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

Federal, State, and Local Laws. All planned activities shall comply with all federal, state, and local laws and regulations. All wells shall be constructed by a licensed well driller listed with the Alabama Department of Environmental Management (ADEM). ADEM form 60 shall be used when completing the well log.

Cultural Resources. Ground disturbing activities have the potential to affect significant cultural resources. A cultural resources review shall be completed prior to ground disturbing activities to assure that existing cultural resources will not be adversely impacted.

Suitability of Site. Determine the availability of ground water for its intended use at the site 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. Locate wells at safe, allowable distances from potential sources of pollution, including unsealed abandoned wells. Base the distances on site-specific hydrogeologic factors that comply with requirements of all applicable state or local regulations or construction codes.

Divert away surface runoff and drainage that might reach the wellhead from potential areas of contamination, such as those used by livestock.

Locate wells a safe distance from both overhead and underground utility lines and other safety hazards.

Unless otherwise approved, protect all wells from freezing, mowing, livestock, etc., by fabricating or installing a manufactured, insulated well house.

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. Install casing 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. Size casing diameter to permit satisfactory installation and efficient operation of the pump. Assure the casing diameter is large enough 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.

Use only steel pipe casings in driven wells.

To prevent galvanic corrosion, do not join dissimilar metals.

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 for human consumption, use plastic pipe 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.

Casing Strength. Provide sufficient well casing wall thickness to withstand all anticipated static and dynamic pressures imposed on the casing during installation, well development and use. Determine required casing strength as shown 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. Install well screens 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.

Construct screens with the slot widths determined from aquifer samples (NEH, Part 631, 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. Size the length and open area of the screen to limit entrance velocity of water into the well to less than or equal to 0.1 foot per second (NEH, Part 631, 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). Provide telescoped screen assemblies with one or more sand-tight seals between the top of the telescoped screen assembly and casing.

Filter Pack. Install a filter pack around the well screen 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. Extend casing 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.

Case all wells to a sufficient height (minimum of 12 inches) above the ground surface to prevent entry of surface and near-surface water.

Seal casing for artesian aquifers 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, seal the zone to prevent infiltration of the poor-quality water into the well and the developed portion of the aquifer.

Well Development. Perform well development 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.

Base method of well development used 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 Fill the annulus surrounding the permanent well casing at the upper terminus of the well 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.

Surround the casing at the ground surface by a 4-inch thick concrete slab extending at least 2 feet in all directions.

Provide a positive seal (grouted in place) or packer 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. Install an access port with a minimum diameter of 0.5 inch 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. Seal or cap access ports and pressure gages or other openings in the cover to prevent entrance of surface water or foreign material into the well. Removable caps are acceptable as access ports.

Disinfection. Disinfect wells 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.

Pressure Tank. Unless otherwise approved, construct all wells utilizing a pressure tank of sufficient size to extend the life of the pump.

Power Source. Electrical components and installations shall meet the requirements of the National Electrical Code (NEC) and state and local codes for outdoor installation. Place all electrical wiring in conduit. A qualified state licensed electrician will certify in writing all electrical installations.. Wherever installation could be classified as a hazardous location, specific conformance to NEC Article 500 will be met.

CONSIDERATIONS

Evaluate the potential for adverse interference with existing nearby production wells in planning.

Consider the potential for ground water overdraft and the long-term safe yield of the aquifer in planning.

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

PLANS AND SPECIFICATIONS

Prepare plans and specifications for specific field sites in accordance with this standard and describe the requirements for applying the practice to achieve its intended uses.

OPERATION AND MAINTENANCE

Prepare a operation and maintenance (O&M) plan for the well. Keep the well construction records on file with the O&M plan by the owner/operator. As a minimum, the O&M 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.

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 316 - Animal Mortality Facility

NRCS, Alabama Job Sheet No. AL 590

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