3745-9-01 **Well standard definitions.**

Except as otherwise noted, the definitions in rule 3745-81-01 of the Administrative Code shall apply to this chapter.

(A)

(1) "Abandoned well" means a well, test hole, or dry hole whose use has been permanently discontinued. A properly abandoned well has been sealed as defined in paragraph (S)(1) of this rule. An improperly abandoned well has not been sealed as defined in paragaph (S)(1) of this rule.

(2) "Alter" or "alteration" means to make a substantial change in construction or configuration of a public water system, including without limitation: changing well pump design capacity; converting a well with a buried seal to a well with a pitless adapter or well house installation; converting a well that uses a well pit to a well with a pitless adapter or well house type of construction; deepening a well; installing a liner; or modifying, extending or replacing any portion of the casing or borehole.

(3) "API" means American petroleum institute.

(4) "ANSI" means American national standards institute.

(5) "Anticipated permanent design pumping rate" means the rate at which the public water system anticipates pumping water from the well during normal operation using the permanent well pump.

(6) "ASTM" means the American society for testing materials.

(7) "AWWA" means American water works association.

(B)

(1) "Bentonite" means a plastic, colloidal clay which has an extensive ability to absorb water and swell in volume, and which is composed predominantly of the mineral sodium montmorillonite.

(2) "Brine" means water that has a total dissolved solids concentration greater than thirty-five thousand milligrams per liter, or greater than thirty-five thousand milligrams per liter multiplied by one and five tenths microsiemens per centimeter. [Comment: Thirty-five thousand parts per million or ppm total dissolved solids is seawater.]

(C)

(1) "Casing" means an impervious durable pipe that is placed in a well and is used to prevent the walls from caving, and to exclude surface drainage, undesirable water or other fluids, or unwanted or harmful materials from a well. Casing includes pipe used for both primary or production casing, and secondary or surface casing.

(2) "Coarse grade bentonite" means bentonite that has been crushed to a size of three-eighths to three-quarters of an inch.

(3) "Conductor pipe--gravity" means allowing cement grout to flow by gravity through a funnel or hopper connected to a conductor pipe.

(4) "Conductor pipe--pumped" means pressure grouting with a conductor pipe that is lowered to the bottom of the annular space with grout pumped from the bottom up in a continuous operation. The end of the conductor pipe remains submerged and full of grout at all times.

(5) "Construction and demolition debris facility" means as defined in rule 3745-500-02 of the Administrative Code.

(D)

(1) "Develop" or "development" means to physically remove, or the process of removing, all fine materials and sediment generated during construction of the well, by means including but not limited to surging, air surging or lifting, overpumping, backwashing, high velocity jetting or bailing of the completed well.

(2) "Drinking water source protection area" means the surface and subsurface area surrounding a public water supply well, which will provide water from an aquifer to the well within five years as delineated or endorsed by the agency under Ohio's source water assessment and protection programs.

(3) "Drive shoe" means a hardened steel collar with a beveled cutting edge that is attached to the lower end of a casing by threading or welding to protect the casing as it is driven.

(4) "Drop pipe" means a pipe or pipes within a well casing which conducts water from the well to the pitless adapter or pitless unit.

(5) "Dry hole" means a well that does not produce water in sufficient quantity for the intended use.

(6) "Dug well" means a well consisting of a large diameter hole, deeper than it is wide, constructed into the ground, usually by hand, but if by mechanical means, by methods other than drilling, jetting, auguring or boring, and within which the side walls are supported by stone, brick, tiles or other similar materials.

(E) "Effective grain size" means the ninety per cent retained size of a sediment as determined from a grain size analysis.

(F)

(1) "FEMA" means federal emergency management agency.

(2) "Floodplain" means the area adjoining any river, stream, watercourse or lake that has been or may be covered by flood water.

(3) "Floodway" means the channel of a river or stream, and those portions of the floodplain adjoining the channel required to carry the flood discharge.

(4) "Formation stabilizer" or "filter pack" means siliceous, well-rounded, clean and uniform sand or gravel that is free of contaminants and foreign matter, properly sized, washed and placed between the borehole wall and the well screen to prevent formation material from entering through the screen and to stabilize the borehole.

(G)

(1) "Granular bentonite" means bentonite that has been processed to coarse granular particles ranging in size from thirty-three to ninety-three thousandths of an inch.

(2) "Grout" means a slurry of cement, bentonite, clay or other impervious material that is used to seal a well, test hole, dry hole or annular space. Grout specifications for sealing are in rule 3745-9-07 of the Administrative Code.

(3) "Grout displacement" method means placing a calculated volume of grout sufficient to fill the annular space plus fifteen per cent extra grout into the

borehole through a conductor pipe. The grout is then pressurized to force the grout into the annular space.

(4) "Grout shoe--continuous injection" means pressure grouting by using a grout shoe with a check valve installed in the bottom of the permanent well casing and connected by a conductor pipe to the surface through which grout is pumped until the entire annular space is filled with grout. The conductor pipe is removed, the permanent casing set at the bottom of the borehole, and the grout allowed to set until cured.

(H)

(1) "Human or animal waste management facility" means any of the following:

(a) A class I, II, or III compost facility as defined in rule 3745-560-02 of the Administrative Code.

(b) A regional sewage sludge storage facility and other bulk storage facility for non-exceptional quality biosolids as defined in rule 3745-40-01 of the Administrative Code.

(c) A manure storage or treatment facility, fabricated manure storage structure, manure storage pond, or manure treatment lagoon as defined in rule 901:10-1-01 of the Administrative Code.

(d) A wastewater treatment facility as defined in rule 3745-33-01 of the Administrative Code, or storage facility as defined in rule 3745-42-13 of the Administrative Code.

(2) "Hydrofracturing" means a method of well development where pressurized water is injected into a well in order to increase the aquifer productivity by artificially creating or modifying existing fissures and fractures within the aquifer unit.

(I) "Inner management zone" means the surface and subsurface area within a drinking water source protection area for a public water supply system using ground water surrounding a public water supply well that will provide water to the well within one year as delineated or endorsed by the agency under Ohio's source water assessment and protection programs.

(J) [Reserved.]

(K) [Reserved.]

(L)

(1) "Land application area", for the purposes of this chapter, means any of the following:

(a) A beneficial use site or area used for field storage for non-exceptional quality biosolids as defined in rule 3745-40-01 of the Administrative Code.

(b) A land application area, staging area or stockpiling area as defined in rule 901:10-1-01 of the Administrative Code.

(c) A wastewater land application area as defined in rule 3745-42-13 of the Administrative Code.

(2) "Landfill" means a sanitary landfill, industrial waste landfill or residual waste landfill as defined in rule 3745-27-01 or 3745-30-01 of the Administrative Code.

(3) "Lead free" means the same as defined in section 6109.10 of the Revised Code.

(4) "Liner" means a well casing installed within another well casing. A liner may include a perforated section that extends into the open portion of a borehole to support the walls of the borehole and allow movement of ground water into the well.

(M)

(1) "Monitoring well" means an excavation by digging, boring, drilling, driving or other method that is done or used to extract samples of ground water or for the purpose of determining the quality, quantity or level of ground water.

(2) "Monofill" means a scrap tire monofill as defined in rule 3745-27-01 of the Administrative Code.

(N)

(1) "Nonpotable well" means any well described in section 6111.42 of the Revised

Code that is not used for the provision of water for human consumption. Nonpotable wells include, but are not limited to, wells used to provide water for irrigation, non-contact cooling water, water for use in commerical and industrial processes, and water for use in open-loop geothermal heating and cooling systems.

(2) "NSF" means the national sanitation foundation.

(O) "One hundred year floodplain" means a portion of a designated floodplain that may be inundated by a flood having a one per cent chance of being equaled or exceeded in any given year.

(P)

(1) "Packer" means a rubber or inflatable device used to temporarily or permanently seal off a portion of the borehole, annular space or well casing.

(2) "Pelletized bentonite" means bentonite that has been processed into pellets or tablets that have a diameter of one fourth to one half inch.

(3) "Permanent design pumping rate" means the nominal capacity of the installed pump, per the manufacturer's specifications.

(4) "Pitless adapter" means an assembly of parts which will permit water to pass through the casing or extension thereof; provides access to the well and to the parts of the water system within the well; and provides for the transportation of the water and the protection of the well and water therein from surface or near surface contaminants.

(5) "Pitless unit" means an assembly which extends the upper end of casing to above grade and prevents the entrance of contaminants into the well, to conduct water from the well, to protect water from freezing or extremes of temperature and to allow access to the well and components of the pumping equipment.

(6) "Point well" means a well with casing with an integral screen and drive point that is installed by driving or jetting.

(7) "Pressure grouting" means any of the following methods of placing a grout slurry into a well or the annular space of a well: conductor pipe-pumped; grout shoe-continuous injection; well seal with conductor pipe-pumped; and,

grout displacement method.

(8) "Private water system" means the same as defined in division (A) of section 3701.344 of the Revised Code.

(9) "Public entity" means the federal government, the state, any political subdivision and any agency, institution or instrumentality thereof.

(10) "Public water system well" means a well, except a monitoring well, for use by a public water system.

(Q) "Qualified ground water professional" means a scientist or engineer who has received a baccalaureate or post-graduate degree in the natural sciences or engineering and has at least five years relevant experience in ground water hydrology and related fields to enable that individual to make sound professional judgments regarding ground water resources; water well construction, testing and development; and identification and migration of contaminants.

(R)

(1) "Radial collector well" means a water collector that is constructed as a dug well that has been sunk as a caisson. Screens are installed radially and approximately horizontally from the caisson into the aquifer.

(2) "Repair" means any work performed on a well for the purpose of servicing or replacing a component with a comparable component. Repair includes, without limitation, servicing pumps or pumping equipment, and couplings. Repair does not include a modification to the casing or wall of a well.

(S)

(1) "Seal" means to close a portion of or the entirety of a well, test hole or dry well for the purposes of closing the annular space of a well or permanently discontinuing (abandoning) use.

(2) "Shale trap" means a conical shaped rubber packer that is attached to the bottom of the casing to seal the annular space and prevent grout from entering the open borehole or screened area of the well.

(3) "Soil absorption system" means the final treatment component of an onsite

sewage treatment system that utilizes absorption and adsorption to treat and disperse the treated sewage into subsurface soils.

(4) "Source water assessment and protection program" means Ohio EPA's program based on the Safe Drinking Water Act (or SDWA) as amended in 1996.

(5) "Specific capacity" means the rate of discharge of a water well per unit of drawdown, commonly expressed in gallons per minute per foot. It varies with duration of discharge and the pumping rate.

(6) "Standard dimension ratio (SDR)" means the ratio of average outside pipe diameter to minimum pipe wall thickness.

(7) "Static water level" means the level of the water when measured from the established ground surface to the water surface in a well that is neither being pumped nor under the influence of pumping.

(8) "Susceptibility" is the likelihood for the source of water used by a public water system to become contaminated, as determined through the source water assessment and protection program.

(T)

(1) "Test hole" means any excavation, regardless of design or method of construction, for the purpose of determining the most suitable site for removing ground water from an aquifer.

(2) "Thermoplastic" means polyvinyl chloride (PVC) or acrylonitrile butadiene styrene (ABS).

(U) "Uniformity coefficient" means a ratio of the sieve-size opening that will pass sixty per cent of a representative sample of the filter material divided by the sieve-size opening that will pass ten per cent of the material.

