APPENDIX 210-1

Additional Requirements by Other State Agencies of Oregon

In the administration of ORS 537.505 to 537.795, the Director of the Water Resources Department has statutory authority under the provisions of ORS 537.780 "to prescribe and enforce general standards for the construction and maintenance of wells and their casings, fittings, valves, and pumps..." Other agencies of the state have statutory responsibilities that relate either directly or indirectly to the construction and operation of public water supply systems and their source of water supply. These agencies and their responsibilities are listed as follows:

OREGON HEALTH AUTHORITY 800 NE Oregon Street Portland, OR 97232 (serving more than three single residents) www.oregon.gov/OHA/Pages/index.aspx	ORS Chapter 448	Municipal Water Supply Systems Public Water Supply Systems Community Water Supply Systems Source Water Protection
BUILDING CODES DIVISION 1535 Edgewater NW Salem, OR 97304-4635 www.cbs.state.or.us/bcd	ORS Chapter 446	Electrical and Plumbing for all Commercial Enterprises Mobile Home Park Water Supply Systems
OREGON PUBLIC UTILITY COMMISSION 550 Capitol St. NE Salem, OR 97301-2551 www.puc.state.or.us/	ORS Chapter 757	Private Owners (water supply systems, 200 homes or more)
DEPARTMENT OF ENVIRONMENTAL QUALITY 811 SW Sixth Ave. Portland, OR 97204-1390 www.oregon.gov/deq	ORS Chapter 468	Water Quality Monitoring Underground Injection Systems Source Water Protection
SECRETARY OF STATE CORPORATION DIVISION Business Services Division Public Service Bldg., Suite 180 Salem, OR 97310 www.sos.state.or.us		Business Registry for Water Districts

APPENDIX 1- CONTINUED

All wells constructed in Oregon, including those to serve as a source of ground water to municipal, community, public, or public utility water supply systems, must be constructed in accordance with the rules and regulations prescribing general standards for the construction and maintenance of wells in Oregon (OAR 690 Divisions 205, 210, 215, 220 and 240). Additional construction standards for water supply systems may be required by the above listed agencies. Such rules and regulations generally include the source of water supply to the systems and may affect well construction requirements. Copies of the various agency rules may be obtained by contacting the responsible agency. Well constructors planning to construct a well as a source of water supply for any of the above systems are advised to contact the responsible agency prior to the beginning of well construction.

APPENDIX 2

I. Recommendations For Disinfection of Wells (OAR 690-210-0380)

Every newly constructed, altered, or repaired well should be assumed to be contaminated by micro-organisms. Before the initiation of use, each well must be thoroughly and carefully cleaned and treated to ensure that all disease carrying organisms are eliminated. Care should be exercised to make certain that all areas of the well come into contact with a solution containing enough available chlorine to completely destroy all harmful bacteria. An initial chlorine concentration of 50 parts per million (ppm) with a residual chlorine requirement of 25 ppm after 24 hours is considered adequate for this purpose. Either domestic laundry bleaches containing sodium hypochlorite, such as Clorox or Purex, or calcium hypochlorite in powder or tablet form (Olin HTH) may be used.

Hypochlorite solutions should be thoroughly mixed throughout the well either by the use of drilling tools, a pump, or by placing a calculated number of HTH tablets at regular intervals on a nylon string and dissolving them in places throughout the well. In all cases, the well casing and pump column standing above the water table should be thoroughly cleaned of all grease and oil and should be carefully washed down with the hypochlorite solution.

The well should be allowed to remain undisturbed after the treatment for a period of 24 hours. Then it is recommended that the well be tested for residual chlorine (at least 25 ppm must remain). After successful treatment, all water remaining in the well and supply system should be run to waste and a sample of fresh water from the well tested by the local county sanitarian for bacteriological purity.

SOLUTIONS CONTAINING HYPOCHLORITES

Laundry Bleach

Common domestic laundry bleaches contain from 5.25 percent to 6.00 percent sodium hypochlorite. These amounts are equivalent to approximately 2.5 percent available chlorine or about 25,000 ppm as originally purchased. A one gallon container of liquid bleach mixed with 500 gallons of water will dilute the original solution to approximately 50 ppm available chlorine.

High-Test Hypochlorite Compounds

Calcium hypochlorite (Olin HTH) in powder or tablet form contains about 50 percent active chlorine. One ounce of dry HTH powder mixed with 75 gallons of water will result in a solution containing approximately 50 ppm available chlorine. Eight tablets V(1/8 oz. each) of HTH are equivalent to one ounce of dry powder or granules.

QUALITY OF HYPOCHLORITE NEEDED TO PROVIDE
50 PPM ACTIVE CHLORINE IN WELL WATER

(1) If using liquid bleaches, the following formula is applicable:

$$\frac{\text{Feet of water in well} \times \text{Gallons per foot}}{62} = \text{Pints of bleach needed}$$

Feet of water = Total depth of well minus static water level multiplied by gallons per foot (See Table II).

(2) If using HTH compounds, the following formula is applicable:

$$\frac{\text{Feet of water} \times \text{Gallons per foot}}{75} = \text{Ounces HTH needed}$$

(3) If HTH tablets are used:

$$\frac{\text{Feet of water} \times \text{Gallons per foot}}{9} = \text{Number of 1/8 oz. tablets needed}$$

WATER RESOURCES DEPARTMENT
CHAPTER 690
DIVISION 210
WELL CONSTRUCTION STANDARDS

APPENDIX 210-3

I. Recommended Methods of Placement of Cement Grout (OAR 690-210-0320)

Method A - The well bore shall be plugged with a drillable plug or bridge at the lowest point to be sealed. A well casing with a float shoe at its lower end shall be placed in the well and suspended slightly above the point of bearing. A grout pipe shall be run inside the casing to the check valve. The grout pipe shall be connected to a suitable pump and water or drilling fluid shall first be circulated to clear the annular space. Grout shall be pumped through the grout pipe until clean grout completely fills the interval to be sealed. The grout pipe shall then be removed and the cement allowed to set. (See Figure 210-1)

Method B - Grout shall be placed by pumping or air pressure injection through a grout pipe installed inside the casing from the casing head to a point five (5) feet above the bottom of the casing. The grout pipe shall extend through an airtight sealed cap on the head of the well casing. The casing head shall be equipped with a relief valve and the grout pipe shall be equipped at the top with a valve permitting injection. The lower end of the grout pipe and the casing shall be open. Clean water shall be injected down the grout pipe until it returns through the casing head's relief valve. The relief valve is then closed and injection of water is continued to clean the hole until it flows from the bore hole outside the casing that is to be grouted in place. Without significant interruption, grout shall be substituted to water and, in a continuous manner, injected down the grout pipe until it returns to the surface outside of the casing. A small amount of water may be used to flush the grout pipe, but the pressure should remain constant on the inside of the grout pipe and the inside of the casing until the grout has set. Pressure shall be maintained for at least twenty-four (24) hours, or until such time as a sample of the grout indicates a satisfactory set. Cement grout shall be used for this procedure with a minimum annular space of one (1) inch completely surrounding the casing. (See Figure 210-1)

Method C - The well bore shall be plugged with a drillable plug or bridge at the lowest point to be sealed. The well casing shall be firmly seated at the bottom of the drillhole. A grout pipe shall be run to the bottom of the hole through the annular space between the casing and the well bore. After water or any other drilling fluid has been circulated in the annular space sufficiently to clear obstructions, the grout pipe shall be connected to a suitable pump and grout shall be pumped through the grout pipe until clean grout is circulated to land surface, or until grout completely fills the interval to be sealed. The lower end of the grout pipe shall remain submerged in grout while grout is being placed. The grout pipe shall be withdrawn before the initial set of the grout. (See Figure 210-1)

Method D - The well bore shall be plugged with a drillable plug or bridge at the lowest point to

be sealed. After the casing is run and landed, a casing plug, having a length greater than the diameter of the casing, shall be placed in the casing. If the drillhole is free of mud or water, this lower separation plug may be eliminated. A measured amount of cement grout necessary to completely fill the annular space of the interval to be grouted is pumped or placed by bailer in the casing. A second casing plug, having a length greater that the diameter of the casing, shall be placed in the casing above the grout. The casing shall then be capped with a pressure cap and shut-off valve, and shall be connected to a suitable pump. The casing shall then be raised far enough above the point of bearing to clear the first separation plug. Water or drilling mud shall then be pumped under pressure into the casing forcing the grout and upper casing plug down the casing. The position of the plug must be known at all times. A small amount of grout may remain in the lower end of the casing. When the plug reaches the point desired above the bottom of the casing, the pump shall be stopped and the casing seated. (See Figure 210-1)

