TITLE 252. DEPARTMENT OF ENVIRONMENTAL QUALITY
CHAPTER 626. PUBLIC WATER SUPPLY CONSTRUCTION STANDARDS

SUBCHAPTER 9. TREATMENT

252:626-9-2. Pretreatment

(a) Provide pre-sedimentation basins for package and slow sand filter water treatment plants if the raw water turbidity is variable and exceeds 30 NTU at any time during the year. Surface water containing an excessive amount of suspended material or high organic content which cannot be readily removed by a package treatment plant or slow sand filtration requires pre-sedimentation and may require additional treatment prior to conventional treatment.

(b) Pre-sedimentation basins shall be designed in accordance with OAC 252:626-9-8.

(c) Provide pre-sedimentation for microfiltration and ultrafiltration (MF/UF) for removal of total organic carbon or other soluble compounds, including, but not limited to iron and manganese. If the engineering report demonstrates that total organic carbon will not cause disinfection by-products violations then pre-sedimentation is not necessary. Other pretreatment methods, other than pre-sedimentation, shall be based on the results of a three (3) month pilot study. The study shall also determine the need for additional treatment if the water is high in turbidity or includes undesirable soluble constituents such as iron and manganese.

(d) Pretreatment for nanofiltration and reverse osmosis (NF/RO) depends on the quality of the raw water. If the feed water has a turbidity of less than 1 NTU or an SDI of less than 5, then cartridge filters with a pore size range of less than 20 μm are required prior to the NF/RO treatment. If the feed water turbidity is 1 NTU or greater or the SDI is 5 or greater, then a more rigorous method of particulate removal, such as conventional treatment (including media filtration) or MF/UF membranes for particle removal is required. The use of MF/UF for pretreatment is more commonly known as an integrated membrane system (IMS). The IMS is one method allowed for the removal of particulate matter and microorganisms as well as some dissolved contaminants such as hardness, iron and manganese or disinfection by-product (DBP) precursors.

~~(e) Large volume off stream storage basins will be considered as a pretreatment method on a case-by-case basis.~~

252:626-9-8. Clarification

(a) **Standard design.**

(1) **Rapid mix.** Rapid mix means the rapid dispersion of chemicals throughout the water to be treated. Provide for the following:

(A) equip mixing basins with mechanical mixing devices capable of adjustment to compensate for variations in raw water quality and flow. Commercial in-line static mixers capable of producing results equal to basins containing mechanical mixers at all anticipated flows will be acceptable,

(B) the maximum detention time of the rapid mix basin, at design flow is 30 seconds, and

(C) locate the rapid mix and flocculation basins as close together as possible.

(2) **Flocculation.** Flocculation means the agitation of water at low velocities through gentle stirring by hydraulic or mechanical means ~~for long periods of time~~. Arrange piping to allow either unit to be removed from service without disrupting operation of the treatment plant.

(A) Flow-through velocity must be 0.5 to 1.5 ft/min, with a detention time for floc formation of at least 30 minutes.

(B) Provide variable speed drives to control the speed of agitators to a peripheral paddle speed of 0.5 to 3.0 ft/s.

(C) Locate flocculation and sedimentation basins as close together as possible. The velocity of flocculated water through pipes or conduits to settling basins must be 0.5 to 1.5 ft/s. Design to minimize turbulence at bends and changes in direction.

(D) Provide a basin drain line of at least ~~4~~ four inches (4") in diameter.

(E) Baffling may be used to provide for flocculation. The design shall be such that the velocities and flows in this paragraph will be maintained.

(3) **Sedimentation.** Conventional horizontal flow sedimentation basins shall conform to the following.

(A) Sedimentation must follow flocculation. Arrange piping to allow either unit to be removed from service without disrupting operation of the treatment plant.

(B) The following criteria apply to conventional sedimentation units:

(i) a minimum detention time of 4 hours is required except when used for lime-soda softening of ground water, the settling time is reduced to a minimum of 2 hours,

(ii) design basins to prevent short-circuiting. Design inlets to distribute water equally and at uniform velocities. Open ports, submerged ports, or similar entrance arrangements are required. Design port to provide uniform flows across the basin and control headloss to prevent floc breakage,

(iii) provide outlet weirs and maintain velocities suitable for settling in the basin,

(iv) limit flow rate over the weir to 20,000 gal/day/ft of weir length,

(v) limit the velocity through the basin to 0.5 ft/min,

(vi) design basins with mechanical residuals removal and slope the floor to conform to manufacturer's recommendations. Provide a basin drain line of at least 4 inches in diameter,

(vii) rectangular basins must have a minimum length-to-width ratio of 2:1, and

(viii) make provisions for the operator to observe or sample residuals being withdrawn from the unit.

(C) **Tube settlers.**

(i) Set tubes at a 60-degree angle to the flow.

(ii) A minimum detention time of three (3) hours is required for surface water treatment and two (2) hours for groundwater treatment.

(iii) Design tube settlers to maintain velocities suitable for settling in the basin and to minimize short-circuiting.