(V) [Reserved.]

(W)

(1) "Well" means any excavation by digging, boring, drilling, driving or other method for the purpose of removing ground water from an aquifer, except a

private water system well or a monitoring well.

(2) "Well cap" or "cap" means a device used to enclose the atmospheric termination of the well casing, and a device that covers and encloses the upper termination of a pitless unit or the well casing and provides protection to the top, exposed portion of the well casing by being tamper resistant, forming a protective cover from the elements, and being resistant to the entry of vermin or contaminants.

(3) "Well house" or "pumphouse" means a building designed and constructed solely to house pumping and water system equipment.

(4) "Well screen" or "screen" means a manufactured intake structure with uniform openings designed to retain the aquifer formation, prevent collapse of the borehole adjacent to the screen, and accommodate a yield adequate for the intended use of the well.

(5) "Well seal with conductor pipe--pumped" means pressure grouting by setting the permanent casing just above the bottom of the borehole and filling the casing and annular space with water, drilling mud or a bentonite slurry. Conductor pipe is then set inside the casing to the bottom of the borehole either through a watertight well seal or packer. Grout is pumped into the annular space displacing all other fluids in the annular space and the permanent casing set in place.

(6) "Well vent" or "vent" means a screened opening in a well seal or cap to allow atmospheric pressure to be maintained in the well.

(X) [Reserved.]

(Y) [Reserved.]

(Z) [Reserved.]

(AA) Referenced materials. This chapter includes references to certain subject matter or materials. The text of the referenced materials is not included in the rules contained in this chapter. Information on the availability of the referenced materials as well as the date of and the particular edition or version of the material is included in this rule. For materials subject to change, only the specific version specified in this rule are referenced. Material is referenced as it exists on the effective date of this rule. Except for subsequent annual publication of existing (unmodified) Code of Federal

Regulation compilations, any amendment or revision to a referenced document is not referenced unless and until this rule has been amended to specify the new dates.

(1) Availability. The referenced materials are available as follows:

(a) "American National Standards/American Water Works Association" (ANSI/AWWA). A copy may be obtained from "AWWA Bookstore, 6666 W. Quincy Avenue, Denver, CO, 80235," (303) 794-7711, www.awwa.org. The standards are available for review at "Ohio EPA, Lazarus Government Center, 50 West Town Street, Suite 700, Columbus, OH, 43215."

(b) "American National Standards/National Sanitation Foundation" (ANSI/NSF). A copy may be obtained from "NSF International, 789 N. Dixboro Road, P.O. Box 130140, Ann Arbor, MI 48105," (734) 769-8010, www.nsf.org. The standards are available for review at "Ohio EPA, Lazarus Government Center, 50 West Town Street, Suite 700, Columbus, OH, 43215."

(c) "American Petroleum Institute" (API). A copy may be obtained from "API, 1220 L Street NW, Washington, DC 20005-4070," (202) 682-8000, www.api.org. The standards are available for review at "Ohio EPA, Lazarus Government Center, 50 West Town Street, Suite 700, Columbus, OH, 43215."

(d) "American Society for Testing Materials" (ASTM). Information and copies of documents may be obtained by writing to: "ASTM International, 100 Bar Harbor Drive, P.O. Box C700, West Conshohocken, Pennsylvania 19426-2959." These documents are also available for purchase at www.astm.org. ASTM documents are also available for inspection and use at most public libraries and "The State Library of Ohio."

(e) "American Welding Association" (AWS). A copy may be obtained from "American Welding Society, 8669 Northwest 36 Street, #130, Miami, FL, 33166-6672," (305) 443-9353, www.aws.org. The standards are available for review at "Ohio EPA, Lazarus Government Center, 50 West Town Street, Suite 700, Columbus, OH, 43215."

(f) Federal Register. Information and copies may be obtained by writing to: "Superintendent of Documents, Attn: New Orders, PO Box 371954, Pittsburgh, PA 15250-7954." Online access to the Federal Register is

available at https://www.govinfo.gov/app/collection/FR/. A copy of the Federal Register is also available for inspection and use at most public libraries and "The State Library of Ohio."

(g) "Method 533: Determination of Per- and Polyflouroalkyl Substances in Drinking Water by Isotope Dilution Anion Exchange Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry." A copy may be obtained from "Ohio EPA, Lazarus Government Center, 50 West Town Street, Suite 700, Columbus, OH, 43215," (614) 644-2752,www.epa.gov.

(h) "Method 537.1: Determination of Selected Per- and Polyfluorinated Alkyl Substances in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS)." A copy may be obtained from "Ohio EPA, Lazarus Government Center, 50 West Town Street, Suite 700, Columbus, OH, 43215," (614) 644-2752,www.epa.gov.

(i) "Ohio EPA Technical Guidance Manual for Hydrogeologic Investigations and Ground Water Monitoring." A copy may be obtained from "Ohio EPA, Lazarus Government Center, 50 West Town Street, Suite 700, Columbus, OH, 43215," (614) 644-2752, www.epa.ohio.gov. The document is available for review at "Ohio EPA, Lazarus Government Center, 50 West Town Street, Suite 700, Columbus, OH, 43215."

(j) The "State of Ohio Regulations and Technical Guidance For Sealing Unused Water Wells and Boreholes." A copy may be obtained from "Ohio EPA, Lazarus Government Center, 50 West Town Street, Suite 700, Columbus, OH, 43215," (614) 644-2752, www.epa.ohio.gov. The document is available for review at "Ohio EPA, Lazarus Government Center, 50 West Town Street, Suite 700, Columbus, OH, 43215."]

(k) United States Code (USC). Information and copies may be obtained by writing to: "Superintendent of Documents, Attn: New Orders, PO Box 371954, Pittsburgh, PA 15250-7954." The full text of the United States Code is also available in electronic format at https://www.govinfo.gov/app/collection/uscode/. The USC compilations are also available for inspection and use at most public libraries and "The State Library of Ohio."

(l) "Water System Council" (WSC). A copy may be obtained from "Water Systems Council, 1101 30th Street NW, Suite 500, Washington, DC,

20007," (202) 625-4387, www.watersystemscouncil.org. This document is available for review at "Ohio EPA, Lazarus Government Center, 50 West Town Street, Suite 700, Columbus, OH, 43215."

(2) Referenced materials:

(a) "ANSI/AWWA C219, Bolted, Sleeve-Type Couplings for Plain-End Pipe," August 1, 2017.

(b) "ANSI/NSF 14, Plastics Piping System Components and Related Materials," June 22, 2020.

(c) "ANSI/NSF 60, Drinking Water Treatment Chemicals - Health Effects," November 4, 2020.

(d) "ANSI/NSF 61, Drinking Water System Components - Health Effects," May 9, 2020.

(e) "API 5L, Specification for Line Pipe," forty-sixth edition, effective date November 1, 2018.

(f) "API RP 5B1, Gauging and Inspection of Casing, Tubing, and Line Pipe Threads," fifth edition, October 1999.

(g) "ASTM A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless," approved July 15, 2020.

(h) "ASTM A106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service," approved November 26, 2019.

(i) "ASTM A500, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes," approved January 21, 2021.

(j) "ASTM A589, Standard Specification for Seamless and Welded Carbon Steel Water-Well Pipe," approved October 2, 2018.

(k) "ASTM C150-00, Standard Specification for Portland Cement," approved August 12, 2021.

(l) "ASTM F480-00, Standard Specification for Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), SCH 40 And SCH 80," approved September 1, 2020.

(m) "AWS D10.12M, Guide for Welding Mild Steel Pipe," approved in 2000.

(n) "AWS D1.1, Structural Welding Code-Steel," approved in 2020.

(o) "AWWA A100, Water Wells," effective date July 1, 2020.

(p) "AWWA C206, Field Welding of Steel Water Pipe," effective date April 1, 2017.

(q) "AWWA C654, Disinfection of Wells," effective date July 1, 2013.

(r) "Safe Drinking Water Act" (SWDA). 88 Stat. 1660 (1974), Title 42 U.S.C. 300(f), as amended by the "Safe Drinking Water Act Amendments of 1977," 91 Stat. 1393, 42 U.S. C. 300(f), the "Safe Drinking Water Act Amendments of 1986," 100 Stat. 642, 42 U.S.C. 300(f), and the "Safe Drinking Water Act Amendments of 1996," 110 Stat. 1613, 42 U.S.C. 300(f), and regulations adopted under those acts.

(s) "Ohio EPA Technical Guidance Manual for Hydrogeologic Investigations and Ground Water Monitoring," published in February 1995 and as amended through April 2015.

(t) The "State of Ohio Regulations and Technical Guidance For Sealing Unused Water Wells and Boreholes," March 2015.

(u) "WSC PAS-97, Performance Standards and Recommended Installation Procedures for Sanitary Water Well Pitless Adapters, Pitless Units, and Well Caps," approved in 2019.

Effective: 9/1/2022

Five Year Review (FYR) Dates: 4/20/2022 and 09/01/2027

CERTIFIED ELECTRONICALLY

Certification

08/16/2022

Date

Promulgated Under: 119.03
Statutory Authority: 6109.04, 6111.42
Rule Amplifies: 6109.04
Prior Effective Dates: 02/15/1975, 05/01/2003, 09/01/2009, 06/13/2016

3745-9-02 **Scope and exemptions.**

(A) In accordance with division (E) of section 6111.42 of the Revised Code, this chapter applies to the drilling, operation, maintenance and abandonment of a well or monitoring well to prevent the contamination of the ground water, except that these rules shall not apply to a private water system well as defined in Chapter 3701-28 of the Administrative Code. Unless otherwise noted, this chapter applies to the drilling, operation, maintenance and abandonment of a nonpotable well as defined in rule 3745-9-01 of the Administrative Code.

(B) No provision of this chapter shall be construed so as to exempt any person from compliance with any section of the Revised Code, or any other rule of the Administrative Code, including the department of natural resources and the department of health, or any local ordinance or regulation.

(C) No person shall provide water from a public water system well to the public following construction or alteration until plans therefor have been approved by the director in accordance with section 6109.07 of the Revised Code and Chapter 3745-91 of the Administrative Code.

(D) Only private contractors holding a valid registration with the Ohio department of health, in accordance with Chapter 3701-28 of the Administrative Code, may do or oversee any of the following except as noted in paragraph (E) of this rule:

(1) Drill, construct, alter, repair or seal a public water system well.

(2) Install a pitless adapter or pitless unit into the casing of a public water system well.

(E) A community water system that is owned or operated by, or serves a public entity, may perform repairs on wells owned and operated by the public water system. Any contractor hired by a public entity must meet the requirements of paragraph (D) of this rule.

(F) The director shall not issue a plan approval for a well serving a public water system, or alteration of such a well, in accordance with Chapter 3745-91 of the Administrative Code, that does not conform to the requirements of this chapter, or which will cause or contribute to contamination of the well or ground water.

(G) The director may grant a variance of this chapter. A public water system requesting a variance shall submit a variance application as part of the process for approval of the well site or well. The variance application shall be reviewed as part of the well site or well approval in accordance with Chapter 3745-9 and Chapter 3745-91 of

the Administrative Code. The public water system shall include in the variance application a detailed explanation of the requested variance and a sufficient demonstration of at least the following information:

(1) Contamination of the ground water will not occur as a result of construction and operation of the well.

(2) The public health and welfare will not be endangered from contaminants because of unsatisfactory location, protection, construction, operation or maintenance of the well, subject to requirements of the Safe Drinking Water Act (or SDWA).

