



**COVER SHEET
STANDARD OPERATING PROCEDURE**

Operation Title: Well and Boring Abandonment

Originator: Kelly Perkins
Quality Assurance Coordinator
Division of Technical Services
Bureau of Remediation and Waste Management

APPROVALS:

Division of Technical Services Director:

Molly King Molly King Oct 26, 2021
Molly King (Oct 26, 2021 10:55 EDT)
Print name Signature Date

Bureau of Remediation and Waste Management Director:

Susanne Miller [Signature] Nov 10, 2021
Print name Signature Date

QMSC Chair:

Kevin Martin [Signature] Nov 15, 2021
Print name Signature Date

Department Commissioner:

Melanie Loyzim [Signature] Nov 15, 2021
Print name Signature Date

DISTRIBUTION:

() Division of Technical Services.....By: _____ Date: _____



1.0 APPLICABILITY

This Standard Operating Procedure (SOP) applies to all programs in the Maine Department of Environmental Protection's (MEDEP) Bureau of Remediation and Waste Management.

This SOP is applicable for the abandonment of water supply wells, geotechnical borings, environmental monitoring wells and soil borings installed in the State of Maine. The procedures apply to wells drilled in overburden, unconsolidated materials, fill, and underlying bedrock formations in Maine. These guidelines pertain to any vertical or high angle boring completed by all drilling or direct push methods.

This SOP is not a rule and is not intended to have the force of law, nor does it create or affect any legal rights of any individual, all of which are determined by applicable statutes and law. This SOP does not supersede statutes or rules.

The Maine Department of Health and Human Services (DHHS), CMR CHAPTER 232 - Well Drillers and Pump Installers Rules is provided as Attachment 1 to this document as it relates to water supply wells.

2.0 PURPOSE

The purpose of this document is to describe the MEDEP-BRWM procedure for Well and Borehole Abandonment. The purpose of these procedures includes:

1. Prevent the possibility of an abandoned well and/or boring to provide a pathway for contaminants to migrate to the groundwater
2. Prevent the possibility of personal injury; and
3. Prevent the intermixing of separate water bearing zones.

Any borehole that may be a conduit for contaminant migration must be properly abandoned. Additionally, any borehole that is no longer functioning as originally designed should also be properly abandoned. The types of boreholes that need to be abandoned by this procedure includes:

- soil borings
- rock borings or boring drilled into bedrock
- monitoring wells
- remediation wells, and
- drinking water wells

3.0 RESPONSIBILITIES

All MEDEP BRWM staff must follow this procedure when performing this task. All Managers and Supervisors are responsible for ensuring that their staff are familiar with and adhere to this



procedure. MEDEP BRWM staff reviewing data by outside parties are responsible for assuring that the procedure (or an equivalent) was utilized appropriately.

MEDEP BRWM staff is responsible for verifying that well/borehole abandonment has been conducted in a manner that is consistent with the methods described below and meets the purpose of these guidelines as state in Section 2.0 above.

MEDEP staff must verify and document the following:

- the depth and diameter of the boring/well
- groundwater depth
- the boring log and well construction details
- well material removed prior to placing abandonment materials
- the volume of borehole that is to be abandoned
- the abandonment method the type(s) and volume(s) of sealing material used
- confirmation that not bridging occurred by comparing boring volume to material volume
- that the sealing material was prepared and applied according to the manufacturer's specifications
- incidences of bridging, corrective actions taken, and the result
- a signed copy of the well abandonment record for the project file
- Updating EGAD and GIS that the borehole or well has been abandoned

4.0 DEFINITIONS

4.1 Annular space The space between the well casing/well screen and the wall of the borehole or in the case of a multiple cased well, all space(s) between casing(s) and all space between the outer casing and the wall of the borehole.

4.2 Aquifer A water-bearing layer of natural earth materials that will yield water in a to a well or spring.

4.3 Backfill A General term that describes non-manufactured material used to fill the borehole or the annular space in a borehole that is derived from locally sourced natural materials of an unspecified composition. Is sometimes referred to as natural backfill material.

4.4 Borehole The hole in the earth formed by the drilling equipment that can be used to construct a well.

4.5 Boring Log A written record of information the describes the soil or rock removed from the hole by the drilling machine.



4.6 Bridging What happens when grout or other materials lodge against the side of the borehole and prevent the material from traveling to the bottom of the space, forming unwanted voids and spaces in the borehole or annular space in the borehole.

4.7 Filter Sand A manufactured or processed sand material of a select particle size designed to remove or filter particles from water and keep them from entering the borehole or well that has been constructed in the borehole.

4.8 Grout A low permeability manufactured material specially formulated as a cement product, such as neat cement, bentonite slurry, bentonite chips, bentonite pellets, granular bentonite, or other materials that have equivalent sealing properties. Numerous grout products are available, and a proper match of grout to method is essential. When cured, grout can be flowable, formable, or ridged depending on the formulated mixture of lime, bentonite, and sand.

4.9 Hydraulically Sealed The process of sealing a well with grout that does not use backfill.

4.10 Hydraulic Sealing Material See Grout as defined above

4.11 Monitoring Well A well specifically used to observe the elevation of the water table or potentiometric surface, or to measure the water quality of a water-bearing zone. This includes piezometers.

4.12 Over-Drilling A drilling process that uses a drill bit that is larger in diameter than the original borehole drilled to install the well. The larger drill bit is advanced over or surrounding the original borehole so that all of the well construction material (PVC, grout, filter sand, etc.) can be removed from the original borehole.

4.13 Well Material Includes all materials used to construct a well and may include the well casing (steel, stone, cement, or PVC used to hold back the surrounding unconsolidated earth or fill), well screen (metal, or PVC), filter sand, and any seal material placed within the borehole.

5.0 GUIDELINES AND PROCEDURES

5.1 INTRODUCTION

Whenever there is a possibility that the well/boring is a conduit for contaminant migration the borehole must be hydraulically sealed.

If there is evidence that Dense Non-Aqueous Phase Liquid (DNAPL) is present (observation of DNAPL, groundwater concentrations exceeding 1% of the contaminant solubility, or field testing results such as a oil-in-soil shake test with a layer denser than water) the hydraulic sealing material must be flowable grout installed using a tremie pipe as described below.



For sites where Light Non-Aqueous Phase Liquids are present, the decision to use flowable grout will be made based on the CSM, the site specific hydrogeology, and the long term remediation plans.

The method used for abandonment of the well/boring must be documented in the project file. A well abandonment record is included as an attachment (Attachment 2) and the information included on this form must be documented in the project file.

Abandoned wells or boreholes must be sealed to prevent existing and future contaminant migration and prevent the mixing of waters from separate water bearing zones or fractures. The abandoned well/boring should not be a physical hazard to any person walking, driving or operating equipment nearby. Below are procedures specific to each well/boring scenario.

5.2 PLANNING

Notify Dig Safe

For wells and borings within the right of way of public roads, secure a permit from the jurisdictional agency (Town or State).

Secure property owner permission for access and the activity.

Manage contaminated and potentially contaminated soil and groundwater using best management practices to avoid runoff and human exposure..

Boring logs and well construction logs should be reviewed prior to well abandonment to properly select the method or methods to be used based on Section 5.3. If the boring log or the well construction log is not available and field measurements cannot be used to determine the stratigraphy or well construction details (including sand pack and hydraulic seal material placed in the annular space of the borehole), and data from other monitoring wells installed at the same time cannot be used to determine if the well was properly constructed with appropriate hydraulic seals, then a more conservative well abandonment procedure must be used (i.e. over drilling and flowable grout).

When more than one well on a site is to be abandoned during one mobilization event, a list of wells to be properly abandoned should be prepared with a summary of the information available and a summary of abandonment methods to be used at each well. The information summarized should include the Well ID, Well type, boring log availability, well construction log availability, well depth, well diameter, riser or casing diameter, casing type (PVC, Steel, etc.), borehole diameter, if the casing is going to be removed or left in place below ground, and the method of abandonment. Attachment 3 is provided as an example Abandonment Planning Table.

5.3 PROCEDURE



The procedure used will be determined by the Conceptual Site Model, the type of boring, borehole, or well being abandoned and the construction information available.

There are five abandonment methods covered by this SOP including:

1. Over drilling and abandonment with flowable tremie grout
2. Flowable tremie grout
3. Dry bentonite chips
4. Backfill
5. Backfill with a surface seal

The five procedures can be applied to abandonment of soil borings, monitoring wells, remediation wells, and water supply wells in accordance with the procedures explained below. Attachment 4 provides a summary table for how the methods are to be applied.

5.3.1 Over drilling and abandonment with flowable tremie grout

This method is not applicable to soil borings, dug wells greater than 6-inches in diameter, or six-inch diameter water supply wells drilled into bedrock.

This method must be used when DNAPL is known or suspected to be present as stated previously. This method must also be used for monitoring wells and remediation wells where either boring logs or well construction logs are not available and construction details cannot be reasonably determined as explained previously.

For all other well types this method is allowable.

Over drilling and abandonment with flowable grout is considered the most conservative method of abandonment because it removes all well construction materials, including hydraulic seals and filter sand within the annular space of the original borehole and eliminates bridging of the hydraulic sealing material placed in the borehole.

Over drilling is accomplished by selecting a drilling method capable of advancing a casing or auger larger in diameter than the original borehole to a depth equal to or greater than the original borehole. All of the components of the original well and associated filter pack and any materials placed in the annular space of the original borehole will be removed from the subsurface through the drilling process. Once the casing or augers have advanced to the targeted termination depth and all well materials and associated materials are removed from the new borehole, a tremie pipe will be placed at the bottom of the borehole and flowable grout will be pumped into the borehole to facilitate filling the borehole from the bottom to the top as the casing or augers used to over drill the original borehole are removed.



5.3.2 Flowable tremie grout

This method is not applicable for dug wells

This method is not allowed for monitoring wells or remediation wells, where the hydraulic seal in the annular space above or below the filter sand in the annular space is insufficient to seal off the borehole, non-existent, or unknown. The determination of a sufficient seal is site specific based on the measured vertical flow components in the subsurface and the presence or absence of contamination.

This method may be allowed to properly abandon monitoring wells and remediation wells when boring logs or well construction logs are not available and field techniques, the CSM, and site specific hydrogeologic information is sufficient to determine that the risk of contaminant migration along the borehole does not pose a risk to human health and the environment and there is no potential to mix groundwater from hydrologically separate aquifers.

This method must be used when soil borings encounter DNAPL or contaminants with densities greater than water at elevated concentrations capable of producing a sheen in a water shake test.

This method is preferred when soil borings extend below 15-feet, the area within 1,000 feet is not served by public water, and contamination is encountered in the borehole, and the hydrogeologic conditions

For all other soil borings and well types this method is allowable.

For soil boring or rock boring abandonment, this method includes the use of a tremie pipe placed at the bottom of the cased soil boring or open rock borehole to facilitate pumping flowable grout. Flowable grout will be pumped from the bottom to the top as the casing or augers are removed from the soil boring. The soil boring casing and tremie pipe will be slowly removed as grout fills the borehole from the bottom. Upon completion, the tremie pipe and soil boring casing will be removed from the subsurface.

For monitoring wells, remediation wells, or water supply wells, where the well screen and/or casing is allowed to remain in place, the tremie pipe will be placed at the bottom of the well to facilitate pumping flowable grout. Flowable grout will be pumped from the bottom up to the top as the tremie pipe is slowly recovered from the well. Any remaining well casing should be cutoff below the ground surface and a hydraulic seal should be placed over the top of the borehole below grade prior to covering with surface soils. Upon completion, the tremie pipe will be removed from the subsurface, but the well materials will remain in place in the subsurface.

5.3.3 Dry bentonite chips

This method is not applicable for dug wells



This method is not allowed when DNAPL or known or suspected to be present, or when contaminants with densities greater than water are present or suspected to be present at elevated concentrations capable of producing a sheen in a water shake test.

This method is not allowed for monitoring wells or remediation wells, where the hydraulic seal in the annular space above or below the filter sand in the annular space is insufficient to seal off the borehole, non-existent, or unknown. The determination of a sufficient seal is site specific based on the measured vertical flow components in the subsurface and the presence or absence of contamination.

This method may be allowed to properly abandon monitoring wells and remediation wells when boring logs or well construction logs are not available and field techniques, the CSM, and site specific hydrogeologic information is sufficient to determine that the risk of contaminant migration along the borehole does not pose a risk to human health and the environment and there is no potential to mix groundwater from hydrologically separate aquifers. For all other well types not discussed above this method is allowable. Additionally, this method is allowable for all soil borings where DNAPL is not present or suspected to be present.

Care must be taken and notes documenting the proper use must be provided to confirm its use when abandoning soil borings that extend below the water table, monitoring wells, remediation wells, and water supply wells. This procedure is susceptible to bridging when it is used below the water table. If there is insufficient documentation provided to demonstrate that the procedure was successfully applied below the water table then corrective steps will be needed to rectify the failure. The steps could result in re-drilling or over drilling the boring to replace and document the hydraulic seal properly. Therefore, care should be taken to use this procedure carefully and document the volume of the borehole and the volume of the bentonite chips used.

For soil boring above the water table, the method is pretty straight forward and involves filling the boring with dry chips. The method becomes more complicated below the water table due to boring collapse, bridging.