(iv) Size drain piping to facilitate a quick flush of the settler units and to prevent flooding other portions of the plant.

(v) Provide sufficient freeboard above the top of settlers to prevent freezing in the units in outdoor installations

(vi) The maximum application rate is 2 gpm per square foot of cross-sectional area.

(vii) Provide flushing lines, equipped with backflow prevention, to facilitate maintenance and cleaning.

(b) **Solids contact unit.**

(1) **Installation of equipment.** Supervision of all mechanical equipment installation by a representative of the manufacturer at the time of installation and initial operation is required.

(2) **Sampling taps.** Adequate piping with sampling taps located to permit the collection of samples from critical portions of the units are required.

(3) **Chemical feed.** Apply chemicals at points and means necessary to ensure satisfactory mixing with the water.

(4) **Mixing.** Rapid mix units ahead of the solids contact units, must comply with OAC 252:626-9-8 (a)(1). Construct solids contact mixing devices to provide good mixing of raw water with previously formed residuals particles, and prevent deposition of solids in the mixing zone.

(5) **Flocculation.** Flocculation equipment must:

(A) be adjustable (speed or paddle pitch),

(B) provide for coagulation in a separate chamber or baffled zone within the unit, and

(C) provide a combined flocculation and mixing period of not less than 30 minutes.

(6) **Residuals concentrators.** Provide either internal or external concentrators to obtain concentrated residuals with a minimum of wastewater.

(7) **Residuals removal.** Provide units with suitable controls for residuals withdrawal and the following:

(A) residuals pipes not less than 4 inches in diameter and equipped with appropriate cleanouts to facilitate cleaning,

(B) entrance to residuals withdrawal piping that will prevent clogging,

(C) valves located outside the tank for accessibility, and

(D) the ability for the operator to observe and sample residuals being withdrawn from the unit.

(8) ~~**Detention**~~ **Settling zone detention period.** Minimum detention times for the settling zone (excluding the zones for mixing, flocculation, and sludge collection) are:

(A) three hours for suspended solids contact clarifiers and for softeners treating surface water, and

(B) one and ~~a half~~ one-half hours for suspended solids contact softeners treating only groundwater.

(9) **Suspended slurry concentrate.** Design softening units so that continuous slurry concentrates of 1% or more, by weight, can be maintained.

(10) **Weirs or orifices.** Design overflow weirs so that water at the surface of the unit does not travel more than 10 feet horizontally to the collection trough.

(A) Weirs must be adjustable, and at least equivalent in length to the perimeter of the tank.

(B) Do not exceed weir loading rates of:

(i) 14,400 gal/day/ft of weir length for units used as clarifiers, and

(ii) 28,800 gal/day/ft of weir length for units used as softeners treating only groundwater.

(C) Weirs must provide uniform rise rates over the entire area of the tank.
(D) Where orifices are used, the loading rates per foot of launder rates shall be equivalent to the weir loading rates.

(11) **Upflow rates.** Do not exceed upflow rates of:
(A) 1.0 gal/min/ft^2 of area at the residuals separation line for units used as clarifiers, and
(B) 1.75 gal/min/ft^2 of area at the slurry separation line, for units used as softeners treating only groundwater.

252:626-9-9. Filtration

(a) **Filtration processes.** When filtration is required, utilize one of the following:
(1) Gravity sand filtration
(A) Slow sand filtration
(B) Rapid sand filtration
(2) Pressure sand filtration
(3) Membrane processes

(b) **Appurtenances.**
(1) Design filters with filter rate controllers that ensure the rated capacity of the filter will not be exceeded.
(2) Head loss through the filter media is monitored by differential pressure-cell devices that measure the water pressure above and below the filter media. The head loss sensor connection to the filter box should be located approximately four inches (4") above the top of the washwater collection trough to prevent the wash water from entering the sensor. A sediment trap with a drain shall be installed on the sensor line to capture any sediment that may enter the line. The end of the sensor shall be turned up, keeping a full column of water in the line at all times to minimize air entrainment. A fine mesh stainless steel screen shall be installed on the end of the sensor to prevent clogging of the filter media.
(3) Include provisions for draining the filters to waste with appropriate measures for backflow prevention.
(4) Provide a means to sample from the combined filter effluent line.
(5) Provide continuous online turbidimeters with a recording device on the effluent line of each filter.