(H) Unless a well is otherwise required to comply with paragraph (A)(17)(b) of rule 3745-9-05 of the Administrative Code, a public water system shall comply with the rules in effect at the date of plan approval issued in accordance with Chapter 3745-91 of the Administrative Code, or the date of installation if no plan was approved, except for the following:

(1) For a well installed prior to May 1, 2003, the casing shall terminate at least eight inches above finished grade and be equipped with a well cap, and the vent shall terminate at least three feet above the one hundred year floodplain elevation and be protected from damage.

(2) The director may require a plan approval for an alteration or other modification to ensure compliance with this chapter, and chemical and microbiological monitoring, for a public water system that had been a private water system well that was constructed in accordance with Chapter 3701-28 of the Administrative Code.

(3) Any submersible well pump with a mercury seal in a public water system well shall be replaced, or modified to eliminate mercury seals, within thirty days of discovery; any submersible pump installed after May 1, 2003 shall not contain a mercury seal in accordance with paragraph (A)(14)(c) of rule 3745-9-05 of the Administrative Code.

(4) If a public water system well has a submersible pump with a mercury seal, the director may require sampling and analysis for mercury in the well and water system to ascertain if mercury has contaminated the ground water or water system.

(5) After January 1, 2024, the well cap for public water system wells shall conform with "Water System Council Pitless Adapter Standard PAS-97" or with an

alternative standard acceptable to the director except for circumstances where an alternative well cap is required based on the well construction or based on well completion in aquifers with hydrostatic heads greater than the land surface elevation.

[Comment: For dates of non-regulatory government publications, publications of recognized organizations and associations, test methods, federal rules, and federal statutory provisions referenced in this rule, see paragraph (AA) of rule 3745-9-01 of the Administrative Code titled "Incorporation by reference."]

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3745-9-03 **Monitoring well.**

(A) If not otherwise regulated by the director, or another Ohio agency, board or commission, the "Ohio EPA Technical Guidance Manual for Hydrogeologic Investigations and Ground Water Monitoring," or other standards adopted by the director, shall be used as a guide for monitoring well construction and sealing to prevent the contamination of ground water.

(B) A monitoring well that is damaged or deteriorated shall be either repaired to a state consistent with construction requirements of paragraph (A) of this rule, or sealed in accordance with paragraph (A) of this rule.

(C) A monitoring well that is no longer being used shall be sealed in accordance with paragraph (A) of this rule.

[Comment: For dates of non-regulatory government publications, publications of recognized organizations and associations, test methods, federal rules, and federal statutory provisions referenced in this rule, see paragraph (AA) of rule 3745-9-01 of the Administrative Code titled "Incorporation by reference."]

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3745-9-04 **Well siting.**

(A) Public water system and nonpotable wells as defined in rule 3745-9-01 of the Administrative Code shall be located in accordance with the following:

(1) Other than a well for the removal of contaminants, the maximum practical distance from potential or known sources of contamination and only where it can be maintained in a sanitary condition.

(2) Other than a well for the removal of contaminants, only where surface and subsurface conditions will not allow contaminants to be conducted into the well.

(3) Where adequately protected from physical damage.

(4) Not within ten feet of or within the foundation of any building, unless the building is a pumphouse.

(5) Where the well is accessible for cleaning, treatment, repair, alteration, testing and such other actions as may be necessary.

(6) Not constructed within a pit, vault or other structure that may subject the well casing to deterioration or contamination.

(B) In addition to paragraph (A) of this rule, a public water system well shall meet the following:

(1) A public water system owns all the land or obtains an easement or lease of the sanitary isolation radius of a public water system well, and such easement or lease is recorded with the county recorder.

[Comment: The director recommends ownership by the public water system of land at least within the sanitary isolation radius.]

(2) The sanitary isolation radius is determined from the estimated average daily water demand of the public water system well. Estimated average daily water demand may be determined by the director from the pumping design rate of the well, as illustrated in the following table:

Sanitary Isolation Radius

Estimated Average Daily Water Demand (Q gallons per day)	Sanitary Isolation Radius (feet)

0 - 2500	50
2501 - 10,000	square root of Q
10,001 - 50,000	50 + Q/200
Over 50,000	300

(3) The director may specify greater sanitary isolation requirements for a public water system well where conditions are determined to exist such that the sanitary isolation radius set forth in paragraph (B)(2) of this rule is insufficient to protect the public health and the public water system from contaminants.

(4) Potential sources of contamination are not to be constructed or placed within the sanitary isolation radius of a public water system well.

(5) Not be located in a floodway without prior acceptance of the director.

[Comment: An owner or operator of a public water system that proposes to locate a well in a one hundred year floodplain or floodway must also obtain approval from state or local floodplain management agencies as appropriate.]

(6) Be located at a minimum in accordance with the following:

(a) Fifty feet from streams and lakes.

(b) Three hundred feet from a human or animal waste management facility.

(c) Three hundred feet from a land application area, stockpile, storage or staging area.

(d) One hundred feet from a land application area field if the waste is injected or three hundred feet if the waste is surface applied, but in no case within the sanitary isolation radius of the well.

(e) Three hundred feet from a soil absorption system handling more than ten thousand gallons per day.

(f) One thousand feet from a landfill or monofill.

(g) Five hundred feet from a construction and demolition debris facility.

(7) Be sited such that no landfill or monofill is located within the proposed well's drinking water source protection area.

(C) In addition to paragraphs (A) and (B) of this rule, a public water system well used by a community or nontransient noncommunity public water system shall be located such that the following are not located within the proposed well's inner management zone:

(1) Human or animal waste management facility, except when a well is used by the facility.

(2) Soil absorption system handling more than ten thousand gallons per day in an area where the Ohio environmental protection agency has determined the aquifer has a high susceptibility to contamination.

(3) Land application stockpile, storage or staging area where the Ohio environmental protection agency has determined the aquifer has a high susceptibility to contamination.

(D) In instances where a proposed public water system well cannot be feasibly located such that the conditions specified in paragraphs (B)(2), (B)(6), (B)(7), and (C) of this rule are met, the director may grant a variance in accordance with paragraph (F) of rule 3745-9-02 of the Administrative Code. The applicant shall make an adequate demonstration that documents the site hydrogeology, engineering controls, or other physical barriers are sufficient to minimize the risk of contamination being drawn into the well.

(E) The director may require a hydrogeologic investigation to select the location of a well to ensure that contaminants will not be drawn into the well and that a sufficient quantity of ground water exists for the intended purpose. These investigations may be required where, without limitation, one of these well siting circumstances exist: potential or known contamination; hydrogeologic setting that may allow transport of contaminants; or initial development of a community well field. The investigation shall be conducted by a qualified ground water professional. A hydrogeological investigation is a study of the subsurface and geologic conditions. Information shall be collected, without limitation, about the type and thickness of geologic materials, the occurrence of ground water, how it flows in pore spaces and fractures, and the quantity and quality of the ground water.

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3745-9-05 **Well construction.**

Applicability. This rule applies to nonpotable wells, public water system wells and radial collector wells, all of which are defined in rule 3745-9-01 of the Administrative Code. Paragraph (A) of this rule applies to both public water system and nonpotable wells, and excludes monitoring wells described in rule 3745-9-03 of the Administrative Code. A nonpotable well shall be constructed in accordance with this rule. Paragraph (B) of this rule only applies to public water system wells. Paragraph (C) of this rule applies only to radial collector wells.

[Comment: "Lead free" is defined in section 6109.10 of the Revised Code.]

(A) Public water system wells and nonpotable wells. Material used in the drilling process or well construction shall meet the following:

(1) Be free of contaminants.

(2) All well components, adapters, and fittings shall be of similar material or constructed in such a way to minimize the potential for galvanic corrosion.

(3) All drilling mud, additives and lubricants used in construction have either standard ANSI/NSF 60 or 61 certification and not contain guar gum, or other such biodegradable organic material.

(4) Potable water, not surface water, which is treated for drilling purposes in accordance with the drilling mud manufacturer recommendations shall be used for drilling purposes.

(5) Well casing, other than in a point well or radial collector well, meet the following:

(a) Nominal pipe size of permanent casing is a minimum of five inches and sized to allow the well to produce water that is adequate for the intended use, and to allow for the installation and maintenance of the well and related pumping equipment.

(b) Steel pipe or tubing used as permanent well casing or liners conforms to the following:

(i) Be new pipe or tubing that has a minimum wall thickness in accordance with the following table:

Steel Well Casing

Nominal Pipe Size (inch)	Minimum Wall Thickness (inch)
< 8	0.280
8	0.322
10	0.365
12	0.375
14	0.375
16	0.375
18	0.375
20	0.375
> 20	0.500

(ii) Be manufactured in compliance with one of the following standards or specifications:

(a) ASTM A53, "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless."

(b) ASTM A589, "Standard Specification for Seamless and Welded Carbon Steel Water-Well Pipe."

(c) ASTM A106, "Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service," excluding pipe marked with "NH," which is pipe with neither a hydrostatic test nor a nondestructive electric test.

(d) API 5L, "Specification for Line Pipe, forty-second edition, Product Number G05L42, Document Number API SPEC 5L."

(e) ASTM A500, "Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes," except this tubing shall not be used in a public water system well.

(iii) Have standard ANSI/NSF 61 certification for use in a public water system well.

(iv) Be greater than minimum wall thickness and weight when required either to withstand the stresses of installation, grouting and operation, or corrosion.

(v) Be equipped with a drive shoe when driven.

(vi) Be legibly marked on each length, by the manufacturer, with all of the following information:

(a) Name of the manufacturer.

(b) Kind of pipe (continuous welded, electric resistance welded or seamless).

(c) Weight or schedule.

(d) Nominal or outside diameter.

(e) Specification number.

(f) Heat or lot number.

(g) A certification mark that verifies compliance with standard ANSI/NSF 61 certification.

(vii) Be structurally sound, watertight throughout its length, and have threaded and coupled or welded joints that meet the following:

(a) Well couplings with a design, taper, and type of thread that is consistent with the thread of the pipe will have no more than three threads exposed on fourteen thread pipe and no more than two threads exposed on eight thread pipe. Threaded pipe and couplings meet one of these standards: ASTM A53, ASTM A589, or "API RP 5B1, Gauging and Inspection of Casing, Tubing, and Line Pipe Threads," fifth edition, Product Number G05B15, Document Number API RP 5B1.

(b) Welded joints form a structurally sound and watertight joint. Welded joints may include butt-welds, band rings, flared joints or welding collars. Butt-welds be made using a guide. Steel pipe that is equal to or less than eight inches in diameter have a minimum of two weld passes. Steel pipe that is greater than eight inches in diameter have a minimum of three weld passes. Acceptable welding procedures are as follows:

(i) Plain end well casing pipe that is eight inches nominal pipe size or less, and with wall thickness up to 0.5 inch be in accordance with specifications in the "American Welding Society" manual, "AWS D10.12M, Guide for Welding Mild Steel Pipe."

(ii) Be in accordance with specifications in standard "AWWA C206, Field Welding of Steel Water Pipe," catalog number 43206.

(c) Thermoplastic pipe that is used as permanent well casing, liners, well screen risers, blanks or tail pipes shall meet the following:

(i) Be new pipe that is manufactured in compliance with the standards of ASTM F480, "Standard Specification for Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), SCH 40 and SCH 80," and ANSI/NSF 14, "Plastics Piping System Components and Related Materials," document number NSF/ANSI 14. (See the appendix to this rule for the diameter and wall thickness of thermoplastic well casing for standard ASTM F480.)