Method E - The well bore shall be plugged with a drillable plug or bridge at the lowest point to be sealed. A sufficient amount of cement grout to completely fill the interval of the well to be sealed shall be placed at the bottom of the drillhole by pump bailer or grout pipe. The well casing shall have centering guides attached at appropriate intervals to keep the casing centered in the bore hole. The bottom of the well casing shall be fitted with a tight drillable plug and shall be lowered into the drillhole forcing the grout upward into the annular space. Gravity installation without the aid of a grout pipe shall not be used. In no instance shall this method be used deeper than thirty (30) feet and in no case for a municipal, community, or public water supply well. (See Figure 210-1)

TABLE 210-1
(690-210-0180)
(Specifications for Drive Pipe)

Nominal Size (inches)	Outside Diameter (inches)	Wall Thickness (inches)	Weight Per Foot (pounds)
1-1/2	1.900	0.145	2.72
2	2.375	0.154	3.65
2-1/2	2.875	0.203	5.79
3	3.500	0.216	7.58
3-1/2	4.000	0.226	9.11

OREGON ADMINISTRATIVE RULES
WATER RESOURCES DEPARTMENT
CHAPTER 690, DIVISION 210
WELL CONSTRUCTION STANDARDS

TABLE 210-2

(Minimum specifications for steel well casing)

Nominal Size (inches)	Outside Diameter (inches)	Wall Thickness (inches)	Weight Per Foot (pounds)
2	2.375	.154	3.65
2-1/2	2.875	.203	5.79
3	3.500	.216	7.58
3-1/2	4.000	.226	9.11
4	4.500	.237	10.79
5	5.563	.244	13.70
6	6.625	.250	17.02
8	8.625	.250	22.36
10	10.750	.250	28.04
*12	12.750	.312	41.45
*14	14.000	.312	45.68
*16	16.000	.312	52.27
*18	18.000	.375	70.59
*20	20.000	.375	78.60

* Note: Steel casing installed in a well greater than a nominal diameter of ten (10) inches, having a wall thickness of .250 inch and meeting ASTM A-53 A or B specifications must not exceed the following depth limitations (Diameter - Maximum Depth, respectively):

1. 12 inches - 500 feet
2. 14 - 16 inches - 250 feet
3. 18 - 20 inches - 100 feet

Table 210-3
Capacity of Drillhole or Casing

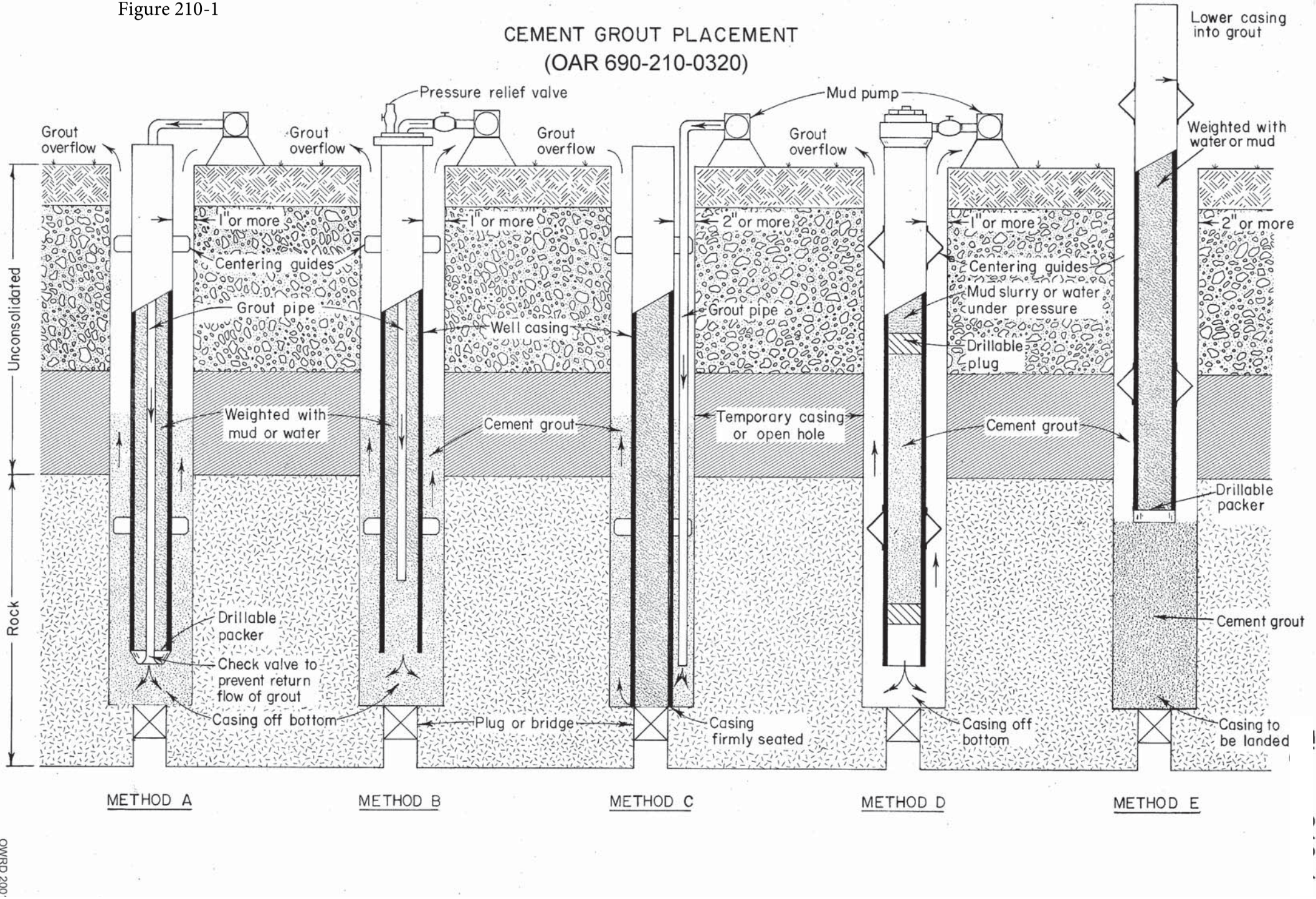
Nominal Size (in inches)	Gallons per Linear Foot
2	0.163
4	0.653
5	1.020
6	1.469
7	1.999
8	2.611
9	3.305
10	4.080
11	4.937
12	5.875
14	7.997
16	10.445
18	13.219
20	16.320
24	23.501

Table 210-4
Set time for plastic casing joints

Temperature Range During Initial Set Time	Set Time for Various Pipe Sizes In Hours					
	3"	4"	6"	8"	10"	12"
60 F - 100 F	1/2	1/2	1/2	3/4	3/4	1
40 F - 60 F	2	2	4	4	4	4
0 F - 40 F	6	6	8	10	12	12

NOTE: After the initial set, the joints will withstand the stress of a normal installation. However, considerable care should be employed in handling the string.