(c) **Slow sand filter design.**
(1) Slow sand filters are allowed for water supplies where raw water turbidity is less than 10 NTU or where this turbidity value can be obtained by pretreatment. Slow sand filters consist of 24 to 48 inches of sand, which has an effective size of 0.15 to 0.30 mm and a uniformity coefficient equal to or less than 2.5 supported by torpedo sand and graded gravel.
(2) A minimum of two filters shall be provided. Design capacity shall be achievable with the largest filter out of service.
(3) Provide for piping for ripening of the filter media.
(4) Water depth above the filter sand surface must be 3 to 5 feet with 6 inches of freeboard.
(5) Provide an underdrain system consisting of a manifold and collector laterals. Construct laterals of open joint, porous or perforated pipe or conduits with even spacing between laterals.
(6) Support media must conform to OAC 252:626-9-9(d)(6).
(7) Provide an orifice on the outlet line from each filter, limiting the flow of water through the system to 50 gal/day/ft^2 of surface area. Size orifices in accordance with Appendix E, Table II. Locate the orifice at least 1 inch above the initial height of the filter sand surface. Alternatively, the outlet line equipped with an orifice may terminate in a weir box with the weir elevation at least 1 inch above the initial height of the filter sand surface.
(8) Equip each filter effluent line with a rate of flow indicator.

(d) **Rapid rate gravity filters.**
(1) **Pretreatment.** Pretreat water to be processed in rapid rate gravity filters prior to filtration by flocculation, coagulation and sedimentation.
(2) **Rate of filtration.**
(A) The maximum filtration rates:
(i) single media filter is 2 gal/min/ft^2 surface area,
(ii) dual media filter is 3 gal/min/ft^2 surface area, and
(iii) multi-media filter is 4 gal/min/ft^2 surface area.
(B) Higher filtration rates will be considered only after pilot studies show that a higher rate is suitable for the raw water source. Approval of higher rates will require continuous monitoring of raw, settled and finished water for turbidity.
(3) **Structural details and hydraulics.**

(A) Define the hydraulic gradient across the rate-of-flow controller on the plans and specifications. Provide for a positive head at the throat of the controller when operating at the design flow rate. Show the entire hydraulic gradient from top of filter to clear well on the plans.

(B) Provide for the following:

(i) vertical walls within the filter,

(ii) no protrusion of filter walls into filter media,

(iii) head room to permit normal inspection and operation,

(iv) minimum depth of filter box of 8.5 feet,

(v) minimum water depth of 3 feet above the surface of filter media,

(vi) trapped effluent to prevent backflow of air to the bottom of the filters,

(vii) a minimum curb height of 4 inches must surround the filters to prevent the entrance of floor drainage,

(viii) overflow with discharge to backwash wastewater facilities,

(ix) maximum water velocity of 2 ft/s in pipes and conduits to filters,

(x) cleanouts and straight alignment for influent pipes or conduits where solids loading is heavy, or following lime-soda softening,

(xi) washwater drain capacity sufficient to carry maximum flow and equipped with an air gap a minimum of 2 times the diameter of the drain line,

(xii) walkways around filters to be a minimum of 24 inches wide, and

(xiii) safety handrails or walls around filter areas adjacent to walkways.

(4) **Washwater troughs.** Design washwater troughs as follows:

(A) bottom elevation above the maximum level of expanded media during washing,

(B) a 2-inch freeboard at the maximum rate of wash,

(C) the top edges to be level,

(D) spacing so that each trough serves an equal number of square feet of filter area, and

(E) do not exceed a 3 foot maximum horizontal travel of suspended particles to trough.

(5) **Filter material.** The media must be clean silica sand or other natural or synthetic material meeting AWWA standard specifications.

(A) Silica sand (single media) must be a total depth of not less than 24 inches and generally not more than 30 inches, an effective size of 0.45 - 0.55 mm and a uniformity coefficient not greater than 1.65.

(B) Anthracite coal (single media) must be a total depth of 30 to 36 inches of clean crushed anthracite coal, an effective size of 0.45 - 1.2 mm and a uniformity coefficient not greater than 1.65.

(C) Silica sand and anthracite coal (dual media) must be a total depth of 24 to 30 inches with at least 12 inches of sand.

(i) Sand must have an effective size of 0.45 - 0.55 mm and a uniformity coefficient not greater than 1.65.

(ii) Anthracite must have an effective size of 0.45 - 1.2 mm and a uniformity coefficient not greater than 1.85.

(D) Garnet, silica sand, and anthracite (multi-media) must have a total depth of media of at least 30 inches with a minimum of 4.5 inches of garnet, 9 inches of silica sand, and 16.5 inches of anthracite.

(i) Garnet must have an effective size of 0.15 – 0.35 mm.

(ii) Silica sand must have an effective size of 0.45 - 0.55 mm and a uniformity coefficient not greater than 1.65.

(iii) Anthracite must have an effective size of 0.45 - 1.2 mm and a uniformity coefficient not greater than 1.85.

(E) Granular activated carbon as a single media may be considered for filtration only after pilot or full scale testing and with prior approval of the DEQ. Granular activated carbon use is covered in 252:626-9-5.

(6) **Supporting media.**

(A) **Torpedo sand.** Provide a 3-inch layer of torpedo sand, with an effective size of 0.8 - 2.0 mm, and a uniformity coefficient not greater than 1.7, as a supporting media for filter sand.

(B) **Gravel.** Gravel, when used as supporting media, must consist of hard, rounded particles and not include flat or elongated particles. The coarsest gravel must be 2-½ inches in size when the gravel rests directly on the strainer system, and extends above the top of the perforated laterals.

