

TITLE 64
LEGISLATIVE RULE
DEPARTMENT OF HEALTH AND HUMAN RESOURCES
BUREAU FOR PUBLIC HEALTH

SERIES 46
WATER WELL DESIGN STANDARDS

§64-46-1. General.

1.1. Scope. -- This legislative rule establishes the design standards for the installation of water wells, pumps and pumping equipment to protect public health and groundwater aquifers from contamination and pollution.

1.2. Authority. -- W. Va. Code §§16-1-4, 16-1-6(n), 16-1-9 and 16-1-9a.

1.3. Filing Date. -- April 2, 2008.

1.4. Effective Date. -- April 2, 2008.

1.5. Repeal of Former Rule -- This rule repeals and replaces West Virginia Department of Health's Interpretive Rule, Water Well Design Standards, 64CSR46, 1984.

§64-46-2. Application.

2.1. This rule applies to all water wells, pumps and pumping equipment installations other than those used to supply public water systems. Water wells for public water systems shall be installed, altered, and deepened in accordance with the Department's rule, Public Water System Design Standards, 64CSR 77.

§64-46-3. Definitions.

3.1. Abandoned water well. -- A water well that is no longer in use or is declared to be abandoned by the owner. A water well is also abandoned if the Commissioner has determined that the well presents a threat to groundwater or public health.

3.2. Abandonment of a water well. -- The act of properly sealing a water well in accordance with applicable standards.

3.3. ANSI. -- American National Standards Institute. ANSI creates standards for many water well applications, especially materials and equipment.

3.4. Annular Space. -- The space between a borehole wall and a permanent casing or between a temporary casing and a permanent casing or both.

3.5. API. -- American Petroleum Institute. API has specifications for steel casing.

3.6. Aquifer. -- A geological formation, group of formations, or part of a formation that yields ground water to a well.

3.7. ASHRAE. -- American Society of Heating, Refrigeration and Air – Conditioning Engineers. ASHRAE applications mainly relate to geothermal systems.

3.8. ASTM. -- American Society for Testing Materials. ASTM develops standards nationally and internationally for a wide array of materials and processes.

3.9. AWWA. -- American Water Works Association. AWWA is a non-profit scientific and educational society dedicated to the improvement of drinking water quality and supply.

3.10. Barnyard. -- A fenced area for animals, which generally adjoins the barn on a farm. It applies to traffic alleys, holding pens, convalescent pens, maternity pens, calf pens and confined exercise yards.

3.11. Bedrock. -- Solid rock exposed at the surface or overlain by unconsolidated materials.

3.12. Bentonite. -- A plastic, colloidal clay derived from volcanic ash consisting of at least

85% montmorillonite, with an ability to absorb fresh water and swell in volume.

3.12.a. Bentonite granules. -- Commercially manufactured pure bentonite, without additives, with a diameter of 3/8 inch or less.

3.12.b. Bentonite pellets. -- Commercially manufactured tablets made by compressing pure bentonite, without additives, into forms with a diameter ranging from 1/4 to 1/2 of an inch.

3.12.c. Bentonite chips. -- Commercially processed angular fragments of pure bentonite, without additives. Size ranges from 3/8 to 3/4 of an inch.

3.13. Bureau. -- The Bureau for Public Health of the West Virginia Department of Health and Human Resources.

3.14. Casing. -- The pipe or tubing, constructed of specific materials with specified dimensions and weights, that is installed in a borehole during or after completion of the borehole to support the side of the hole and thereby prevent caving, to allow completion of the water well, to prevent formation material from entering the water well, and to prevent entry of undesirable water into the well.

3.15. Closed-Loop Heat Pump Well. -- A well in which fluid is circulated in a continuous unbroken pipe beneath the surface of the earth or in a medium where the system can obtain a sufficient cooling or heat exchange. Depths of installation vary and are dependent upon the type and size of the closed-loop system, the land area available, soils/formation, climate, and seasonal variation in ground temperature, etc.

3.16. Commissioner. -- The Commissioner of the West Virginia Bureau for Public Health or his or her designee.

3.17. Commercial Well. -- A well that serves small businesses and facilities in which water is the prime ingredient of the service rendered.

3.18. Confined Water Table. -- Groundwater confined by an impervious layer of rock or other material under sufficient pressure to raise the water level above the upper level of the saturated zone when penetrated by a well.

3.19. Confined Aquifer. -- An aquifer bounded above and below by beds of distinctly lower permeability than that of the aquifer itself containing groundwater under pressure greater than that of the atmosphere. The term is synonymous with the term "artesian aquifer".

3.20. Contaminant. -- Any substances either manmade or natural, which are concentrated enough to degrade water quality to a degree making the water harmful to public health or to the environment.

3.21. Contamination. -- Any manmade, man-induced or natural alteration of the chemical, physical, or biological integrity of the ground water, resulting from activities regulated under the West Virginia Department of Environmental Protection's rule, Groundwater Protection Regulations, 47CSR58. Any alteration in excess of existing ground water quality, unless that site has been granted a deviation or variance from existing quality as provided in the West Virginia Ground Water Protection Act, or is subject to an order, permit, or other regulatory action that requires restoration or maintenance of ground water quality at a different concentration or level.

3.22. Dewatering Well. -- A well used to lower groundwater levels to allow for construction of footings, sewer lines, building foundations, dams, etc.

3.23. Direct Exchange Well (DX) -- A small diameter bore hole constructed for the purpose of sinking or sourcing thermal energy between the direct exchange loop and the earth. The refrigerant circulates throughout the heat exchange loop.

3.24. Disinfection. -- The inactivation of pathogenic organisms in water by chemical oxidants or equivalent agents, ultraviolet light, ozonation, or other methods approved by the Commissioner.

