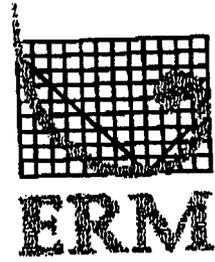


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### Facsimile Cover Sheet

To Bob Gilkeson

Company ERM PMC Los Alamos

Fax Number 1-505-661-9699

From Mark Levorsen

Project Number AD

Number of Pages 31 (including cover page)

Date 2/12/96

To be mailed after faxing      YES      NO

Bob - Here's the complete Colorado State Water Well guidelines document. Have fun. Holler, if there is a problem with the fax transmission.

Thanks. Mark K. Levorsen

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STATE OF COLORADO  
DIVISION OF WATER RESOURCES  
STATE BOARD OF EXAMINERS OF WATER WELL CONSTRUCTION AND  
PUMP INSTALLATION CONTRACTORS

1313 Sherman Street  
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REVISED AND AMENDED RULES AND REGULATIONS  
OF THE BOARD OF EXAMINERS OF WATER WELL CONSTRUCTION AND  
PUMP INSTALLATION CONTRACTORS

Permit 2-12-96

**FAX RECEIVED FROM ERM OFFICE IN COLORADO**

Rule 10.4.1 on page 15 states annular space requirements.

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**REVISED AND AMENDED RULES AND REGULATIONS  
FOR WATER WELL CONSTRUCTION AND PUMP INSTALLATION**

**RULE 1            TITLE**

1.1 The title of these rules and regulations is "The Rules and Regulations for Well Construction and Pump Installation Applying to the Construction of Water Wells, Test Holes, Monitoring and Observation Wells, Dewatering Wells, and the Installation of Pumping Equipment into Such Wells." The short title for these rules and regulations is "Water Well Construction and Pump Installation Rules," and they may be referred to herein collectively as the "Rules" or individually as a "Rule."

**RULE 2            AUTHORITY**

2.1 These Rules are promulgated pursuant to the authority granted the State Board of Examiners of Water Well Construction and Pump Installation Contractors (the Board) in Sections 37-91-104(1)(c)(j) and (k), 37-91-106(4) and 37-91-110(2), C.R.S.

2.2 These Rules also provide for alternatives to surety bonds needed to obtain a license and the specific Rules are promulgated pursuant to Sections 11-35-101(2) and 101.5(2), C.R.S.

**RULE 3            SCOPE OF RULES**

3.1 These Rules apply to the construction of water wells, test holes, dewatering wells, monitoring and observation wells, well abandonment, and pump installation and repair as those terms are defined by these Rules and Section 37-91-102, C.R.S.

3.2 By statute these Rules do not apply to excavations made for the purpose of obtaining or prospecting for minerals or to those wells subject to the jurisdiction of the Oil and Gas Conservation Commission as provided in article 60 of title 34, C.R.S. or those wells subject to the jurisdiction of the Mined Land Reclamation Board as provided in article 32 of title 34 (Minerals), and article 33 of title 34 (Coal), C.R.S.

3.3 These Rules apply to well construction and pump installation contractors, private drillers and private pump installers and any persons excluded from the licensing requirements as further described by these Rules in conjunction with Sections 37-91-102, 104(j) and (k), and 106(4), C.R.S.

3.4 These Rules further define the requirements for obtaining and keeping a valid license as a well construction contractor or pump installation contractor.

#### RULE 4 PURPOSE

##### 4.1 Purpose of Rules

4.1.1 To enable the Board to carry out the provisions of Sections 37-91-101 to 112 C.R.S.

4.1.2 To safeguard the public health of the people of Colorado and for the protection of the ground water of the State of Colorado.

4.1.3 To set minimum standards for the construction and abandonment of all wells, test holes, monitoring and observation wells and dewatering wells.

4.1.4 To allow certain types of monitoring and observation wells, dewatering wells, and test holes to be constructed, utilized and abandoned by other than a licensed well construction contractor.

4.1.5 To set minimum standards for the installation of pumping equipment.

4.1.6 To set standards for the licensing and bonding of well construction and pump installation contractors.

4.1.7 To allow the use of alternatives to surety bonds and to develop procedures and other statutory requirements for the use of alternatives to surety bonds.

#### RULE 5 DEFINITIONS

5.1 The following terms are defined in the statute, Section 37-91-102, C.R.S., and the terms shall have identical meaning where used in these Rules:

Board, Construction of Wells, Dewatering Well, Directly Employed, Ground Water, Installation of Pumping Equipment, License, Monitoring and Observation Well, Person, Private Driller, Private Pump Installer, Pumping Equipment, Pump Installation Contractor, Repair, Supervision, Test Hole, Well, Well Construction Contractor, and Well Seal.

