

## CHAPTER 5 -- CRITERIA FOR WELL CONSTRUCTION

### 5.1 INTRODUCTION

The objective of this Chapter is to outline the standards for the construction, alteration, operation, maintenance, and abandonment of any water well.

### 5.2 DEFINITIONS

**5.2.1 Annulus or Annular Space** means any artificially created void existing between a well casing or liner pipe and a borehole wall, or the space between two casings or liner pipes.

**5.2.2 Aquifer** means a geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield useful quantities of groundwater to wells and springs.

**5.2.3 Casing Diameter or Diameter of Casing** means the largest inside diameter of the final casing.

**5.2.4 Dewatering** means the use of wells or other such equipment to temporarily lower a water level, as may be necessary during construction activities.

**5.2.5 Drive Shoe** means any device specifically designed, fabricated, or installed to protect the end of a well casing or liner pipe from collapse or other damage while the casing or liner pipe is being driven into place in a well.

**5.2.6 Gang Well** means a system where two (2) or more water wells are coupled together with a common header or manifold.

**5.2.7**        **Grout** means a mixture of water, Portland cement (American Concrete Institute type 1; American Concrete Institute type II, Class H; American Concrete Institute type III; or any other types of cement approved by the District), and sand (not more than two (2) parts of sand to one (1) part of cement by weight), and other additives listed under 5.2.11, or other additives approved by the District. Grout composition shall not exceed six (6) gallons of water per cubic foot of cement.

**5.2.8**        **Inspection Port** means any opening not less than three-quarters (3/4) inch in diameter through which unobstructed access to the inside of the casing can be obtained for measuring water levels. Inspection ports shall be threaded openings temporarily sealed with a removable watertight plug.

**5.2.9**        **Liner** means a metallic or non-metallic pipe which is installed either within the outer casing to improve, repair, or protect the outer casing, or below the outer casing to seal off caving material which may be encountered in the open hole of the well.

**5.2.10**       **Monitoring Well** means a well used primarily to monitor hydrologic parameters such as water levels or water quality.

**5.2.11**      **Neat Cement Grout** means grout without addition of sand but may include bentonite (not to exceed five (5) pounds per ninety-four (94) pound sack of cement), calcium chloride (not to exceed 3 lbs. per 92 lb. sack of cement), or retarder (not to exceed 1 lb. per 94 lb. sack of cement), or other admixtures approved by the District to reduce permeability or shrinkage, increase fluidity, adjust slurry weight and/or control set time. Neat cement grout composition shall not exceed six (6) gallons of water per cubic foot of cement.

**5.2.12**      **Observation Well** means a well used primarily to observe the elevation of the water table or potentiometric surface, or to determine water quality, in the aquifer.

**5.2.13**      **Public Water Supply Well** means a well constructed for the purpose of supplying water to a public water system.

**5.2.14**      **Public Water System** means a system designed to provide to the public piped water for human consumption, if such a system has at least fifteen (15) service connections, or regularly serves at least twenty-five (25) individuals daily, at least sixty (60) days out of the year.

**5.2.15**      **Sand-Point Well** means any device which is driven into place in unconsolidated earth materials, and which consists of a pipe with an attached perforated metal tube or screen, designed to permit the passage of water.

**5.2.16**      **Test Hole** means an artificial hole in the ground drilled, bored, cored, washed, or jetted, the intended use of which includes obtaining data for engineering and/or for geophysical or geological exploration; prospecting for minerals or products of mining of quarrying; not for the purposes of either producing, disposing of, or searching for water.

**5.2.17**      **Well** means a water well, but specifically excludes a test hole, or observation well or a monitoring well.

**5.2.18**     **Well Casing** means a metallic or non-metallic pipe installed in a borehole to prevent caving, provide structural strength, seal off zones of poor water quality, or prevent the interchange of waters between aquifers.