The method includes the use of appropriately coated bentonite chips to abandon the borehole or well where the coating delays hydration of the bentonite long enough for the chips to fall and settle on the bottom without bridging. The deeper the standing water in the well or boring, the longer the hydration delay needed, the higher the rating of the coating that will be needed. The manufacturers instructions should be followed to properly select the appropriate coating. This information should be recorded on the abandonment form. Care must be taken to monitor the rate of bentonite chips being poured with the rate of borehole filling from the bottom to the top. A weighted take measure must be used to document the filling rate for wells and borings deeper than 20-feet below the water table. Steps must be taken to eliminate any bridging by following the manufactures instructions and evaluating the borehole volume and the volume of bentonite



being used to be sure they match. Corrective measures may be needed, such as drilling out bridged bentonite to eliminate void spaces. A two-inch riser may be appropriate to use as a tremie pipe for the bentonite chips when abandoning large diameter boring or wells.

For soil borings deeper than 15-feet, where the boring penetrates a confining layer or more than one geologic formation, temporary steel casing or hollow stem augers must be used to properly seal the bottom of the boring when the CSM and site specific hydrogeologic information indicates a potential risk of contaminant migration along the borehole.

5.3.4 Backfill

This method is not allowed when DNAPL or known or suspected to be present, or when contaminants with densities greater than water are present or suspected to be present at elevated concentrations capable of producing a sheen in a water shake test.

This method is not allowed to abandon monitoring wells or remediation wells.

This method is not allowed to abandon Driven Point, Drilled Overburden, or Drilled Bedrock water supply wells.

This method of abandonment is allowed for the following:

- Dug Well water supply wells
- Soil Borings completed in an area with a very shallow water table (<10-feet),; completed above the water table when the level of contamination is consistent long the length of the borehole; the area within 1,000 feet is served by public water; or the CSM concludes that there is no risk of contaminant migration from a backfilled boring

For soil borings where this method is allowed, this method uses locally derived uncontaminated soils or soils previously removed from the boring to backfill the soil boring. Care should be made to avoid bridging by breaking up soils and slowly placing them in the borehole. Hand or hydraulic tools can be used to compact soils within the borehole from the bottom to the top.

For abandonment of dug wells, this method allows uncontaminated native soils sourced from a local native borrow pit to be placed in the dug well after all pumps, foot valves, and water supply lines are removed from the well. It is recommended that the upper most cement well tile be removed, and soils and loam be placed at the surface.

5.3.5 Backfill with a surface seal

This method is not allowed when DNAPL or known or suspected to be present, or when contaminants with densities greater than water are present or suspected to be present at elevated concentrations capable of producing a sheen in a water shake test.



This method is not allowed to abandon monitoring wells or remediation wells.

This method is not allowed to abandon Driven Point, Drilled Overburden, or Drilled Bedrock water supply wells.

This method of abandonment is allowed for the following:

- Dug Well water supply wells
- Soil Borings completed in an area with a very shallow water table (<10-feet); completed above the water table when the level of contamination is consistent long the length of the borehole; the area within 1,000 feet is served by public water; or the CSM concludes that there is no risk of contaminant migration from a backfilled boring

For soil borings where this method is allowed, this method uses locally derived uncontaminated soils or soils previously removed from the boring to backfill the soil boring. Care should be made to avoid bridging by breaking up soils and slowly placing them in the borehole. Hand or hydraulic tools can be used to compact soils within the borehole from the bottom to the top.

For abandonment of dug wells, and similar to Section 5.3.4, this method allows uncontaminated native soils sourced from a local native borrow pit to be placed in the dug well after all pumps, foot valves, and water supply lines are removed from the well. Soils can be placed in the well to within 3-feet of the surface. The well casing material should be removed as appropriate and a two-foot hydraulic seal should be placed within the top three feet using dry bentonite chips or another acceptable grout. The grout should be covered to prevent the grout or bentonite from making a slipping hazard at the surface.

5.3.3 PROJECT SPECIFIC CONSIDERATIONS

The project-specific methodology needs to consider factors such as access to the well head for equipment, including drill rig, as necessary. BMPs should be used to control erosion from wash water or displaced water from the well. During wet weather considerations for keeping abandonment materials dry must be made.

6.0 QUALITY ASSURANCE/QUALITY CONTROL

Data quality objectives should be in place to assure that the appropriate amount of well abandonment materials were used based on the volume of the boring or well being abandoned. If there is a difference of more than 20% then there is likely a bridge formed within the borehole by the well abandonment material that needs to be addressed.

7.0 REFERENCES



AMERICAN WATER WORKS ASSOCIATION, 1990, Abandonment of Test Holes, partially completed wells and completed wells: AWWA Standard for Water Wells, A100-90, pp. 25-26.

DRISCOLL, F.G., 1986, Groundwater and Wells, 2nd ed., Johnson Filtration Systems, Inc., St. Paul, Minnesota 55112, 1089 pp.

MAINE DHHS, CMR CHAPTER 232 - Well Drillers and Pump Installers Rules

RENZ, M.E., May 1989, In Situ Decommissioning of Ground Water Monitoring Wells, Water Well Journal, pp. 58-60.

U.S. ENVIRONMENTAL PROTECTION AGENCY, 1975, Manual of Water Well Construction Practices, Office of Water Supply, EPA-570/9-75001.



Attachment 1
DHHS Chapter 232

10 - DEPARTMENT OF HEALTH AND HUMAN SERVICES

CMR CHAPTER 232 - Well Drillers and Pump Installers Rules

SUMMARY

This rule describes the examination and license requirements for persons and companies that perform well drilling, including geothermal heat exchange wells, pump installation and hydrofracturing. This rule also prescribes a code of conduct for well drillers and pump installers.

BASIS STATEMENT

The Maine Water Well Program was authorized and established by the Maine Legislature to provide the public with the highest quality drinking water possible by ensuring that water wells and geothermal heat exchange wells are drilled, constructed, altered or abandoned in a manner that protects ground water from contamination.

NON-DISCRIMINATION NOTICE

In accordance with Title VI of the Civil Rights Act of 1964, as amended by the Civil Rights Restoration Act of 1991 (42 U.S.C. 1981,2000d *et seq.*) Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), the Age Discrimination Act of 1975, as amended (42 U.S.C. 6101 *et seq.*), Title II of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 *et seq.*), and Title IX of the Education Amendments of 1972, the Maine Department of Health and Human Services does not discriminate on the basis of sex, race, color, national origin, disability or age in admission or access to or treatment or employment in its programs and activities.

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CHAPTER 1

DEFINITIONS

SECTION 100.0 GENERAL

100.1 Requirements: All well drillers and pump installers shall comply with the applicable rules.

100.2 Scope: Unless otherwise expressly stated, the following terms shall, for the purpose of this rule, have the meanings set forth in the following sections.

100.3 Interchangeability: Words used in the present tense include the future tense; words in the masculine gender include the feminine and neuter; the singular number includes the plural, and the plural includes the singular.

100.4 Terms not defined: Terms not defined in the following sections shall have ascribed to them their ordinarily accepted meanings such as the context may imply.

SECTION 101.0 DEFINITIONS

Abandonment: The complete sealing of a well or borehole with grout or other impermeable material to prevent contamination of the aquifer.

Apprentice pump installer: A person who is engaged to work at and learn the trade of water well pump installation, repair and maintenance under the direct supervision of a master or journeyman pump installer. A person who is licensed under chapter 49 as a master plumber is not required to register with the commission as a pump installer.

Apprentice well driller: A person who is engaged to work at and learn the trade of well drilling under the direct supervision of a master or journeyman well driller.

Bentonite: A clay which consists of a majority of montmorillonite and expands by absorbing water. It is commercially available in a variety of forms designed to add viscosity to drilling fluids or to create a seal of low hydraulic conductivity.

Borehole: See well or water well.

Casing: Any pipe installed in the excavated borehole to prevent the collapse of the walls of the borehole through unconsolidated formations.

Closed loop geothermal company: A person, firm, partnership or corporation that owns or otherwise operates any mechanical equipment used to drill, drive or bore closed loop geothermal heat exchange wells.

Closed loop geothermal heat exchange well: A geothermal heat exchange well with a sealed and pressurized loop of pipe containing a heat exchange solution, which is circulated below the earth's surface and utilizes the earth for the purpose of heat transfer.

Closed loop geothermal installer: A person, firm or corporation engaged in the work of installing closed loop geothermal heat exchange wells.

Coastal Zone: The land area bounded by the medium high water mark along all ocean front property and all saltwater or brackish marshes or inland rivers, extending 600 feet inland.

Commission: Maine Water Well Commission

Department: The Department of Health and Human Services

Development: The act of flushing or pressurizing the aquifer to increase the efficiency, and clean the well.

Disposal field: Any system designed to dispose of waste or waste water on or beneath the surface of the earth; includes, but is not limited to: crushed rock or chambered disposal fields; grandfathered cesspools; or any other fixture, mechanism, or apparatus used for those purposes.

Drilling rig: A mechanical device used to drill, drive, or bore water wells.

Drive shoe: A hardened steel cylinder designed to be welded or threaded onto the end of the steel casing and manufactured to provide a seal to the bedrock surface.

Geothermal heat exchange well: A hole drilled, driven or bored into the earth for the purpose of using the heat exchange capacity of the earth for heating and cooling.

Geothermal heat exchange well driller: A person, firm or corporation engaged in the work of drilling, driving or boring geothermal heat exchange wells.

Geothermal heat exchange well pump installer: A person who is engaged to work at and learn the trade of geothermal heat exchange well pump installations.

Gravel packed well: A type of gravel well in which filter material is placed in the annular space to increase the effective diameter of the well, and to prevent fine-grained sediments from entering the well.

Gravel well: A well drilled and completed in unconsolidated surficial deposits of sand, gravel or till.

Ground water: The water contained within the interconnected pores, cracks or fractures located below the water table of a confined or unconfined aquifer.

Grout: A fluid mixture of neat cement and water, bentonite and water or both, possibly with additives, of a consistency which can be forced through a pipe and which is designed to provide a seal.

Holding tank: A closed watertight structure designed and used to receive and store waste water or septic tank effluent. A holding tank does not discharge waste water or septic tank effluent to surface or ground water or onto the surface of the ground. Holding tanks are designed and constructed to facilitate ultimate disposal of waste water at another site.

Hydrofracturing: A process of putting hydraulic pressure on the bedrock surrounding the borehole that has been drilled for the purpose of enhancing the quantity of water.

IGSHPA: International Ground Source Heat Pump Association. Address: 374 Cordell South, Stillwater Oklahoma, 74078. IGSHPA Certification as required in these rules shall mean either IGSHPA certification as an "Installer" by successfully completing the "Accredited Drillers Training" or as an "Accredited Vertical Loop Installer" by successfully completing the "Accredited Installers Workshop".

Jaswell type seal: A flexible rubber like collar with circular rings designed to provide a water tight seal between the well casing or liner and a larger diameter hole. Although one such seal is manufactured by the Jaswell Corporation, in these

rules the term means all similar products of other manufacturers.

Journeyman pump installer: A person doing the work of pump installation, repair or replacement who is in the employment of a master pump installer. A person who is licensed under chapter 49 as a master plumber is not required to register with the commission as a pump installer.

Journeyman well driller: A person doing the work of drilling, driving or boring wells who is in the employment of a master well driller.

Lift Station: A closed, water tight structure equipped with a sewage pump and designed and used to receive and store waste water or septic tank effluent and then pump the waste water or effluent to a disposal field.

Liner: Any pipe installed after the installation of the casing, which is used to prevent the collapse of the walls of the boreholes, to exclude pollutants or undesirable water from entering the water source at the well, or to provide a channel for conveying the water to the surface.

License endorsement: Additional authorities granted to existing Journeymen or Master licensees upon satisfying relevant knowledge and experience requirements established by the Commission.

Master pump installer: A person firm or corporation engaged in the installation, repair or replacement of a pump in a water well. The licensure of a master pump installer under this chapter must specify the name of the person licensed. In the case of a firm, the person registered as a master pump installer must be a member or employee of the firm. In the case of a corporation, the person registered as a master pump installer must be an employee of the corporation or an officer of the corporation.

Master well driller: A person, firm or corporation engaged in the business of drilling, driving or boring wells. The licensure of a master well driller under this chapter must specify the name of the person licensed. In the case of a firm, the person licensed as a master well driller must be a member or employee of the firm. In the case of a corporation, the person licensed as a master well driller must be an employee of the corporation or an officer of the corporation.

Modified concentric well: A closed loop geothermal heat exchange well that utilizes two concentric pipes, consisting of smaller diameter

pipe inside larger diameter pipe, to circulate the heat exchange solution through the borehole in a sealed and pressurized loop.

Non-submersible pump: Mechanical device that is used to move water from the well to higher elevation and the pump and motor are installed outside the well.

Open end casing: Casing terminated in a gravel aquifer without a screen.

Open hole setting: Installing casing when the overburden is stable enough to remain free of impediments.

Open loop geothermal heat exchange well: Any geothermal heat exchange well that utilizes groundwater pumped from a well as a heat exchange medium whether water pumped from the well is returned to the well or disposed of elsewhere.

Overburden: The loose soil, silt, sand, gravel, or other unconsolidated material overlaying bedrock.