5.2 Specific Definitions - Unless expressly stated otherwise the following

terms when used in these Rules shall have the meaning indicated in this Rule. Words used in the present tense include the future; words used in the masculine gender include the feminine and neuter.

5.2.1 "Annular Space" means the space between the wall of the borehole or excavation and the casing or the space between two casings.

5.2.2 "Aquifer" means a geologic formation, group of formations or part of a formation that can both store and transmit ground water. It includes both the saturated and unsaturated zone but does not include the confining layer which separates two adjacent aquifers.

5.2.3 "Artificial Recharge" means the intentional introduction of water into any underground formation.

5.2.4. "Casing" means the pipe installed in the borehole or excavation to provide unobstructed access to the water-bearing formation. The term includes both nonperforated and perforated pipe and screen.

5.2.5 "Cathodic Protection Hole" means a well used for the installation of an electrical conductor as a part of a corrosion prevention system.

5.2.6 "Centralizer" means a device attached to the outside of a casing or liner to center it within a borehole or casing.

5.2.7 "Conductor Casing" means the temporary casing used in the upper portion of the borehole to prevent collapse of the formation during the construction of the well.

5.2.8 "Confining Layer" means all or part of a formation which impedes the flow of ground water from an adjacent aquifer.

5.2.9 "Confined Well" means a well completed in or producing from an aquifer or portion of an aquifer in which the static water level in the well rises above where it was first encountered in the aquifer due to hydrostatic pressure.

5.2.10 "Contaminant" means any chemical material, organic material, live organisms, radioactive material or heated or cooled water that will adversely affect the quality of ground water.

5.2.11 "Contamination" means the introduction of contaminants into ground waters.

5.2.12 "Filter Pack", also referred to as "gravel pack", means selected granular materials placed in the annular space.

5.2.13 "Grout" means any material approved by the Board which is used to form a permanent impermeable seal between the casing and the well bore or between two strings of casing or which is used in plugging and abandoning wells.

5.2.14 "Grouting" means the process by which a grout is placed in the borehole or casing.

5.2.15 "Grouting Holes" means holes constructed for the injection of grout to stabilize and/or reduce the permeability of the adjacent geologic strata.

5.2.16 "Horizontal Drain" means a well constructed to increase slope stability or as a permanent dewatering system.

5.2.17 "Lithology" means the type and character of the soil and rock materials.

5.2.18 "Monitoring and Observation Hole" means a cased hole constructed for the purpose of sampling, measuring or test-pumping for scientific, engineering or regulatory purposes. A monitoring and observation hole shall not be converted to a production water well unless the well was originally constructed by a licensed water well contractor.

5.2.19 "Nested Well" means the installation of two or more casings in a single borehole or excavation.

5.2.20 "Nominal Size" means the standard commercial designation of the diameter of a casing.

5.2.21 "Percolation Holes" means holes constructed in unsaturated materials to determine infiltration rates into the underlying or adjacent strata.

5.2.22 "Pier or Caisson Holes" means holes which are drilled, augered or bored to allow the installation of pilings or other foundation supports.

5.2.23 "Piezometer Holes" means holes that are constructed into or in the vicinity of manmade structures to monitor water pressures, soil-moisture tensions or water table elevations.

5.2.24 "Pitless Adapter or Pitless Unit" means a device designed for attachment to one or more openings through a well casing, which will permit water service pipes to pass through the wall of a well casing or extension thereof and prevent entrance of contaminants into the well or water supply.

5.2.25 "Recovery Well" means a well which is constructed specifically for the removal of contaminants from an aquifer.

5.2.26 "Sump Pumps and Permanent Foundation Dewatering Systems" means a well or drain system constructed for the purpose of keeping the water table below the foundations of a structure where the water produced is not put to beneficial use.

5.2.27 "Thermoplastic Casing" means PVC (polyvinyl chloride), ABS (acrylonitrile-butadiene-styrene) or SR (styrene rubber) casing specified in ASTM Standard F480-81 or similar well casing approved by the Board.

5.2.28 "Watertight" means a condition which does not allow the entrance, passage or flow of water under normal operating conditions.

5.2.29 "Well Owner" means any person or his agent who holds the title or other rights of property in a well.

5.2.30 "Well Pit" means a structure for the underground installation of equipment and piping. If the well terminates in the pit, the structure shall be deemed to be a vault.

5.2.31 "Well Test" means a test of a well conducted to determine the sustained yield and the stabilized pumping water level.

5.2.32 "Well Vault" is an underground structure in which the well casing terminates below ground surface. A vault may include the installation of additional equipment and piping.

