

(43) "Retention pond" means an excavated or diked structure or combination of structures designed for interception and temporary storage of runoff water contaminated by leachings, washwaters or similar liquid wastes on farms or on other property where cattle or other livestock are raised.

(44) "Reservoir" means a facility for storage of water for drinking or culinary purposes constructed entirely or partially below the ground surface.

(45) "Safe water" means water that is free from contaminating matter.

(46) "Sanitary condition" (a) When referring to a well or reservoir means that the construction of the well or reservoir and the installation of the pumping equipment are such that the well or reservoir is effectively protected against entrance of contaminating matter.

(b) When referring to the surroundings of a well or reservoir means that the location and the surrounding area are free from debris or filth of any character and not subject to flooding.

(47) "Seepage bed" means an excavated area similar to a seepage trench but larger than 3 feet in width and containing more than one distribution line.

(48) "Seepage pit" means an underground receptacle so constructed as to permit disposal of septic tank effluent, milkhouse washwater, silage juices, clear water wastes and similar wastes by soil absorption through its walls and bottoms.

(49) "Seepage trench" means an area excavated 3 feet or less in width which contains a bedding of aggregate and a single distribution line.

(50) "Septic tank" means a watertight tank which receives sewage.

(51) "Sewage" means any water carried wastes created in and conducted away from residences, industrial establishments and public buildings with such surface or ground water as may be present and for the purpose of these rules includes any other liquid wastes except clear water wastes.

(52) "Sewer" means any conduit used or intended to be used for conveying sewage.

(53) "Sanitary building sewer" means that part of the plumbing system beginning at the immediate outside foundation or proposed foundation wall and extending to its connection with the main of a public sewer, private sewer, private sewage disposal system or other point of disposal.

(54) "Sanitary building drain" means the lowest horizontal piping of a drainage system which receives the discharge from soil, waste and other drainage pipes inside any building and conveys same to the building sewer by gravity flow. The minimum building drain extends from the building sewer to all soil stacks.

(55) "Sanitary building subdrain" means the horizontal portion of a drainage system within a building which cannot flow by gravity to the building drain.

(56) "Solid manure storage structure" means a structure used for stacking or composting and containment of animal wastes consisting of excreta, feed losses, litter or associated solid wastes.

(57) "Specific capacity" means the continuous yield of a well at a given well water or pressure drawdown expressed in gallons per minute, per foot of drawdown.

(58) "Static water level" means that elevation of the surface of the water in a well or water pressure at the top of a well, in the case of some artesian wells, when no water is being pumped or flows therefrom. In the case of artesian wells with a positive water pressure at the top of the well, the static water elevation is determined either by a stilling pipe or pressure gauge and under either condition water elevations are referred to the elevation of the top of the well or the ground grade at the well.

(59) "Storm sewer" means any conduit used or intended to be used for conveying surface water runoff, clear water waste and subsoil drainage with such ground water as may be present.

(60) "Storm building sewer" means that part of the storm water system which receives the discharge from building storm drains and sub-drains, parking lots, yard fountains and other similar sources, and conveys such waters to a public storm water system, private storm water system or other approved point of disposal.

(61) "Storm building drain" means the lowest horizontal piping which receives storm waters or other similar water from roofs, area ways, courtyards, canopies, enclosed parking ramps and other sources inside any building or structure and conveys same to the storm building sewer by gravity flow.

(62) "Storage pond" means an excavated or diked earthen structure including partially fabricated liquid manure holding tanks designed for containing animal wastes consisting of excreta, leachings, feed losses, litter, washwaters or other associated liquid wastes.

(63) "Stuffing box" means an approved receptacle in which packing may be compressed to form a watertight or airtight junction between 2 objects.

(64) "Subsoil drain" means that part of the drainage system which conveys the ground or seepage water from the footings of walls or below the basement floor under buildings to the storm sewer or other point of disposal.

(65) "Sump" means a tank or pit which receives sewage or other liquid wastes located below the normal grade of a gravity system and which must be emptied by mechanical means.

(66) "Treatment pond" means an earth structure with sealed bottom and walls constructed for the purpose of holding sewage or other liquid waste for a period of time to reduce BOD and suspended solids.

(67) "Vertical zone of contamination" means that depth of geologic formations, generally near the ground surface, containing connecting pore spaces, crevices or similar openings, including artificial channels, such as unprotected wells, through which contaminated water may gain access to a well or the ground water body.

(68) "Watertight construction" means cased and grouted construction through firm formations like clay or rock. Through granular material like sand or gravel, it means that the casing pipe is of approved quality and assembled watertight.

(69) "Well" means an excavation or opening into the ground made by digging, boring, drilling, driving or other methods for the purpose of obtaining ground water for human consumption.

(70) "Well cap" means an approved removable non-watertight apparatus or device used to cover a well.

(71) "Well driller" means any person, firm or corporation who has duly registered as such with the department, has paid the annual registration fee and has obtained a permit to construct wells.

(72) "Well seal" means an approved removable apparatus or device used as follows:

(a) To close the well opening watertight or to establish and maintain a watertight junction between the upper terminal of protective casing or curbing of a well and the piping or equipment installed therein, so as to prevent water from entering the well; or

(b) To establish and maintain a watertight junction between the basement end of non-pressure pipe conduit, installed between a well and a building basement, and the pump piping installed within the conduit.

(73) "Well vent" means an outlet at the upper end of the well casing or basement end of a non-pressure conduit to allow equalization of air pressure in the well.

(74) "Yield" means the quantity of water which may flow or be pumped from the well per unit of time.

**History:** Cr. Register, June, 1976, No. 234, eff. 10-1-76; renum. (65) to (73) to be (56) to (74), cr. (65), Register, March, 1977, No. 255, eff. 4-1-77.

**NR 112.04 Approved comparable construction.** When strict compliance with this chapter appears to be impracticable, the reasons therefor shall be communicated in writing to the department for advice and approval of comparable specifications.

**History:** Cr. Register, June, 1976, No. 234, eff. 10-1-76.

**NR 112.05 Existing installations.** Existing well, pump, pressure tank, pit, subsurface pumphouse and reservoir installations that conform to section NR 112.23 are acceptable. Noncomplying existing well, pump, pressure tank, pit, subsurface pumphouse and reservoir installations shall be corrected to comply with NR 112.23 or the specifications in this chapter for new construction.

**History:** Cr. Register, June, 1976, No. 234, eff. 10-1-76.

**NR 112.06 Contracts for nonconforming installations.** Well drillers and pump installers shall ensure that the construction and reconstruction of wells or appurtenances thereto or the installation of pumping equipment adheres to all the applicable provisions of this chapter or to approved comparable requirements. Well drillers and pump installers shall not enter into any agreement, written or oral, for such construction, reconstruction or installation which does not require compliance with all applicable provisions of this chapter or with approved comparable requirement.

**History:** Cr. Register, June, 1975, No. 234, eff. 10-1-75.

**NR 112.07 Well location.** (1) **GENERAL.** Where a well is constructed to supply ground water for human consumption and preparation of food products, such well shall be located:

(a) In such manner that the well and its surroundings can be kept in a sanitary condition.

(b) At the highest point on the premises consistent with the general layout and surroundings, but in any case protected against surface water flow and flooding.

(c) As far removed from any known or probable source of contamination as the general layout of the premises and the surroundings permit.

(2) **RELATION TO CONTAMINATION SOURCES.** Unless modified by written department approval under NR 112.04, minimum separating distances between wells or reservoirs and sources of contamination shall be maintained as follows:

(a) Eight feet between well or reservoir and cast iron or equivalent sanitary or storm building sewer or sanitary or storm building drain or a basement floor drain connected to a cast iron or equivalent sanitary building sewer or sanitary building drain; cast iron or equivalent subdrain; cast iron or equivalent sewage sump; cast iron or equivalent milkhouse floor drain; cast iron or equivalent drain from a conventional silo or glass lined storage facility, cast iron or equivalent sewer conducting manure juices to point of disposal.

(b) Ten feet between well and independent clear water waste drain, rainwater downspout outlet, cistern, hydrant drain, or similar unit; building foundation-drain connected to independent clear water waste drain or other subsoil drain; nonconforming existing or unapproved new well pit, pump pit, pressure-tank pit, pressure-tank access pit or subsurface pumphoom; nonconforming reservoir.

(c) Fifteen feet between well and sewer-connected foundation drain.

(d) Twenty-five feet between well or reservoir and watertight grease basin, septic tank, holding tank, subdrain other than cast iron or equivalent pipe; sewage sump other than cast iron or equivalent material; sanitary building or storm building sewer other than cast iron or equivalent material; sanitary building or storm building drain other than cast iron or equivalent material; floor drain connected to sanitary building sewer or drain of other than cast iron or equivalent pipe material; lake or stream shoreline; below-ground swimming pool.

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(e) Twenty-five feet between well or reservoir and watertight barn gutter; animal barn pen with concrete floor; glass-lined storage facility without pit; conventional silo without pit but with concrete floor and proper drain; watertight, milkhouse floor drain other than cast iron or equivalent material; watertight, conventional silo drain or glass-lined storage facility drain other than cast iron or equivalent material; watertight sewer other than cast iron or equivalent material conveying manure juices.

(f) Twenty-five feet between well or reservoir and a pressurized sewer, other than a street sanitary or storm sewer or similar sanitary or storm sewer piping comprising part of the drainage system on public or private property, for which the required minimum separating distance between a well or reservoir and such sewers is specified in NR 112.07 (2) (h).

(g) Fifty feet between well or reservoir and seepage pit, seepage bed, seepage trench or other similar sewage or waste water disposal unit; privy; dog-waste pit disposal unit; animal yard, animal shelter, animal enclosure or animal lot; conventional silo with pit; glass-lined storage facility with pit; outlet of watertight milkhouse drain; seepage pit for drain of conventional silo or glass-lined storage facility; loose-jointed field-drain pipe lines.

(h) Fifty feet between well or reservoir and street sanitary or storm sewer; similar sanitary or storm sewer piping comprising part of the drainage system on public or private property.

(i) One hundred feet between well or reservoir and a temporary manure stack; solid manure storage structure; watertight reinforced poured concrete or equivalent concrete fabricated liquid-manure holding tank; earthen silage storage trench or pit.

(j) One hundred feet between well or reservoir and bulk subsurface storage tanks for refined petroleum products such as gasoline and fuel oil, except in the case of fuel oil tanks for private residential use, in which case the separating distance shall be at least 25 feet or farther where practical.

