

**Natural Resources Conservation Service
Conservation Practice Standard**

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

DEFINITION

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

PURPOSE

- Eliminate physical hazard to people, animals, and farm machinery; and to prevent entry of animals, debris, or other foreign substances
- Prevent contamination of groundwater by surface water inflow
- Restore the natural hydrogeologic conditions, to the extent possible, by preventing vertical cross-contamination or commingling of groundwaters between separate water bearing zones
- Eliminate the possibility of the water well being used for any other purpose
- Allow future alternative use or management of the site

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to any drilled, dug, driven, bored, or otherwise constructed vertical water well that is to be decommissioned.

This practice does not apply to wells that were used for waste disposal, or if evidence of contamination still exists. 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 all purposes shall conform to decommissioning procedures presented in ASTM D5299, "Standard Guide for Decommissioning of Groundwater Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities."

Decommissioning shall be compatible with all applicable local, State, Tribal, and Federal requirements.

All work planned shall be in compliance with "Mississippi Surface Water and Groundwater Use and Protection Regulations." Regulations are available from the Mississippi Department of Environmental Quality - Office of Land and Water Resources (www.deq.state.ms.us).

Data collection. As-built construction documents, maintenance records, and other available data (such as well log, materials schedule, length and diameter of casing, total well depth, type of liners and screens, and other related information) for the water well shall be collected, reviewed, and included in a well decommissioning plan. 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, grease, oil, scum, debris, and other foreign material. Casings, liners, and screens shall also be removed, unless impracticable.

Disinfection. Water wells shall be disinfected as an integral part of the decommissioning process. Before sealing, the well water shall be decontaminated by bringing the well water to a 100 ppm chlorine concentration. A 100 ppm chlorine solution will require: 1 pint of 5 percent chlorine bleach per 62 gallons of water or 1.3 pounds high-test calcium hypochlorite tablets per 1000 gallons of water. After being agitated in the well water, the solution shall remain for no less than 12 hours to assure complete disinfection.

Plugging the well. The well shall be plugged by using suitable fill materials, with layers of sealing material emplaced to restrict movement of water vertically in the well.

Sealing materials. All materials used for sealing any portion of the well shall have a

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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. Acceptable sealing materials are provided in ASTM D5299, part 6.4 to 6.6. Sealing materials do not require disinfection.

Fill materials. Fill material shall be clean and free of organic or other foreign matter. The fill material will be graded so that bridging will not occur during placement. 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. Exception: Irrigation wells in the Mississippi River alluvial floodplain may be filled with a clean sand/gravel mixture up to at least 10 feet above the top of screen but not closer than 20 feet to ground surface. The casing area above the sand/gravel shall be grouted with other materials conforming to ASTM D 5299. Other methods of sealing a well may be approved upon written request to MDEQ-OLWR.

Placement of materials. Sealing and fill materials shall be placed in the well only after the well water has been disinfected. Place fill material from the bottom of the well to the top of the lowest water-bearing zone. Sealing material is placed at a minimum thickness of one foot starting at the top of the lowest water bearing zone and successively placed at intervals every 10 feet or less throughout the remaining well column. All material shall be placed from the bottom of the well upward by methods that avoid segregation, dilution, or bridging of the material. Sand/gravel mixture and bentonite pellets placed in wells less than 10 inches in diameter at depths greater than 20 feet shall be placed with a tremie pipe to ensure continuous placement of the material without air or water gaps. The cement-bentonite mixture, neat cement, and cement grout shall be placed by pumping methods. 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.

Removal of well casing. If possible, the casing shall be completely removed from the well by either pulling or over drilling (over-reaming) as explained in ASTM D5299, part 7.3.1 and 7.3.8. Casing that cannot be removed completely shall be ripped, perforated, or cut off at a depth

greater than the maximum potential for frost penetration or any other near surface soil fracturing hazard (such as desiccation), or two feet, whichever is greater.

Casings grouted in place. Casings to be grouted in place shall employ a pressurized grouting procedure that will completely fill and seal any open space around the casing. Grout may consist of cement, sand, bentonite, an approved combination of these constituents, or other approved sealing materials. Casings to be removed from a collapsing formation shall be grouted concurrently with removal, so that the bottom of the casing remains submerged in the grout.

Well-head surface seal. For those wells where removal of the well casing is impractical, the well casings shall be cut off at least 3 feet below the land surface. The area around and on top of the cutoff casing shall be backfilled with compacted, clean native clayey soils and shaped with a slight mound to direct surface water away from the site and prevent ponding. Backfill material shall be free of pesticide and waste contaminants and shall conform to ASTM D5299, part 6.3. These materials may be an extension of the sealing materials used below this depth. The soil material or sealing materials shall achieve an in-place hydraulic conductivity equivalent to or less than the surface soil surrounding the well.

Dug wells. Dug wells shall have the upper 3 feet of lining removed. The well cavity shall be filled with local, uncontaminated clay. Backfill material shall be placed in 2-foot layers and compacted to form a low permeability fill. The surface area shall be slightly mounded and shaped to direct surface water away from the site and prevent ponding.

Control of artesian pressure. If a well is under artesian pressure (flowing or not flowing), the grout pressure must be maintained to counteract the artesian pressure until initial grout set occurs. Procedures for balancing pressures during grouting operations shall conform to ASTM D5299, part 7.3.7.

Vegetation. All disturbed areas associated with the well decommissioning shall be vegetated according to NRCS Conservation Practice Standard 342 – Critical Area Planting.

Additional Criteria to Prevent Mixing 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. Wells with gravel exposed in the annular space at casing cutoff depth shall have at least an additional 3-foot depth of gravel removed and space backfilled with compacted, clean native (clayey) soils.

