R309-515 Source Development

Table of Contents

R309. Environmental Quality, Drinking Water.

R309-515. Facility Design and Operation: Source Development.

R309-515-1. Purpose.

This rule specifies requirements for public drinking water sources. It is intended to be applied in conjunction with R309-500 through R309-550. Collectively, these rules govern the design, construction, operation, and maintenance of public drinking water system facilities. These rules are intended to assure that such facilities are reliably capable of supplying adequate quantities of water that consistently meet applicable drinking water quality requirements and do not pose a threat to general public health.

R309-515-2. Authority.

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code Annotated and in accordance with 63G-3 of the same, known as the Administrative Rulemaking Act.

R309-515-3. Definitions.

Definitions for certain terms used in this rule are given in R309-110, but may be further clarified herein.

R309-515-4. General.

(1) Issues to be Considered.

The selection, development, and operation of a public drinking water source must be done in a manner that will protect public health and assure that all required water quality standards, as described in R309-200, are met.

Guidance: Among the issues which should be considered before source selection and any preparation of development plans are the following:

(2) Communication with the Division.

Because of the issues described above in (1), engineers are advised to work closely with the Division to help assure that sources are properly sited, developed, and operated.

(3) Number of Sources and Quantity Requirements.

Community water systems serving more than 100 connections shall have a minimum of two sources, except where served by a surface water treatment plant. For all systems, the total developed source capacity shall equal or exceed the peak day demand of the system. Refer to R309-510-7 of these rules for procedure to estimate the peak day demand.

(4) Quality Requirements.

In selecting a source of water for development, the designing engineer shall demonstrate to the satisfaction of the Director that the source(s) selected for use in public water systems are of satisfactory quality, or can be treated in a manner so that the quality requirements of R309-200 can be met.

(5) Initial Analyses.

All new drinking water sources, unless otherwise noted below, shall be analyzed for the following:

(a) all the primary and secondary inorganic contaminants listed in R309-200, Table 200-1 and Table 200-5 (excluding Asbestos unless it would be required by R309-205-5(2) ;

(b) Ammonia as N; Boron; Calcium; Copper; Lead; Magnesium; Potassium; Turbidity, as NTU; Specific Conductivity at 25 degrees Celsius, micro hos/cm; Bicarbonate; Carbon Dioxide; Carbonate; Hydroxide; Phosphorous, Ortho as P; Silica, dissolved as SiO2; Surfactant as MBAS; Total Hardness as CaCO3; and Alkalinity as CaCO3;

(c) pesticides, PCBs and SOCs as listed in R309-200-5(3)(a), Table 200-2 unless the system is a transient non-community PWS or, if a community PWS or non-transient non-community PWS, has received waivers in accordance with R309-205-6(1)(f). The following six constituents have been excused from monitoring in the State by the EPA, dibromochloropropane, ethylene dibromide, Diquat, Endothall, glyphosate and Dioxin;

(d) VOCs as listed in R309-200-5(3)(b), Table 200-3 unless the system is a transient non-community PWS; and,

(e) radiologic chemicals as listed in R309-200-5(4) unless the system is a non-transient non-community PWS or a transient non-community PWS.

All analyses shall be performed by a certified laboratory as required by R309-205-4 (Specially prepared sample bottles are required),

(6) Source Classification.

Subsection R309-505-7(1)(a)(i) provides information on the classification of water sources. The Director shall classify all existing or new sources as either:

(a) surface water or ground water under direct influence of surface water which requires conventional surface water treatment or an approved equivalent; or as,

(b) ground water not under the direct influence of surface water.

(7) Latitude and Longitude.

The latitude and longitude, to at least the nearest second, or the location by section, township, range, and course and distance from an established outside section corner or quarter corner of each point of diversion shall be submitted to the Director prior to source approval.

R309-515-5. Surface Water Sources.

(1) Definition.

A surface water source, as is defined in R309-110, shall include, but not be limited, to tributary systems, drainage basins, natural lakes, artificial reservoirs, impoundments and springs or wells that have been classified as being directly influenced by surface water. Surface water sources will not be considered for culinary use unless they can be rendered acceptable by conventional surface water treatment or other equivalent treatment techniques acceptable to the Director.

(2) Pre-design Submittal.

The following information must be submitted to the Director and approved in writing before commencement of design of diversion structures and/or water treatment facilities:

(a) a copy of the chemical analyses required by R309-200 and described in R309-515-4(5) above; and,

(b) a survey of the watershed tributary to the watercourse along which diversion structures are proposed. The survey shall include, but not be limited to:

(i) determining possible future uses of impoundments or reservoirs;

(ii) the present stream classification by the Division of Water Quality, any obstacles to having stream(s) reclassified 1C, and determining degree of watershed control by owner or other agencies;

(iii) assessing degree of hazard to the supply by accidental spillage of materials that may be toxic, harmful or detrimental to treatment processes;

(iv) obtaining samples over a sufficient period of time to assess the microbiological, physical, chemical and radiological characteristics and variations of the water;

(v) assessing the capability of the proposed treatment process to reduce contaminants to applicable standards; and,

(vi) consideration of currents, wind and ice conditions, and the effect of tributary streams at their confluence.

(3) Pre-construction Submittal.

Following approval of a surface water source, the following additional information must be submitted for review and approval prior to commencement of construction:

(a) acceptable evidence that the water system has a legal right to divert water for the proposed uses from the proposed sources;

(b) minimum quantity that the surface water source is capable of producing (see R309-515-5(4)(a) below); and,

(c) complete plans and specifications and supporting documentation for the proposed treatment facilities to ascertain compliance with R309-525 or R309-530.