3.25. Drive Shoe. -- A device fastened to the bottom of a length of casing to protect the casing during driving.

3.26. Feedlot. -- A lot or facility (other than an aquatic animal production facility) where the following conditions are met: 1. animals (other than aquatic animals) have been, are or will be stabled or confined and fed or maintained for a total of forty-five days or more in any twelve month period, and 2. crops, vegetation forage growth, or post-harvest residues are not sustained in the normal growing season over other portions of the lot or facility. Two or more animal feeding operations under common ownership shall be considered, for the purposes of this rule, to be a single feedlot if they adjoin each other or if they use a common area or system for the disposal of wastes.

3.27. Filter Pack. -- Sand, gravel, or both placed in direct contact with the well screen.

3.28. Grout or Grout Material. -- A stable and impervious bonding material, with minimum shrinkage, capable of producing a watertight seal to protect against contamination, approved by the Commissioner.

3.29. Grouting. -- The placement of grout into the annular space to seal the annular space, and prevent the infiltration or migration of surface water and contaminants into the ground water aquifer.

3.30. Hand Dug Well. -- A manually excavated well of permanent nature installed for water supply.

3.31. Heat Pump or Geothermal Well. -- Any well constructed to use the heat exchange properties of either groundwater or of geologic material penetrated by the well.

3.32. IGSHPA. -- International Ground Source Heat Pump Association. IGSHPA is a non-profit organization, established in 1987 to advance ground source heat pump technology and applications.

3.33. Inactive Well. -- A well that is no

longer actively used. It shall have a sanitary well cap and remain in a state of repair to prevent contamination from entering the well. It may be used in the future or be properly abandoned.

3.34. Industrial Well. -- A well used in industrial processing, fire protection, washing, packing, or manufacturing of a product excluding food and beverages, or similar non-potable uses.

3.35. Installation. -- The installation, alteration or deepening of a water well, pump and pump equipment.

3.36. Irrigation Well. -- A well used to provide water for plants, livestock, or other agricultural processes.

3.37. Location. -- The designation of the well site by using longitude and latitude or other approved means.

3.38. NSF. -- The National Sanitation Foundation. The NSF assists in educational and research programs, and develops standards pertinent to the areas of environmental sanitation and health.

3.39. NSF Potable Water (PW). -- Product standards for pressure-rated potable water applications as required by ANSI/NSF Standard 14 and ANSI/NSF Standard 61 for health effects.

3.40. Neat Cement. -- A mixture of Portland cement (ASTM C-150) and water in the proportion of 5 to 6 gallons of clean potable water per bag (94 pounds or 1 cubic foot) of cement.

3.41. Open-Loop Heat Pump Supply Water Well. -- A well drilled to supply water for heat transfer. Water quality, quantity and disposal are primary concerns with open-loop systems.

3.42. Permanent Casing. -- A durable, impervious pipe placed or driven into the borehole and left in place to maintain the well opening.

3.43. Pitless Adapter. -- A device approved by the Commissioner for attachment to one (1) or more openings through a well casing and constructed to prevent the entry of contamination into the well. The adapter is used to transfer water from the well, decrease the probability of frozen water lines and provide access to the well and water system components within the well.

3.44. Pitless Well Cap. -- A sanitary device, approved by the Commissioner, that covers and encloses the upper termination of a pitless well unit or the well casing to prevent entry of contamination into the well.

3.45. Pitless Unit. -- A preassembled device approved by the Commissioner which extends from the upper end of a well casing to above grade, provided with an approved well cap, and constructed to prevent the entry of contamination into the well. The unit is used to conduct water from the well, prevent the water from freezing and provide access to the well and water system components within the well.

3.46. Potable Water. -- Water free from impurities in amounts sufficient to cause disease or harmful physiological effects, with bacteriological, chemical, physical and radiological quality conforming to applicable rules and standards of the Bureau for Public Health.

3.47. Potable Water Well. -- Any water well that provides potable water, other than a public water supply for human consumption.

3.48. PPI. -- Plastics Pipe Institute. Founded in 1950, The Plastics Pipe Institute Inc. (PPI) is the major trade association representing all segments of the plastics piping industry.

3.49. Pressure Tank. -- A closed water and air storage device that modulates the water supply system pressure and sometimes allows for expansion during temperature fluctuations in the water system.

3.50. Public Water System. -- A public water system is any water supply or system that regularly supplies or offers to supply water for

human consumption through pipes or other constructed conveyances, if serving at least an average of twenty-five individuals per day for at least sixty days per year, or which has at least fifteen service connections, and shall include:

3.50.1 Any collection, treatment, storage, and distribution facilities under the control of the owner or operator of the system and used primarily in connection with the system; and

3.50.2 Any collection or pretreatment storage facilities not under such control which are used primarily in connection with the system.

3.50.3. A public water system does not include a system that meets all of the following conditions:

3.50.3.a. It consists only of distribution and storage facilities, and does not have any collection or treatment facilities;

3.50.3.b. It obtains all of its water from, but is not owned or operated by, a public water system that otherwise meets the definition;

3.50.2.c. It does not sell water to any person; and

3.50.3.d. It is not a carrier conveying passengers in interstate commerce.

3.51. Pump. -- Any mechanical equipment or device used to transfer water from a well.

3.52. Pumping Equipment. -- Equipment or related materials that are used or intended to assist withdrawing groundwater from a well, including seals and other safeguards to protect the water from contamination; associated fittings; intake and discharge piping; and controls to provide sanitary water storage facilities and deliver water to a distribution piping system.

3.53. Rapid Joint Assembly. -- A device intended to join two pieces of pipe without threads or glue and approved by the ASTM or NSF.

3.54. Standard Dimension Ratio (SDR). -- The quotient obtained when the outside diameter of thermoplastic well casing is divided by the wall thickness.

3.55. Standing Column Open-Loop Well. -- A vertical well filled with water, in which water is removed from and returned to the same well for heat exchange.

