



Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

WELL DECOMMISSIONING

CODE 351

(no)

DEFINITION

The sealing and permanent closure of an inactive, abandoned, or unusable water well, monitoring well, observation well, or piezometer.

PURPOSE

This practice is used to accomplish one or more of the following purposes:

- Protect groundwater from surface water infiltration and contamination by nutrients, pesticides, pathogens, salts, petroleum, heavy metals and other chemicals and pollutants.
- ~~Protect the groundwater from contamination.~~
- ~~Protect the aquifer water quality.~~
- Conserve aquifer yield and hydrostatic head by preventing groundwater depletion.
- ~~Eliminate the physical hazard.~~

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to any cased or uncased water well, monitoring well, observation well, dug well, or piezometer or similar device that creates a conduit from the ground surface to groundwater and has been selected for decommissioning.

~~This practice is intended for wells where no unidentified waste or hazardous waste has been observed or is expected per NRCS National Engineering Manual (NEM) (Title 210), Part 503, Subpart E, "Prohibited Technical Assistance."~~

CRITERIA

General Criteria Applicable to All

Purposes

Laws and Regulations

Plan, design, and construct this practice to meet all federal, state and local laws and regulations. Well decommissioning must comply with all applicable governmental regulations.

NRCS reviews and periodically updates conservation practice standards. To obtain the current version of this standard, contact your Natural Resources Conservation Service State office or visit the Field Office Technical Guide online by going to the NRCS website at <https://www.nrcs.usda.gov/> and type FOTG in the search field.

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~~laws, permits, licenses, and registrations.~~

Roles and responsibilities

A water well must be decommissioned by a licensed water well driller. When allowed by state and local regulations, dug wells less than 60 feet deep and without steel or plastic casing ~~dug less than 60 feet deep and without steel or plastic casing~~, may be decommissioned by the landowner, engineer, geologist, licensed pump installer, or licensed water well driller.

When groundwater or soil is known to be or suspected to be contaminated, a licensed well driller who is trained and equipped to safely decommission the well, decontaminate reusable equipment, and properly dispose of waste materials must perform the decommissioning.

The person decommissioning the well is responsible for submitting the well closure report to all applicable government entities.

Data collection

Collect and review all as-built construction documents, maintenance records, and other available data for the well. Include this information in the decommissioning plan.

Several conditions may require special sealing techniques including karst and paleokarst, flowing artesian conditions, and underground mine shafts or rooms. It is important that these conditions be identified.

~~Inspect the well prior to decommissioning as part of the planning process. Inspect the well to determine the length and condition of any casing and screen. Removing the casing when the well is in poor condition may damage the aquifer or confining layer. Methods of examining the condition could include down hole cameras, casing depth indicators, and geophysical logging.~~

~~Water quality information is also needed to know the most appropriate material to use to seal the well. Sulfates, iron, pH, chlorides, and calcium concentrations factor into deciding what grout components to use or avoid using. Experienced and licensed drillers should be aware of groundwater quality issues in their area that would affect well decommissioning. See GPS-355 Groundwater Testing.~~

Well preparation

Remove all equipment, material, and debris that may obstruct access to the bottom of the well. Sound the well to verify all obstructions were removed.

~~Remove casing by either pulling or over drilling (over reaming) for monitoring wells according to ASTM D5299, "Standard Guide for Decommissioning of Groundwater Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities." For irrigation or livestock wells see American Society of Agricultural and Biological Engineers (ASABE), EP400.3 Section 8.0, "Designing and Constructing Irrigation Wells."~~

Remove the casing and screen by pulling or overdrilling (overreaming) when it is practical to do so. If some or all the equipment, and casing, or screen resists removal by pulling or over drilling, the casing must be ripped, perforated, or cut off a minimum of 2.0 feet below the ground surface or according to state requirements.

Disinfection

~~Prior to filling and/or sealing,~~ Disinfect the well with a minimum chlorine solution concentration of 50 mg/L (50 ppm), or the minimum chlorine solution concentration specified by the regulating authority, whichever one is greater prior to filling and/or sealing the well. After adding the chlorine solution, agitate the well water to distribute the solution, and keep the

well undisturbed for a minimum of 12 hours to allow for disinfection.

Sealing materials

Select sealing materials that have an in-place hydraulic conductivity equivalent to or less than the ground surface soil surrounding the well head.

Water quality for water used to mix sealing materials must be compatible ~~with the grouting material~~ and not introduce contamination to the subsurface. When using cement, water should be free of silt, alkali compounds, organic matter and have a total solids content of 500 mg/L or less. Potable water generally meets these requirements. Don't use bentonite grout if the water in the well or water used in decommissioning has a chloride concentration greater than 1500 ppm, or if hydrocarbons are present.

Fill (coarse-grained) materials

When allowed by state regulations, clean fill materials, such as sand, pea gravel, and sand-gravel mix; crushed rock; or agricultural lime can be used to fill the well, if sealing material zones conform to ~~ASTM D5299 or~~ state regulatory requirements. Select a soil gradation and a filling process that will not cause bridging during installation. ~~Fill materials require disinfection or chlorination prior to placement.~~

Sealing/filling procedures

~~When well disinfection is required by state law, do~~ When well disinfection is required by state law, do not place sealing or select fill materials until after disinfecting the well.

Place filling and sealing materials from the well bottom to ground surface. If allowed by applicable regulations, backfill with select fill materials. Use installation methods that avoid segregation, dilution, or bridging of fill or sealant, such as a pump and hose, or tremie pipe.

Use boring logs to identify zones for fill and sealant placement. In the absence of a boring log, use a downhole camera or other method to identify sealant placement. ~~Downhole cameras are~~ This is not needed for wells where sealing material is used for the entire well column.