(ii) Be standard dimension ratio (SDR) 21 or thicker pipe wall, for casings with diameters of five to eight inches.

(iii) Be SDR 17 or thicker pipe wall, for casings that are either larger than eight inches in diameter or installed at two hundred feet or greater below ground surface.

(iv) Be SDR 13.5 or thicker pipe wall, for casings that are installed at five hundred feet or greater below ground surface.

(v) Have greater than minimum wall thickness and weight when

required either to withstand stresses of installation, or grouting, or operation, or because of collapse considerations.

(vi) Be legibly marked, by the manufacturer, with the following information:

(a) Nominal pipe size.

(b) Standard dimension ratio or schedule.

(c) Type of plastic.

(d) Words "well casing."

(e) Impact classification (IC).

(f) Specification number.

(g) Manufacturer's name or trademark.

(h) Lot number and date of manufacture.

(i) A certification mark that verifies compliance with standard.

(vii) Be structurally sound and watertight throughout its length with casing joints or couplings meeting the following:

(a) Thermoplastic casing joints and couplings meet standards ASTM F480 and ANSI/NSF 14.

(b) Thermoplastic spline lock joints may be installed and need not meet standards ASTM F480 or ANSI/NSF 14. For purpose of this rule, a spline lock joint is a nonmetallic, watertight coupling designed for thermoplastic pipe which incorporates the use of a bell or coupling with machined grooves on the interior of the bell or coupling, and is joined by inserting thermoplastic pipe with an elastomeric sealing gasket which seats into the machined grooves, and is locked in place by insertion of a high-strength flexible thermoplastic spline to provide full three hundred sixty

degree restraint with evenly distributed loading on the joint.

(c) Thermoplastic couplings be legibly marked as applicable with the nominal well casing pipe coupling size, type of plastic, designation of compliance with standards ASTM F480 and ANSI/NSF 14, and the manufacturer's name or trademark.

(viii) Not be installed where potential or known contaminants may degrade or permeate plastic.

(ix) Not be driven.

(6) Defective, visibly damaged or reject pipe shall not be used as casing or liner pipe for wells.

(7) Casing extends continuously, at a minimum, either to the top of the aquifer or to the top of the non-water bearing consolidated formations above an aquifer.

(8) Casing and borehole shall be sufficiently straight and vertical to allow for normal installation and operation of the pump and uniform placement of grout.

(9) A pitless adapter or pitless unit may be installed when piping from the casing is below ground surface. The pitless adapter or pitless unit and installation procedures in above and below ground surface installations shall adequately prevent the entrance of surface water, dirt, animals, insects or other foreign matter.

(10) A pitless adapter or pitless unit connection to a well casing that is made either below ground surface or less than twelve inches above ground surface shall be installed through the following methods:

(a) The pitless adapter or pitless unit shall be connected by welding or threading as required by the type of unit and the manufacturer. A pitless adapter may be attached by clamping. Any hole penetrating the side of the casing for access by the pitless adapter or pitless unit shall be of the size and dimension as required by the manufacturer, and shall be made using a hole saw or other tool capable of making a clean and uniform hole to allow proper sealing. A cutting torch shall not be used to install a pitless adapter except for a non-circular hole in the casing where the manufacturer's recommended guide is used and all edges and the exterior casing surface are ground or filed to a smooth and uniform

surface.

(b) The inside diameter of the pitless unit shall not be smaller than the inside diameter of the casing. No part of a pitless adapter or pitless unit shall extend into the inside diameter of a well casing so that setting or removal of the pump, pump piping or drop pipe, or the use of tools for well rehabilitation or disinfection is impeded.

(c) Upon installation of the pitless adapter or pitless unit below ground surface, the annular space that is required in accordance to paragraph (A)(17) of this rule surrounding the casing and pitless adapter or pitless unit shall be filled with either re-compacted clean cohesive native soil or grout.

(d) A pitless unit may be attached using a structural or mechanical joint that shall do the following:

(i) Provide for the well casing to extend at least 2.5 inches into the throat of the pitless unit.

(ii) Be composed of a cast steel unit with the collar held in place with a minimum of four corrosion-resistant bolts, nuts and washers spaced uniformly around the circumference of the coupling.

(iii) Have a collar with the same or better strength and rigidity as the well casing.

(iv) Use a ramped compression gasket seal that fits between the upper and lower portions of the coupling to ensure a watertight seal.

(v) Ensure that the coupling is centered over the joint.

(vi) Conform to ANSI/AWWA C219, "Bolted, Sleeve-Type Couplings for Straight-End Pipe," catalog number 43219.

(e) Pitless adapter or pitless unit connections to thermoplastic pipe shall meet the following:

(i) Where a pitless adapter is installed by clamping on thermoplastic casing, a backing plate, wide steel strap or casting be installed to

protect the integrity of the thermoplastic casing at the point of the pitless adapter connection.

(ii) Steel well casing pipe extension, pitless unit and pitless adapter shall not be welded after they are attached to thermoplastic well casing. Thermoplastic coupling be threaded onto the pitless unit before it is solvent cemented to the top of the casing.

(iii) Threaded connections shall only be installed on a pitless unit or pitless adapters after attachment to the well casing pipe.

(f) When steel well casing pipe is not terminated at the desired depth for the installation of a pitless unit, the well casing pipe shall be cut off at the desired height, and the pitless unit may be welded or threaded and coupled to the top of the well casing pipe by one of the following methods:

(i) Cutting of the well casing pipe squarely, providing a bevel for the top of the well casing pipe and welding the beveled end of the unit to the beveled end of the well casing pipe.

(ii) Welding a pipe nipple, having threads at one end and beveled on the other end, to the cut off top beveled end of the well casing pipe and threading a full length standard recessed coupling watertight to the threaded end of the unit and to the nipple. The top of the well casing pipe and the bottom of the pipe nipple to be welded shall both have beveled ends. If the pitless unit has female threads, the unit may be threaded watertight to the threaded end of the pipe nipple.

(iii) Reaming out the threads of a full standard recessed coupling at least one-third the length of the coupling, and welding the coupling to the top of the cut off well casing pipe.

(11) A connection to a well casing that is made above ground shall be installed through the following methods:

(a) Threaded connection.

(b) Welded connection.

(c) Bolted flanges with rubber gaskets at twelve inches or greater above ground surface.

(d) Extension of the casing at least 0.5 inch into the base of a pump mounted on and sealed to a concrete pedestal.

(12) Well casing height above finished grade shall be at least twelve inches, and at least twelve inches above the well house floor or concrete apron surface, per the following:

(a) Where a well house is constructed, the floor surface shall be at least six inches above the finished grade.

(b) The finished grade be sloped for surface water runoff away from the well.

(13) A well shall have a well cap or seal.

(a) The top of the casing at its finished height shall be cut so that the surface will fit flush with the well cap and provide a tight seal to prevent the entrance of water, dirt, animals, insects or other foreign matter.

(b) The well cap or seal shall fit securely to the top of the well casing and be, secured with screws or other appropriate connections, and vent to the atmosphere.

(c) A point well that is not a public water system well may have a watertight well cap that does not vent to the atmosphere.

(d) Electrical conduit connections on the well cap or seal shall be threaded and sealed to prevent the entrance of insects and water. Any portion of electrical wiring to a well that is not buried by the ground shall be fully enclosed in conduit to prevent the entrance of insects and water, and to protect from potential electrical hazard.

(14) A room housing pumping equipment, well house or pumphouse, shall conform to the following:

(a) Allow access for maintenance, alteration, removal and repair of the public water system components.

(b) Be constructed above ground surface.

(15) Pump construction, installation, design and maintenance shall comply with the following:

(a) A pump shall be constructed so that there are no unprotected openings into the interior of the pump or well casing.

(b) If an above ground pump or line shaft pump are used, it shall be attached to the casing, or suction or discharge line by a watertight connection, or shall have a base plate that conforms to paragraph (A)(10) of this rule.

(c) A submersible pump motor shall not have a mercury seal.

(d) Below ground water service pipe shall be maintained under positive pressure at all times. A check valve or backflow prevention assembly, shall not be installed between a pitless adapter or pitless unit and the pressure tank.

(e) To prevent contaminants from entering the well, a temporary watertight well cap or seal shall be provided until the pumping equipment is installed.

(16) Well vent construction, installation, and maintenance shall conform to the following:

(a) A well vent shall be provided on all well caps and seals except for those used on deep well single pipe packer jet installations, or flowing wells where the flow rate is greater than the pumping rate of the permanent pump.

(b) A well vent shall be self-draining, screened with a noncorroding mesh screen of fifteen to thirty mesh, pointed downward at or above the top of the casing or pitless unit.

(c) A vent shall terminate not less than twelve inches above ground surface, and at least twelve inches above the well house floor or concrete apron surface.

(d) The well vent shall extend a minimum of three feet above the one hundred

year floodplain elevation, or highest known flood elevation, whichever is higher.

(e) A vent shall be maintained in a sanitary condition to prevent the entrance of surface water, dirt, animals, insects, or other foreign matter.

(17) Maintenance, modification and alteration of a well shall comply with the following:

(a) Casing and top of well shall be protected against contamination or inadvertent damage.

(b) A well shall be altered, modified or repaired in accordance with this chapter, or a well shall be sealed in accordance with rule 3745-9-10 of the Administrative Code, if one or more of the following situations exist:

(i) The pump or any part of a well malfunctions or is defective.

(ii) The top of the casing is buried below ground surface.

(iii) Potential or actual risk of contamination of ground water exists due to casing deterioration or the condition of the well, including the potential for standing water against the well casing.

(18) If the casing is not driven and the drilling method requires the drilling of an oversized borehole, the annular space shall be a minimum of 1.5 inches for a well less than or equal to fourteen inches in diameter, and a minimum of two inches for a well greater than fourteen inches in diameter.

(19) A casing may be extended to meet the requirements in paragraph (A)(11) of this rule using a structural or mechanical joint that shall do all of the following:

(a) Provide for the well casing to extend at least 2.5 inches into the throat of the coupling.

(b) Be composed of a cast steel unit with the collar held in place with a minimum of four corrosion-resistant bolts, nuts and washers spaced uniformly around the circumference of the coupling.

(c) Have a collar with the same or better strength and rigidity as the well casing.

(d) Ensure that the coupling is centered over the joint.

(e) Conform to ANSI/AWWAC219, "Bolted, Sleeve-Type Couplings for Plain-End Pipe," catalog number 43219.

(20) Be constructed in accordance with the requirements in rule 3745-9-06 of the Administrative Code.

(B) Public water system wells. In addition to the requirements of paragraph (A) of this rule, the material used in the drilling process or the construction of a public water system well shall meet the following:

(1) Unless otherwise noted in this chapter, all chemicals, substances, and materials added to or brought in contact with water in a public water system well shall have either standard ANSI/NSF 60 or 61 certification in accordance with rule 3745-83-01 of the Administrative Code.

(2) Tubing per ASTM A500 shall not be used in a public water system well.

(3) Well casings shall extend at least twenty-five feet below ground surface. If nonpotable water is encountered, one of the following must be completed:

(a) Above an aquifer containing potable water, the casing shall extend to the bottom of the aquifer containing the nonpotable water and shall be grouted as deep as necessary to prevent the nonpotable water from entering the aquifer containing potable water.