(k) One hundred feet between well or reservoir and nearest existing or future grave sites in cemeteries.

(l) Two hundred feet between well or reservoir and sludge disposal area on same property or adjoining property.

(m) Two hundred fifty feet between well or reservoir and an absorption, storage, retention or treatment pond; ridge and furrow waste disposal site; or a spray irrigation waste disposal site.

(n) Four hundred yards between well or reservoir and the nearest edge of an existing or proposed sanitary land fill disposal site.

(o) For the purpose of paragraphs NR 112.07 (2) (a), (d) and (e), the term "equivalent" means, as it pertains to a cast iron sewer, drain or subdrain, approved plastic pipe as listed and limited in Wis. Adm. Code chapter H 62 (State Plumbing Code) for specific uses and as it pertains to a sewage sump, a plastic sump fabricated from a plastic material approved by the division of health, department of health and social services.

(3) **RELATION TO BUILDINGS.** With respect to buildings the location of a well shall be as follows:

(a) When a well is located outside and adjacent to a building, it shall be located so that the center line of the well extended vertically will clear any projection from the building by not less than 2 feet.

(b) Every well shall be located so that it will be reasonably accessible with proper equipment for cleaning, treatment, repair, test, inspection, and such other maintenance as may be necessary.

(c) No well shall be located nor shall a building extension be constructed so that the top of the well will be within the basement of any building or building extension or under a building or building extension having no basement.

(4) **RELATION TO FLOOD PLAINS.** (a) Wells may be constructed and replaced on property on the flood plain outside of the floodway provided that the top of the well is terminated a minimum of 2 feet above the regional flood elevation for the well site.

(Note: This is the required minimum elevation of the first floor of any new building in the flood plain.)

(b) A well may be reconstructed or replaced on property in a floodway provided that a permit is first obtained from the department.

(c) No well may be constructed on floodway property that is either undeveloped or has building structures but no existing well.

Note: Attention of well drillers and pump installers is called to Volume I, of the Wisconsin State Electrical Code which can be found in Volume 4 of the Wisconsin Administrative Code, for restrictions on proximate locations of well drilling and pump installing equipment relative to electric power lines.

History: Cr. Register, May, 1975, No. 233, eff. 5-1-75; am. (2) (a), (b), (d) and (e), renum. (2) (f) to (m) to be (2) (g) to (n), cr. (2) (f) and (o), Register, March, 1977, No. 255, eff. 4-1-77.

**NR 112.08 Drilled type well design and construction. (1) GENERAL.** The construction of every well shall be planned and carried out so that it will be:

(a) Adapted to the geologic (earth structure) and ground water conditions existing at the site of the well so as to insure full utilization of every natural protection afforded thereby against contamination of water bearing formations and to exclude known sources of contamination.

(b) Designed to permit such supplementary construction as may be required to provide a sufficient and safe water supply, where obtainable, and to conserve ground water.

(c) Capable of satisfying where obtainable, the yield requirements of an "adequate water supply".

(2) **SPECIFIC.** The requirements of NR 112.08(1) for drilled-type wells shall be deemed to be fulfilled when minimum construction and material requirements set forth in table 1 and in paragraphs (a) through (i) below are met. (Note: See Appendix figures A1 through A25.)

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TABLE I  
DRILLED TYPE WELL REQUIREMENTS

1	2	3	4	5 UPPER DRILLHOLE				6 LOWER DRILLHOLE	7 MAXIMUM PROTECTIVE WELL DIAMETER	8 CONSTRUCTION CONDITIONS	9		
				UPPER ENLARGED DRILLHOLE		REGULAR DRILLHOLE						MINIMUM DRILLHOLE	MINIMUM
				MINIMUM DIAMETER	MINIMUM DEPTH	MINIMUM DIAMETER	BOTTOM ELEVATION					DIAMETER	DIAMETER
a.	Sand or gravel	Sand or mixture of sand and gravel.	None required with cable tool drilling but shall be casing diameter plus 1" if rotary drilling. One is constructed. See construction conditions. Casing diameter plus 2" with rotary drilling.	None required with cable tool drilling. To depth of casing setting with rotary drilling.	2"	See Construction Conditions		The depth of protective well casing pipe will be governed by the pumping level. For pumping levels 20' or less the casing shall extend 10' below the pumping level. For pumping levels 20' to 25' the casing shall extend to a depth of 10'. For pumping levels greater than 25' the casing shall extend 5' below the pumping level. When an enlarged upper drillhole is constructed with cable tool equipment, the annular space shall be filled with clay slurry or cement grout placed in an approved manner. See Note 2 below. With rotary drilling, the upper enlarged drillhole shall be maintained at full diameter with drilling mud and the annular space shall be permanently sealed with drilling mud or cement grout. See Note 2 below. Also see Appendix.	a,b,c Protective well casing placed in an upper enlarged drillhole only 2" greater in diameter than the nominal well casing pipe diameter, as is only permissible with rotary-air drilling, shall be assembled with welded joints and sealed in place with drilling mud or cement grout placed in the annular space by a suitable pump from the bottom of the casing upward.				
b.	Sand or gravel	Clay or similar material to depth of 20' or more, containing layers of sand or gravel.	Casing diameter plus 1" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	5' into clay below any sand or gravel above the 20' depth with cable tool drilling. To depth of casing placement with rotary drilling.	2"	See Construction Conditions		The protective well casing pipe shall extend 5' below the pumping level. With cable tool drilling the upper enlarged drillhole shall be kept open with temporary well casing and the upper drillhole shall be kept 1/3 filled with clay slurry throughout the driving of the permanent well casing. The balance of the annular space shall be filled with clay slurry or cement grout. With rotary drilling, the upper enlarged drillhole shall be maintained at full diameter with drilling mud and the annular space shall be permanently sealed with drilling mud or cement grout. See Note 1 below. Also see Appendix.	An adequate screen shall be provided where necessary. It shall be installed in such manner that removal or replacement can be accomplished without adversely affecting the water-tight construction of the well.				
c.	Sand or gravel	Clay or similar material from the ground surface to varying depths.	Casing diameter plus 1" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	To the bottom of the clay or a minimum of 20' whichever is the lesser with cable tool drilling. To the depth of casing setting with rotary drilling.	2"	See Construction Conditions		See (a) above for minimum casing depth requirements. With cable tool drilling, the upper drillhole shall be kept 1/3 filled with clay slurry throughout the driving of the permanent well casing. The balance of the annular space shall be filled with clay slurry or cement grout. With rotary drilling the upper enlarged drillhole shall be maintained at full diameter with drilling mud and the annular space shall be permanently sealed with drilling mud or cement grout. See Note 1 below. Also see Appendix.	Approval from the Department is required for a gravel-pack well construction in conformance with Section NR 112.04.				

NOTE 1. Greater depth of casing is required in areas where well histories show that the vertical zone of contamination extends to a greater depth.

NOTE 2. Some drillers construct an enlarged upper drillhole to a depth of several feet with cable tool equipment by choice under geologic conditions of column 3, line a, to facilitate use of long lengths of pipe.

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TABLE I  
 DRILLED TYPE WELL REQUIREMENTS

1	2	3	4 MINIMUM NOMINAL CASING DIAMETER INCHES	5 UPPER DRILLHOLE				6 LOWER DRILLHOLE MINIMUM WELL DIAMETER	7 MAXIMUM NOMINAL PROTECTIVE LINER DIAMETER	8 CONSTRUCTION CONDITIONS	9
				UPPER ENLARGED DRILLHOLE		REGULAR DRILLHOLE					
				5 MINIMUM DIAMETER INCHES	6 MINIMUM DEPTH FEET	7 MINIMUM DIAMETER INCHES	8 BOTTOM ELEVATION FEET				
d.	Limestone (See Note 3)	Unconsolidated materials, mainly sand or gravel, to depth of at least 40' to a radius of 1/2 mile. No record of sink holes, test holes, quarries or abandoned wells in above area.	6"	Casing diameter plus 4" if one is constructed with cable tool drilling. See construction conditions. Casing diameter plus 2" with rotary drilling.	None required with cable tool drilling. To rock with rotary drilling.	6" with cable tool drilling. Not applicable with rotary drilling.	See construction conditions.	6"	2" less than the lower drillhole diameter.	The protective well casing pipe shall be firmly seated in the rock formation. When an upper enlarged drillhole is constructed with cable tool equipment, the annular space shall be filled with clay slurry or cement grout placed in an approved manner. See Note 3 below. With rotary drilling, the upper enlarged drillhole shall be maintained at full diameter with drilling mud or with temporary well casing and the annular space shall be permanently sealed with drilling mud or cement grout, except that only cement grout shall be used when the upper enlarged drillhole is constructed more than 20' into the limestone. The vertical zone of contamination must be sealed off. See Note 1 below. Also see Appendix.	d,e Protective well casing pipe placed in an upper enlarged drillhole only 2" greater in diameter than the nominal well casing pipe diameter, as is only permissible with rotary-air drilling, shall be assembled with welded joints and sealed in place with drilling mud or cement grout placed in the annular space by a suitable pump from the bottom of the casing upward.
e.	Limestone (See Note 3)	Clay or similar material or such materials with some sand and gravel zones to depth of at least 40' to a radius of 1/2 mile. No record of sink holes, test holes, quarries or abandoned wells in above area.	6"	Casing diameter plus 4" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	To the bottom of the clay or to the 40' depth, whichever is the lesser, with cable tool drilling. To rock with rotary drilling.	6" with cable tool drilling. Not applicable with rotary drilling.	See construction conditions.	6"	2" less than the lower drillhole diameter.	The protective well casing pipe shall be firmly seated in the rock formation. With cable tool drilling, the upper enlarged drillhole shall be kept open by temporary well casing, when necessary and shall be kept 1/3 filled with clay slurry throughout drive of the protective well casing. The balance of the annular space shall be filled with clay slurry or cement grout applied in an approved manner. Construction conditions for drilling with rotary equipment are the same as above for line d. The vertical zone of contamination must be sealed off. See Note 1 below. Also see Appendix.	d,e,f Protective liner pipe shall be assembled with welded joints, placed concentrically within the drillhole and sealed in place with cement grout placed by a suitable pump or other approved method from the bottom of the liner pipe upward.
f.	Limestone (See Note 3)	Unconsolidated materials for depth less than 40' within a radius of 1/2 mile. No record of sink holes, test holes, quarries or abandoned wells in above area.	6"	Casing diameter plus 4" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	10' into unconsolidated rock below 40'.	Not applicable.	-	6"	2" less than the lower drillhole diameter.	The upper enlarged drillhole through cavities formations above the rock shall be kept open by temporary well casing with cable tool drilling and with such casing or drilling mud with rotary drilling. If the formation over the rock is clay or material which will similarly stand open, with rotary drilling the drill cuttings preferably shall be removed by drilling mud but use of air will be permitted for such geologic formations. The annular space shall be permanently filled with cement grout. The vertical zone of contamination must be sealed off. See Note 1 below. Also see Appendix.	f The upper enlarged drillhole diameter need be only 2" greater than the nominal well casing pipe diameter when the well casing pipe is assembled with welded joints and the cement grout is placed in the annular space by a suitable pump or other approved pressure method from the bottom of the casing upward.

