

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

RULES AND REGULATIONS GOVERNING THE ENFORCEMENT
OF CHAPTER 46-13.2 RELATING TO THE DRILLING
OF DRINKING WATER WELLS

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

DIVISION OF GROUNDWATER AND FRESHWATER WETLANDS
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TABLE OF CONTENTS

SECTION	PAGE
1.00 Purpose	1
2.00 Authority	1
3.00 Definitions	1
4.00 Registration Required to Construct or Alter Wells	17
5.00 Application Procedures and Qualifications	17
6.00 Well Completion Report	18
7.00 Construction Standards for Non-Public Water Wells	19
8.00 Maintenance, Repair and Deepening of Wells	28
9.00 Abandonment of Wells	28
Appendix A Well completion Report	
Appendix B Well Disinfection Guidelines	
Appendix C Well Yield Guidelines	

RULES AND REGULATIONS GOVERNING THE ENFORCEMENT OF CHAPTER 46-13.2
RELATING TO THE DRILLING OF DRINKING WATER WELLS

1.00 Purpose

1.01 The purpose of the regulations is to establish the minimum standards for the design, construction installation and location of groundwater wells and the procedures for registering well drillers and pump installers.

2.00 Authority

2.01 Authority for these rules and regulations is contained in 46-13.2-4 of the general laws of Rhode Island.

3.00 Definitions

3.01 Abandonment, permanent: means to remove a well from service by completely filling it in such a manner that vertical movement of water within the well bore and within the annular space surrounding the well casing, is effectively and permanently prevented.

Abandonment, temporary: means to remove a drilling machine from a well site prior to putting the well into service or returning it to service or subsequent to completing or altering a well, or to remove a well from service with the intent of using it in the future.

Access Port: means a minimum 3/4 inch tapped hole and plug or a 3/4 inch capped pipe welded onto the casing in the upper portion of a well casing to permit entry of water-level measuring devices into the well.

Adequate Protection: Construction methods which assure protection of ambient groundwater from the introduction of contamination.

Airline: means a water level measuring device consisting of a pressure gauge attached to an airtight line or pipe within the well bore extending from land surface to below the pumping level measuring the stable air pressure remaining in the line after completely purging water from within the line.

Alter: The replacing or repairing of any portion of an existing water supply system: and the terms "alteration" and "altering" shall be construed accordingly.

Altering a well: means the deepening, reaming, casing, recasing, perforation, re-perforating, installation of liner pipe, packers, seals, and any other material change in the design or construction of a well.

Annular Space: The space between two objects, one of which is surrounded by the other. This includes the space between the wall of an excavation and the wall of a pit: between the wall of an excavation and the casing of a well: or between two casings.

Aquifer: Means a geologic formation, group of formations, or part of a formation that contains saturated and permeable material capable of transmitting water in sufficient quantity to supply wells or springs; the terms water-bearing zone or water-bearing stratum are synonymous with the term aquifer.

Artesian Well: means a well in which groundwater is under sufficient head to rise above the level at which it was first encountered whether or not the water flows at land surface. If the water level stands above land surface the well is a flowing artesian well.

Bentonite clay grout: A mixture of bentonite clay and water with not more than two pounds of bentonite clay for every gallon of water.

Board: The Rhode Island Well Drilling Board.

Bored Well: means a well constructed with the use of earth augers turned either by hand or by power equipment.

Buried Slab Type Well: means a dug well in which well casing is used to case the upper hole. A slab, sealed with cement grout, is placed between the upper hole and lower drillhole, and the remainder of the annulus is filled with concrete.

Building Sewer: The pipe extending from the outer wall of the building, or as defined in the plumbing-code to a septic tank or approved place of disposal including a public sewer, and the lines to all parts of the disposal system, except those classified as distribution lines.

Casing: means the tubing, pipe or conduit, welded or screw coupled, and installed in the borehole during or after drilling to support the sides of the well and prevent caving, to shut off water or contaminated fluids from entering the hole, and to prevent waste of groundwater. the term "casing" does not include slotted or perforated pipe, well screens, or liner pipe.

Casing Seal: means the watertight seal established in the well bore between the well casing and the drillhole wall to prevent the inflow and movement of surface water or shallow ground water in the well annulus, or to prevent the outflow or movement of water under artesian or hydrostatic pressures.

Cement grouts: A mixture of cement, sand and water.
The mixture is usually composed of one bag of cement weighing ninety-four (94) pounds, an equal volume of dry sand, and five to six gallons of water.

A) Neat Cement Grout: A mixture of not more than six gallons of clear water to one bag of cement.

B) Sand Cement Grout: A mixture of not more than two parts sand to one part cement, and not more than six gallons of clear water to each bag of cement.

Cesspool: A covered pit with open jointed lining for the reception of untreated sewage, the liquid portion of which is disposed of by seepage or leaching into the surrounding soil and the solids or sludge being retained in the pit.

Cistern: A tank for the reception of rain water from a roof, or roofs, intended for potable purposes.

Clay: means a fine-grained, inorganic material having plastic properties and with a predominant grain size of less than 0.005 mm.

Community Water System: A public water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.

Confining Formation: means the "impermeable" stratum immediately overlying an artesian (confined) aquifer.

Confining Layer: A formation which separates aquifers and which consists of material that does not permit perceptible vertical transmission of water to other aquifers; and includes such formations as clay, unfractured rock, and so forth.

Consolidated Formation: means materials that have become firm through natural rock-forming processes. It includes such materials as basalt, sandstone, hard claystone, conglomerate, and granite.