5.3 Other Definitions - All other words used herein shall be given their usual customary and accepted meaning. Terms that were not defined in this Rule which are defined in the statutes or other rules of the State Engineer shall use the meaning given therein. All words of a technical nature specific to the water well industry shall be given the meaning which is generally accepted in the said water well industry.

## RULE 6 GENERAL RULES

6.1 Permit Requirement - A permit issued by the State Engineer is required prior to constructing or changing the producing interval of a well or prior to installing the initial pumping system or a pumping system having a sustained production rate in excess of the permitted pumping rate.

6.1.1 It is the responsibility of all persons authorized to construct wells or install pumping equipment to ensure that a valid permit

issued by the State Engineer exists prior to and during all work performed to construct or modify a well. A copy of the permit or verbal approval number shall be available on the drilling rig.

6.1.2 All well construction, repair of an existing well or installation or replacement of a pump shall comply with the conditions of approval on the valid well permit or the verbal approval.

6.2 Authorized Well Construction or Pump Installation Contractor - Well construction, repair, modification or abandonment or pump installation, repair, or modification shall be performed only by a contractor or a direct employee of the contractor or by a person who is under supervision of an individual having a valid license issued by the State Board of Examiners of Water Well and Pump Installation Contractors unless exempt under provisions of Rule 7 or Section 37-91-106(3), C.R.S.

*We should  
do this*

6.3 Notice of Intent to Construct - When these Rules require that the State Engineer be notified of the intent to construct, the notice shall be submitted in writing at least three (3) days prior to construction. The notice requirement is summarized in Table 2. The notice shall contain as a minimum the following information:

Landowner's name; well owner's name; approximate date of construction; location by 1/4 section, township and range; number and type of holes or wells to be constructed; estimated total depths; and purpose.

6.4 Compliance with Regulations - Construction of all wells shall as a minimum comply with the standards in these Rules. In the case where federal, state, county, municipal or local government laws, regulations or codes are more stringent than these Rules or contain standards not covered by these Rules, then the contractor shall comply with those standards.

6.5 License Number - Any well drilling rig or pump installation rig owned, leased or operated by any well construction or pump installation contractor shall be registered with the Board and have prominently displayed thereon the contractor's license number in letters at least two inches in height and other comparable dimension; for example: "Lic. 1234".

6.6 Advertisement - All advertisements for services offered by well construction and pump installation contractors shall state the contractor's license number.

**RULE 7                    WELLS WHICH MAY BE CONSTRUCTED BY OTHER THAN A WELL  
                                 CONSTRUCTION CONTRACTOR**

7.1 General - The following types of wells which do not penetrate through

a confining layer between the aquifers recognized by the State Engineer shall not be included in the definition of well in order to allow for their construction, use and abandonment by authorized individuals other than well construction contractors:

Cathodic Protection Holes, Dewatering Wells, Grouting Holes, Horizontal Drains, Monitoring and Observation Holes and Wells, Percolation Holes, Pier Holes, Piezometer Holes, Recovery Wells, Sump Pumps and Permanent Foundation Dewatering Systems, and Test Holes.

**7.2 Authorized Individuals** - Only professional engineers, professional geologists, licensed well construction contractors, individuals holding special licenses, or anyone directly employed by or under the supervision of one of these individuals shall construct, use, or abandon wells or holes specified in Rule 7.1. See Table 2 for a summary of who is authorized to construct each type of well.

**7.2.1** Monitoring and observation holes and wells shall not be converted to production water wells unless the holes or wells were originally constructed by a well construction contractor.

**7.3 Construction and Abandonment Standards** - The exclusion granted by this Rule 7 does not exempt these wells or holes from meeting the construction requirements of Rule 10, except where Rule 10 conflicts with the intended use of the well. All of these wells shall be abandoned according to the provisions of Rule 11.

**7.3.1** If during construction the borehole penetrates through the confining layer into a lower aquifer, the hole shall be plugged back within twenty-four (24) hours. The plug shall consist of an acceptable grout as described in Table 1, placed opposite the confining layer for an interval of twenty (20) feet or seventy-five (75) percent of the thickness of the confining layer, whichever is less.

## **RULE 8 LICENSING**

**8.1 License Required** - Every individual, before engaging in the business of contracting either for the construction of wells or for the installation of pumping equipment shall obtain a license for one or more methods of well construction or pump installation from the Board.

**8.2 Water Well Construction Licenses** - The Board designates the following types of licenses for methods of water well construction:

- a. Rotary construction.

- b. Reverse rotary construction.
- c. Cable tool construction.
- d. Dug or auger construction.

8.3 Pump Installation Licenses - The Board designates the following types of licenses for the installation of pumping equipment in water wells:

- a. Pumps with motors less than 5 horsepower.
- b. Pumps with motors 5 to 20 horsepower.
- c. Pumps with motors greater than 20 horsepower.