NOTE 1. Casing only in rock under conditions of column 3, lines d & e and to the depth indicated in column 6, line 1 for condition of column 3, line 1, is only acceptable as a minimum when it is adequate to seal off the vertical zone of contamination. Greater depth of protective casing is required in areas where well histories show that the vertical zone of contamination extends to a greater depth.  
 NOTE 2. Some drillers construct an enlarged upper drillhole with cable tool equipment by choice under geologic conditions of column 3, line d, to facilitate use of longer lengths of pipe.  
 NOTE 3. Although the carbonate rocks in this state are primarily dolomite, the term limestone has been given to them in the well construction specifications because it is the common term given to them by drillers.



TABLE 1  
DRILLED TYPE WELL REQUIREMENTS

1 TYPE	2 NATURE OF WATER BEARING FORMATION (See Note 3)	3 GEOLOGIC FORMATIONS OVERLYING AQUIFER	4 MINIMUM NOMINAL CASING DIAMETER (INCHES)	5 UPPER DRILLHOLE			6 LOWER DRILLHOLE MINIMUM WELL DIAMETER	7 MAXIMUM NOMINAL PROTECTIVE LINER DIAMETER	8 CONSTRUCTION CONDITIONS	9 REMARKS	
				UPPER ENLARGED DRILLHOLE		UPPER DRILLHOLE					
				MINIMUM DIAMETER	MINIMUM DEPTH	MINIMUM DIAMETER					
g.	Shale (See Note 3)	Unconsolidated materials, mainly sand or gravel, to depth of at least 40' to a radius of 1/2 mile.	6"	Casing diameter plus 4" if one is constructed with cable tool drilling. See construction conditions. Casing diameter plus 2" with rotary drilling.	None required with cable tool drilling. To shale with rotary drilling.	8" with cable tool drilling. Not applicable with rotary drilling.	See construction conditions.	6"	Less than the lower drillhole diameter.	The protective well casing pipe shall be firmly seated in the shale formation. When an upper enlarged drillhole is constructed with cable tool equipment, the annular space shall be filled with clay slurry or cement grout placed in an approved manner. See Rule 2 below. With rotary drilling, the upper enlarged drillhole shall be maintained at full diameter with drilling mud or temporary well casing and the annular space shall be permanently sealed with drilling mud or cement grout, except that only cement grout shall be used when the upper enlarged drillhole is constructed more than 2" into the shale. The vertical zone of contamination must be sealed off. See Note 1 below. Also see Appendix.	g.h. Protective well casing pipe placed in an upper enlarged drillhole only 2" greater in diameter than the nominal well casing pipe diameter, as is only permissible with rotary drilling, shall be assembled with welded joints and sealed in place with drilling mud or cement grout placed in the annular space by a suitable pump from the bottom of the casing upward.
h.	Shale (See Note 3)	Clay or similar material or such materials with some sand and gravel zones to a depth of at least 40 feet to a radius of 1/2 mile.	6"	Casing diameter plus 4" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	To the bottom of the clay or to the 20' depth, whichever is the lesser, with cable tool drilling. To shale with rotary drilling.	8" with cable tool drilling. Not applicable with rotary drilling.	See construction conditions.	6"	Less than the lower drillhole diameter.	The protective well casing pipe shall be firmly seated in the shale formation. With cable tool drilling, the upper enlarged drillhole shall be kept open with temporary well casing, when necessary, and shall be kept 1/3 filled with clay slurry throughout the drilling of the protective casing. The balance of the annular space shall be filled with clay slurry or cement grout applied in an approved manner. Construction conditions for drilling with rotary equipment are the same as above for line g. The vertical zone of contamination must be sealed off. See Note 1 below. Also see Appendix.	g.h.i. Protective liner pipe shall be assembled with welded joints, placed concentrically within the drillhole and sealed in place with cement grout placed by a suitable pump or other approved method from the bottom of the liner pipe upward.
i.	Shale (See Note 3)	Unconsolidated materials or limestone with or without unconsolidated formations above to a depth of less than 40' within a radius of 1/2 mile. No record of abandoned wells or test holes within the area.	6"	Casing diameter plus 4" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	40 feet	Not applicable	See construction conditions.	6"	Less than the lower drillhole diameter.	The upper enlarged drillhole through casing formations above the rock shall be kept open by temporary well casing with cable tool drilling and by such casing or drilling mud with rotary drilling. If the unconsolidated formation over the rock is clay or material which will similarly stand open, with rotary drilling the drill cuttings preferably shall be removed by mud but use of air will be permitted for such geologic formations. The annular space surrounding the well casing shall be permanently filled with cement grout. The vertical zone of contamination must be sealed off. See Note 1 below. Also see Appendix.	The upper enlarged drillhole diameter need be only 2" greater than the nominal well casing pipe diameter when the well casing pipe is assembled with welded joints and the cement grout is placed in the annular space by a suitable pump or other approved pressure method from the bottom of the casing upward.

NOTE 1. Casing only in shale under conditions of column 3, lines g & h and to the depth indicated in column 6, line i, for condition of column 3. This 1" is only acceptable as a minimum when adequate to seal the vertical zone of contamination. Greater depth of protective casing is required in areas where well histories show that the vertical zone of contamination extends to a greater depth.

NOTE 2. Some drillers construct an enlarged upper drillhole with cable tool drilling equipment by choice under geologic conditions of column 3, line g, to facilitate use of longer lengths of pipe.

NOTE 3. Wells normally shall not be developed into a shale formation. Such constructions are limited primarily to "Maquoketa" shale where the limestone is missing or very thin but only when the shale is known to be firm enough so that the drillhole will remain open and the water therefrom is not turbid. These wells may occur along the western edge of the Niagara dolomite extending from Door County to the Illinois border, at Blue Mound, at the Plateville Mound and in the Sinsinawa area in Grant County. Shale wells under similar geologic conditions in other areas of the state where overlying rock is missing or thin will also be acceptable.

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DRILLED TYPE WELL REQUIREMENTS

1 TYPE	2 NATURE OF WATER BEARING FORMATION (AQUIFER)	3 GEOLOGIC FORMATION OVERLYING AQUIFER	4 MINIMUM NOMINAL CASING DIAMETER INCHES	5 UPPER DRILLHOLE			6 MINIMUM DIAMETER	7 MINIMUM DEPTH	8 MINIMUM DIAMETER	9 MINIMUM BOTTOM ELEVATION	10 LOWER DRILLHOLE MINIMUM DIAMETER	11 MAXIMUM NOMINAL PROTECTIVE LINER DIAMETER	12 CONSTRUCTION CONDITIONS
				UPPER ENLARGED DRILLHOLE		13 SMALLER DRILLHOLE							
				MINIMUM DIAMETER	MINIMUM DEPTH	MINIMUM DIAMETER							
1	Granite or Quartzite (See Note 1)	Unconsolidated materials mainly sand or gravel, to depth of at least 40' to a radius of 1/2 mile.	6"	Casing diameter plus 1" with cable tool drilling. Casing diameter plus 2" with rotary drilling.	None required with cable tool. To rock with rotary drilling.	6" with cable tool drilling. Not applicable with rotary drilling.	See construction conditions.	6"	See construction conditions.	6"	2" less than the lower drillhole diameter.		<p>The protective well casing pipe shall be firmly seated into the rock formation. When an enlarged upper drillhole is constructed with cable tool equipment, the annular space shall be filled with clay slurry or cement grout placed in an approved manner. See Note 2 below. With rotary drilling equipment, the upper enlarged drillhole shall be maintained at full diameter with drilling mud or temporary well casing and the annular space shall be permanently sealed with drilling mud or cement grout, except that only cement grout shall be used when the upper enlarged drillhole is constructed more than 2' into the granite. The vertical zone of contamination must be sealed off. See Note 3 below. Also see Appendix.</p> <p>J,k Protective well casing pipe placed in an upper enlarged drillhole only 2" greater in diameter than the nominal well casing pipe diameter, as is only permissible with rotary-air drilling, shall be assembled with welded joints and sealed in place with drilling mud or cement grout placed in the annular space by a suitable pump from the bottom of the casing upward.</p>
2	Granite or Quartzite (See Note 1)	Clay or similar material or such materials with some sand and gravel zones to a depth of at least 40' to a radius of 1/2 mile.	6"	Casing diameter plus 1" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	To the bottom of the clay or to the 20' depth whichever is the lesser with cable tool drilling. To rock with rotary drilling.	6" with cable tool drilling. Not applicable with rotary drilling.	See construction conditions.	6"	See construction conditions.	6"	2" less than the lower drillhole diameter.		<p>The protective well casing pipe shall be firmly seated into the rock formation. With cable tool drilling the upper enlarged drillhole shall be kept open with temporary well casing, when necessary, and shall be kept 1/3 filled with clay slurry throughout the drilling of the protective casing. The balance of the annular space shall be filled with clay slurry or cement grout applied in an approved manner. Construction conditions for drilling in an approved manner are the same as above for line 1. The vertical zone of contamination must be sealed off. See Note 3 below. Also see Appendix.</p> <p>J,k,l Protective liner pipe shall be assembled with welded joints, placed concentrically within the drillhole and sealed in place with cement grout placed by a suitable pump or other approved method from the bottom of the liner pipe upward.</p>
3	Granite or Quartzite (See Note 1)	Unconsolidated materials for depth less than 40' within a radius of 1/2 mile.	6"	Casing diameter plus 1" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	40'. See construction conditions for exceptions.	Not applicable.	See construction conditions for exceptions.	6"	See construction conditions for exceptions.	6"	2" less than the lower drillhole diameter.		<p>Normally 40' of rise is required to seal off the vertical zone of contamination. An attempt shall be made to obtain water in quantity during drilling at a depth above 40'. Should an adequate water producing zone not be encountered below 40' and down to a depth of 75' or lower, consideration may be given by the Department to permit production of the water above 40'. Department approval is required for such well. Other construction conditions are the same as for line 1. The vertical zone of contamination must be sealed off. See Note 3 below. Also see Appendix.</p> <p>J The upper enlarged drillhole diameter need be only 2" greater than the nominal well casing pipe diameter when the well casing pipe is assembled with welded joints and the cement grout is placed in the annular space by a suitable pump or other approved pressure method from the bottom of the casing upward.</p>

NOTE 1. Crystalline rocks are classed as granite because they are commonly referred to as granite by drillers regardless of their true rock type. This includes trap rock.  
NOTE 2. Some drillers construct an enlarged upper drillhole with cable tool equipment by choice under geologic conditions of column 3, line 1, to facilitate use of longer lengths of pipe.  
NOTE 3. Casing only to rock under conditions of column 3, line 1 & X and to the depth indicated in column 6, line 1, for condition of column 3, line 1, is only acceptable as a minimum when it is adequate to seal off the vertical zone of contamination. Greater depth of protective casing is required in areas where well histories show that the vertical zone of contamination extends to a greater depth.