Packer: Down-hole equipment consisting essentially of a sealing device, a holding or settling device, and an inside passage for fluids. It is used to block the flow of fluids through the annular space between the tubing and the wall of the well-bore, or between the tubing and the casing, by sealing off the space between them.

Perforated casing: A series of openings in a well casing, made either before or after installation of the casing to permit the entrance of water into the well.

Permanent structure: A building, constructed to house people, vehicles, or equipment and supplies, of sufficient size and weight, or anchored to the ground in such a way, that it is unreasonable to relocate it for the purpose of drilling a water well.

Potable: Water suitable for drinking.

Public water supply: A water system which serves 25 or more people for at least 60 days per year or which has at least 15 service connections. Examples include water districts, mobile home parks, campgrounds, restaurants, apartment buildings, and hotels.

Pump installation company: A person, firm, partnership or corporation that is engaged in the trade of water well pump installation, repair or replacement.

Pump installer: An apprentice pump installer, journeyman pump installer or master pump installer. A person who is licensed under 32 M.R.S.A. chapter 49 as a master plumber is not required to register with the commission as a pump installer.

Pump or pump system: For the purpose of a water well, "pump" or "pump system" means mechanical equipment or a device used to remove water from a well including all piping and wiring up to the existing equipment in the structure. For the purpose of a geothermal heat exchange well, "pump" or "pump system" means the mechanical equipment or devices used to move fluid from the geothermal heat exchange well, including all piping and wiring, up to the existing equipment in the structure.

Road box: A covered box of adequate size and strength to provide protection for the top of a well that has been terminated below the surface of the ground, from foot and vehicle traffic.

Rules: Means these rules.

Sealed vault privies: See "Septic Tank"

Septic tank: A watertight receptacle which receives the discharge of a drainage system or part thereof, designed and constructed so as to retain solids, digest organic matter through a period of detention and allow the liquids to discharge into the soil outside of the tank through a system approved by the Administrative Authority. **Sealed vault privies** are considered "septic tanks" for the purpose of setback distances.

Shale packer: A flexible rubber like cone collar designed to fit between a well casing or liner and a larger diameter hole. The collar prevents material placed above it from passing by it and into the well below.

Submersible pump: Mechanical device that is used to move water from the well to higher elevation and is completely submerged in the well.

Surface water: Water occurring above the ground water table.

Underreamer: Method of drilling borehole, and installing casing at the same time. The underreamer bit extends to drill a slightly larger bore than the O.D. of the casing, then it is retracted after the borehole is drilled.

Well driller: An apprentice well driller, journeyman well driller or master well driller.

Well drilling company: A person, firm, partnership or corporation that owns or otherwise operates any mechanical equipment used to drill, drive or bore water wells or geothermal heat exchange wells.

Well, water well or borehole: Any hole drilled, driven or bored into the earth used to extract drinking water. The terms "well" and "water well" do not include:

1. Dug wells;
2. Monitoring wells;
3. Wells constructed exclusively for the relief of artesian pressure at hydroelectric projects;
4. Wells constructed for temporary dewatering purposes;
5. Wells constructed for the purposes of extracting oil, gas or brine; and
6. Wells on private property for private use that are constructed by the property owner or lessee of the property.

Well screen: The intake section of the well that obtains water from an aquifer of unconsolidated materials such as sand.

Yield: The volume of water discharged from a well in gallons per minute.

SECTION 102.0 PUBLICATIONS REFERENCED

The "*Manual of Water Well Construction Practices, Second Edition*" published in 1998 by the National Groundwater Association referenced in these regulations can be purchased from the NGWA on-line at www.ngwa.org or by calling 800-551-7379. Copies are also available at the Commission office for in-house review.

The "*Closed-Loop/Geothermal Heat Pump Systems, Design and Installation Standards, 2010 Edition*" published by the International Ground Source Heat Pump Association referenced in these regulations as "*IGSHPA Standards*" can be purchased from IGSHPA on-line at www.igshpa.okstate.edu or by calling 800-626-4747. Copies are also available at the Commission office for in-house review.

The Commission office is located at:

Maine Well Drillers Commission
286 Water Street
Augusta, Maine 04333

SECTION 103.0 WAIVER

Except as otherwise provided, the Commission may waive any performance standard, or portion thereof, established in Chapters 3, 4, 5 or 6 of these Rules upon a demonstration of extraordinary extenuating circumstances and a finding that strict application of these rules would result in an undue hardship. In no event may the Commission waive enforcement of any performance standard established by these Rules if to do so would be to establish a significant threat to public health.

CHAPTER 2

GENERAL REQUIREMENTS

SECTION 200.0 APPLICATION PROCEDURES

200.1 General: Effective January 1, 1994 for water wells and May 25, 2011 for geothermal heat exchange wells, a person may not engage in the business of constructing, altering or repairing water or geothermal heat exchange wells including installing seals, liners and grout within the State or engage in the installation, alteration, repair or replacement of a pump or pump system in a water or geothermal exchange well unless licensed with the Commission. All provisions herein related to geothermal heat exchange well construction, geothermal heat exchange well pump installation and licensing requirements for geothermal heat exchange well drillers and geothermal heat exchange well pump installers shall apply on the effective date of these rules. A minimum of an apprentice license is required for any person participating in the drilling, construction, alteration or repair of a water well or geothermal heat exchange well, including the setup and/or taking down of a drill rig, and the installation, replacement, alteration or repair of all materials used to construct water or geothermal heat exchange wells including pumps or pump systems and all other materials used specifically in water and geothermal heat exchange wells. A master or journeyman licensee must be present to supervise apprentice licensees at all times when activities covered by these regulations are in progress. All individual licensees must be in the responsible charge of a licensed company. A company license is valid only while the company employs at least one licensed or endorsed master appropriate for each type of company license. License application requests shall be on application forms furnished by the Department and require the information set forth in the Section.

200.2 References: Three (3) references shall be submitted by persons who have a professional knowledge of the applicant's work. At least one reference must be from a master licensee or for out of state applicants the equivalent.

200.3 Work experience: Documentation showing that the minimum work experience criteria set forth in Section 202.0 has been met. Failure to provide appropriate evidence of work experience will result in the denial of an application.

200.4 Time frame: The applicant's request for examination/license, along with the completed application and reference forms, must be received by the Department no later than thirty (30) days prior to the examination date.

200.5 Application review / examination fee: Twenty-five (25) dollars shall be submitted with each application and is non-refundable. This fee covers the initial application review and one examination. Checks shall be made payable to Treasurer of State.

200.6 Exemptions: This subsection does not prevent a person from making water well, geothermal heat exchange well or pump system installations, alterations, repairs or replacements in a single-family residence owned and occupied by that person and to be occupied by that person as a bona fide personal abode, providing the installation, alteration, repair or replacement conforms to the standards set forth in this chapter and any rules adopted by the Maine Water Well Commission or the department. This subsection does not prevent a person from removing and replacing an existing pump for the purpose of well inspection or to test pumping if the pump and electrical system are not being modified.

200.7 Applicability: These rules are applicable when determining the appropriate setbacks for new water supply and geothermal heat exchange wells from existing disposal system components. The Maine Subsurface Waste Water Disposal Rules, 144A CMR 241, are the applicable rules for determining the appropriate setbacks for new or replacement disposal system components from existing water supply wells. When both a new water supply well and a new or replacement disposal system are being designed simultaneously

homeowners are advised to verify that the proposed well location does not conflict with requirements of the Maine Subsurface Waste Water Disposal Rules.

200.8 Updating information: Licensees must notify the Commission in writing of any changes of name, address, phone number, or in the case of a company license, a change of ownership or the loss or change of the master licensee responsible for that license within 30 days of the effective date of the change or loss.

SECTION 201.0 GRANDFATHER CLAUSE:

201.1 Open loop geothermal heat exchange license endorsements: Current master and journeyman well driller licensees shall be grandfathered for open loop endorsement for a period of 180 days from the effective date of these rules geothermal heat exchange well rules, May 25, 2011. Appropriate application must be made on forms provided by the Commission prior to the expiration of the grandfathering period.

201.2 Closed loop geothermal heat exchange license endorsements: Current master and journeyman well driller licensees with current IGSHPA certification shall be grandfathered for closed loop endorsement for a period of 180 days from the effective date of these geothermal heat exchange well rule, May 25, 2011.. Appropriate application must be made on forms provided by the Commission prior to the expiration of the grandfathering period.

201.3 Master closed loop geothermal heat exchange installers: A grandfathering period of 180 days from the effective date of these geothermal heat exchange well rules, May 25, 2011, shall be provided for master closed loop geothermal heat exchange installers. To qualify, evidence of a minimum of 10 completed closed loop geothermal heat exchange wells and current IGSHPA certification must be provided to the Commission along with appropriate application prior to the expiration of the grandfathering period.

SECTION 202.0 MINIMUM WORK AND KNOWLEDGE EXPERIENCE FOR EXAMINATION ADMITTANCE

202.1 General: The minimum work experience and/or knowledge required for admittance to examinations is set forth in this section.

202.2 Master well driller: A master well driller must have a minimum of three (3) years experience in well drilling and have worked an average of 1000 hours per year as a licensed journeyman well driller for each of those years.

202.3 Journeyman well driller: A journeyman well driller must have at least one (1) year experience in well drilling and have worked at least 1000 hours during that year as a licensed apprentice well driller.

202.4 Apprentice well driller: An apprentice well driller is an applicant who is not eligible under subsections 202.2 or 202.3.

202.5 Master pump installer: A master pump installer must have a minimum of three (3) years experience as a pump installer and have worked at least 350 hours as a licensed journeyman pump installer during each of those years.

202.6 Journeyman pump installer: A journeyman pump installer must have at least one (1) year experience in pump installing and have worked at least 350 hours during that year as a licensed apprentice pump installer.

202.7 Apprentice pump installer: An apprentice pump installer is an applicant who is not eligible under subsection 202.5 or 202.6.

202.8 Closed loop geothermal driller endorsement: Current IGSHPA certification or certification from another nationally accredited standards setting organization approved by the Commission and a valid master or journeyman well drilling license is required for this endorsement examination.

202.9 Master closed loop geothermal heat exchange installer: A master closed loop geothermal heat exchange well installer must have (1) a minimum of three (3) years experience; (2) have worked an average of 1000 hours per year as a licensed journeyman closed loop geothermal heat exchange installer for each of those years and (3) have current IGSHPA certification or certification from another nationally accredited standards setting organization approved by the Commission.

202.10 Journeyman closed loop geothermal heat exchange installer: A journeyman closed loop geothermal heat exchange well installer must have (1) at least one (1) year experience in closed loop geothermal heat exchange well installations (2) have worked at least 1000 hours during that year as a licensed apprentice closed loop geothermal heat exchange well installer and (3) have current

IGSHPA certification or certification from another nationally accredited standards setting organization approved by the Commission.

202.11 Apprentice closed loop geothermal heat exchange well installer: An apprentice closed loop geothermal heat exchange well installer is an applicant who is not eligible under subsections 202.9 or 202.10.

202.12 Open loop geothermal heat exchange driller and pump installer endorsements: Current master and journeyman water well drillers and pump installers may be admitted to appropriate endorsement examinations.

202.13 Work experience from another state: The Commission may consider work experience obtained from another state for satisfying the relevant requirements of sections 202.2, 202.3, 202.5, 202.6, 202.9 and 202.10 on a case-by-case basis. For any state with comparable licensing or registration requirements, applicants shall be required to provide a copy of a valid license or registration and evidence of good standing with the regulatory agency from that state which has jurisdiction over well drillers in addition to references and proof of appropriate work experience. For states without comparable licensing or registration requirements, the Commission may require any information it deems necessary to verify adequate work experience and demonstrate good standing in that state in addition to appropriate references and other required information.

SECTION 203.0 EXAMINATIONS

203.1 Qualifying: Only persons meeting the work experience criteria set forth in Section 202.0 and having suitable references as determined by the Commission will be admitted to the examination.

203.2 Examination dates: Examinations shall be held on dates and places as determined by the Department, but in no case shall the Department hold less than one (1) examination per calendar year.

203.3 Examination fee: The twenty-five (25) dollar fee in Section 200.5 includes the costs for one examination. Applicants needing to retake an examination or wishing to take another examination, shall submit a new application along with the application fee set forth in Section 205.

203.4 Examination content: The written examination focuses on matters appropriate for the

license or endorsement for which an application is made.

203.5 Passing exam scores: The minimum passing score for all license exams is 70%.

SECTION 204.0 LICENSURE

204.1 General: The Department shall issue a license to an applicant who meets the qualifications as set forth in Sections 202.0 and 203.0 and this Section.

204.2 Renewal date: Licenses shall be renewed the first day of January of each year by submitting the renewal application form and registration fee, provided his/her record of compliance with these rules and standards and applicable statutes is acceptable to the Department. **A late fee of \$50.00 shall be assessed to all master and journeyman license renewals received after January 31 of each year.**

204.3 Renewal of license: If a licensee has not complied with the rules and standards and applicable statutes, the Commission or Department shall notify the licensee that the license shall not be renewed and the reasons for such action. A licensee who receives a notification may request a hearing before the Commission (207.5). A license shall not expire until final agency action has been taken.