Construct: The building, assembly or installation of a new water supply system or the enlargement or alteration of an existing water supply system; and the term "construction" shall be construed accordingly.

Contamination: The presence of sewage, industrial wastes, organisms of the coliform group, or harmful or objectionable material which is in, or may gain access to, potable water.

Department: means the Department of Environmental Management.

Director: means the Director of the Department or the Director's authorized representative.

Disinfection: the inactivation of harmful organisms present in water, through use of an accepted chlorine solution or other accepted disinfection material or procedure.

Disposal Field: An area consisting of disposal trenches, a disposal bed, or a combination thereof used for dispersion of the liquid portion of sanitary sewage into the ground as close to the surface as feasible.

Disposal Trench: A shallow ditch with vertical sides and flat bottom partially filled with a satisfactory filtering material in which a single distribution line has been laid, covered with top soil and suitable vegetation.

Distribution Box: A watertight structure which receives sanitary sewage effluent from a

septic tank and distributes such sewage effluent to two or more pipelines leading to a disposal field.

Distribution Lines: A series of open-jointed or perforated pipes used for dispersion of sewage into a disposal field.

Distribution Main: A pipe for the transmission or conveyance of potable water to more than one realty improvement.

Domestic Well: means a well used to serve a residence for the purpose of supplying water for drinking, culinary, or household uses, and which is not used as a public water supply.

Drawdown: means the difference in vertical distance between the pumping level and the static water level in a well or the area outside of the well.

Drive Point Well: means a well constructed by driving into the ground a well-point fitted to the end of a pipe section or series of pipe sections.

Dry Well: A covered pit with open-jointed lining through which drainage from roofs, basement floors or area-ways may seep or leach into the surrounding soil.

Dug Well: means a well in which the excavation is made by the use of picks, shovels, spades or digging equipment such as backhoes, clam shell buckets, or sand bucket.

Established ground surface: The permanent elevation of the surface of the ground at the site of the well after completion of grading, excavation; or other land movement.

Filter Pack Well: means a well in which the area immediately surrounding the well screen or perforated pipe within the

water-producing zone is filled with graded coarser material.

Finished Water: Potable water which does not require either treatment, or further treatment.

Ground Water: Water encountered below the ground surface of the earth within the zone of saturation that can supply wells and springs.

Grout: A supple, impervious bonding material which is capable of providing a water tight seal between the casing and the formation throughout the depth required to protect against objectionable matter, and which is essentially free of shrinkage. This shall include but not be limited to heat cement grout, sand clay, bentonite cement grout.

Grout Pipe: means a pipe which is used to place grout at the bottom of the sealing interval of a well.

Hydraulic Conductivity: means the ability of material to transmit fluid, usually described in units of gallons per day per square foot of cross-section area. It is related to the effectiveness with which pore spaces transmit fluids.

Hydrofracturing: a procedure whereby high-pressure water injection is used in an attempt to fracture or widen existing fractures or propagate limited fractures in a water bearing to increase a well's productivity.

Individual Sewage Disposal System: A system for the disposal of sanitary sewage into the ground, which is so designed and constructed to treat such sewage in a manner that will retain most of the settleable solids in a septic tank and discharge the liquid portions to an adequate disposal field.

Industrial Waste: Liquid or solid waste resulting from the processes employed in industrial establishments.

Installation of pumps and pumping equipment: The procedure employed in the placement and preparation for operation of pumps and pumping equipment, including all construction involved in making entrances to the well and establishing seals.

Jetted Well: means a well in which the drillhole excavation is made by the use of a high velocity jet of water.

Leakage: means leakage of surface and/or subsurface water around the well casing.

Liner Pipe: Pipe that is installed inside a completed and cased well for the purpose of sealing off undesirable water or for repairing ruptured or punctured casing or screens.

Locate: The designation of the site or place of the sources or other appurtenances of a water supply system, and the term "location" shall be construed accordingly.

Lower Drillhole: means that part of the well bore extending below the surface seal interval in a well.

Mineralized Water: means any naturally occurring ground water containing an amount of dissolved chemical constituents limiting the beneficial uses to which the water may be applied.

Municipal or Quasi-Municipal Well: means a well owned by a municipality, nonprofit corporation or for profit corporation, that may be used as a community or public water supply.

Non-Community Water System: A public water system that is not a community water system.

Non-Public Water System: A water system that is not a public water system.

Oversized Drill Hole: An excavation which is larger than the outside diameter of the well casing, constructed for the emplacement of a well.

Owner: Any person or his agent who holds the title or other rights of property in a well that is constructed, repaired, or abandoned.

Perched Ground Water: means ground water held above the regional or main water table by a less permeable underlying earth or rock material.

Persons: Includes individuals, corporations, associations, firms, partnerships, joint stock companies, public and municipal corporations, political subdivisions, the state and any agencies thereof, and the Federal Government and any agencies thereof.

Petcock Valve: Is a valve used to contain pressure and when opened to drain the line or pipe.

Pitless Adaptor: A device fabricated at the job site designed for attachment to one or more openings through a well casing, and so constructed as to prevent the entry of contamination into the well or potable water, conduct water from the well, prevent the water from freezing or extremes of temperature and provide access to water system components within the well.

Pitless Well Cap: A watertight sanitary device that covers and encloses the upper termination of a pitless well unit or the well casing, and provided with water-tight connections for electrical power lines and well vent.

Pitless Well Unit: A pre-assembled device which extends the upper end of a well casing to above grade, provided with a pitless well cap, and so constructed as to prevent the entry of contamination into the well or potable water, conduct water from the well, protect the water from freezing or extremes of temperature, and provide access to the well and to the water system components within the well.