3.56. Temporary Casing. -- A durable pipe placed or driven into a borehole to maintain an open annular space around the permanent casing during construction of a well.

3.57. Test Wells (Exploratory/Observation). -- A well that is used to obtain information on groundwater quantity; quality; aquifer characteristics; and availability of production water supply for manufacturing, commercial, and industrial facilities.

3.58. Tremie Pipe. -- A small diameter pipe, hose, or tubing used in the down hole placement of well construction grouting material.

3.59. Unconsolidated Formation. -- A sediment that is loosely arranged whose particles are not cemented together, occurring either at the surface or at depth.

3.60. Under-reaming. -- A process of drilling just below casing to allow casing to be set while drilling, especially in unconsolidated or unstable formations.

3.61. Under-reamer. -- A drill bit used for under-reaming.

3.62. Unweathered Bedrock. -- Bedrock that is competent, firmly consolidated, and unaltered by erosion or surficial weathering.

3.63. Vertical Closed Loop Heat Pump Well. -- A borehole essentially perpendicular to the horizon into which a closed-loop pipe is placed for heat transfer.

3.64. Water system. -- Includes any well and equipment for distribution, extending from

and including the source of the water to the point of discharge from any pressure tank or other storage vessel to the point of discharge from the water pump where no pressure tank or other storage vessel is present.

3.65. Watertight. -- A condition that does not allow the entrance, passage or flow of water under normal operating conditions.

3.66. Water Return Well. -- A well constructed for returning water that has passed through the heat pump system to the subsurface.

3.67. Water Well. -- Any excavation or penetration in the ground, whether drilled, bored, cored, driven, washed, jetted, hand dug or otherwise constructed that enters or passes through an aquifer for purposes that may include, but are not limited to, a potable water supply, exploration for water, industrial, irrigation, commercial, dewatering, or geothermal heat pump wells, and water return wells. This definition shall not include ground water monitoring activities, and all activities for the exploration, development, production, storage and recovery of coal, oil and gas and other mineral resources regulated under Chapters 22, 22a, or 22b of the WV Code.

3.68. Well Cap. -- A casing seal, approved by the Commissioner, that covers and encloses the upper termination of the well casing above the pitless well adapter or unit to prevent entry of contamination into the well.

3.69. Well Liner. -- A casing placed inside the well, which may be required due to conditions encountered during and after drilling. A liner does not include casing that, once installed, requires the placement of grout to comply with construction standards of this rule.

3.70. WSC. -- Water System Council. WSC is the only national, non-profit organization solely focused on household wells and small, water well systems.

§64-46-4. Location.

4.1. A water well shall be located at least ten (10) feet from a property line to allow access

without encroaching on property owned by others.

4.2. A water well shall be located as far as possible from any existing or potential sources of contamination in accordance with the following:

4.2.a. The required minimum horizontal distance between a water well, other than a well serving a public water system, and a source or potential source of pollution or contamination is shown in Table 64-46 A of this rule.

4.3. The top of the well casing shall not extend or terminate in the basement of any building or in a pit, room, or other space below ground surface.

4.4. All water wells shall be located to be accessible for cleaning, treatment, repair, testing, abandonment, and other maintenance.

4.5. A well located in an area subject to seasonal flooding or surface water contamination, shall be constructed in such a manner that seasonal floodwater cannot enter the well.

§64-46-5. Materials.

5.1. Water well casing shall be sized to allow for installation of equipment for producing water that is adequate for the intended use and to allow for the installation and the maintenance of the well, pumps and related pumping equipment. In casing selection, certified well drillers should give consideration to forces imposed during installation and other forces that can be expected after installation and the corrosiveness of the water with which it comes in contact.

5.1.a. Steel casing shall be new, meeting AWWA Standard A-100, ASTM, or API specifications for water well construction, with a minimum wall thickness of 0.188 inches if the nominal pipe size is up to ten (10) inches and have a minimum wall thickness of .375 inches if the nominal pipe size is greater than ten (10) through twenty (20) inches:

5.1.a.1. Steel casing shall be joined

by welds, threads, threaded couplings, or any combination thereof; and

5.1.a.2. When steel casing is driven, a standard drive shoe shall be welded or threaded on the lower end of the casing. The drive shoe shall have a beveled and tempered cutting edge of metal forged, cast or fabricated for this purpose.

5.1.b. Well liners and temporary steel casing used for construction shall be capable of withstanding the structural load imposed during their installation and removal. Well liners and temporary steel casing shall be approved by the ANSI/NSF, AWWA, ASTM, or their equivalent for potable water use.

5.1.c. Plastic well casings, liners, rapid joint assembly couplings, and solvents shall be approved by the ANSI/NSF Standard 14 and 61 and meet ASTM Standard F480.

5.1.c.1. Temporary casing shall meet ANSI/NSF Standard 61.

5.1.c.2. Plastic well casing shall not be driven during installation.

5.1.c.3. Plastic well casing shall be installed in accordance with the manufacturer's specifications and shall have an outside diameter and minimum wall thickness as specified in Table 64-46 B of this rule.

5.1.c.4. All plastic casing and liners shall have a wall thickness that shall be of adequate thickness to prevent collapse due to hydrostatic pressure or temperature effects.

5.1.c.5. Each section of casing and liner shall display the NSF seal.

5.2. Nonferrous casing material proposed as a well casing, shall be resistant to the corrosiveness of water and to the stresses to which it shall be subjected to during installation and grouting. Casing material shall comply with ANSI/NSF Standard 61, Water System Components - Health Effects.

5.3. Well screens shall be constructed of

materials resistant to damage by the chemical action of groundwater or cleaning operations, have size of openings based on sieve analysis of formation or gravel pack materials; have sufficient length and diameter to provide adequate specific capacity; and low aperture entrance velocity.

5.3.a. Well screens other than those commercially manufactured shall be constructed by creating slots or openings in approved casing material.

