for varying the amount of oxygen transferred in proportion to the load demand on the plant; and

(D) If depth of submersion is an important criteria, the aerators must be adjustable or the basin liquid levels must be easily controlled with regard to depth.

(f) **Sequencing batch reactor systems.**

(1) **Reactor design.** Provide at least three (3) reactors. Design each reactor to operate in a cyclic mode with sufficient time to fill, aerate, settle and remove the clarified liquid.

(A) Organic loading shall be between 5 to 20 pounds of BOD per thousand cubic feet per day. Design the system using food to mass (F/M) ratios of 0.05 to 0.30. The total reactor volume must provide at least 18 hours of hydraulic detention time. Size the reactor volume on the hydraulic retention time and decant volume.

(B) The design operating levels shall be 10 to 20 feet with at least two feet of freeboard.

(C) Design for no more than four operating cycles per day per reactor at average design flow.

(D) Sludge production depends on the mode of operation. For extended aeration mode (24 hours retention time), base sludge handling design on a minimum sludge production of 0.5 lbs. per lb. of BOD removed. For conventional activated sludge mode, or for systems using more than two cycles per day, base sludge production on 0.75 to 0.95 lbs. per lb. of BOD.

(E) Base sludge storage requirements on a concentration of 8,000 mg/l with a specific gravity of 1.02 for the settled sludge. Base the calculated sludge volume on the liquid depth after decanting.

(2) **Aeration equipment.** Aeration equipment must provide at least 1.4 lbs. of oxygen per lb. of BOD removed at a minimum residual dissolved oxygen level of 2.0 mg/l during the aeration period. Where nitrification is required, the aeration equipment shall have the capacity to provide an additional 4.6 lbs. of oxygen per lb. of ammonia nitrogen.

(3) **Decanter systems.** Design the decanter system to draw effluent from 12 to 18 inches below the surface and to prohibit floating scum from entering the system during fill and aeration periods. The design must not create currents that pull solids from the settled zone at the lowest point in the cycle. The entrance velocities into the decanter shall not exceed 1.0 fps at the maximum design flow condition.

(4) **Scum management.** Provide resuspension or removal equipment to control excessive scum build-up.

(g) **Oxidation ditches.** An oxidation ditch may take any linear shape as long as it forms a closed circuit, and does not produce any eddies or dead spots.

(1) **Pretreatment.** Bar screens and grit removal facilities are required. Primary settling is not necessary except for high strength waste.

(2) **Aeration basin.**

(A) The volume of the oxidation ditch must provide 18 to 24 hours hydraulic detention time at average dry weather flow. Organic loading may range from 12 to 15 pounds BOD per 1,000 ft^3/day.

(B) Depth shall be at least 3 feet.

(C) Freeboard shall be at least one foot at maximum water depths.

(D) Aeration equipment shall maintain at least 1 fps velocity throughout the ditch.

(E) Construct the ditch with reinforced concrete at least 4 inches thick for ditches up to 5 feet deep, and 6 inches thick where deeper.

(F) Rotor weight shall not be supported directly by gear reduction or motor equipment. Protect motors, gear reduction equipment and bearings from inundation and rotor spray.

(3) **Rotor aerators.**

(A) Install at least two complete rotor units. Design the system so a single rotor can provide the average design oxygen demand and minimum velocity of 1 fps throughout the basin.

(B) Place rotors before a long, straight ditch section.

(C) Provide a method to control rotor submergence.

(4) **Miscellaneous.**

(A) Introduce raw sewage and returned sludge immediately upstream of the rotor that is farthest from the effluent control weir.

(B) Provide elevated walkways for rotor maintenance.

(h) **Return sludge equipment.**

(1) **Return rate.** Design all return pumping systems for the capability to be operated at the following return rates:

(A) Standard Rate:
- (i) 15% minimum to
- (ii) 75% maximum

(B) Carbonaceous Stage of Separate Stage Nitrification:
- (i) 15% minimum to
- (ii) 75% maximum

(C) Step Aeration:
- (i) 15% minimum to
- (ii) 75% maximum

(D) Extended Aeration:
- (i) 50% minimum to
- (ii) 150% maximum

(E) Nitrification Stage of Separate Stage Nitrification:

(i) 50% minimum to
(ii) 200% maximum.

(2) **Return pumps.** Maintain the maximum return sludge requirement with the largest pump out of service. Provide a positive head on all pumps' suctions under all operating conditions. Provide a minimum pump's suction and discharge opening of at least 3 inches. Air lift systems shall be at least 3 inches in diameter. Further, air compressors shall be of sufficient capacity to supply design air requirements plus a 25% safety factor.

(3) **Return piping.** Provide 4-inch discharge piping designed to maintain a minimum velocity of 2 fps at normal return rates. Provide mechanisms for observing, sampling and controlling return sludge flow from each clarifier.

(i) **Waste sludge facilities.** Waste sludge control facilities shall have a maximum capacity of not less than 25 percent of the average rate of sewage flow and function satisfactorily at rates of 0.5 percent of average sewage flow or a minimum of 10 gpm, whichever is larger.

(j) **Measuring devices.** Install a means to measure flow rates of raw sewage, primary effluent, waste sludge, return sludge, and air to each basin unit.

252:656-16-2. Attached growth systems

(a) **Rotating biological contactors (RBC).** An RBC can only be installed to replace or to add to an existing RBC.

(1) **Winter protection.** Enclose RBC units in a corrosion resistant structure to protect biological growth from cold temperatures and excessive heat loss.

(2) **Pretreatment.** Provide primary clarifiers with scum and grease collecting devices. Bar screening and/or comminution alone are not suitable pretreatment.

(3) **Staging.** Provide at least four stages for secondary treatment applications, with more stages for greater nitrification and BOD removal.

(4) **Loading.**

(A) **Hydraulic.** Equalize flow where the ratio of peak flow to average flow is 2.5 or greater. For secondary treatment hydraulic loading shall be from 2 to 4 gpd/ft^2 and shall not exceed 0.75 to 2.0 gpd/ft^2 where nitrification is required.

(B) **Organic.** First stage loading rates shall be from 2.5 to 4.0 lbs. of soluble BOD/day/1,000 ft^2. 3.0 lbs. is recommended.

(5) **Tanks.** Provide at least 0.12 gal/ft^2 of media for RBC tanks to maintain a hydraulic load of 2 gpd/ft^2. Provide a side water depth of 5 feet or submerge the media at least 40%.

(b) **Trickling filters.** Trickling filters may be installed to pretreat high-strength waste only, or to add to or replace existing trickling filters. Provide primary clarifiers with scum and grease collecting devices before filters so the influent will be relatively free from settleable, floating, or suspended matter. Design secondary clarifiers to meet the criteria of Appendix B of this Chapter.

(1) **Design basis.** Filters are termed standard or high rate on the basis of hydraulic and biological loading. High rate filters may be used to pretreat wastewater before further biological treatment. High rate systems can withstand highly variable hydraulic overload conditions without significant deterioration of the biological growth. For design criteria, see Appendix A, Design Tables.

(2) **Hydraulics.** Sewage application shall be continuous. Provide all pump stations with a backup.

(A) **Head requirements.** For reaction type distributors, a minimum head of 24 inches above the center of the arms is required. Design distributors to uniformly distribute wastewater over at least 90% of the surface area.

(B) **Clearance.** Provide at least 6 inches of clearance between the media and distributor

arms.

(C) **Piping system.** Design the piping system, including dosing equipment and distributor, for the peak hourly flow rate, including recirculation.

(3) **Media.**

(A) **Quality.** Plastic media or its approved equivalent shall be used. Manufactured media must also be resistant to ultraviolet degradation, disintegration, erosion, aging, common acids and alkalies, organic compounds, and fungus and biological attack.

(B) **Depth.** Media depth for standard rate filters must be 6 to 8 feet deep and, for high rate filters, from 10 to 30 feet. Depths that deviate from the above criteria must be justified by a pilot study.

(4) **Underdrain system.** The underdrain system shall cover the entire floor of the filter. Inlet openings into the underdrains shall have an unsubmerged gross combined area at least 15 percent of the surface area of the filter.

(A) **Hydraulic capacity and ventilation.** Underdrains shall slope at least 1%. Design effluent channels to produce a minimum velocity of 2 fps of the average daily application rate. Design the underdrain system, effluent channels and effluent pipe to allow free air passage. Not more than 50% of the cross sectional area for all drains, channels and pipe may be submerged under the design hydraulic loading.

(B) **Flushing.** Design the underdrains to be flushed.

(5) **Freeboard.** Provide two feet of freeboard to prevent splashing and to protect the distributor. Structures taller than 25 feet shall have 4 feet of freeboard to contain windblown spray.

(6) **Recirculation.** Recirculate effluent to maintain an active biological growth and to increase overall efficiency.

(7) **Dosing rate.** The dosing rate on a trickling filter is the depth of liquid discharged on top of the packing for each pass of the distributor. For a standard rate filter, the dosing rate shall be in the range of 0.4 inches per pass to 1.2 inches per pass. For high rate filters, the rate shall be in the re range of 0.6 inches per pass to 7.0 inches per pass.

(c) **Whole effluent toxicity failures.** Attached growth systems may not consistently provide ammonia removal through the nitrification process so the effluent from these facilities may be toxic to aquatic life and thus cause whole effluent toxicity test failures.

252:656-16-3. Biological nutrient removal

(a) **Purpose.** Processes for nutrient removal in wastewater include conversion of ammonia and organic nitrogen to nitrate nitrogen (nitrification), the conversion of nitrate nitrogen to nitrogen gas (denitrification) and removal of phosphorus.

(b) **Single stage (combined carbonaceous BOD removal and nitrification).** Design processes according to the requirements of 252:656 and submit all design calculations. The following factors will have a significant impact on the nitrification process: ammonia and nitrite concentrations, BOD/TKN ratio, dissolved oxygen concentration, temperature, alkalinity and pH. The following steps shall be considered in the design of the suspended growth reactor and the resulting calculations submitted to DEQ for review. If actual kinetic coefficients cannot be obtained, textbook values may be used for design.

(1) Select an appropriate safety factor to handle peak, diurnal and transient loadings (a minimum safety factor of 2.0 applied to design mean cell residence time is required).

(2) Select the mixed liquor dissolved oxygen (DO) concentration. The minimum acceptable level is 2.0 mg/l. Determine the amount of oxygen required to satisfy the nitrogenous oxygen demand. Provide a minimum of 4.6 mg O_2/mg N oxidized.

(3) Evaluate the requirement for pH control. Every mg/l of ammonium-nitrogen (NH_4-N) oxidized will result in the destruction of 7.14 mg/l alkalinity.

(4) Estimate the maximum growth rate of nitrifying bacteria under the most adverse DO, pH and temperature conditions.