Figure 210-1

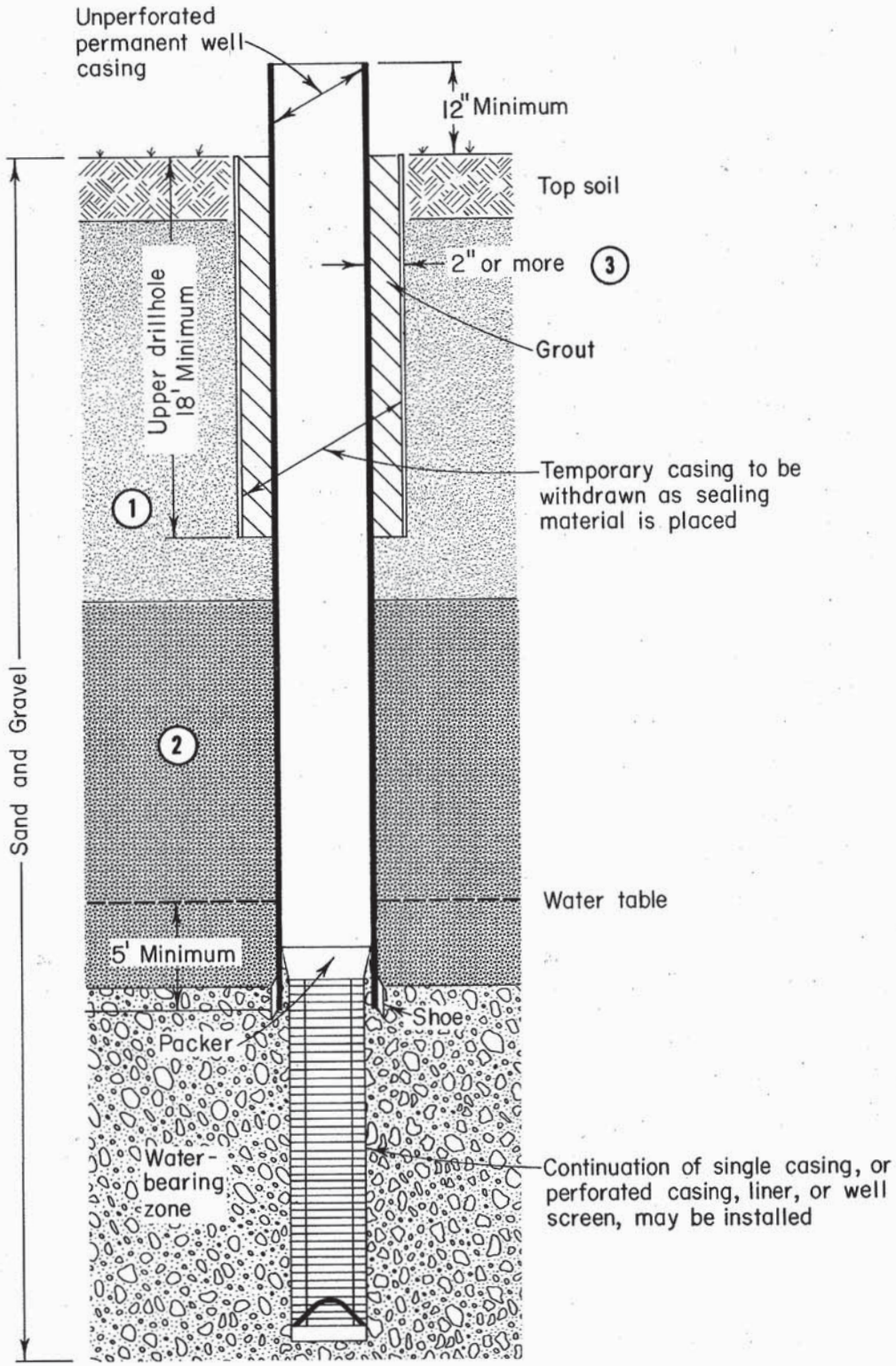


SEALING OF WATER SUPPLY WELLS IN UNCONSOLIDATED FORMATIONS WITHOUT SIGNIFICANT CLAY BEDS (OAR 690-210-0130)

Figure 210-2

Overlying Material - Sand and Gravel without Clay

Water-bearing Formation - Sand and Gravel or Similar



(1) Upper oversize drillhole and annular seal must extend to a depth of at least 18 feet.

(2) Unperforated watertight well casing must extend at least 5 feet below the water table and to a minimum depth of 18 feet.

(3) Annualar sealing space requirements are based on nominal casing sizes

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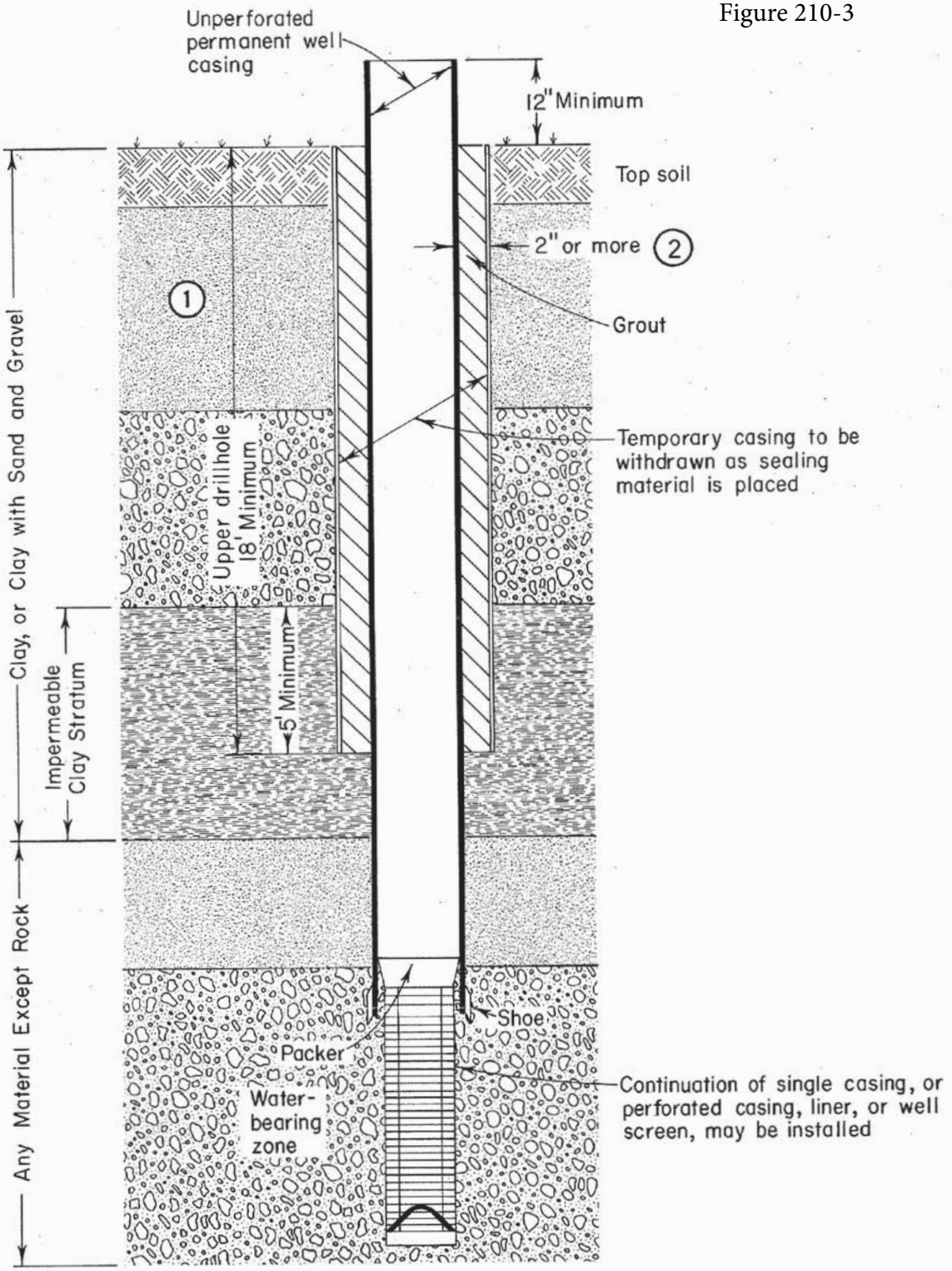
SEALING OF WATER SUPPLY WELLS IN UNCONSOLIDATED FORMATIONS WITH SIGNIFICANT CLAY BEDS (OAR 690-210-0140)

Overlying Material – Clay, or Sand and Gravel with Interbedded Clay

Water-bearing Formation – Any Material Except Rock

Figure 210-3



(1) Unperforated well casing and annular seal must extend at least 5 feet into impermeable stratum, and must extend at least 18 feet below land surface.