5.3.b. Plastic well screens shall comply with the ANSI/NSF Standard 61 - Water System Components - Health Effects.

5.3.c. Well screens shall not interconnect aquifers or zones which have suspected or documented differences in water quality that could result in contamination of any aquifer or zone; or interconnect aquifers or zones with different static water levels that would result in depletion of water from any aquifer or zone, or significant loss of head in any aquifer or zone.

5.4. Filter packs shall be silica based sand or gravel. The sand or gravel used for filter packs shall be hard and durable and shall have an average specific gravity of not less than 2.50. The sand and gravel shall be visibly free of clay, dust, and micaceous and organic matter. Not more than 5% of the sand or gravel shall be soluble in a 10% hydrochloric acid solution. Uniformity coefficients for filter pack material shall range from 1 to 3. All filter pack material should be purchased from a supplier who has properly cleaned and bagged the material.

5.5. Grout shall be neat cement, bentonite with cement mixtures, or bentonite. Other materials require the written approval of the Commissioner. The neat cement, bentonite with cement mixtures, and bentonite shall be mixed according to the manufacturer's specifications. No drilling muds shall be used for grouting. Cement grouts shall be allowed to cure according to the manufacturer's specifications before well drilling, construction, or testing may be resumed.

5.6. Water used during the initial construction of a water well shall be obtained from a public water system, water well or protected spring box. If additional water is required to complete the construction of the well, the driller shall use water from the best available potable source near the drill site. In the event that water from a public water system, water well or protected spring box is not available, the driller may obtain water directly from a surface supply other than a farm pond, open ditch or waste lagoon.

5.6.a. All water from a public water system, well or spring box shall also be treated with enough liquid bleach or hypochlorite granules to retain a free chlorine residual of at least two parts per million (2 ppm).

5.6.b. All water from a surface source shall be dosed with a fifty parts per million (50 ppm) of chlorine, i.e., two (2) gallons of sodium hypochlorite (laundry bleach, approximately five percent (5%) available chlorine) per one thousand (1,000) gallons of drilling water.

5.6.c. Surface water sources shall be free of mud, algae and other visible contaminants.

5.7. Packers, shall be made of material that shall not impart taste, odor, toxic substance, or bacterial contamination to the well water. They are usually made of rubber or neoprene collar (boot). Lead packers shall not be used.

5.8. Any additive used in the drilling, development, or grouting of a water supply designed for that purpose shall meet ANSI/NSF Standard 61.

§64-46-6. Construction; general.

6.1. The minimum protected depths of drilled wells shall provide watertight construction to the depth required by the Commissioner to: exclude contamination; seal off formations that are, or may be, contaminated or yield undesirable water; and provide a minimum casing length as follows:

6.1.a. Nineteen (19) feet of casing in

unconsolidated water bearing formations below ground level plus at least one (1) foot above finished grade, resulting in a total of twenty (20) feet;

6.1.b. Nineteen (19) feet of casing in bedrock wells with a minimum of five (5) feet of casing installed into unweathered bedrock below ground level, plus at least one (1) foot above finished grade resulting in a total of twenty (20) feet; or

6.1.c. The Commissioner may require other minimum casing depths in special circumstances.

6.2. The minimum borehole diameter, at the top of the water well, shall be four (4) inches.

6.3. The full length of the well casing shall be fully grouted from the lower terminus up to the ground surface, except as noted in subdivisions 6.3.a through 6.3.c of this section.

6.3.a. When drilling through caves, mines, or other cavities, the lower portion of the casing shall be grouted in accordance with the method described in subdivision 6.4.d of this section and a packer or similar bridging device shall be used to permit grouting above the cavity.

6.3.b. In unconsolidated aquifers (i.e., sand and gravel) above bedrock, the permanent casing shall be grouted.

6.3.c. In cases where a pitless adaptor is to be installed, upward grouting may terminate at the pitless adaptor level to allow for the installation of a pitless adapter.

6.4. All water wells shall have an annular space seal between the casing and borehole that forms a seal to prevent the entrance of water from sources other than the aquifers selected. The borehole diameter shall be sufficient to allow placement of the material to fully enclose and entirely seal the pipe.

6.4.a. When grouting below the water level, grout material shall be installed by a positive placement method, such as pumping or forced injection by air or hydraulic pressure,

placed from the bottom up. The annular space shall be a minimum of 1.5 inches completely around the casing for grout. Grout shall be injected in the annular space between the inner casing and either the outer casing or the borehole. In wells where the outer casing shall be left in place, a dry bentonite is used while driving the casing.

6.4.b. When grouting above the water level, grout material installed by a positive placement method, such as pumping or forced injection by air or hydraulic pressure, placed from the bottom up, is the preferred method for grouting. The annular space shall be a minimum of 1.5 inches completely around the casing. A gravity emplacement method may be used for grouting above the water level, not exceeding thirty (30) feet in depth.

6.4.c. When under-reaming is used to set permanent casing in unconsolidated materials, either a dry or wet bentonite grout shall be used at the ground surface while the casing is being installed. Upon termination of casing in unweathered bedrock and removal of the under-reamer, bentonite or neat cement shall be placed in the bottom of the casing by a positive displacement or gravity placement method before casing is set in bedrock.

6.4.d. If rapid loss of grout material occurs during emplacement, coarse fill material (e.g., sand, gravel, crushed stone or dry cement) may be used in the zones in which the loss is occurring. The remainder of the annular space shall be grouted as provided in this section.

6.4.e. When driving casing with a cable tool rig through unconsolidated alluvial formations, a cone shaped depression or temporary outer casing filled with bentonite grout shall be maintained around the outside of the casing. The bottom of the driven casing shall be equipped with a drive shoe.

6.4.f. If the annular space cannot be grouted in accordance with this section, alternative methods shall obtain the written approval of the Commissioner.