8.4 License Application - An applicant for a well construction or pump installation contractor's license shall specify to the Board for which of the above methods of well construction or pump installation a license is sought. The applicant shall satisfy the statutory requirements. An applicant, once licensed in one of the above methods, is eligible without further experience to take an examination for another listed method of well construction or pump installation.

8.5 Special License - A well construction or pump installation license may be issued by the Board for well construction or pump installation methods other than those listed above. Such license shall be designated as a special license. The applicant shall make written application specifying the type of special license requested identifying the type of equipment and installation methods to be used. The Board shall administer an examination as it deems necessary for the issuance of such license. A special license holder shall be limited to the stated methods of well construction, pump installation, or use of special equipment and procedures, as stated on his license. A special licensee shall not be entitled to examine for another method of well construction or type of pump installation without meeting the statutory requirements for such license and having experience in such method as required by the statutes for initial licensing. A special license holder shall comply with all statutory requirements and all Rules and Regulations.

8.6 Examination - An applicant for a license shall demonstrate professional competence by passing a written and oral examination prescribed by the Board.

8.6.1 The written examination shall test an applicant's technical knowledge and his knowledge of applicable state laws and local ordinances concerning the construction of wells or the installation of pumping equipment, or both, and Rules promulgated in connection therewith.

## RULE 9 BONDING

9.1 Financial Responsibility Required - Prior to the initial issuance or

renewal of any license, the applicant or licensee shall file with the Board, on a form provided by the Board, evidence of financial responsibility as required or allowed by Section 37-91-107, C.R.S., by means of a corporate surety bond or alternative bond. A license is valid only if an adequate bond is in effect. If the bond is cancelled or terminated, or its funds are less than the required statutory amount, the license automatically becomes invalid.

9.1.1 The bond shall specifically cover the licensee's compliance with applicable laws and regulations for all activities for which the individual is licensed.

9.1.2 The bond shall specifically list the individuals covered by that bond and also state the type of license or licenses held by each individual that is covered.

## 9.2 Alternative Bonds

9.2.1 The requirement of a corporate surety bond may be satisfied by a savings account, deposit or a certificate of deposit meeting the requirements of Sections 11-35-101 and 37-91-107, C.R.S.

9.2.2 The requirement of a corporate surety bond may be satisfied by an irrevocable letter of credit meeting the requirements of Sections 11-35-101.5 and 37-91-107, C.R.S. and shall be completed on a form available from the Board.

9.2.3 Assignment of Funds - Alternative bonds shall be in the name of the Board, on behalf of any person or the State of Colorado suffering loss or damage, as beneficiary.

9.2.4 The licensee is responsible to pay all costs incurred from the maintenance or administration of alternative bonds. Any costs incurred by the Board from the payment of claims, negotiation or litigation of claims, and court action taken pursuant to such bonds shall be paid by the licensee. These costs may be taken from the bond if sufficient funds remain after satisfying claims. Otherwise, the Board may take any other action to collect these costs.

9.3 Period of Liability - The period of liability of a bond or alternative bond is two (2) years after the submission of the last accepted work report. Where there is an outstanding claim, the bond shall not be released until such claim is finally resolved and the two-year time period has passed.

## 9.4 Claims Against a Bond

9.4.1 A claim against a corporate surety bond is made to the

corporate issuer of the bond, and not to the Board.

9.4.2 A claim against an alternative bond shall be initiated by certified mail to the contractor and filing a copy with the Board. The merits of the claim shall be resolved by the parties and not by the Board. The Board shall not make payments or release funds from the alternative bond until it receives either a written and notarized agreement between the parties or a court order directing the Board to release payments.

9.5 Cancellation of Bond - The bonding company and the licensee shall notify the Board of any change in the amount or status of a bond or alternative bond. Notification of cancellation or change shall be submitted to the Board at least 30 days prior to the effective date.

#### RULE 10 MINIMUM WELL CONSTRUCTION STANDARDS

10.1 General - To assist in the orderly development of the ground water resources of Colorado, to insure the protection of the public health, and to prevent degradation of the ground water resource all wells shall be constructed, maintained, or repaired in such a manner that will: maintain existing natural protection against pollution of aquifers; prevent the entry of contaminants through the borehole; limit ground water production to one aquifer unless permitted otherwise by the State Engineer; and prevent the intermingling of ground water from different sources through the borehole. If site specific conditions indicate that the minimum standards will not provide adequate integrity of the well and protection to the aquifer, the contractor shall be responsible for constructing the well using standards which are greater than the minimum specified in these Rules.