(5) Determine the design mean cell residence time with the safety factor (10-day is recommended).

(6) Predict the effluent nitrogen concentration.

(7) Determine the hydraulic retention time to achieve the necessary nitrogen concentration. A 10-hour retention time is needed to compensate for lower nitrification rates when wastewater temperatures are below 50 degrees F.

(c) **Separate-stage nitrification.** Design processes according to the requirements of 252:656 and submit all design calculations. Separate-stage suspended growth nitrification processes are similar in design to the activated sludge process. Show the process factors, considering the following:

(1) Experimentally measured nitrification rates are more appropriate than theoretical rates.

(2) Nitrification rates increase as the temperature increases.

(3) Nitrification rates increase as the BOD/TKN ratio decreases.

(4) Nitrification rates are affected by pH.

(5) Nitrification rates vary from 0.05 to 0.6 lbs. NH_4-N oxidized per pound of MLVSS.

(d) **Biological phosphorus removal.** Design proprietary processes and submit all design calculations according to the manufacturer's recommendations or *Wastewater Engineering: Treatment, Disposal & Reuse*, Metcalf & Eddy, Inc. 4th Edition (2003).

(e) **Chemical phosphorus removal.**

(1) **Preliminary testing.** Laboratory, pilot, or full scale studies of various chemical feed systems and treatment processes are recommended for existing plant facilities to determine the achievable performance level, cost-effective design criteria, and ranges of required chemical dosages.

(2) **System flexibility.** Systems shall be designed with sufficient flexibility to allow for several operational adjustments in chemical feed location, chemical feed rates, and for feeding alternate chemical compounds.

(3) **Dosage.** The design chemical dosage shall include the amount needed to react with the phosphorus in the wastewater, the amount required to drive the chemical reaction to the desired state of completion, and the amount required due to inefficiencies in mixing or dispersion. Excessive chemical dosage should be avoided.

(4) **Chemical feed points.** Selection of chemical feed points shall include consideration of the chemicals used in the process, necessary reaction times between chemical and polyelectrolyte additions, and the wastewater treatment processes and components utilized. Flexibility in feed locations shall be provided to optimize chemical usage.

(5) **Flash mixing.** Each chemical must be mixed rapidly and uniformly with the flow stream. Where separate mixing basins are provided, they shall be equipped with mechanical mixing devices. The detention period shall be at least 30 seconds.

(6) **Flocculation.** The particle size of the precipitate formed by chemical treatment may be very small. Consideration shall be given in the process design to the addition of synthetic polyelectrolytes to aid settling. The flocculation equipment shall be adjustable in order to obtain optimum floc growth, control deposition of solids, and prevent floc destruction.

(7) **Liquid-solids separation.** The velocity through pipes or conduits from flocculation basins to settling basins shall not exceed 1.5 feet per second in order to minimize floc destruction. Entrance works to settling basins shall also be designed to minimize floc shear.

(8) **Sludge handling.** For design of the sludge handling system, special consideration shall be given to the type and volume of sludge generated in the phosphorus removal process.

(9) **Filtration.** Effluent filtration shall be provided where effluent phosphorus concentrations of 1 mg/l or less must be achieved.

SUBCHAPTER 17. CLARIFIER STANDARDS

Section
252:656-17-1. General considerations [REVOKED]
252:656-17-2. Clarifier design considerations
252:656-17-3. Sludge and scum removal

252:656-17-1. General considerations [REVOKED]

252:656-17-2. Clarifier design considerations

(a) **Flow distribution.** Effective flow splitting devices and control appurtenances (i.e. gates, splitter boxes, etc.) shall be provided to permit proper proportioning of flow and solids loading to each unit, throughout the expected range of flows.

(b) **Primary clarifier design criteria.** Primary clarifiers shall be placed downstream of flow distribution devices. Surface settling rates for primary tanks shall not exceed 1,000 gal/ft^2/day at design average flows or 1,500 gal/ft^2/day for peak hourly flows. Peak hourly flow is based upon a 2-hour sustained peak, as defined by *Wastewater Engineering: Treatment, Disposal & Reuse*, Metcalf & Eddy, Inc. 4th Edition (2003). The primary clarifier must have a minimum side water depth of twelve feet (12'). Clarifier sizing shall be calculated for both flow conditions and the larger surface area determined shall be used. Primary settling of normal domestic sewage can be expected to remove 30 to 35% of the influent BOD. However, anticipated BOD removal for sewage containing appreciable quantities of industrial wastes (or chemical additions to be used) shall be determined by laboratory tests and consideration of the quantity and character of the wastes.

(c) **Secondary clarifier design criteria.** See Appendix B.

(d) **Inlet structures.** Design inlets to prevent short-circuiting, to dissipate velocity and diffuse flow equally across the entire cross-section of the settling chamber. Design channels to maintain a velocity of at least 1 fps at one-half design flow. When scum ports in the inlet diffusion well baffle are provided, the elevation of the bottom edge of the ports shall be no lower than 0.10 feet below the elevation of the crest of the overflow weirs.

(e) **Weirs.** Overflow weirs shall be adjustable and level.

(1) **Location.** Locate overflow weirs to optimize hydraulic retention time and minimize short-circuiting.

(2) **Design rates.** Weir loadings shall not exceed 10,000 gal/linear foot/day for plants designed for average flows of 1.0 mgd or less. Higher weir loadings may be used for plants designed for larger average flows, but shall not exceed 15,000 gal/linear foot/day. Where the flow is pumped to the clarifier, the weir length shall be based on the average pump delivery rates to avoid short-circuiting.

(3) **Weir troughs.** Design weir troughs to prevent submergence at maximum design flow, and to maintain a velocity of at least 1 fps at one-half design flow.

(4) **Dewatering.** Provide the necessary piping and equipment to permit complete dewatering to the floor for the bypassing of individual units for maintenance and repair.

(5) **Freeboard.** Walls shall extend at least 6 inches above the surrounding ground surface and provide at least 12 inches of freeboard. Provide additional freeboard or wind screens for larger clarifiers subject to high velocity wind currents that would cause tank surface waves and inhibit scum removal.

252:656-17-3. Sludge and scum removal

(a) **Scum removal.** Provide scum collection and removal facilities, including baffling, for all settling tanks.

(b) **Sludge removal.** Design collection and withdrawal facilities for rapid sludge removal.

(1) **Sludge hopper.** The minimum slope of the sidewalls of sludge hoppers shall be 1.7 vertical to 1.0 horizontal. Hopper floors shall not be larger than 2 feet in diameter if round, or 2 feet on any side if square. Hopper wall surfaces shall be made smooth with rounded corners to aid in sludge removal.

(2) **Sludge removal piping.** Each hopper shall have an individually-valved sludge withdrawal line at least 6 inches in diameter for gravity withdrawal or pump suction. Design sludge withdrawal to maintain a 3 fps velocity in the withdrawal pipe. Provide for rodding or back-flushing individual pipe runs.

(3) **Sludge removal control.** Provide equipment to view, sample and control the rate of sludge withdrawal. Provide a means of measuring the sludge removal rate. Air lift type of sludge removal will not be approved for removal of primary sludges. Include time clocks and valve activators to regulate the duration and sequencing of sludge removal for sludge pump motor control systems.

SUBCHAPTER 19. SLUDGE FACILITY STANDARDS

Section

252:656-19-1. Design considerations

This Subchapter establishes design criteria for converting sludge from municipal wastewater treatment processes to biosolids that will meet at least one of the processes to significantly reduce pathogens ("PSRPs") (Class B) of the State and Federal requirements for land application and landfilling. Sludge may ultimately be beneficially reused or disposed in a landfill. All methods of off-site and on-site sludge reuse and disposal are subject to 40 CFR Part 503 as adopted by reference in OAC 252:606, and to OAC 252:521 if landfilled. Processes to further reduce pathogens ("PFRPs") (Class A) may be proposed and will be evaluated and approved using a composting procedure pursuant to the requirements of OAC 252:606. Any other process from converting municipal sludge to biosolids will be reviewed and may be approved by the DEQ on a case by case basis. A sludge management plan shall be approved by the DEQ before any construction permit for a new or upgraded wastewater treatment facility can be issued. On-site sludge dewatering facilities shall be provided for all plants although the following requirements may be reduced with on-site liquid sludge storage facilities or approved off-site sludge disposal. For calculating design sludge handling and disposal needs for sludge stabilization processes, a rational basis of design for sludge production values shall be developed and provided to the reviewing authority for approval on a case-by-case basis.

252:656-19-1.1. Process selection

Equivalency processes will be approved on a case by case basis. A pilot study may be required.

252:656-19-2. Anaerobic sludge digestion

(a) **Tanks.**

(1) **Multiple units.** Provide dual units or alternate methods of sludge processing or emergency storage to maintain continuity of service.

(2) **Depth.** Provide a sidewater depth of at least 20 feet.

(3) **Slope.** Slope the tank bottoms towards withdrawal piping. The bottom slope must be at least 1:12 for mechanical removal, or 1:4 for gravity removal.

(4) **Manholes.** Provide at least two 36-inch diameter manholes in the top of the digester in addition to the gas dome. At least one opening must be large enough for equipment to remove grit and sand. Provide stairways to reach the access manholes.

(b) **Sludge inlets and outlets.** Provide for sludge recirculation. Provide multiple recirculation withdrawal and return points unless mixing facilities are incorporated within the digester(s). Return flow must discharge above the liquid level near tank center. Discharge raw sludge to the digester through the sludge heater recirculation return piping unless internal mixing facilities are provided.

(c) **Tank capacity.** Determine total tank(s) capacity by rational calculations based on such factors as volume of sludge added, its percent solids and character, the temperature to be maintained in the digesters, type of mixing provided, the degree of volatile solids reduction and pathogen reduction requirements. Submit all calculations and design assumptions for review. For design purposes, use the following assumptions:

(1) The raw sludge is derived from ordinary domestic wastewater.

(2) The sludge shall be heated, through the controlled biological decomposition of organic material, and maintained at a temperature between 35 deg. C to 55 deg. C (95 deg F to 131 deg F) for 15 days or at 20 deg. C (68 deg F) for 60 days.

(3) That 40 to 50% volatile matter will be maintained in the digested sludge.

(A) **Completely-mixed systems.** Provide sufficient mixing to prevent stratification and to assure homogeneity of digester content. Active digestion units may be loaded with volatile solids at a rate up to 80 lb/1,000 ft^3 tank volume/day.