6.4.g. The annular space shall be

grouted as soon as possible, but not later than seven (7) calendar days after the well drilling has been completed and the drill rig is removed from the drill site location of a well.

6.5. Every well shall be developed to remove the native silts and clays, drilling mud, or finer fraction of the gravel pack resulting from drilling operations.

6.6. During the progress of work, water wells shall be provided protection to prevent tampering with the well or entrance of foreign materials. Once well drilling is complete and prior to departure of the drilling equipment from the well site, a WSC approved vector proof cap shall be securely installed. The well cap shall provide for ventilation. Vents shall be part of the well cap or may be attached to the well cap. They shall be turned down and screened to prevent entry of vermin. Toxic or flammable gasses shall be vented from a well to the outside above roof level or a point where they shall not produce a hazard. Wells installed in flood prone areas shall be watertight to prevent intrusion of floodwaters.

6.7. Permanent casing for all groundwater sources shall project a minimum of twelve (12) inches above the ground surface upon completion.

6.8. Pitless units designed to replace a section of well casing shall meet the standards of the WSC and shall be factory fabricated from point of connection with the well casing to the unit cap or cover. The materials used shall be durable and approved by the WSC. The pitless unit shall:

6.8.a. form an unbroken extension of the well casing from the point of discharge to a point above ground level as specified for upper well terminals; and

6.8.b. be installed by a threaded connection or welded to the cutoff casing. A compression flange gasket is not allowed. The threaded or welded connection to the cutoff casing shall be watertight.

6.9. Commercially manufactured pitless

adapters shall be connected to the well casing with clamps, compression nuts, or by welding and shall form a watertight seal. To assure a watertight seal between the pitless adapter and the well casing, care shall be used in cutting the hole in the well casing with a hole-cutting saw or other Commissioner approved methods. All burs from the cutting process shall be removed. Both the outside and the inside surfaces of well casing surrounding the hole shall be smoothed. Pitless adapters shall be installed according to manufacturer's specifications and shall meet the standards of WSC.

6.9.a. Pitless adapters shall be constructed and installed to prevent the entrance of contaminants into the well or water supply through openings in the well casing.

6.9.b. The pitless adapter shall provide adequate clearance within the well to allow insertion and withdrawal of the pump and system components through the upper terminal of the well casing.

6.10. Pump installation contractors shall not cut off or penetrate well casing below ground level except to install a pitless adapter or a pitless unit. A certified pump installer may join casing in accordance with this rule after obtaining the proper permit.

6.11. Well houses, if constructed, shall not be built directly over a water well.

§64-46-7. Pump Installation.

7.1. At all times during the pump installation, the certified pump installer or well driller or both shall provide protection to prevent tampering with the well or entrance of foreign materials. The approved well cap shall be re-installed immediately upon completion of the pump installation and prior to departure of the certified pump installer or well driller.

7.2. The pumping capacity of the pump installed in a well shall be consistent with the intended use of the ground water and with the yield characteristics of the well.

7.3. Submersible pumps shall have a

minimum of two (2) check valves installed. Install a properly sized (based on discharge pipe diameter) check valve for the pump, plus one (1) on the outer casing on top of the well unless it interferes with the function of the system.

7.4. Jet pumps shall have a check valve installed on the discharge side of the pressure tank and all clamps used shall be stainless steel.

7.5. Piping for turbine pump installation:

7.5.a. steel column pipe for line shaft turbine pump wells shall be standard weight flanged or threaded steel pipe, or

7.5.b. a plastic column pipe may be used for turbine pump installation provided the pipe is designed and manufactured for that purpose.

7.6. Torque arresters and cable guards shall be used as required by the manufacturer's specification.

7.7. Electrical wiring and equipment used in connection with the installation of a water pump shall meet and be installed in accordance with any national, state, or local codes and ordinances.

7.7.a. All splices in electrical wiring shall be watertight.

7.7.b. Electrical wiring from the wellhead to the house shall be in a conduit or be an approved underground cable.

7.8. Pump controls for water wells shall be installed in accordance with manufacturer's recommendations and shall include a pressure relief valve. All conduits, valves, piping, other plumbing fixtures and fittings should be NSF approved and suitable for potable water used to convey water from a water well to any building or other outlet.

7.9. Water service pipe from the well to the point of entrance to a building shall comply with all applicable standards and carry the seal of the NSF-Potable Water (PW).

7.9.a. The materials from which water supply system pipe fittings are made shall be compatible with the type of piping materials used in the water supply system.

7.9.b. All materials used for water piping shall be suitable for use with the maximum temperature, pressure, and velocity that may be encountered in the installation, including temporary increases and surges.

7.9.c. Water service piping shall be installed below the anticipated frost line, with a minimum depth of two (2) feet.

7.10. All components of a pumping system shall be in compliance with NSF standard 61.

7.11. Pressure tanks and switches shall be located above ground. A pressure tank and switch may be buried, provided the tank and switch are designed for installation below ground.

7.12. Water filters and water treatment units that are installed to accommodate water quality problems, as determined by physical, chemical, or bacteriological evaluation or field-testing shall achieve the results specified by the manufacturer. During installation or repair of the treatment units the sanitation of the water supply shall be protected.

§64-46-8. Disinfection.

8.1. New potable water wells and existing potable water wells being placed into service or that have been disrupted for service or repair, such as new pump installation or reinstallation of an existing pump shall be disinfected.

8.1.a. The following standard disinfection procedure shall be used:

8.1.a.1. Materials which may be used for disinfection are; calcium hypochlorite, sodium hypochlorite, or other materials approved by the Commissioner; and

8.1.a.2. Disinfectant shall be placed in the well in quantities that produce a minimum concentration of at least 50 mg/l or parts per

million (ppm). The amount required to obtain this concentration shall depend on the casing diameter and the amount of water standing in the well. The solution shall remain in the well for a period of at least 12 hours.