(i) Provide at least 4 layers of gravel in accordance with Appendix E.

(ii) Reduction of gravel depths may be considered upon justification to the DEQ when proprietary filter bottoms are specified.

(7) **Underdrainage system.**

(A) Design all filter piping based on a minimum flow rate of 5 gal/min/ft^2 of surface area.

(B) Design underdrainage system to collect water with minimum uniform loss-of-head over the filter bed during filtration and for uniform upward velocities throughout the entire filter bed during the backwash process.

(C) Do not use porous types of underdrainage systems where the water has appreciable iron or manganese content, or where softening by lime is considered.

(D) For underdrainage systems using strainers, the maximum ratio of area of strainer openings to area of filter is 0.003.

(E) Direct laterals perforations without strainers downward.

(F) Total cross-sectional area of laterals on underdrain systems must be twice the cross-sectional area of the final openings.

(G) Design the cross-sectional area of the manifold to be twice the cross-sectional area of the laterals in order to minimize friction loss.

(H) Design the manifold so that air cannot accumulate as the result of slope or connection to effluent piping.

(8) **Rate of flow controllers.** Equip each filter with a rate of flow controller to ensure that the rated capacity of each filter is not exceeded during operation of other filters.

(9) **Surface wash or subsurface wash.** Surface or subsurface wash facilities are required except for filters used exclusively for iron or manganese removal, and may be accomplished by a system of fixed nozzles or a revolving-type apparatus.

(A) Install a reduced pressure zone (RPZ) back-flow preventer on surface wash units and the potable water supply.

(B) Minimum water pressure is 45 psi on the high side of the pressure-reducing valve.

(C) Install a pressure regulator on the surface wash supply line.

(D) The minimum design flow rate is 2.0 gal/min/ft^2 of filter area for fixed nozzle designs and 0.5 gal/min/ft^2 for revolving arm designs.

(E) Air-operated surface wash systems are allowed.

(10) **Air scouring.**

(A) Design underdrain to accommodate air scour piping, when piping is installed in the underdrain.

(B) Air flow for scouring the filter must be 3-5 standard ft^3/min/ft^2 of filter area when introduced in the underdrain.

(C) Make provisions to avoid excessive loss of filter media during backwashing.

(D) Air must be free from contamination.

(E) Place the air scour distribution systems below the filter media and supporting bed interface.

(F) Do not use flexible hose piping that is capable of collapsing when not under pressure, or of materials easily eroded at the orifice by high velocity air.

(G) To prevent short-circuiting, do not place air delivery piping in the filter media.

(H) Design for ease of maintenance and replacement of air delivery piping.

(I) Design the backwash water delivery system for 15 gal/min/ft^2 of filter surface area. Where design includes air scour, backwash water rate must be variable with a normal operating range up to 8 gal/min/ft^2 unless experience shows that a higher rate is necessary to remove scoured particles from filter media surfaces.

(11) **Backwash.** Make provisions for backwashing filters as follows:

(A) a minimum backwash rate of 15 gal/min/ft^2, or at a rate necessary for 50 percent expansion of the filter bed. A reduced rate of 10 gal/min/ft^2 may be acceptable for full depth anthracite or granular activated carbon filter,

(B) filtered water must come from washwater tanks, washwater pump(s), high service main, or a combination of these,

(C) duplicate washwater pumps unless an alternate means of obtaining washwater is available,

(D) sufficient water to backwash 1 filter for at least 15 minutes at design backwash rate,

(E) regulator or control valve for each filter to obtain desired rate of filter wash,

(F) rate-of-flow indicator on main washwater line, located so that it can be easily read by the operator during the back-washing process, and

(G) design to prevent rapid changes in backwash water flow.

(e) **Rapid rate pressure filters.**

(1) **General.** Rapid rate pressure filters are only allowed for iron and manganese removal for ground water systems.

(2) **Details of design.** Provide the following:

(A) pressure gauges on inlet and outlet pipes of each filter,

(B) filtration and backwashing of each filter individually,

(C) minimum side wall shell height of 5 feet. A corresponding reduction in side wall height is acceptable where proprietary bottoms permit reduction of the gravel depth,

(D) top of washwater collectors to be at least 18 inches above surface of media,

(E) underdrain system to efficiently collect the filtered water and to uniformly distribute the backwash water at a rate no less than 15 gal/min/ft^2 of filter area,

(F) an air release valve on the highest point of each filter,

(G) an accessible manhole to facilitate inspections and repairs,

(H) means to observe wastewater during backwashing,

(I) construction to prevent cross-connection,

(J) rate of filtration must not exceed 3gal/ft^2 of filter area, and

(K) sufficient information on the filter media to allow review and approval on a case-by-case basis.