(B) **Moderately-mixed systems.** For systems where mixing is accomplished only by circulating sludge through an external heat exchanger, the system may be loaded at a rate up to 40 lb/1,000 ft^3 tank volume/day. Where actual data are not available, the following unit capacities may be used for plants treating domestic sewage:

(i) Primary facility - 3 ft^3/PE heated or 4 ft^3/PE unheated

(ii) Primary and standard rate filter facility - 4 ft^3/PE heated or 5 ft^3/PE unheated

(iii) Primary and high rate filter facility - 4 ft^3/PE heated or 5.5 ft^3/PE unheated

(d) **Gas collection, piping and appurtenances.**

(1) **Gas collection and containment.** Design all portions of the gas system, including the space above the digester liquor to operate under pressure. Mechanically ventilate all areas where gas leakage might occur and separate from areas where extraneous sparks or fire might occur.

(2) **Safety equipment.** Where gas is produced, provide pressure and vacuum relief valves and flame traps, together with automatic safety shut-off valves. Water seal equipment shall not be installed. House gas safety equipment and gas compressors in a separate room with an exterior entrance.

(3) **Gas piping and condensate.** Gas piping must be at least 2 inches in diameter and shall slope to condensation traps at low points. Float-controlled condensate traps are not permitted.

(4) **Gas utilization equipment.** All gas burning boilers and engines must be located at or above ground level and in well ventilated rooms. Gas lines to these units must have suitable flame traps.

(5) **Waste gas.** Waste gas burners must have automatic ignition and be located at least 50 feet away from all digesters and suitably isolated from any other plant structure.

(6) **Meter.** Provide a gas meter with bypass to measure total gas production.

(e) **Supernatant withdrawal.**

(1) **Piping size.** Supernatant piping shall be at least 6 inches in diameter.

(2) **Withdrawal levels.** Arrange withdrawal piping to allow for at least three levels of sludge withdrawal. Provide a positive unvalved emergency overflow, designed to return the flow back to the headworks.

(3) **Supernatant withdrawal.** Provide at least one draw-off point that is located in the supernatant zone of the tank. On fixed-cover digesters, provide means to adjust the supernatant withdrawal level.

(4) **Sampling.** Provide a means to sample each supernatant draw-off level. Sampling pipes must be at least 1.5 inches in diameter with a quick-acting valve.

(f) **Temperature.**

(1) The sludge shall be heated, through the controlled biological decomposition of organic material, and maintained at a temperature between 35 deg. C to 55 deg. C (95 deg F to 131 deg F) for 15 days or at 20 deg. C (68 deg F) for 60 days.

(2) Provide a temperature probe and recording device to continuously record digester temperature.

252:656-19-3. Aerobic sludge digestion

(a) **General.** Aerobic digestion can be used to stabilize primary sludge, secondary sludge or a combination of the two. Multiple units are required at treatment facilities with a capacity of 1,000 PE or more. Treatment plants, designed for less than 1,000 PE, may use a single unit if adequate provisions are made for sludge handling and redundency.

(b) **Mixing and air requirements.** Provide sufficient air to keep the solids in suspension and maintain dissolved oxygen between 1 and 2 mg/l. A minimum mixing and air requirement of 30 ft^3/min/1,000 ft^3 tank volume shall be maintained with the largest blower out of service.

(c) **Tank capacity**. Determine total tank(s) capacity by rational calculations based on such factors as volume of sludge added, sludge characteristics, time of aeration, sludge temperature and ultimate disposal methods. Submit all calculations and design assumptions for review.

(d) **Volatile solids loading.** Volatile suspended solids loading must not exceed 100 lb/1,000 ft^3 tank volume per day.

(e) **Time and temperature.** Install a temperature probe and recording device to continuously record digester temperature.

(f) **Supernatant separation.** Provide for separation and withdrawal of supernatant and for collection and removal of scum and grease.

(1) **Supernatant withdrawal.** Design for supernatant withdrawal at least 6 inches below the liquid surface level after a minimum one-hour settling period. Return supernatant to the head of the plant.

(2) **Sampling facilities.** Provide a sampling line (at least 1.5 inches in diameter) with a quick-closing valve no more than 1 foot from the tank bottom.

(3) **Maintenance provisions.** Slope the tank bottoms toward the sludge withdrawal pipe. Minimum slope to be at least 1 foot vertical to 4 feet horizontal.

252:656-19-4. Sludge pumps and piping

(a) **Sludge pumps.**

(1) **Duplicate units.** Provide duplicate units.

(2) **Minimum head.** Pumps must provide at least 24 inches of positive head.

(3) **Sampling facilities.** Provide a means to sample sludge. All sampling pipes and valves must be at least 1.5 inches.

(b) **Sludge piping.** Sludge withdrawal piping must be at least 8 inches in diameter for gravity systems and 6 inches for pump suction and discharge lines. A minimum velocity of 3.0 fps for gravity lines is required.

252:656-19-5. Sludge dewatering

An on-site sludge dewatering facility shall be provided at all plants and, at a minimum, shall provide the following:

(1) **Sludge drying beds.**

(A) **Area.** Provide all design analyses for dewatering systems. Where drying is the selected method for production of a PSRP sludge, provide at least 3 months holding time, 2 months of which the holding temperature must average above 0 deg. C. A temperature recording device must be installed to continuously record the ambient temperature at the plant site.

(B) **Media-percolation type.**

(i) **Gravel.** Provide at least 12 inches of coarse gravel around the underdrains. Place the gravel in layers and extend at least 6 inches above the top of the underdrains. The top layer must consist of at least 3 inches of gravel from 1/8 to 1/4-inch in size.

(ii) **Sand.** The top course shall consist of at least 9 inches of clean coarse sand. The sand shall have an effective size of 0.3 to 1.2 and a uniformity coefficient of less than 5.0.

(iii) **Underdrains.** Perforated PVC sewer pipe at least 6 inches in diameter spaced not more than 10 feet apart on center must be used.

(C) **Partially paved type.** Provide for the removal of dried sludge with mechanical equipment.

(D) **Walls.** Walls shall be watertight and extend 15 to 18 inches above and at least 6 inches below the sand surface. Outer walls shall extend at least 6 inches above the surrounding ground elevation.

(E) **Sludge removal.** A minimum of two beds must be provided in all cases. Provide concrete truck tracks for all percolation-type sludge beds. Pairs of tracks for the percolations-type beds shall be on 20-foot centers.

(F) **Sludge influent.** Sludge piping must terminate at least 12 inches above the sand surface and be sloped for drainage. Provide a concrete splash pad at sludge discharge points. Piping must allow control flexibility to discharge sludge to any drying bed.

(2) **Sludge dewatering container filters (sludge boxes).** Provide sufficient capacity for container dewatering facilities to dewater all sludge produced with the largest unit out of service. Sludge dewatering container filters shall be constructed out of non-corrosive material and designed in accordance with manufacturer's recommendations. Provide adequate storage facilities unless other standby facilities are available.

(3) **Mechanical dewatering facilities.** Provide sufficient capacity for mechanical dewatering facilities to dewater all sludge produced with the largest unit out of service. Provide adequate storage facilities unless other standby facilities are available.

(A) **Ventilation.** Provide adequate ventilation for the dewatering area.

(B) **Chemical handling enclosures.** Enclose all lime-mixing facilities.

(4) **Liquid return.** Provide for the return of all drainage from beds or filtrate from dewatering units to plant head works.

(5) **Sludge conditioning.** Sludge conditioning shall be required for container filters and/or mechanical dewatering facilities. Provide for coagulant feed and commercial in-line static mixers for sludge conditioning.

252:656-19-5.1. Lime stabilization

Alkaline material may be added to liquid primary or secondary sludges for: sludge stabilization in lieu of digestion facilities; to supplement existing digestion facilities; or for interim sludge handling. The design of the lime stabilization system shall account for the increased sludge quantities for storage, handling, transportation, and disposal methods and associated costs.

(1) **Operational criteria.** Sufficient alkaline material shall be added to liquid sludge in order to maintain a homogeneous mixture with a minimum pH of 12 after 2 hours of vigorous mixing. Facilities for adding supplemental alkaline material shall be provided to maintain the pH of the sludge during interim sludge storage periods.

(2) **Odor control and ventilation.** Odor control facilities shall be provided for sludge mixing and treated sludge storage tanks. Ventilation is required for indoor sludge mixing, storage and processing facilities. Provide 12 complete air changes per hour.

(3) **Tanks.** Mixing tanks shall be designed to operate as either a batch or continuous flow process. The following items shall be addressed in determining the number and size of tanks:

(A) peak sludge flow rates;
(B) storage between batches;
(C) dewatering or thickening performed in tanks;
(D) repeating sludge treatment due to pH decay of stored sludge;
(E) sludge thickening prior to sludge treatment; and
(F) type of mixing device used and associated maintenance or repair requirements.

(4) **Equipment.** Mixing equipment shall be designed to provide vigorous agitation within the mixing tank, maintain solids in suspension and provide for a homogeneous mixture of the sludge solids and alkaline material. Mixing shall be accomplished either by diffused air or mechanical mixers. If diffused aeration is used, an air supply of 30 cfm per 1,000 cubic feet of mixing tank volume shall be provided with the largest blower out of service. When diffusers are used, the nonclog type is required, and shall be designed to permit continuity of service. If mechanical mixers are used, the impellers shall be designed to minimize fouling with debris in the sludge and provide continuity of service during freezing weather conditions.

(5) **Feed and slaking equipment.** Feed and slaking equipment shall be sized to handle a minimum of 150% of the peak sludge flow rate including sludge that may need to be retreated due to pH decay.

252:656-19-6. Stabilized sludge holding facilities

For systems that land apply biosolids, design on-site temporary sludge storage facilities to hold the sludge volume produced during a three-month period. Biosolids shall not be stored for greater than six (6) months without prior written approval from the DEQ and in no case longer than one (1) year. For dewatered sludge, provide concrete or equivalent surfaced facilities with appropriate drainage systems to store treated sludge. Drainage systems must return supernatant or other liquids to the headworks of the treatment system. Sludge storage must accommodate daily sludge production volumes and function as an operational buffer for unit outage and adverse weather conditions. Designs utilizing increased sludge age in the activated sludge system as a means of storage are not acceptable. On-site storage of dewatered high pH stabilized sludge shall be limited to 30 days. Provisions for rapid retreatment or disposal of dewatered sludge stored on-site shall also be made in case of sludge pH decay.

SUBCHAPTER 21. DISINFECTION STANDARDS

Section
252:656-21-1. Disinfection criteria
252:656-21-2. Chlorine disinfection
252:656-21-3. Ultraviolet radiation disinfection
252:656-21-4. Ozone disinfection [REVOKED]

252:656-21-1. General disinfection criteria

(a) **Applicability.** The requirements in this section apply to all disinfection systems.

(b) **Design considerations.** A disinfection system used to comply with the disinfection requirements:

(1) in an OPDES permit shall be designed, constructed and operated to meet bacteria limits in the Water Quality Standards and the OPDES permit.