Porosity: means the ratio of the volume of voids in the geologic formation being drilled to the overall volume of the material without regards to size, shape, inter-connection, or arrangement of openings.

Potable Water: means water which meets consumption standards of the R.I Department of Health or the U.S. Environmental Protection Agency, which ever is more restrictive.

Potentiometric Surface: means the level to which water will rise in tightly cased wells.

Pressure Grouting: means a process by which a cement grout is confined within the drillhole or casing by the use of retain plugs or packer and by which sufficient pressure applied to drive the grout slurry into the annular space or zone to be grouted.

Public Health Hazard: means a condition whereby there are sufficient types and amounts of biological, chemical, or physical, including radiological, agents in relation to water which are likely to cause human illness, disorders, or disability. These include, but are not limited to pathogenic viruses, bacteria, toxic chemicals, and radioactive isotopes.

Public Water System: A system for the provision to the public of piped water for human consumption, if such system has at least fifteen (15) service

connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year. Such term includes any collection, treatment storage, and distribution facilities under control of the operator of such system and used primarily in connection with such system. A public water system is either a "community water system" or a "non-community water system."

Public Well: means a well, whether publicly or privately owned other than a municipal well, where water is provided for or is available through the single user for public consumption including, but not limited to a school, a farm labor camp, an industries establishment, a recreational facility, a restaurant, a motel, or a group care home.

Pump: is mechanical equipment or a device used to remove water from a well.

Pump Installer: Is any person who is certified to engage in the installation, removal, alteration or repair of water pumps and appurtenances in connection with any water well including water lines between well and storage tank and registered as such by the Department.

Pump test: means the procedure involving pumping water for a specified period of time to determine the yield characteristics of a well.

Pumping Level: means the level of the water surface in a well while it is being pumped or bailed.

Realty Improvement: Any proposed new residence or other building (including condominiums, garden-apartment, town houses, mobile homes, and so forth) the

useful occupancy of which shall require the installation or erection of a water supply system.

- Repair: Any work involved in the reaming, sealing, installing, changing of casing depths, perforating, screening, cleaning, acidizing, or other redevelopment of a well.
- Respondent: means the person against whom an enforcement action is taken.
- Revoke: means termination of a well driller's or pump installer's registration.
- Rough Drilling Log: means a record kept on the well site of the information needed to complete the well report for the well being constructed.
- Sand: means a detrital material having a prevalent grain ranging from 2 millimeters to 0.06 millimeters.
- Sand Clay or Bentonite Cement grout: A mixture of one part fine sand, one part clay or bentonite, and one part cement and five to six gallons of water for every hundred pounds of the mixture.
- Sanitary Sewage: Any liquid waste containing animal or vegetable matter in suspension or solution, or the water-carried wastes resulting from the discharge toilets, laundry tubs, washing machines, sinks, dishwashers or any other source of water-carried waste of human origin or containing putrescible material.
- Sanitary Sewer: A pipe which carries sewage and to which storm, surface and groundwater waters are not intentionally admitted.
- Seepage Pit: A covered pit with open-jointed lining material through which septic tank effluent or laundry waste may seep or leach into the surrounding soil.

Septic Tank: A watertight receptacle which receives the discharge of sanitary sewage, and is designed and constructed so as to permit settling of settleable solids from the liquid, digestion of the organic matter by detention, and discharge of the liquid portion into a disposal field.

Service Line: A pipe for the transmission or conveyance of potable water under pressure either from an individual well or from a distribution main, to a single realty improvement.

Silt: means an unconsolidated elastic sediment composed predominantly of particles between 0.06 and 0.005 mm in diameter.

Specific Capacity: The yield of a well expressed in gallons per minute per foot of drawdown, as abbreviated "gpm/ft."

Spring: A natural surface feature where groundwater issues from the rock or soil onto the land or into a body of water.

Static Water Level: The depth to the surface of the water in a well measure from the land surface or other convenient, permanent, and specified datum, when no water is being discharged from the well and the water level has reached equilibrium.

Stratum: means a bed or layer of a formation that consists throughout of approximately the same type of consolidated or unconsolidated material.

Subsurface Sewage Disposal System: An individual sewage disposal system.

Suction Line: A pipe which conveys water at less than atmospheric pressure from a well to a pump.

Sump: means a hole dug to a depth of ten feet or less with a diameter greater than ten feet in which water is sought or encountered.

Surface Water: That water found on the ground surface or contained in a stream, pond, lake, wetland, or other natural watercourse; and the terms "surface source" and "surface supply" shall be construed accordingly.

Surging: a procedure used to increase well productivity. A solid plunger is utilized with an up and down plunging motion causing water to be forced into existing fissures which is followed by reverse suction.

Suspension: means the temporary removal of the privilege to construct well or install pumps under an existing license for a period of time not to exceed one year.

Tremie Pipe: See Grout Pipe.

Unconsolidated Formation: means naturally occurring, loosely cemented or poorly indurated materials including clay, sand, silt, and gravel.

Upper Drillhole: means that part of the well bore extending from land surface to the bottom of the surface seal interval.

Undersize Hole: An excavation which is no larger than the internal diameter of the well casing, constructed for the emplacement of a well.

Violation: means an infraction of any statute, rule, standard, order, license, compliance schedule, or any part thereof and includes both acts and omissions.

Water Bearing Formation: Shall mean and include the same definition as given for aquifer.

Water Level: See Static Water Level

Water Table Well: means the upper surface of an unconfined water body, the surface of which is at atmospheric pressure and fluctuates seasonally. The water table is defined by the levels at which water stands in wells that penetrate the water body.