### **5.3 CONSTRUCTION, REPAIR AND ABANDONMENT STANDARDS--**

This Part relates to the standards and criteria for the construction, repair and abandonment of wells.

**5.3.1**     **Construction Methods** -- Wells must be so constructed, cased, grouted, plugged, capped, or sealed as to prevent uncontrolled surface flow, uncontrolled movement of water from one aquifer or zone to another, contamination of groundwater or surface water resources, or other adverse impacts.

**5.3.2**     **Location** -- Wells shall be located so as not to pose a threat of contamination to the water resource.

#### **5.3.3**     **Casing and Liner Pipe Standards**

**5.3.3.1**     Well casing and liner pipe shall be new, or shall be pipe or casing in like new condition. Such casing or pipe shall not be used unless free of leaks, corrosion, and dents; is straight and true, and is not out of round. Welded or seamless black or galvanized pipe or casing, or stainless steel pipe or casing, or approved types of non-metallic pipe shall be used for well casing or liner pipe.

Well casing installed by driving, shall not have less than the dimensions and weights specified in Table 1, unless otherwise approved by the District, and shall conform to the American Society for Testing and Materials (ASTM) A53-77A Type S, Grade A, except as noted below.

**Table 1**  
**MINIMUM DIMENSIONS AND WEIGHTS FOR**  
**BLACK OR GALVANIZED STEEL CASING OR**  
**LINER PIPE INSTALLED BY DRIVING**

nominal size (in.)	outside diameter (in.)	wall thickness (in.)	plain end weight (lbs./ft)
3	3.500	0.216	7.58
3.5	4.000	0.226	9.11
4	4.500	0.237	10.79
	or	0.188	or 8.62
5	5.563	0.258	14.62
6	6.625	0.280	18.97
8	8.625	0.277	24.70
10	10.750	0.307	31.20
12	12.750	0.330	43.77

**5.3.3.2** Black or galvanized steel casing or liner pipe set into place without driving shall not have less than the dimensions and weights specified in Table 2 and shall conform to the American Petroleum Institute (API) Standard 5L, Grade A.

**Table 2**  
**MINIMUM DIMENSIONS AND WEIGHTS FOR**  
**BLACK OR GALVANIZED STEEL CASING OR**  
**LINER PIPE SET INTO PLACE WITHOUT DRIVING**

nominal size (in.)	outside diameter (in.)	wall thickness (in.)	plain end weight (lbs./ft)
3	3.500	0.125	4.51
3.5	4.000	0.134	5.53
4	4.500	0.142	6.61
5	5.500	0.154	8.79
5.5	6.000	0.164	10.22
6	6.625	0.185	12.72
8	8.625	0.188	16.90

**5.3.3.3** Black or galvanized steel casing installed by driving with a nominal size between twelve (12) and thirty (30) inches shall have a minimum wall thickness of 0.375 inches and shall be of weights as specified by American National Standards for Wrought Steel and Wrought Iron Pipe ANSI B36.10-1970, for standard pipe. Pipes larger than thirty (30) inches shall have a minimum wall thickness of 0.500 inches and shall be of weights as specified by American National Standards for Wrought Steel and Wrought Iron Pipe ANSI B36.10-1970, for standard pipe.

Four (4) inch nominal size pipe with a wall thickness of 0.188 shall be certified by the manufacturer to be in accordance with American Petroleum Institute (API) Standard 5L or ASTM A589-73, A120-77, A53-77A, A252-77A Grade 2.

**5.3.3.4** Black or galvanized steel casing or liner pipe set into place without driving, with an outside diameter less than 3.500 inches shall have a wall thickness of not less than 0.125 inches. Black or galvanized steel casing or liner pipe with a nominal size between eight (8) and sixteen (16) inches shall have a wall thickness of not less than 0.250 inches. Steel casing or liner pipe with a nominal size of sixteen (16) inches or more shall have a wall thickness of not less than 0.375 inches.