(2) for a reclaimed water system shall be designed, constructed and operated to meet the bacteria limits in the water reuse permit and Appendix A of OAC 252:627.

(c) **Piping.** The piping shall be:

(1) appropriate and compatible for the type of disinfection to be used. Steel is suitable for use with dry chlorine when the correct thickness or weight is specified. Low-pressure lines made of hard rubber, saran-lined, rubber-lined, polyethylene, polyvinyl chloride (PVC), or Uscolite materials are satisfactory for liquid chlorine. Unplasticized PVC, Type I, may be used in submerged piping if the gas pressure is low and the temperature is below 140 ° F; and

(2) supported and protected from temperature extremes.

(d) **Alarms.** Provide alarms to warn of equipment failures and leaks.

(e) **Redundancy.** All disinfection systems shall have the following available:

(1) standby equipment to replace the largest unit;

(2) a separate backup power supply; and

(3) spares for all parts that may break or wear.

252:656-21-2. Chlorine disinfection systems

(a) **Equipment capacity.** The following requirements are for the chlorination of non-industrial wastewater. The equipment shall be capable of supplying the following dosage as applicable:

(1) Trickling filter plant effluent - 10 mg/l;

(2) Activated sludge plant effluent - 8 mg/l;

(3) Tertiary filtration effluent - 6 mg/l;

(4) Nitrified effluent - 6 mg/l; and

(5) Category 2 water reuse chlorination systems - 12 mg/l or a dose sufficient to achieve high level disinfection for water reuse requirements.

(b) **Chlorine mixing.**

(1) **Mixing.** The disinfectant shall be mixed as rapidly as possible to ensure complete mixing.

(2) **Contact period.** Provide the following contact periods:

(A) For OPDES permit compliance or Categories 3 and 4 water reuse chlorination systems, provide a minimum contact period of 15 minutes at peak hourly wastewater flow or maximum pumping rate after mixing.

(B) For Category 2 water reuse chlorination systems, alone or in combination with UV, provide sufficient free chlorine residual concentration at the end of the contact tank and modal contact time sized using the anticipated design flow after mixing at a design temperature of 5 ° C (41 ° F) and a pH of 8.0 to meet the micro-organism log removal

requirements in 252:656-27-3(a)(6).

(3) **Contact tank.** Construct chlorine contact tanks to minimize short-circuiting. "Over-and-under" or "end-around" baffling shall be provided to reduce short-circuiting. Design the tanks for easy maintenance and cleaning without reducing the effectiveness of disinfection. Provide duplicate tanks, mechanical scrapers or portable deck-level vacuum cleaning equipment. Provide skimming devices on all contact tanks, and provide for draining the tanks.

(c) **Gas chlorine equipment rooms.**

(1) **Separation.** If the building that houses the gas chlorine equipment is used for other purposes, a gas-tight room shall be provided to separate the gas chlorination equipment and chlorine cylinders from other parts of the building. Do not connect floor drains from the chlorine room to floor drains from other rooms. Doors to this room shall open only to the outside of the building, with panic hardware, at ground level and allow easy access to all equipment. For one-ton chlorine cylinders, separate the storage area from the feed area. Locate chlorination equipment as close to the application point as is reasonably possible. Certify the installation will meet OSHA standards, and that the doors and emergency equipment are compatible with chlorine.

(2) **Inspection window.** Install a shatter resistant, clear glass, gas-tight window in an exterior door or interior wall of the chlorinator room so the units can be viewed without entering the room.

(3) **Heating.** Heat disinfection equipment rooms to maintain at least 60 ˚ F. Protect the gas chlorine cylinders from excess heat, and maintain the cylinders at essentially room temperature.

(4) **Ventilation.** Provide mechanical ventilation capable of one air change per minute for chlorine. The entrance to the room exhaust duct shall be near the floor. The point of discharge shall not contaminate inhabited areas or the air inlet to any buildings. Locate fresh air inlets to provide cross ventilation with air and at a temperature that will not adversely affect the chlorination equipment. Discharge the chlorinator vent hose above-grade to the outside atmosphere.

(5) **Electrical controls.** Locate fan and light switches outside the room near the entrance. A labeled signal light indicating fan operation shall be provided at each entrance when the fan can be controlled from more than one point.

(d) **Water supply.** Provide an ample supply of water to operate the chlorinator and protect it according to 252:656-9-2(b). Back up any booster pumps according to the power requirements of 252:656-9-2(a).

(e) **Scales.** Provide corrosion-resistant scales to weigh chlorine gas cylinders. Provide at least a platform scale. Provide a recording device for the weight of the chlorine gas cylinders for installation where one-ton cylinders or larger are used.

(f) **Containers.** One-ton containers or larger are required if more than 150 pounds of chlorine per day is needed. Limit the withdrawal rate to 40 pounds per day per cylinder for cylinders up to 150 pounds, and to 400 pounds per day for one-ton cylinders.

(g) **Handling equipment.** For cylinders up to 150 pounds, provide securing restraints and a hand-truck designed for the cylinders. For one-ton cylinders, provide:

(1) a hoist with 4,000-pound capacity;

(2) a cylinder lifting bar;

(3) a monorail or hoist with sufficient lifting height to pass one cylinder over another; and

(4) a cylinder trunnion(s) to allow exchanging the cylinders for proper connection.

(h) **Manifolds.** Gaseous chlorine cylinders may be connected to a manifold, only when all cylinders are maintained at the same temperature or the system is designed for gas transfer from a warm container to a cooler one. Do not connect liquid chlorine cylinders to a manifold.

(i) **Leak detection and controls.** Provide an emergency response plan for chlorine leaks. Provide a bottle of 56% ammonium hydroxide solution for detecting chlorine leaks. Where one-ton containers are used, provide a leak repair kit approved by the Chlorine Institute, include caustic soda solution reaction tanks to absorb leaks. Provide automatic gas detection and related alarm equipment. Air Pollution Control regulations may also require air scrubbing equipment.

(j) **Evaporators.** Demonstrate the required volume of chlorine can be supplied.

(k) **Respiratory protection.** Where chlorine gas is handled, provide respiratory air-pac protection equipment that meets the National Institute for Occupational Safety and Health (NIOSH) standards. Store the equipment and operating instructions at a convenient location outside the room where chlorine is used or stored. The units shall use compressed air, with at least a 30-minute capacity, and be compatible with units used by the local fire department. In the emergency response plan, describe how to maintain the equipment.

(l) **Sodium hypochlorite.** Follow equipment standards in OAC 252:626-11-4(g).

(1) **On-site Generation of Sodium Hypochlorite:**

(A) **Contact Time.** On-site generation is limited by the upper concentration of the chlorine solution produced. Design should account for concentration limit where contact time is required. Contact time is determined from free chlorine concentration only.

(B) **Ventilation.** A by-product of on-site generation is the formation of hydrogen gas. Design shall meet the following:

(i) Ventilation shall be designed to take suction from as near the ceiling as practical.

(ii) Ventilation piping shall slope towards an outlet and in a manner that does not trap hydrogen gas.

(iii) Provide hydrogen gas sensing equipment capable of interlocking with sodium hypochlorite generation equipment.

(iv) System shall have automatic turn off of the equipment in the event that one-half (½) the lower explosive limit (LEL) is reached.

(v) Separate gas sensing equipment shall interlock with the ventilation equipment.System shall automatically turn on in the event that one-fourth (¼) the LEL for hydrogen is reached.

(vi) Provide at least one hydrogen sensor for any space that hydrogen gas is likely to accumulate.

(vii) Piping penetrating the roof must have a "T" or an "L" shape and a 24 mesh corrosion resistant screen.

(C) **Pretreatment.** To avoid fouling of the electrolytic cell, a water softener or other pretreatment method is required to prevent scaling during the process.

(D) **Brine Solution.** The salt used for the brine shall be high grade (99% pure) and shall be certified for use by the NSF for electrochlorination (NSF Standard 60). Provide the capability for diluting 12.5% bulk sodium hypochlorite to create less than one percent (1%) solution.

(E) **Storage.** Design shall meet the following:

(i) All chemical handling and storage shall be in accordance with OAC 252:626-11

(ii) Provide at least two (2) tanks with thirty (30) hours storage capacity at average daily for usage solution.

(iii) Protect concrete from corrosion.

(iv) Tanks shall be located in a structure to prevent freezing of all system components.

(v) Tanks shall be clear or provide a sight glass to determine brine level.

(F) **Waste Disposal.** Design shall be in accordance with OAC 252:626-13 to ensure proper disposal of the waste stream.

(G) **Warranty.** Provide a two (2) year warranty and maintenance on all equipment.

(H) **Redundancy.** Provide multiple units to meet maximum daily demand with the largest unit out of service.

(m) **Dechlorination.** When dechlorination is required by DEQ, the discharges shall have less than 0.1 mg/l total residual chlorine.

(1) **Equipment.** Do not chlorinate and dechlorinate with the same units. Handle aqueous solutions of sulphite or bisulfite with positive displacement pumps. Sulfur dioxide (SO_2) feed equipment shall account for the property of the gas to easily liquefy. With one-ton containers, take special precautions to prevent chemicals from liquefying. Provide multiple units to meet the operating requirements between the minimum and maximum wastewater flow rates and to avoid depleting dissolved oxygen in receiving waters.

(2) **Mixing.** Mechanical mixers are required unless the design will provide hydraulic turbulence to assure thorough and complete mixing.

(3) **Sulfonator water supply.** Provide an ample supply of water to operate the sulfonator, and protect it according to 252:656-9-2(b). Back up booster pumps according to the power requirements of 252:656-9-2(a).

(4) **Housing.** Storage and feed equipment for SO_2 shall be in a separate room from chlorine gas storage and feed equipment. The same storage requirements apply to SO_2 as for chlorine gas in (c) of this Section. Mixing, storage, and feed equipment areas shall be designed to contain spillage or leakage or to route it to an appropriate containment unit.

(5) **Respiratory protection.** Same as for chlorine gas in (k) of this Section.

252:656-21-3. Ultraviolet radiation disinfection systems (UV systems)

(a) **Use of UV for disinfection.** Ultraviolet radiation disinfection systems ("UV systems") shall only be used to disinfect high quality effluent having:

(1) at least 65% ultraviolet radiation transmittance at 254 nanometers wave length; and

(2) BOD and suspended solids concentrations no greater than 30 mg/l at any time.

(b) **Sizing and UV dosage.** The following are the sizing and dosage requirements for UV systems:

(1) A wastewater treatment system utilizing a UV system to comply with disinfection requirements in an OPDES permit and/or to disinfect Category 3 reclaimed water shall be:

(A) sized using the:

(i) design peak hourly flow for OPDES permits; or

(ii) sized using the anticipated design flow for Category 3 reclaimed water; and

(B) designed to deliver a UV dosage of no less than 30 mJ/cm^2 (30,000 $\mu W \cdot sec/cm^2$) based on MS-2 phage inactivation after adjustments for maximum tube fouling, lamp output reduction after 8,760 hours of operation, and other energy absorption losses.

