

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WATER WELL

(No.)

CODE 642

DEFINITION

A hole drilled, dug, driven, bored, jetted, or otherwise constructed to an aquifer.

PURPOSE

To provide water for livestock, wildlife, irrigation, human, and other uses.

To provide for general water needs of farming/ranching operations.

To facilitate proper use of vegetation on rangeland, pastures, and wildlife areas.

CONDITION WHERE PRACTICE APPLIES

On all land uses where the underground supply of water is sufficient in quantity and quality for the intended purpose.

This practice standard applies only to production wells. Specifically excluded are any types of wells installed solely for monitoring or observation purposes; injection wells; and piezometers. The standard does not apply to pumps installed in wells; above-ground installations, such as pumping plants, pipelines, and tanks; temporary test wells; and decommissioning of wells (ASTM D 5299).

CRITERIA

Suitability of Site: The availability of ground water for its intended use at the site shall be determined by using reliable local experience and reviewing all available relevant geologic maps and reports; well records maintained by state and federal

agencies; and design, construction, and maintenance records of nearby wells. An appropriate level of investigation, including test well drilling, is conducted on-site, as needed, prior to well construction to determine site-specific hydrogeologic conditions.

The site shall be suitable for safe operation of the drilling equipment.

Well Head Protection: Wells shall be located at safe distances from potential sources of pollution, including unsealed abandoned wells. The allowable distance shall be based on consideration of site-specific hydrogeologic factors and shall comply with requirements of all applicable state or local regulations or construction codes and including but not limited to NRCS conservation practice standards and Alabama Department of Environmental Management, Administrative Code, Chapter 335-6-7, as amended (AFO/CAFO Rule).

Surface runoff and drainage that might reach the wellhead from areas used by livestock or from other sources of pollution shall be diverted.

Wells shall be located a safe distance from both overhead and underground utility lines and other safety hazards.

Borehole: Drilled, jetted, bored, and driven wells shall be sufficiently round, straight, and of adequate diameter, to permit satisfactory installation of inlet, well casing, filter pack, and annular seal, and passage of tremie pipe (including couplings), if used.

Use of Casing: Casing shall be installed to seal out undesirable surface or shallow ground water and to support the side of the hole through unstable earth materials. The intake portion of a well through stable geologic formations may not require casing.

Casing Diameter: Casing diameter shall be sized to permit satisfactory installation and efficient operation of the pump, and large enough to assure that uphole velocity is 5 feet per second or less, to protect against excessive head loss.

Materials: Casings may be of steel, iron, stainless steel, copper alloys, plastic, fiberglass, concrete, or other material of equivalent strength and durability consistent with the intended use of the water and the maximum anticipated differential head between the inside and outside of the casing.

Steel well casings shall meet or exceed requirements specified in ASTM A 589. Steel pipe manufactured for other purposes may be used if the quality of the pipe meets or exceeds requirements specified in ASTM A 589.

Only steel pipe casings shall be used in driven wells.

To prevent galvanic corrosion, dissimilar metals shall not be jointed.

Plastic casings made of acrylonitrile-butadiene-styrene (ABS), polyvinyl chloride (PVC), or styrene-rubber (SR) shall conform to material, dimensional and quality requirements specified in ASTM F 480.

If the water is to be used for human consumption, plastic pipe shall be approved by the National Sanitation Foundation.

Plastic pipe manufactured for water or irrigation pipelines may be used if the quality equals or exceeds requirements specified in ASTM F 480.

Fillament-wound fiberglass casings (glass-fiber-reinforced-thermosetting-resin pipe, RTRP) may be used if material meets requirements specified in ASTM D 2996. Tests for long-term cyclic pressure strength, and short-term rupture strength as required in ASTM D 2996 are not needed because the pipe is to be used for well casing. Joints shall meet requirements specified in ASTM F 480.

Fiberglass pressure pipe, (also called reinforced plastic mortar pipe, RPMP, or fiberglass pipe with aggregate) shall meet or exceed requirements specified in ASTM D 3517.

Casing Strength: Well casing wall thickness shall be sufficient to withstand all anticipated static and dynamic pressures imposed on the casing during installation, well development, and use. The casing shall be designed to withstand the maximum anticipated differential hydrostatic pressure based on procedures in NRCS, National Engineering Handbook Series, Part 631, Chapter 33.

Joint Strength: Joints for well casings shall have adequate strength to carry the load due to the casing length and still be watertight, or shall be mechanically supported during installation to maintain joint integrity. Such mechanically supported casings shall terminate on firm material that can adequately support the casing weight.