204.4 Reinstatement of lapsed licenses: Well drillers and pump installers who allow a license to lapse for more than three (3) years will be required to take an examination and pay the examination fee. After successful completion of an examination and provided his/her record of compliance with these rules and standards and applicable statutes is acceptable to the Department, a license will be issued upon receipt of the appropriate licensure fee. Licenses that have lapsed for less than three (3) years may be reinstated by paying the current year's license fee and lapsed years fees.

204.5 License required: No individual or company shall perform drilling or pump installation, repair or replacement without an appropriate and current license.

204.6 Company licenses: One well drilling company license shall be issued for each well drilling company that employs at least one licensed master well driller, pays the appropriate fees and makes application to the commission, and to each

pump installation company that employs at least one licensed master pump installer, pays the appropriate fees and makes application to the commission.

204.7 The licensure fee(s) is as follows:

- 204.7.1** \$120.00 - Master Well Driller or Master Closed Loop
- 204.7.2** \$88.00 - Journeyman Well Driller or Journeyman Closed Loop
- 204.7.3** \$ -0- All Apprentice Drillers
- 204.7.4** \$ 60.00 - Master Pump Installer
- 204.7.5** \$ 40.00 - Journeyman Pump Installer
- 204.7.6** \$ -0- Apprentice Pump Installer
- 204.7.7** \$10.00 - Well Drilling Company
- 204.7.8** \$10.00 - Pump Installation Company
- 204.7.9** \$10.00 - Closed Loop Geothermal Company
- 204.7.10** \$10.00 - Each Endorsement

Make checks payable to Treasurer of State.

SECTION 205.0 RECIPROCITY

205.1 General: The commission may issue a license without examination, in a comparable classification, to any person who holds a registration or license in any state, territory or possession of the United States or any country, if the commission determines that the requirements for licensure of well drillers, geothermal heat exchange well drillers, geothermal heat exchange well pump installers or pump installers under which the person's license was issued do not conflict with this rule or the code of performance adopted by the commission under this rule.

SECTION 206.0 VEHICLE IDENTIFICATION

206.1 Required rig and pump service vehicle identification: A company shall display its license number on both sides of each drilling rig and pump service vehicle.

206.1.1 Size of numbers: The numbers and/or letters shall be 1.5" in size and located immediately adjacent to the Maine Well Drillers Commission seal.

206.1.2 Contrasting colors: The license number and rig number and/or letter shall be of a contrasting color to the drilling rig and pump service vehicle.

SECTION 207.0 CONTRACTS

207.1 Contracts and complaints: In the absence of a written agreement, whose terms satisfactorily address water quality or water quantity, the Commission may apply any of the recommended practices established in these rules as the standard upon which to evaluate a complaint against a driller or pump installer related to the drilling of a water well or installation of a water pump.

SECTION 208.0 SEVERABILITY CLAUSE

208.1 General: If any section, subsection, sentence, clause, phrase or portion of these rules is for any reason held to be invalid or unconstitutional by the decision of any court of competent jurisdiction, such decision shall not affect the validity of the remaining portions of these rules.

CHAPTER 3

CODE OF ETHICS

SECTION 300.0 CONTENTS

300.1 General: All work shall be performed in accordance with State and local regulations, and shall be performed with the customer's best interest as a primary goal.

300.2 Professionalism: The process of selecting the well site, getting to, constructing, developing, and completing the job will be done with as much concern for the customers wishes, neatness, speed, safety, and professionalism as possible. Striving to make the end results beneficial, acceptable and pleasing to all parties concerned.

300.3 Ethical practices: The purpose of the Maine well and or pump contractor, is not only to make a living, but to show our concern for the environment and to help make Maine a cleaner and safer place for all who live here.

300.3.1 When drilling or installations are practiced as a profession, the privilege of practice requires professional, ethical conduct and professional responsibility.

300.3.2 Each driller or installer is to be guided by the highest standards of ethics, personal honor, and professional conduct.

300.3.3 A driller or installer shall not engage in false or deceptive advertising, or make false, misleading or deceptive representations or claims in regard to the profession, or in regard to others in the practice of the profession, which concern his or her own professional qualifications or abilities.

300.3.4 A driller or installer shall not issue a false statement or false information even though directed to do so by an employer or client.

300.3.5 A driller or installer shall protect, to the fullest possible extent, the interest of his or her employer or client so far as is consistent with the law and the well drillers and pump installers professional obligations and ethics.

300.3.6 A driller and installer shall endeavor to cooperate with others in the profession and encourage ethical and educational advancement.

300.3.7 It shall be the duty and professional responsibility of every driller and installer not only to uphold these standards of ethics by precept and example, but also, where necessary, to encourage by counsel and advise to other drillers and installers, their adherence to such standards.

CHAPTER 4

NEW WATER WELL CONSTRUCTION

SECTION 400.0 WATER WELL LOCATION

400.1 Scope: This Chapter governs the horizontal setback distances between new water supply wells and disposal fields, septic tanks, holding tanks and lift stations, and includes standards for the construction of drinking water and open-loop geothermal wells.

400.1.1 General: The minimum setback distances from waste water systems set forth in this rule are designed to minimize water well contamination by waste water disposal systems. A well driller must make every reasonable effort to determine the location of all septic system components on the subject property and any adjacent properties of concern. The natural flow of ground water on a particular piece of property, as well as the type of water well and the manner in which it will be constructed, are primary considerations when siting a water well in relationship to a waste water disposal systems. This section establishes minimum setback distances for private wells from waste water disposal fields, septic tanks, holding tanks and lift stations and provides for reductions to those distances for bedrock wells when one or more of the conditions defined in section 400.2 below exists at a drilling site.

400.1.2 Public water supply wells: The State of Maine Rules Relating to Drinking Water, 10-144 CMR Ch. 231, Section 3, describes the approval process for a new well which will serve a public water supply and states that "no new production well shall be installed prior to preliminary approval being granted in writing by the Department of Health and Human Services." Examples include water districts, mobile home parks, campgrounds, restaurants, apartment buildings and hotels. Any setbacks for public water supply wells from septic systems or other potential sources of contamination shall be determined by the Department of Health and Human Services during the preliminary approval review process. See definition in Chapter 1.

Point of Contact is:

Maine Drinking Water Program
#11 State House Station
Augusta, ME 04333-0010
Telephone (207) 287-2070

400.1.3 Gravel wells: The minimum setbacks provided for in this Chapter cannot be reduced for gravel wells without a specialty well application as provided for in Section 400.7 having been approved by the Commission prior to drilling.

400.2 Minimum setback distances between water supply wells, and disposal fields: The minimum horizontal setback distance of a water supply well from a waste water disposal field designed to treat less than 2,000 gpd (gallons per day) is 100 feet, and the minimum horizontal setback distance of a water supply well from a waste water disposal field designed to treat 2,000 gpd or more is 300 feet, except as provided for in Sections 400.3 and 400.7.

400.2.1 Wells intended to serve Public Water Supplies, as defined in Chapter 1 of these rules, must be approved in writing by the Department of Health and Human Services prior to being drilled and shall be constructed with a setback from disposal fields or other potential sources of contamination as required by the Department of Health and Human Services, Drinking Water Program.

400.3 Reduction in minimum setback distances between bedrock water supply wells and disposal fields: The well driller, after consultation with the property owner or customer, may determine that it is not practical to maintain the minimum setback distances from disposal fields as specified in Section 400.2. In these instances, the minimum setback distance for bedrock water supply wells may be reduced, depending upon the amount of casing or liner seal installed below ground level, as provided in Table 400.1 for the following reasons:

- a) the size of the property is not sufficient to allow for the required setback; or
- b) sufficient setbacks from other potential sources of contamination cannot be met; or
- c) excessive slopes prohibit access; or

- d) the location of permanent structures would result in unreasonable impacts or damage to the structures; or
- e) the location of lakes, ponds, streams or wetlands prohibits meeting the required setback; or
- f) the presence of bedrock at or within three vertical feet the surface would result in unreasonable trenching requirements.

In these cases a bedrock well must be installed and the setback reductions set forth in Table 400.1, shall be used. In addition, a Setback Reduction Notification Form as described in Section 400.5 must be completed. All other reasons for reducing the setback from a bedrock well to a disposal field shall require a Specialty Well application approved by the Commission prior to drilling. In no case shall the minimum setback be reduced to less than 60 feet from disposal fields designed for less than 2,000 gpd, or 180 feet in the case of wells with sewage systems designed for 2000 gpd (gallons per day) or more, without written approval of a Specialty Well application as described in Section 400.7 by the Commission.

400.3.1 Reduction in minimum setback distances between gravel water supply wells and disposal fields: There is no setback reduction allowed for gravel wells without a Specialty Well application approved by the Commission as described in Section 400.7.

Table 400.1

Reduction in disposal field setbacks, for bedrock wells and a Wastewater Disposal Field

Depth of Well Casing or Liner Seal Below Ground Level	Minimum Setback Distance for Disposal System < 2,000 gpd	Minimum Setback Distance for Disposal System > 2,000 gpd
40 feet	90 feet	270 feet
55 feet	80 feet	240 feet
70 feet	70 feet	210 feet
90 feet	60 feet	180 feet

400.4 Minimum setback distances between water supply wells and septic tanks, holding tanks and lift stations: The minimum horizontal setback distance of a water supply well from septic tanks, lift stations, and holding tanks is 60 feet. In no case shall the minimum setback be reduced to less than 60 feet from septic tanks, lift stations or holding tanks without written approval of a Specialty

Well application as described in Section 400.7 by the Commission.

400.5 Setback reduction notification forms: The well driller is required to submit a complete Setback Reduction Notification Form to the Commission, on a form provided by the Commission, for all wells drilled less than 100 feet from a disposal field, or 60 feet from a septic tank, holding tank, or lift station, or 300 feet from a disposal field designed for 2,000 gpd or more. The well driller shall indicate on the form which situation(s) described in Section 400.2. resulted in the reduced setback, or indicate the date Specialty Well approval as described in Section 400.7 was granted by the Commission. The well driller will also include the setbacks achieved, a description of the construction details of the completed well, including the depth of casing seal below ground, the length of any liners and the depth of any liner seals below ground. The form, signed and dated by the property owner and well driller, shall be submitted to the Commission no later than thirty (30) days from the completion of the well. If the Commission reviews the setback reduction notification form and finds the reduction not acceptable, the Commission may order corrective measures to be taken.

400.6 Water wells located adjacent to property lines: The Maine Subsurface Waste Water Disposal Rules provide for special setback conditions between a well and an abutter's subsequently located waste water disposal field (whether located purposefully or not). Specifically, Sections 702 and 703 of the Waste Water Rules (144A CMR 241, pages 7-2, 7-3 and 7-4, and Tables 700.2, 700.3 and 700.4) establish conditions and requirements for setbacks between wells and proposed disposal fields.

400.7 Specialty wells: The Commission is authorized to review and approve or deny, in writing, on a case-by-case basis, the location of bedrock wells that cannot meet the setback and/or casing provisions described in Sections 400.2, 400.3 and 400.4, or is a gravel well that cannot meet the setbacks described in Sections 400.2 and 400.4. Application for a Specialty Well shall be made directly to the Commission by a duly licensed well driller on a form provided by the Commission. In such instances, if it is not practical to meet the requirements established by these rules, the Commission may permit the location of water supply wells through a written waiver. In such cases the Commission may prescribe other such conditions as it deems necessary for the protection of public health, including having an independent inspector present during specialty well installation.

400.7.1 Registry of Deeds: When the Commission authorizes a waiver, the owner may be required by the Commission to file with the Registry of Deeds, a form clearly stating the particular aspects of the well location with reference to the waste water disposal field. The application form will be provided by the Commission and presented to the owner by the well driller. The well driller shall obtain a copy of the recorded deed covenant form prior to the well being drilled.

400.7.2 Expiration and transferability: Approved Specialty Well applications shall expire one year from the date of issue unless drilling and construction have been completed or the applicant has requested and received an extension from the Commission in writing prior to the expiration date. Specialty well approvals are not transferable between well drilling companies.

400.7.3 Setbacks less than 40 feet from a disposal field: Specialty wells required to be less than 40 feet from the nearest septic system disposal field shall be constructed with an annular space of not less than a nominal two (2) inches in radius between the outside of the casing and the inside of the borehole. For example, six (6) inch casing requires a borehole at least ten (10) inches in diameter. This space shall be grouted from bottom to top using methods described in the "Manual of Water Well Construction Practices, Second Addition", published by the National Groundwater Association in 1998, Chapter 4, section 4.5, or another method approved by the Commission. Grout shall be either neat cement grout or high-solids bentonite grout with at least 20% solids by weight or another material approved by the Commission. The casing must have a centralizer installed at the bottom. The Commission may require its independent inspector to be present during the grouting process. A driller that has demonstrated familiarity with the required grouting process may have this requirement waived on a case by case basis. Mixtures used for drilling mud are not suitable for use as sealing grout.

SECTION 401.0 STANDARD PRACTICE FOR CONSTRUCTION OF WELLS DRILLED IN BEDROCK

401.1 Well casing and liner material: Well casings and liners shall be made of a material and weight appropriate to assure adequate performance of the functions for which they are used. The minimum characteristics of well casing and liners are as follows:

401.1.1 Contaminants from casing and liners: Casing and liner material shall not be a source of pollution.

401.1.2 Steel casing or liners: Steel well casing or liners shall have a minimum wall thickness of .250 inches.

401.1.3 Plastic casing or liners: Plastic well casing or liners shall be schedule 40 or heavier and National Sanitation Foundation approved for potable water use, including but not limited to Polyvinylchloride (PVC), Chlorinated polyvinyl chloride (CPVC), or Acrylonitrile butadiene styrene (ABS) or a Commission approved substitute.