**5.3.3.5** Stainless steel pipe used for casing or liner pipe shall be Schedule 10S of the American National Standards Institute (ANSI B 36.19-1976), or stronger classification.

**5.3.3.6** Polyvinyl Chloride (PVC) pipe may be used for well casing or liner pipe. Any PVC pipe used to construct a water well shall have been marked by the manufacturer, under a method specified by the National Sanitation Foundation, Ann Arbor, Michigan, as suitable for use in potable water systems. Any PVC pipe larger than 4.5 inches outside diameter used for well construction or repair shall have a working pressure rating of not less than 200 p.s.i. at seventy-three degrees (73°F) Fahrenheit or shall be ASA Schedule 40. Other non-metallic pipe may be approved by the District.

**5.3.3.7** Steel well casing and liner pipe may be joined in a watertight manner by threaded couplings or electrical welding methods. PVC pipe shall be joined by solvent bonded or threaded couplings or other approved method which shall meet the strength requirements of casing as specified in 5.3.3.6 above.

**5.3.3.8** Non-metallic and stainless steel well casing or liner pipe shall not be installed or seated by driving, unless prior approval is obtained from the District.

For well casing or liner pipe installed by driving, the casing or pipe shall not butt together inside threaded couplings unless the joint is electrically

welded so as to be completely watertight. A drive shoe is required for use on casing or pipe installed by driving unless exempted by the District.

#### **5.3.4 Well Construction Requirements**

**5.3.4.1** In the construction of a well, reasonable caution shall be taken to maintain the premises in sanitary condition and to minimize the entrance of contaminants into the water resource. Water and materials used in construction shall be reasonably free of contamination.

**5.3.4.2** Wells which penetrate multiple aquifers or zones shall be completed so as to prevent cross-contamination of different aquifers or zones if significantly different water quality exists between these aquifers or zones, and to prevent leakage of water from one aquifer or zone to another aquifer or zone.

**5.3.4.3** Casing shall extend from above top of grade to the well screen for wells finished into unconsolidated aquifers.

- A. The well screen shall be attached to the casing with a watertight seal. or:
- B. Be sealed against the casing with a packer. Or:
- C. The screen assembly shall overlap the casing by at least ten (10) feet.

**5.3.4.4** Wells finished into consolidated aquifers, require a continuous casing to extend from above top of grade into the top of the aquifer. For artesian wells the casing shall penetrate the entire thickness of the overlying formations above the aquifer or producing zone within the aquifer.

**5.3.4.5** Notwithstanding the provisions of 5.3.4.4 above, the District may grant waivers for seating or casing within the confining zone above an artesian aquifer on a case-by-case basis when, in the opinion of the



District, extending casing to the top of the aquifer would present undue hardship, provided that:

- A. The casing extends a sufficient distance into the confining zone so as to prevent movement of water from the artesian aquifer to overlying aquifers.
- B. The District determines that such construction will not adversely affect the water resources.

**5.3.4.6** In all cases casing shall extend from land surface to a minimum of three (3) feet below land surface.

**5.3.5** **Grouting and Sealing** Wells shall be grouted and sealed to protect the water resources from degradation caused by movement of waters along the well annulus either from the surface to the aquifer or between aquifers, and to prevent loss of artesian pressure in artesian aquifers. All wells shall be constructed and sealed using a method which insures that an open or unnaturally permeable annular space does not remain when a well is completed.

**5.3.5.1** The casing shall be centered in the borehole prior to grouting and sealing. In those cases where, during grouting operations, circulation of the grout is lost so that the annular space being grouted cannot be filled in one continuous operation, a tremie pipe shall be installed in the annular space to a point immediately above the zone of lost circulation, and the annulus shall be bridged at that point by sand and other approved material introduced through the pipe. Grouting or sealing of the annular space shall be completed using the pipe or other approved methods. A tremie pipe, or other approved technique, may also be used to complete grouting when the total volume of grout to be emplaced exceeds that which can be safely emplaced in one continuous operation. The minimal set time for grouting of casing before drilling operations may continue, shall be twelve (12) hours.