10.1.1 All wells when unattended shall be securely sealed, capped or covered.

10.1.2 When hazardous contaminants are known or suspected to be encountered during well construction, the contractor shall be responsible for ensuring that his personnel are adequately trained and that proper safety equipment is provided to handle and contain those substances.

10.1.3 Nested wells completed in different aquifers or production zones shall be grouted to prevent intermingling of ground water.

10.1.4 The construction of monitoring and observation wells shall be performed in a manner that minimizes the disturbance of subsurface materials, and prevents the movement of contaminants through the borehole.

10.1.5 All persons authorized to construct wells shall investigate

and become familiar with the geology of potential aquifers, anticipated water quality problems and known contaminated water bearing zones which may be encountered in the area of the proposed drilling activity.

## 10.2 Well Location

10.2.1 When selecting a well location consideration shall be given to topography, drainage, sources of contaminants and other on-site conditions in order to promote sanitary conditions and prevent contamination of the well and aquifer.

10.2.2 Wells shall not be located closer than 100 feet from the nearest potential source of contaminants, such distance being measured from that potential source of contaminants to the base of a continuous grout seal extending to either the ground surface or not more than three (3) feet below the expected depth of the pitless adapter. In no case shall the horizontal distance of the well to the nearest potential source of contaminants be less than 25 feet. (See Figure 1). Monitoring and observation, dewatering and recovery wells are exempted from this requirement.

10.2.3 When locating wells, all well construction contractors and private drillers shall comply with the regulations of state, county, municipal or local governments, including distances from sources of contaminants, provided those regulations are more stringent than the minimum standards of these Rules and Regulations.

10.3 Well Casing - An acceptable well casing is one which will ensure adequate protection against failure for the intended use of the well.

10.3.1 All production casing shall be new or unused pipe, however, casing recovered when a well is deepened or replaced may be reused in the new well if it will ensure satisfactory well performance.

10.3.2 Steel surface casing may be used pipe if it is in like new condition, being free of pits or breaks and has been decontaminated.

10.3.3 Used oilfield pipe shall not be installed in any well.

10.3.4 Water well casing shall be adequate in size to accept a pump capable of producing the desired pumping rate, but in no instance shall the nominal diameter of the casing be less than four inches. Dewatering wells, and monitoring and observation wells are exempt from this minimum inside diameter.

10.3.5 All casing wall thickness shall be adequate to withstand collapse due to hydrostatic pressures.

10.3.5.1 Except for monitoring and observation wells the following minimum wall thicknesses shall be applicable to well casings:

- a. Steel well casing: 0.188 inches
- b. Thermoplastic well casing: 0.200 inches
- c. Precast concrete rings: 3.00 inches

10.3.6 All thermoplastic water well casing shall meet the standards of the American Society for Testing Materials (ASTM) as set forth in ASTM F480-81 (1981) and be clearly marked by the manufacturer "well casing". Later amendments to or editions of ASTM standards are not included in this Rule.

10.4 Construction Procedures - The excavation of the well bore, selection and installation of the casing, grouting, development and disinfection of a new well and repair or deepening of an old well shall protect the health and safety of the public utilizing workmanship and materials which meet with the intended use of the well.

10.4.1 The borehole shall be at least one and three-quarters (1.75) inches in diameter larger than the nominal diameter of the casing when grout is required in the annulus.

10.4.2 Centralizers shall be used on casing when the borehole diameter is more than three (3) inches greater than the nominal diameter of the casing unless the casing is mechanically centered in the borehole during grout placement. The distance between centralizers shall not exceed 50 feet.

10.4.3 All wells shall have watertight steel casing and joints installed from one (1) foot above to nineteen (19) feet below ground surface. Watertight casing and joints shall be installed to the top of the production zone. Dewatering, monitoring and observation, and recovery wells are exempt from this standard if it conflicts with the intended use of such wells.

10.4.4 In the event the outermost casing does not extend one (1) foot or more above ground surface, the annulus between the two outermost casings must have a watertight seal.

10.4.5 It shall be the responsibility of all persons authorized to construct wells to make sure the well is completed in only one aquifer unless permitted otherwise by the State Engineer.

10.4.6 All wells except recovery and monitoring and observation wells shall be constructed to seal off known sources of contaminants.

10.4.7 If a filter pack is installed in a well, the interval of the

filter pack materials shall not extend through either the upper or lower confining layer. If additional filter pack materials are to be added after the well has been completed, those materials shall be installed through a filler tube.

10.4.8 Prior to the construction of infiltration galleries, written plans detailing the location and size of the proposed excavation, size and materials to be installed, amounts, types and placement method of grout and backfill materials to be used and other information pertinent to the construction and use shall be submitted to the Board. If the Board finds the proposed gallery acceptable, it shall approve the construction plan in writing, imposing conditions necessary to protect the public health and prevent contamination of the aquifer.