(4) Quantity.

The quantity of water from surface sources shall:

(a) be assumed to be no greater than the low flow of a 25-year recurrence interval or the low flow of record for these sources when 25 years of records are not available;

(b) meet or exceed the anticipated peak day demand for water as estimated in R309-510-7 and provide a reasonable surplus for anticipated growth; and,

(c) be adequate to compensate for all losses such as silting, evaporation, seepage, and sludge disposal, which would be anticipated in the normal operation of the treatment facility.

(5) Diversion Structures.

Design of intake structures shall provide for:

(a) withdrawal of water from more than one level if quality varies with depth;

(b) intake of lowest withdrawal elevation located at sufficient depth to be kept submerged at the low water elevation of the reservoir;

(c) separate facilities for release of less desirable water held in storage;

(d) occasional cleaning of the inlet line;

(e) a diversion device capable of keeping large quantities of fish or debris from entering an intake structure; and,

(f) suitable protection of pumps where used to transfer diverted water (refer to R309-540-5).

(6) Impoundments.

The design of an impoundment reservoir shall provide for, where applicable:

(a) removal of brush and trees to the high water level;

(b) protection from floods during construction;

(c) abandonment of all wells, which may be inundated (refer to applicable requirements of the Division of Water Rights); and,

(d) adequate precautions to limit nutrient loads.

R309-515-6. Ground Water - Wells.

(1) Required Treatment.

If properly developed, water from wells may be suitable for culinary use without treatment. A determination concerning whether treatment may be required can only be made after the source has been developed and evaluated.

(2) Standby Power.

Water suppliers shall assess the capability of their system in the event of a power outage. If a community water system has no naturally flowing water sources such as springs or flowing wells, one or more of the system's sources shall be equipped for operation during power outages. In this event:

(a) to ensure continuous service when the primary power has been interrupted, a redundant power supply shall be provided. A redundant power supply may include a transfer switch for auxiliary power such as a generator or a power supply service with coverage from two independent substations.

(b) when automatic pre-lubrication of pump bearings is necessary, and an auxiliary power supply is provided, the pre-lubrication line shall be provided with a valved by-pass around the automatic control, or the automatic control shall be wired to the emergency power source.

(3) The Utah Division of Water Rights.

The Utah Division of Water Rights (State Engineer's Office) regulates the drilling of water wells. Before the drilling of a well commences, the well driller must receive a start card from the State Engineer's Office. For public drinking water supply wells, the rules of R655-4 apply and shall be followed in addition to these rules.

Guidance: The most current set of Administrative Rules for Water Well Drillers should be consulted for additional well drilling information. The engineer and driller should be aware that requirements governing the design of public drinking water wells, as described herein, are generally more stringent than requirements of the State Engineer's Office.

(4) Source Protection.

Public drinking water systems are responsible for protecting their sources from contamination. The selection of a well location shall only be made after consideration of the requirements of R309-600. Sources shall be located in an area that will minimize threats from existing or potential sources of pollution.

Generally, sewer lines may not be located within zone one and zone two of a public drinking water system's source protection zones. However, if the following precautions are taken, sewer lines may be permitted within a public drinking water system's source protection zone one and zone two. Sewer lines shall meet the conditions identified in R309-600-13(3), and shall be specially constructed as follows throughout zone one in aquifers classified as protected, and zones one and two, if the aquifer is classified as unprotected.

(a) Sewer lines shall be constructed to remain watertight. The lines shall be deflection-tested in accordance with the Division of Water Quality Rule R317-3. The lines shall be video-inspected for any defect following completion of construction and before being placed in service. The sewer pipe material shall be:

(i) high density polyethylene (HDPE) pipe with a PE3408 or PE4710 rating from the Plastic Pipe Institute and have a Dimension Ratio (DR) of 17 or less, and all joints shall be fusion-welded; or,

(ii) polyvinyl chloride (PVC) pipe meeting AWWA Specification C900 or C905 and have a DR of 18 or less. PVC pipe shall be either restrained gasketed joints or shall be fusion-welded. Solvent cement joints shall not be acceptable. The PVC pipe shall be clearly identified when installed, by marking tape or other means as a sanitary sewer line; or,

(iii) ductile iron pipe with ceramic epoxy lining, polyethylene encasement, restrained joints, and a minimum pressure class of 200.

(b) Procedures for leakage tests shall be specified and comply with Division of Water Quality Rule R317-3 requirements.

(c) Lateral to main connection shall be fusion-welded, shop-fabricated, or saddled with a mechanical clamping watertight device designed for the specific pipe.

(d) Inlet and outlet sewer pipes shall be joined to a manhole with a gasketed flexible watertight connection.

(e) The sewer pipe shall be laid with no greater than 2 percent deflection at any joint.

(f) Backfill shall be compacted to not less than 95 percent of maximum laboratory density as determined in accordance with ASTM Standard D-690.

(g) Sewer manholes shall meet the following requirements.

(i) The manholes shall be constructed of reinforced concrete.

(ii) Manhole base and walls, up to a point at least 12 inches above the top of the upper most sewer pipe entering the manhole, shall be fabricated in a single concrete pour without joints.

(iii) The manholes shall be air pressure tested after installation.

(h) In unprotected aquifers, an impermeable cutoff wall shall be constructed in all sewer trenches on the up-gradient edge of zone two. In protected aquifers, an impermeable cutoff wall shall be constructed in all sewer trenches on the up-gradient edge of zone one.