Screen: Well screen shall be installed in any earth material likely to produce silt or sand. Well screens may be constructed of commercially manufactured screen sections, well points, or field-perforated sections and shall be made of material which is resistant to the chemical action of the water.

Perforation by any method is allowable provided proper slot size and entrance velocity limits can be met. The length and open area of the screen shall be sized to limit entrance velocity of water into the well to less than or equal to 0.1 foot per second.

Depth of the aquifer below ground surface and the thickness of aquifer to be penetrated by the well shall govern the position of the screen in the well.

Maximum drawdown shall not be permitted below the top of the highest screen or pump intake.

Seals (Packers): Telescoped screen assemblies shall be provided with one or more sand-tight seals between the top of the telescoped screen assembly and casing.

Filter Pack: Installation of a filter pack around the well screen shall be considered under the following conditions: presence of a poorly graded, fine sand aquifer; presence of a highly variable aquifer; such as alternating sand and clay layers; presence of a poorly cemented sandstone or similar aquifer; a requirement for maximum yield from a low-yielding aquifer; and holes drilled by reverse circulation.

Prepacked Well Screens: For heaving or caving sands, silty or fine-grained aquifers, and for horizontal or angled wells, a commercial prepacked well screen may be substituted for a conventionally installed (by tremie) filter pack.

Installation: Casing shall extend from above the ground surface down through unstable earth materials to an elevation of at least 2 feet into stable material or to the top of the screen.

All wells shall be cased to a sufficient height (minimum of 12 inches) above the ground surface to prevent entry of surface and near-surface water.

Casing for artesian aquifers shall be sealed into overlying, impermeable formations in such a manner as to retain confining pressure.

If a zone is penetrated that is determined or suspected to contain water of quality unsuitable for the intended use, the zone

shall be sealed to prevent infiltration of the poor-quality water into the well and the developed portion of the aquifer.

Well Development: Wells to be completed without a filter pack in unconsolidated granular aquifers shall be developed following guidance provided in ASTM D 5521, Standard Guide for Development of Ground-Water Monitoring Wells in Granular Aquifers.

The method shall be selected based on geologic character of the aquifer, type of drilling rig, and type of screen.

Aquifer Development: For massive, unfractured rock formations unresponsive to well development procedures, the use of aquifer stimulation techniques may be considered to improve well efficiency and specific capacity. Techniques may include dry ice, acidizing, explosives, or hydrofracturing, depending on the composition and structure of the formation.

Grouting and Sealing: The annulus surrounding the permanent well casing at the upper terminus of the well shall be filled with expansive hydraulic cement (ASTM C 845), shrinkage-compensating concrete, bentonite-based grout, clay, or other material with similar sealing properties. The length of the grout seal shall be no less than 10 feet and not less than the minimum specified in state or locally applicable construction codes.

If the water is intended for human consumption, the casing shall be surrounded at the ground surface by a 4-inch thick concrete slab extending at least 2 feet in all directions.

A positive seal (grouted in place) or packer shall be provided between the casing and the less pervious material overlying the aquifer of artesian wells, and in all aquifers where co-mingling of waters is undesirable.

Access Port: An access port with a minimum diameter of 0.5 inch shall be

installed to allow for unobstructed measurement of depth of the water surface, or for a pressure gage for measuring shut-in pressure of a flowing well. Access ports and pressure gages or other openings in the cover shall be sealed or capped to prevent entrance of surface water or foreign material into the well. Removable caps are acceptable as access ports.

Disinfection: Wells shall be disinfected immediately following their construction or repair to neutralize any contamination from equipment, material, or surface drainage introduced during construction. The disinfection process shall comply with all local or state requirements.

Free-flowing Wells: All free-flowing wells shall be provided with valves for positive control of the flow of water.

Water Quality Testing: Sampling and testing shall comply with all applicable federal, state, and local requirements. These requirements vary according to the water quality parameters associated with the intended use(s) of the water.

CONSIDERATIONS

The potential for adverse interference with existing nearby production wells needs to be evaluated in planning.

The potential for groundwater overdraft and the long-term safe yield of the aquifer needs to be considered in planning.

If practicable, wells should be located in higher ground and up gradient from sources of contamination or flooding.

Potential effects of installation and operation of the well on cultural, historical,

archeological, or scientific resources at or near the site need to be considered in planning.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared for specific field sites in accordance with this standard and shall describe the requirements for applying the practice to achieve its intended uses.

OPERATION AND MAINTENANCE

A plan for maintenance of a well shall be prepared. The well construction records shall be kept on file with the maintenance plan by the owner/operator. As a minimum, the plan shall include a statement of identified problems, corrective action taken, date, and specific capacity (yield per unit drawdown) of well before and after corrective action was taken.