TABLE I  
DRILLED TYPE WELL REQUIREMENTS

1 TYPE	2 NATURE OF WATER BEARING FORMATION (AQUIFER)	3 GEOLOGIC FORMATION OR OVERLYING AQUIFER	4 MINIMUM NOMINAL CASING DIAMETER INCHES	5 UPPER DRILLHOLE			7 MINIMUM BOTTOM DIAMETER	8 MINIMUM ELEVATION	9 LOWER DRILLHOLE		11 CONSTRUCTION CONDITIONS
				6 ENLARGED DRILLHOLE		10 MINIMUM WELL LINER DIAMETER					
				MINIMUM DIAMETER	MINIMUM DEPTH	MINIMUM DIAMETER			MINIMUM DIAMETER		
m. Sandstone	Unconsolidated materials mainly sand and gravel to a depth of 25' or more.		6"	Casing diameter plus 4" with cable tool. One is constructed with cable tool drilling. See construction conditions. Casing diameter plus 2" with rotary drilling.	None required with cable tool. Into firm sandstone with rotary drilling.	6" with cable tool construction conditions. Not applicable with rotary drilling.	See construction conditions.	6"	6" less than the lower drillhole diameter.	The protective well casing pipe shall be firmly seated in the rock formation. When an upper enlarged drillhole is constructed with cable tool equipment, the annular space shall be filled with clay slurry or cement grout placed in an approved manner. See Note 2 below. With rotary drilling, the upper enlarged drillhole shall be maintained at full diameter with drilling mud or with temporary well casing and the annular space shall be permanently sealed with drilling mud or cement grout, except that only cement grout shall be used when the upper enlarged drillhole is constructed more than 2' into the sandstone. The vertical zone of contamination must be sealed off. See Note 1 below. Also see Appendix.	n. Protective well casing pipe placed in an upper enlarged drillhole only 2" greater in diameter than the nominal well casing pipe diameter, as is only permissible with rotary-air drilling, shall be assembled with welded joints and sealed in place with drilling mud or cement grout placed in the annular space by a suitable pump from the bottom of the casing upward.
n. Sandstone	Clay or similar material with some sand and gravel zones to depth of 25' or more.		6"	Casing diameter plus 4" with cable tool drilling, whichever is the lesser, with rotary drilling. See construction conditions.	To the bottom of the clay or to the 20' depth whichever is lesser, with cable tool drilling. Into firm sandstone with rotary drilling.	6" with cable tool drilling conditions. Not applicable with rotary drilling.	See construction conditions.	6"	6" less than the lower drillhole diameter.	The protective well casing pipe shall be firmly seated in the rock formation. With cable tool drilling, the upper enlarged drillhole shall be kept open by temporary well casing, when necessary and shall be kept 1/3 filled with clay slurry throughout the drilling of the protective casing. The balance of the annular space shall be filled with clay slurry or cement grout applied in an approved manner. Construction conditions for drilling with rotary equipment are the same as above for line n. The vertical zone of contamination must be sealed off. See Note 1 below. Also see Appendix.	n.o. Protective liner pipe shall be assembled with welded joints, placed concentrically within the drillhole and sealed in place with cement grout placed by a suitable pump or other approved method from the bottom of the liner pipe upward.
o. Sandstone	Any material except clays to a depth of less than 25'.		6"	Casing diameter plus 4" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	Into firm sandstone or to the 30' depth whichever is greater.	Not applicable.		6"	6" less than the lower drillhole diameter.	The upper enlarged drillhole through casing formations above the rock shall be kept open by temporary well casing with cable tool drilling and by such casing or drilling mud with rotary drilling. If the formation over the rock is clay or material which will similarly stand open, with rotary drilling the drill cuttings preferably shall be removed by mud but use of air will be permitted for such geologic formations. The annular space surrounding the protective well casing shall be permanently filled with cement grout. The vertical zone of contamination must be sealed off. See Note 1 below. Also see Appendix.	o. The upper enlarged drillhole diameter need be only 2" greater than the nominal well casing pipe diameter when the well casing pipe is assembled with welded joints and the cement grout is placed in the annular space by a suitable pump or other approved pressure method from the bottom of the casing upward.

NOTE 1. Casing only to the depth indicated in column 6, lines m, n & o, for conditions of column 3, lines m, n & o, is only acceptable as a minimum when it is adequate to seal off the vertical zone of contamination. Greater depth of protective casing is required in areas where well histories show that the vertical zone of contamination extends to a greater depth.

NOTE 2. Some drillers construct enlarged upper drillholes to a depth of several feet with cable tool equipment by choice under geologic conditions of column 3, line m, to facilitate use of longer lengths of pipe.

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TABLE 1  
 DRILLED TYPE WELL REQUIREMENTS

1 WELL TYPE	2 NATURE OF WATER BEARING FORMATION (AQUIFER)	3 GEOLOGIC FORMATION OVERLYING AQUIFER	4 MINIMUM NOMINAL CASING DIAMETER (INCHES)	5 UPPER DRILLHOLE				6 LOWER DRILLHOLE MINIMUM WELL DIAMETER	7 TO MAXIMUM NOMINAL PROTECTIVE LOWER DIAMETER	8 CONSTRUCTION CONDITIONS
				UPPER ENLARGED DRILLHOLE		ANNULAR DRILLHOLE				
				9 MINIMUM DIAMETER	10 MINIMUM DEPTH	11 MINIMUM DIAMETER	12 BOTTOM ELEVATION			
p	Sandstone	Limestone to depth of 40' or less with DP without unconsolidated overburden over the limestone.	Casing diameter plus 4" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	15' into firm sandstone.	Not applicable.	0"	2" less than the lower drillhole diameter.	<p>The upper enlarged drillhole through casing formations above the rock shall be kept open by temporary well casing with cable tool drilling and by such casing or drilling mud with rotary drilling. If the formation over the rock is clay or material which will similarly stand open, with rotary drilling the drill cuttings preferably shall be removed by mud but use of air will be permitted for such geologic formation. The annular space surrounding the protective well casing shall be permanently filled with cement grout. The vertical zone of contamination must be sealed off. See Note 1 below. Also see Appendix.</p>	<p>pq                      Protective well casing pipe placed in an upper enlarged drillhole only 2" greater in diameter than the nominal well casing pipe diameter, shall be assembled with welded joints and sealed in place with cement grout placed in the annular space by a suitable pump from the bottom of the casing upwards.</p> <p>Protective liner pipe shall be assembled with welded joints, placed concentrically within the drillhole and sealed in place with cement grout placed by a suitable pump or other approved method from the bottom of the liner pipe upward.</p>	
q	Sandstone	limestone extending to a depth greater than 40' with or without unconsolidated overburden over the limestone.	Casing diameter plus 4" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	40' or 10' into unconsolidated rock below 30'.	Not applicable.	0"	2" less than the lower drillhole diameter.	<p>The upper enlarged drillhole diameter need be only 2" greater than the nominal well casing pipe diameter when the well casing pipe is assembled with welded joints and the cement grout is placed in the annular space by a suitable pump or other approved procedure method from the bottom of the casing upward.</p>		

NOTE 1. Although the carbonate rocks in this state are primarily dolomites, the term limestone has been given to them in the well construction specifications because it is the common term given to them by the drillers.  
 NOTE 2. Casing only to the depth indicated in column 6, lines p & q, for conditions of column 3, lines p & q, is only acceptable as a minimum when it is adequate to seal off the vertical zone of contamination. Greater depth of protective casing is required in areas where well histories show that the vertical zone of contamination extends to a greater depth.

(a) *Well casing pipe.* The protective well casing pipe materials shall be steel pipe having the nominal diameters and the weights as specified in table 2.

TABLE 2  
MINIMUM  
CASING PIPE AND COUPLING  
WEIGHTS AND DIMENSIONS

Size in Inches	Wgt. Lbs. Per Ft.		Thickness in Inches	Pipe		Threads Per Inch	Couplings	
	Threads & Coupling	Plain End		Diameter - Inches External Internal	External Diameter Inches		Length in Inches	
1	1.70	1.68	.133	1.315	1.049	11-1/2	1.576	2-5/8
1-1/4	2.30	2.27	.140	1.660	1.380	11-1/2	1.900	2-3/4
1-1/2	2.75	2.72	.145	1.960	1.610	11-1/2	2.200	2-3/4
2	3.75	3.66	.154	2.375	2.067	11-1/2	2.750	2-7/8
2-1/2	5.90	5.79	.203	2.875	2.469	8	3.250	2-15/16
3	7.70	7.58	.216	3.500	3.068	8	4.000	4-1/16
3-1/2	9.25	9.11	.226	4.000	3.548	8	4.625	4-3/16
4	11.00	10.79	.237	4.500	4.026	8	5.200	4-5/16
5	15.00	14.62	.258	5.563	5.047	8	6.298	4-1/2
6	19.45	18.97	.280	6.625	6.065	8	7.390	4-11/16
6-5/8 OD	20.00	19.49	.288	6.625	6.049	8 R	7.390	7-1/4
7 OD	23.00	22.63	.317	7.000	6.366	8 R	7.657	7-1/4
8	25.55	24.70	.277	8.625	8.071	8	9.625	5-1/16
10	35.75	34.25	.307	10.750	10.136	8	11.750	6-9/16
12	46.45	43.77	.330	12.750	12.090	8	14.000	6-15/16
14 OD	57.00	54.57	.375	14.000	13.250	8	15.000	6-3/8
16 OD	65.30	62.58	.375	16.000	15.250	8	17.000	6-3/4
18 OD	73.00	70.59	.375	18.000	17.250	8	19.000	7-1/8
20 OD	81.00	78.60	.375	20.000	19.250	8	21.000	7-5/8

R = Round Threads

(b) *Assembly.* Well casing pipe shall be assembled watertight by means of joints welded in accordance with the standard welding procedure specifications of the department of industry, labor and human relations, Ind 53.53(3), Wisconsin Administrative Code or by correctly mated, recessed type couplings as used on drill pipe, line pipe or reamed and drifted pipe and having weights and being threaded as indicated in table 2.