(f) **Membrane filtration.** There are four categories of membrane filtration: microfiltration (MF), ultrafiltration (UF), nanofiltration (NF) and reverse osmosis (RO). For the purposes of this design standard, membranes shall be defined strictly by pore size as follows: MF, 0.1 - 0.2 µm; UF, 0.01 - 0.1 µm; NF, 0.001 - 0.01 µm; and RO 0.0001 - 0.001 µm. Using these membrane sizes, MF and UF are used for particle and microbial removal, while NF and RO reject most dissolved contaminants.

(1) **Source water testing.** Source water shall be tested for all parameters that may affect membrane filtration and finished water quality. Historic information shall be reviewed to determine water quality extremes that may be expected. Tabulated results of tests done, summaries and conclusions shall be submitted as part of the engineering report proposing membrane filtration.

(2) **Pilot plant verification study.** Prior to initiating the design of a membrane treatment facility, the DEQ must be contacted to determine if a pilot plant study is required to determine the best membrane to use, type of pretreatment, type of post treatment, the blending ratio (blending is not allowed if the source water is surface water or GWUDI), the amount of reject water produced, process efficiency, process control monitoring, cold and warm water flux, fouling potential, operating and TMP, differential pressure and other design criteria. The DEQ must be contacted prior to iniating any pilot study to establish a protocol. The use of membrane processes for treatment of surface water shall require a pilot study for a minimum duration of three (3) months during the time period identified as having the historically poorest water quality for contaminants tested.

(3) **Log inactivation.** Challenge testing removal efficiency for *Giardia* and *Cryptosporidium* shall be accepted by the DEQ if the system or modules meet the following:

(A) Challenge testing shall be conducted according to the criteria established by 40 CFR § 141.179 (b)(2) and show at a minimum 2.5 log removal of *Giardia* and 2.0 log removal for *Cryptosporidium*.

(B) At least 0.5 log removal credit shall be from approved disinfection process using chlorine, chlorine dioxide, ozone or UV.

(4) **Membrane materials.** Provide for compatibility of membrane material and the use of oxidants in the engineering report.

(5) **Pretreatment.** Membrane processes treating surface water shall require pretreatment in accordance with OAC 252:626-9-2. NF or RO processes treating surface water shall require pre-sedimentation in accordance with OAC 252:626-9-2 (d).

(6) **Post treatment.** Post treatment shall be addressed in the engineering report, which shall demonstrate the degasification of carbon dioxide, hydrogen sulfide removal, organic removal, pH, hardness adjustment for corrosion control, and disinfection as a secondary pathogen control for the distribution system.

(7) **Cross-connections.** Membrane systems piping for feed water, filtrate, backwash water, waste and chemical cleaning shall be designed to prevent any cross connection with any potable water supply, in accordance with OAC 252:626-5-15.

(8) **Flow meters.** Flow meters shall be provided on the source water influent piping, the plant finish water piping and on membrane backwash piping.

(9) **Pressure gauges.** Pressure gauges shall be provided on the influent and effluent piping to each membrane unit.

(10) **Turbidity monitoring.** Turbidity monitoring equipment shall be required on all membrane processes treating surface water and GWUDI. 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.

(11) **Membrane cleaning.** A schedule and procedure for proper membrane cleaning shall be developed based on manufacturer's recommendations to prevent contamination of both raw and finished water. The Clean-In-Place procedures shall be approved by the DEQ. Chemicals shall meet AWWA, ANSI and/or NSF requirements, where applicable. Only treatment devices approved by ANSI or NSF shall be used.

(12) **Direct testing equipment.** Equipment for direct testing shall be provided to monitor membrane integrity and to detect and locate defects or breaches that could allow raw water to be diverted around the membrane process.

(13) **Indirect testing.** The membrane system shall be designed to conduct and record indirect integrity continuously on each membrane unit.

(14) **Redundancy.** Redundancy of control components, including, but not limited to, valves, air supply and computers shall be required. Provide membrane units to meet the design capacity with the largest unit out of service.

(15) **Flux rates.** The design engineer shall address the following factors in the engineering report and/or pilot study:

(A) Flux rate shall be based upon the coldest average monthly temperature anticipated and the reference temperature (20° Celsius for MF/UF and 25° Celsius for RO/NF).

(B) Chemical cleaning strategy shall be determined to restore membrane permeability and acceptable flux without damaging the membrane integrity.

(C) Backwash strategies shall be implemented for MF/UF membranes to enhance membrane flux and to extend intervals between chemical cleanings.

(D) Flux rate shall be guaranteed by the manufacturer for a minimum of one (1) year.

(16) **Backwashing.** Provisions for backwashing shall be included in the design according to the manufacturer's recommendations.

(17) **Disinfection.** The system shall be properly disinfected and water shall be run to waste each time the membrane units are opened for maintenance. Certain disinfectants shall not be used through the membranes, if prohibited by the manufacturer.

(18) **Reject water and solids.** Waste from membrane filtration shall be handled in accordance with the requirements in OAC 252:626-13.

(19) **Operation and maintenance requirements.** Operation and maintenance manuals for membrane filtration systems shall be in accordance with OAC 252:626-3-7 (c)(6).