(2) A wastewater treatment system utilizing a UV system to disinfect Category 2 reclaimed water shall be:

(A) sized using the anticipated design flow; and

(B) designed to deliver a UV dosage of no less than 210 mJ/cm^2 (210,000 $\mu W \cdot sec/cm^2$) after adjustments for maximum tube fouling, lamp output reduction after 8,760 hours of operation, and other energy absorption losses. This dosage is to be delivered assuming a UV transmittance of 55%. [See 252:656-27-3(a)(6) (relating to log removal requirements).]

(3) A wastewater treatment system utilizing both chlorination and UV disinfection to obtain required log removal for Category 2 reclaimed water shall be:

(A) sized using the anticipated design flow; and

(B) designed to deliver a UV dosage of no less than 40 mJ/cm^2 (40,000 $\mu W \cdot sec/cm^2$) after adjustments for maximum tube fouling, lamp output reduction after 8,760 hours of operation, and other energy absorption losses. This dosage is to be delivered assuming a UV

transmittance of 55%. [See 252:656-27-3(a)(6) (relating to log removal requirements).]

(c) **Control system.** All UV systems shall have:

(1) controls capable of maintaining the UV dosage proportional to the wastewater flow through the system,

(2) the capacity to determine the actual wastewater flow going through the UV system,

(3) the capability to measure UV transmittance manually or automatically, and

(4) indicators for:

(A) UV intensity,

(B) lamp and ballast panel temperatures,

(C) power (on/off),

(D) lamp output,

(E) elapsed time of lamp usage,

(F) all alarms, and

(G) metering power.

(d) **Maintenance.** UV systems shall:

(1) be equipped with a drain; and

(2) be designed so that equipment can be isolated for maintenance.

(e) **Safety equipment.** Proper safety equipment (i.e., goggles, clothing, etc.) shall be provided to protect persons from UV radiation.

(f) **Lamps and ballasts.** The UV system shall be constructed so that its lamps and ballasts are accessible.

(g) **Availability of spare parts.** The minimum number of spare parts necessary to ensure continuous disinfection during maintenance and repair shall be available at the facility. The spare parts required shall include lamps, ballasts, quartz sleeves, sleeve wiper rings, cleaning chemicals, and any other items required by the manufacturer, owner, and engineer.

(h) **Monitoring and alarms**. The design engineer shall be responsible for specifying what the monitoring and alarm requirements need to be in order to assure continuous disinfection in compliance with the limits in the permit.

(i) **Cleaning and maintenance.** UV systems shall be routinely and properly maintained to assure disinfection requirements are continuously met.

(j) **Additional requirements when using UV disinfection for reclaimed water.** For systems supplying Category 2 reclaimed water, filtration is required as part of the disinfection process. The particle removal system shall meet the redundancy requirements in 252:656-21-1(e) and be designed to handle the anticipated design flow.

(1) The hydraulic capacity of the inactivation step shall be sized to convey the anticipated design flow.

(2) An independent, third party bioassay based on MS-2 phage shall be used to verify the design UV requirements. Only bioassay methods described in this Section will be approved by DEQ. The UV system shall deliver the target dosage based on the equipment's derating factors described below. Before design approval, the bioassay reports for the specific equipment being considered shall be approved and on file with the DEQ, with specific sections marked confidential, if applicable. If needed, the UV equipment manufacturer shall verify that the scale up or scale down factor utilized in the design is appropriate for the specific application under consideration. Without exception, the basis for verifying the design delivered UV dose meets the requirements of this Section shall be an independent third party bioassay, signed and sealed by a professional engineer licensed by the State of Oklahoma.

(A) The bioassay procedure shall conform to an applicable protocol in the:

(i) National Water Research Institute's Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse (August 2012);

(ii) NSF International, The Public Health and Safety Company, 40 CFR 35.6450 Environmental Technology Verification Protocol (October 2002);

(iii) USEPA Design Manual: Municipal Wastewater Disinfection, EPA/625/1-86/021 (1986); or

(iv) USEPA Ultraviolet Disinfection Guidance Manual for the Final Long Term 2 Enhanced Surface Water Treatment Rule, 815-R-06-007 (November 2006).

(B) The design equations provided by the validation report shall be developed in accordance with a standardized bioassay protocol approved by DEQ.

252:656-21-4. Ozone disinfection

Use of Ozone for disinfection. Requests for use of ozone disinfection shall be reviewed and approved on a case-by-case basis. All ozone systems shall meet the requirements established in OAC 252:626-9-4 including the following:

(1) Disinfection by ozone shall meet requirements pursuant to OAC 252:656-27-3(b)(3).

(2) Disinfection by ozone shall meet inactivation of microorganisms as required in OAC 252:656-27-3(a)(6).

(3) Design shall identify the total CT requirement and evaluate ozone dose, potential ozone demand, plug flow contact time, and whether microflocculation of solids could cause compliance problems with other permit limits, such as effluent, TSS, and turbidity. These factors shall be determined based on one of the following:

(A) pilot studies

(B) a minimum of three (3) well documented analogous projects.

(C) CT calculations, EPA LTIESWTR Disinfection Profiling and Benchmarking Technical Guidance Manual, EPA 816-R-03-004, May 2003.

SUBCHAPTER 23. SUPPLEMENTAL TREATMENT STANDARDS

Section

252:656-23-1. Effluent filtration

(a) **Design flow rate.** A wastewater treatment system:

(1) required to have filtration to maintain OPDES permit compliance shall be sized using the design peak hourly flow; and

(2) that produces Category 2 reclaimed water shall be sized using the anticipated design flow.

(b) **Conditions requiring pretreatment.** Filtration systems shall be preceded with a pretreatment process, such as chemical coagulation and sedimentation or other acceptable process, when:

(1) permit requirements for suspended solids are less than 10 mg/l,

(2) effluent quality can be expected to fluctuate significantly,

(3) significant amounts of algae will be present,

(4) a lagoon is used for polishing effluent, which requires pilot testing for which the protocol has been pre-approved by DEQ, or

(5) the systems supplies Category 2 reclaimed water for reuse.

(c) **Reliability.** Filtration systems shall be designed and constructed with:

(1) convenient access to all components and the media surface for inspection and maintenance

without taking other units out of service; and

(2) enclosed controls and equipment with heating and ventilation equipment to control humidity.

(d) **Redundancy.** Filtration systems shall have at least 2 units with the capacity to handle the maximum wastewater flow in the OPDES permit and/or the anticipated design flow for reclaimed water systems with the largest unit out of service.

(e) **Backwash.** Filtration systems shall have the capacity to backwash all filters.

(1) The backwash filter unit pumps shall be designed to backwash any filter with the largest pump out of service.

(2) Filtration systems shall be backwashed with filtered water.

(3) Backwash wastewater shall be returned to the headworks.

(4) The return rate of backwash water from filtration systems to treatment units shall not exceed 15% of the wastewater design daily average flow rate to the treatment units.

(5) The hydraulic and organic load from the backwash water shall be taken into account in the overall design of the treatment plant.

(6) Surge tanks, if necessary, shall hold at least 2 backwash volumes.

(7) Where backwash water is pump-returned for treatment, the required pumping capacity shall be maintained with the largest unit out of service.

(f) **Back-up power.** Filtration systems shall have a back-up power source that meets the requirements of 252:656-9-1.

(g) **Drain line.** Each filter unit shall be equipped with a drain line at least 6 inches in diameter capable of draining the basin to the headworks.

(h) **Flocculation.** Flocculation shall be used prior to filtration when supplying Category 2 reclaimed water for reuse. Flocculation shall:

(1) include chemical feed equipment to meet the reclaimed water system's anticipated design flow and the ability to proportion chemical feed rates;

(2) ensure the rapid dispersion and mixing of chemicals throughout the wastewater by providing mechanical or in-line static mixers; and

(3) include a minimum of 2 flocculation basins. Each basin shall be equipped with a:

(A) method to control the speed of the paddles; and

(B) drain line at least 6 inches in diameter capable of draining it to the head of the plant.

(i) **Granular media filtration.** The following are the requirements when using granular media filtration:

(1) **Gravity filter use.** Use gravity filters where greases or similar solids are expected to be present in the wastewater.

(2) **Filtration rates.** Filtration rates shall not exceed 5 gpm/ft^2 at the peak hourly flow for OPDES permits or the anticipated design flow for water reuse systems with the largest unit out of service.

(3) **Backwash rate.** The backwash rate shall be adequate to fluidize and expand each media layer a minimum of 20%. The backwash system shall provide a variable backwash rate of at least 20 gpm/ft^2 for 10 minutes.

(4) **Filter media.**

(A) **Selection.** Media size will depend on the filtration rate, treatment prior to filtration, filter configuration, and effluent quality requirements.

(B) **Specifications.** Minimum media depths and media sizes [shown in brackets], with a uniformity coefficient of 1.7 or less, are:

(i) **Anthracite**

(I) Single-medium - none

(II) Dual-media - 20 inches [1.0-2.0 mm]

(III) Multi-media - 20 inches [1.0-2.0 mm]

(ii) **Sand**

(I) Single-medium - 48 inches [1.0-4.0 mm]

(II) Dual-media - 12 inches [0.5-1.0 mm]

(III) Multi-media - 10 inches [0.6-0.8 mm]

(iii) **Garnet or similar**

(I) Single-medium - none

(II) Dual-media - none

(III) Multi-media - 2 inches [0.3-0.6 mm]

(5) **Filter appurtenances.** Filters shall be equipped with:

(A) washwater troughs,

(B) surface wash or air scouring equipment,

(C) low control for effluent rate,

(D) measurement and positive control of backwash rate,

(E) capability to measure filter head loss,

(F) positive means to shut off flow to filter during backwash,

(G) filter influent and effluent sampling points,

(H) a manual override for automatic controls and each individual valve essential to the filter operation,

(I) an underdrain system to uniformly distribute backwash water (and air, if provided) without clogging from solids in the backwash water,

(J) a method for periodic chlorination of the filter influent or backwash water to control slime growths, and

(K) pressure filters with convenient access to the media for treatment or cleaning.

(j) **Traveling bridge filters.** All of the requirements in (a) through (i) of this Section apply to traveling bridge filters with the following exceptions:

(1) **Filtration rates.** With one cell out of service, the peak application rate to any unit shall not exceed twice the applicable design filtration rate below:

(A) A single media filter shall have a maximum design filtration rate of 3.0 gpm/ft^2 of media surface at the peak hourly flow.