401.2 Well casing placement: Well casing placement shall be as follows:

401.2.1 General: Casings shall prevent intrusion of contaminants from the ground surface or unconsolidated soil layers into the well.

401.2.2 Soil particles: Casings shall prevent entrance of soil particles into the well.

401.2.3 Termination above ground: Well casings shall extend above ground surface a minimum of eight inches. Additional height or a vented water tight cap may be required to prevent entrance of surface water in areas prone to flooding. (see 402.0)

401.3 Covers: Well casings shall have a cover to prevent the entrance of foreign matter into the well.

401.4 Drive shoe or coupling: Drive shoe or coupling shall be used for all rotary drilled wells to assist in sealing the casing into bedrock when steel casing is used. A coupling may be used in an open hole setting.

401.5 Casing extension into bedrock: It shall be the responsibility of the Water Well Contractor to install a sufficient length of well casing into bedrock, and to affect a proper seal in order to prevent surface water and shallow ground water from transmitting gravel, sand, silt, clay, and coliform bacteria into the wellbore at the bottom of the casing or anywhere along the length of the casing. The below requirements shall not preclude the use of additional protective measures if approved by the Commission.

401.5.1 Twenty (20) foot minimum: For any drilled bedrock well, in addition to the requirements of 401.5, a contractor is responsible for the installation of a minimum of 20 feet of casing. At least 10 feet of casing extending into the bedrock is recommended.

401.5.2 Plastic casing seal: When plastic casing is used, the seal shall be created by using a "jaswell" type seal tip, shale packer or equal, and the casing shall be placed in an open hole.

401.5.3 Steel casing seal: "Jaswell" type seal tips, shale packers or their equal may be used on steel casing when the casing is placed in an open hole.

401.5.4 Void area seal: The void area outside the casing shall be filled with cement grout, bentonite or ledge cuttings.

401.5.5 Bit size: All wells shall be started with a bit at least .5 inches larger than the drive shoe or coupling being used, except when a casing underreamer is used.

401.5.6 Cable tool wells: For cable tool wells, a tapered hole with ledge drilling or bentonite grout is an acceptable substitute for a drive shoe.

401.5.7 Placement of liners: All liners must be installed in such a manner that they will stay permanently in place, unless intentionally removed at a later date.

401.5.8 "Jaswell" type seals installed on liners: When "Jaswell" type seal tips are installed on liners, they shall be water-tight and leak-free.

401.5.9 Additional protective measures: The above requirements shall not preclude the use of additional protective measures. When the annulus of a well casing is grouted, it is recommended that the materials, methods and procedures in the "Manual of Water Well Construction, Second Edition, published in 1998 by the National Groundwater Association", chapter 4 be used.

SECTION 402.0 TERMINATION OF WELL CASINGS BELOW GROUND SURFACE

402.1 General: Notwithstanding 401.0 and 403.0, which stipulate that well casings shall be terminated a minimum of 8 inches above the ground surface, it

is possible to terminate a well casing below the ground surface if the following conditions are met:

402.2 Hazardous location: Locations in driveways, parking lots and walkways shall be considered potentially hazardous. Locations in lawn or yard areas, out of a direct walkway shall not be considered hazardous.

402.3 Advise owner: The well contractor shall advise the well owner of the advantages of leaving the well casing above ground, including but not limited to:

402.3.1 Easy access to well: Ease of locating the well should maintenance be needed;

402.3.2 Easy access to pump: Ease of access to the pump in all seasons when maintenance is needed;

402.3.3 Surface contamination protection: Protection against unwanted surface or ground waters; and

402.3.4 Additional protection: The additional construction requirements necessary if the top of the well be left below the land surface.

402.4 Owners request: Once advised, the well owner may request in writing that the top of the well be terminated below the land surface.

402.5 Construction requirements: The top of the well terminated below the land surface shall:

402.5.1 Road box: Be terminated in a drained, and/or slightly elevated road box with an appropriate, secure cover.

402.5.2 Sealed cap: Be completely sealed to prevent the entrance of surface water, soil, or other matter.

402.5.3 Venting: Be properly vented to avoid the creation of a vacuum. Vents shall be constructed in a manner such that they will not become blocked or allow contamination to enter the well.

SECTION 403.0 STANDARD PRACTICE FOR CONSTRUCTION OF WELLS DRILLED IN UNCONSOLIDATED MATERIALS

403.1 General: This section refers to wells commonly known as gravel wells and are constructed by drilling or washing into unconsolidated materials.

403.2 Casing Materials: Well casing materials. Refer to 401.1.

403.3 Extension above ground: Well casing shall extend above the ground surface a minimum of eight inches. In areas prone to flooding, additional height, or a vented watertight cap may be required to prevent entrance of surface water. (see 406.0)

403.4 Well casing covers: Well casings shall have a cover to prevent the entrance of foreign matter into the well.

403.5 Termination of the bottom of the casing: The bottom of the well casing shall be terminated in a manner appropriate for the conditions present and the uses of the well. Acceptable treatments include but shall not be limited to:

403.5.1 Open end casing

403.5.2 Well screen

403.5.3 Gravel packs

403.5.4 Perforated casings

403.6 Adequate quantity of water: Drilled or washed wells, constructed for household use, shall not be terminated in unconsolidated materials unless an adequate quantity of water free from fine soil particles can be withdrawn.

403.7 Method and duration of development: The contractor shall develop the well by using appropriate methods of his or her choice until such time as the well produces water substantially free from fine soil particles.

SECTION 404.0 STANDARD PRACTICE IN DEVELOPMENT OF WELL YIELD

404.1 Periodic measurement: Well yield may be measured periodically during well construction when there is a readily observable increase in yield.

404.2 Final measurement: The final yield shall be measured for all new wells after development, and indicated on well completion report.

SECTION 405.0 STANDARD PRACTICE FOR DISINFECTION

405.1 General: Water used for the development of gravel wells, or water used hydrofracturing bedrock wells will be chlorinated or potable.

405.2 New well disinfection: All new wells shall be chlorinated to a minimum concentration of 50 PPM for a minimum of 4 hours upon completion of the well. See table 405.1 for the recommended amounts of chlorine bleach.

Table 405.1

Recommended chlorine dosages using 5.25% chlorine bleach

Diameter of the well	Amount of chlorine bleach needed for each 100 feet of water depth
2 inches	2 ounces
4 inches	9 ounces
6 inches	20 ounces
8 inches	34 ounces
12 inches	80 ounces
24 inches	298 ounces

SECTION 406.0 WELL CASING EXTENSIONS

406.1 Steel casing extensions: Steel casings shall be extended by welding or threading.

406.2 Plastic casing extensions: Plastic casing shall be extended by cement welding, or by threading. No other methods will be acceptable.

SECTION 407.0 RECOMMENDED MINIMUM RECOVERY RATES

407.1 Recommended minimum recovery rates for single-family homes: These standards are based on a static water level of approximately 25 feet below ground surface. Every foot of a 6" wells holds approximately 1 1/2 gallons of water.

Table 407.1

Recommended minimum recovery rates

Well Depth (Feet)	Recovery rates (GPM)
75	5
110	4
160	3
250	2
320	1
420	1/2

407.2 Hydrofracturing: Hydrofracturing a drinking water well must be performed by a licensed journeyman or master well driller or by individuals in

the responsible charge of a licensed well drilling company.

407.3 Water used: All water used in the hydrofracturing of a drinking water well must be from a potable source or be disinfected prior to introduction of the water into the well.

407.4 Packers: All packers used in hydrofracturing must have been designed specifically for use in hydrofracturing including, but not by way of limitation, any mechanical, inflatable or cylinder activated packer. A non-toxic or food grade fluid must be used as an inflation fluid in any such packer.

407.4.1 Packer settings: The top most packer must be located at least forty feet below the bottom of the well casing and a minimum of sixty feet below the ground surface.

407.5 Disinfection: All wells hydrofractured must be properly disinfected prior to the well being placed in service.

407.6 Notification of neighboring well owners: The owner, operator or person in responsible charge of any public water supply well within 150 feet of a well to be hydrofractured must be notified in writing at least 48 hours before hydrofracturing is to commence. Notification must include a warning that hydrofracturing can cause short term temporary water quality changes in adjacent wells, and a contact name and telephone number of the person in responsible charge of the hydrofracturing process. It is strongly recommended that drillers and hydrofracturing companies provide notification to owners of private wells in close proximity to proposed hydrofracturing sites in form and manner acceptable to the Commission. The Commission shall make available hydrofracturing notification forms for this purpose.

SECTION 408.0 WELL INFORMATION

408.1 Required well information recording: Upon the effective date of these rules, any construction, enlarging or deepening of a drinking water well requires that the well driller who constructed, enlarged or deepened the drinking water well shall be responsible for recording in a permanent manner, including but not limited to, the name of the driller or drilling company, the date that the well was constructed, enlarged or deepened, the depth of the well and the yield in gallons per minute.

408.2 Approved methods for information recording: The information required in 408.1 may be recorded using one or more of the following methods:

408.2.1: Stamping engraved numbers and letters on the well cap using pre-cast stamping tools.

408.2.2: Stamping engraved numbers and letters on an aluminum plate permanently attached to the well casing using pre-cast stamping tools.

408.2.3: Permanently affixing a placard to the forward facing side of the pressure tank using permanent marker.

408.2.4: Permanently affixing a placard on a wall near and in clear and obvious view from the pressure tank using permanent marker.

408.3 Other methods of information recording: The commission may at its discretion approve an alternative method of well information recording reasonably calculated to provide the well owner, or its successors in interest, with the information required in Subsection 408.1.

408.4 The information must be maintained: Any work performed on a water well and pump system which results in the alteration or removal of any well information initially recorded will require that person or entity to record such information in a manner consistent with Subsection 408.2.

CHAPTER 5

OPEN-LOOP GEOEXCHANGE WELLS

SECTION 500.0 OPEN-LOOP WELLS

500.1 Scope: This Chapter governs the location and construction of open-looped geoexchange wells. Open-loop geoexchange wells include standing column wells with or without bleed, and open-to-recycle wells.

500.2 General: All Rules that apply to water supply wells in Chapter 4 shall also apply to open-loop geoexchange wells.

500.3 Variances: Variances from the standards outlined in these Rules for geoexchange wells must be approved by the Commission in advance using the procedures and forms used for Specialty Wells.

SECTION 501.0 SPECIFIC REQUIREMENTS

501.1 Return water quality: Any water returned to an open loop well shall be the same water that was pumped from that well, or another well in the same aquifer, modified only by a change in temperature due to the heat pump and a reduction in particulates using generally accepted means of filtration. No other form of water treatment, filtration or any addition of chemical or biological substances is allowed.

501.2 Bleed water discharge: An open-loop well for a single-family, residential, detached home should have a bleed rate of no more than one (1) gallon per minute (gpm) per acre for lots greater than one (1) acre in size that discharges to a point other than the aquifer from which it came. For lots less than one (1) acre in size, bleed water that discharges to somewhere other than the aquifer from which it came is not recommended. All other water must be returned back into the same aquifer from which it was produced.

501.3 Return Water: Any water from an open-loop well that is returned back into a ground water aquifer shall be returned back into the same aquifer from which it was produced.

501.4 Bedrock return wells: If the water from a bedrock well is returned to another bedrock well, it will be considered that the water is being returned to the same aquifer.

501.5 Gravel return wells: If the water from a "gravel" well is returned to another "gravel" well, it will be considered that the water is being returned to the same aquifer.

501.6 Return well/geoexchange well separation: Return wells for single-family detached homes shall not be more than 200 feet away from the pumped well.

501.7 Return line depth: All return lines installed in open-loop wells shall be installed so they will always be submerged below the lowest pumping water level in the well so as to prevent the cascading of return water back into the well.

501.8 Coastal zones: Any open-loop well drilled within a defined coastal zone shall always have 100% of the water that is pumped from it (for geothermal purposes) returned into the exact aquifer from whence it originated. This may be in the exact same well or in a different well. No bleed shall be allowed unless it is returned back into the same aquifer.

501.9 Coastal zone definition: The "coastal zone" is defined as the land area bounded by the medium high water mark along all ocean front property and all saltwater or brackish marshes or inland rivers, extending 600 feet inland.

501.10 Chloride levels: If the driller encounters water in an open-loop well which is drilled within the coastal zone, with a chloride level of more than 1,500 mg/l, the driller must suspend drilling and seal off the salt water fracture with a neat cement grout.

501.11 Chloride level measurements: For any well drilled within the coastal zone, a driller must perform a field measurement of the chloride content of the water produced from the well after encountering each water-bearing fracture and shall record the results on a permanent driller's log.

SECTION 502.0 GUIDELINES FOR STANDING COLUMN WELLS

502.1 Total depth: The total depth of a standing column well is determined by adding the following items:

- a) Depth to the static water level,
- b) Drawdown resulting from domestic water use, if any,
- c) Drawdown resulting from geothermal bleed, if any,
- d) Recirculation distance between the pump intake and the discharge of the return line, and
- e) Length of sump in the bottom of the well.