Water Well: See Well

Well: means any artificial opening or artificially altered natural opening, however made, by which ground water is sought or through which ground water flows under natural pressure, or is artificially withdrawn or injected. This definition shall not include a natural spring nor test holes for water table determinations.

Well, Bored or Augered: Any excavation made for water, or in exploration for water, using power driven equipment, where the drill consists of a continuous spiral of metal or a hollow cylinder or bucket attached to a shaft, and where the excavated material is brought to the ground surface by upward movement along the surface of the spiral or removed by the bucket.

Well, Drilled: A well constructed by drilling a hole and inserting a casing to support the sides of the hole. The portion of the well which is in consolidated rock may not require support of a casing.

Well Driller: Any person who engages in drilling, digging, driving, boring, coring, construction, altering or repairing any well.

Well Drilling Machine: means any power-driven percussion, rotary, boring, digging, or augering machine used in the construction or alteration of wells.

Well, Dug: A well excavated into a shallow aquifer.

Well, Gravel: A well constructed into unconsolidated material. In the zone immediately surrounding the well screen more permeability is obtained by hydraulic action or by removing the finer formation material and replacing it with artificially graded coarser material.

Well Seal: An approved arrangement or device used to cap a well or to establish and maintain a junction between the casing or curbing of a well and the pipe or equipment installed therein, the purpose or function of which is to prevent contaminants from entering a well at the upper terminal.

Well Vent: An outlet at the upper terminal of a well casing to allow equalization of air pressure in a well but at the same time so constructed as to avoid entry of water and foreign material into the well.

Well Yield: The quantity of water per unit of time which may flow or be pumped continuously from a well.

4.00 Registration Required to Construct or Alter Wells

4.01 No person shall construct, alter or abandon a well for another unless that person has been registered as a well contractor by the department. Exceptions to this are provided for in chapter 46-13.2-4 (c) and (d), as well as in chapter 46-13.2-7.

4.02 Any action to construct, alter or abandon a well not in conformance with these rules and regulations shall be deemed a violation and shall be subject to the administrative penalty authorized in chapter 42-17.5.

4.03 Violation of section 4.01 may make the person subject to penalties provided for in 46-13.2-10 as well as those provided for in 46-13.2-4 (e)(1).

4.04 No person who does not have a pump installers certificate shall install a well pump unless that person has been registered as a pump installer by the department. These regulations shall not, however, restrict a plumber or electrician from engaging in the trade for which he has been licensed, 46-13.2-4(d).

4.05 Violations of section 4.04 shall make the person subject to penalties provided for in 46-13.2-10 as well as refusal to register as provided for in 46-13.2-4 (e)(1).

5.00 Application Procedures and Qualifications.

5.01 Any person wishing to obtain a well drillers registration shall:

(a) designate one or more of the following categories for which certification is requested; 1) cable tool; 2) air rotary; 3) mud rotary; 4) driving and jetting; or 5) boring and augering.

(b) submit a certificate of liability insurance specifying well drilling purposes and providing liability coverage for bodily injury coverage of at least \$100,000 per person with an aggregate of at least \$300,000 and for property damage of at least \$50,000 per accident with an aggregate of at least \$100,000.

(c) submit proof of financial resources sufficient to have and maintain tools and machines adequate for the work, commensurate with the category of certification required;

(d) pay an initial registration fee of \$200 and annually there after on the 1st of July a renewal fee of \$100.

(e) a well driller may renew his certificate four (4) times upon demonstrating compliance with (b) and (c) above and paying the renewal fee in (d). After the fourth renewal a driller must either retake the examination in (f) or demonstrate continued certification by the National Water Well Association.

(f) demonstrate knowledge of well drilling by passing a written examination prepared and administered by the National Water Well Association if an individual or by providing evidence that an employee has passed such an examination commensurate with the type of drilling being applied for by the employer;

5.02 Any person wishing to obtain a pump installers registration shall:

(a) submit a certificate of liability insurance specifying pump installing purposes and providing liability coverage for bodily injury coverage of at least \$100,000 per person with an aggregate of at least \$300,000 and for property damage of at least \$50,000 per accident with an aggregate of at least \$100,000.;

(b) demonstrate knowledge of pump installation by passing a written examination prepared and administered by the National Water Well Association or providing evidence that an employee has passed such an examination;

(c) submit proof of financial resources sufficient to have and maintain tools and machines adequate for the work;

(d) pay an initial registration fee of \$200 and there after on the 1st of July a renewal fee of \$100

(e) a pump installer may renew his certificate four (4) times upon demonstrating compliance with (a) and (c) above and paying the renewal fee in (d). After the fourth renewal an installer must either retake the examination in (b) or demonstrate continued certification by the National Water Well Association.

6.00 Well Completion Report

6.01 Upon completion of construction alteration or abandonment of a well, the well driller shall submit a well completion report to the department upon a form provided by the department. (See Appendix A). Such report shall be submitted within 15 working days of the completion of the well and shall include the results of a 5 hour pump test.

7.00 Construction Standards for Non-Public Water Wells

7.01 Well Location

- A. Wells shall be located in a manner to reduce the likelihood of contamination from sources of pollution at or near the ground surface. The following are minimum isolation distances from the listed potential contamination sources:

2distribution box and septic tank -----75 feet
sewage disposal field -----100 feet
sewer line -----50 feet
road -----50 feet*

*(from the edge of the road surface)

Fuel storage tanks should be located as far as possible from wells or animal waste storage facilities.

