

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

**WELL DECOMMISSIONING
(No.)
CODE 351**

DEFINITION

The sealing and permanent closure of a water well no longer in use.

PURPOSE

Prevent entry of vermin, debris, fertilizer, pesticides, or other foreign substances into the well or well bore hole;

Eliminate the physical hazard of an open hole to people, animals, and farm machinery;

Prevent entry of contaminated surface water into well and the migration of contaminants into unsaturated (vadose) zone or saturated zone.

Prevent the commingling of chemically or physically different ground waters between separate water bearing zones.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to any drilled, dug, driven, bored, or otherwise constructed vertical water well or cistern determined to have no further beneficial use.

This practice does not apply to wells that were used for waste disposal, or if evidence of contamination still exists. Sampling of the fluids in the well may be required. This practice does not apply to wells that contain contaminant levels that exceed state or federal water quality standards. Treatment of contamination source(s) is required before a well is decommissioned.

CRITERIA

General criteria for design parameters, acceptable installation processes, or minimum performance requirements applicable to all purposes named above:

All planned work shall comply with Missouri Well Construction Rules, Missouri Department of Natural Resources, Division of Geology and Land Survey, Wellhead Protection Section. ASTM Standard Guide D 5299 provides information on properties of common well sealing materials.

Persons plugging wells, other than the landowner, must be permitted by Missouri DNR-DGLS.

The well owner shall contact Missouri DNR-DGLS, before commencing plugging operations, for approval of plans for sealing a well when the plan deviates from Missouri DNR-DGLS requirements.

Data collection. All available data for the well shall be collected and reviewed from as-built construction and maintenance records; i.e., well log, the materials schedule, length, and diameter of casing, total well depth, type of liners and screens, and related information. The existing conditions of the well shall be documented as shown in the "Plans and Specifications" section.

Well preparation. The well shall be cleared of all pumping equipment, valves, pipelines, casing liners, debris, and other foreign material.

Casing. The well casing should be removed if possible. Where the well casing cannot be removed and an open annular space exists between the outside of the casing and the well bore, then the annular space must be sealed, using sealing materials described in this standard.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version, contact the Natural Resources Conservation Service.
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Sealing materials can be directed into the annular space as grout.

As an alternative, the casing may be ripped or perforated to ensure that sealing materials completely fill the casing and any annular space. Also see "Surface Seal" part of this standard.

Disinfection. Before sealing, the well water shall be brought to at least 100 ppm chlorine concentration.

Sealing materials. All materials used for sealing any portion of the well shall have a hydraulic conductivity equivalent to or less than that of the lowest hydraulic conductivity of the geologic materials being sealed.

Properties of sealing materials shall conform to characteristics listed in ASTM D5299, part 6.3 Plugging Materials.

Fill materials. Fill materials, such as sand, pea gravel, sand-gravel mix, crushed stone, or agricultural lime can be used to plug the well provided that zones of sealing materials (conforming to ASTM D5299, part 6.3) are placed no less than one foot thick each at intervals no greater than 10 feet within the column. Fill materials shall be clean and free of organic or other foreign matter. The gradation shall be such that bridging will not occur during placement.

Placement of materials. All materials shall be placed without bridging. For wells greater than 30 inches in diameter, backfill shall be placed in a manner that minimizes segregation and bulking in order to prevent surface subsidence.

Surface seal. The casing shall be completely removed from the well or cut off at a depth not less than 3 ft. below ground surface or at the maximum depth of frost penetration, whichever is greater. This also means removing rock or brick from hand dug wells. Local frost heave and fracturing hazards shall be considered in the design of the surface seal. The interval not less than 3 ft between the ground surface and the top of the cut-off casing shall be filled with soil materials that achieve an in-place hydraulic conductivity equivalent to or less than the surface soil surrounding the well. The ground surface at the sealed well site shall be mounded and graded

in a manner that prevents ponding of surface runoff.

Additional criteria to prevent commingling of ground waters between separate water bearing zones:

Wells with open annular space around the casing shall be treated in a manner that seals the voided annular space. Methods of treatment include (1) removing the casing or (2) grouting the casing in place.

Casing removal is acceptable when the entire casing can be removed from the well. Casings removed from a collapsing formation shall be grouted concurrent with removal such that the bottom of the casing remains submerged in the grout.

Casings grouted in place shall employ a grouting procedure that will fill the open space. Perforated or ripped casing shall provide sufficient apportioned open area to assure passage of the grout to the annular space. The casing shall be perforated or ripped throughout the entire length of a confining layer.

CONSIDERATIONS

This practice may be part of a ground water protection system that includes water and chemical management practices.

To the extent practicable, an abandoned well should be decommissioned in a manner that restores the original hydrogeologic conditions of the well site and does not preclude the use of the site from future land management practices.

Decommissioning requires special consideration of specific geological, biological, physical, and climatic conditions, the chemical composition of the surrounding soil, rock, and ground water at the well site, and the well's construction practices. All procedures, fill and sealing materials need to be selected according to these considerations.

PLANS AND SPECIFICATIONS

Plans and specifications for decommissioning abandoned water wells shall be consistent with the standard and shall describe the requirements for applying the practice to achieve its intended purposes.