252:626-9-14. Anion exchange for nitrate removal

(a) **Pilot study.** A pilot study protocol shall be approved prior to conducting the pilot study. A pilot study is required prior to submission of an engineering report and must be conducted for a minimum duration of time sufficient to process water through at least one full bed volume and resin regeneration cycle, or 3 days, whichever is longer. The results of the pilot study shall be included in the engineering report.

(b) **Pretreatment.** Pretreatment shall be required if the total concentration of iron, manganese, and heavy metals exceeds 0.1 mg/L.

(c) **Process Design.**

(1) **Redundancy.** Redundancy of control components, including, but not limited to, valves, air supply and computers, shall be provided. Anion exchange units shall be provided and meet the design capacity at a level below the nitrate/nitrite MCL with the largest unit out of service.

(2) **Automatic controls.** Automatic regeneration based on volume of water treated shall be provided unless manual regeneration can be justified and is approved by DEQ. A manual override shall be provided for all automatic controls.

(3) **Exchange capacity.** The design capacity of the anion exchange system shall not exceed the manufacturer's recommended design capacity of the resin for nitrate removal and regeneration.

(4) **Flow rates.** The design shall not exceed 7 gallons/min/ft^2 of bed area for the treatment flow rate. The backwash flow rate should be 2-3 gallons/min/ft^2 of bed area with a fast rinse approximately equal to the service flow rate.

(5) **Flow meters.** Flow meters shall be provided on the source water influent piping and the plant finished water piping.

(6) **Blending.** If a portion of the water is bypassed around the treatment unit and blended with the treated water, the maximum blend ratio allowable must be determined based on the highest anticipated raw water nitrate level. If a bypass line is provided, a totalizing meter and a proportioning or regulating device or flow regulating valves must be provided on the bypass line.

(7) **Stabilization.** Stabilization for corrosion control shall be provided.

(8) **Appurtenances.** An adequate underdrain and supporting gravel system, brine distribution equipment, and cross connection control shall be provided.

(9) **Construction material.** Pipes and contact materials must be resistant to the aggressiveness of salt.

(10) **Cross connections.** Anion exchange system piping shall be designed to prevent any cross connection with any potable water supply, in accordance with OAC 252:626-5-15.

(d) **Sampling and monitoring.**

(1) **Sampling taps.** Smooth-nose sampling taps for the collection of representative samples shall be provided. The taps shall be located to provide sampling of the anion exchange unit influent, effluent, and blended water. Sampling taps for the blended water shall be located at least 20 feet downstream from the point of blending.

(2) **Water quality test equipment.** Test equipment for pH, alkalinity, stability, total hardness, and nitrate shall be provided to determine treatment effectiveness.

(3) **Monitoring.** The treated water nitrate/nitrite level shall be monitored using continuous monitoring and recording equipment with a high nitrate level alarm. In addition to continuous monitoring and recording equipment, the finished water nitrate/nitrite levels shall be determined (using a test kit) no less than once per day, preferably just prior to regeneration of the unit.

(e) **Brine System.**

(1) **Brine and salt storage tanks.** Cover brine measuring or salt dissolving tanks and wet salt storage facilities and construct them of corrosion-resistant material. The make-up water inlet shall have a free fall discharge of two pipe diameters above the maximum liquid level of the unit or obtain DEQ approval of other methods of protection from back-siphonage. Support the salt on graduated layers of gravel with a suitable means of collecting the brine. Equip wet salt storage basins with manhole or hatchway openings having raised curbs and watertight covers with overhanging edges similar to those required for finished water storage. Overflow, where provided, must have a free fall discharge and terminate at an approved brine waste disposal facility.

(2) **Salt storage capacity.** Design salt storage large enough to accommodate a 30-day supply.

(3) **Housing.** Enclose and separate salt storage from other operating areas.

(f) **Waste disposal.** A DEQ approved disposal plan is required for brine waste. If brine waste is to be disposed of in a lagoon, then the lagoon must be permitted and constructed in accordance with OAC 252:656 and lined with a synthetic liner in accordance with the requirement contained in OAC:626-13-4.

SUBCHAPTER 13. RESIDUALS AND DECANT WATER MANAGEMENT

252:626-13-1. General

(a) Provide for proper disposal of WTP waste such as sanitary, laboratory, clarification residuals, softening residuals, iron residuals, filter backwash water, and brines.

~~(b) An approved Residuals Management Plan is required for storage, disposal, or reuse of WTP residuals, including residuals from iron and manganese removal plants.~~

~~(c)~~ (b) Do not discharge wastewater to waters of the state without first obtaining an OPDES permit from the DEQ.