(5) Outline of Well Approval Process.

(a) Well drilling shall not commence until both of the following items are submitted and receive a favorable review:

(i) a Preliminary Evaluation Report on source protection issues as required by R309-600-13, and

(ii) engineering plans and specifications governing the well drilling, prepared by a licensed well driller holding a current Utah Well Drillers License or prepared, signed, and stamped by a licensed professional engineer or professional geologist licensed to practice in Utah.

(b) Inspection of Well Sealing During Construction.

(i) Authorized Individuals

(A) The following individuals are authorized to witness the well sealing procedure for a public drinking water well:

(I) an engineer or a geologist from the Division of Drinking Water;

(II) a district engineer of the Department of Environmental Quality;

(III) an authorized representative of the Division of Water Rights; or,

(IV) an individual having written authorization from the Director and meeting the below listed criteria.

(B) At the time of the well sealing an individual, who is authorized per (i)(A)(IV), shall present to the well driller a copy of the letter authorizing him or her to witness a well sealing on behalf of the Division of Drinking Water. A copy of this letter shall be appended to the witness certification letter.

(C) At least three days before the anticipated well sealing, the well driller shall arrange for an authorized witness listed in (i)(A) above to witness the procedure. (See R309-515-6(6)(i)).

(ii) Obtaining Authorization

(A) To be authorized per (i)(A)(IV) above to witness a well sealing procedure, an individual must have no relationship to the driller or the well's owner. The individual must have at least five years professional experience designing wells, supervising well drilling or other equivalent experience associated with well drilling or well sealing that is acceptable to the Director.

(B) Individuals, desiring the Director's authorization to witness a well sealing procedure, shall provide the following information to the Director for review over his or her signature attesting to the correctness of the information:

(I) a detailed description of the applicant's experience with well drilling projects, including number of years of experience and type of work. Three references confirming this professional experience are required.

(II) evidence of licensure as a professional engineer or professional geologist in Utah.

(III) no relationship may exist between a person authorized to witness well sealings and a well driller that would serve as the basis for suspicion of favoritism, leniency, or punitive action in the performance of this task. Examples of such relationships would be family; former long-term employment associations; business partnerships, either formal or informal; etc. The Director's decision, with right of appeal as provided in R305-7, shall be accepted relative to what constitutes a conflict of interest or a relationship sufficient to disqualify an applicant from all or specific witness opportunities.

(IV) An acknowledgement that he/she would not be acting as an agent or employee of the State of Utah and any losses

incurred while acting as a witness would not be covered by governmental immunity or Utah's insurance.

(V) Willingness to follow established protocols and attend such training events as may be required by the Director.

(VI) Complete with a minimum 75 percent passing grade, an examination on water well drilling rules, as offered by the Division of Water Rights.

(C) The Director may rescind the authorization if an individual fails to comply with the criteria or conditions of authorization listed above.

Guidance: A conflict of interest occurs whenever a duty, such as acting in the interest of the public, intersects with a personal desire (either positive or negative), such as monetary gain or a personal relationship, requiring a decision to be made between them. Each individual faced with a conflict between acting in the public's interest or acting for personal benefit is expected to act in the public's interest as it relates to sealing a well. Questions relating to possible conflicts may be referred to the Director.

(iii) Well Seal Certification

The individual witnessing the well sealing procedure shall provide a signed letter, including the following information, to the Director within 30 days of the well sealing:

(A) certification that the well sealing procedure met all the requirements of Rule R309-515-6(6)(i);

(B) the water right under which the well was drilled and the well driller's license number;

(C) the public water system name (if applicable);

(D) the latitude and longitude of the well and method used for its determination;

(E) the well head's approximate elevation;

(F) casing diameter(s), length(s), and material(s);

(G) the size of the annulus between the borehole and casing;

(H) a description of the sealing process including the sealing material used, its volume, density, method of placement, and depth from surface; and,

(I) the names and company affiliations of other individuals observing the sealing procedure including, but not limited to, the well driller, the well owner, and/or a consultant.

(c) After completion of the well drilling, the following information shall be submitted and receive a favorable review before water from the well can be introduced into a public water system:

(i) a copy of the "Report of Well Driller" as required by the State Engineer's Office which is complete in all aspects and has been stamped as received by the same;

(ii) a copy of the letter from the authorized individual described in R309-515-6(5)(b) above, indicating inspection and confirmation that the well was grouted in accordance with the well drilling specifications and the requirements of this rule;

(iii) a copy of the aquifer drawdown test data, as a minimum, including the yield versus drawdown test data, as described in R309-515-6(10)(b) along with comments and interpretation by a licensed professional engineer or licensed professional geologist of the graphic drawdown information required by R309-515-6(10)(b)(vi)(E);

(iv) a copy of the chemical analyses required by R309-515-4(5);

(v) acceptable evidence that the water system owner has a legal right to divert water for the proposed use(s) from the well source(s);

(vi) a copy of complete plans and specifications prepared, signed, and stamped by a licensed professional engineer covering the well housing, equipment, and diversion piping necessary to introduce water from the well into the distribution system; and

(vii) a bacteriological analysis of water obtained from the well after installation of permanent equipment, disinfection, and flushing.

(d) An Operation Permit shall be obtained in accordance with R309-500-9 before any water from the well is introduced into a public water system.

(6) Well Materials, Design, and Construction.

(a) ANSI/NSF Standards 60 and 61 Certification.

All interior surfaces must consist of products complying with ANSI/NSF Standard 61. This requirement applies to drop pipes, well screens, coatings, adhesives, solders, fluxes, pumps, switches, electrical wire, sensors, and all other equipment or surfaces which may contact the drinking water.