(c) *Pipe installation.* Well casing pipe shall be driven or installed so that no injury to the pipe results which may affect the quality of the water supply.

(d) *Pipe specifications.* 1. No used pipe shall be installed as protective well casing in the permanent construction of a well. The pipe used as the permanent protective well casing either in initial well construction or as a liner subsequent to the initial construction shall be new pipe produced to and meeting ASTM A-53; ASTM A-106; ASTM A-120; API 5A; API 5AX; API 5L; API 5LX; standards.

2. Each length of pipe 2 inches in diameter and larger shall be legibly marked in accordance with the ASTM or API marking specifications for the particular pipe standard showing the manufacturer's name or trade mark; size in inches; weight in pounds per foot; whether seamless or welded and, if welded, type of weld; and the ASTM or API specification and grade monogram.

3. The above listed ASTM and API references are available for inspection at the offices of the department of natural resources, the secretary of state and the revisor of statutes and may be obtained for personal use from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103 and from the American Petroleum Institute, Division of Production, 300 Conigan Tower Bldg., Dallas, Texas 75201.

(e) *Bit sizes.* 1. Cable-tool drilling. Cable tool bits shall have a size no smaller than  $\frac{1}{8}$  inch less than the nominal diameter of the drillhole to be constructed at the beginning of construction of a new rock hole or at the beginning of deepening of any existing rock hole. The bits shall be kept dressed.

2. Rotary drilling. a. Cone bits. Cone bits shall have a minimum size not less than  $\frac{1}{8}$  inch smaller than the nominal diameter of the drillhole to be constructed.

b. Hammer bits. Hammer bits shall have a size no smaller than  $\frac{1}{8}$  inch less than the nominal diameter of the drillhole to be constructed at the beginning of drilling of a new rock hole or at the beginning of deepening of any existing rock hole.

(f) *Liner pipe for caving zones.* Liner pipe installed during or subsequent to the initial well construction to seal off a caving zone in a well shall be new, unused and non-reclaimed pipe but may have a lesser thickness than shown in table 2 for the nominal diameter of pipe used and may have the largest practical diameter permitting installation in the well.

(g) *Rotary-air drilling.* When constructing wells with combination rotary and cable-tool equipment, the respective drilling methods shall comply with the requirements for rotary-air drilling and for cable-tool drilling.

(h) *Water used in drilling.* Water needed in the construction of drillholes shall be clear water obtained from an uncontaminated source. Such water should be disinfected with chlorine so as to reduce to a minimum the time and effort involved in the required final disinfection of the well. (Note: See NR 112.15(3) (a).)

(i) *Drilling delays following grouting.* Following placement of grout in the annular space between a protective well casing pipe and upper enlarged drillhole or between a protective liner pipe and lower drillhole and protective well casing pipe, drilling shall be delayed for a minimum of 24 hours, whether using either cable-tool or rotary equipment.

(3) **FLOWING WELLS.** The construction of flowing wells shall comply with the minimum requirements of NR 112.08(2) and the following special conditions:

(a) Every practicable effort shall be made to extend the watertight (cased and cement grouted) construction into the upper confining bed of the artesian basin.

(b) When it is impractical to extend the watertight construction in accordance with paragraph (a), an adequate packer shall be set and

maintained in the confining bed with a flowpipe extending therefrom to a point at least one foot above the established grade.

(c) The driller shall temporarily install an approved well seal with overflow pipe extending therefrom, if necessary, in which case a control valve shall be installed in the overflow pipe and the flow therefrom either limited or stopped. (Note: See figure 1.)

**History:** Cr. Register, June, 1975, No. 234, eff. 10-1-75; am. table 1, Register, March, 1977, No. 255, eff. 4-1-77.

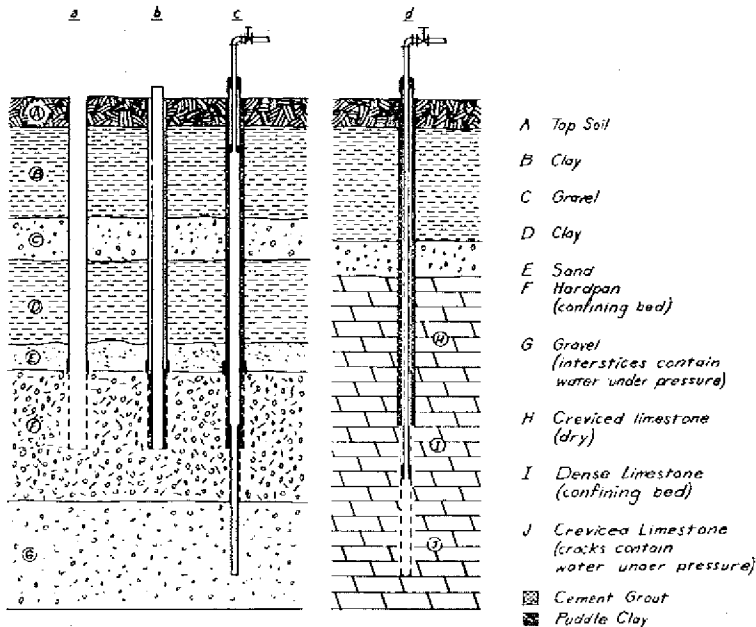


Figure 1. Principle of Construction and Control of Flowing Well.

**NR 112.09 Bored type well design and construction. (1) GENERAL.** The general construction requirements are the same as NR 112.08 (1).

(2) **SPECIFIC.** Through the vertical zone of contamination the construction of bored type wells shall conform to the specifications for drilled type wells prescribed by NR 112.08 (2). They shall also conform to the following additional requirements:

- (a) The minimum diameter of the casing pipe shall be 6 inches.
- (b) The top of the well casing pipe shall terminate at least 8 inches above the ground grade.
- (c) The curbing below the vertical zone of contamination shall be properly cured concrete pipe or equal. In such case the joints shall be the tongue and groove type. Plain end or bell and spigot pipe shall not be used.

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(d) The minimum inside diameter of well curbing shall be 8 inches.

(Note: The vertical zone of contamination is the same as for a drilled sand or sand and gravel type well. See table 1, NR 112.08(2) and figure 2.)

History: Cr. Register, June, 1975, No. 234, eff. 10-1-75.

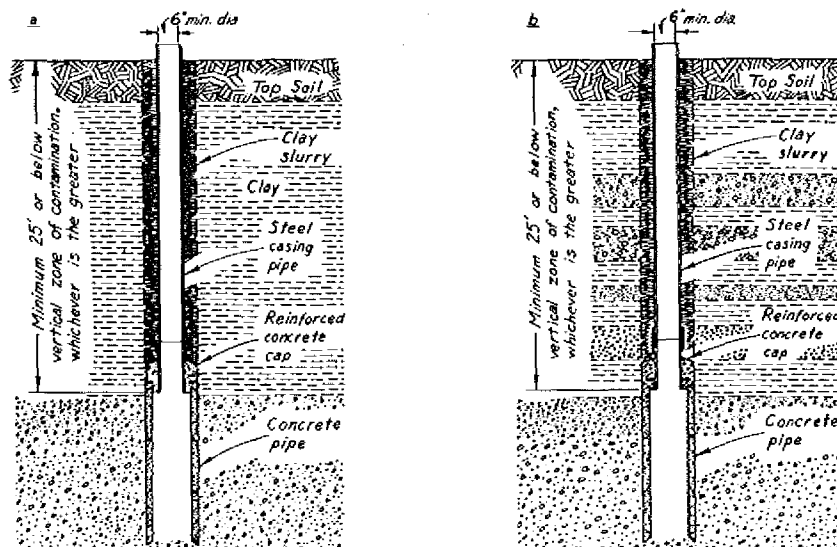


Figure 2. Bored Type Well Construction. See NR 112.09.

**NR 112.10 Driven point type well design and construction.** (1) **GENERAL.** The general construction requirements are the same as NR 112.08(1).

(2) **SPECIFIC.** Through the vertical zone of contamination the depth of the unperforated pipe of a driven point well shall conform to the specifications of NR 112.08(2) for drilled sand or sand and gravel type wells. Driven point wells shall also conform to the following additional requirements:

(a) The diameter of the driven point well shall be selected with the expected depth of ground water in mind so as to make a pump installation practical.

(b) The depth of a driven point well shall be sufficient to prevent breaking suction when pumping the well at a rate of 50% greater than the capacity of the permanent pump.

(Note: See figure 3.)