10.5 Grout and Grout Placement - All wells shall be grouted to prevent contaminants from entering the well bore, to separate ground waters in different aquifers, and to seal off water bearing zones known or suspected to contain contaminants. To achieve these objectives, the selection, mixing and placement of all grout shall be the responsibility of the person authorized to construct the well.

10.5.1 Only grout materials which meet the requirements set forth in Table 1 shall be used.

10.5.1.1 All grout slurry shall be uniformly mixed prior to placement in the well. The grout slurry density shall be reported on the completion report along with the percent of each additive material used in the grout mixture.

10.5.2 The following minimum grout intervals shall be used in all wells:

10.5.2.1 At least ten (10) vertical feet of grout shall be placed around the outermost casing. The top of this interval shall be either the ground surface or not more than three (3) feet below the pitless adapter. Dewatering, monitoring and observation, and recovery wells are exempt from this standard if it conflicts with the intended use of such well.

10.5.2.2 A minimum grout interval of twenty (20) feet shall be placed opposite each confining layer.

10.5.2.3 All known water bearing zones containing contaminants shall be sealed off by placing grout throughout the interval from 20 feet below to 20 feet above those zones. Monitoring and observation wells are exempt from this requirement to the extent it interferes with the purpose of the wells.

10.5.3 The method of grout placement shall achieve a watertight seal for the required interval(s).

10.5.3.1 Grout slurries shall be placed by positive displacement using either the well casing or a tremie pipe, and grouting of each interval or stage shall be installed from the bottom up in one continuous operation unless placed in accordance with Rules 10.5.3.2 or 10.5.3.3.

10.5.3.2 Only neat cement or cement-bentonite grouts can be poured and then only into a dry annulus where the borehole diameter is at least two (2) inches larger than the outside diameter of the casing and the placement depth does not exceed thirty (30) feet. The borehole diameter need only be one and three quarters (1.75) inches larger than the nominal casing size when the cement is placed into the annulus and the casing is vibrated using a down hole air hammer.

10.5.3.3 Cement sand or concrete grout mixtures can be poured only into a dry annulus where the borehole diameter is at least twelve (12) inches larger than the outside diameter of the casing and the placement depth does not exceed twenty (20) feet.

10.5.4 It is the responsibility of the person authorized to construct the well to allow the grout to set before resuming construction. The recommended minimum setting time shall be four (4) hours for grout with accelerators and twenty-four (24) hours for grout without accelerators.

10.6 Well Development and Cleaning - Immediately following construction, all wells shall be cleaned and developed to remove drilling fluids and other foreign materials, except where this procedure interferes with the purpose of the well.

10.7 Well Testing - When water from the well will be put to beneficial use, the well shall be tested to determine the stabilized pumping conditions wherein the sustained yield and the drawdown do not change by more than ten (10) percent during the last hour of the test.

10.8 Disinfection - Prior to leaving the well site the person authorized to construct the well shall disinfect the well according to the provisions of Rule 16. Monitoring and observation wells, recovery wells and dewatering wells are exempt from this standard if it conflicts with the purpose of the well.

10.9 Water Level Measurement - The static water level in all newly constructed or modified wells, where water will be put to beneficial use, shall be measured by the well construction or pump installation contractor, or private driller, within seven days after the well has been cleaned and

developed. This measurement shall be reported on the well completion report.

10.10 Flowing Wells - Upon completion of grouting, flowing wells shall be equipped with either a valve, threaded coupling, or other suitable means to completely control the flow from the well, or the well shall be abandoned in accordance with Rule 11. Flowing wells shall be constructed to prevent any leakage around the casing or adjacent to the well.

## RULE 11 ABANDONMENT STANDARDS

### 11.1 General

11.1.1 The plugging and sealing of all wells and test holes is necessary to prevent contamination of ground water and the migration of water through the unused borehole. It is the ultimate responsibility of the well owner to have a well properly plugged and abandoned. The well construction contractor is responsible for notifying the well owner of the plugging and abandonment requirement pursuant to this Rule 11.

11.1.2 Persons authorized to install pumping equipment may plug and abandon wells which do not require the removal of casing from more than one aquifer or the ripping or perforating of casing opposite confining layers.