(2) 1" or more if cement grout is placed by grouting method A, B, or D. Annualar sealing space requirements are based on nominal casing sizes

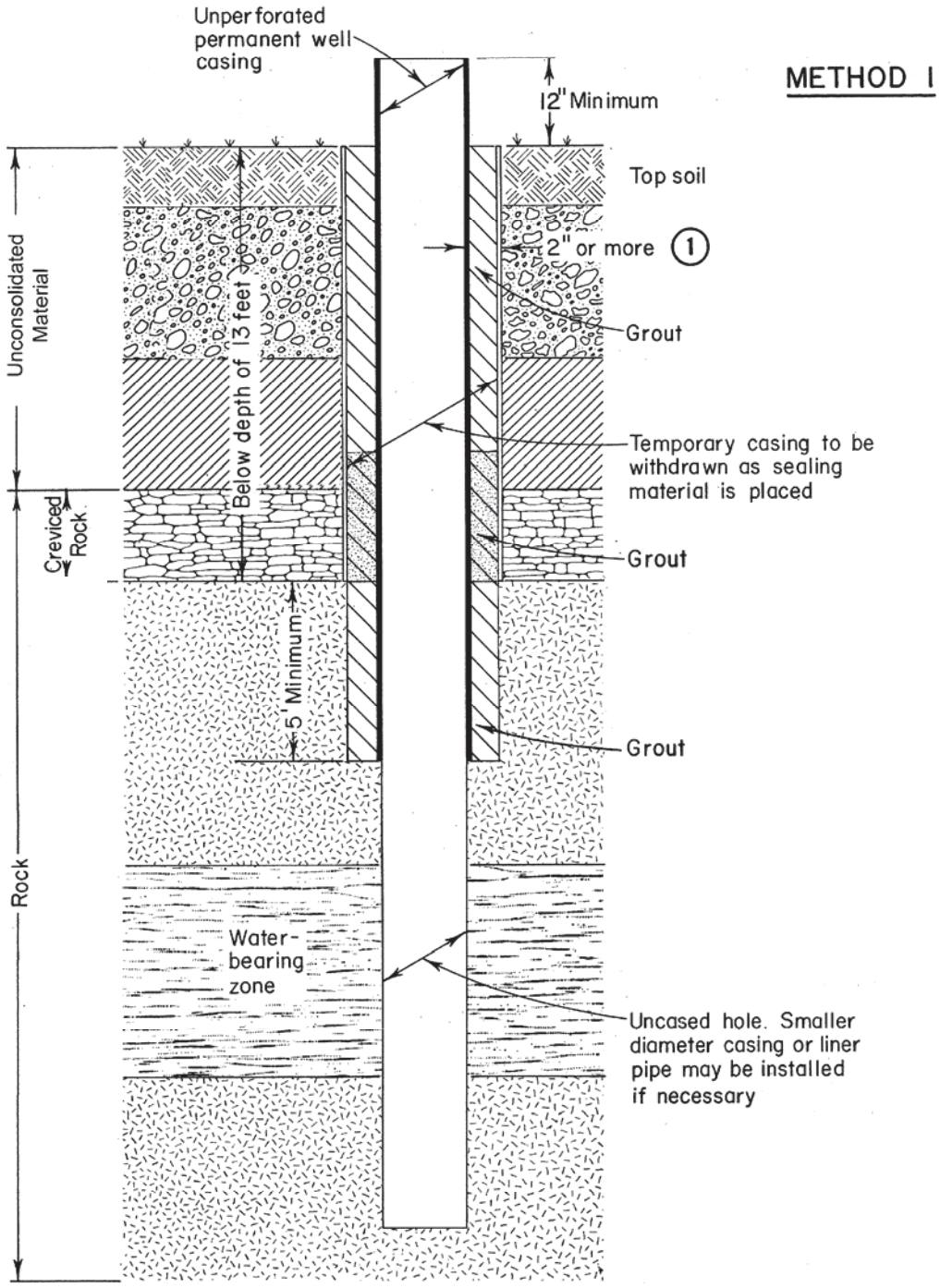
Water-bearing Formation — Rock

Figure 210-4

SEALING OF WATER SUPPLY WELLS IN CONSOLIDATED FORMATIONS (OAR 690-210-0150)

Overlying Material – Unconsolidated Material

Water-bearing Formation – Rock



(1) 1" or more if cement grout is placed by grouting method A, B, or D. Annular sealing space requirements are based on nominal casing sizes.

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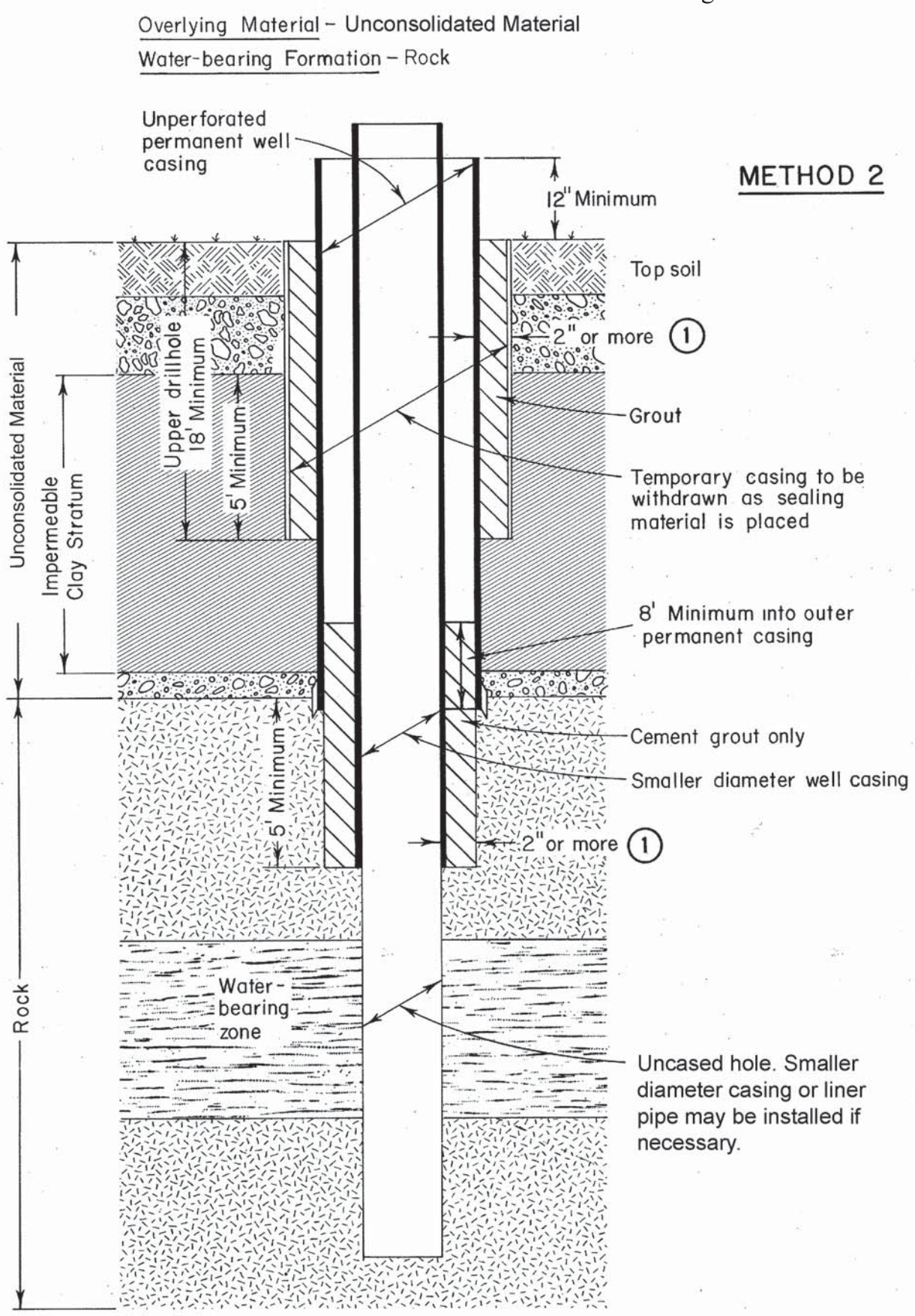
SEALING OF WATER SUPPLY WELLS IN CONSOLIDATED FORMATIONS (OAR 690-210-0150)

Figure 210-5



(1) 1" or more if cement grout is placed by grouting method A, B, or D.
Annular sealing space requirements are based on nominal casing sizes.