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 and fill/sealing materials need to be selected according to these considerations.

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

PLANS AND SPECIFICATIONS

Plans and specifications for decommissioning abandoned water wells shall be consistent with this standard and shall describe the requirements for applying the practice to achieve its intended purposes. Specifications for the plugging and sealing of abandoned water wells shall use or be in conformance with the requirements of the attached "Construction

Specification." Any variation from these specifications shall be approved by MDEQ-OLWR or NRCS field office.

A record of the installation of this practice shall be made and shall include the following information:

- Location of the decommissioned well by GPS, latitude/longitude, township/range, or other georeferencing convention, of such precision that it can be readily located in the field, if required, in the future
- 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
- Length of casing removed or length of casing cut off below ground level
- Inside diameter of well bore or casing
- Casing material type (e.g., standard weight steel, or PVC sch-80)
- Static water level measured from ground surface
- Photographs before and after decommissioning
- Types of materials used for filling and sealing, quantities used, depth intervals for emplacement of each type, and emplacement method used
- All other pertinent information based on site conditions and any other problems encountered during decommissioning should be documented in detail

The person who plugs the abandoned well shall complete and submit the MDEQ-OLWR Water Well Plugging/Decommissioning Form OLWR-DF-1 (04/08) within 30 days of completion and provide a copy to the Natural Resources Conservation Service field office for records. This form can be found on the MDEQ-OLWR website (www.deq.state.ms.us).

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 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.

REFERENCES

ASTM D5299, "Standard Guide for Decommissioning of Groundwater Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities."

Mississippi Department of Environmental Quality
- Office of Land and Water Resources
(www.deq.state.ms.us)

NRCS Conservation Practice Standard:
342 – Critical Area Planting

**Natural Resources Conservation Service
Construction Specifications**

WATER WELL DECOMMISSIONING

1. SCOPE

Work shall consist of recording well data, providing and installing well sealing materials, and shaping well area.

2. SITE PREPARATION

All well equipment, trash and debris shall be removed from the well area and disposed of in an appropriate manner.

3. DISINFECTION

The well water shall be decontaminated by bringing the well water to a 100 ppm chlorine concentration. A 100 ppm chlorine solution will require: 1 pint of 5 percent chlorine bleach per 62 gallons of water or 1.3 pounds high-test calcium hypochlorite tablets per 1000 gallons of water. After being agitated in the well water, the solution shall remain for no less than 12 hours to assure complete disinfection.

4. MATERIALS

Well grouting and backfill materials shall be clean and free from contaminants and pollutants. Materials shall be in accordance with the following and meet ASTM D5299, part 6.3 characteristics:

- a. Sand/gravel mixture shall consist of a sand and gravel "filter pack" compatible with the well screen. The maximum particle size of the gravel shall not exceed 1/10 of the diameter of the well or 2 inches in diameter, whichever is smaller.
- b. Cement grout shall consist of a mixture of cement, sand, (1:1 ratio) and not more than 7 gallons of clean water per sack (94 pounds) of cement.
- c. Neat cement shall consist of a mixture of cement and water with not more than seven (7) gallons of water per sack (94 pounds) of cement.
- d. Cement-bentonite mixture shall consist of cement and bentonite (5-8 percent bentonite by dry weight) with not more than 10 gallons of clean water per sack (94 pounds) of cement.

e. Bentonite may be used in powder, granular, chip, or pelletized form. Powder bentonite will be used in slurry and grouting mixtures. Granular, chip, and pellet bentonite will be used to fill the inside of the well casing.

f. Native clayey soil used for backfill shall be free from pesticides and other contaminants.

5. PLUGGING

Measured or estimated well diameter and depth shall be used for calculating material quantities needed to fill the well.

Each well shall be completely filled starting at the bottom and proceeding to the top by methods that avoid segregation, dilution, or bridging of the material. Granular material may be allowed to free-fall for depths less than 20 feet provided that the material is tamped into place. Fill material for a dug well shall be placed in 2-foot layers and compacted.

Sand/gravel mixture and bentonite pellets placed in wells less than 10 inches in diameter at depths greater than 20 feet shall be placed with a tremie pipe to ensure continuous placement of the material without air or water gaps. The cement-bentonite mixture, neat cement, and cement grout shall be placed by pumping methods. 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.

6. CASING REMOVAL

If possible, the casing shall be completely removed from the well by either pulling or over drilling (over-reaming) as explained in ASTM D5299, part 7.3.1 and 7.3.8. For those wells where removal of the well casing is impractical, the well casing or dug well liner shall be cut off at least 3 feet below ground surface and removed from the site. Casings to be grouted in place shall employ a pressurized grouting procedure that will completely fill and seal any open space around the casing.

7. WELL-HEAD SEAL

The area over the sealed well shall be backfilled with compacted, clean native clayey soil and shaped with a slight mound to direct surface water away from the site and prevent ponding. Backfill material shall be free of pesticide and waste contaminants and shall conform to ASTM D5299, part 6.3.

8. VEGETATION

All disturbed areas associated with the well decommissioning shall be vegetated according to NRCS Conservation Practice Standard 342 – Critical Area Planting.

9. CONSTRUCTION DETAILS

10. FORM COMPLETION

The person who plugs the abandoned well shall complete and submit the MDEQ-OLWR Water Well Plugging/Decommissioning Form OLWR-DF-1 (04/08) within 30 days of completion and provide a copy to the Natural Resources Conservation Service field office for records. This form can be found on the MDEQ-OLWR website (www.deq.state.ms.us).