8.2. When working with disinfectants in ventilated places, the powder or strong liquid should not come in contact with skin or clothing. Solutions are best handled in wood, plastic or crockery containers because metals are corroded by strong disinfectant solutions.

§64-46-9. Repair of Water Wells.

9.1. All materials used in the replacement, alteration or repair of any water well shall meet or exceed the requirements for a new installation.

9.2. Repairs or retrofits or both to wells, with the top of the well casing terminating below ground shall include extending the well casing above land surface with like material coupled in accordance with section 5 of this rule.

§64-46-10. Heat Pump Construction.

10.1. Design Methods and Compliance.

10.1.a. The manufacturer's design procedure shall follow a recognized methodology as presented in the most recent editions of IGSHPA and ASHRAE.

10.1.b. The ground heat exchanger design shall be clearly documented in order to determine compliance with the heat pump manufacturer's or utility's specifications or both.

10.2. Location of Heat Pump Wells Criteria.

10.2.a. Heat pump closed-loop wells shall be located at least twenty-five (25) feet from sewage absorption systems and known sources of contamination.

10.2.b. A closed-loop shall be located twenty-five (25) feet from all water wells. An open-loop shall be one hundred (100) feet from all water wells.

10.3. Casing Material.

10.3.a. If permanent casing is needed in a heat pump well, it shall be new steel casing.

10.4. Heat Pump Loop Material.

10.4.a. All pipe and heat-fused materials shall be manufactured from a virgin polyethylene extrusion compound material in accordance with ASTM Standard D-2513, and located in accordance with subsections 4.1 and 4.2 of this rule. The pipe shall be manufactured to outside diameters and wall thickness as specified in ASTM Standard D-3035 or D-2447. Fittings shall be manufactured to diameters, wall thicknesses, and respective tolerances as specified in ASTM Standard D-2683 for socket fittings and ASTM Standard F-1055 for electrofusion fittings.

10.4.a.1. The material shall maintain a 1600 psi (110.316 bar) Hydrostatic Design Basis at 73.4°F (23.5°C) per ASTM Standard D-2837, and be listed in PPI TR4 as a PE3408 piping formulation. The material shall be a high density extrusion compound having a cell classification of PE345434, PE355434, or PE345534 with a UV stabilizer of C, D, or E as specified in ASTM Standard D-3350 with the following exception: this material shall exhibit zero failures (F0) when tested for a minimum of 192 hours under ASTM Standard D-1693, condition C, as required in ASTM Standard D-3350.

10.4.a.2. Dimensions.

10.4.a.2.A. Pipe with a diameter of less than 1¼" (3.175cm) (nominal) shall be manufactured in accordance with ASTM D-3035 with a minimum (based on pressure rating) dimension ratio of 11.

10.4.a.2.B. Pipe manufactured with a diameter from 1¼" (3.175cm) (nominal) up to three (3) inches in diameter, shall be manufactured in accordance with ASTM D-3035 with a minimum (based on pressure rating) dimension ratio of 11.

10.4.a.2.C. Pipe 3" (7.62cm)

(nominal) and larger shall be manufactured in accordance with ASTM D-3035, (with a minimum [based on pressure rating] dimension ratio of 17) or D-2447 (Schedule 40). Table 64-46 C of this rule indicates the Water Pressure Ratings at 73.4°F (23.5°C) for DR-PR PE 3408 Plastic Pipe.

10.4.a.3. Markings, defined by the appropriate ASTM pipe standard shall be permanently marked on the length of the pipe as required information.

10.4.a.4. The manufacturer shall supply a notarized document confirming compliance with these standards, called a Certification of Materials.

10.4.b. All pipe joints and fittings installed and buried shall be socket or butt thermally fused according to the pipe manufacturer's specifications. Glued or clamped joints shall not be used below ground. Joints shall not leak after assembly. Pressure testing of the closed-loop heat pump system network shall be conducted prior to putting the system into operation.

10.4.b.1. Acceptable methods for joining buried pipe systems are:

10.4.b.1.A. a heat fusion process;

10.4.b.1.B. stab-type fittings, quality controlled to provide a leak-free union between pipe ends that are stronger than the pipe itself or;

10.4.b.1.C. polyethylene pipe heat fused by butt, socket, sidewall, or electrofusion in accordance with the pipe manufacturer's procedures. The individual performing fusion shall possess a fusion technician certification from IGSHPA or the pipe manufacturer. The instructor shall be IGSHPA approved to conduct pipe fusion classes.

10.4.b.1.D. Fusion transition fittings shall have threads used to adapt to copper, or fusion transition fittings shall have

threads or barbs used to adapt to high strength hose. Barbed fittings shall not be permitted to be connected directly to polyethylene pipe, with the exception of stab-type fittings as described in subparagraph 10.4.b.1.B of this section. All mechanical connections shall be accessible.

10.5. Heat transfer liquids shall be IGSHPA approved fluids.

10.6. The diameter of a heat pump well shall be sufficient to allow placement of grout. The minimum diameter shall be four (4) inches.

10.7. Heat Pump Vertical Closed-Loop Wells.

10.7.a. Approved Grout Materials.

10.7.a.1. Approved sealing and filling materials shall include high solids bentonite grout—20-30% solids by weight, bentonite pellets or chips, or approved high efficiency, thermally enhanced grouts designed for heat transfer in geothermal applications. All shall meet manufacturer's specifications.

10.7.a.2. All materials placed in the borehole shall be uncontaminated. All sand and gravel placed in the borehole shall be silica based and inert, unless a material other than silica is used in an IGSHPA approved, commercially available product that meets all other requirements.

10.7.a.3. Drill cuttings shall not be placed in the borehole as fill material.

10.7.b. Grouting.

10.7.b.1. Grout the entire length of the borehole from bottom to top with bentonite or thermally enhanced grout specifically designed to facilitate heat transfer and provide low permeability.

10.7.b.2. Boreholes with temporary casing may be grouted during or before removal of casing depending on borehole stability.