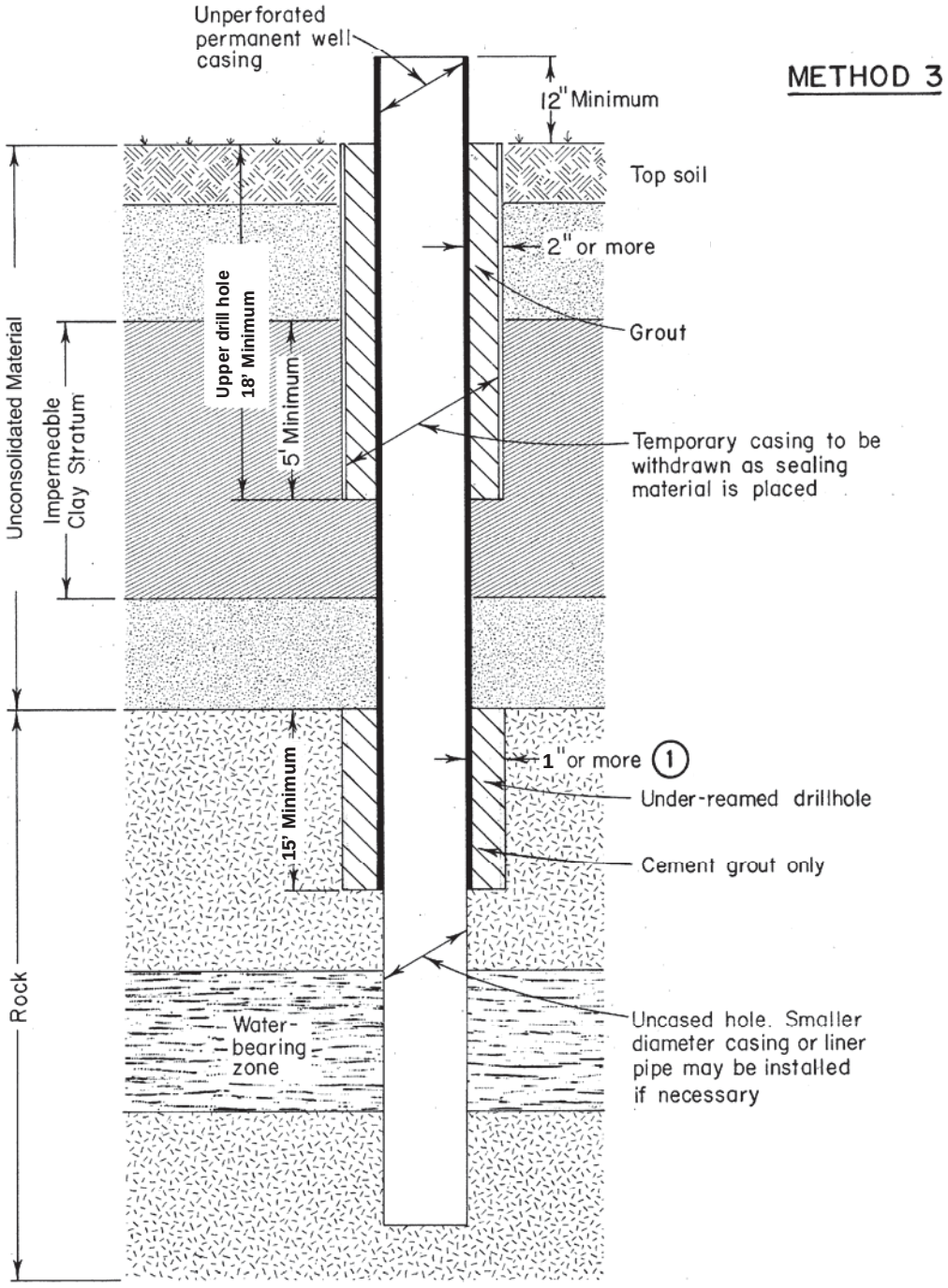
Water-bearing Formation — Rock

Figure 210-6

SEALING OF WATER SUPPLY WELLS IN CONSOLIDATED FORMATIONS (OAR 690-210-0150)

Overlying Material – Unconsolidated Material

Water-bearing Formation – Rock

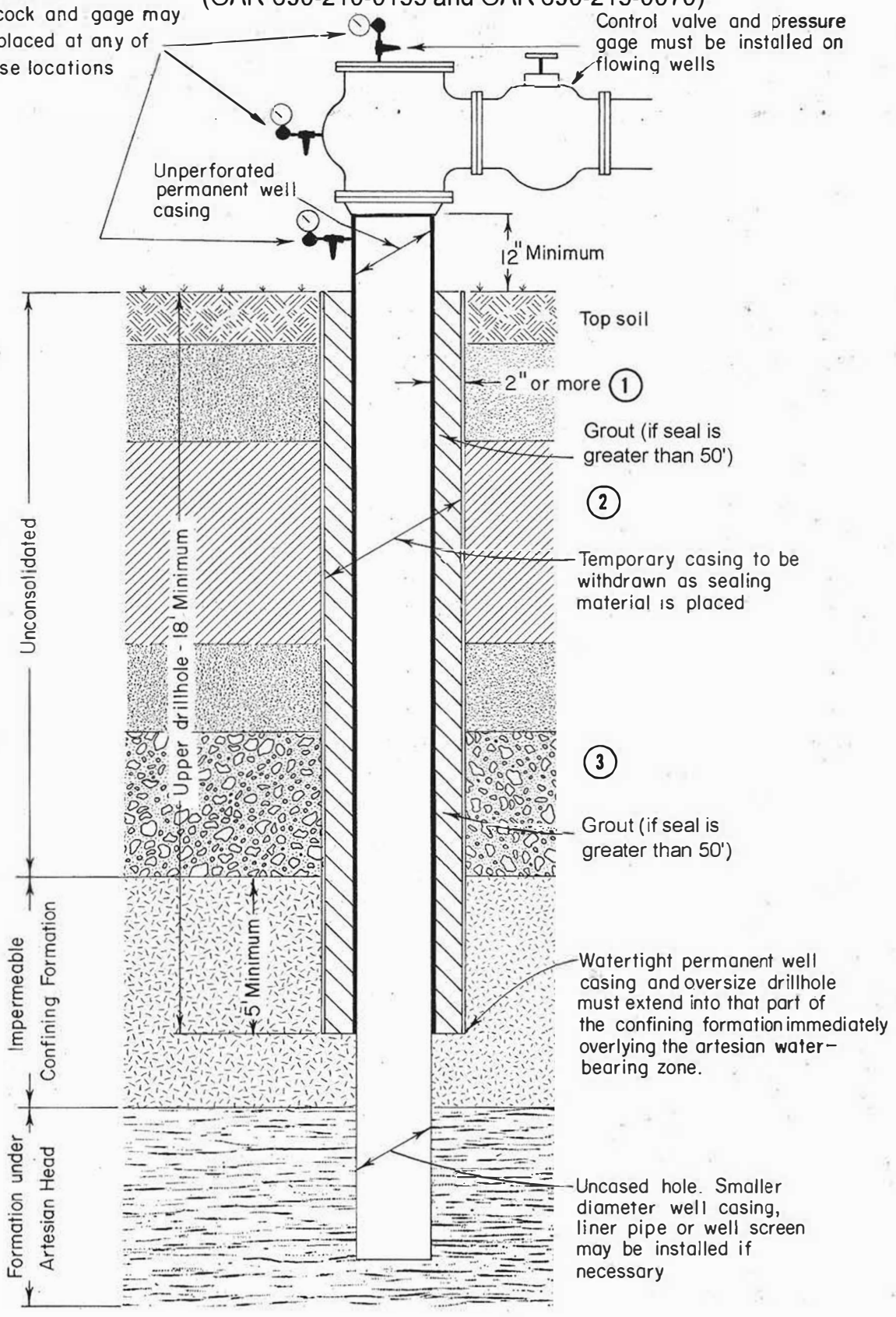


(1) 1" or more if cement grout is placed by grouting method A, B, or D. Annular sealing space requirements are based on nominal casing sizes.