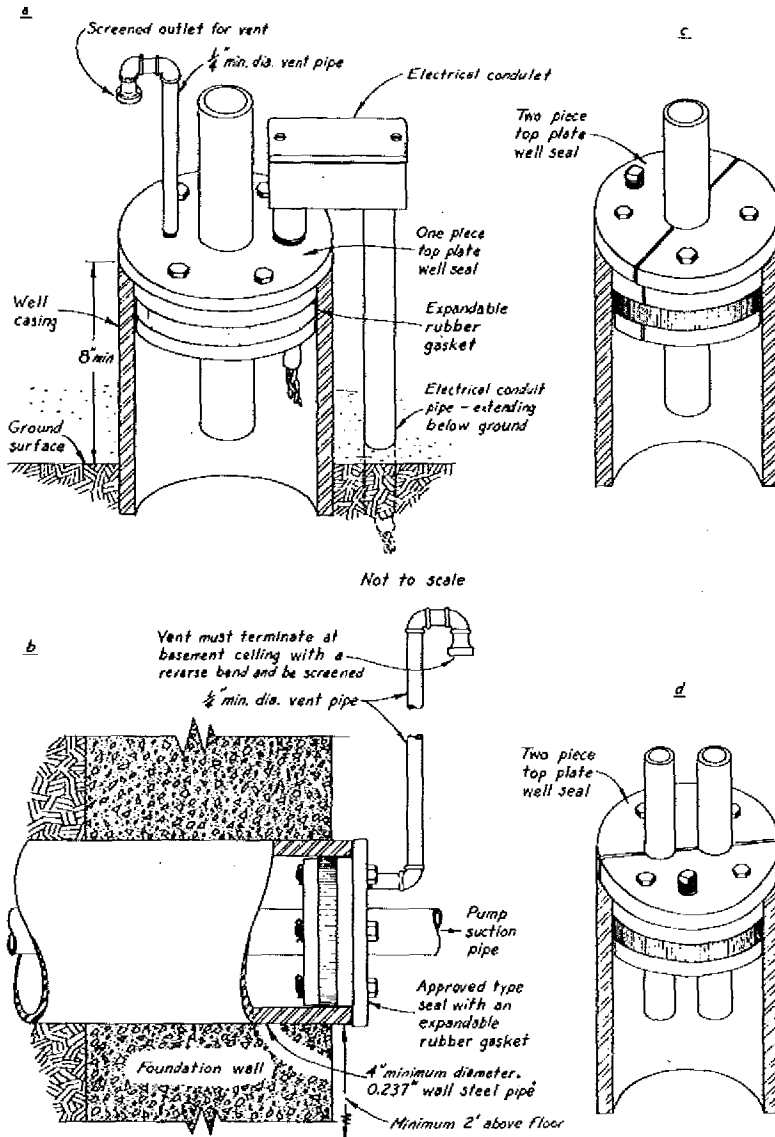


Figure 11. Types of Well Seals. (a) top of well seal using compressible rubber gasket. (c) and (d) also top of well seals with compressible rubber gaskets but with split top and bottom plates and gasket requiring acceptable housing protection. (b) nonpressure conduit seal using compressible rubber gasket. See NR 112.17(2) and (4).

3. On above-ground pump installations the extension of the well casing at least 1 inch above a concrete pump support base and into the pump base will be considered an effective seal if the elevation of the top of the well is at least 2 feet above the regional flood water level at the site and provided the pump base is mounted on a base plate or foundation in such manner as to exclude entrance of insects into the well. (Note: See sections NR 112.14(1) and (2) and NR 112.17(8).)

4. If the pump base of a deep well vertical centrifugal pump is not of a recessed type or if the pump support flange for the pump column is of larger diameter than the well casing, the extension of the well casing 1 inch above the bottom of a pump subbase also will be considered an effective seal, subject to the same restrictions as stipulated in subparagraph 3 and provided that:

a. The top of the subbase and the bottom of the pump base are secured together as an integral unit by bolts, and

b. if either the top surface of the subbase or the bottom of the pump base is not a machined surface, a gasket is provided between the 2 surfaces prior to joining them permanently together.

c. The structure housing a power driven pump shall be constructed having the following minimum features:

i. Reinforced poured-concrete floor with top of the floor at least 4 inches above the established grade.

ii. Walk-in door opening outward when the pumproom is large enough.

iii. Trapped floor drain discharging to the ground surface when a door is not installed.

iv. Thermostatically controlled electrical heating unit.

v. Removable or hinged roof.

vi. Insulated walls and roof.

vii. Walls firmly secured to floor.

viii. Dimensions and actual details of wall and roof design are optional. The dimensions in table 3, figure 12 are recommendations. (Note: See section NR 112.14(2) and figures 12 and 13.)

d. Unless an approved-type above-ground discharge unit is installed as illustrated in figures 14 or 15, or the discharge pipe is installed above grade and drains back above grade into the well between pumping cycles, the pump discharge line and accessory equipment installed above grade shall be protected against freezing by insulation of structure and piping and installation of dependable heating facilities, preferably a thermostatically controlled type.

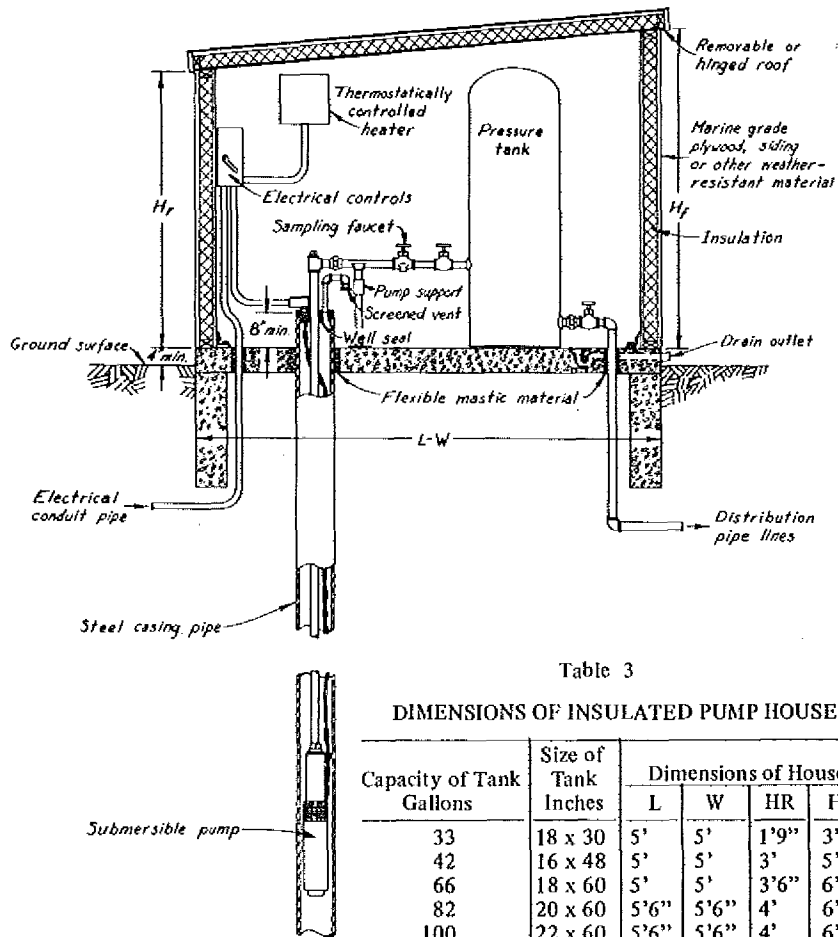


Table 3  
DIMENSIONS OF INSULATED PUMP HOUSE

Capacity of Tank Gallons	Size of Tank Inches	Dimensions of House			
		L	W	HR	HF
33	18 x 30	5'	5'	1'9"	3'6"
42	16 x 48	5'	5'	3'	5'
66	18 x 60	5'	5'	3'6"	6'6"
82	20 x 60	5'6"	5'6"	4'	6'6"
100	22 x 60	5'6"	5'6"	4'	6'6"
120	24 x 60	5'6"	5'6"	4'	6'6"
220	30 x 72	6'6"	6'6"	5'	7'6"

Figure 12. Insulated Pumphouse Enclosing Pressure Tank.

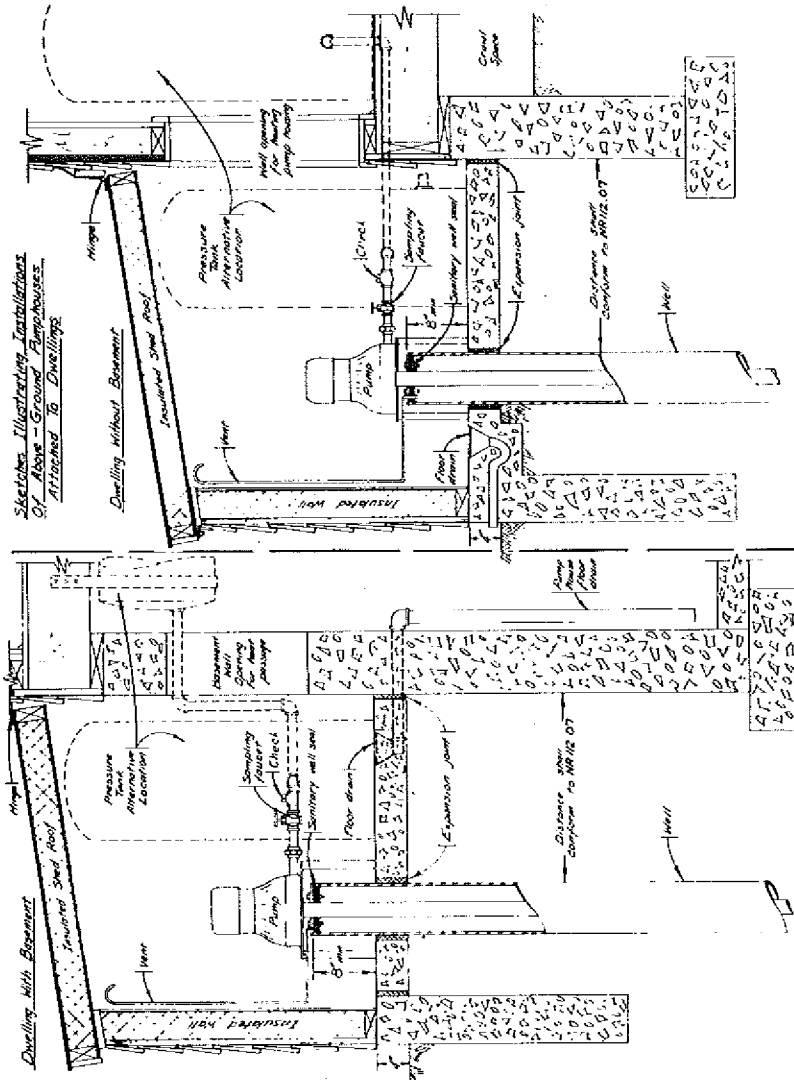


Figure 15. Insulated Pumphouse Adjoining a Dwelling.