(b) Below an aquifer containing potable water, the lower portion of the well shall be filled with cement grout or bentonite grout, to a height sufficient to prevent entrance of nonpotable water into the aquifer containing potable water.

(4) For a public water system well with vertical turbine or line shaft pumps, the well shall be tested for plumbness and alignment in accordance with appendix D of standard "AWWA A100, Water Wells," catalog number 41100, or alternative procedures acceptable to the director.

(5) The maximum allowable horizontal deviation from vertical shall not exceed two thirds of the smallest inside diameter of that part of the well being tested per one hundred feet of depth.

(6) Well screens shall be installed in a public water system well in unconsolidated or incompetent geologic formations per the following:

(a) Screen shall be constructed of steel, stainless steel, thermoplastic or lead free brass. A lead free brass screen shall have a dielectric connection to the casing to reduce corrosion.

(b) Thermoplastic screens shall have standard ANSI/NSF 61 certification.

(c) Lead free brass screens shall meet a director approved standard, including but not limited to ANSI/NSF 61 certification.

(d) For a well with a design pumping rate greater than three hundred fifty gallons per minute, the screen shall have size of openings determined upon sieve analysis of the aquifer formation or filter pack in accordance with standard AWWA A100, "Water Wells," and the screen shall have uniform openings and a maximum entrance velocity of 0.1 feet per second.

(e) The screen shall provide sufficient column and collapse strength to withstand installation and borehole pressures.

(f) Screen joints between screen sections and blank casing shall be welded, or threaded and coupled.

(g) Screen installation using telescoping methods shall be attached either directly to the bottom of the casing or to a packer.

(h) Screens shall be installed that minimize corrosion caused by contact with dissimilar steel casing. Thermoplastic screen may be attached to steel casing with the use of an appropriate coupler.

(i) Screen shall be provided with a bottom plate or washdown bottom fitting of the same material as the screen. Neither lead shot nor lead wool shall be installed to seal the screen bottom.

(j) Where filter pack or formation stabilizer is installed, the screen shall have centralizers outside the top and bottom of the screen to ensure an even filter pack.

(7) Filter pack or formation stabilizer for a public water system well shall consist of well-rounded particles that conform to the following:

(a) Ninety-five per cent siliceous in composition.

(b) Smooth, uniform and free of foreign matter.

(c) Properly sized, washed and disinfected prior to installation in the well.

(8) Filter pack shall be installed in a well where the formation is nonhomogeneous, the uniformity coefficient of the aquifer formation is less than 3.0, and the effective grain size is less than 0.01 inches. Filter pack or formation stabilizer installed in unconsolidated or incompetent formations shall be placed in accordance with the following specifications:

(a) Filter pack or formation stabilizer shall extend a minimum of two feet above the screen for a well less than or equal to six inches in diameter, or a minimum of four feet above the screen for a well greater than six inches in diameter. Filter pack or formation stabilizer shall be at least twenty-five feet below ground surface.

(b) Filter pack or formation stabilizer shall be no less than three inches thick and no more than eight inches thick, to facilitate proper well development.

(c) Filter pack effective grain size shall be determined by a sieve analysis of the aquifer formation. The seventy per cent retained size of the filter pack shall be four to six times greater than seventy per cent retained size of the aquifer formation. The uniformity coefficient of the filter pack shall not exceed 2.5.

(d) If installed, filter pack refill pipes shall be standard weight steel or plastic pipe incorporated within the pump foundation and terminate with screwed or welded caps at least twelve inches above the pumphouse floor or concrete apron. Filter pack refill pipes shall pass through the grouted annular space where they shall be surrounded by a minimum of 1.5 inches of grout.

(9) Packers and shale traps shall be constructed of materials that have standard ANSI/NSF 61 certification. Lead packers shall not be used.

(10) The pitless adapter or pitless unit shall meet the following:

(a) Be lead free.

(b) Conform with "Water System Council Pitless Adapter Standard PAS-97, Performance Standards and Recommended Installation Procedures for Sanitary Water Well Pitless Adapters, Pitless Units, and Well Caps," or with an alternative standard acceptable to the director.

(c) If welded, have connections to steel well casing made watertight in accordance with welding procedures in the "American Welding Society Structural Welding Code, AWS D1.1."

(11) The well cap shall conform with "Water System Council Pitless Adapter Standard PAS-97" or with an alternative standard acceptable to the director. In circumstances where an alternative well cap is required based on the well construction or geologic setting, the alternative well cap must be approved by the director prior to installation.

(12) A well located in a floodplain shall comply with the following:

(a) The casing, well cap, well vent and pumphouse floor shall extend a minimum of three feet above the one hundred year floodplain elevation or highest known flood elevation, whichever is higher. With prior acceptance of the director, in lieu of extending the casing a minimum of three feet above the one hundred year floodplain, a noncommunity public water system well may have both a watertight well cap and a well vent extending a minimum of three feet above the one hundred year floodplain elevation or highest known flood elevation, whichever is higher.

(b) The one hundred year flood elevation shall be determined by reference to the FEMA flood map for the well location. The director may require the wellhead and floodplain elevations to be determined by a professional surveyor or professional engineer. For purposes of this rule, professional surveyor and professional engineer shall have the same meanings as defined in section 4733.01 of the Revised Code.

(C) Radial collector wells. A radial collector well shall comply with the following:

(1) The caisson shall be constructed of watertight reinforced portland cement concrete with watertight joints.

(2) The caisson wall shall be reinforced to withstand the forces to which it will be subjected.

(3) Lateral collectors shall be in areas and at depths accepted by the director. The area around the laterals shall be under the control of the public water system for a distance of three hundred feet beyond the laterals.

(4) Provisions shall be made to assure that lateral collectors are essentially horizontal.

(5) The top of the caisson shall be covered with a watertight floor.

(6) All openings in the floor shall be curbed and protected from entrance of foreign material.

(7) The pump discharge piping shall not be placed through caisson walls.

[Comment: For dates of non-regulatory government publications, publications of recognized organizations and associations, test methods, federal rules, and federal statutory provisions referenced in this rule, see paragraph (AA) of rule 3745-9-01 of the Administrative Code titled "Incorporation by reference."]

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Table 1: Diameter and Wall Thickness of Thermoplastic Well Casing for Standard ASTM F480

Nominal Pipe Size (inch)	Outside Diameter (inch)	Wall Thickness SDR 21 (inch)	Wall Thickness SDR 17 (inch)	Wall Thickness SDR 13.5 (inch)	Wall Thickness SCH 80 (inch)
5	5.563	0.265	0.327	0.412	0.375
6	6.625	0.316	0.390	0.491	0.432
8	8.625	0.410	0.508	--	0.500
10	10.750	--	0.632	--	--
12	12.750	--	0.750	--	--
14	14.000	--	--	--	0.750
16	16.000	--	--	--	0.843

Where schedule 80 pipe is used, the wall thickness shall be at least as thick as required in accordance with paragraph (A)(4)(c) of this rule.

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3745-9-06 **Well construction, specific geologic conditions.**

(A) In addition to the requirements of rule 3745-9-05 of the Administrative Code, a well completed in specific geologic conditions shall be constructed according to the following procedures:

(1) Where consolidated formations are encountered within twenty-five feet of the ground surface, an oversized borehole shall be drilled and the annular space shall be filled with grout by pressure grouting.

(2) A well completed where multiple aquifers are present shall have the casing extend through aquifers that are not contributing to the water supply of the well. The annular space contiguous to aquifers that are not contributing to the water supply of the well shall be filled with grout by pressure grouting.

(3) A well completed in confined aquifers shall have the casing extend through the confining layer to the top of the aquifer. The annular space contiguous to the confining formation shall be filled with grout by pressure grouting. Filter packs and formation stabilizers shall not extend significantly into a confining formation or allow interconnection of two separate aquifers along the annular space.

(4) A well completed in aquifers with hydrostatic heads greater than the land surface elevation shall have casing and grout installed to protect the aquifer, prevent erosion of the overlying geologic materials and confine the flow to within the casing, and shall be constructed according to the following procedures:

(a) If the anticipated flow at the ground surface is not excessive, after the borehole is drilled, and the casing set, the water in the casing may be pumped to lower the water level in the casing and the annular space. The annular space shall then be filled with cement grout by pressure grouting. The density of cement grout shall be sufficient to control flow in the annular space, but no less than that required by rule 3745-9-07 of the Administrative Code.

(b) If the water flow at the ground surface is anticipated to exceed five gallons per minute, an upper enlarged borehole shall be drilled partially into the confining formation. The upper enlarged borehole shall be at least four inches in diameter larger than the nominal diameter of the outer well casing. The annular space between the upper enlarged borehole and outer well casing shall be filled with cement grout by pressure grouting. The outer casing may be left as permanent casing once the well is completed, or it may be removed. Where outer casing is

not removed, the casing shall be withdrawn at least five feet to ensure grout contact with the formation.

(i) If the confined aquifer is consolidated, a smaller diameter borehole shall be drilled through the upper enlarged borehole, the inner casing shall be firmly seated into the bedrock, and the remaining annular space shall be filled with cement grout by pressure grouting. The density of cement grout shall be sufficient to control flow in the annular space, but no less than that required by rule 3745-9-07 of the Administrative Code.

(ii) If the confined aquifer is unconsolidated, a smaller diameter borehole shall be drilled through the upper enlarged borehole, with casing and a screen installed into the confined aquifer. The well shall be double-cased, and the remaining annular space filled with cement grout by pressure grouting. The density of cement grout shall be sufficient to control flow in the annular space, but no less than that required by rule 3745-9-07 of the Administrative Code.

(c) Flowing wells shall be completed at the surface to ensure water does not flow from under the well cap.

(d) Flowing well discharge control shall be provided to conserve ground water and to prevent the loss of artesian head by preventing or reducing continuous discharges. Flow control shall consist of one of the following methods:

(i) The extension of the well casing to an altitude corresponding to that of the artesian head.

(ii) Installation of a vermin proof cap, well pitless adapter or wire spud, or a point of discharge that complies with paragraph (A)(4)(e) of this rule.

(iii) Installation of flowing well or spool type pitless unit, when installed within the manufacturer's specification for rated pressure.

(iv) Other methods approved by the Ohio EPA.

(e) After all uses for the public water system are met, flowing wells may discharge up to ten gallons per minute when the public water system's owner demonstrates that a suitable discharge point exists on the owner's property, that the flow control discharge line can be adequately protected from any possible cross connection, and when one of the following conditions exist:

(i) Control of the flow is not practical due to excessive hydrostatic pressure.

(ii) Control of the flow will likely result in the production of sand or turbidity in the water.

(iii) The discharge will not adversely affect surrounding users of ground water or impact surface water drainage.

(iv) The discharge line from the well shall either be protected by an air gap with an animal guard or a backflow prevention device.

(5) A well completed in a cavernous formation or mine shall be constructed according to the following:

(a) A cavernous formation or mine that is not being used as a source of water shall have casing installed through the formation or mine, as follows:

(i) If a cavernous formation or mine is greater than twenty-five feet below ground surface, then the formation or mine shall be filled with cuttings, clean gravel or grout. Packers or shale traps shall be installed at the top and bottom of the formation or mine. The annular space shall then be filled with grout by pressure grouting.

(ii) If a cavernous formation or mine is less than twenty-five feet below ground surface, casing shall be installed in an enlarged borehole and the annular space shall be filled with a cement grout containing additives that promote bridging of the cavernous formation or mine by pressure grouting to a depth of at least five feet beyond the formation or mine.