A record of the installation of this practice shall be made on DNR-DGLS's "Registration Record" and shall include the following information:

- Location of the decommissioned well by latitude/longitude, township/range, or other georeference convention, of such precision that it can be readily located in the field, if required, in the future.
- Date of well decommissioning
- Name of landowner
- Total depth of well

- Inside diameter of well bore or casing
- Casing material type or schedule (e.g. standard weight steel, or PVC Schedule 80)
- Static water level measured from ground surface
- Types of materials used for filling and sealing, quantities used, and depth intervals for emplacement of each type.

Registration Record must be submitted to Missouri DNR-DGLS after completion.

OPERATION AND MAINTENANCE

The practice site shall be inspected periodically to ensure that the decommissioned well and the adjacent area have not settled or eroded, or are otherwise adversely disturbed. The well site and adjacent ground surfaces shall be maintained in a manner that prevents ponding of surface runoff on the site.

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**NATURAL RESOURCES CONSERVATION SERVICE
MISSOURI CONSTRUCTION SPECIFICATION**

FOR

WELL DECOMMISSIONING

(351)

General

Construction operations shall be carried out in such a manner and sequence that erosion and air and water pollution will be minimized and held within legal limits. Do not disturb area larger in size than is needed for site preparation. Trees, stumps, and brush removed from the construction area may be piled for wildlife habitat when approved by the landowner.

The completed job shall present a workmanlike appearance and shall conform to the line, grades, and elevations shown on the drawings or as staked in the field.

All operations shall be carried out in a safe and skillful manner. Safety and health regulations shall be observed and appropriate safety measures used.

All work shall comply with Chapter 3, Missouri Well Construction Code, "Private Water Wells, Heat Pump Systems, Pump Installations and Monitoring Wells".

Site Preparation

All well equipment, trash, and debris shall be removed from the well and immediate area and disposed of in an appropriate manner. Any obstruction in the well shall be removed before initiating the plugging operation.

Fill Materials

Fill materials shall be in accordance with one of the following:

1. Clean fill such as gravel, sand, varied sized agricultural lime or other approved material.
2. Clean surface clay - Material of local origin from below the topsoil, free of organic material, pesticides, hydrocarbon residue, and other

contaminants with a medium or loamy texture or classified as a silty clay (CL-ML) or lean clay (CL) in the Unified Soil Classification System.

3. High solids grout - Blend of powdered polymer-free bentonite clays mixed with fresh water that forms a creamy slurry with a minimum of 20% solids by weight and a density of 9.4 lb/gal.

4. Bentonite pellets - Granular powdered bentonite, compressed into tablets 1/4 inch to 3/4 inch in diameter.

5. Bentonite chips - Raw mined bentonite in the form of chunks, 1/4 inch to 3/4 inch in diameter. Fine-grained material resulting from handling and shipping should be screened through a 1/4 inch mesh screen and removed to prevent clumping and bridging during placement of the chips.

Note: The rate of pour of bentonite chips and pellets into the bore hole should not be more than 50 pounds (one bag) in 5 minutes. If there is not sufficient water in the well to saturate the bentonite, water should be added at the rate of 8 gallons per bag of bentonite pellets or chips.

Sealing Materials

Any of the following sealing materials shall be used in the 2 foot cap (from 4 feet to 6 feet below ground surface) for dug wells and the 10 foot cap (from 4 feet to 14 feet below ground surface) for drilled wells.

1. Cement Grout - Mixture of cement, sand (1:1 ratio) and water (not more than 6 gallons of fresh water per sack of cement).
2. Cement (neat cement) - Mixture of cement and water with not more than 6 gallons of fresh water per sack of cement.

This mixture will yield 1.1 cubic feet of volume (estimated).

3. Cement-bentonite - Mixture shall consist of cement and bentonite (up to 6 percent by dry weight) with water (not more than 6 gallons of clean water per sack of cement).

Cements shall be in accordance to ASTM C-150, Types I, II, and V, commonly known as Portland cement. One sack of cement weighs 94 pounds and is one cubic foot in volume.

Topsoil

Compacted, uncontaminated surface soil is topsoil of local origin, free from pesticides, hydrocarbon residue and other contaminants, that is placed and compacted over the well seal (cap) for the 4 foot depth. The ground surface at the sealed well site shall be mounded and graded in a manner that prevents ponding of surface runoff.

Plugging and Sealing

Well diameter and depth may be used to calculate quantity of materials needed to fill the well. To determine the volume of materials needed or volume of water (per foot of depth) in the hole, use the following table.

Table - Hole Diameter vs. Volume

Hole diameter	Volume (per foot of depth)	
	Gal/Ft	Cu Ft/Ft
<u>Inches</u>		
4	0.7	0.1
6	1.5	0.2
8	2.6	0.3
10	4.1	0.5
12	5.9	0.8
14	8.0	1.1
16	10.5	1.4
20	16.4	2.2
24	23.6	3.1
36	53.0	7.1
48	94.2	12.6

Properties of fill and sealing materials shall conform to characteristics listed in ASTM D-5299, Part 6.3, Plugging Materials. Materials to be used shall be kept clean and free of contamination.

Each well casing and boring shall be completely filled, including the annular space outside of the casing or liner. The well casing or dug well liner that was removed shall be disposed of properly.

On areas not cultivated, the disturbed area shall be vegetated in accordance with the Field Office Technical Guide (FOTG) Standard for Critical Area Planting (342).

Additional Comments _____