502.2 Recirculation distance: The minimum recommended recirculation distance per ton of heat pump capacity for a single family residential detached home is as follows:

- a) 125 feet for a geothermal well with no bleed,
- b) 85 feet for a geothermal well with a 10% bleed,
- c) 75 feet for a geothermal well with a 20% bleed, and
- d) 60 feet for a geothermal well with a 30% bleed.

502.3 Pump tests: It is recommended that a pump test, sufficient to evaluate the actual drawdown in the well, be completed for standing column wells to be used for domestic water and/or bleed water. The pumping rate to be used for the pump test should be no less than the total of the domestic water use and any anticipated geothermal bleed. The pump test should proceed until water levels are stabilized in the well. For standing-column wells, it is recommended that a driller's log be recorded and include the following:

- a) Depth to bedrock
- b) Total length and diameter of casing installed and the total depth and diameter of borehole.
- c) Depth and yield of each water-bearing fracture and the static water level.
- d) In the same manner as used for closed loop wells, identification of the material of which each stratum is composed.
- e) Identification and description of any potentially troublesome zones in the uncased borehole.
- f) Tonnage of heat pump to be served by the standing column well

- g) Design heat pump pumping rate for the well.
- h) Recommended depth setting of pump in the well.
- i) Recommended maximum bleed rate for the system.
- j) Recommended depth setting of the return pipe in the well.
- k) Time at which pumping started.
- l) Record of pumping rates and pumping water levels recorded during the test.
- m) Time at which pumping stopped.

502.4 Pump depth: The depth of the pump setting and the depth of the discharge of the return pipe in the well shall be determined from the results of the pump test and shall be set so the discharge of the return pipe and the pump intake shall always be submerged below the lowest pumping water level.

502.5 Sediment filters: A sediment or spin-down filter should be installed on the intake line before the heat pump to prevent sediment from the well damaging the heat pump heat exchanger.

502.6 Additional design requirements: Before drilling any standing column well to be utilized as a heat source for any structure other than a single-family, residential, detached home and associated structures (for example, garages and other outbuildings), the driller shall first obtain a design for that specific well provided by either a Professional Engineer (PE) or a Certified Geothermal Designer (CGD)

502.7 Maine DEP requirements: A driller who drills either a standing column well with bleed, or an open-to-recycle well, and a pump installer who installs a pump system into such a well, shall perform the work in accordance with current Maine Department of Environmental Protection rules regulating the proper discharge of water from the well to a location other than back into the same well.

CHAPTER 6

CLOSED LOOP GEOEXCHANGE WELLS

602.0 GROUT

SECTION 600.0 CLOSED LOOP WELLS

600.1 Scope: This Chapter governs the location and construction of closed-loop geoexchange wells.

600.2 Variances: Variances from the standards outlined in these Rules for geoexchange wells must be approved by the Commission in advance using the procedures and forms used for Specialty Wells.

601.0 SETBACK DISTANCES

601.1 Setback distances: Setback distances for closed loop geo-exchange wells are as follows:

Leach fields less than 2,000 gpd:	50 feet
Leach fields equal to/greater than 2,000 gpd:	100 feet
Septic tanks, lift stations & holding tanks:	30 feet
Private potable water supply well:	45 feet
Public potable water supply well with a withdrawal rate equal to or less than 10 gpm:	45 feet
Public potable water supply well with a withdrawal rate greater than 10 gpm but equal to or less than 25 gpm:	75 feet
Public potable water supply well with a withdrawal rate greater than 25 gpm but equal to or less than 50 gpm:	125 feet
Public potable water supply well with a withdrawal rate greater than 50 gpm:	200 feet
(Withdrawal rate is determined based on the nominal size of the actual well pump installed in the well)	
Property lines:	10 feet

602.1 Placement method: Thermally enhanced grout shall be placed by the tremie method with the tremie first installed to the bottom of the borehole. Grout shall then be placed by pressure pumping through the tremie and the tremie should be raised slowly as the material is introduced. The tremie pipe should be continuously submerged in the grout. All grout shall be emplaced to the maximum extent possible in a single continuous operation upward from the bottom of the borehole so the entire length of the borehole is filled with grout.

602.2 Coefficient of permeability: All thermally enhanced grout shall have a maximum coefficient of permeability of 10⁻⁷ cm/sec.

602.3 Grouting timeframe: All boreholes are recommended to be grouted within seven (7) days from the date they are drilled.

602.4 Loss of grout: When a significant loss of grout is observed to large open bedrock fractures, it is generally permissible to place clean crushed stone into the annulus from the bottom of the bedrock fracture to as much as 10 feet above the fracture before resuming with the placement of the thermally enhanced grout. When a driller chooses to place stone into the annulus in these situations, the driller shall record the location of the fracture and the specific interval in the borehole where stone is placed, instead of grout, on the driller's log.

602.5 Grouting near bedrock surface: The annulus of a closed-loop well must always be grouted from a depth ten feet below the top of bedrock to at least ten feet above the top of bedrock to prevent the migration of shallow ground water down the borehole to the bedrock aquifer. It is not permissible to place stone in this interval if large open fractures are present.

602.6 Salt water resistant grout: When grout extends through zones of saltwater with chloride concentrations equal to or greater than 500 mg/l, a salt water resistant grout shall be used.

602.7 Grout additives: Any grout additives, other than bentonite, silica sand and water shall meet the requirements of NSF/ANSI Standards 60 and 61.

603.0 HEAT TRANSFER FLUIDS

603.1 Water used: Any water used as a heat transfer fluid shall be from a potable water supply.

603.2 Propylene glycol: It is recommended that food grade propylene glycol be used as an antifreeze material and that it be used at 20% or more concentration to inhibit bacterial growth.

604.0 CLOSED-LOOP PIPING

604.1 Piping certification: Piping shall be as specified in the most recent edition of the International Ground Source Heat Pump Association (IGSHPA) Closed Loop/Geothermal Heat Pump Systems Design and Installation Standards, 2010 Edition, Copyright, 2010, referenced in these regulations as “IGSHPA standards”.

604.2 High density polyethylene: All pipe and heat fused materials should be manufactured from virgin polyethylene extrusion compound material in accordance with IGSHPA standards. Pipe should be manufactured to outside diameters, wall thickness, and respective tolerances as specified in IGSHPA standards for *Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter*, IGSHPA standards for *Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter*, or IGSHPA standards for *Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter*. Fittings shall be manufactured to diameters, wall thickness, and respective tolerances as specified in IGSHPA standards for *Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing for butt-fusion fittings*, IGSHPA standards for *Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing* for socket-fusion fittings and IGSHPA standards for *Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing* for electro-fusion fittings.

Table 604.1 Pressure ratings and applicable standards for high density polyethylene pipe:

Nominal Diameter	Pressure Rating (psi) at 73.4°F	Applicable Standard
< 1¼ in.	160	IGSHPA standards
1¼ - 3 in.	110	IGSHPA standards
> 3 in.	100	IGSHPA standards

(1) If the pipe is used in a vertical bore application, it should be manufactured in accordance with IGSHPA standards with a minimum working pressure rating of 160 psi.

Table 604.2: Pressure ratings of water filled pipe at 73.4°F for DR-PR PE 3408/3608 plastic pipe:

Dimension Ratio	Pressure Rating (psi)
9	200
11	160
13.5	128
15.5	110
17	100

Table 604.3: Pressure ratings of water filled pipe at 73.4°F for DR-PR PE 4710² plastic pipe:

Dimension Ratio	Pressure Rating (psi)
9	252
11	202
13.5	161
15.5	139
17	126
21	101

(2) Please note that as of the IGSHPA approval date (October 2007) of DR-PR PE 4710, there are a limited number of pipe manufacturers offering a geothermal pipe produced from DR-PR PE 4710 material.

604.3 Material: The material should have a Hydrostatic Design Basis of 1600 psi at 73°F per IGSHPA standards and should be listed in PPI

TR4 as either a PE 3408/3608 or PE 4710 piping formulation. The material should also be a high-density polyethylene compound having a minimum cell classification of PE345464C per IGSHPA standards for.

604.4 Markings: Sufficient information should be permanently marked on the length of the pipe as defined by appropriate IGSHPA pipe standard(s).

604.5 Cross-linked polyethylene tubing: Cross-linked polyethylene tubing should be manufactured by the high-pressure peroxide method (PEXa), and should conform to IGSHPA standards for *Crosslinked Polyethylene (PEX) Tubing*, and IGSHPA standards for *Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems*, or *Crosslinked high-density polyethylene (PE-X) pipes—General quality requirements and testing*. PEXa material should be high-density cross-linked polyethylene manufactured using the high-pressure peroxide method of cross-linking (minimum degree of 75% when cross-linking and tested in accordance with IGSHPA standards for *Test Methods for Determination of Gel Content and Swell Ratio of Crosslinked Ethylene Plastics*, (Method B)). The tubing material designation code as defined in IGSHPA standards should be PEX 1006 or PEX 1008.

Table 604.4: Pressure ratings of water filled tubing at 73.4°F (23°C) for DR-PR PEX 1006 or PEX 1008 plastic pipe:

Dimension Ratio	Pressure Rating (psi)	Applicable Standard
9	160	IGSHPA standards

604.6 Polymer electro-fusion fitting material: All fittings used with PEXa tubing intended for geothermal applications should be polymer electro-fusion fittings or cold expansion compression-sleeve metal fittings. Polymer electro-fusion fittings should conform to IGSHPA standards for *Plastics pipes and fittings. Crosslinked polyethylene (PE-X) pipe systems for the conveyance of gaseous fuels. Metric series. Specifications. Part 2: Fittings for heat-fusion jointing-First Edition*. Polymer electro-fusion fittings for PEXa pipes of each dimensional specification should conform to IGSHPA standards. Polymer electron-fusion fitting should also be manufactured using materials in accordance to IGSHPA Standard 1C.2.2.

604.7 Metal cold compression sleeve fittings:

Metal cold compression sleeve fittings should conform to IGSHPA standards for *Cold-Expansion Fittings with Metal Compression-Sleeves for Cross-Linked Polyethylene (PEX) Pipe*. Cold compression sleeve fittings should conform to IGSHPA standards, and have a minimum inside diameter of 82% of inside pipe diameter.

604.8 Markings: Product standard information should be marked on PEXa tubing and fittings as defined by the appropriate product standard specifications.

604.9 Joining: Joining should be as specified in International Ground Source Heat Pump Association (IGSHPA) *Closed Loop/Geothermal Heat Pump Systems Design and Installation Standards*. The most current edition of standards should be utilized and followed. All pipe joining should be performed by certified installers and follow manufacturers' recommended fusion procedures.

604.10 Polyethylene pipe: Polyethylene fusion transition fittings with threads should be used to join with copper. Polyethylene fusion transition fittings with threads or barbs should not be used to join to high strength hose. Barbed fittings utilizing mechanical clamps are not permitted to be connected directly to polyethylene pipe, with the exception of stab-type fittings. All mechanical connections must be accessible in case of emergency or maintenance. The only acceptable methods for joining buried polyethylene pipe systems are a heat fusion process or stab-type fittings. If using stab-type fittings, quality control should be assessed to ensure a leak-free union between pipe ends which are stronger than the pipe itself. If heat fusing, butt, socket, sidewall or electro-fusion processes are acceptable when performed in accordance with the pipe manufacturer's procedures.

604.11 Cross-linked polyethylene tubing: PEXa tubing should not be butt-fused or socket-fused to fittings. Polymer electro-fusion fittings may be used with PEXa tubing when installed in accordance with the manufacturer's published procedures. Cold-expansion compression sleeve fittings may also be used for all PEXa connections when installed according to the manufacturer's published procedures and is permitted to be direct buried with manufacturer-approved corrosion covering. New joining technologies may be developed which meet all IGSHPA standards for closed loop piping.

604.12 Centralized placement: Due to the flexible nature of the piping material, geology, and borehole geometry, centralized placement of pipe in the borehole may or may not be practical. In general, pipe centralized placement is not necessary for closed loop boreholes.

604.13 Placement to the bottom of the borehole:

Due to the specific gravity of the loop piping, it may be necessary to artificially weight the pipe loop to allow placement to the bottom of the borehole. External weights shall be attached to the pipe in a manner that does not damage the pipe. Only potable water may be placed inside the pipe to add weight to the pipe loop. Using steel pipe for the tremie can assist in the placement to the bottom. The loop assembly shall extend to the bottom of the borehole. If an obstruction is encountered in the borehole, preventing the installation of the loop to the borehole bottom, the loop and the obstruction must be removed or provisions made for the sealing of the borehole below the obstruction and the designer needs to be notified so adjustments can be made to the design of the system.

604.14 Header backfilling: Because the contractor is motivated to produce a leak-free system, backfilling procedures for horizontal header trenches will include prevention of any sharp-edged rocks from coming into contact with the piping by removal of the rocks before backfilling. Sand bedding (native or foreign) is recommended for headers.