~~(d) WTP residuals may be discharged to a sanitary sewer, provided the discharge will not cause pass-through or interference to the publicly-owned treatment works and the owner of the treatment works agrees to accept the discharge. A pre-treatment permit may be required if the discharge to the publicly-owned treatment works meets the requirements of 40 CFR, Part 403. Where discharging to a sanitary sewer, a flow-equalization system may be required to prevent the overloading of the sewer and interference with the waste treatment processes.~~

~~(e) Mechanical dewatering of residuals is acceptable. Mechanical dewatering equipment will be approved on a case-by-case basis.~~

~~(f) Provide storage facilities for concentrated residuals.~~

~~(g)~~ (c) Discharge sanitary waste from water treatment plants, pumping stations, etc., directly to a sanitary sewer system or to an on-site waste treatment facility constructed and approved in accordance with OAC 252:641 or OAC 252:656.

~~(h) The waste from ion exchange plants, demineralization plants, etc. that cannot flow to a sanitary sewer or meet discharge permit requirements without cost prohibitive treatment may flow to evaporation ponds meeting the requirements of OAC 252:626-13-4.~~

~~(i) A permit is required for the land application of WTP residuals. If the residuals are being applied as a fertilizer or soil-amendment, the Oklahoma Department of Agriculture, Food and Forestry regulations apply.~~

~~(j) The requirements of OAC 252:515 apply to WTP residuals disposal in landfills.~~

~~(k) A permit is required if wastewater is to be land applied from a water treatment plant. The requirements contained at OAC 252:626-13-5 shall be submitted to the DEQ before a permit may be issued.~~

252:626-13-2. Residuals ~~Management Plan~~ management plan

(a) An approved Residuals Management Plan is required for storage, disposal or reuse of WTP residuals, including residuals from iron and manganese removal plants. When a permit is required, a residuals management plan shall be filed with the DEQ and shall include the following:

(1) estimate the volume of residuals produced using Appendix F,
(2) method of residuals management and storage,
(3) method for drying residuals,
(4) characterization of residuals, and
(5) method of ultimate disposal or reuse.

(b) WTP residuals may be discharged to a sanitary sewer, provided the discharge will not cause pass-through or interference to the publicly-owned treatment works and the owner of the treatment works agrees to accept the discharge. A pre-treatment permit may be required if the discharge to the publicly-owned treatment works meets the requirements of 40 CFR, Part 403. When discharging to a sanitary sewer, a flow-equalization system may be required to prevent the overloading of the sewer and interference with the waste treatment processes.

(c) Mechanical dewatering of residuals is acceptable. Mechanical dewatering equipment will be approved on a case-by-case basis.

(d) Storage facilities shall be provided for concentrated residuals.

(e) An approved sludge management plan is required for the land application of WTP residuals. If the residuals are being applied as a fertilizer or soil-amendment, the Oklahoma Department of Agriculture, Food and Forestry regulations apply.

(f) The requirements of OAC 252:515 apply to WTP residuals disposal in landfills.

252:626-13-3. Drying beds

~~Design drying~ Drying beds shall be designed based on the amount of residuals produced and other site specific criteria including climatic conditions, quantity of residuals products, the method and frequency of solids removal, and land requirements. ~~Include~ The design shall include the following:

(1) a minimum total filter area, regardless of the volume of water to be handled, of 100 ft^2,
(2) protection from flooding by surface runoff or floodwaters, in accordance with OAC 252:626-5-3,
(3) design drying beds to facilitate maintenance, mechanical cleaning, and removal of surface sand and residuals,
(4) drying bed media consisting of a minimum of 12 inches of sand, 3 inches of supporting gravel or torpedo sand, and 9 inches of gravel in graded layers. Wash all sand and gravel to remove fines,
(5) drying bed sand with an effective size of 0.8 to 1.2 mm and a uniformity coefficient not to exceed 1.7. Alternate bed material will be considered on a case-by-case basis,
(6) an adequate under-drainage collection system to permit satisfactory discharge of the filtrate to the backwash lagoons, and
(7) surface area shall be designed so that during any one filtration cycle, no more than 2 feet of wastewater will accumulate over the sand surface.

252:626-13-4. Lagoons

(a) **General.** Lagoons used for the treatment of WTP waste shall be designed, permitted and constructed in accordance with OAC 252:656. ~~Provide for~ In addition, lagoon designs shall include the following:

(1) two or more ~~lagoons~ lagoon cells that provide for a minimum residual storage time of six (6) months per lagoon cell,
(2) design lagoons for the periodic removal of residuals as required in OAC 252:631-3-19,
~~(3) dikes, deflecting gutters or other means of diverting surface water so that it does not flow into the lagoons,~~
~~(4) construct dikes of relatively impervious material and compacted to 90 percent standard proctor density. The top of the dike must be a minimum of 8 feet wide. Inner and outer dike slopes must not be steeper than 3 horizontal to 1 vertical (3:1),~~
~~(5) erosion control of the dike by seeding or sodding with Bermuda grass. Riprap is required on lagoons larger than 5 acres,~~
~~(6) seal the bottom of the lagoons up to the maximum water level in accordance with OAC 252:616,~~
~~(7) a minimum depth of 8 feet,~~
~~(8) a minimum of 3 feet freeboard,~~

