

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

WATER WELL

(number)
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, pasture, 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.

Wells are applicable on rangeland, pastures, cropland, farmsteads, and wildlife and recreation areas where present facilities are inadequate, and the underground water supply is adequate in quantity and quality for the purpose to be served and can be developed at an economical cost.

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 local, state, and federal agencies; and design, construction, and maintenance records (from local contractors and consultants) 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.

All wells shall comply with Missouri Well Construction Rules, administered by Missouri Department of Natural Resources, Division of Geology and Land Survey, (DGLS), Wellhead Protection Section. If there is a difference between MoDNR DGLS Rules and this standard, the most restrictive criteria applies.

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

Well Head Protection. Wells shall be located at safe distances from potential sources of surface and groundwater pollution, including unsealed abandoned wells. The allowable distance shall be based on consideration of site-specific hydrogeologic factors, well head protection best management practices, and shall comply with requirements of all applicable Federal, state, or local regulations or construction codes.

Sanitary protection. Ground water sources shall be a safe distance from sources of known

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contamination. Details pertaining to local water wells, such as depth, type of construction, and vertical zone of influence, together with data on the geological formations and porosity of subsoil strata, shall be considered in determining safe allowable distances. Minimum recommended distances between water supplies and source of contamination are:

Source of Contamination	Minimum Distance (feet)
Waste disposal lagoons	300
Storage area for commercial fertilizer or chemicals	300
Below-grade manure storage area	300
Land application areas for animal waste	300
Uncovered animal composters	300
Earthen, concrete, or other manure storage structure or lagoons	300
Silo pits, seepage pits	150
Cesspools	150
Animal or poultry yards, building, or privy	100
Other contaminants that may drain into the soil	100
Enclosed composters with concrete floor and roof	100
Dry litter storage in poultry building during normal operations	100
Single family lagoon	100
Septic tanks and disposal fields	100
Gravity sewer or drain (not pressure tight)	50
Gravity sewer or drain (pressure tight)	25

If possible, the well shall be located in ground that is higher than any source of contamination or flooding. For existing wells, if the above distances cannot be maintained employ well head protection and contact area engineer for assistance. Wells must be readily accessible for maintenance and repair. Each well shall be provided with a watertight cover or seal to prevent the entry of contaminated water or other objectionable material. Sealing of the annular space around the casing shall meet

the requirements of the Missouri Construction Specification for Water Well installation.

Surface runoff and drainage that might reach the wellhead from areas used by livestock shall be diverted.

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 casings. 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. When passing through stable geologic formations the intake portion of a well may not require casing. Extend casing far enough above soil surface to protect the water well.

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. Materials shall be in accordance with the requirements in the Materials section of the construction specification. 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 A589 or A53. Steel pipe manufactured for other purposes may be used if the quality of the pipe meets or exceeds requirements specified in ASTM A589 or A53.

Only steel pipe casings shall be used in driven wells.

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

Plastic casings made of polyvinyl chloride (PVC) shall conform to material, dimensional, and quality requirements specified in ASTM F480.

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

Plastic pipe manufactured for water or irrigation pipelines may be used if the quality equals or exceeds requirements specified in ASTM F480.

Filament-wound fiberglass casings (glass-fiber-reinforced-thermosetting-resin pipe, RTRP) may be used if material meets requirements specified in ASTM D2996. Tests for long-term cyclic pressure strength, long-term static pressure strength, and short-term rupture strength as required in ASTM D2996 are not needed because the pipe is to be used for well casing. Joints shall meet requirements specified in ASTM F480.

Fiberglass pressure pipe, (also called reinforced plastic mortar pipe, RPMP, or fiberglass pipe with aggregate) shall meet or exceed requirements specified in ASTM D3517.

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 strength will comply with 10 CSR 23-3.030 Standards for Construction of Wells.

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. Mechanically supported casing installations 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. All wells finished in unconsolidated aquifers shall be equipped with manufactured screen

sections, well points, or field perforated sections meeting the criteria stated. Well screens may be constructed of commercially manufactured screen sections, well points, or field-perforated sections. The screen openings for aquifer material of near uniform size shall be smaller than the average diameter of the aquifer material.

For graded aquifer materials (of nonuniform gradation), 25 to 40 percent of the aquifer material shall be larger than the screen opening. In wells using a gravel pack envelope, the screen shall have openings that will exclude at least 85 percent of the gravel pack material. 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.

The position of the screen in the well shall be governed by the depth of the aquifer to be penetrated by the well. If practical, the top elevation of the screen shall be below the lowest water level expected during pumping and be located opposite the most permeable area in the water-bearing strata.

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 well holes drilled by reverse circulation.

Filter packs shall be used in wells developed in stratas of fine material of relatively uniform grain size to prevent the aquifer materials from passing through the well screen or perforated casing. The pack shall be 3 to 12 inches thick and shall consist of sand or gravel material having a grain size 5 to 12 greater than the grain size of the strata material.

Prepacked Well Screens. For heaving or caving sands, silty or fine-grained aquifers,

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and for horizontal or angled wells, a commercial prepacked well screen may be substituted for a conventionally installed (by tremie) filter pack.

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.

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 D5521.

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 limit of the well shall be filled with

expansive hydraulic cement (ASTM C845), 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.

In a new well, 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.

Access Port. An access port with a minimum diameter of 0.5 inches 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.

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.

Additional Criteria Applicable to Irrigation Use

All irrigation wells shall be planned and located to serve as a source of water for an irrigation

water distribution or conveyance system designed to facilitate the conservation of soil and water resources.

Irrigation wells are limited to geological sites where sufficiently large volumes of underground water are available at a rate that will permit practical irrigation of the land on which the water is to be used. Wells may be the only source of supply or they may supplement other sources. The land on which the water is to be used must be suitable for the production of locally adapted crops grown under irrigation farming. The water quality must be of such that it will not materially reduce the productive capacity of the soil on which it is to be used.

Additional Criteria Applicable to Livestock Use

Water sources for livestock should be adequately dispersed to facilitate distribution of grazing areas.

CONSIDERATIONS

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

The potential for excessive use of ground water 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. In determining gradient, both pumped and unpumped conditions shall be considered.

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

Consider using backflow devices on faucets and hose connectors to minimize effects on the quality of the water well.

Consider decommissioning any preexisting wells to prevent underground water sources being contaminated.

Consider, in planning, potential effects of installation and operation of the well on cultural, historical, archeological, or scientific resources at or near the site.

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.

A Registration Record must be submitted to Missouri DNR-DGLS after completion. Include well decommissioning in conjunction with water well construction, if applicable.

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 the well before and after corrective action was taken.

REFERENCE USED IN PREPARATION OF STANDARD

Missouri Well Construction Rules - Private Water Wells, Heat Pump Systems, Pump Installations and Monitoring Wells; MO Department of Natural Resources, June 1996