- B. Wells shall not be located within 100 feet of livestock pens or animal waste storage facilities. A 20 foot wide distance shall be maintained between a well and active agricultural areas. Wells shall be located uphill from grazing areas whenever possible. Such wells are suggested to be analyzed for nitrate levels prior to use (Does not apply to wells used solely for irrigation).
- C. The well driller shall inform the owner of the proper isolation distances from pollution sources. The property owner shall provide information to the well driller on the location of existing reserved and permitted areas for subsurface disposal fields and other pollution sources. If the property owner is unable to provide such information, the well driller shall obtain that information from the city/town hall or the ISDS Section of the Department.
- D. Recommended distances from other potential contamination sources may be obtained by the Department of Health.
- E. The well should be located in a location where it will not be subject to damage from vehicles and similar hazards.

7.02 Basic Restrictions

- A. All water used in the construction, alteration, repair, hydrofracturing, surging or abandonment of a well shall be potable.

- B. Organic materials which foster or promote undesired organic growth or have the potential to degrade water quality shall not be employed in the construction of a water well. This includes but is not limited to brans, hulls, grains, starches, and proteins.
- C. In no case shall explosives be detonated inside the well casing or liner pipe without written permission from the Director. The request shall include the type of explosive to be used, how they will be placed. In no case shall an explosive charge be dropped down a well or used to sever installed well casing or liner pipe.
- D. No well shall be used for the injection of surface or groundwater, or chemically or thermally altered waters.
- E. In no case shall a well be constructed to allow commingling or leakage of groundwater within an individual well by gravity flow or artesian pressure from different groundwater aquifers associated with different geological units.
- F. Hydrofracturing shall not be permitted in cases where neighboring wells are at risk by either physical damage and/or productivity loss.
- G. All formations which yield contaminated or mineralized water shall be adequately cased and sealed off so as to prevent contamination of the overlying or underlying water-bearing zones.
- H. All wells when unattended during construction shall be covered to protect public health and safety.

7.03 Drilling --General

- A. The well driller shall not cause undue soil erosion or water pollution and shall not pollute the site with fuels, lubricants, solvents or other contaminants used in construction of the well. Any drilling fluids used shall be disinfected and disposed of properly.
- B. The well driller shall use care in the selection and use of drilling fluids, additives, cements, and other materials to avoid materials and procedures which may adversely affect the drill site or any groundwater encountered. Any chemical or other

additives used in drilling along with rock cuttings shall be cleaned out from the well.

- C. Well drillers drilling a well for potable water shall not reuse casing, or drilling fluids which may have become contaminated. All drilling equipment which may have become contaminated during a drilling operation shall be thoroughly cleaned and decontaminated before reuse.
- D. All new wells shall be chlorinated for a minimum of 4 hours upon completion of the well construction and completion of the pump installation. (See table located in Appendix B).
- E. Wells shall be designed to be of adequate diameter and depth to be capable of yielding the quantity of water required by the user (See Appendix C).

7.04 Pumps and Pumping Equipment

- A. Pumps and pumping equipment shall be installed to make the most efficient use of well storage.
- B. Pumps and pumping equipment shall be located to permit convenient access for inspection, maintenance and repair.
- C. In the event the base plate of a pump is placed directly over the well, the base plate shall be a type designed to form a water tight seal with the well casing or pump foundation.
- D. The well shall be properly vented in the building to allow for pressure changes within the well. It shall also be fitted with a "so called" pitless adaptor.
- E. Contaminated water shall not be used for the purpose of priming any pump.
- F. The electrical wiring used in connection with the pump shall conform to the current specifications of the National Electrical Code.
- G. The pump installer shall disinfect a well subsequent to installation of a pump to the standards set forth in Appendix B.

7.05 Standards for wells in unconsolidated materials

- A. Any well constructed to obtain water from an unconsolidated rock formation shall be equipped with a screen, for the purpose of preventing the entrance of formation material into the well after the well has been developed and completed.
- B. The well screen shall:
 - 1.) be of a standard design and manufacture, for the specific purpose of well construction.
 - 2.) be made of material adequate to withstand normal physical and chemical forces, applied to it during and after installation.
 - 3.) shall have openings free of rough edges, irregularities, or other defects that may contribute to corrosion or clogging.
 - 4.) shall be provided with such fittings as are necessary to seal the top of the screen to the casing and to close the bottom, and in no case shall fittings be made of lead.
- C. Any well constructed in very coarse gravel largely free of fines, shall not, however, be required to have a screen; or, if a screen is used, the bottom may be left open.
- D. Jetted or washed wells shall not be terminated in unconsolidated materials unless an adequate quantity of water free from fine soil particles can be withdrawn.

7.06 Standards for Artesian Wells

- A. To allow for grouting artesian wells shall have an upper drillhole 4" greater in diameter than the nominal diameter of the permanent well casing.
- B. Watertight unperforated casing shall extend and be sealed at least 5' into the confining formation immediately overlying the artesian water-bearing zone.

- C. In all cases a minimum of 18 feet of casing and casing seal will be required.
- D. If a well flows at land surfaces, the well shall be equipped with a watertight mechanical cap, threaded or welded, and a control valve, so that all flow of water from the well can be completely stopped.
- E. All flowing artesian wells shall be tested for artesian shut-in pressure in (psi) and rate of flow in ft³/sec., or gal/min. under free discharge conditions. This data shall be reported on the well report.