(B) A dual media filter shall have a maximum design filtration rate of 4.0 gpm/ft^2 of media surface at the peak hourly flow.

(2) **Backwash system.** The backwash system shall:

(A) provide a minimum of 20 gpm/ft^2 of media being backwashed at a given time;

(B) have a minimum duration of at least 20 seconds for each compartment;

(C) expand the media a minimum of 20%;

(D) provide a backwash rate, pressure and backwash water storage based on the manufacturer's recommendations; and

(E) have the ability for manual override.

(3) **Traveling bridge mechanism.** The traveling bridge mechanism shall:

(A) provide support and access to the backwash pumps and equipment;

(B) be constructed of corrosion resistant materials;

(C) have provisions for consistent tracking of the bridge;

(D) provide support of the power cords; and

(E) initiate a backwash cycle automatically when a preset head loss through the filter media occurs.

(4) **Floating material control.** A traveling filter system shall provide for automatic and regular removal of any floating material from the surface of a filter and return the floating material to the headworks.

(k) **Disc filters.** All of the requirements in (a) through (h) of this Section apply to disc filters with the following exceptions:

(1) Provide a minimum of 2 disc filter units capable of independent operation.

(2) The size of the opening in the screen material shall be a nominal 10 μm.

(3) Base the design on:

(A) an average hydraulic loading rate of 3.25 gpm/ft^2; and

(B) a peak day hydraulic loading rate of 6.0 gpm/ft^2.

(4) Equip the filter drum motor with a variable speed drive capable of adjusting the motor speed based on the plant flow.

(5) The backwash rate, pressure and backwash water storage on the disc filter shall be based on the manufacturer's recommendations.

(6) The disc filter and backwash operation shall be managed according to manufacturer's recommendation with the ability for manual override.

(7) Each unit shall be equipped with a level sensor to initiate the backwash cycle. The design of each unit shall also include a high water level sensor with a telemetry system capable of alerting the responsible person(s) in charge in case of equipment failure.

252:656-23-2. Disc filters [REVOKED]

252:656-23-3. Post-aeration

(a) **Cascade aeration.** Cascade aeration may be used where site topography permits. Head requirements will vary from three to ten feet, depending on the initial DO, temperature of the wastewater and the required DO level before discharge. The formulas used to determine the required cascade height are listed in Appendix C.

(b) **Mechanical aeration.** Provide design calculations to meet Water Quality Standards effluent requirements.

(c) **Diffused-air aeration.** Provide design calculations to meet Water Quality Standards effluent requirements.

252:656-23-4. Membrane filtration

Requests to use membrane filtration shall be reviewed and approved on a case-by-case basis. All membrane filtration systems shall meet the construction standards outlined in OAC 252:626-9-9(f) with the following exceptions:

(1) **Source water testing [Exception to OAC 252:626-9-9(f)(1)].** For wastewater and reuse applications, source water shall be defined as the effluent from a suitable treatment process designed according to the construction standards outlined in this chapter. This water shall be tested for all parameters that may affect membrane filtration and reuse water quality. Historic information shall be reviewed to determine water quality extremes that may be expected. Tabulated results of tests performed, summaries, and conclusions shall be submitted as part of the engineering report proposing membrane filtration.

(2) **Pilot plant verification study [Exception to OAC 252:626-9-9(f)(2)].** Prior to initiating the design of a membrane filtration system for wastewater or reuse applications, a pilot plant study is required to determine the best membrane to use. Submit pilot study protocol to DEQ for approval prior to initiating any pilot study. Pilot study duration shall be a minimum of three (3) months unless low variability in parameters critical to design warrant a shorter duration.

(3) **Log removal [Exception to OAC 252:626-9-9(f)(3)].** A pilot verification study shall be required for a membrane filtration system for wastewater or reuse applications only when removal credit is requested pursuant to OAC 252:656-27-3(a)(6).

(4) **Pretreatment [Exception to OAC 252:626-9-9(f)(5)].** Membrane filtration systems for

wastewater and reuse applications shall be preceded by suitable biological treatment, disinfection to prevent biological growth and, if necessary, clarification processes designed according to the construction standards outlined in OAC 252:656-16 and OAC 252 656-17.

(5) **Turbidity monitoring [Exception to OAC 252:626-9-9(f)(10)].** Turbidity monitoring equipment shall be installed on all influent and effluent piping of membrane units. Continuous turbidity recording equipment shall be provided on the effluent piping and connected to an alarm system to warn operators of an excessive turbidity breakthrough for reuse applications.

(6) **Disinfection [Exception to OAC 252:626-9-9(f)(17)].** Membrane filtration systems shall be properly disinfected each time the membrane units are opened for maintenance and water shall not be sent into the reuse distribution system. Disinfectants prohibited by the membrane manufacturer shall not be used through the membranes.

SUBCHAPTER 25. LAND APPLICATION OF RECLAIMED WATER

Section

252:656-25-1. The slow rate land application process

Slow rate land application is the controlled application of wastewater to the surface of land to achieve a designed degree of treatment through natural, chemical and biological processes that occur on and in the soil. In Oklahoma, slow rate land application systems are acceptable for meeting the agronomic water needs of pasture land, hay meadows and for crop production where the crops will not be eaten raw. See Appendix D for the loading rate, field area and storage volume equations. Refer to OAC 252:627 for permit and operations criteria.

252:656-25-2. Slow rate land application design

(a) **Treatment.** Primary treatment of wastewater shall be completed in the primary lagoon cell(s) prior to being land applied. Wastewater shall not be land applied out of a primary lagoon cell.

(b) **Loading rates.** Hydraulic loading, BOD, suspended solids, nitrogen, phosphorus and crop selection shall all be considered in the process design of land applications systems. Typically loading rates of BOD and SS for municipal wastewater are far below the loading rates determined by other parameters and will not be a concern in system design.

(c) **Land area.** The total area required for a slow rate land application system includes the field area (application site), treatment and storage site (normally primary treatment lagoons and storage ponds), buffer zones and service roads.

(d) **Control.** The applicant shall show they have the right to control the use of the land application site. A long-term contract for a minimum of 20 years is required.

(e) **Buffer zone.** A buffer zone of at least 100 feet in width shall be provided between the land application site and adjacent property. Additional distance may be required where prevailing winds could cause aerosols to drift into residential areas. The buffer zone shall be a part of the permitted site. [See 252:656-27-2(b) (relating to separation distance requirements).]

(f) **Public contact.** Wastewater shall be disinfected in accordance with 252:656-21 if it is to be applied to public contact areas.

(g) **Storage.** Storage of wastewater is required for periods when available wastewater exceeds design hydraulic loading rate, and when the ground is saturated or frozen. A water balance computation is used to estimate the storage requirement. Provide water balance computations of the estimated storage needs. There shall be at least 90 days of storage in addition to the detention time required for primary treatment. The monthly available wastewater for each month shall be

determined by equation (25-5) in Appendix D.
(h) **Flow measurement.** Provide for the measurement of wastewater to be land-applied. Flow measurement shall be accomplished by flow meters, or the calibration of pumps and installation of run-time meters.
(i) **Restrictions.** There shall not be any berms or other barriers on a land application site that would cause the pooling or ponding of wastewater at the land application site. Additionally, there shall not be any berms or barriers that impede the natural flow of stormwater from the site. No land application site shall exceed the maximum slope requirements at OAC 252:627-3.
(j) **Signs.** Suppliers are responsible for ensuring that the required signs, which describe the nature of the facility and advise against trespassing, are posted on signs every 200 feet around the perimeter of the permitted land application site.
(k) **Fencing.** All Category 5 reclaimed water land application sites shall be fenced to prevent unauthorized entry.

SUBCHAPTER 27. WATER REUSE

Section

252:656-27-1. Categories of reclaimed water

The following are the categories of and allowed uses for reclaimed water:

(1) **Category 1.** Reserved.

(2) **Category 2.** Category 2 reclaimed water shall only be used for the allowed uses in Categories 3, 4 and 5, and:

(A) drip irrigation on orchards or vineyards;

(B) spray or drip irrigation on sod farms, public access landscapes and public use areas/sports complexes, including unrestricted access golf courses;

(C) toilet and urinal flushing;

(D) fire protection systems;

(E) commercial closed-loop air conditioning systems;

(F) vehicle and equipment washing (excluding self-service car washes);

(G) range cattle watering, and

(H) make-up water for oil and gas production.

(3) **Category 3.** Category 3 reclaimed water shall only be used for the allowed uses in Categories 4 and 5, and:

(A) subsurface irrigation of orchards or vineyards;

(B) restricted access landscape irrigation;

(C) irrigation of livestock pasture;

(D) concrete mixing;

(E) dust control;

(F) aggregate washing/sieving;

(G) new restricted access golf course irrigation systems;

(H) industrial cooling towers, once-through cooling systems, and closed loop systems such as boiler feed water;

(I) restricted access irrigation of sod farms; and
(J) hydraulic fracturing.

(4) **Category 4.** Category 4 reclaimed water shall only be used for the allowed uses in Category 5 and:

(A) soil compaction and similar construction activities; and

(B) existing restricted access golf course irrigation systems utilizing water that has received primary treatment in lagoon systems. Permits to construct shall not be issued for new Category 4 restricted golf course irrigation systems pending further research and evaluation of performance data collected from existing systems.

(5) **Category 5.** Category 5 reclaimed water shall only be used for:

(A) restricted access pasture irrigation for range cattle;
(B) restricted access irrigation of fiber, seed, forage and similar crops; and
(C) irrigation of silviculture.

(6) **Category 6.** Category 6 reclaimed water, which does not require a permit to supply, shall only be used within the wastewater treatment plant and includes:

(A) dilution water for chemicals used in the process such as polymers, coagulants, chlorination or dechlorination;
(B) mechanical seal water for gas compressors, pumps and other equipment;
(C) mechanical seal water and cooling water for pumps;
(D) odor and gas absorption including bio-filters used for odor control;
(E) centrifuge flushing;
(F) flushing grit and sludge pipes;
(G) gravity thickener make-up water;
(H) supply water for filter backwash;
(I) headworks screen washing;
(J) headworks screening washer-compactors;
(K) belt filter press;
(L) other reclaimed water that is permanently plumbed to a fixed nozzle and contained within unit operations;
(M) yard hydrants; and
(N) hose bibs.

252:656-27-2. General provisions

(a) **Prohibition against cross connections.** Permittees shall not allow physical connections between reclaimed water lines and public water supply lines. Permittees shall follow the requirements of OAC 252:626-5-15 and OAC 252:656-9-2.