All substances introduced into the well during construction or development shall be certified to comply with ANSI/NSF Standard 60. This requirement applies to drilling fluids (biocides, clay thinners, defoamers, foamers, loss circulation materials, lubricants, oxygen scavengers, viscosifiers, weighting agents) and regenerants.

(b) Permanent Steel Casing Pipe shall:

(i) be new single steel casing pipe meeting AWWA Standard A-100, ASTM or API specifications and having a minimum weight and thickness as given in Table 6 found in R655-4-11.2.3 of the Utah Administrative Code (Administrative Rules for Water Well Drillers, adopted April 11, 2011, Division of Water Rights);

(ii) have additional thickness and weight, if minimum thickness is not considered sufficient to assure reasonable life expectancy of the well;

(iii) be capable of withstanding forces to which it is subjected;

(iv) be equipped with a drive shoe when driven;

(v) have full circumferential welds or threaded coupling joints; and

(vi) project at least 18 inches above the anticipated final ground surface and at least 12 inches above the anticipated pump house floor level. At sites subject to flooding, the top of the well casing shall terminate at least three feet above the 100-year flood level or the highest known flood elevation, whichever is higher.

(c) Non-Ferrous Casing Material.

The use of any non-ferrous material for a well casing shall receive prior approval of the Director based on the ability of the material to perform its desired function. Thermoplastic water well casing pipe shall meet AWWA Standard A100-06 and shall bear the logo NSF-wc indicating compliance with NSF Standard 14 for use as well casing.

Guidance: Approval for non-ferrous well casing will be determined considering well depth, formations, temperatures, corrosion potential, well seal material, and other pertinent information.

(d) Disposal of Cuttings.

Cuttings and waste from well drilling operations shall not be discharged into a waterway, lake, or reservoir. The rules of the Utah Division of Water Quality must be observed with respect to these discharges.

(e) Packers.

Packers, if used, shall be of material that will not impart taste, odor, toxic substances, or bacterial contamination to the well water. Lead or partial lead packers are specifically prohibited.

(f) Screens.

The use of well screens is recommended where appropriate and, if used, they shall:

(i) be constructed of material resistant to damage by chemical action of groundwater or cleaning operations;

(ii) have size of openings based on sieve analysis of formations or gravel pack materials;

(iii) have sufficient diameter to provide adequate specific capacity and low aperture entrance velocities;

Guidance: Usually the entrance velocities should not exceed 0.1 fps.

(iv) be installed so that the operating water level remains above the screen under all pumping conditions; and,

(v) be provided with a bottom plate or wash-down bottom fitting of the same material as the screen.

(g) Plumbness and Alignment Requirements.

Every well shall be tested for plumbness and vertical alignment in accordance with AWWA Standard A100. Plans and specifications submitted for review shall:

(i) have the test method and allowable tolerances clearly stated in the specifications; and,

(ii) clearly indicate any options the design engineer may have if the well fails to meet the requirements. Generally, wells may be accepted if the misalignment does not interfere with the installation or operation of the pump or uniform placement of grout.

(h) Casing Perforations.

The placement of perforations in the well casing shall:

(i) be located, as far as practical, to permit the uniform collection of water around the circumference of the well casing; and,

(ii) be of dimensions and size to restrain the water bearing soils from entrance into the well.

(i) Well Sealing Techniques and Requirements.

For all public drinking water wells, the annulus between the outermost well casing and the borehole wall shall be sealed with grout to a depth of at least 100 feet below the ground surface unless an "exception" is issued by the Director (see R309-500-4(1)). If more than one casing is used, including a conductor casing, the annulus between the outermost casing and the next inner casing shall be sealed with grout (meeting the sealing materials requirements of R309-515-6(6)(i)(ii) herein) or with a water tight steel ring having a thickness equal to that of the permanent well casing and continuously welded to both casings. If a public drinking water well will be equipped with a pitless adapter or unit, a well seal shall be installed to a minimum depth of 110 feet to take into account the top 10 feet of compromised seal interval.

Guidance: This is required in order to prevent the seepage of undesirable surface or shallow ground water along the casing into the water bearing aquifer. The Division of Water Rights Administrative Rules for Water Wells Rule R655-4-11.7.5, Pitless Adapters/Units states, "A cement grout seal shall not be allowed within the pitless unit or pitless adapter sealing interval. The pitless adapter or unit sealing interval shall be sealed with unhydrated bentonite. The pitless adapter or unit, including the cap or cover, pitless case and other attachments, shall be designed and constructed to be watertight to prevent the entrance of contaminants into the well from surface or near-surface sources." Therefore, a cement seal shall not be used in the future pitless interval as a cement seal would need to be chipped and broken away from the casing when the pitless area is excavated and installed which could lead to casing damage. A bentonite seal must be used in the future pitless interval.

The following shall apply to all drinking water wells:

(i) Consideration During Well Construction.

(A) Sufficient annular opening shall be provided to permit a minimum of two inches of grout between the outermost permanent casing and the drilled hole, taking into consideration any joint couplings.

(B) The casing(s) must be placed to permit unobstructed flow and uniform thickness of grout.

Guidance: For the purpose of determining the dimension of the annular opening between the drilled hole and or any carrier casing or permanent casing which may be used, the nominal pipe dimension of casing or hole can be used. Centralizers, casing spacers, or welded guides are recommended to center the casing and to provide uniform grout thickness.

(ii) Sealing Materials.