7.07 Construction of drilled rock wells

- A. The area chosen must be suitable and distances from any source of contamination adhered to.
- B. The bottom of the casing shall be set securely into the rock in a manner which is adequate to prevent fluids, contaminations or rock material from the ground surface or from any zone from entering the well.
- C. All wells drilled into bedrock shall be completed with a water tight casing to a minimum depth of 18 feet below the land surface and no less than 5 feet into the bedrock.
- D. A drive shoe may be used to assist in sealing the casing into bedrock.
- E. When plastic casing is used, the seal shall be created by the use of a Jaswell seal tip, shale packer or equal.
- F. When a well is recased for the purpose of shutting off undesirable water or sand, a Jaswell seal tip shall be used and the annular space be grouted with an acceptable material.
- G. A tapered hole to receive the O.D. of the plain end casing is acceptable.
- H. When bedrock is encountered within 10 feet, air may be used to lift the cuttings from the bore hole. However, when the depth to bedrock is greater the cuttings must be removed by slurries (mudding method) which will then insure the annular space to be free from voids and become a grouting agent.

7.08

Construction of Shallow Wells in Unconsolidated Materials by Excavation (Dug Wells).

- A. Dug wells ARE NOT RECOMMENDED for drinking water for sanitary reasons.
- B. Dug wells shall not be located in areas subject to standing water.
- C. Upper joints in well casings shall be sealed to exclude surface and near surface water from entering the well.
- D. The bottom of the casing shall be set on a bed of clean crushed stone or naturally occurring coarse gravel, if present.
- E. Crushed stone shall be placed around the exterior of the casing at the bottom section (s) to promote infiltration of water and provide additional storage, if appropriate for the soil conditions at the site.
- F. Backfill shall be of an appropriate material and placed in a manner which will deter intrusion of soil into the well and reduce the likelihood of surface waters percolating directly into the well through the backfill.
 - 1) Organic material shall not be used in the backfill including but not limited to; loam, peat, building paper, hay or soil with organic matter.
 - 2) Pea stone or other non-polluting barriers shall be used over the crushed stone to prevent fine soils from entering the crushed stone.
 - 3) Backfill shall be compacted to reduce settlement.
 - 4) The top of the backfill shall be covered with at least 2 feet of impervious material such as clay.
 - 5) The ground surface at the well should be raised and graded to drain away from the well taking into consideration future settlement of the backfill.

- G. The dug well shall be provided with a watertight cover constructed of a single integral material so as to prevent sources of contaminants from entering the well.

7.09

Casing

The Casing Material used on all water wells shall be of such strength and composition as to prevent the movement of water or contaminants into or out of the well in the interval so cased; and shall not distort, deform, collapse, crack, or disintegrate under normal conditions for the life of the well or contaminate the water in the well. The casing shall be adequate to provide for the installation, removal and maintenance as appropriate of caps, pitless adaptors, screens, pumps, pipes, wires or other devices which may be used throughout the normal life of the well.

- A. Casing shall provide access for withdrawal of groundwater.
- B. Casing shall prevent intrusion of contaminants from the ground surface or unconsolidated soil layers into the well.
- C. Casing shall prevent entrance of soil particles into the well.
- D. Casing shall provide a reference for locating the well.
- E. Casing materials shall not be a source of pollution.
- F. Steel well casing shall have a minimum wall thickness of .23 inches for wells drilled in Bedrock and deep wells in unconsolidated materials.
- G. Casing shall transmit the driving force to the well point for driven wells.
- H. Well casings shall have an anaerobic cover with venting into the house to prevent the entrance of foreign matter into the well
- I. Well casing shall extend above the ground surface a minimum of 18 inches. In areas prone to flooding, additional casing heights must be installed to prevent entrance of surface water.

- J. The void area outside the casing shall be filled with cement grout, bentonite or rock drillings or cuttings.
- K. The above requirements do not preclude the use of additional protection measures.

7.10 Annular Space

Any annular space between the outside of the casing and the natural materials penetrated by the well shall be filled with suitable material to make this space as impervious to the movement of fluids and competent to support the casing as are the natural materials surrounding the well. This may be accomplished as follows:

- A. In cases where:
 - 1.) No more stringent standards are required; and
 - 2.) there is no evidence of existing or potential contamination sources or excessively corrosive condition; and
 - 3.) the natural materials contain a significant proportion of naturally impervious materials mixed with drilling mud;

The driller may fill the annular space with the natural materials excavated during the drilling of the well to meet the following requirements:

- 1.) The annular space shall be fitted as completely as possible from the bottom of the casing to the land surface without any depressions, voids, holes or channels;
 - 2.) the driller shall employ whatever techniques are effective for the existing conditions to achieve maximum density, strength and impermeability of the fill material; and
 - 3.) the surface of the fill material shall be sloped away from the casing.
- B. In cases where potentially contaminating or corrosive fluids are encountered, or impermeable natural materials cannot be adequately placed and compacted or where geologic conditions or the isolation distance may not be adequate, the annular

space shall be grouted for the full length of the casing, or the portion thereof below the frost line or pitless adaptor, so that no fluids may move in the zone needing to be grouted.

- C. In cases where frost heaving is likely, the annular space from the frost line to the ground surface may be filled with compacted granular fill to reduce the potential for frost heaving or the casing.
- D. The casing shall be securely supported by the surrounding fill material to a degree that it cannot be moved by manual means.
- E. In no case will a driller leave a completed well with water flowing or standing in the annular space.