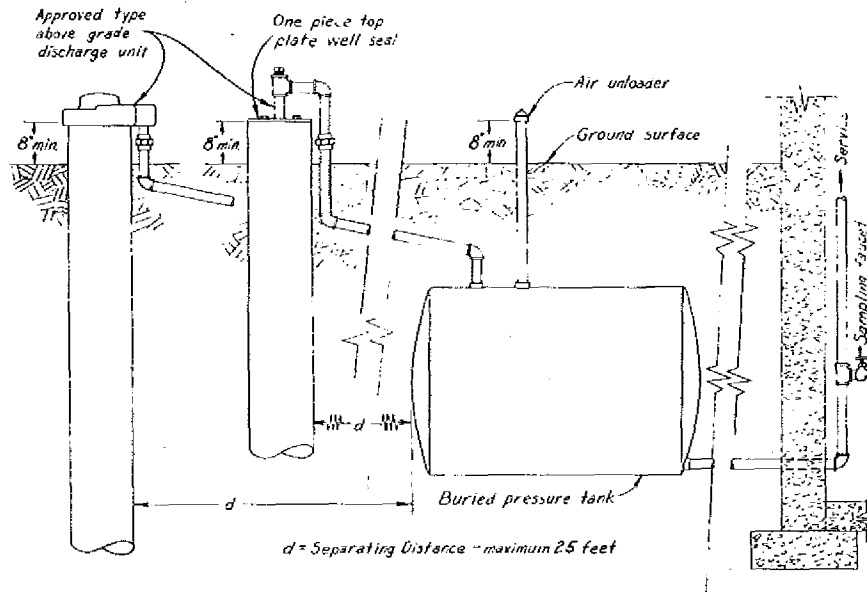


Figure 14. Pump Installations using Submersible Pumps and Approved Above-Ground Discharge Unit.

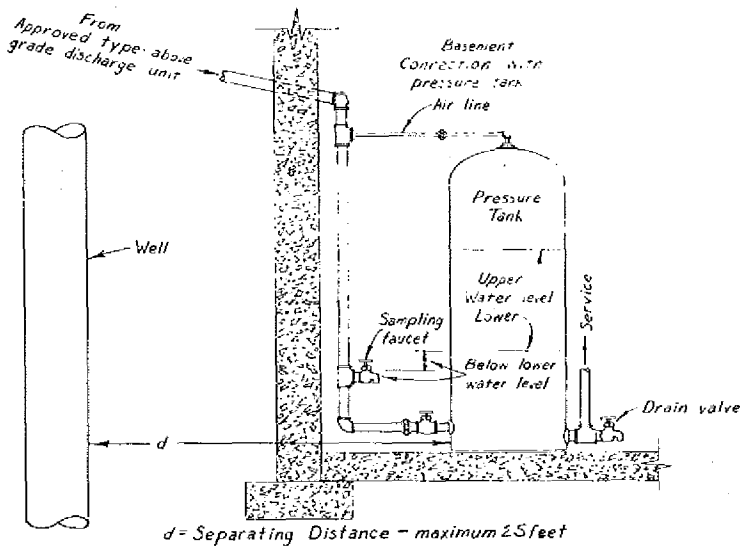


Figure 15. Alternative Pressure Tank Location with Submersible Pump Installation and Approved Above-Ground Discharge Unit.

(5) **RESERVOIR CONSTRUCTION.** (a) A subsurface ground storage reservoir may be used to store water for drinking and other domestic purposes providing that it is constructed in accordance with the following minimum specifications:

1. **Floor.** The floor of a reservoir shall be reinforced poured concrete with a thickness of at least 5 inches and a curbing wall 6 inches high and 6 inches thick, having a keyway for a construction joint with the walls. Any pump supply pipe and service pipe planned to extend through the floor, any copper water stop strip for the wall construction joint, and any reservoir drain facility shall be installed during the time of pouring the concrete floor.

2. **Walls.** The walls of a reservoir shall be reinforced poured concrete at least 6 inches thick. Should it be planned to install the pump supply pipe to the reservoir through a wall and to install the service line pipe in a wall as opposed to installation of the units in the reservoir floor, the pipe fittings for such units shall be installed at the time of pouring the walls so as to effect a watertight joint.

3. **Roof.** The roof shall be reinforced poured concrete at least 5 inches thick. An access manhole at least 24 inches in diameter or 24 inches square shall be constructed as an integral part of the reservoir roof. The manhole shall have a curbing wall extending at least 12 inches above the earth covering the roof or at least 6 inches higher than the roof, if the roof is not buried. The manhole curbing preferably shall be constructed entirely of 4-inch thick reinforced poured concrete, but may be partially steel or cast iron. The curbing shall be provided with a snug fitting, overlapping cover with a minimum of 3-inch wide skirted sides. The cover preferably shall be constructed with welded sheet steel but may be constructed with reinforced poured concrete.

4. **Overflow.** An overflow pipe, if used, shall be located just under the roof of the reservoir entirely above grade and terminate with a down-turned pipe at a point at least 12 inches above the ground grade. The pipe shall have a screened outlet. The overflow pipe shall be of sufficient diameter to permit waste of water at a rate in excess of the well pump operating capacity.

5. **Vent pipe.** A vent pipe shall be installed whenever the roof of the reservoir will terminate below the ground surface or at an inadequate distance above grade to permit installation of an overflow pipe in a reservoir wall just below the roof. The diameter of such vent pipe shall be large enough so that it can act as an overflow pipe to permit waste of water in excess of the well pump operating capacity. It shall be installed in the reservoir roof at the time of construction of the roof and shall be encased with 6 inches of concrete from the top of the roof to the ground surface if the roof is buried. The vent pipe shall terminate with a "U" bend with screened outlet a minimum of one foot above the ground grade or top of the reservoir. (Note: See Figures 16 and 17 for acceptable pump installation with reservoir.)

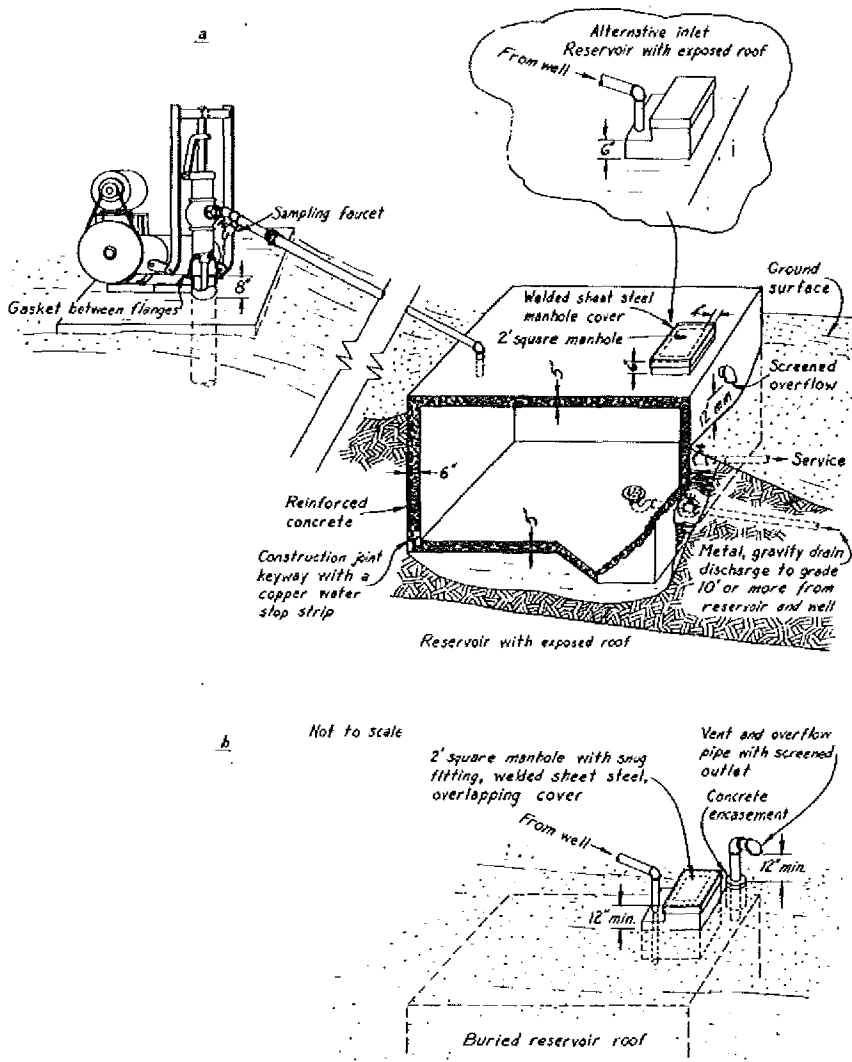


Figure 16. Water Storage Reservoir. (b) shows Acceptable Method of Supplying Water to Reservoir from pump when roof of reservoir is buried.

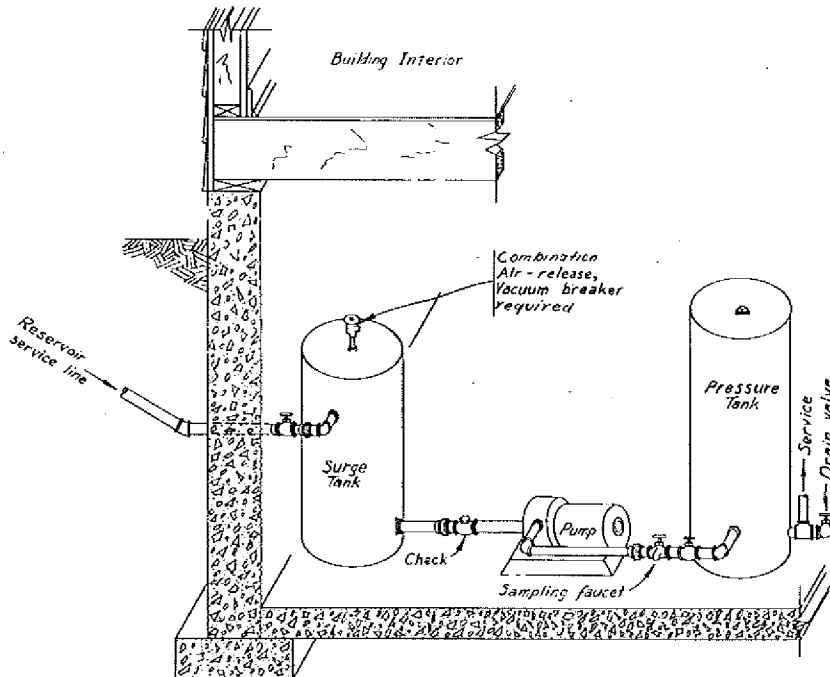


Figure 17. Acceptable Installation of Booster Pump on Service Line from Reservoir, when necessary.