(A) Neat Cement Grout.

Cement, conforming to ASTM Standard C150, and water, with no more than six gallons of water per sack of cement, shall be used for two-inch openings. Additives may be used to increase fluidity subject to approval by the Director.

(B) Concrete Grout.

Equal parts of cement conforming to ASTM Standard C150, and sand, with not more than six gallons of water per sack of cement, may be used for openings larger than two inches.

(C) Clay Seal.

Where an annular opening greater than six inches is available, a seal of swelling bentonite meeting the requirements of R655-4-11.4.2 may be used when approved by the Director.

(iii) Application.

(A) When the annular opening is less than four inches, grout shall be installed under pressure, by means of a positive displacement grout pump, from the bottom of the annular opening to be filled.

(B) When the annular opening is four or more inches and 100 feet or less in depth, and concrete grout is used, it may be placed by gravity

through a grout pipe installed to the bottom of the annular opening in one continuous operation until the annular opening is filled.

(C) All temporary construction casings shall be removed prior to or during the well sealing operation. Any exceptions shall be approved by the State Engineer's Office, and evidence of State Engineer's Office's approval shall be submitted to the Director (see R655-4-11.4.3.1 for conditions concerning leaving temporary surface casing in place). A temporary construction casing is a casing not intended to be part of the permanent well.

(D) When a "well in a protected aquifer" classification is desired, the grout seal shall extend from the ground surface down to at least 100 feet below the surface, and through the protective clay layer (see R309-600-6(1)(x)).

(E) After cement grouting is applied, work on the well shall be discontinued until the cement or concrete grout has properly set, usually a period of 72 hours.

Guidance: "Public Water Supply Well Grouting Requirements and Procedures" is available on the Division's website as additional information for grout placement.

(j) Water Entered Into Well During Construction.

Any water entering a well during construction shall not be contaminated and should be obtained from a chlorinated municipal system. Where this is not possible, the water must be treated to produce a 100 mg/l free chlorine residual in accordance with R655-4-11.6.5.

(k) Gravel Pack Wells.

The following shall apply to gravel packed wells:

(i) the gravel pack material shall be of well-rounded particles, at least 90 percent siliceous material, no more than five percent acid solubility, smooth and uniform, free of foreign material, properly sized, washed, and then disinfected immediately prior to or during placement;

(ii) the gravel pack shall be placed in one uniform continuous operation;

(iii) refill pipes, when used, shall be Schedule 40 steel pipe incorporated within the pump foundation and terminated with screwed or welded caps at least 12 inches above the pump house floor or concrete apron;

(iv) refill pipes located in the grouted annular opening shall be surrounded by a minimum of 1.5 inches of grout;

(v) protection shall be provided to prevent leakage of grout into the gravel pack or screen; and,

(vi) any casings not withdrawn entirely shall meet requirements of R309-515-6(6)(b) or R309-515-6(6)(c).

(7) Well Development.

(a) Every well shall be developed to remove the native silts and clays, drilling mud, or finer fraction of the gravel pack.

(b) Development should continue until the maximum specific capacity is obtained from the completed well.

(c) Where chemical conditioning is required, the specifications shall include provisions for the method, equipment, chemicals, testing for residual chemicals, and disposal of waste and inhibitors.

(d) Where blasting procedures may be used, the specifications shall include the provisions for blasting and cleaning. Special attention shall be given to assure that the grouting and casing are not damaged by the blasting.

(8) Capping Requirements.

(a) The well shall be securely capped in accordance with R655-4-14.1 until permanent equipment can be installed.

(b) At all times during the progress of work, the contractor shall provide protection to prevent tampering with the well or entrance of foreign materials.

Guidance: A welded metal plate or a threaded cap is the preferred method for capping a completed well until permanent equipment is installed.

(9) Well Abandonment.

(a) Test wells and groundwater sources, which will be permanently abandoned, shall be abandoned in accordance with R655-4-14.

(b) Wells to be abandoned shall be sealed to prevent undesirable exchange of water from one aquifer to another. Preference shall be given to using a neat cement grout. Where fill materials are used, which are other than cement grout or concrete, they shall be disinfected and free of foreign materials. When an abandoned well is filled with cement-grout or concrete, these materials shall be applied to the well- hole through a pipe, tremie, or bailer.

(10) Well Assessment.

(a) Step Drawdown Test.

Preliminary to the constant-rate test required below, it is recommended that a step-drawdown test (uniform increases in pumping rates over uniform time intervals with single drawdown measurements taken at the end of the intervals) be conducted to determine the maximum pumping rate for the desired intake setting.

(b) Constant-Rate Test.

A "constant-rate" yield and drawdown test shall:

(i) be performed on every production well after well development and prior to placement of the permanent pump;

(ii) have the test methods clearly indicated in the specifications;

(iii) have a test pump with sufficient capacity that when pumped against the maximum anticipated drawdown, it will be capable of pumping in excess of the desired design discharge rate;

(iv) provide for continuous pumping for at least 24 hours or until stabilized drawdown has continued for at least six hours when test pumped at a "constant-rate" equal to the desired design discharge rate,

(v) provide the following data:

(A) capacity vs. head characteristics for the test pump (manufacturer's pump curve);

(B) static water level (in feet to the nearest tenth, as measured from an identified datum; usually the top of casing);

(C) depth of test pump intake; and,

(D) time and date of starting and ending test(s);

Guidance: It is recommended to monitor any existing wells in the area during the pump test to perform a more useful aquifer test and determine if there will be interference from other wells.