(b) If a cavernous formation or mine will be the source of water supply, then a packer or shale trap shall be installed at the top of the formation or mine and the annular space shall be filled by pressure grouting with

grout.

(6) A well encountering brine producing formations shall be constructed according to these procedures. Brine producing formations that are encountered during drilling shall have casing installed throughout the entire formation. The annular space contiguous to the brine producing formation shall be filled with grout by pressure grouting, or the well shall be sealed to an elevation higher than the top of the brine producing formation. Grout that is not adversely affected by the brine water shall be used for sealing the well or annular space.

(7) Except when a well is completed in the upper-most weathered portion of a consolidated formation, a well completed in a consolidated formation shall have the casing extend into the formation so that the well casing will not settle or shift, and will have a proper annular seal.

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3745-9-07 **Well grouting for construction or sealing.**

(A) One of the following grouts shall be used for sealing a well, or annular space:

(1) Cement grouts that meet standard ASTM C150, Standard Specification for Portland Cement, have standard ANSI/NSF 61 certification, and include one of the following types of cement:

(a) Type I, general purpose cement.

(b) Type II, for use in water with moderate sulfate content between one hundred fifty to fifteen hundred milligrams per liter, and conditions requiring lower heat of hydration.

(c) Type III, for use in conditions requiring high early strength.

(d) Type IV, for use in conditions requiring low heat of hydration.

(e) Type V, for use in ground water with a high sulfate content greater than fifteen hundred milligrams per liter.

(2) Bentonite grouts that have standard ANSI/NSF 60 certification, and include one of the following:

(a) High solids bentonite grout using powdered bentonite clay or granular bentonite.

(b) Coarse grade or pelletized bentonite.

Bentonite grout shall not contain bentonite drilling mud or cuttings.

(B) Grout shall be processed and placed in a well, or annular space in accordance with the following:

(1) Cement grout shall be mixed using potable water and cured according to the following specifications:

(a) Type I, II, IV and V cement shall be mixed by adding not more than 5.2 gallons of water per ninety-four pounds of cement, with a minimum density of fifteen pounds per gallon.

(b) Type III cement shall be mixed by adding 6.3 to seven gallons of water

per ninety-four pounds of cement.

(c) Concrete with a minimum density of 17.5 pounds per gallon shall be mixed by adding ninety-four pounds of cement, an equal amount of sand, and not more than six gallons of water.

(d) Cement with a minimum density of fifteen pounds per gallon that has calcium chloride added as an accelerator to speed up the rate of curing shall be mixed by adding two to four pounds of calcium chloride per ninety-four pounds of cement and not more than six gallons of water.

(e) Cement grout shall cure a minimum of twenty-four hours before drilling operations are resumed either when standard type I and type II cement is used or when calcium chloride additive is used. Cement grout shall cure a minimum of twelve hours before drilling operations are resumed when high early type III cement grout is used.

(2) Bentonite grout shall be mixed according to the manufacturer's recommendations to achieve at least twenty per cent solids. Synthetic organic polymers that have standard ANSI/NSF 60 certification may be added to bentonite grout to suppress hydration of the bentonite particles and shall be mixed according to the manufacturer's recommendations.

(3) When using coarse grade or pelletized bentonite, the bentonite shall be poured slowly into the top of the well to prevent bridging in the casing or borehole, in accordance with the following procedures:

(a) Coarse grade or pelletized bentonite shall be poured over a wire one fourth inch mesh screen to keep the fine bentonite powder from entering the well. Fine bentonite particles that accumulate in the shipping container shall not be used.

(b) Coarse grade or pelletized bentonite shall be poured at a continuous rate, no faster than fifty pounds per three minutes.

(c) The pouring process shall be halted intermittently in order to lower a weighted measuring tape into the well to determine the top of the grout and confirm that bridging has not occurred. Where possible, a tamping device shall be used to break any bridges that may form.

(d) Coarse grade or pelletized bentonite shall be periodically hydrated when

poured above the static water level.

(4) When pressure grouting, the grout shall be placed in a continuous operation without interruption until the cement or bentonite grout of approximately the same density as the grout being placed into the borehole is coming out of the annular space.

(5) After grout has been placed, the grout shall cure a minimum of twelve hours to assess whether any settling of the grout has occurred. If settling has occurred, then additional grout shall be placed.

(C) An annular space shall be completely filled with grout from the bottom of the annular space, or from the top of the filter pack or formation stabilizer, upward to the ground surface. (See the appendix to this rule for the volume of annular space between casing and borehole.) The annular space shall be completely filled in accordance with the following:

(1) If a pitless adapter or pitless unit will be installed and if well construction is not completed when casing is set, compacted clean clay may be temporarily used from the expected point of attachment to the ground surface.

(2) Except as otherwise provided in this rule, and rule 3745-9-06 of the Administrative Code, the annular space shall be filled with cement grout or bentonite grout, which shall be placed in the annular space of a well by pressure grouting.

(3) An annular space between a permanent casing and a temporary casing shall be filled with grout during temporary casing removal. Where temporary casing removal is not possible or practical, temporary casing shall be withdrawn at least five feet to ensure grout contact with the formation.

(4) Cement grout may be placed into the annular space of a well using the conductor pipe-gravity method where the annular space is greater than or equal to two inches, no greater than fifty feet below ground surface, and where a minimal amount of water is in the borehole. The conductor pipe shall be lowered to the bottom of the annular space and the grout placed from the bottom up with the conductor pipe submerged at all times.

(5) Coarse grade or pelletized bentonite may be poured into the annular space where the annular space is greater than or equal to two inches, no greater than fifty feet below ground surface, and where a minimal amount of water is in the borehole. Coarse grade bentonite may be poured into the annular space

between a permanent casing and temporary casing during temporary casing removal.

(6) The dry driven grouting method may be used under the following conditions. Well construction using a cable tool, driven casing hammer or any other method where the permanent casing is driven, and where temporary outer casing or an oversized borehole is not used, a collar, flared joint or well bead shall extend beyond the outside diameter of the permanent casing and dry granular bentonite shall be poured around the permanent casing as it is being driven. The well site shall be where thick deposits of low permeable clayey glacial till or other low permeable materials overlie the aquifer and where the well site is not located in an area of microbiological or chemical contamination.

[Comment: For dates of non-regulatory government publications, publications of recognized organizations and associations, test methods, federal rules, and federal statutory provisions referenced in this rule, see paragraph (AA) of rule 3745-9-01 of the Administrative Code titled "Incorporation by reference."]

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3745-9-08 **Well disinfection.**

(A) A public water system well shall be disinfected after completion of construction, installation, development, alteration or repair, or any other actvity or event that might lead to the contamination of the water, and before supplying water for human consumption.

(B) The standard AWWA C654, "Disinfection of Wells," shall be used as a guide except for the topics presented in sections 4.2, 4.5 and 5, that are otherwise specified in paragraphs (C), (D) and (E) of this rule.

(C) The following disinfection procedures shall apply:

(1) Disinfectant shall be slowly poured into the well by wetting the inside casing circumference, drop pipe and electrical cable.

(2) Disinfectant concentration in the water column shall be initially at least one hundred milligrams per liter chlorine. A public water system may use an alternative disinfectant concentration following consultation with the office staff of the district in which the public water system is located, provided the disinfection procedure will ensure complete disinfection and includes the following:

(a) A mechanical cleaning of the well casing and screen to remove loose debris, sediment, mineral encrustation and bacterial slime before disinfection.

(b) Monitoring of the pH and chlorine residual.

(c) Maintaining at least fifty milligrams per liter free chlorine residual throughout the water column.

(3) Water in the well shall be agitated or surged to ensure even dispersal of the disinfectant throughout the entire water column.

(4) Disinfectant contact time shall be at least eight hours.

(5) Disinfectant shall be thoroughly flushed or dissipated from the well before supplying water for human consumption.

(6) When calcium hypochlorite is used for disinfection, the tablets or granules shall be completely dissolved in water prior to placement into the well. Sodium

hypochlorite solution shall be used within the manufacturer's posted expiration date. Sodium hypochlorite solution with fragrance additives shall not be used for disinfection.

(7) A buffering chemical that has standard ANSI/NSF 60 certification may be used to enhance disinfection efficacy. The director may require submission of chemical disinfection procedures with specifications for the method, equipment, chemicals and testing for residual chemicals.

(8) Disinfectant shall have ANSI/NSF 60 certification.

(D) After disinfection, a well shall be flushed for a minimum of fifteen minutes and total chlorine undetectable before sampling for total coliform. The well shall not be placed into service until two consecutive samples collected from the well at least thirty minutes apart are total coliform-negative. Microbiological and total chlorine samples shall be analyzed in accordance with Chapter 3745-89 and rule 3745-81-27 of the Administrative Code.

(E) If a sample is reported positive for total coliform, a system shall do one of the following:

(1) Continue to flush the well and collect total coliform samples to achieve compliance with paragraph (D) of this rule.

(2) Repeat the well chlorination procedures as described in paragraph (C) of this rule if necessary to achieve compliance with paragraph (D) of this rule.

(F) A system with a well unable to meet paragraph (D) of this rule after the second chlorination must consult with the director for corrective action, which may include compliance with paragraph (B) of rule 3745-81-42 of the Administrative Code.

[Comment: For dates of non-regulatory government publications, publications of recognized organizations and associations, test methods, federal rules, and federal statutory provisions referenced in this rule, see paragraph (AA) of rule 3745-9-01 of the Administrative Code titled "Incorporation by reference."]

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3745-9-09 **Well development and pumping test.**

(A) A public water system well shall be developed upon completion to remove the native silts and clays, drilling mud or finer fraction of the filter pack until turbidity or sand content in the well is minimal.

(1) Mechanical development shall be performed so as not to cause damage to the components of the well. Mechanical development techniques include: mechanical surging; air surging or air lifting; overpumping and backwashing; high velocity jetting; bailing; and hydrofracturing.

(2) With prior consultation with the district office, chemical development procedures may be used in conjunction with mechanical procedures. Chemical development techniques include use of an acid or dispersant that has standard ANSI/NSF 60 certification. The director may require submission of chemical development procedures with specifications for the method, equipment, chemicals, and testing for residual chemicals.

(a) Dispersants that contain phosphorous compounds shall not be used during the development of a well.

(b) Dispersant may be used to disaggregate clay particles to enhance removal. Dispersant shall be immediately flushed from the well and aquifer to prevent bacterial growth in the aquifer.

(c) Dispersant shall be premixed and used according to the manufacturer's recommendations.

(d) Acid shall be used according to the manufacturer's recommendations. Proper pH shall be maintained in the borehole to ensure the effective action of the acid.

(B) A pumping test shall be conducted upon completion of development of the public water system well and conform to the following:

(1) Be used to calculate the specific capacity of the well at the anticipated permanent design pumping rate for all high use wells intended to serve as a source to a community public water system.

(2) Be used to demonstrate that the well can supply water at the anticipated permanent design pumping rate while at a minimum maintaining the operational capacity of the well field and without degrading the water quality of any well in the well field.

(3) The determination of a permanent design pumping rate for a new public water system well shall include analysis of the effects of interference drawdown from other wells owned by the public water system as well as other high capacity wells not owned by the public water system. Operational practices and the potential to cause degradation of water quality at the well field should also be considered when establishing a permanent design pumping rate for a new public water system well.

