

**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

- Provide water for livestock, wildlife, irrigation, human, and other uses.
- Provide for general water needs of farming/ranching operations.
- Facilitate proper use of vegetation on rangeland, pastures and wildlife areas.

CONDITION WHERE PRACTICE APPLIES

This practice applies on all land uses where the underground supply of water is sufficient in quantity and quality for the intended purpose.

This practice 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

General. Water wells constructed under this standard shall meet the requirements of Title 16, Part 4, Chapter 76 of the Texas Administrative Code (TAC). Wells shall be constructed by a well driller with a valid license from the Texas Department of Licensing and Regulation (TDLR). Drillers may obtain from the TDLR, Austin, Texas, the Rules, Regulations, and Modes of Procedure of

Texas Water Well Drillers, and Procedures and Standards of Water Well Plugging. The well driller shall be responsible for complying with the above rules and regulations. When a drilled or constructed well produces unacceptable results (either by reason of water quality or yield quantity), or for other reasons the well must be abandoned, the well shall be plugged or completed in accordance with State rules and regulations. The landowner and well driller shall be responsible for complying with the above regulations.

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.

Surface runoff and drainage that might reach the wellhead from potential areas of contamination, such as those used by livestock, shall be diverted.

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service State Office or visit the electronic Field Office Technical Guide.

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State wellhead protection requirements are contained in Water Well Drillers and Pump Installers Administrative Rules, Section 76.1000, Technical Requirements, Locations, and Standards of Completion for Wells.

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 materials 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. Used steel pipe can be used for well casings if it is of good quality and has a wall thickness equal to or greater than that of Schedule 40.

Schedule 40, Steel Pipe

(All units in inches)

Pipe Size	Outside Diameter	Wall Thickness
4"	4.500	0.237
5"	5.563	0.258
6"	6.625	0.280
8"	8.625	0.322

Only steel pipe casings shall be used in driven wells.

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

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.

Filament-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, long-term static 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 section 3.8, 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.

Pipe used for well casing shall be marked in accordance with the specified ASTM designation. For example, PVC plastic casing shall be marked as follows:

- (1) Nominal pipe diameter (e.g., 4 inches)
- (2) Type of plastic material (e.g., PVC-1120)
- (3) The schedule size or SDR as applicable
- {4) The pressure rating in psi (e.g., 220 psi)
- {5) ASTM designation
- (6) Manufacturer's name or trademark
- (7) Pipe intended for the transport of potable water shall also include the seal of approval (or mark) of the laboratory making the evaluation for this purpose.

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.

Determination of the maximum depth of installation for well casings is associated with the difference in hydrostatic pressure between the inside and outside of the casing. This normally occurs upon pumping startup when the water level in the casing is rather quickly drawn down and the static water level outside of the casing is not yet depressed and the ultimate development of the cone of depression (inflow equilibrium) under sustained pumping has not occurred.

Well development procedures usually extend to the lowest casing or screen openings, which are most often at or very near the bottom of the well. Therefore differential head limitation tables shown in NEH, Part 631, Chapter 33, Investigations for Ground Water Resources Development are assumed to apply to a difference in elevation between static water surface and bottom of the well bore.

Design procedures, additional guidance, and example computations for determining casing size, thickness, and material requirements are included in NEH, Part 631, Chapter 33, Investigations for Ground Water Resources Development.

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 screens shall be installed in any aquifer material likely to produce silt or sand. Well screens may be constructed of commercially manufactured screen sections, well points, or field-perforated sections.

The screen shall be constructed with the slot width determined from aquifer samples (Part 631, NEH, Chapter 33). Perforation by any method is allowable provided proper slot size and entrance velocity limits can be met. Screen open areas can range from 1 percent for field-perforated screens to 25 percent or more for continuous wire-wrapped screens. To assure good well efficiency, open areas should be designed to approximate aquifer porosity. High open area percentages also make well development more effective. 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 (Part 631, NEH, Chapter 33, Example 33-2).

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.

Pre-packed Well Screens. For heaving or caving sands, silty or fine-grained aquifers, and for horizontal or angled wells, a

commercial pre-packed 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. Well development shall be performed to repair damage done to the formation by the drilling process, and to alter the physical characteristics of the aquifer surrounding the borehole so that water will flow more freely to the well.

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

Aquifer Development. For massive, unfractured rock that is 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 mortar containing expansive hydraulic cement (ASTM C 845), or bentonite-based grout. 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 commingling of waters is undesirable. State grouting and sealing requirements are contained in Water Well Drillers and Pump Installers Administrative Rules, Section 76.1000, Technical Requirements, Locations, and Standards of Completion for Wells.

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. State disinfection requirements are contained in Water Well Drillers and Pump Installers Administrative Rules, Section 76.1000, Technical Requirements, Locations, and Standards of Completion for Wells. Water wells drilled for or located within public water supply system sanitary easements must be constructed to public well standards pursuant to 30 TAC, Chapter 290.

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 shall be evaluated in planning.

The potential for ground water overdraft and the long-term safe yield of the aquifer shall be considered in planning.

If practicable, wells shall be located in higher ground and up gradient from sources of surface contamination or flooding. In determining gradient, both pumped and unpumped conditions shall be considered.

Potential effects of installation and operation of the well on cultural, historical, archeological, or scientific resources at or near the site shall be considered in planning.

When water is obtained that has poor quality because of dissolved substances, its use in the surface environment or discharge downstream has the potential to degrade surface-water quality.

During well site selection, consideration must be given to the natural water quality and the hazards of its use in the potential contamination of the environment.

Aquifer quality damage from pollutants entering the well by accidental back flushing, or by flow down the annular space between the well casing and the bore hole is a potential hazard that exists during well development, operation, and maintenance.

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.

Well specifications associated with this Standard are to be amplified with the following additional stipulations:

Storage Facilities: An adequate storage facility should be provided for water used for livestock, wildlife, and recreation purposes. An electric pump and pressure tank unit may be used to meet the requirement.

Certification: Copies, signed by driller, of the following shall be furnished NRCS by the landowner and made part of supporting records for the well installation:

- (1) Copy of drillers log,
- (2) Certificate stating depth of well, quality, length, and size of casing installed, and length of well screen or casing perforated; and
- (3) Statement that the installation complies with the rules of the Texas Department of Licensing and Regulation (TDLR).

For steel casing, certificate will include outside diameter, wall thickness, and whether new or used. For plastic casing, certificate will include the manufacturer of the casing and markings on the casing.

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

National Engineering Handbook, Part 631, Chapter 33, Investigations for Ground Water Resources Development.

Title 16, Part 4, Chapter 76 of the Texas Administrative Code (TAC).

APPROVAL AND CERTIFICATION

Water Well

(No.)

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PRACTICE STANDARD APPROVED:

John W. Mueller
State Conservation Engineer

11/21/08
Date

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