Figure 210-7

SEALING OF AN ARTESIAN WELL

(OAR 690-210-0155 and OAR 690-215-0070)



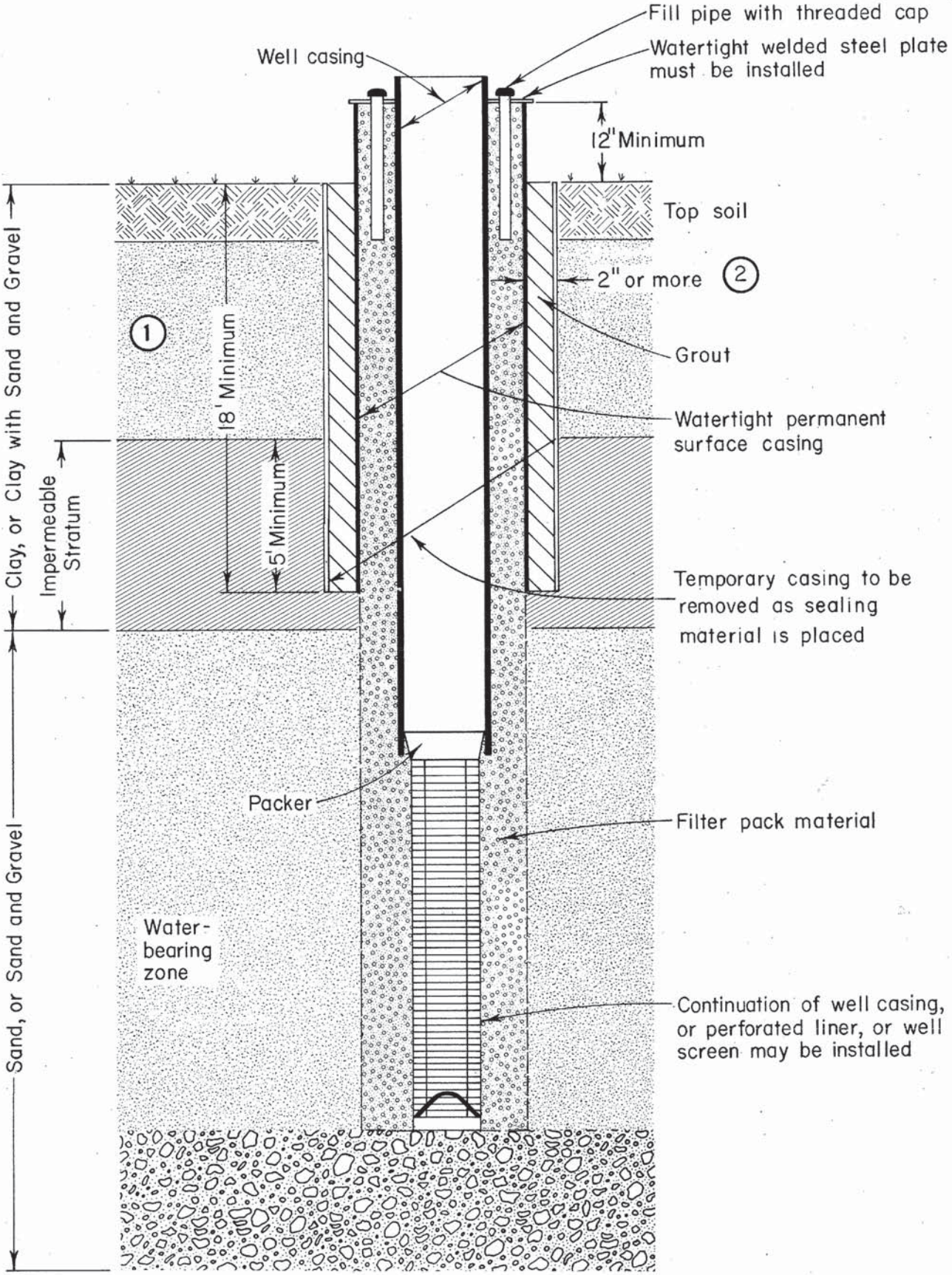
(1) 1" or more if cement grout is placed by grouting method A, B, or D. Annular sealing space requirements are based on nominal casing sizes.

(2) Well must not be constructed in a manner that will allow water from an artesian zone to commingle with other confined or unconfined water-bearing zones.

(3) Must be completed with the seals, packers, or casing necessary to eliminate subsurface or surface leakage.

SEALING OF A FILTER PACKED WELL WITH SURFACE CASING

(OAR 690-210-0160) Figure 210-8



(1) Minimum of 18 feet provided that the impermeable stratum is at or near land surface.

(2) Annular sealing space requirements are based on nominal casing size.

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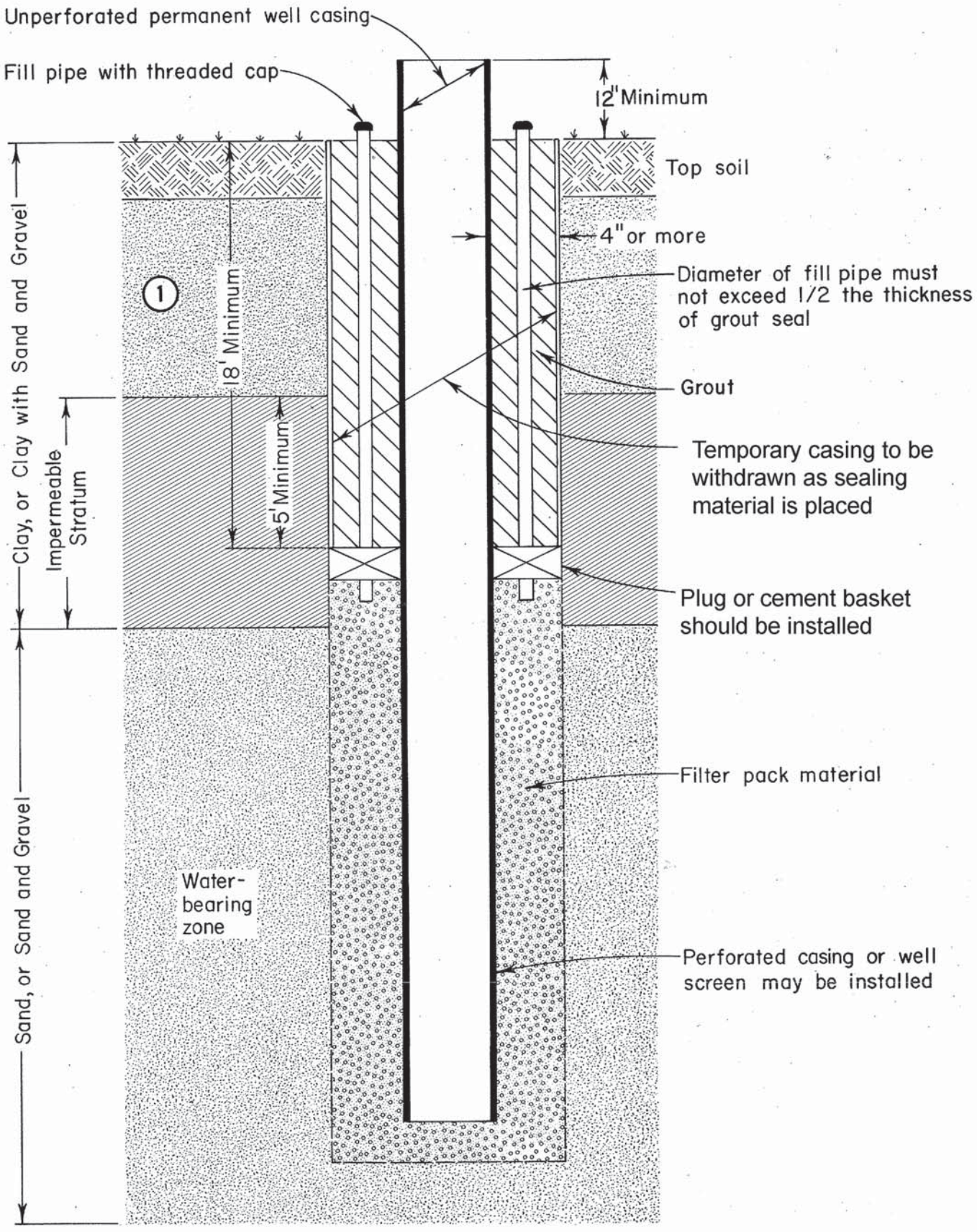
SEALING OF A FILTER-PACKED WELL WITHOUT SURFACE CASING

(OAR 690-210-0170)

Figure 210-9



(1) Minimum of 18 feet provided that the impermeable stratum is at or near land surface.