6. Supply pipe. Any gravity supply pipe from a hand type pump shall be assembled with permanent pipe fittings and shall be conducted into the reservoir through the roof or curbing for the manhole, if the roof is not buried, and only through the manhole curbing if the roof is buried. A supply pipe may be connected to the reservoir below grade provided that it will be under no less than 5 feet of head at any time. This will necessitate a pitless adapter installation, either with a submersible or deep well reciprocating type pump. The supply pipe in such case shall terminate at or no more than a few inches above the bottom of the reservoir and a float control switch or low and high water level electrical pump-control rods shall be installed. Any check valve shall be placed only in the portion of the pump discharge pipe located within the well. The supply and service pipe may be combined.

(6) PRESSURE VESSELS: (a) *Steel pressure vessels.* All steel tanks for containing water under pressure for domestic supplies, including those having an air space for expansion, shall meet the following specifications:

1. They shall have a  $\frac{1}{4}$  inch minimum side wall and head wall thickness, when the tanks are approved pitless receiver units attached directly to well casings.
2. They shall have a  $\frac{3}{16}$ -inch minimum side wall and head wall thickness when the tanks will be buried within 10 feet of wells.



3. They shall be identified by stamping showing the manufacturer's name, a serial number, the allowable working pressure and the year fabricated.

4. No tanks relying on expansion of a rubber cylinder or liner within a restricting metal container rather than on compression of air to provide pressure in the water supply system shall be used unless approved by the department. Approvals are based on strength of container and information indicating either National Sanitation Foundation (NSF) or Food and Drug Administration (FDA) approved products are used.

5. Inner tank surface paints and other coatings shall comply with the American Water Works Association (AWWA) standard D102 and be approved by the department. The AWWA Standard D102 is available for inspection at the offices of the department of natural resources, the secretary of state, and the revisor of statutes and may be obtained for personal use from the American Water Works Association, Inc., 6666 W. Quincey Ave., Denver, Colorado 80235.

6. No floating discs shall be used in tanks to reduce the air-water contact surface unless the disc material is approved by the department. Approvals are based on information indicating either NSF or FDA approved products are used.

(b) *Nonmetal pressure vessels.* No nonmetal tanks for containing water under pressure for domestic supplies, including those having an air space for expansion shall be used unless approved by the department. Approvals are based on strength of container and information indicating either NSF or FDA approved products are used and practicability in making pipe connections.

(Note: For safety requirements for both steel and nonmetal pressure vessels, consult Wis. Adm. Code, chapter Ind. 41, which contains the Boiler & Pressure Vessel Code of the department of industry, labor and human relations.)

(7) **PIPE MATERIALS.** Pump piping shall conform to the State Plumbing Code as set forth in Wis. Adm. Code, chapter H62. Limitations on use of plastic pipe are also found in chapter H62. Similar quality plastic pipe will be acceptable as drop pipe installed entirely within a well below the well seal.

(8) **WELL VENT.** Any well vent pipe shall be installed watertight to a point not less than 24 inches above any known flood water level but at least 6 inches above the top of the well except that in well pits or subsurface pumprooms or when a vent exists in the well seal at the basement end of a nonpressure conduit the vent pipe shall extend to the ceiling of the structure. Such pipe shall be not less than 1/4 inch in diameter and shall be firmly attached to a well seal or base of a deep well vertical centrifugal pump when one is installed. The vent pipe shall be terminated in a reverse bend and be screened so as to prevent entrance of foreign matter. Any opening in a pump base shall be sealed watertight.

(9) **SAMPLING FAUCET.** (a) In all pressure water systems provision shall be made for collection of water samples by installation of a sampling faucet on the discharge side of the pump. Such faucet shall be installed between the pump and a reservoir or between a pump and pressure tank when the tank is not buried, or when the tank position

or the type of pump installation permits this without loss of air from the tank.

(b) In the case of buried pressure tanks, when either an approved type pitless adapter or an approved type above-ground discharge unit, depending on displacement of water in the exposed discharge pipe by air from the tank for frost protection, is installed, a sampling faucet is required in the service line from the tank at a point immediately following the point of entry into the building or building basement.

(c) When an approved above ground discharge unit is used, and the tank is in the basement the sampling faucet must be installed in the service pipe from the tank at an elevation sufficiently above the floor to facilitate obtaining a water sample unless the installation is so made that a sampling faucet can be placed in the discharge line without the problem of permitting loss of air from the system when the faucet is opened. Drain valves for tanks which are often placed in the service line from the tank at a point very near the floor are not acceptable as a sampling faucet.

(10) CASING NOT PART OF PUMP INSTALLATION. In areas where ground water is known to be corrosive, no pipe serving as the casing of any well shall be used as a delivery pipe or be utilized in the pumping operation. Moving pump parts located in any well shall be enclosed.

(11) DISINFECTION AND SAMPLING. Upon completing the installation of pumping equipment, the installer thereof shall disinfect the equipment by disinfecting the well and drawing water into the system by pumping and shall sample water in accordance with NR 112.15(3) (a) and (b) and NR 112.16(1) and (4).

(12) EMERGENCY PUMP INSTALLATIONS. No pump shall be repaired and reinstalled or newly installed for a well when it is a nonconforming structure except that a pump may be reinstalled or newly installed in such well in an emergency situation provided that the owner is informed in writing of the needed correction or replacement of the well, as the case may be, and a copy of such communication is filed with the department.

(13) PUMP INSTALLATIONS FOR FLOWING WELLS. (a) *Underground pipe connections.* No underground pipe connections shall be made to a flowing well except when an approved type pitless adapter is used.

(b) *Suction lines.* No shallow well type pump shall be connected directly to the pipe connected to a pitless adapter of a flowing well or to a pipe extending out of the seal at the top of the well and redirected back into the ground and over to a building basement. Such piping from the well shall enter a surge tank having either an overflow pipe or a vacuum breaker valve installed in the top of the tank. Any booster pump shall be connected to the surge tank and can discharge into a hydropneumatic tank.

(c) *Overflow piping.* 1. Where possible, once an artesian well is placed in use, the flow from the well to waste shall be stopped.

2. If the well has been constructed in conformance with section NR 112.08(3), a controlled overflow pipe may be installed, if necessary, to prevent physical damage due to escaping water upward outside the

well casing or to prevent a freezing problem from occurring in the top portion of the well.

3. Any overflow to prevent freezing shall be limited to the absolute minimum to preserve ground water and pressure. The overflow pipe may be either installed at the top of the well or on a surge tank. The overflow pipe shall terminate at least 2 pipe diameters above a drain at the well site or in a building or building basement. (Note: Illustrations of acceptable pump installations with flowing wells are illustrated in figures 18 through 24.)

History: Cr. Register, June, 1975, No. 234, eff. 10-1-75; am. (4) (a) 4. d. and figures 13, 14 and 15, Register, March, 1977, No. 255, eff. 4-1-77.

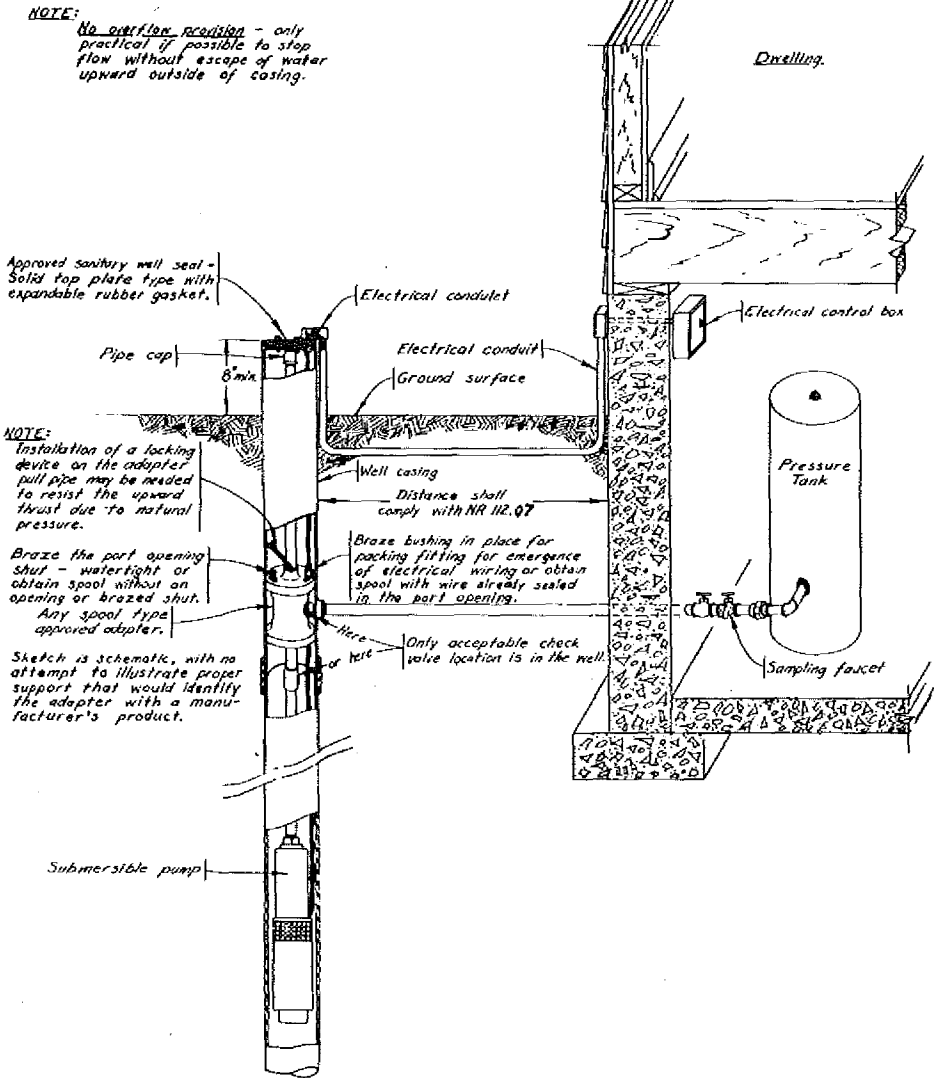


Figure 18. Pump Installation for Flowing Artesian Well using an Approved Pitless Adapter and Submersible Pump with no Overflow Provision.