(vi) For the "constant-rate" test, provide the following at time intervals sufficient for at least ten essentially uniform intervals for each log cycle of the graphic evaluation required below:

(A) record the time since starting test (in minutes);

(B) record the actual pumping rate;

(C) record the pumping water level (in feet to the nearest tenth, as measured from the same datum used for the static water level;

(D) record the drawdown (pumping water level minus static water level in feet to the nearest tenth);

(E) provide graphic evaluation on semi-logarithmic graph paper by plotting the drawdown measurements on the arithmetic scale at locations corresponding to time since starting test on the logarithmic scale; and,

(vii) Immediately after termination of the constant-rate test, and for a period of time until there are no changes in depth to water level measurements for at least six hours, record the following at time intervals similar to those used during the constant-rate pump test:

(A) time since stopping pump test (in minutes),

(B) depth to water level (in feet to the nearest tenth, as measured from the same datum used for the pumping water level).

(c) Safe Yield.

If the aquifer drawdown test data shows that the drawdown has stabilized, the Director will consider 2/3 of the pumping rate used in the constant-rate test as the safe yield to determine the number of permanent residential connections or ERCs that a well source can support.

(11) Well Disinfection.

Every new, modified, or reconditioned well including pumping equipment shall be disinfected before being placed into service for drinking water use. These shall be disinfected according to AWWA Standards C654-03 and A100-06 as modified to incorporate the following as a minimum standard:

(i) the well shall be disinfected with a chlorine solution of sufficient volume and strength and so applied that a concentration of at least 50 parts per million is obtained in all parts of the well and the equipment installed in the well. This solution shall remain in the well for a period of at least eight hours; and,

(ii) a satisfactory bacteriologic water sample analysis shall be obtained prior to the use of water from the well in a public water system.

(12) Well Equipping.

(a) Naturally Flowing Wells.

Naturally flowing wells shall:

(i) have the discharge controlled by valves;

(ii) be provided with permanent casing and sealed by grout; and,

(iii) if erosion of the confining bed adjacent to the well appears likely, special protective construction may be required by the Director.

(b) Well Pumps.

(i) The design discharge rate of the well pump shall not exceed the rate used during the constant-rate aquifer drawdown test.

(ii) Wells equipped with line shaft pumps shall:

(A) have the casing firmly connected to the pump structure or have the casing inserted into the recess extending at least 0.5 inches into the pump base;

(B) have the pump foundation and base designed to prevent fluids from coming into contact with joints between the pump base and the casing;

(C) be designed such that the intake of the well pump is at least ten feet below the maximum anticipated drawdown elevation; and,

(D) avoid the use of oil lubrication for pumps with intake screens set at depths less than 400 feet (see R309-105-10(7) and/or R309-515-8(2)for additional requirements of lubricants).

(iii) Where a submersible pump is used:

(A) the top of the casing shall be effectively sealed against the entrance of water under all conditions of vibration or movement of conductors or cables;

(B) the electrical cable shall be firmly attached to the riser pipe at 20-foot intervals or less; and,

(C) the intake of the well pump must be at least ten feet below the maximum anticipated drawdown elevation.

(c) Pitless Well Units and Adapters.

If the excavation surrounding the well casing allowing installation of the pitless unit compromises the surface seal, the competency of the surface seal shall be restored. Torch-cut holes in the well casing shall be to neat lines closely following the outline of the pitless adapter and completely filled with a competent weld with burrs and fins removed prior to the installation of the pitless unit and adapter.

Pitless well units and adapters shall:

(i) be used to make a connection to a water well casing that is made below the ground. A below-the-ground connection shall not be submerged in water during installation;

(ii) terminate at least 18 inches above final ground elevation or three feet above the highest known flood elevation, whichever is greater;

(iii) contain a label or have a certification indicating compliance with the Water Systems Council Pitless Adapter Standard (PAS-97);

(iv) have suitable access to the interior of the casing in order to disinfect the well;

(v) have a suitable sanitary seal or cover at the upper terminal of the casing that will prevent the entrance of any fluids or contamination, especially at the connection point of the electrical cables;

(vi) have suitable access so that measurements of static and pumped water levels in the well can be obtained;

(vii) allow at least one check valve within the well casing;

(viii) be furnished with a cover that is lockable or otherwise protected against vandalism or sabotage;

(ix) be shop-fabricated from the point of connection with the well casing to the unit cap or cover;

(x) be of watertight construction throughout;

(xi) be constructed of materials at least equivalent to and having wall thickness compatible to the casing;

(xii) have field connection to the lateral discharge from the pitless unit of threaded, flanged, or mechanical joint connection;

(xiii) be threaded or welded to the well casing. If the connection to the casing is by field weld, the shop-assembled unit must be designed specifically for field welding to the casing. The only field welding permitted on the pitless unit is to connect the pitless unit to the casing; and,

(xiv) have an inside diameter as great as that of the well casing, up to and including casing diameters of 12 inches, to facilitate work and repair on the well, pump, or well screen.

(d) Well Discharge Piping.