~~(9)~~ (3) adjustable decanting device,
~~(10)~~ (4) effluent sampling point (if lagoon is permitted to discharge),
~~(11)~~ (5) a pond gauge, to measure the level of residuals in the lagoon~~, and~~
~~(12) adequate fencing with a gate to prevent entrance by livestock and discourage trespassing if the lagoon is not located in the plant site, with permanent signs along the fence that designate the nature of the facility. A sign shall be placed on each side of the site. The sign shall include the name and contact information (address, phone number and e-mail address) for the owner.~~

~~(b) **Surface evaporation lagoons (total retention).**~~
~~(1) Size lagoons to store both the expected wastewater and residuals produced.~~
~~(2) Provide sufficient surface area to evaporate the wastewater generated.~~
~~(3) Base evaporation rates on the annual average pan evaporation minus the 90th percentile annual rainfall.~~

~~(c)~~ (b) **Surface water treatment wastewater handling.**
Design for:
(1) at least 4-hours settling time prior to recycling,
(2) wastewater to be returned to a point prior to the point of primary coagulant addition, and
(3) wastewater to be returned at an instantaneous rate of 10 percent or less of the raw water entering the plant. Total flow shall not exceed the WTP maximum design flow rate.

(c) **Sealing of lagoons**. Water treatment plants utilizing conventional, microfiltration or softening treatment may seal the lagoons with any approvable material listed in OAC 252:656. For all other types of treatment, the lagoons shall have a synthetic liner that meets the requirements of OAC 252:656.

(d) **Evaporation ponds.** The waste from ion exchange plants, demineralization plants, etc., that cannot flow to a sanitary sewer or meet discharge permit requirements without cost prohibitive treatment may flow to evaporation ponds meeting the requirements of OAC 252:619, 252:621 and 252:656.

252:626-13-5. Land application of ~~wastewater~~ decant water or residuals

A permit is required if WTP decant water or WTP residuals are to be land applied from a water treatment plant. Refer to OAC 252:621, 252:627 and 252:656 for permit and operations criteria.

~~When wastewater from a water treatment plant is to be land applied, the following shall be required:~~
~~(1) Land apply wastewater in a manner to prevent surface runoff and to control objectionable odors.~~
~~(2) Land application of wastewater can only occur for the purpose of beneficial use.~~
~~(3) The land application site shall have minimal slope or be contoured to prevent ponding and soil erosion. No application shall occur on land having a slope exceeding five percent (5%) unless erosion and runoff control provisions are implemented. Land having a slope greater than ten percent (10%) may be utilized for land application only with Department approval. For land application for dust suppression on roadways, clean wastewater hauling vehicles prior to leaving the site with provisions for disposition of rinse water.~~
~~(4) Land application shall be uniform over each plot (a predetermined portion of the land application site) unless otherwise permitted by the DEQ.~~
~~(5) Annual land application shall not exceed permit limits set for each constituent and shall not be applied in rates that result in toxicity to site vegetation.~~
~~(6) Land application shall occur on soils which exhibit physical and chemical properties that promote assimilation and treatment of the wastewater (e.g., infiltration rate, storage capacity, or other properties) and which support vegetation (e.g., native grasses) or in order to prevent erosion of the soil (such as dust suppression). Add minerals and other materials to ensure levels of oxygen, pH, nutrients and moisture as needed to sustain native vegetation.~~
~~(7) The soil profile depth to bedrock shall be three (3) times the depth of incorporation or three (3) feet, whichever is greater unless prior written approval is obtained from the DEQ.~~
~~(8) The municipality, rural water district or entity in control of the water treatment plant shall have the right to control the use of the land application site and shall maintain at least 10-foot-wide setbacks on the boundaries of each site, and take other actions necessary to prevent runoff and aerosols from leaving the site as required by the DEQ. A buffer is not required between adjacent sites.~~
~~(9) The following records must be kept at the water treatment plant:~~
~~(A) location, day and hour land application began and ended, and the method of application;~~
~~(B) analytical data, volume and source(s) of wastewater applied;~~
~~(C) loading rates;~~
~~(D) weather conditions during the application period;~~
~~(E) type of crop, grass or vegetation grown on site;~~

(F) pH of wastewater at beginning of application, or weekly if application exceeds seven consecutive days; and

(G) monitoring records, including the date, time and exact place of the sampling or measurement, the name of the sampler, when analysis began, the name of the certified laboratory and the analytical results.

(10) Divert stormwater run-off around land application sites.

(11) The following prohibitions shall apply to all land application sites:

(A) Do not land apply wastewater if it adversely affects a threatened or endangered species listed under section 4 of the federal Endangered Species Act, 16 U.S.C. 1533(c), or the critical habitat of such species.

(B) Do not land apply during rainfall, or when saturated or frozen soil hinders absorption.

(C) Do not land apply or allow runoff of wastewater to wetlands or waters of the State. Discharges to waters of the State are prohibited without a discharge permit under OAC 252:606.

(D) The land application of demineralized water is prohibited.