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Figure 210-10

SEALING OF A DRIVEN OR JETTED WELL

(OAR 690-210-0180)

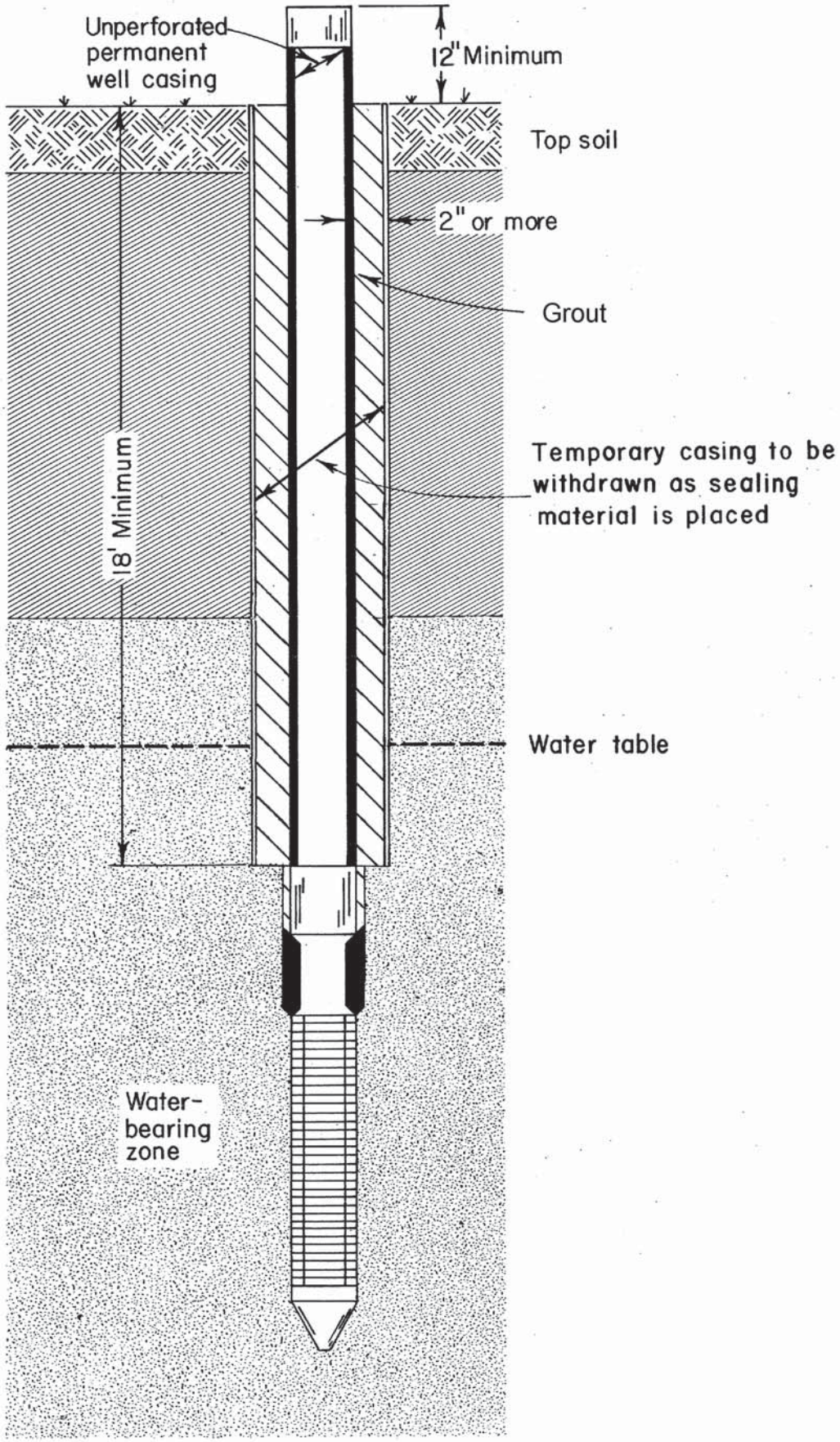

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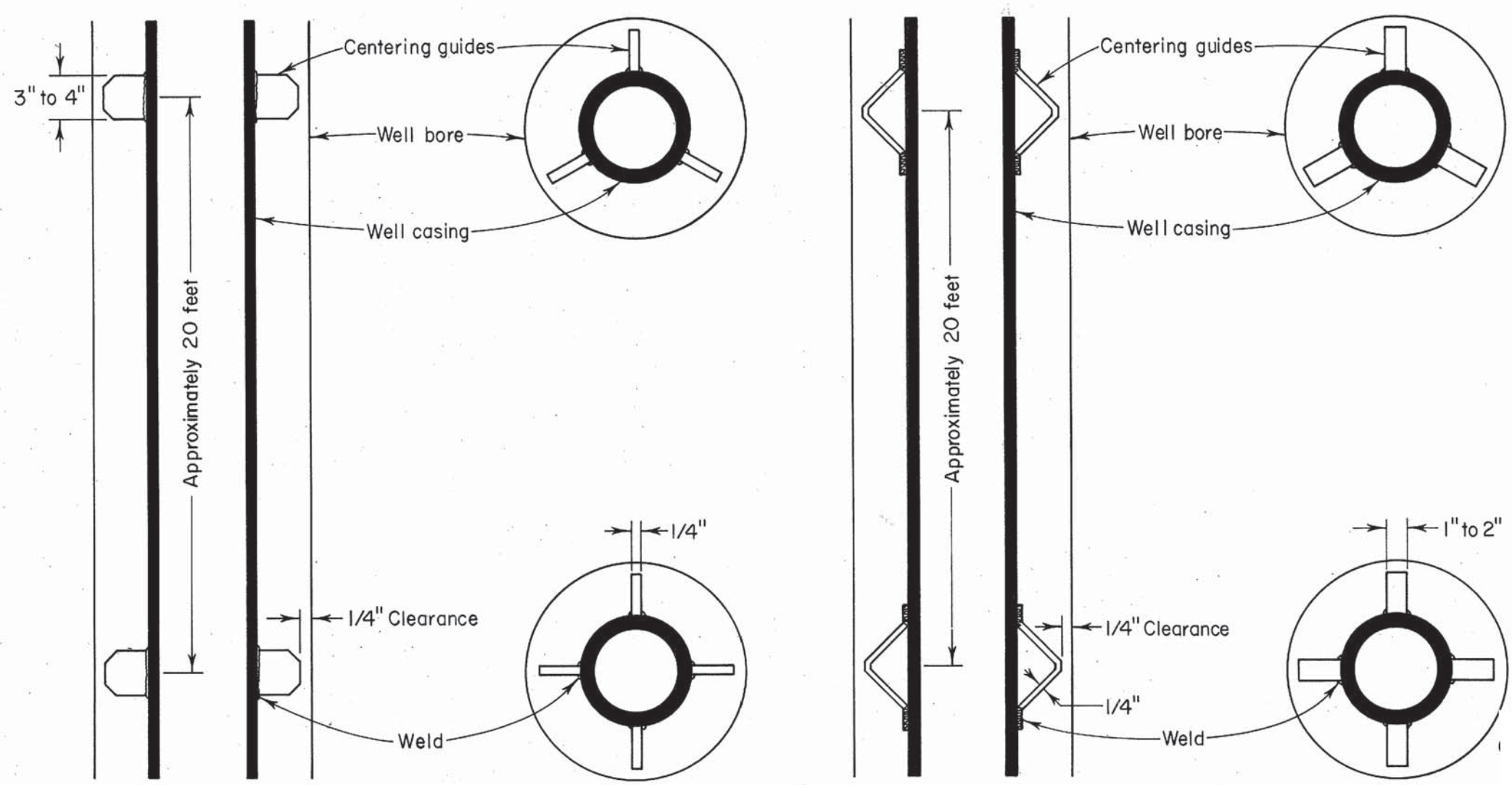
Figure 210-11

RECOMMENDED USE OF CENTERING GUIDES
(OAR 690-210-0240)

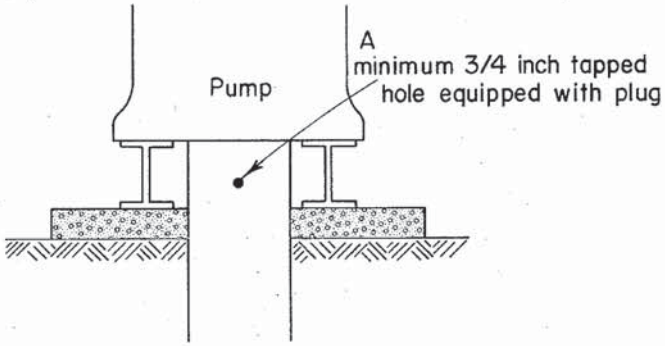


NOTE: Well casing, to be sealed into an oversize drillhole, should be equipped with a series of centering guides to insure proper centering of casing. Guides should be evenly spaced in groups of 3 or 4, and attached to the casing.