The discharge piping shall:

(i) be designed so that the friction loss will be low;

(ii) have control valves and appurtenances located above the pump house floor when an above-ground discharge is provided;

(iii) be protected against the entrance of contamination;

(iv) be equipped with a smooth-nosed sampling tap, a check valve, a pressure gauge, a means of measuring flow, and a shutoff valve (with the smooth-nosed sampling tap being the first item from the well head and the shut-off valve as the last item), unless it is a naturally flowing well which may need an alternative design;

(v) where a well pumps directly into a distribution system, be equipped with an air release vacuum relief valve located upstream from the check valve, with exhaust/relief piping terminating in a down-turned position at least six inches above the well house floor and covered with a No. 14 mesh corrosion resistant

screen. An air release vacuum relief valve is not required if the specific proposed well head valve and piping design includes provisions for pumping to waste all trapped air before water is introduced into the distribution system;

(vi) have all exposed piping valves and appurtenances protected against physical damage and freezing;

(vii) be properly anchored to prevent movement;

(viii) be properly protected against surge or water hammer; and,

(ix) if a pump to waste line exists, it shall not be connected to a sewer/storm drain without a minimum 12-inch clearance to the flood rim, and the discharge end of the pump-to-waste line shall be downturned and covered with a No. 4 mesh corrosion resistant screen (refer to R309-545-10(1)).

Guidance: It is recommended that discharge piping be provided with a means of pumping to waste. All pump-to-waste discharge lines should be designed for complete drainage to minimize freezing and unprotected cross connection problems.

Guidance: Provisions should be made for venting the well casing to atmosphere, particularly if a large or sudden water drawdown is expected. The vent shall terminate in a down turned position, at or above the top of the casing or pitless unit in a minimum 1.5 inch diameter opening covered with a No. 14 mesh, corrosion resistant screen (refer to section R309-545-15). The pipe connecting the casing to the vent shall be of adequate size to provide rapid venting of the casing.

(e) Water Level Measurement.

(i) Provisions shall be made to permit periodic measurement of water levels in the completed well.

(ii) Where permanent water level measuring equipment is installed, it shall be made using corrosion resistant materials attached firmly to the drop pipe or pump column and installed to prevent entrance of foreign materials.

(f) Observation Wells.

Observation wells shall be:

(i) constructed in accordance with the requirements for permanent wells if they are to remain in service after completion of a water supply well; and,

(ii) protected at the upper terminal to preclude entrance of foreign materials.

(g) Electrical Protection.

Sufficient electrical controls shall be placed on all pump motors to eliminate electrical problems due to phase shifts, surges, lightning, etc.

(13) Well House Construction.

The use of a well house is strongly recommended, particularly in installations utilizing above ground motors.

In addition to applicable provisions of R309-540, well pump houses shall conform to the following:

(a) Casing Projection Above Floor.

The permanent casing for all ground water wells shall project at least 12 inches above the pump house floor or concrete apron surface and at least 18 inches above the final ground surface. However, casings terminated in underground vaults may be permitted if the vault is provided with a “drain-to-daylight” sized to handle in excess of the well flow and surface runoff is directed away from the vault access.

(b) Floor Drain.

Where a well house is constructed, the floor surface shall be at least six inches above the final ground elevation and shall be sloped to provide drainage. A "drain-to-daylight" shall be provided unless highly impractical.

(c) Earth Berm.

Sites subject to flooding shall be provided with an earth berm terminating at an elevation at least two feet above the highest known flood elevation or other suitable protection as determined by the Director.

(d) Well Casing Termination at Flood Sites.

The top of the well casing at sites subject to flooding shall terminate at least three feet above the 100-year flood level or the highest known flood elevation, whichever is higher (refer to R309-515-6(6)(b)(vi)).

(e) Miscellaneous.

The well house shall be ventilated, heated, and lighted in such a manner as to assure adequate protection of the equipment (refer to R309-540-5(2) (a) through (h)).

(f) Fencing.

Where necessary to protect the quality of the well water, the Director may require that certain wells be fenced in a manner similar to fencing required around spring areas.

(g) Access.

An access shall be provided either through the well house roof or sidewalls in the event the pump must be pulled for replacement or servicing the well.

R309-515-7. Ground Water - Springs.

(1) General.

Springs vary greatly in their characteristics and they should be observed for some time prior to development to determine any flow and quality variations. Springs determined to be under the direct influence of surface water shall comply with surface water treatment requirements.

(2) Source Protection.

Public drinking water systems are responsible for protecting their spring sources from contamination. The selection of a spring shall only be made after consideration of the requirements of R309-515-4. Springs must be located in an area that shall minimize threats from existing or potential sources of pollution. A Preliminary Evaluation Report on source protection issues is required by R309-600-13(2). If certain precautions are taken, sewer lines may be permitted within a public drinking water system's source protection zones at the discretion of the Director. When sewer lines are permitted in protection zones both sewer lines and manholes shall be specially constructed as described in R309-515-6(4).

(3) Surface Water Influence.

Some springs yield water that has been filtered underground for years; other springs yield water that has been filtered underground only a matter of hours. Even with proper development, the untreated water from certain springs may exhibit turbidity and high coliform counts. This indicates that the spring water is not being sufficiently filtered in underground travel. If a spring is determined to be under the direct influence of surface

water, it shall be treated to meet the surface water treatment requirements specified in R309-505-6.

(4) Pre-construction Submittal

Before beginning spring development construction, the following information shall be submitted to the Director and approved in writing:

(a) detailed plans and specifications covering the development work;

(b) if available, a copy of an engineer's or geologist's statement indicating:

(i) the historical record of spring flow variation;

(ii) expected minimum flow and the time of year it will occur;

(iii) expected maximum flow and the time of year it will occur;

(iv) expected average flow; and,

(v) the behavior of the spring during drought conditions;

(c) acceptable evidence that the water system has a legal right to divert water for the proposed use(s) from the spring source(s);

(d) a Preliminary Evaluation Report on source protection issues as required by R309-600-13;

Guidance: The public water system management and the design engineer should refer to R309-505-7(1) before considering a spring as a source for a public water system.