11.1.3 All materials used for backfilling shall be clean, free from contaminants and chemically inert.

11.2 Unconfined Wells - Wells completed into unconfined aquifers shall be abandoned by filling with either on-site materials, clean sand or gravel to the static water level, then with chemically inert materials to the ground surface. A permanent watertight cover shall be installed at the top of the casing. The casing may be cut off up to five (5) feet below ground level provided the watertight cover is welded or permanently attached to the top of the casing and the hole is backfilled to the land surface. (1)

11.2.1 Cathodic protection holes, dewatering wells, horizontal drains, monitoring and observation holes, percolation holes, piezometer holes, sump pumps and test holes shall be abandoned either pursuant to Rule 11.2 or by removing all casing which was installed and by filling the hole(s) with drill cuttings or chemically inert materials to within five (5) feet of the ground surface. The top five (5) feet of the hole shall be sealed with materials equal to or less permeable than the top foot of the surrounding soils. (2)

### 11.3 Confined Wells

11.3.1 Wells which were constructed through more than one aquifer

shall be abandoned by placing a grout plug at the confining layer above each aquifer. If records do not show that the casing opposite each confining layer has been grouted when originally installed, the casing shall be either completely removed from the hole, or perforated or ripped opposite such layer prior to placing the grout plug. No plug shall be less than twenty (20) feet in length.

11.3.2 The well casing except for the grout plug intervals shall be completely filled to the land surface with chemically inert materials. A watertight cover will be permanently welded or attached to the top of the casing. The casing may be cut off up to five (5) feet below land surface provided the watertight cover is welded or permanently attached to the top of the casing and the hole is backfilled to the land surface.

## RULE 12 MONITORING AND OBSERVATION HOLES AND TEST HOLES

12.1 General - Monitoring and observation holes and test holes may be constructed by other than a well construction contractor pursuant to Rule 7. Table 2 summarizes the license and notice requirements for monitoring and observation holes and test holes. The person authorized to construct and to plug these holes shall keep accurate records of their work.

12.1.1 All monitoring and observation holes and test holes shall be constructed pursuant to the provisions of Rule 10 except where those requirements conflict with the intended use of the holes. All of these holes shall be abandoned according to the provisions of Rule 11.

12.1.2 When unattended, all monitoring and observation holes and test holes shall be securely capped or covered. Precautions shall be taken at all times to prevent contamination of the aquifer.

### 12.2 Monitoring and Observation Holes

12.2.1 Prior to the start of construction of any monitoring and observation hole, the State Engineer shall be notified pursuant to Rule 6.3. The notice shall be valid for three (3) months from the date of its writing. The State Engineer may require a geologic log for any monitoring and observation hole.

12.2.2 The testing and/or pumping of any monitoring and observation hole shall not exceed a total of seven (7) days in any one year unless prior written approval for additional testing is obtained from the State Engineer. The well owner or his agent shall be responsible for obtaining permits and complying with all rules and regulations pertaining to the discharge of all fluids produced during the testing.

12.2.3 All monitoring and observation holes shall be plugged and abandoned within one (1) year after their construction unless a permit has been obtained from the State Engineer. \*

12.2.4 The geologic log and any water level or water quality data obtained from monitoring and observation holes shall be submitted to the State Engineer upon their request.

### 12.3 Test Holes

12.3.1 Notice of the intent to construct test holes shall be submitted to the State Engineer for those holes which are expected to penetrate through a confining layer. Notice is not required for holes which are not expected to penetrate a confining layer.

12.3.2 Test holes shall be plugged and abandoned within ninety (90) days of their construction. \*

12.3.3 Submittal to the State Engineer of a geologic log or completion report is not required unless the test hole penetrates through a confining layer between aquifers.

## RULE 13 MINIMUM PUMP INSTALLATION STANDARDS

13.1 General - All permanent pump installations shall be completed only by a pump installation contractor or a private pump installer.

13.1.1 Well drilling contractors who are not pump installation contractors shall be allowed to install temporary pumps used only for development, testing and determination of well yield.

13.1.2 Pump installation contractors shall not remove and install casing except for the installation of pitless adapters or pitless units, the repair and extension of existing casing and the replacement of liners through only one aquifer.

13.2 Installation Standards - Pumps and related equipment shall be installed in such a manner that the well, pump and surrounding area can be kept in a sanitary condition, and will provide adequate protection against contamination from any surface or subsurface source.

13.2.1 The outermost casing shall be steel and extend a minimum of one (1) foot above the finished ground level. No casing shall be cut off or penetrated below ground level except to install a pitless adapter.

13.2.2 In the event the outer casing is cut off and a pitless unit installed on the production casing, the annulus between the production casing and the outer casing shall have a watertight seal.

13.2.3 All pumping equipment where water will be used for human consumption shall be installed with an effective watertight well seal at the top of the casing which will prevent the entry of contaminants into the well. The pumping equipment shall be designed to allow for its installation and removal through an approved well seal and to prevent unprotected openings from connecting with the interior of the pump or well. Other pumping equipment shall be installed to prevent aquifer contamination.