**5.3.5.2** Wells less than four (4) inches in diameter must have a minimum of a one (1) inch annular space for grouting. Wells equal to or greater than four (4) inches in diameter must have an annular space equal to

or greater than two (2) inches for grouting.

**5.3.5.3** Wells constructed in unconsolidated formations by any method which creates an annular space shall be grouted no more than ten (10) feet above the top of the screen to land surface.

**5.3.5.4** The District may grant individual exceptions or may exempt any areas of Tribal lands from the requirements of grouting the annular space of that part of the well which penetrates an unconsolidated formation, except that the uppermost three (3) feet of the casing must be grouted to provide protection from contaminated surface water.

**5.3.5.5** All other wells shall be grouted from the bottom of the casing to land surface.

**5.3.5.6** Grouting and sealing of water wells shall be accomplished by the practices and methods recommended by section A1-8.4 of AWWA A100-66, AWWA Standard for Deep Wells, American Water Works Association, Inc., or other methods approved by the District.

**5.3.5.7** Wells constructed by methods which require driven well casing are exempt from section 5.3.5, provided the following conditions are met:

- A. Casing shall be driven from land surface to its final depth in a borehole smaller in diameter than nominal outside diameter for the casing used, or be driven from land surface to its final depth ahead of the drill bit.
- B. A drive shoe is used.
- C. No annular space exists after casing is installed.
- D. The uppermost three (3) feet of the casing must be grouted to provide protection from contaminated surface water.
- E. The well is sealed in accordance with subsection 5.3.5.9.
- F. All other requirements of Part 5.3 are met.

**5.3.5.8**            **Temporary Well Seals**            Whenever there is a temporary interruption in work on the well during construction, repair, or abandonment, the well opening shall be sealed with a substantial watertight cover. Except for those areas of the District designated by the District, any well in which pumping equipment is installed, seasonally or periodically shall, whenever pumping equipment is not installed, be capped with a watertight cap or valve. If a temporary well seal is installed, an unobstructed inspection port must be provided for wells six (6) inches or greater in diameter.

**5.3.5.9**            **Permanent Well Seals**            Wells located on ground subject to flooding shall be properly sealed to prevent the movement of contaminants and surface water into the well. The upper end of the well casing shall include a watertight seal with any vent above the one hundred (100) year flood level. Pumping equipment and any necessary pipe or electrical connections shall be so installed as to prevent inadvertent introduction of contaminants into the well. Pumping equipment and any necessary piping or electrical connections installed within the casing shall be installed through a well seal. An unobstructed inspection port equipped with a temporary removable plug shall be provided and accessible at the wellhead for wells six (6) inches or greater in diameter.

**5.3.6**            **Explosives**            The use of explosives in well construction or development is prohibited unless specifically approved by the District.

**5.3.7**            **Flowing Wells**            If the well flows at land surface, each well shall be provided with a valve so adjusted that only a supply of water is available which is necessary for ordinary use by the Tribe. Upon determination by the District that the water in an artesian well is of such poor quality as to have an adverse impact upon an aquifer or other water body which serves as a source of public drinking water, or which is likely to be such a source in the future, such well shall be plugged in accordance with 5.3.8.

**5.3.8**            **Abandoned Well Plugging**

**5.3.8.1**            Any well which was not constructed in accordance with the

standards of Part 5.3 and fails to be corrected upon written notice shall be deemed an abandoned well.

**5.3.8.2** Any well which is an abandoned artesian well under section 5.3.7 or subsection 5.3.8.1, shall be plugged in accordance with subsection 5.3.8.3.

**5.3.8.3** All abandoned wells shall be plugged by filling them from bottom to top with neat cement grout. The plugging shall be to restore or improve the hydrologic conditions which existed before the well was constructed.