7.11 Grouting

- A. When sealing of the annular space requires placement of a grout seal a material or mixture shall be utilized which will:
 - 1.) provide negligible movement of potentially contaminating fluids in the annular space;
 - 2.) provide protection of the casing from corrosive waters;
 - 3.) provide support of the casing;
 - 4.) provide negligible shrinkage, breakage, or deterioration of the grout after placement;
 - 5.) prevent Artesian flow in the annular space; and
 - 6.) not cause or allow contamination of the aquifer.
- B. The grout should be placed in a continuous operation in a manner to best ensure against creating any voids, mixing with diluting or contamination fluids, or damaging the casing or borehole.

7.12 Construction standards for public water wells shall be set by the Department of Health.

8.00 Maintenance, Repair and Deepening of Wells

8.01 Valves and casing on all artesian wells shall be maintained in a condition so that the flow of water can be completely stopped when the water is not being put to beneficial use. All casing, liner pipe, and casing seals shall be maintained in a condition that will prevent surface or subsurface leakage of groundwater. Valves shall be closed when water is not being put to beneficial use. During period of subfreezing temperatures, care shall be taken to prevent damage due to freezing.

8.02 If in repair of a drilled well the old casing is withdrawn, the well shall be recased and resealed.

8.03 The access port or airline on all wells shall be maintained in a condition that will prevent contamination of the water body. Access ports and airlines shall be maintained so that the position of the water table can be determined at any time.

8.04 The pressure gauge and petcock valve shall be maintained so that the artesian pressure can be accurately determined at any time.

8.05 The Director may require the landowner to install totalizing flowmeters on any well.

8.06 In no case shall a dug well be deepened by drilling methods.

9.00 Abandonment of Wells

9.01 Temporary Abandonment

Any well to be temporarily removed from service, temporarily abandoned due to a recess in construction, or temporarily abandoned before commencing service, shall be capped with a watertight seal, watertight welded steel cap, or threaded cap. In the event that temporary abandonment is to be of 90 days or less, the temporary steel cap may be welded to the well casing with a minimum of four (4) separate welds, evenly spaced, each at least one-half (1/2) of an inch in length. Steel or cast iron caps shall be at least three-sixteenth (3/16) of an inch in thickness.

9.02 Procedure for Permanent Abandonment

In the event of permanent abandonment of any water well the proper procedure and materials shall be used, as follows:

- A. The well shall be plugged to prevent the entrance of surface water, circulation of water between or among producing zones, or any other process resulting in the contamination or pollution of groundwater resources.
- B. The well shall be sealed with a watertight cap or seal.
- C. The well shall be chlorinated prior to abandonment using a chlorine solution with a minimum concentration of one hundred fifty parts per million (150 ppm) of residual chlorine.
- D. The well shall be checked from land surface to the entire depth of the well before it is sealed, to ensure against the presence of any obstruction that will interfere with sealing operations.
- E. All casing and screen materials that have salvage value may be removed by the contractor.
- F. The well bore shall be filled and sealed with any of the following materials: heat cement grout, or sand clay or bentonite cement grout.
- G. The grout material shall be placed through a pipe extending to the bottom of the well, which shall be raised as the well is filled.
- H. Any well constructed in a consolidated rock formation, may be filled with fine sand in the zone or zones of consolidated rock but cannot allow the circulation of water between or among producing zones. The top of the sand fill shall be at least ten (10) feet below the top of the consolidated rock, and the remaining space with the materials specified in subsection (F.).
- I. Any test well or bore shall be abandoned in such a manner that it does not become a channel for the vertical movement of water or other substance to the potable groundwater resource.
- J. Upon completion of abandonment of the well, the top of the casing or grout material shall be terminated at least for (4) feet below the ground surface.
- K. Plugging and abandoning of a well to be abandoned shall be performed only by a licensed well driller.

9.03 Monitoring Well Abandonment

Upon termination of the monitoring program, all monitoring wells must be abandoned unless written approval is received from the Director for continued use. If the well casing is not removed during the abandonment of a well, the casing shall be thoroughly ripped or perforated from top to bottom, except that perforations will not be required over intervals of the well that are sealed with cement. The screened portion of the well and the annular space between the casing and the drillhole wall shall be effectively and completely filled with cement grout applied under pressure in a positive manner. The casing of wells to be abandoned may be severed below land surface and removed.

If unusual circumstances exist, the Director is able to:

1. Impose additional protective measures in addition to minimum standards for the location, construction and abandonment of non-public water wells.
2. Issue variances for reducing the set minimum standards for the location, construction and abandonment of non-public water wells. The well owner must demonstrate the variance will not cause undo harm to the well. The Director shall establish priorities for issuing variances while the burden of proof will be on the well owner.

WELL COMPLETION REPORT

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
Groundwater Section
235 Promenade St., Providence, RI 02903