10.7.b.3. Grouting shall be completed immediately after installing the

geothermal loop when reasonable to do so.

10.7.b.4. Boreholes with permanent casing shall be grouted before the top of the casing is terminated below ground level.

10.7.b.5. Boreholes with no casing shall be looped and grouted immediately after drilling.

10.7.b.6. Boreholes drilled with a mud system in unconsolidated formations shall be looped and grouted immediately after drilling.

10.7.b.7. Slurry mixtures shall be installed by pumping through a tremie pipe using a positive placement technique.

10.7.b.8. When voids are encountered (i.e. mined coal seams or caves), the borehole shall be cased from below the void to the surface.

10.7.c. Flushing, Purging, Pressure, and Flow Testing.

10.7.c.1. Loops shall be pressure tested before installation.

10.7.c.2. Loops shall be pressure tested after installation and grouting.

10.7.c.3. All horizontal components of the ground heat exchanger shall be flushed, pressure tested, and flow tested prior to backfilling.

10.7.c.4. Heat exchangers shall be tested hydrostatically at 150% of the pipe design rating or 300% of the system operating pressure if this value is the smaller of the two.

10.7.c.5. No visible leaks shall occur within a thirty (30) minute period.

10.7.c.6. Soil thermal conductivity testing overseen by an IGSHA certified designer or comparable certification, shall be required for all systems with 50 or more tons capacity. The thermal conductivity test shall be conducted for a minimum of 48 hours.

10.8. Heat Pump Open-Loop Requirements.

10.8.a. Open loop wells shall be constructed in the same manner and conform to the water well construction standards set forth in this rule. This applies to return wells, standing column wells and supply wells. DEP generally requires permits for injecting or returning water to the subsurface and for surface discharges. It is the homeowner's responsibility to obtain any required permits.

10.8.b. Pump tests shall be required for all open loop wells. The pump test shall demonstrate the well's ability to produce 150 percent of the anticipated demand by sustaining this level of volume for twenty-four (24) continuous hours of stabilized flow; recovering to pre-pump test levels within twelve hours.

10.9. Direct Exchange Wells.

10.9.a. Direct exchange wells shall be constructed in the same manner and conform to the construction standards set out in this rule.

10.9.b. The direct exchange loop shall be constructed of copper tubing or other material approved by the Commissioner. All joints in the direct exchange loop shall be soldered and not brazed. The solder used shall withstand stresses associated with the direct exchange process.

10.9.c. The thermal fluid or refrigerant used in the direct exchange well tubing shall be biodegradable and non-toxic.

10.9.d. All loops shall be at least ten (10) feet from underground utilities due to the potential for freezing as heat is removed from the ground for heating.

§64-46-11. Dewatering and Dug Wells Construction.

11.1. Dewatering wells generally withdraw shallow ground water for construction purposes; grouting of the annular space may be minimized. Each dewatering well is unique. Submit plans to the Commissioner for approval. Dewatering wells shall be immediately sealed using methods

described in section 12 of this rule after dewatering has ceased.

11.2. Every hand dug well shall have a continuous watertight lining of steel casing, concrete pipe, or other approved casing material, extending from above ground surface to a depth of at least ten (10) feet below the ground surface. When more than one formation bearing suitable water exists, the lower formation should be used. The lining in the producing zone shall readily admit water and shall be structurally sound to withstand external pressures. Each hand dug well is unique. Develop and submit plans to the Commissioner for approval.

11.2.a. The open space between the excavation and the installed lining shall be sealed with grout. If the first ten (10) feet of the casing is jointed, such as concrete, and would allow surface water to seep into cracks of casing, the grout shall continue from the ten (10) foot seal to ground level.

§64-46-12. Water Well Abandonment.

12.1. When a water well is abandoned, the work shall be performed by a West Virginia Certified Water Well Driller.

12.2. All wells shall be completely filled with grout to prevent contamination from entering the subsurface water bearing formations and ground water mixing with one aquifer to another. Bentonite or cement grout shall be used for grouting material. If the well is so large that, the use of these materials is not practical, the Commissioner shall determine a proper plugging process. Methods and materials shall be selected only after careful consideration of casing material, casing condition, the diameter of the casing, the quality and quantity of the original grout seal, the depth of the well, well plumbness, the hydrogeologic setting, the level of contamination, and the zones where contamination occurs. All abandonment of a water well procedures shall prevent groundwater contamination.

12.3. Screens, casings, and liner pipes shall be pulled whenever possible to assure placement of an effective seal. The borehole shall be

completely sealed in such a manner that the vertical movement of water within the annular space is effectively and permanently prevented. When the casing is removed and the borehole is unstable, grout shall be simultaneously emplaced as the casing is removed to prevent collapse of the borehole; however, if the casing is left in place, the borehole shall be completely grouted from the bottom to the top with approved grouting material to reduce the possibility of annular channeling.

12.4. All pumps, wiring, pipes, valves, accessories, and hardware that may interfere with abandonment of a water well operations shall be removed prior to abandonment of a water well.

12.5. Water wells in consolidated formations shall be completely filled with grout to prevent contaminating materials from entering the subsurface water bearing formations and ground water from one aquifer mixing with that of another aquifer.

12.6. Water wells in unconsolidated formations shall be sealed with bentonite, cement, or a bentonite-cement mixture from bottom to top.

12.7. For abandoned water wells that penetrate limestone or other creviced or channelized rock formations that show a loss of grout while filling; stone, pea gravel, or other approved bridging agents may be used to seal these zones.

12.8. Hand dug or bucket drilled water wells exceeding twenty-four (24) inches in diameter shall be abandoned by the same method and with the same grouting materials as used in unconsolidated formations.