(b) **Separation distances.** Systems shall be designed to ensure that direct and wind-blown spray from irrigation systems and other sources are confined to the designated irrigation areas. Systems shall also be designed to comply with the following minimum buffer zones and setback distances, with all distances being measured from the edge of the wetted perimeter of the irrigation area to the edge of the following features:

(1) **Wells.** Permittees shall maintain the following separation distances from wells for all categories of reclaimed water:

(A) three hundred feet (300') from public wells; and
(B) fifty feet (50') from private water wells.

(2) **Waters of the state.** Permittees shall maintain the following separation distances from creeks, lakes, ponds and other waters of the state:

(A) Category 2 reclaimed water - twenty-five feet (25'); and
(B) Categories 3, 4 and 5 reclaimed water - fifty feet (50').

(3) **Property lines.** Permittees shall maintain the following separation distances from adjacent property lines:

(A) Category 2 reclaimed water - twenty feet (20'); and

(B) Categories 3, 4 and 5 reclaimed water - one hundred feet (100').

(c) **Flow measuring devices.** Permittees shall provide flow measuring devices to measure the amount of reclaimed water being generated and distributed. Flow measurement devices shall have recording, totalizing and instantaneous indicating capabilities.

(d) **Control of land application site(s).** Wastewater treatment facilities that depend on land application to maintain total retention shall demonstrate they have the right to control the site(s) on which the effluent is applied. If Permittees do not own the land application site(s), long-term leases and/or contractual agreements for a minimum of twenty (20) years are required for each land application site.

(e) **Prohibition.** Wastewater facilities that utilize lagoon systems for treatment shall not be used as sources of Categories 2 or 3 reclaimed water.

(f) **Reclaimed water sources.** Only wastewater from facilities permitted pursuant to this Chapter may be used as a source for reclaimed water.

252:656-27-3. Treatment

(a) **Category 2 reclaimed water.** Water reuse systems generating Category 2 reclaimed water shall include the following:

(1) **Secondary treatment.** A secondary suspended growth mechanical treatment process, or the equivalent approved by DEQ as a variance, capable of producing an effluent that conforms to the limits specified in Appendix A of OAC 252:627.

(2) **Nutrient removal.** A process in accordance with OAC 252:656-16-3 that will remove nutrients to the level required based on the final use of the reclaimed water. Systems may be exempt from the requirement to remove nutrients when documentation is provided to show that nutrients are utilized based on the agronomic and/or crop uptake rates of the final use.

(3) **Coagulation.** Coagulation with chemicals following the secondary treatment process.

(A) Coagulation, chemical feed and storage equipment shall meet the requirements of OAC 252:626-9 and OAC 252:626-11; and

(B) Rapid mix or inline static mixers shall be used to ensure the rapid dispersion and mixing of chemicals through the reclaimed water.

(4) **Filtration.** Granular media effluent filtration in accordance with OAC 252:656-23-1.

(5) **Turbidimeters.** Continuous online turbidimeters with recording devices installed following filtration and prior to disinfection.

(6) **Disinfection.** Disinfection by chlorination or a combination of UV and chlorination in accordance with OAC 252:656-21 and OAC 252:656-3-4(b)(7)(C). The method of disinfection shall achieve:

(A) 5-log removal or inactivation of Adenovirus type 15;

(B) 5-log removal or inactivation of *Salmonella typhimurium*; and

(C) 3-log removal or inactivation of *Giardia lamblia*.

(b) **Category 3 reclaimed water.** Water reuse systems generating Category 3 reclaimed water shall include the following:

(1) **Secondary treatment.** The secondary suspended growth mechanical treatment process, or the equivalent approved by DEQ as a variance, shall be capable of producing an effluent that conforms to the limits specified in Appendix A of OAC 252:627.

(2) **Nutrient removal.** A process in accordance with OAC 252:656-16-3 that will remove nutrients to the level required based on the final use of the reclaimed water. Systems may be exempt from the requirement to remove nutrients when documentation is provided to show that nutrients are

utilized based on the agronomic and/or crop uptake rates of the final use.

(3) **Disinfection.** Disinfection by chlorination in conformance with OAC 252:656-21 at the point of entry into the distribution system.

(c) **Category 4 reclaimed water.** Existing golf course land application systems generating Category 4 reclaimed water shall include the following:

(1) **Primary treatment.** Primary treatment through a wastewater lagoon system designed in accordance with OAC 252:656-11 and OAC 252:656-25-2(g) and (h).

(2) **Disinfection.** Chlorination in conformance with OAC 252:656-21 to disinfect the reclaimed water at the point of entry into the distribution system.

(3) **Storage detention time.** Storage detention time following primary treatment in accordance with OAC 252:656-25-2(g).

(d) **Category 5 reclaimed water.** Water reuse systems generating Category 5 reclaimed water shall include primary treatment through a wastewater lagoon system designed in accordance with OAC 252:656-11 and OAC 252:656-25-2(g) and (h).

252:656-27-4. Distribution systems

(a) **Cautionary language required**. The following cautionary language is required for reclaimed water piping, valves, outlets and appurtenances in distribution systems.

(1) Effective July 1, 2012, all reclaimed water piping, valves, outlets and appurtenances in distribution systems shall be colored purple (Pantone 522).

(2) Effective July 1, 2012, reclaimed water piping in a distribution system shall be embossed or integrally stamped on opposite sides every 3 feet with a warning that includes the following language: "CAUTION: RECLAIMED WATER–DO NOT DRINK."

(3) All reclaimed water piping installed prior to July 1, 2012, that does not comply with this subsection shall, at a minimum, be identified with above-ground signs containing the cautionary language in (2) of this subsection together with the international "Do Not Drink" symbol:

(A) every 300 feet;

(B) at every change in direction;

(C) in the road easement on both sides of the road at every road crossing; and

(D) at every outlet.

(b) **Hose bibs and yard hydrants.** Hose bibs shall be located in locked, below-grade vaults. Reclaimed water hose bibs, yard hydrants and/or similar outlets shall be equipped with a warning sign containing the cautionary language required in (a)(3) of this Section.

(c) **Distribution pipes.** Reclaimed water distribution pipes shall be designed and constructed to meet the requirements for sanitary sewer pipes in of 252:656-5-2, 252:656-5-3, 252:656-5-4 and 252:656-5-5.

(d) **Pumping stations and force mains.** Pumping stations and force mains shall be designed and constructed in accordance with 252:656-7-1 through 4, with the following exceptions:

(1) Pump openings less than three inches (3") may be allowed when settled or filtered reclaimed water is pumped.

(2) Water reuse systems with the ability to divert all reclaimed water to the wastewater's permitted discharge point, without operator assistance, may be exempt from the requirement to equip the lift station with emergency wet well storage, backup power supply or duplicate pumps.

(e) **Reclaimed water flushing system.** Reclaimed water distribution systems shall be designed with all appurtenances necessary to adequately flush the distribution system to prevent slime growth and the regrowth of pathogens. Flushing plans shall be developed for all reclaimed water distribution systems and submitted for DEQ approval. Flushing plans shall also be included in reclaimed water systems' O&M manuals [see 252: 656-3-10] and in suppliers' DEQ approved inspection programs [see 252:627-1-5(f)]. All flushing systems shall include at a minimum:

(1) provisions for disposal of flushed water that prevent bypasses and discharges to waters of the state or elsewhere; and
(2) air gaps designed pursuant to 252:656-9-2 for all discharges to sanitary sewers.

252:656-27-5. Storage, retreatment and chlorination

(a) **Storage.** Reclaimed water may be stored as follows:
(1) **Storage tanks.** Categories 2-5 reclaimed water may be stored in storage tanks that meet NSF or ASTM standards for public water supply storage tanks.
(2) **Open storage basins.** Categories 2 and 3 reclaimed water may be stored in open storage basins that are permitted and constructed in compliance with OAC 252:656-11-3 and operated as a lagoon in accordance with OAC 252:619 or OAC 252:621.
(3) **Lagoons.** Categories 4 and 5 reclaimed water may be stored in lagoons that are permitted and constructed in compliance with OAC 252:656-11-3 and operated in accordance with OAC 252:619 or OAC 252-621.

(b) **Retreatment.** Following storage in an open storage basin, Category 2 reclaimed water shall be retreated with filtration and chlorination, at a minimum, to prevent slime growth and regrowth of pathogens to end-of-pipe.

APPENDIX A. DESIGN TABLES

OAC 252:656-13-2 (c) Aerated Grit Chambers:

Grit Chamber Measurement Units[a]		
Item	Unit	Range
Detention time at peak flowrate	Minutes	2-5
Dimension – Depth	Feet	7-16
Dimension – Length	Feet	25-65
Dimension – Width	Feet	8-23
Width to Depth Ratio	Ratio	From 1:1 to 5:1
Length to Width Ratio	Ratio	From 3:1 to 5:1
Air Supply per unit of Length	$Feet^3$ per minute per foot	3 – 8

[a]Chart from 1*Wastewater Engineering: Treatment, Disposal & Reuse*, Metcalf & Eddy, Inc., 4th Edition, (2003)

OAC 252:656-16-1(d)(1), Activated Sludge Aeration Basins:

AERATION TANK CAPACITIES & PERMISSIBLE LOADINGS FOR ACTIVATED SLUDGE PROCESSES			
Type of Process	Aeration Retention time[b]	Aeration Basin Loading[c]	F/M Ratio
	(Hours)	(lb BOD_5 per 1,000 ft^3/d)	(lb BOD_5/lb MLSS)
Conventional	6 – 8	30 - 40	0.25 - 0.50
Step Aeration	6 – 8	30 - 50	0.17 - 0.50
Extended Aeration/Oxidation Ditch	24	12 - 15	0.05 - 0.10

[b]Larger values for smaller plants, up to 5,000 "PE" design capacity
[c]Larger values for larger plants, over 5,000 "PE" design capacity

OAC 252:656-16-2(b), Trickling Filter Design:

DESIGN PARAMETERS FOR TRICKLING FILTERS				
	Hydraulic Loading		Organic Loading	
	gal/ft^2/day	Million gallons/acre/day	^{3}lbs BOD_5/1,000 ft of media/day	lbs BOD_5/acre-ft of media/day
Standard Rate	45-90	2-4	5-12	218-523
High Rate	230-690	10-30	30-100	1300-4300

APPENDIX B. SECONDARY AND/OR FINAL CLARIFIER MINIMUM DESIGN CRITERIA

As used in Rule 252:656-17-2

Treatment Process*****	Surface Overflow Rate (gal/day/ft^2)		Peak Solids Loading Rate*** (lb/day/ft^2)
	Average Design Flow*	Peak Hourly Flow	
Conventional, trickling filter, step aeration, complete mix, and carbonaceous state of separate nitrification	600	1,200**	40
Extended aeration and Single stage nitrification	400	1,000	35
Two-stage nitrification	400	800	35
Activated sludge with chemical addition to mixed liquor to remove Phosphorus to less than 1.0 mg/l	400	900****	35

* Based on influent design flow only

** Plants needing to meet 20 mg/l suspended solids should reduce surface overflow rate to gal/day/ft2

*** Base the clarifier peak solids loading rate on the design maximum day flow rate plus the design maximum return sludge rate requirement and the design MLSS under aeration

**** When phosphorus removal to a concentration of less than 1.0 mg/l is required

***** All clarifiers must have a minimum side water depth of 12 feet

APPENDIX C. CASCADE AERATION

Formulas that may be used to determine the required cascade height (see rule 252:656-23-3):

(23-1) $$r = \frac{(C_s - C_0)}{(C_s - C)}$$

(23-2) $$h = \frac{(r - 1)}{[0.11\ ab\ (1 + 0.046\ T)]}$$

where:

r = The deficit ratio
C_s = DO saturation concentration of the wastewater at temperature T, mg/l
C_o = DO concentration of water before aeration, mg/l
C = Required DO concentration after aeration, mg/l
a = Water quality parameter equal to 0.8 for a wastewater treatment plant effluent
b = Weir geometry parameter equal to unity for a free weir, 1.1 for steps, and 1.3 for the step weirs
T = Water temperature in degrees ^{o}C
h = Total height in feet through which water falls.