DO NOT FILL IN
STATE WELL NUMBER

OTHER NUMBER

OWNER	Name _____		Address _____				
LOCATION OF WELL	(No. & Street) _____		(Town) _____	(Plot#) _____	(Lot #) _____	(Pole #) _____	
DRILLING EQUIPMENT	ROTARY _____ COMPRESSED AIR PERCUSSION _____ CABLE PERCUSSION _____ OTHER _____						
CASING DETAILS	DIAMETER _____	LENGTH _____	TYPE _____	NEW _____	USED _____	DEPTH OF COMPLETED WELL IN FT. BELOW LAND SURFACE: _____	
	THREADED _____ WELDED _____		DRIVE SHOE YES _____ NO _____		GROUTING MATERIAL _____		
PUMP TEST DATA (5 HR. MIN.)	STATIC WATER LEVEL (FT.) _____		PUMPING LEVEL (FT.) _____		DRAWDOWN (FT.) _____		
	DURATION (HOURS) _____		YIELD (GPM) _____	DEPTH TO BEDROCK _____			
SCREEN DETAILS	MAKE _____ MATERIAL _____		LENGTH _____	DIAMETER _____	SLOT SIZE _____		
HAS WATER BEEN TESTED? _____ WHEN? _____			USE OF WELL _____ BUSINESS ESTABLISHMENT _____ TEST WELL				
WHERE? (LAB) _____ LAB # _____			_____ DOMESTIC _____ INDUSTRIAL _____ OTHER (SPECIFY) _____ PUBLIC _____ SUPPLY _____ FARM				
ISDS APPROVAL NUMBER _____ LOT SIZE _____							
DEPTH FROM LAND SURFACE			SKETCH EXACT LOCATION OF WELL WITH DISTANCES, TO AT LEAST TWO PERMANENT LANDMARKS, INCLUDING HOUSE (IF PRESENT).				
FEET	TO	FEET	FORMATION DESCRIPTION				
			 INDICATE NORTH				
			LOCATION OF LOT TO AT LEAST TWO ROADS (INCLUDE DISTANCES AND A POLE #)				
			 INDICATE NORTH				
DATE WELL COMPLETED		DATE OF REPORT	WELL DRILLER (SIGNATURE)		WELL DRILLER (PRINT)		
REGISTRATION #	REGISTERED WELL DRILLER (SIGNATURE)		REGISTERED WELL DRILLER (PRINT)				

WELL DRILLER

APPENDIX B

Table 5. Well Disinfection Guidelines (quantities* of calcium hypochlorite in rows A, 70 percent, and liquid household bleach in rows B, 5.25 percent, required for water well disinfection)**

Depth of Water in Well (ft.)		Well diameter (in.)															
		2	3	4	5	6	8	10	12	16	20	24	28	32	36	42	48
5	A	1T	1T	1T	1T	1T	1T	2T	3T	5T	6T	3 oz.	4 oz.	5 oz.	7 oz.	9 oz.	12 oz.
	B	1C	1C	1C	1C	1C	1C	1C	1C	2C	4C	1Q	2Q	3Q	3Q	4Q	5Q
10	A	1T	1T	1T	1T	1T	2T	3T	5T	8T	4 oz.	6 oz.	8 oz.	10 oz.	13 oz.	1.5 lb.	1.5 lb.
	B	1C	1C	1C	1C	1C	1C	2C	2C	1Q	2Q	3Q	4Q	4Q	6Q	8Q	2.5G
15	A	1T	1T	1T	1T	2T	3T	5T	8T	4 oz.	6 oz.	9 oz.	12 oz.	1 lb.	1.5 lb.	1.5 lb.	2 lb.
	B	1C	1C	1C	1C	1C	2C	3C	4C	2Q	2.5Q	4Q	5Q	6Q	2G	3G	4G
20	A	1T	1T	1T	2T	3T	4T	6T	3 oz.	5 oz.	8 oz.						
	B	1C	1C	1C	1C	1C	2C	4C	1Q	2.5Q	3.5Q						
30	A	1T	1T	2T	3T	4T	6T	3 oz.	4 oz.	8 oz.	12 oz.						
	B	1C	1C	1C	1C	2C	4C	1.5Q	2Q	4Q	5Q						
40	A	1T	1T	2T	4T	6T	8T	4 oz.	6 oz.	10 oz.	1 lb.						
	B	1C	1C	1C	2C	2C	1Q	2Q	2.5Q	4.5Q	7Q						
60	A	1T	2T	3T	5T	8T	4 oz.	6 oz.	9 oz.								
	B	1C	1C	2C	3C	4C	2Q	3Q	4Q								
80	A	1T	3T	4T	7T	9T	5 oz.	8 oz.	12 oz.								
	B	1C	1C	2C	4C	1Q	2Q	3.5Q	5Q								
100	A	2T	3T	5T	8T	4 oz.	7 oz.	10 oz.	1 lb.								
	B	1C	2C	3C	1Q	1.5Q	2.5Q	4Q	6Q								
150	A	3T	5T	8T	4 oz.	6 oz.	10 oz.	1 lb.	1.5 lb.								
	B	2C	2C	4C	2Q	2.5Q	4Q	6Q	2.5G								

*Quantities are indicated as: T=tablespoon; oz. = ounces (by weight); C = cups; lb.= pounds; Q = quarts; G = gallons.

** Table 5 shows quantities of disinfectants to be used in treating wells of different diameters and water depths. For sizes or depths not shown, the next larger figure should be used.

NOTE: Figures corresponding to rows A are amounts of solid calcium hypochlorite required; those corresponding to rows B are amounts of liquid household bleach. For cases lying in green-shaded area, add 5 gallons of chlorinated water, as a final step, to force solution into formation. For those in blue-shaded area, add 10 gallons of chlorinated water. (See "Disinfection of Wells", pp. 50 ff.)

APPENDIX C

For the use of an individual household, a bedrock well of 6 inches in diameter shall be satisfactory when it meets the following minimum criteria:

with a yield of 5 gallons per minute a minimum depth of 100' is required.

with a yield of 3 1/2 gpma minimum depth of 150' is required.

with a yield of 2 gpma minimum depth of 200' is required.

with a yield of 1 gpm.....a minimum depth of 300' is required.

with a yield of 1/2 gpm.....a minimum depth of 450' is required.

This is assumed that the static level is between 25 to 35 feet and the pump has been appropriately set to insure maximum productivity.

The above is intended as a construction standard and does not imply or guarantee actual yield.

Special caution should be exercised in coastal areas because of potential saltwater intrusion.