12.9. Flowing artesian wells shall be abandoned with grout from the bottom of the well to the ground surface, using a tremie pipe and pump. The added slurry weight of the cement-based or bentonite materials shall be necessary to overcome the naturally occurring pressuring characteristic of artesian flowing wells. For a large artesian flowing well (pressure head), it may be necessary to control

the head or flow while placing the sealing material with the use of an inflatable packer to stop or restrict the flow of water.

12.10. Boreholes drilled for any geothermal uses or for a potential system that are unused in the final system shall be abandoned in accordance with this section.

§64-46-13. Additional Requirements.

13.1. All installations and operations shall meet or exceed relevant requirements of national, state, or local codes, whichever government body has jurisdiction.

13.2. The Commissioner shall specify construction requirements more stringent than those specified in this rule within specific areas of concern to protect the public health or prevent contamination of groundwater. The specific areas of concern recommendations shall be based on the assessment of the hydrologic condition and contaminant characteristics that may require more stringent design standards. Prior to requiring more stringent standards within a specific area of concern the Commissioner shall submit a report to the advisory board, established under the Bureau's rule, Water Well Regulation, 64CSR19, section 11, for its review and recommendations.

13.3. When the strict application of any provision of this rule presents practical difficulties or unusual hardship, the Commissioner may grant a variance for that specific instance. Variance requests shall be made in writing to the Commissioner on forms prescribed by the Commissioner. The request shall include a thorough description of the site (lot size, the location of sewers, septic tanks, buildings, seepage fields, and other sources of contamination on the property and adjacent property with distances shown to the proposed well) and a brief summary of the provisions for which a variance is requested, and a complete justification as to why the variance is needed. The requestor shall include how the alternate standard protects the quality of groundwater and protects public health and safety. The request shall provide a description of site-specific geologic and soil conditions. The Commissioner shall not grant any variance unless the applicant demonstrates that there will be unusual and unnecessary hardship in complying with the rules; contamination of the water well will not occur as a result of construction and

operation of the system; the health of persons using water from the private water system will not be endangered thereby; and no other technically feasible and economically reasonable means of obtaining water from the proposed type of water source exists. The Commissioner shall notify the applicant in writing within thirty (30) calendar days of its decision to either grant or deny the variance. In all cases, variances shall be approved in advance of the performance of the actual work.

13.3.a. After any variance is issued regarding the location of a well with respect to various contamination sources in Table 46-46 A of this rule, the Commissioner shall take two (2) water samples from the well and have them analyzed for Total coliform and *E. coli* at an approved laboratory. The Commissioner may require analysis for other water quality parameters that may exist in conjunction with the source of potential pollution as necessary to protect the health or safety of potential users. At the time the variance is approved, the Commissioner shall notify the owner as to what these parameters are. One (1) sample shall be taken within thirty (30) days and the second sample shall be taken within sixty (60) days, after completion of the well. After receiving the water analysis, the Commissioner shall determine if a water treatment unit shall be installed to accommodate any water quality problems as determined by the chemical and bacteriological testing.

13.3.b. Examples of location problems which could preclude compliance with this rule include the proposed location of a well being too close to septic tanks, buildings, sewer lines, or barnyards as indicated in Table 64-46 A of this rule.

13.3.c. Examples of public health and engineering principles that may be considered in issuing a variance are ground surface conditions, the depth of the water table, the location of sources of pollutants, the vulnerability of the aquifer to bacteria and other pollutants, and the geologic conditions at the site.

TABLE 64-46 A

Minimum Horizontal Distance Between a Groundwater Well and Source

<u>Source</u>	<u>Minimum Distance</u>
Septic Tanks	50 feet (100 feet)*
Sewage Treatment Facilities	200 feet
Sewers and Drains (Watertight)	10 feet
Drains (Non-watertight)	50 feet (100 feet)
Sewage Holding Tanks and Privies (Vault)	50 feet (100 feet)
Barnyard/Feeding and Watering Areas	100 feet
Streams, Rivers, and Impoundments	25 feet
Sewage Absorption Fields	100 feet
Existing Building or Foundation	10 feet
Storage or Preparation Area for Fertilizers and Pesticides	150 feet
Buried Oil, Gasoline, Chemical Storage Tanks	50 feet (100 feet)
Cemetery	50 feet (100 feet)

*Note: The distance noted in parenthesis is required when a water well is lower in elevation than the source of pollution or contamination referenced.

TABLE 64-46 B
Diameter and Wall Thickness of Plastic Well Casing and Liners

Nominal Size	O.D.*	Class	Minimum Wall Thickness
2"	2.375	SCH 40	.154
3"	3.500	SCH 40	.216
4"	4.500	SDR 26**	.173
		SDR 21	.214
		SDR 17	.265
4 ½ "	4.950	SDR 26**	.190
		SDR 40	.248
		SDR 17	.291
5"	5.563	SDR 21	.265
		SDR 17	.327
6"	6.625	SDR 26**	.255
		SCH 40	.280
		SDR 21	.316
		SDR 17	.390
6 ¼ "	6.900	SDR 21	.329
		SDR 27.6	.250
8"	8.625	SDR 26**	.332
		SDR 21	.410
10"	10.750	SDR 26**	.413
		SDR 21	.511
12"	12.750	SDR26**	.490
		SDR 21	.606
14"	14.000	SCH 40	.437
		SDR 21	.667
16"	16.000	SCH 40	.500
		SDR 26	.616

Note: Dimensions are in inches.

* O. D. = outer (or outside) diameter

** = Used for liner only

Liner Pipe Only for the 2", 3" and 4" nominal pipe size.

All dimensions and weights are subject to normal manufacturing tolerances.

TABLE 64-46 C

Geothermal Water Pressure Ratings at 73.4°F (23.5°C) for DR-PR PE 3408 Plastic Pipe for
Closed Loop Ground Heat Exchangers

Dimension Ration of Pipe	Pressure Rating (psi)
7	267
9	200
9.3	193
11	160
13.5	128
15.5	110
17	100