(4) The pumping test classification is determined from the estimated average daily water demand of the well and type of water system, as illustrated in the following table. Estimated average daily water demand may be determined by the director from the design pumping rate of the well. With prior consultation, the director may accept an alternative constant rate pumping test that is conducted under the supervision of a qualified ground water professional or person with demonstrated competency in performing pumping or aquifer tests.

Pumping Test Classification	Estimated Average Daily Demand of the Well (gallons per day)
Low use	0 to 10000
Medium use	10001 to 100000
High use	greater than 100000

Acceptable pumping tests for low, medium and high use classifications are as follows:

(a) For low or medium use wells, the pumping test shall be conducted at a constant rate for a period of at least normal operation either at the peak hourly demand, or at least 1.5 times the anticipated permanent design pumping rate, whichever is greater. If the well cannot sustain peak hourly demand, the pumping test shall be conducted at a minimum of 1.5 times the anticipated design pumping rate. For a community water system well, the duration of the constant rate pumping test shall be no less than twenty-four hours.

(b) For all high use wells, a step-drawdown test shall be conducted, followed by a constant rate pumping test.

(i) The step-drawdown test shall be used to obtain sufficient hydrogeologic information to design an appropriate constant rate

pumping test for the well. The step-drawdown test shall, at a minimum conform to the following:

(a) Consist of three or more steps of progressively increasing pumping rates.

(b) One step shall be performed at the anticipated permanent design pumping rate.

(c) Each step shall be of approximately equal duration.

(d) Each step shall be performed at a constant pumping rate for no less than forty-five minutes.

(ii) The constant rate pumping test shall be conducted for at least twenty-four hours at a pumping rate of at least 1.5 times the anticipated permanent design pumping rate. The constant rate pumping test shall not commence until the water level has recovered to at least ninety per cent of the drawdown caused by the step-drawdown test or twenty-four hours after the completion of the step-drawdown test, whichever comes first.

(c) The public water system shall consult with the Ohio environmental protection agency to determine if the constant rate pumping test will need to extend beyond twenty-four hours if any of the following conditions exist at the time a new well site is proposed or can be expected to result from the well's operation:

(i) Pumping at the new well may cause interference with existing wells.

(ii) Prolonged pumping at the new well may cause changes in water quality.

(iii) The well will have special design criteria such as a radial collector well.

(iv) Information about the aquifer's response to pumping is needed for ground water modeling.

[Comment: If any of these conditions exist, the public water system should consult with a qualified ground water professional

to design and implement a pumping test or tests which will address the noted condition.]

(d) For low, medium or high use wells, the constant rate pumping test may be conducted at a lower pumping rate if there is concern that pumping the well at 1.5 times the anticipated permanent pump design rate will be overly excessive, will not be possible, or will have adverse effects on the long-term performance of the well or aquifer. The test may be conducted at a lower pumping rate if the following criteria are met:

(i) The constant rate pumping test is conducted at no less than 1.2 times the pump design rate.

(ii) A demonstration is provided that supports the reasoning for a lower pumping rate that even under adverse conditions, including but not limited to severe drought, the well will likely be able to supply water at the anticipated permanent design pumping rate over the anticipated functional life of the well.

[Comment: If the permanent pump design rate will not be known until after the constant rate test, then the maximum permanent pump design rate will be based on back-calculation of the pumping rate used for the constant rate test. For example, if the constant rate test is performed at three hundred gallons per minute, the maximum permanent pump design rate will then be two hundred gallons per minute if the 1.5 times factor is used or two hundred and fifty gallons per minute if the 1.2 times factor is used.]

(5) The pumping test shall include the following:

(a) The flow rate shall be measured using an orifice weir with manometer, or equivalent method acceptable to the director.

(b) During a step-drawdown or constant rate pumping test, water level measurements shall be taken from the well starting with the static water level and continuing during drawdown to the nearest 0.1 foot, as measured from an identified datum.

(i) Water level measurements shall be at the following time intervals:

Time After Test Started (minutes)	Time Interval Between Measurements (minutes)

0 - 15	1
16 - 60	5
61 - 120	10
121 - 180	20
181 - 300	30
Greater than 300	60

(ii) Recovery water level measurements shall be taken immediately after termination of the constant rate pumping test at time intervals of five minutes for the first hour and every thirty minutes thereafter until the water level has recovered to at least ninety per cent of the drawdown caused by the pumping test, twenty-four hours after the completion of the pumping test, or recovery is interrupted by pumping of another well, whichever occurs first.

(iii) For high use wells, all pumping tests shall include water level measurements from observation or surrounding wells. An observation well shall be selected or sited such that the water level measurements obtained before, during and after the pumping test will, upon analysis, provide information about the aquifer's response to pumping. The selection or siting process shall consider the distance between the observation well and the pumping well, the type of aquifer from which water is being withdrawn, the hydraulic gradient and other aquifer characteristics.

(6) The well owner shall submit a report of the pumping tests with their results, interpretations and conclusions.

(a) The pumping test report shall include the following:

(i) The date and times of starting through ending the pumping test.

(ii) A data table for each well used to observe the drawdown and recovery water level measurements, as required by paragraph (B)(5)(b) of this rule, showing the time after the pump test started and the corresponding water level measurements to the nearest 0.1 foot.

(iii) The height above ground (in feet) of the water level measurement reference point.

(iv) The pumping rate and depth at which the pump used for the test was set.

(v) The anticipated permanent pump setting depth (in feet below ground).

(vi) The specific capacity of the well at the tested pumping rates.

(vii) For high use wells only, the specific capacity of the well at the anticipated permanent design pumping rate after drawdown has stabilized.

(b) In addition to paragraph (B)(6)(a) of this rule, the report for a high use well pumping test report shall include the following:

(i) A map showing the location of the pumping wells and the location of other wells used to observe drawdown. The map shall, at a minimum, include the names of the wells as used in the report and the distance between the pumping well and other wells used to observe drawdown.

(ii) Graphs plotted on semi-logarithmic graph paper showing the drawdown measurements on the arithmetic scale and time on the logarithmic scale.

Graphs must be submitted for the pumping well and any other wells used to observe drawdown and recovery during the pumping test.

(iii) Graphs plotted on semi-logarithmic graph paper showing the recovery measurements on the arithmetic scale and time on the logarithmic scale.

Graphs must be submitted for the pumping well and any other wells used to observe drawdown and recovery during the pumping test.

(iv) Arithmetic graphs showing all water-level data collected during the

pumping test and recovery period from the pumping well and all observation wells.

(c) In addition to paragraph (B)(6)(b) of this rule, when a high use community water system well is part of a multiple-well system the report shall include documentation that the well meets the demonstration requirements in paragraphs (B)(2) and (B)(3) of this rule.

(C) Samples shall be collected and analyzed from a public water system well for contaminants at the conclusion of the constant rate pumping test, performed in accordance with paragraph (B) of this rule, and prior to initiation of the recovery period.

(1) A community water system well shall be sampled and analyzed for the contaminants that are listed in appendix A of this rule, "Required Analyses for Wells Utilized by Community Public Water Systems."

(2) A nontransient noncommunity water system well shall be sampled and analyzed for the contaminants that are listed in appendix B of this rule, "Required Analyses for Wells Utilized by Nontransient Noncommunity Public Water Systems."

(3) A transient noncommunity water system well shall be sampled and analyzed for the contaminants that are listed in appendix C of this rule, "Required Analyses for Wells Utilized by Transient Noncommunity Public Water Systems."

(4) The director may reduce or add to the contaminants that are listed in the appendices to this rule because of well siting, well construction, treatment, promulgated drinking water standards, or other criteria to assess if the ground water is acceptable for human consumption.

(5) Samples that are collected from a public water system well in accordance with this rule shall be analyzed in a laboratory certified to analyze drinking water for contaminants in accordance with Chapter 3745-89 of the Administrative Code. The analytical methods shall be the same as required by the entry point to the distribution system monitoring in accordance with rule 3745-81-27 of the Administrative Code and shall include all the volatile organic and synthetic organic analytes that are quantified by the laboratory for the organic analytical method. Per- and polyfluoroalkyl substances (PFAS) shall be analyzed using EPA analytical method 533 or EPA method 537.1.

[Comment: For dates of non-regulatory government publications, publications of recognized organizations and associations, test methods, federal rules, and federal statutory provisions referenced in this rule, see paragraph (AA) of rule 3745-9-01 of the Administrative Code titled "Incorporation by reference."]

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Appendix A 3745-9-09

Required Analyses for Wells Utilized by Community Public Water Systems

Inorganic

Alkalinity, total (as CaCO3)	Cyanide	Nitrite-(as N)
Antimony, total	Fluoride, total	pH
Arsenic, total	Iron, total	Selenium, total
Barium, total	Lead, total	Silver, total
Beryllium, total	Magnesium, total	Sodium, total
Cadmium, total	Manganese, total	Sulfate
Calcium, total	Mercury, total	Thallium, total
Chloride	Nickel, total	Total Dissolved Solids
Chromium, total	Nitrate-(as N)	Zinc, total
Copper, total	Nitrate-Nitrite-(as N)	

Radiological

Gross Alpha	
Gross Beta	
Radium-228	
Radium-226	(if either gross alpha analysis exceeds 5pCi/L or radium-228 analysis exceeds 1 pCi/L)
Uranium	(if gross alpha analysis exceeds 15 pCi/L)

Synthetic Organic Chemicals (SOC)

Alachlor
Atrazine
Simazine

Bacteria Standards

Total Coliform (2 samples collected at least 30 min. apart)	1 Positive = Standard Exceeded

Volatile Organic Chemicals (VOC)

Benzene	Ethylbenzene	trans-1,2-Dichloroethene (or –ethylene)
Carbon Tetrachloride (tetrachloromethane)	Monochlorobenzene (chlorobenzene)	Trichloroethene (or –ethylene)
cis-1,2-Dichloroethene (or –ethylene)	ortho-Dichlorobenzene (1,2-Dichlorobenzene)	1,1,1-Trichloroethane (methyl chloroform)
Dichloromethane (methylene chloride)	para-Dichlorobenzene 1,4-Dichlorobenzene	1,2,4-Trichlorobenzene
1,1-Dichloroethene (or –ethylene, 1,1-DCE)	Styrene	1,1,2-Trichloroethane
1,2-Dichloroethane	Tetrachloroethene (or –ethylene, perchloroethylene)	Vinyl Chloride
1,2-Dichloropropane	Toluene	Xylenes, total

Per- and polyfluoroalkyl Substances (PFAS)

Analyte	Abbreviation	CASRN
Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6
Perfluorobutanesulfonic acid	PFBS	375-73-5
Perfluorohexanesulfonic acid	PFHxS	355-46-4
Perfluorononanoic acid	PFNA	375-95-1
Perfluorooctanoic acid	PFOA	335-67-1
Perfluorooctanesulfonic acid	PFOS	1763-23-1

Appendix B 3745-9-09

Required Analyses for Wells Utilized by Nontransient Noncommunity Public Water Systems

Inorganic

Alkalinity, total (as CaCO3)	Cyanide	Nitrite-(as N)
Antimony, total	Fluoride, total	pH
Arsenic, total	Iron, total	Selenium, total
Barium, total	Lead, total	Silver, total
Beryllium, total	Magnesium, total	Sodium, total
Cadmium, total	Manganese, total	Sulfate
Calcium, total	Mercury, total	Thallium, total
Chloride	Nickel, total	Total Dissolved Solids
Chromium, total	Nitrate-(as N)	Zinc, total
Copper, total	Nitrate-Nitrite-(as N)	