APPENDIX D. SLOW-RATE LAND APPLICATION

Referenced in Subchapter 25 of Chapter 656

1. Hydraulic loading based on soil permeability

The general water balance equation is based on a monthly time period. With applied wastewater runoff assumed to be zero, the equation is:

(**Equation 25-1)** $L_W = ET - Pr + P_W$

where L_W = wastewater hydraulic loading rate
ET = evapotranspiration rate
Pr = precipitation rate
P_W = percolation rate

The basic steps in the procedure are:

(A) Estimate the monthly ET rate of the selected crop.

(B) Determine design precipitation for each month.

(C) Determine the maximum daily design percolation rate based on soil permeability analyses.

(i) **Evapotranspiration.** Consumptive water use by vegetation is also termed evapotranspiration (ET). Consumptive water use varies with the physical characteristics and th e growth stage of the crop, the soil moisture level, and the local climate. Estimates of maximum monthly consumptive water use of many crops can be obtained from local agricultural extension offices or the NRCS (formerly SCS). Where this information is no t available, it will b e necessary to estimate evapotranspiration using temperature and other climatic data. Annual lake evaporation is a good estimate of evapotranspiration. The supplemental information Table of Rainfall and Evaporation Data may be used t o estimate the amount of water expected to be lost through consumptive use. Water consumption by vegetation should be considered zero f or months where vegetation is dormant or where there is no ground cover.

(ii) **Precipitation.** Determine design precipitation for each month based on a five year return period frequency analysis for monthly precipitation. Alternatively, use a 10 year return period for annual precipitation and distributed monthly based o n the ratio of ave rage monthly to ave rage annual precipitation. Where local precipitation data are no t available, the su pplemental information Table of Rainfall and Evaporation Data may be used to estimate precipitation for the area.

(iii) **Percolation Rate.** Determine by field test the minimum clear water permeability of the soil profile. If th e permeability varies over the site, d etermine an average minimum permeability based on areas of different soil types. The maximum daily design percolation rate is based on 4 to 10% of the minimum soil permeability. Use percentages on the lower end of the scale for variable or poorly defined soil conditions. Percolation rate of 4% of the permeability rate should be used when the permeability is less th an 0.6 in/hr. Values up to 10 % of the permeability may be used for soils having permeability rates greater than 2.0 in/hr. The maximum perc. rate shall not exceed 28 inches per year East of I-35, or 39 inches per year West of I-35.

(Equation 25-2) $P_{W(daily)}$ = permeability, in/h (24h/d) (4 to 10%)

(D) Calculate the monthly rate by multiplying the daily rate by th e number of operating days during the month. Non-operating days may be due to:

(i) Crop management. Downtime must be allowed for planting, cultivation and harvesting.

(ii) Freezing temperatures. T he design s hould allow for no application when the m ean day temperature is less than 0º C (32º F).

(iii) Precipitation downtime is factored into the water balance computation and further adjustment is not necessary.

(iv) Where seasonal crops are grown, wastewater is not normally applied during the winter months. Design must account for all time periods when wastewater will not be applied.

2. Table 25 – Nitrogen uptake of selected crops

Forage Crop	Nitrogen uptake	
	Lbs/acre/year	(Kg/ha/year)
Alfalfa	200 - 601	(225 - 675)
Coastal Bermuda grass	178 - 601	(200 - 675)
Kentucky bluegrass	356 - 601	(400 - 675)
Reed canary grass	298 - 400	(335 - 450)
Tall fescue	134 - 289	(150 – 325)
Vetch	347	(390)
Field crops		
Corn	156 - 223	(175 – 250)
Barley	111 - 143	(125 – 160)
Cotton	67 - 160	(75 – 180)
Grain sorghum	120 - 223	(135 – 250)
Wheat	143 - 156	(160 – 175)

3. Hydraulic loading based on Nitrogen

The annual hydraulic loading rate based on nitrogen is determined by using equation **(25-3). Table 25** may be used to estimate nitrogen uptake for typical crops.

(Equation 25-3)

$$L_{W(n)} = \frac{(C_p)(Pr - ET) + (U)(4.416)}{(1 - f)(C_n) - C_p}$$

Where $L_{W(n)}$ = allowable annual hydraulic loading rate based on nitrogen limits, inches
Cp = percolate nitrogen concentration, mg/l. Maximum allowable value is 10 mg/l
Pr = design precipitation, in/yr
ET = evapotranspiration rate, in/yr
U = crop nitrogen uptake lb/ac/yr
f = fraction of applied nitrogen removed by volatilization, denitrification and storage. Unless actual data can be obtained, a value of 0.2 should be used.
Cn = applied wastewater nitrogen concentration, mg/l

Determine the hydraulic loading rate base on soil permeability and nitrogen requirements. System design approval will be based on the lower of the two rates.

4. Field area determination

The area required for wastewater application is determined using equation **(25-4)**. In areas where a significant loss of wastewater occurs from storage ponds, adjustments may be made to the field area requirement.

(Equation 25-4)

$$A = \frac{(Q)(1118)}{L_W}$$

Where A = field area, acres
Q = average daily wastewater flow, MGD
L_W = design hydraulic loading rate, ft/yr

5. Storage volume estimates

To estimate storage volume requirements:

(A) Develop a table to determ ine the storage requirement which accounts for the monthly hydraulic loading rate. (Enter the nitrogen loading rate if nitrogen is the limiting factor)

(B) Convert the volume of wastewater available each month by equation **(25-5).**

(Equation 25-5)

$$W_a = \frac{Q(D)(C)}{A_w}$$

Where W_a = monthly effluent available, inches/month
Q = daily effluent flow, MGD
D = number of days in the month
A_w = field area, acres
C = 36.8 acre-in/mg

(C) Compute the monthly net change in storage by subtracting the hydraulic loading rate from the available wastewater for each month.

(D) Compute the cumulative storage at the end of each month by adding the change in storage for each month to the accumulated quantity from the previous month. The computation should begin with the reservoir empty at the beginning of the largest storage period. (Note. If treatment lagoons are used for all or part of the storage, the lagoons liquid depth must be at least 2 feet at the beginning of the largest storage period)

(E) Compute the required storage volume using the maximum cumulative storage and the field area by

(Equation 25-6)

$$S_v = \frac{(A_w)(S_c)}{C}$$

Where S_v = required storage volume, ac-ft
A_w = field area, acres
S_c = maximum cumulative storage, from table
C = Conversion, 12 in/ft

Adjust the final sto rage design to account for net g ain or loss in volume from precipitation of evaporation.

APPENDIX E. TABLE OF RAINFALL AND EVAPORATION DATA BY COUNTY

County	Rainfall * (in inches)	Average Pan Evaporaton (in inches)	Average Lake Evaporation (in inches)	County	Rainfall * (in inches)	Average Pan Evaporaton (in inches)	Average Lake Evaporation (in inches)
Adair	59.90	65	47	LeFlore	62.01	65	48
Alfalfa	38.12	90	62	Lincoln	46.13	80	57
Atoka	61.45	75	53	Logan	46.06	85	60
Beaver	28.57	90	62	Love	51.56	80	58
Beckham	32.86	90	64	McClain	48.08	85	60
Blaine	38.17	90	62	McCurtain	67.41	65	49
Bryan	55.60	75	54	McIntosh	59.39	70	52
Caddo	39.15	90	63	Major	35.22	90	63
Canadian	44.44	90	62	Marshall	55.70	75	55
Carter	50.87	80	58	Mayes	56.42	70	49
Cherokee	61.28	70	48	Murray	55.89	80	58
Choctaw	61.42	70	52	Muskogee	56.82	80	50
Cimarron	21.70	90	58	Noble	47.27	85	59
Cleveland	46.59	85	60	Nowata	50.93	70	51
Coal	64.06	75	55	Okfuskee	51.62	75	55
Comanche	42.08	90	64	Oklahoma	44.53	85	60
Cotton	44.22	90	64	Okmulgee	56.29	75	53
Craig	59.59	70	49	Osage	50.81	75	54
Creek	52.16	75	55	Ottawa	64.92	65	47
Custer	39.05	90	64	Pawnee	46.58	80	56
Delaware	62.82	65	47	Payne	44.24	80	52
Dewey	33.48	90	63	Pittsburg	54.33	75	58
Ellis	29.83	90	64	Pontotoc	49.44	75	56
Garfield	43.26	90	61	Pottawatomie	47.71	80	58
Garvin	45.02	80	59	Pushmataha	65.61	70	50
Grady	44.55	90	62	Roger Mills	35.52	90	64
Grant	44.11	90	60	Rogers	54.57	70	51
Greer	37.31	90	64	Seminole	52.15	75	55
Harmon	36.93	90	64	Sequoyah	55.66	65	48
Harper	29.66	90	62	Stephens	44.28	85	62
Haskell	61.04	70	49	Texas	24.53	90	62
Hughes	53.92	75	54	Tillman	41.14	90	64
Jackson	39.39	90	64	Tulsa	49.54	75	53
Jefferson	42.08	85	61	Wagoner	52.50	70	51
Johnston	61.46	75	55	Washington	49.79	70	53
Kay	46.96	80	58	Washita	40.55	90	64
Kingfisher	40.77	90	62	Woods	35.42	90	62
Kiowa	35.84	90	64	Woodward	31.93	90	62
Latimer	73.97	70	50	* Rainfall data is the 90th percentile			

Source of data: OGS average rainfall data for 1970 – 2004; evaporation data from 1976 OSDH Design Guidelines