604.15 Pressure and flow testing: The entire system should be filled with water and tested to the system pressure recommended by manufacturer specifications for that loop with no observed leaks prior to backfilling the loop field connection trenches. Flow and pressure loss testing should be performed and the actual flow rates and pressure drops should be compared to the calculated design values. If actual flow rate or pressure drop values differ from calculated design values by more than 10%, the problem should be identified and corrected. At the contractor's option, in addition to the final test, it may be desirable to test subcircuits of the loop field. Pressure in the pipe is greater at the bottom of the borehole than at the top due to the hydrostatic head. Caution should be exercised if hydrostatically testing vertical loops in boreholes of depths greater than 200 feet that have not been grouted or filled so as not to exceed the pressure rating of the pipe material. The pressure in the pipes being tested can vary with changes in temperature or from normal expansion of the pipe after being first pressurized. Approved pressure test procedures cannot

guarantee that proper fusion/joining techniques or procedures were followed. Additional tests may be required by the overseeing engineer.

604.16 Temporary conditions: Any vertical closed loop piping that is completed prior to being placed in service, or is left uncompleted due to a recess or delay in construction, shall be equipped with a watertight cap.

605.0 CASING IN CLOSED-LOOP WELLS

605.1 Temporary Casing: Temporary casing shall be installed through the overburden and into bedrock.

605.2 Temporary casing removal: Temporary casing shall remain in place until the closed loop is installed and the borehole completely grouted to the ground surface.

605.3 Final grouting: After the removal of the temporary casing, the grout shall be topped off back to ground level.

606.0 DECOMMISSIONING

606.1 Grouting an abandoned closed-loop geoexchange well: Any vertical closed-loop geoexchange borehole that is to be permanently abandoned shall be completely flushed and filled with a suitable grouting material.

606.2 Loop fluids: Loop fluids that contain antifreeze or other additives shall be captured and disposed of according to local, state and federal requirements.

606.3 Decommissioning documentation: All information relative to the decommissioning procedures of the abandoned vertical loop piping shall be prepared and assembled, with a copy supplied to the owner of the land and a copy retained by the licensed closed-loop driller who performed the decommissioning.

607.0 DRILLER'S LOGS & SITE PLANS

607.1 NGWA standards: For closed-loop wells, follow the NGWA recommended practices listed as follows:

607.1.1 Minimum driller's log requirements: During the drilling of the test borehole or the first vertical loop borehole, the contractor shall prepare and keep a complete log setting forth the following:

1. The geographic location sufficient to permit later location and identification relative to other boreholes or wells in the area;
2. The reference point for all depth measurements;
3. The depth at which each change of formation occurs;
4. The identification of the material of which each stratum is composed, such as:
 - a) Clay;
 - b) Sand or silt;
 - c) Sand and gravel: Indicate whether gravel is loose, tight, angular or smooth; color;
 - d) Cemented formation: Indicate whether grains (if present) have natural cementing material between them; e.g., silica, calcite, etc.;
 - e) Hard rock: Indicate whether sedimentary bedrock or igneous (granite-like, basalt-like, etc.);
5. Total depth of completed vertical closed loop borehole;
6. Depth or location of any lost drilling fluids, drilling materials, or tools;
7. The nominal borehole diameter(s) of the vertical closed loop borehole;
8. The nominal diameter, depth, and length of any casing;
9. Type of grout material used;
10. Bags of grout used;
11. Grout additives used;
12. Borehole grouted from a depth of ___ feet to ___ feet;
13. Method of drilling;
14. Groundwater depth (groundwater elevation); and
15. Thermal conductivity of the grout.

607.1.2 Distribution of driller's log: Within 10 days of the completion, the contractor shall submit a copy of the completed driller's log to the project

owner/designated agent or their designated representative and keep a copy for his/her file.

607.1.3 Driller's logs and reports: Every vertical borehole should have a basic log as described in Section 607.1.1. The test borehole or the first production borehole should be used to log the essential lithology information. However, the driller should watch for noticeable changes in underground lithology during production drilling, and if observed, a subsequent next production borehole should also be logged. In some cases, a qualified geologist may be necessary to adequately characterize a site. See the *Manual of Water Well Construction Practices* (Smith, 1998) for details of performing the driller's log and report.

607.1.4 Loop field identification - site plan: The drilling contractor shall provide the owner/designated agent with "as-built" drawings of the installation. Such drawings shall show sufficient detail to locate the boreholes, show the finished borehole depth, and actual borehole heat exchanger lengths.

608.0 MODIFIED CONCENTRIC CLOSED-LOOP WELL

608.1 Modified concentric well: A closed loop geothermal heat exchange well that utilizes two concentric pipes, consisting of smaller diameter pipe inside larger diameter pipe, to circulate the heat exchange solution through the borehole in a sealed and pressurized loop.

608.2 Casing installation: Casing shall be permanently installed and sealed into bedrock using the criteria required for drinking water wells in Chapter 4.

608.3 Casing seal: A proper water tight seal is required at the top of the casing.

608.4 Piping standards: All piping shall comply with IGSHPA standards for closed-loop wells. (IGSHPA standards currently approve the use of HDPE and PEXa pipe.)

609.0 Additional design requirements

609.1 Additional design requirements: Before drilling any closed-loop well to be utilized as a heat source for any structure other than a single family, residential, detached home and associated structures (for example, garages and other outbuildings), the driller shall first obtain a design for that specific well provided by either a Professional Engineer (PE) or a Certified Geothermal Designer (CGD).

CHAPTER 7

ABANDONMENT OF WELLS

SECTION 700.0 GENERAL

700.1 Applicability: These provisions shall apply to all water wells and geothermal heat exchange wells abandoned after the effective date of the rules. Well abandonment shall be performed by either a licensed Master or Journeyman Well or Geothermal Heat Exchange Driller or a licensed Master or Journeyman Pump Installer in the responsible charge of a licensed well drilling company.

700.2 Purpose: This Article is intended to prevent the possibility of abandoned wells providing a means for contaminants to enter the ground water, and to prevent personal injury.

SECTION 701.0 DETERMINING WHEN TO ABANDON WELLS

701.1 Contaminated wells: A well subject to defilation by either chemical or microbial contaminants which may not be adequately remediated, and whose source of contamination neither identified or removed, and which is determined by the commission to constitute a significant threat to public health or to contamination of the groundwater below, shall be abandoned.

701.2 Improperly installed wells: A water or geothermal heat exchange well determined by the commission to have been installed in violation of any part of these rules which can not be altered or repaired in a manner that will result in compliance with these rules including adequate set back from potential sources of contamination shall be abandoned.

701.3 Open boreholes: Any open borehole that is not properly cased, including the annular space being properly backfilled and the casing secured by a well cap or cover adequate to prevent access to the borehole, shall be abandoned.

SECTION 702.0 DETERMINING SIGNIFICANT THREATS TO PUBLIC HEALTH

702.1 Determining significant threats to public health: A finding by the commission that a water or geothermal heat exchange well has been contaminated by any chemical or microbe identified by the U. S. Environmental Protection Agency or the State of Maine Department of Health and Human Services, Maine Center for Disease Control and Prevention, as an acute contaminant shall support a Commission determination that the condition constitutes a significant threat to public health for the purposes of section 501.1

SECTION 703.0 DETERMINING SIGNIFICANT THREATS TO GROUNDWATER

703.1 Determining significant threats to groundwater: A finding by the commission that a water or geothermal heat exchange well is likely to undergo contamination in the movement of water, chemicals or microbes from the surface or near-surface to groundwater, either because of improper well installation or the absence of an adequate seal of the casing into bedrock shall support a Commission determination that the condition constitutes a significant threat of contamination of the groundwater below for the purposes of Section 501.1

SECTION 704.0 STANDARD PRACTICE FOR ABANDONING WELLS

704.1 General standards: Abandoned wells or boreholes shall be sealed in a manner appropriate to prevent the entry of contaminants and from the mixing of waters from separate water bearing zones. Neat cement, high solids (greater than or equal to 20%) bentonite grout or bentonite chips using the manufacturer's instructions or methods for placement described in the "Manual of Water Well Construction Practices, Second Edition", published in 1998, or other materials or methods of placement approved by the Commission are recommended.

704.2 Sealing: Well casings shall not be removed without the borehole in bedrock having been permanently sealed, using practices currently accepted by the water well industry.

704.3 Open borehole filling: Open boreholes shall be filled in a manner appropriate to prevent the possibility of personal injury, contamination of groundwater or future collapse of the area around the borehole.

704.4 Time frame: When a new water or geothermal heat exchange well is to be drilled to replace a contaminated drilled water or geothermal heat exchange well the abandoned well shall be sealed within a reasonable length of time, at the owner's expense. It shall be the responsibility of the driller to inform the homeowner of this action in writing. The notice shall be signed by both parties and shall include a statement of acceptance of these conditions by the homeowner as a requirement of remaining in compliance with these rules. Water or geothermal heat exchange wells ordered abandoned by the commission shall be abandoned within thirty (30) days of the date of determination at the expense of the homeowner if the well has been found by the commission to be a threat to public health or contamination of groundwater or at the expense of the driller if a determination is made by the commission that the well was installed in violation of any part of these rules.

CHAPTER 8

REQUIREMENTS OF PUMPS

SECTION 800.0 ELECTRICAL REQUIREMENTS

800.1. Electric code: Pump installers shall comply with National Electrical Code requirements.

800.2 Securing the wire: Number 10, 12, or 14 gauge electrical wire shall be secured to the drop pipe in a well at a minimum of 10 foot intervals and less than number 10 gauge electrical wire shall be secured to the drop pipe at a minimum of 5 foot intervals.

800.3 Securing materials: Materials used for securing the wire to the pipe shall not contain materials hazardous to the water quality.

SECTION 801.0 SUBMERSIBLE PUMPS

801.1 Pump type and size: Size and install pump to at least the minimum of the Manufacturer's recommendations.

801.2 Check valves: One (1) check valve shall be installed within 20 feet of the discharge of the pump. All check valves shall be accessible for service but shall not be direct buried.

801.3 Disinfection: For any new installation of a submersible pump or servicing of wire, pipe and/or pump repair within the well, the well shall be chlorinated to a minimum concentration of 50 parts per million for a minimum of 24 hours upon completion of installation or repair.

SECTION 802.0 NON-SUBMERSIBLE PUMPS

802.1 Pump type and size: Size and install pump to at least the minimum of the Manufacturer's recommendations.

802.2 Check valves: A non-submersible pump installed on a driven point shall have a minimum of one (1) check valve installed on the suction line. All check valves shall be accessible for service but shall not be direct buried.

802.3 Foot valves: One (1) foot valve shall be installed at the end of the suction line for a non-submersible pump with the exception of a driven point.

802.4 Minimum pressure: Any non-submersible pump with the capacity to develop more than 75 psig shall have a relief valve. A shutoff valve shall not be installed between the pump and the relief valve. The installation of a relief valve shall conform to a minimum of the current State of Maine Internal Plumbing Rules Chapter 238, Section 11.

802.5 Shutoff: No shutoff valve shall be installed between a non-submersible pump and the operating control for the pump.

SECTION 803.0 PIPING MATERIALS

803.1 Piping materials: Acceptable materials for pipe and fittings used in well or trench are:

803.1.1 Copper: Minimum type "K" copper.

803.1.2 Steel: Minimum Sch. 40 Galvanized steel.

803.1.3 Polyethylene: Minimum 160 psi polyethylene coil plastic.

803.1.4 Polyvinylchloride: Minimum Schedule 40 PVC plastic.

803.1.5 Other: Any material approved by the Commission.

803.2 Pipe rating: No installation of materials shall exceed the manufacturer's rating and specifications.

803.3 Cemented fittings: No plastic or nylon fittings shall be used in the well or in the trench in submersible pump installations unless they are cement type fittings for use with rigid or semirigid pipe.

803.4 Stainless steel clamps: All connections to flexible plastic pipe in the well or under ground outside the building foundation shall be double clamped with all stainless steel clamps.

803.5 Torque arrestors: On all wells cased 5 inches or larger for submersible pump installations, one (1) torque arrestor shall be installed within 5 feet of the discharge of the pump for all materials used. One (1) torque arrestor, cable guide, or acceptable centralizer shall be used at a minimum

of 50-foot intervals for the first 200 feet above the discharge of the pump for all nonmetallic piping materials.

803.6 Pump safety lines: If safety lines are used for submersible pump installation, they should be installed to at least the manufacturer's minimum strength recommendations. The safety line shall be secured to the drop pipe at a minimum of 10 foot intervals and should be secured inside the casing when pitless adapters are used. Materials used for safety lines and secureness shall not contain materials hazardous to the water quality.

803.7 Pitless adapters: All pumps installed for drilled wells shall be installed with a pitless adapter or a sanitary seal. Pitless adapters shall be installed in a manner to exclude the entrance of water or other material into the well. All pitless adapters shall be installed not to exceed the weight recommendation of the manufacturer. Any above ground installation shall use a sanitary well seal.

803.8 Casing cover: Drilled well casing shall have a manufactured cover to prevent the entrance of foreign matter into the well.

803.9 Underground shutoff values: Installation of underground shutoff valves shall conform to the current State of Maine Internal Plumbing Rules Chapter 238.

SECTION 804.0 PIPE TRENCHES

804.1 General: Trenches for well lines shall conform to the current edition of Chapter 238 State of Maine Internal Plumbing Rules and Chapter 241 State of Maine Subsurface Wastewater Disposal Rules.

804.2 Water and sewer pipes in same trench: Building sewer or drainage piping shall not be run or laid in the same trench with water service pipes or any underground water pipes unless both of the following requirements are met:

804.2.1 Separation distance: The bottom of the water piping at all points shall be at least twelve (12) inches above the top of the sewer piping.