(e) a copy of the chemical analyses required by R309-515-4(5); and,

(f) an assessment of whether the spring is under the direct influence of surface water (refer to R309-505-7(1)(a)).

Guidance: This assessment can be based on site inspection, known geological conditions, or specific water analysis, such as Microscopic Particulate Analysis (MPA) and chemical analysis.

(5) Information Required after Spring Development.

After development of a spring as a drinking water source, the following information shall be submitted to the Director for review.

(a) proof of satisfactory bacteriologic quality ;

(b) information on the rate of flow developed from the spring.

Immediately after spring development, the water system shall collect monthly spring flow data during operating seasons when the spring is reasonably accessible, as a minimum, for three years, and submit spring flow data to the Director for determination of spring yield. After evaluating the spring flow information including seasonal and annual variations, the Director will determine a spring yield, which will be used in assessing the number of and type of connections that can be served by the spring. The spring yield typically is set at the 25th percentile of the spring flow data. If the spring exhibits significant seasonal or annual variations, the spring yield may be assessed on a case-by-case basis.

(c) Record drawings of spring development.

(6) Operating Permit Required.

Water from the spring can be introduced into a public water system only after it has been approved for use, in writing, as evidenced by the issuance of an Operating Permit by the Director (see R309-500-9).

(7) Spring Development.

The development of springs for drinking water purposes shall comply with the following requirements.

(a) The spring collection device, whether it be collection tile, perforated pipe, imported gravel, infiltration boxes, or tunnels must be covered with a minimum of 10 feet of relatively impervious soil cover. Such cover must extend a minimum of 15 feet in all horizontal directions from the spring collection device. Clean, inert, non-organic material shall be placed in the vicinity of the collection device(s).

(b) Where it is impossible to achieve the 10 feet of relatively impervious soil cover, an acceptable alternate will be the use of an impermeable liner provided that:

(i) the liner has a minimum thickness of at least 40 mils;

(ii) all seams in the liner are folded or welded to prevent leakage;

(iii) the liner is certified as complying with ANSI/NSF Standard 61. This requirement is waived if certain that the drinking water will not contact the liner;

(iv) the liner is installed in such a manner as to assure its integrity. No stones, two inch or larger or sharp edged, shall be located within two inches of the liner;

(v) a minimum of two feet of relatively impervious soil cover is placed over the impermeable liner; and,

(vi) the soil and liner cover are extended a minimum of 15 feet in all horizontal directions from the collection devices.

(c) Each spring collection area shall be provided with at least one collection box to permit spring inspection and testing.

(d) All junction boxes and collection boxes, must comply with R309-545 with respect to access openings, venting, and tank overflow. Lids for these spring boxes shall be gasketed and the box adequately vented.

(e) The spring collection area shall be surrounded by a fence located a distance of 50 feet (preferably 100 feet if conditions allow) from all collection devices on land at an elevation equal to or higher than the collection device, and a distance of 15 feet from all collection devices on land at an elevation lower than the collection device. The elevation datum to be used is the surface elevation at the point of collection. The fence shall be at least "stock tight" (see R309-110). In remote areas where no grazing or public access is possible, an exception to the fencing requirement may be granted by the Director. In populated areas, a six-foot high chain link fence with three strands of barbed wire may be required.

(f) Within the fenced area all vegetation having deep roots shall be removed by a means not negatively affecting water quality.

(g) A diversion channel, or berm, capable of diverting all anticipated surface water runoff away from the spring collection area shall be constructed immediately inside the fenced area.

(h) A permanent flow-measuring device shall be installed. Flow measurement devices such as critical depth meters or weirs shall be properly housed and otherwise protected.

(i) The spring shall be developed as thoroughly as possible to minimize the possibility of excess spring water ponding within the collection area. Where the ponding of spring water is unavoidable, the excess shall be collected by shallow

piping or french drain, and be routed beyond and down grade of the fenced area required above, whether or not a fence is in place.

R309-515-8. Operation and Maintenance.

(1) Spring Collection Area Maintenance.

(a) Spring collection areas shall be periodically (preferably annually) cleared of deep-rooted vegetation to prevent root growth from clogging collection lines. Frequent hand or mechanical clearing of spring collection areas and diversion channel is strongly recommended. It is advantageous to encourage the growth of grasses and other shallow rooted vegetation for erosion control and to inhibit the growth of more detrimental flora.

(b) No pesticide (e.g., herbicide) may be applied on a spring collection area without the prior written approval of the Director. Such approval can be granted only when:

(i) acceptable pesticides are proposed;

(ii) the pesticide product manufacturer certifies that no harmful substance will be imparted to the water; and,

(iii) spring development construction meets the requirements of these rules.

(2) Pump Lubricants.

The U.S. Food and Drug Administration (FDA) has approved propylene glycol and certain types of mineral oil for occasional contact with or for addition to food products. These oils are commonly referred to as "food-grade mineral oils". All oil lubricated pumps shall utilize food grade mineral oil suitable for human consumption as determined by the Director.

(3) Algicide Treatment.

No algicide shall be applied to a drinking water source unless specific approval is obtained from the Director. Such approval will be given only if the algicide is certified as meeting the requirements of ANSI/NSF Standard 60, Water Treatment Chemicals - Health Effects.

KEY: drinking water, source development, source maintenance
Date of Enactment or Last Substantive Amendment: January 21, 2014
Notice of Continuation: March 22, 2010
Authorizing, and Implemented or Interpreted Law: 19-4-104

Page Deliberately Left Blank