

**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).

FEDERAL, STATE and LOCAL LAWS

Design and construction activities shall comply with all federal, state, and local laws, rules, and regulations governing activities in or along streams, pollution abatement, health, and safety.

**NRCS, NHCP
February 2005**

The owner or operator shall be responsible for securing all required permits or approvals and for performing all planned work in accordance with such laws and regulations. NRCS employees are not to assume responsibility for procuring these permits, rights, or approvals, or for enforcing laws and regulations. NRCS may provide the landowner or operator with technical information needed to obtain the required rights or approvals to construct, operate, and maintain the practice.

There are specific WV requirements for wells issued by the WV Department of Health and Human Resources. Permits and well certifications may be required from the following agencies:

- 1. Local Health Department Requirements***
- 2. WV Department of Health and Human Resources***
- 3. West Virginia Department of Agriculture***

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.

**NRCS, WV
September, 2009**

Conservation practice standards are reviewed periodically, and updated as needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service **State Office** or visit the **electronic Field Office Technical Guide (e-FOTG)** located on our web site.
Note: Bold italics is information added or changes made to the National Conservation Standard by WV.

Geological investigations shall be made documenting:

- 1. Potential water supply availability and capacity (based on other wells in area, if known) for the intended purpose and performs as intended (WV EngWS 642-A).**
- 2. Evaluate the well site for accessibility and suitability, ease of maintenance and repair, cleaning, treatment, and testing or other such attention.**

Required minimum distance between a water well, (non-public water system) and the source of potential pollution or contamination shall be as follows or according to WV Department of Health and Human Resources, whichever distance is greater:

Source	Minimum Distance (Feet)
Property Lines	10
Streams, Rivers and Impoundments ²	25
Sewers and Drains ¹ (Hydrostatically Tested)	25
Existing Buildings or Foundations	30
Sewage Holding or Septic Tanks ¹	100
Sewage Absorption Fields, Privies (Vault)	100
Sewers and Drains (Non-Watertight),	100
Barnyard/Feeding, Watering Areas,	100
Cemeteries, Other existing wells	100
Open Manure Piles	100
Buried Oil, Gasoline Tanks	100
Chemical Storage Tanks (no leak)	100
Silo or Seepage Pit, Storage or Preparation Site	150
Storage or Preparation Site for Fertilizers	150
Storage or Preparation Site for Pesticides	150
Other Known or Potential Contamination Sites	150
Lagoons, Waste Storage Ponds	300
Chemical Storage Areas	300
¹ Sewer and drain materials shall be of potable water main standards, installed, and hydrostatically tested as approved by the director.	
² The upper well casing shall extend one foot above the twenty-five (25) year flood level or greater according to WV-DOHHR regulations.	

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.

The well upper casing shall be a minimum of 12 inches above the 25 year,24 hour flood event elevation or when adjacent to a watercourse or impoundment. It shall be constructed in such a manner the floodwater cannot enter the well. A watertight cap shall protect the well according to state regulations.

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, 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 or **AWWA Standard A-100. Steel casing shall be new with a minimum wall thickness of 0.188 inches if the nominal pipe size is ten (10) inches diameter or less and have a minimum wall thickness of 0.375 if the nominal pipe size is greater than ten (10) and less than twenty (20) inches.** 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 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.

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.

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 or below 80% of the documented water column depth.

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 **5 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. ***The full length of the well casing shall be fully grouted from the lower terminus to the ground surface, except as noted***

- a. When drilling through caves, mines, or other cavities, the lower portion of the casing shall be grouted in accordance with the method described in b. of this section and a packer or similar bridging device shall be used to permit grouting above the cavity.***
- b. In unconsolidated aquifers (i.e., sand and gravel) above bedrock, the permanent casing shall be grouted.***
- c. In cases where a pitless adaptor is installed, upward grouting may terminate at the pitless adaptor level to allow for the installation of a pitless adaptor (refer to state law).***

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. Prior to the driller leaving the site, the well shall be capped with a watertight seal

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.

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. ***Well water for microirrigation shall be tested if known contaminants, high turbidity or potential such as iron, sulfides or hardness is a concern and could cause plugging of the microirrigation.***

CONSIDERATIONS

The potential for adverse interference with existing nearby production wells shall be evaluated 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.

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

The following items shall be documented

- 1) Purpose of the well**
- 2) Anticipated Demand**
 - a) Rate (GPM)**
 - b) Daily Volume (Gallons/day)**
 - c) Daily Use (hours/day)**

NRCS, NHCP
February 2005

- 3) Well Site Selection Documentation**
- 4) The owner shall provide a copy of the driller's WV Certified Water Well Record to NRCS personnel prior to acceptance of well.**
- 5) A WV Certified Well Driller shall be on site in direct charge of drilling, construction, altering or abandonment of a water well.**
- 6) Compare the estimated well yield information to the pump selection data curve and criteria according to CP Pumping Plant (533).**
- 7) A well for a irrigation systems shall yield a minimum of 125% of the rate (GPM) and volume (Gallons/day) to prevent excessive drawdown.**
- 8) A well requiring more than 20 GPM or requiring in excess of 12 hours/day pump time shall be yield tested (contact the State Geologist for yield test criteria), unless other evidence exists documenting the volume and recharge capabilities of the well. The water well plan schematic WV-ENG-63 shall be completed.**
- 9) For Water Well decommissioning or abandonment, refer to PS Well Decommissioning (351) and WV Dept. of Health and Human Resources Water Well Regulations and Design Standards for guidance.**
- 10) Reference WV Title 64 Series 46 Water Well Design Standards 54-46-5 for Material Specifications and 54-46-6 for construction criteria and NRCS WV Water Well (642) Specifications.**

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

NRCS, WV
September, 2009

taken. ***Refer to WV ENG Water Well O&M worksheet.***

REFERENCES

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

***WV-64 CSR 19-Title 64; Interpretive Rule;
Dept. of Health; Series 19 Water Well
Regulations***

***WV-64 CSR 46-Title 64; Interpretive Rule;
Dept. of Health; Series 46 Water Well Water
Well Design Standards.***

WV Eng WS -Water Well Work Sheets

WV ENG-63 Water Well Schematic

***WV NRCS -Water Well Operation and
Maintenance***

WV Water Well (642) Specifications