804.2.2 Separate shelf: The water piping shall rest on a solid shelf at one side of the common trench.

804.3 Fill material: Pipes in trenches are recommended not to be installed in direct contact with rocks. Use loose soil whenever possible.

SECTION 805.0 PRESSURE TANKS

805.1 Storage capacity: Pressure tanks should be installed to the minimum capacity recommendation of the pump and motor manufacturer. Tanks shall be constructed of materials that are not hazardous to the water quality.

805.2 Relief valve: At least one (1) relief valve shall be required for a submersible pump installation. A shutoff valve shall not be installed between the pump and the relief valve. The installation of a relief valve shall conform to a minimum of the current State of Maine Internal Plumbing Rules Chapter 238, Section 11.

SECTION 806.0 DISINFECTION

806.1 General: For any new installation of a pump or servicing of pipe within the well, the well shall be chlorinated to a minimum concentration of 50 parts per million for a minimum of twenty-four (24) hours upon completion of installation or repair. (See Table 405.2)

CHAPTER 9

COMPLAINTS INVESTIGATIONS AND PENALTIES

SECTION 900.0 COMPLAINTS AND INVESTIGATIONS

900.1 Written petitions: Complainants must petition the commission in writing within 24 months of completion of a water well or geothermal heat exchange well. Complainants must petition the commission within 24 months of the installation, repair or replacement of a pump system. A licensee must respond to a complaint filed with the Commission and provide requested information to the best of his or her ability within 14 days of the date of written notice unless a written request for additional time has been approved by the Commission.

900.2 Investigations: The commission or the Department shall investigate complaints and cases of noncompliance with, or violation of the applicable statutes or the well driller and pump installer code of performance adopted by the commission.

900.3 Third party investigators: At the commission's discretion, an investigation of an alleged violation may be conducted by a neutral qualified individual. Upon the filing of a complaint, in form satisfactory to the Commission, the licensee who is the subject of the complaint may petition the Commission within 30 days of notification of the complaint to have a neutral qualified individual other than the Commission's initial choice, acceptable to both the licensee and the Commission, appointed to conduct the investigation and report to the Commission. All costs and expenses charged by the licensee's neutral qualified individual shall be the responsibility of and paid for by the licensee.

900.4 Referrals: The commission may refer a complaint to the Attorney General.

900.5 Suspension and/or revocation: The commission will determine if a violation has occurred and shall notify the responsible well driller, well drilling company, closed loop geothermal installer, closed loop installation company, pump installer or pump installation company by certified or registered mail of the violation and order the responsible party to correct the violation within sixty (60) days of receipt of the notification, or within 48

hours of receipt of the notification if the commission makes a determination that the violation has resulted in a significant threat to public health, including but not limited to verified or potential contamination by pathogenic organisms. If the violation is not corrected within sixty (60) days, or within 48 hours of receipt of the notification if the commission makes a determination that the violation has resulted in a significant threat to public health, or if the commission finds a violation of any section of these rules, the commission may initiate revocation or suspension of the license of the responsible party or parties. The duration of the suspension shall be determined by the commission upon a review of the number of violations accumulated by the licensee, the severity of the violation and its potential impact on public health, and the level of cooperation with the commission by the licensee to resolve the violation. A violation committed by either a licensed well driller or licensed pump installer is chargeable against both the individual licensee and the company for whom the individual is employed. A registrant who receives a written notice of a violation or of a proposed revocation or suspension of license under this rule may request a hearing before the commission. The commission shall conduct a hearing in accordance with the Administrative Procedures Act and issue its decision within thirty (30) days of the request for a hearing. A decision of the commission under this rule is a final agency action.

900.6 Reinstatement: A well driller, well drilling company, closed loop geothermal installer, closed loop installation company, pump installer or pump installation company whose license has been suspended may apply for license reinstatement in writing after the duration of the suspension has elapsed, any fines levied by the commission have been paid in full and any corrective measures ordered by the commission have been completed. The commission may verify by inspection that corrective measures required by the commission have been properly completed prior to license reinstatement.

SECTION 901.0 COMPLIANCE WITH OTHER LAWS AND RULES

901.1 General: All water and geothermal heat exchange wells must be constructed and maintained in accordance with all other laws and rules in effect, including the water well information laws, Title 12, section 550-B.

SECTION 902.0 PENALTIES

902.1 General: Any person, company, firm, partnership or corporation who installs, alters, repairs or replaces a water well, geothermal heat exchange well or pump system without being licensed as provided in this chapter or in violation of the code of performance adopted by the Maine Water Well Commission pursuant to section 4700-A, subsection 5, except for an apprentice driller or an apprentice installer as set forth in this chapter, or any person, firm, partnership or corporation who procures a license as provided in this chapter wrongfully or by fraud or violates any standard or provision of this rule commits a civil violation punishable by a fine of not more than \$1,000.

902.2 Fines: The commission may levy fines for violations of the well driller and pump installer code of performance of not more than \$1,000 per violation. Fines must be paid within 30 days from the date written notice is provided the licensee, individual or company by the Commission.

902.3 Injunction: The State may bring action in Superior Court to enjoin any person, firm, partnership or corporation from violating this chapter, regardless of whether proceedings have been or may be instituted in the District Court or whether civil proceedings have been or may be instituted.

902.4 Exclusion: This chapter does not prevent a person from making water well, geothermal heat exchange or pump system installations, alterations, repairs or replacements in a single-family residence owned and occupied by that person or to be occupied by that person as a bona fide personal abode, provided the installation, alteration, repair or replacement conforms to the standards set forth in this chapter and any rules adopted by the commission or the department.

STATUTORY AUTHORITY: 32 M.R.S.A. c.69-C

EFFECTIVE DATE:
January 1, 1994

EFFECTIVE DATE (ELECTRONIC CONVERSION):
May 5, 1996

AMENDED:
January 31, 1997
March 14, 1997
October 16, 1999
May 5, 2002
October 1, 2005 – filing 2005-383
September 30, 2008 – filing 2008-416
October 4, 2010 – filing 2010-458
(EMERGENCY major substantive)
May 25, 2011 – filing 2011-129 (Final adoption, major substantive)
January 1, 2012 – filing 2011-472

APPROPRIATION 014-10A-2422-032



Attachment 2
Abandonment Record

WELL ABANDONMENT RECORD
Maine Department of Environmental Protection
Bureau of Remediation and Waste Management

<p>1. Date of Abandonment: _____</p> <p>2. Abandonment Contractor:</p> <p>_____</p> <p>Company _____</p> <p>Printed Name of Individual Abandoning Well _____</p> <p>3. Well Location:</p> <p>_____</p> <p>Address _____</p> <p>_____</p> <p>County _____</p> <p>_____</p> <p>Nearest Town _____</p> <p>_____</p> <p>Latitude (D,M,S or DD format) _____</p> <p>_____</p> <p>Longitude _____</p> <p>4. Well Type:</p> <p><input type="checkbox"/> direct push <input type="checkbox"/> drilled</p> <p>5. Well Use:</p> <p><input type="checkbox"/> monitoring <input type="checkbox"/> residential <input type="checkbox"/> industrial</p> <p><input type="checkbox"/> injection <input type="checkbox"/> recovery <input type="checkbox"/> geotechnical</p> <p>6. Reason for abandonment:</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>7. Are boring logs available?</p> <p><input type="checkbox"/> Yes, attached <input type="checkbox"/> No</p> <p>8. Are well construction logs available?</p> <p><input type="checkbox"/> Yes, attached <input type="checkbox"/> No</p>	<p>9. Well Depth (ft): _____</p> <p>10. Boring Diameter (in): _____</p> <p>11. Riser/Casing Diameter (in): _____</p> <p>12. Type of Casing:</p> <p><input type="checkbox"/> steel <input type="checkbox"/> PVC</p> <p>13. Was any casing removed?</p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>If yes, length removed (ft.): _____</p> <p>14. Was well abandoned in place?</p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>If yes, was casing perforated?</p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>15. Abandonment Material:</p> <p><input type="checkbox"/> bentonite grout <input type="checkbox"/> dry bentonite</p> <p><input type="checkbox"/> cement grout <input type="checkbox"/> native soil</p> <p>16. Quantity of Material Used:</p> <p># of bags _____, or</p> <p>cubic feet _____</p> <p>17. Explain Method of Material Placement:</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>18. Signature of Person Abandoning the Well:</p> <p>_____</p>
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Attachment 3
Abandonment Planning Table

Borehole-Well Abandonment Planning Table

Well #	Well Type Direct Push (DP) or Drilled (D)	Boring Logs Yes or No	Well Con. Logs Yes or No	Well Depth feet	Boring Diameter inches	Riser/ Casing Diameter inches	Type of Casing Steel or PVC	Riser To Be Removed		Abandonment Method Overdrill (OD) or Abandon in Place (AIP)	Quantity of Material Used		Overdrill Yes or No	Method of Material Placement Chip from Surface (CS), Chip by Drop Pipe (CDP), Tremie (T)
								Yes or No	feet		Number of Bags	cubic feet		



Attachment 4
Abandonment Procedure Summary Table

Boring/Well	Specific Information	Over Drill the well, use flowable grout and tremie	Flowable Tremie Grout	Dry Bentonite Chips	Backfill Only	Backfill with Surface Seal	Well Screen Abandoned in Place	Comments
Section of SOP that describes method		Section 5.3.1	Section 5.3.2	Section 5.3.3	Section 5.3.4	Section 5.3.5	N/A	
All Boreholes	When DNAPL is known or suspected to be present as explained in Section 5.3 or when contaminants with densities greater than water are potentially present at concentrations capable of producing a sheen in a water shake test	Allowable	Method Must be used	Not Allowed	Not Allowed	Not Allowed	Not Allowed	
Soil Borings	Boring depth is above water table	Not Applicable	Allowed	Allowed	Allowed	Allowed	Not Applicable	
	Shallow Water Table (<10 feet bgs) and shallow boring depth (<15 fbgs)	Not Applicable	Allowed	Allowed	Allowed	Allowed	Not Applicable	
	Boring deeper than 15 feet bgs. Area within 1,000 feet served by public water	Not Applicable	Allowed	Allowed	Allowed	Allowed	Not Applicable	
	Soil contamination extends from the source to or below the water table	Not Applicable	Allowed	Allowed	Allowed	Allowed	Not Applicable	
	CSM- No risk of contaminat migration from soil boring regardless of depth	Not Applicable	Allowed	Allowed	Allowed	Allowed	Not Applicable	
	Soil boring depth is below 15 feet bgs, the boring penetrates a confining layer, the boring penetrates more than one geologic formation, or the CSM suggests that there is a potential risk of migration down the borehole	Not Applicable	Preferred	Allowed with the use of temporary casing	Not Allowed	Not Allowed	Not Applicable	
Monitoring Wells	Soil Boring Logs and Well Construction Logs both available demonstrate proper seals in place	Allowed	Allowed	When well ID is greater than 1.5 inches	Not Allowed	Not Allowed	Allowed	
	Soil boring log or well construction log indicates proper seal not in place	Preferred	Not Allowed	Not Allowed	Not Allowed	Not Allowed	Not Allowed	
	Soil boring log is available, but well construction log is not available	Preferred	May be allowed if field techniques can determine well construction details				May be allowed if field techniques can determine well construction details	
	Soil boring log is not available	Preferred	Not Allowed (see comment)	Not Allowed (see comment)	Not Allowed	Not Allowed	Not Allowed (see comment)	May be allowed if soil boring is completed near or next to the well prior to abandonment
Remediation Wells greater than 2-inch diameter	Soil Boring Logs and Well Construction Logs both available demonstrate proper seals in place	Allowed	Allowed	Allowed	Not Allowed	Not Allowed	Allowed	Well screen may be filled with filter sand when well is not longer used for product reovery and maintaining porosity in the screened zone is beneficial for natural attenuation
	Soil boring log or well construction log indicates proper seal not in place between overburden and bedrock aquifers	Preferred	Not Allowed (see comment)	Not Allowed (see comment)	Not Allowed	Not Allowed	Not Allowed	Depending on the CSM, it may be possible to remove the well material and establish a proper seal between the overburden aquifer and bedrock aquifer is one is contaminated and thother is not contaminated
	Soil boring log is available, but well construction log is not available	Preferred	May be allowed if field techniques can determine well construction details		Not Allowed	Not Allowed	May be allowed if field techniques can determine well construction details	
	Soil boring log is not available	Preferred	Not Allowed (see comment)	Not Allowed (see comment)	Not Allowed	Not Allowed	Not Allowed (see comment)	May be allowed if soil boring is completed near or next to the well prior to abandonment
Water Supply Wells	Dug Well	Not Appropriate	Not Appropriate	Not Appropriate	Allowed	Preferred	Not Applicable	
	Driven Point Well (Overburden)	Allowed	Allowed	Allowed	Not Allowed	Allowed	Allowed	
	Drilled Overburden Well	Allowed	Allowed	Allowed	Not Allowed	Allowed	Allowed	
	Drilled Bedrock Well	Not Appropriate	Allowed	Allowed	Not Allowed	Not Allowed	Not Applicable	

The table is a summary of the SOP. The entire document should be read to be sure the SOP is followed in detail.











RWM-PP-020_Well-Boring-AbandonmentProcedure


Final Audit Report

2021-11-15

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