When pressure grouting, avoid hydrofracturing or blowout in shallow holes in unconsolidated materials. As a general rule, restrict pumping pressure to about 0.5 lb/in² of hydraulic pressure for each foot of overburden.

When decommissioning a well that is under artesian pressure or under pressure from escaping gasses, maintain grout pressure greater than the formation pressure until initial grout setting occurs. For grouting ratios and placement procedures, follow Section 8 of ASABE ANSI/ASAE EP400.3 "Designing and Constructing Irrigation Wells," American Water Works Association (AWWA), A100-15, "Water Wells Standard," and ASTM D5299.

Well-head seal

~~Some states require concrete for the top two feet of sealing material. Concrete acts as an atmospheric seal for bentonite. In other states these materials may be an extension of the sealing materials used below this depth. Sealing thickness must comply with all applicable federal and state requirements.~~

Mound or crown the native soil to compensate for settling and to prevent ponding of water directly over the well site.

Sealing collapsible formations

When casings are within a collapsing formation, install sealing material concurrently with

casing removal so that the bottom of the casing remains submerged in the grout.

Sealing wells drilled through fractured or cavernous formations, or mine shaft

When sealing an abandoned well drilled through fractured or cavernous formations or in a mine shaft or other opening, determine the depth and thickness of the fractured or cavernous zone. If the void is greater than 25 ft from the ground surface, install a packer, shale trap, or other similar device at the top of the fractures or opening, then pressure grout from the device to the ground surface or fill the fracture zone or cavernous zone with disinfected gravel or cement grout, then grout to the surface.

If the fractured or cavernous zone or mine shaft is less than 25 ft from the ground surface, fill the abandoned well with cement grout containing additives that promote bridging across the fractured, cavernous zone, or mine shaft. Alternatively, install a packer, shale trap, or other similar device at the top of the fractures or opening, then pressure grout from the device to the ground surface.

In both cases, grout beneath the fractured or cavernous zone as well as above the fractured or cavernous zone when a well is cased or screened below that fractured or cavernous zone. Use a packer, shale trap, or other similar device to exclude the fractures or cavernous zone from grouting the well above and below.

Control of artesian pressure

~~When a well is under artesian pressure (flowing or not flowing), pressure grout from the bottom of the well to ground surface. Procedures for balancing formation pressures during grouting operations must conform to ASTM D5299.~~

CONSIDERATIONS

Safety is a secondary purpose of well decommissioning. Wildlife, domestic animals and humans can trip over or fall into open wells causing harm or death.

Before sealing the well, consider bringing the entire column of well water to an available chlorine concentration of no less than 50 ppm, or use the greatest concentration specified by government authority. Agitate the well water and keep the solution undisturbed for no less than 12 hours to assure complete disinfection.

Use available water quality information or NRCS Conservation Practice Standard (CPS) Groundwater Testing (Code 355) if water quality is unknown, to determine the most appropriate material to use to seal the well. Sulfates, iron, pH, chlorides, and calcium concentrations are factors in deciding what grout components to use or avoid using. See ASTM D5299/D5299M-18, "Standard Guide for Decommissioning of Groundwater Wells, Vadose Zone Monitoring Devices, Boreholes, and other Devices for Environmental Activities" for detailed discussion. Experienced and licensed drillers should be aware of groundwater quality issues in their area that would affect well decommissioning.

When feasible, consider adding a metal "target" to the top 3 inches of the well-head seal so that the decommissioned well may be easily located with a metal detector.

Some states require concrete for the top two feet of sealing material. Concrete acts as an atmospheric seal for bentonite. In other states these materials may be an extension of the sealing materials used below this depth

PLANS AND SPECIFICATIONS

Prepare plans and specifications for decommissioning a well that describe the requirements for applying the practice to achieve its intended purposes. Record the following information

about the completed installation of this practice:

- Location of water well by Global Positioning System (GPS) coordinates or in a sufficiently detailed narrative description to readily locate the well.
- Date of completion of well decommissioning.
- Name of landowner.
- Name, title, and address of person responsible for well decommissioning.
- Total depth of well.
- Length of casing removed or length of casing cut off below ground level.
- Lengths of casing ripped or perforated and the method used.
- Inside diameter of well bore or casing.
- Type or schedule of casing material (e.g., standard weight steel, or PVC Sch-80).
- Static water level measured from ground surface immediately prior to decommissioning.
- Photographs before and after decommissioning.
- Types of materials used for filling and sealing, quantities used, depth intervals for installation of each type of material, and the placement method used.
- Detailed documentation of all other information pertinent to site conditions and other problems encountered during decommissioning.
- Schematic drawing of well construction showing well diameter and depth, casing diameters, fill, bentonite, or grouting depths.
- How well information was obtained. i.e. well log, as-built, camera inspections, etc.

OPERATION AND MAINTENANCE

Inspect the practice site periodically to ensure there is no ground settlement, erosion, or other disturbance. Maintain the site in a manner that prevents ponding or surface runoff toward the site.

REFERENCES

~~American National Standard/American Water Well Association. 2015. ANSI/AWWA A100-15, Standard for Water Wells. Denver, CO. AWWA catalog no: 41100-2015. <http://www.awwa.org>.~~

American Society of Agricultural and Biological Engineers (ASABE). 2007. ANSI/ASAE EP400.3. Designing and Constructing Irrigation Wells. <https://elibrary.asabe.org>.

ASTM D5299/D5299M. 2018. Standard Guide for Decommissioning of Groundwater Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities. ASTM International, West Conshohocken, PA. DOI: 10.1520/D5299_D5299M-18. <http://www.astm.org>.

~~USDA NRCS. 2017. National Engineering Manual (Title 210), Part 503, Subpart E, Prohibited Technical Assistance. Washington, D.C. <https://directives.sc.egov.usda.gov/>.~~