REFERENCES

ASTM Specifications:
A 589, C 845, D 2996, D 3517, D5299,
D 5221, and F 480.

NRCS Conservation Practice Standards
Code 313 - Waste Storage Facility
Code 359 - Waste Treatment Lagoon
Code 749 - Waste Field Storage
Code 769 - Incinerator

NRCS, National Engineering Handbook
Series, Part 631, Chapter 33.

NRCS, Alabama Guide Sheet No. AL 633A

ADEM, Administrative Code,
Chapter 335-6-7, as amended
(AFO/CAFO Rule).

CONSTRUCTION SPECIFICATION

FOR

WATER WELL CODE 642

SCOPE

This item consists of all materials, equipment, and labor necessary for the installation of a well. The construction operations shall be done in such a manner that erosion, air, water, and noise pollution will be minimized and held within legal limits as specified by state regulations.

INSTALLATION REQUIREMENTS

Alignment

Drilled wells shall be round, plumb, and aligned so as to permit satisfactory installation and operation of a pump of the proposed size and type to the greatest anticipated depth of setting.

Casing Installation

In consolidated formations, the casing shall extend from the ground surface through the overburden material to an elevation at least 2 feet into the consolidated foundation.

In unconsolidated formations, the casing shall extend from the ground to the screen.

For artesian aquifers, the casing shall be sealed into the overlying impermeable formations so as to retain the artesian pressure.

If a water-bearing formation containing water of poor quality is penetrated, the formation shall be sealed off to prevent infiltration of poor-quality water into the well and the developed aquifer.

Developing

The well shall be developed until it has stopped producing detrimental quantities of solid particles when the continuous discharge rate is approximately 20 percent greater than the anticipated normal production rate.

Protection

All wells, and the area around the wells, shall be constructed at a sufficient height above the adjacent ground surface to exclude the entrance of surface water.

Wells used for human consumption shall have the annular space outside the casing filled with a watertight cement grout or clay having similar sealing properties from the surface to a minimum of 10 feet below the ground surface. The casing shall be surrounded at the ground surface by a 4-inch concrete slab extending at least 2 feet in all directions. A sanitary well seal shall be installed at the top of the well casing to prevent the entrance of contaminated water or other objectionable material.

Gravel Pack

If gravel packing is used, it shall be of the specified gradation and thickness and shall be carefully placed to prevent segregation and bridging. Gravel pack materials shall extend a minimum of 10 feet above the top of the perforated or screened section and shall extend through the length of the water-bearing formation.

Materials

Casing materials may be pipe made of steel, copper, plastic, fiberglass, concrete, or other similar materials of equivalent strength and durability.

Steel pipe, copper, reinforced plastic mortar, or plastic pipe may be used for well casings in drilled wells. Only steel pipe shall be used for driven wells. Plastic casing shall be NSF approved for transport of potable water supplies if the water will be used for human consumption. Used steel pipe may be used for well casing, provided that it is of good quality and has a wall thickness equal to or greater than Schedule 40. Plastic casing shall be acrylonitrile-butadiene-styrene (ABS), or polyvinyl chloride (PVC), or styrene-rubber (SR) conforming to ASTM F 480.

Concrete well casings shall be reinforced and shall meet or exceed the requirements of ASTM C 76. The minimum 28-day compressive strength shall be 4,000 psi.

RPM well casings shall equal or exceed the requirements of ASTM Specification D 3517.

Steel well casings shall equal or exceed the requirements of ASTM A 589.

Joints

Joints for well casing shall have adequate strength to carry the load due to the casing length and still be watertight or shall be mechanically supported during the installation process to maintain joint integrity. Such mechanically supported

casings shall terminate on firm material that can adequately support the casing.

Joints for plastic well casing pipe may be solvent cement or threaded couplings and shall have sufficient strength to carry the load due to the casing length and still remain watertight. Solvent cement must meet the requirements of ASTM specifications appropriate for the material used.

Workmanship

The well casing pipe, couplings, and screens shall be homogeneous throughout and shall be free from visible cracks, holes, foreign materials, or other injurious defects. The well casing pipe, couplings, and screens shall be as uniform in color, density, and other physical properties as is commercially possible.

Markings

The well casing pipe shall be marked according to the ASTM specification for the material used.

Certification

Markings on material identifying the manufacturer and indicating compliance with appropriate specifications can be accepted as evidence that the material meets the requirements of this standard. If the material does not bear these markings, the manufacturer can certify that it complies with the requirements of this standard. Tests supporting this certification shall be furnished if requested by the state conservation engineer.