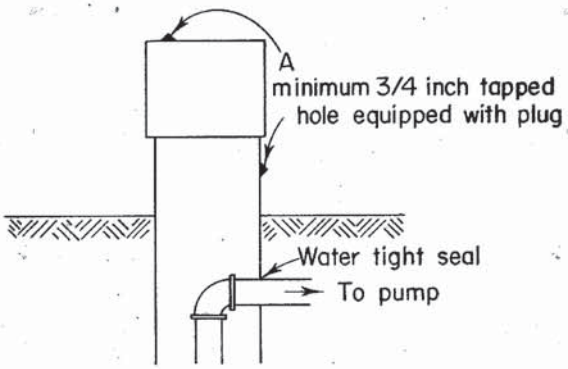
Figure 210-12

SUGGESTED METHODS OF INSTALLING ACCESS PORTS, PRESSURE GAUGES, AND AIR LINES FOR MEASURING WATER LEVELS IN WELLS

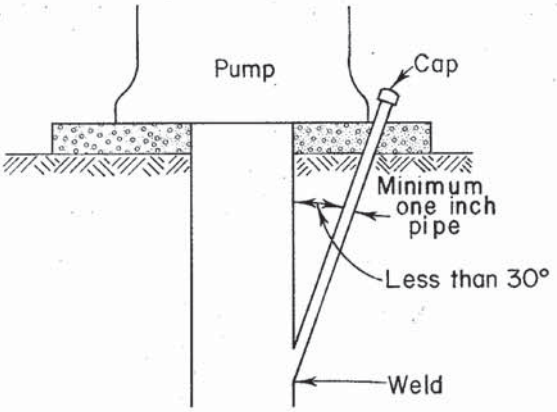
(OAR 690-210-0280)



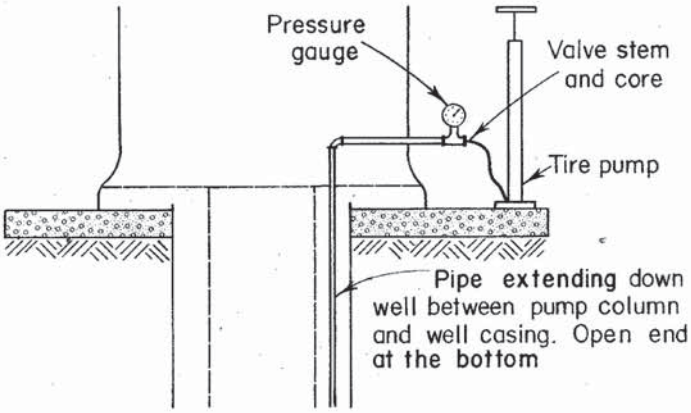
ACCESS PORT FOR MEASURING DEVICE



ACCESS PORT FOR MEASURING DEVICE



ACCESS PORT FOR MEASURING DEVICE

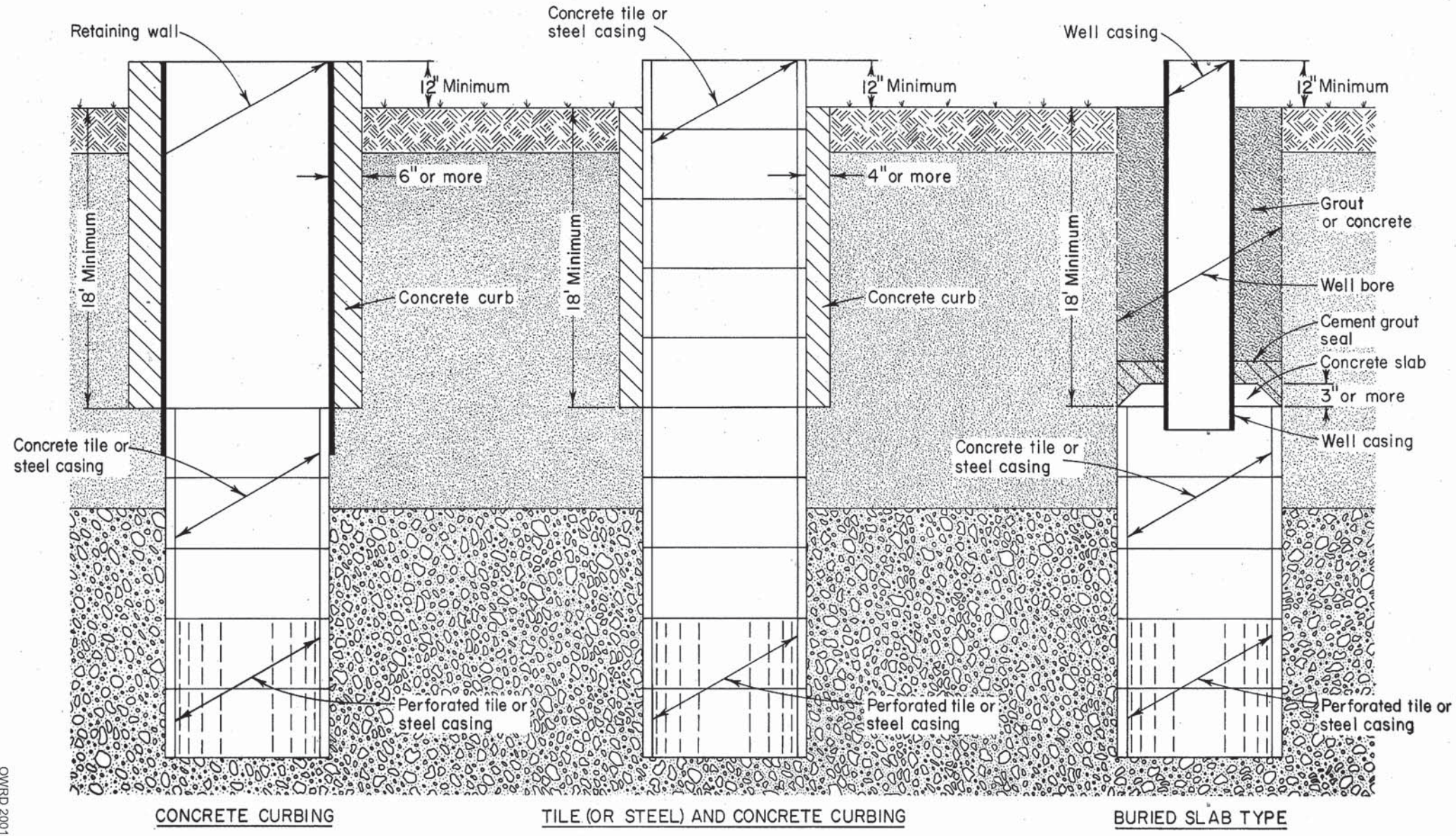


AIR LINE INSTALLATION

An air line installation is recommended where the water level lies at a considerable depth below land surface. The amount of air pressure that can be built up inside the air line will be equal to the depth of water standing above the bottom of the air line. The exact depth to the bottom of the air line is required to obtain an accurate measurement of the water level in the well. One pound per square inch pressure equals 2.31 feet of water.

Figure 210-13

SEALING OF DUG WELLS
(OAR 690-210-0400, 0410, 0420)



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