

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 D5299).

**FEDERAL, STATE, AND LOCAL LAWS**

Well construction and installation shall comply with all federal, state, and local laws, rules or regulations. In California, counties are required to adopt well standards that equal or exceed those developed by the California Department of Water Resources. The operator is responsible for securing permits if required.

**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.

**Drilling Contractors.** California State Law requires that wells be constructed by contractors licensed in accordance with the provisions of the Contractors License Law (Chapter 9, Division 3, of the Business and Professions Code) unless exempted by that act.

**Well Head Protection.** Wells shall be located a safe distance 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.

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

The wellhead area shall be reasonably protected from damage that might be incurred by livestock, vehicles, acts of carelessness, and vandalism.

**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 A589. Steel pipe manufactured for other purposes may be used if the quality of the pipe meets or exceeds requirements specified in ASTM A589.

Neither used steel pipe nor galvanized sheet metal pipe such as 'downspout' tile pipe shall be used as well casing. To prevent galvanic corrosion, dissimilar metals shall not be joined.

Only steel pipe casings shall be used in driven wells.

Plastic casings and couplings made of acrylonitrile-butadiene-styrene (ABS) or polyvinyl chloride (PVC) shall conform to material, dimensional, and quality requirements specified in ASTM F480.

Plastic pipe manufactured for water or irrigation pipelines may be used if the quality equals or exceeds 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.

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 D 2996 are not needed because the pipe is to be used for well casing.

Fiberglass pressure pipe, (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. Required casing strength shall be determined as shown in NEH Part 631, Chapter 33, Investigations for Ground Water Resources Development, and summarized in Practice Specification 642.

**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 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. Perforation by any method is allowable provided proper slot size and entrance velocity limits can be met.

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.

The designed gradation and thickness of the gravel pack shall be provided by the contractor and shall be approved by NRCS prior to installation.

**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.

**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 C845), 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. Water well standards issued by the State of California require that the grout seal extends at least 20 feet deep in agricultural and individual domestic wells. Exceptions to minimum seal depths can be made for shallow wells at the approval of the enforcing agency, where the water to be produced is at a depth less than 20 feet. In no case shall an annular seal extend to a total depth less than 10 feet below land surface. County and local requirements may be more restrictive.

The casing shall be surrounded at the ground surface by a 4-inch thick concrete slab extending at least 2 feet in all directions. The upper surface of the base shall slope away from the well casing. Contacts between the base and the annular seal, and the base and the casing, shall be water tight and shall not cause the failure of the annular seal or the well casing.

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.

**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.

**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 (Driscoll, chap. 15).

**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. Refer also to NRCS Conservation Practice Standard 355, Water Well Testing, and to the California Water Well Standards.

**Reporting.** As required by California State Law, the well drilling contractor shall complete a Well Completion Report and file it with the California Department of Water Resources (DWR) in accordance with DWR instructions available online.

## 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.

**Cultural Resources.** NRCS's objective is to avoid any effect to cultural resources and protect them in their original location. Determine if installation of this practice will have any effect on any cultural resources.

Document any specific considerations for cultural resources in the design docket and the Practice Requirements worksheet.

GM 420, Part 401, the California Environmental Handbook and the California Environmental Assessment Worksheet provide guidance on how the NRCS must account for cultural resources. The Field Office Technical Guide, Section II contains general information, with websites for additional information.

**Endangered Species.** Determine if installation of this practice with any others proposed will have any effect on any federal or state listed Rare, Threatened or Endangered species or their habitat. NRCS's objective is to benefit these species and others of concern or at least not have any adverse effect on a listed species. If the Environmental Evaluation indicates the action may adversely affect a listed species or result in adverse modification of habitat of listed species which has been determined to be critical habitat, NRCS will advise the land user of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the landowner selects one of the alternative conservation treatments for installation; or at the request of the landowners, NRCS may initiate consultation with the Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game. If the Environmental Evaluation indicates the action will not affect a listed species or result in adverse modification of critical habitat, consultation generally will not apply and usually would not be initiated. Document any special considerations for endangered species in the Practice Requirements Worksheet.

## 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

USDA-NRCS, Nov. 1998, Investigations for Ground Water Resources Development: National Engineering Handbook, Part 631, Chapter 33. <http://www.info.usda.gov/CED/ftp/CED/neh631-33.pdf>.

California Department of Water Resources, Nov. 1999, How to Fill Out a Well Completion Report: DWR Instruction Manual by Carl Hauge, 29 p., [http://www.dpla.water.ca.gov/sd/groundwater/publications/wcr\\_instruction\\_pamphlet.pdf](http://www.dpla.water.ca.gov/sd/groundwater/publications/wcr_instruction_pamphlet.pdf).

California Department of Water Resources, Southern District, 1998, California Well Standards: online integration of DWR Bulletins 74-81 and 74-90 (last modified June 10, 2004), [http://www.dpla.water.ca.gov/sd/groundwater/california\\_well\\_standards/well\\_standards.html](http://www.dpla.water.ca.gov/sd/groundwater/california_well_standards/well_standards.html).

Driscoll, F.G., 1986, Groundwater and Wells: 2<sup>nd</sup> ed., Johnson Division, St. Paul MN, 1089 p.