Radiological

Gross Alpha	
Gross Beta	
Radium-228	
Radium-226	(if either gross alpha analysis exceeds 5pCi/L or radium-228 analysis exceeds 1 pCi/L)
Uranium	(if gross alpha analysis exceeds 15 pCi/L)

Synthetic Organic Chemicals (SOC)

Alachlor
Atrazine
Simazine

Bacteria Standards

Total Coliform (2 samples collected at least 30 min. apart)	1 Positive = Standard Exceeded

Volatile Organic Chemicals (VOC)

Benzene	Ethylbenzene	trans-1,2-Dichloroethene (or –ethylene)
Carbon Tetrachloride (tetrachloromethane)	Monochlorobenzene (chlorobenzene)	Trichloroethene (or –ethylene)
cis-1,2-Dichloroethene (or –ethylene)	ortho-Dichlorobenzene (1,2-Dichlorobenzene)	1,1,1-Trichloroethane (methyl chloroform)
Dichloromethane (methylene chloride)	para-Dichlorobenzene 1,4-Dichlorobenzene	1,2,4-Trichlorobenzene
1,1-Dichloroethene (or –ethylene, 1,1-DCE)	Styrene	1,1,2-Trichloroethane
1,2-Dichloroethane	Tetrachloroethene (or –ethylene, perchloroethylene)	Vinyl Chloride
1,2-Dichloropropane	Toluene	Xylenes, total

Per- and polyfluoroalkyl Substances (PFAS)

Analyte	Abbreviation	CASRN
Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6
Perfluorobutanesulfonic acid	PFBS	375-73-5
Perfluorohexanesulfonic acid	PFHxS	355-46-4
Perfluorononanoic acid	PFNA	375-95-1
Perfluorooctanoic acid	PFOA	335-67-1
Perfluorooctanesulfonic acid	PFOS	1763-23-1

Appendix C 3745-9-09

Required Analyses for Wells Utilized by Transient Noncommunity Public Water Systems

Inorganic

Alkalinity, total (as CaCO3)	Fluoride, total	Nitrate-Nitrite-(as N)
Arsenic, total	Iron, total	Nitrite-(as N)
Barium, total	Lead, total	pH
Calcium, total	Magnesium, total	Sodium, total
Chloride	Manganese, total	Sulfate
Copper, total	Nitrate-(as N)	Total Dissolved Solids

Radiological

Gross Alpha	
Gross Beta	
Radium-228	
Radium-226	(if either gross alpha analysis exceeds 5pCi/L or radium-228 analysis exceeds 1 pCi/L)
Uranium	(If gross alpha analysis exceeds 15 pCi/L)

Bacteria Standards

Total Coliform (2 samples collected at least 30 min. apart)	1 Positive = Standard Exceeded

3745-9-10 **Abandoned well, test hole, dry well sealing.**

(A) An abandoned well, test hole, or dry well shall be sealed in accordance with this rule and rule 3745-9-07 of the Administrative Code.

(1) "The State of Ohio Regulations and Technical Guidance For Sealing Unused Water Wells and Boreholes" shall be used as a guide.

(2) Plan approval is not required in accordance with Chapter 3745-91 of the Administrative Code to seal an abandoned well, test hole or dry hole. A public water system may apply to the director for a variance from this rule in accordance with rule 3745-9-02 of the Administrative Code.

(B) A test hole shall either be permanently sealed or converted into a well upon completion of testing.

(C) An abandoned well shall be sealed in accordance with the following:

(1) All obstructions shall be removed from the abandoned well, including the pump and related equipment, drop pipe, pitless adapter, suction line, trash or other debris. Unless permanently attached, all liner pipe shall be removed from the well prior to placement of sealing materials.

(2) Casing shall be removed, ripped or perforated, or with prior consultation with the district office the casing may be left intact or in place.

(a) Casing shall be removed to a depth of at least three feet below ground surface, except for a dug or bucket augered well covered by paragraph (C)(13)(b)(ii) of this rule. The remaining borehole shall be filled with clean clay.

(b) If possible, casing shall be removed by overdrilling when the annular seal is inadequate, or water is flowing from around the outside of the casing, or gravel packing connects two or more hydraulic zones.

(3) Where evidence of microbiological growth is present, an abandoned well shall be disinfected by slowly wetting the casing or borehole with a solution of sodium hypochlorite or calcium hypochlorite. Disinfectant concentration in the water column shall be at least fifty milligrams per liter total chlorine.

(a) Disinfectant shall have standard ANSI/NSF 60 certification.

(b) Contact of disinfectant with bentonite shall be avoided.

(4) Cement grout may be gravity poured into a dry hole where no water is present.

(5) After the sealing material and grout have been placed into the abandoned well, the grout shall cure a minimum of twelve hours to assess whether any settling of the sealing material has occurred. If settling has occurred, then additional grout shall be placed into the remaining borehole.

(6) The finished grade shall ensure that surface water runoff drains away from the sealed abandoned well.

(7) An abandoned well that is less than two hundred feet deep and greater than four inches in diameter may be sealed using coarse grade bentonite.

(8) An abandoned well that is less than one hundred feet deep and greater than four inches in diameter may be sealed using pelletized bentonite or coarse grade bentonite.

(9) An abandoned well that is constructed into or through a single aquifer that is not flowing at the surface shall be sealed in accordance with the following:

(a) Clean and disinfected sand or gravel may be placed either from the bottom of the abandoned well to the top of the aquifer, or to twenty-five feet below ground surface, whichever is encountered first.

(b) An abandoned well shall be sealed by either pressure grouting, or pouring coarse grade bentonite from twenty-five feet below ground surface to the ground surface.

(c) If casing is removed, sealing material and grout shall be placed while casing is being removed from the borehole.

(10) An abandoned well that is constructed into or through multiple aquifers that is not flowing at the surface shall be sealed in accordance with the following requirements:

(a) An abandoned well shall be sealed by pressure grouting.

(b) Pelletized bentonite or coarse grade bentonite may be poured.

(c) If detailed construction and geologic data is available, then clean and disinfected sand or gravel may be placed adjacent to the aquifer zones and grout placed adjacent to the confining units. The abandoned well shall then be sealed from the top of the uppermost aquifer or from twenty-five feet below ground surface, whichever is encountered first, to the surface with either cement grout or bentonite grout.

(11) An abandoned well that is flowing shall be sealed in accordance with the following requirements:

(a) If practical, the casing may be extended until the flow of water over the top of the casing stops. An abandoned well shall be sealed by pressure grouting, or coarse grade or pelletized bentonite may be poured.

(b) If casing extension is impractical because of the hydraulic head, one of the following shall be met:

(i) An inflatable packer shall be installed at the top of the producing formation to stop or restrict the flow of water. The abandoned well shall be sealed by pressure grouting through the packer from the bottom of the hole to the bottom of the packer. The packer shall then be deflated and pressure grouting shall continue to the ground surface.

(ii) A shut-in device shall be installed at the top of the abandoned well to prevent flow. A conductor pipe shall be inserted through the shut-in device and the abandoned well shall be sealed by pressure grouting from the bottom of the hole to the ground surface.

(iii) Disinfected gravel shall be poured into the abandoned well to reduce the flow of water and the abandoned well shall be sealed by pressure grouting from the top of the aquifer, or from twenty-five feet below ground surface, whichever is encountered first.

(iv) If additives are used to increase the density of cement grout to control the flow of water, appropriate placement techniques shall be used to ensure that separation does not occur.

(12) An abandoned well drilled through fractured or cavernous formations or a mine shaft, shall be sealed in accordance with the following:

(a) The depth and thickness of the fractured, cavernous zone or mine shaft shall be determined, if possible, and the fractured, cavernous zone or mine shaft shall be sealed in accordance with the following:

(i) Where the fractured, cavernous zone or mine shaft is greater than twenty-five feet from the ground surface, a packer, shale trap, or another similar device shall be installed at the top of the fractured, cavernous zone or mine shaft and the well shall then be sealed by pressure grouting up to the ground surface. In lieu of installing a packer, shale trap, or another similar device, the fractured, cavernous zone or mine shaft may be filled with clean and disinfected gravel, or cement grout, and the abandoned well shall then be sealed by pressure grouting up to the ground surface.

(ii) Where the fractured, cavernous zone or mine shaft is less than twenty-five feet from the ground surface, the abandoned well shall be filled with cement grout with additives that promote bridging across the fractured, cavernous zone or mine shaft.

(b) The remainder of the abandoned well shall be sealed by pressure grouting.

(13) A dug or bucket auguered abandoned well that is greater than twenty-four inches in diameter and less than twenty-five feet deep shall be sealed in accordance with one of the following:

(a) The entire depth of the dug abandoned well shall be filled with concrete that meets the specifications of paragraph (B)(1)(c) of rule 3745-9-07 of the Administrative Code and the concrete mix shall not exceed aggregate sizes greater than medium sand or three-fourths inch gravel.

(b) The static water level shall be measured and the abandoned well pumped dry, if possible.

(c) If the static water level is less than five feet below ground surface, then the following apply:

(i) The abandoned well shall be filled with clean clay or cement grout to the elevation of the static water level.

(ii) The liner shall be removed to the depth of the static water level, and the borehole shall be excavated radially six inches beyond the

original borehole.

(iii) A one foot layer of bentonite or cement grout shall be placed in the abandoned well at the elevation of the static water level. If the abandoned well is dry and bentonite is used, it shall be hydrated with five gallons of water per fifty pounds of bentonite.

(iv) The remaining borehole shall be filled with clean clay to ground surface.

(d) If the static water level is greater than five feet below ground surface, then the following apply:

(i) The abandoned well shall be filled with clean clay or cement grout to the elevation of the static water level.

(ii) At least the top three feet of casing, wall or liner material shall be removed and the borehole shall be excavated radially six inches beyond the original borehole.

(iii) A one foot layer of bentonite or cement grout shall be placed in the abandoned well at the elevation of the static water level. If the abandoned well is dry and bentonite is used, it shall be hydrated with five gallons of water per fifty pounds of bentonite.

(iv) A layer of clean clay or cement grout shall be added above the grout until the level in the abandoned well is three feet below ground surface.

(v) Another one foot thick layer of bentonite or cement grout shall be added at the level at which the casing, wall or liner material was removed. If the abandoned well is dry, the bentonite shall be hydrated with five gallons of water per fifty pounds of bentonite.

(14) A dug or bucket auguered abandoned well that is greater than twenty-four inches in diameter and greater than twenty-five feet deep shall be sealed in accordance with either paragraph (C)(9) or (C)(10) of this rule.

(D) A copy of the well sealing report that is required by section 1521.05 of the Revised Code shall be submitted to the district office within thirty days of sealing a public water system well. The abandoned well location shall be clearly noted on a site map

with reference to highways, streets, corporate boundaries and local physical landmarks.

[Comment: For dates of non-regulatory government publications, publications of recognized organizations and associations, test methods, federal rules, and federal statutory provisions referenced in this rule, see paragraph (AA) of rule 3745-9-01 of the Administrative Code titled "Incorporation by reference."]

Effective: 9/1/2022

Five Year Review (FYR) Dates: 4/20/2022 and 09/01/2027

CERTIFIED ELECTRONICALLY

Certification

08/16/2022

Date

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