13.2.4 Pitless adapters if used shall be connected to the well casing and shall be watertight.

13.2.4.1 All connections to the pitless adapters shall be made with threaded, flanged, welded or mechanical joints. Mechanical joints shall be rodded across the connection and secured to the body of the well casing or pitless assembly.

13.2.5 All non-flowing pump installations shall be vented to the atmosphere at the well seal. This vent shall permit air to enter and leave the well freely as the water level changes. Vents may be an integral part of the well seal or be attached to the seal and terminate a minimum of one (1) foot above the finished ground level, be turned down, and screened to prevent entry of insects and rodents. Vents shall be constructed to vent all gases to the atmosphere outside of a building and to prevent gas accumulation which could produce a health or explosion hazard.

13.2.6 Flowing wells shall be equipped to prevent the uncontrolled discharge of water from the well.

13.2.7 Pump Sizing - All pumping systems shall be designed not to exceed the permitted pumping rate at the point of delivery when operating under normal design conditions.

13.3 Well Vaults - Well vaults shall be properly constructed and maintained to prevent contaminants from entering the well.

13.3.1 Existing Well Vaults -

13.3.1.1 The vault shall be structurally sound to support anticipated surface loads and the top shall be watertight including any manhole covers.

13.3.1.2 The well casing shall extend at least one (1) foot above

the floor of the vault and have a well seal to prevent contaminants from entering the well.

13.3.1.3 Provisions shall be made for gravity drainage of the vault through a floor drain or to an automatic sump pump. All drain openings shall be screened to prevent the entry of rodents and insects.

13.3.2 New well vault installations are not permitted unless specifically approved by the Board.

13.3.3 All well construction or pump installation contractors encountering unacceptable well vaults shall make every effort to bring the well vault into compliance with these Rules. If it is not possible to correct the problems, then the contractor shall notify the State Engineer.

13.4 Water Level Measurement Access - An air line, water level sounding tube or other method approved by the Board shall be installed on all wells whenever the permit issued by the State Engineer requires the installation of water level measuring equipment.

13.4.1 An air line tube shall consist of tubing extending from the well head to the top of the pump discharge case. This tubing shall be capable of withstanding the maximum pressures developed during use. The tube shall be securely fastened to the pump discharge case, column pipe or drop pipe. The depth of the air line shall be recorded on the Pump Installation Report.

13.4.2 The water level sounding tube shall have a minimum inside diameter of 3/4 inch. It shall extend from the well head to the top of the pump discharge case and shall be securely attached to the column or drop pipe so that it hangs straight. All tubes shall be equipped with a removable cap or plug to prevent entry of foreign material. The bottom of the tube shall be constructed to allow the free entry and exit of water and to prevent the measuring device from passing out of the bottom of the tube.

13.5 Compliance with Applicable Law - All persons authorized to install pumps shall comply with applicable federal, state, county, municipal, or local laws, regulations, and codes.

13.5.1 Electrical Connection of Pumping Equipment - All persons authorized to install pumps or licensed electrical contractors, using appropriately licensed personnel, may install all electrical materials and connections between the well head junction box and the pump disconnect box (see Figure 2). Electric power to the disconnect box shall be installed by either a licensed electrical contractor or the homeowner with proper permits and inspection. As a minimum, all materials and fittings used to connect

the electric power to the pump motor shall meet the standards of the Colorado State Electrical Board.

13.5.2. Plumbing Connection of the Pumping Equipment - All persons authorized to install pumps or a licensed plumbing contractor may install all piping and connection between the well and the point of discharge from the pressure tank, if such a tank is installed. As a minimum, all materials and fittings used to connect the well to the pressure tank shall meet the standards of the Colorado Examining Board of Plumbers.

13.6 Pressure Relief Valve - All pressurized pumping systems capable of producing a pressure greater than seventy-five (75) pounds per square inch shall be equipped with a pressure relief valve sized to relieve the production rate of the pumping system.

13.7 Backflow Prevention - Pump installations shall have check valves, backflow preventing devices or suitable air gap cross-connection controls, if necessary to prevent damage to the pumping equipment and contamination of the aquifer.

13.7.1 Pump installations supplying irrigation water where fertilizers, insecticides, herbicides or other chemicals are injected into the water shall be equipped to prevent well or aquifer contamination. The installation shall comply with Section 35-11-107, C.R.S. and the rules and regulations promulgated pursuant to Section 35-11-104, C.R.S.

13.7.2 Pump installations supplying water where contaminants are injected into the water system shall be equipped to prevent the contaminated water from flowing back into the well and aquifer.

13.8 Disinfection - After installing a pump and prior to leaving the well site, persons authorized to install pumps shall disinfect the well, pump, and accessible water supply system according to the Provisions of Rule 16. Monitoring and observation wells, dewatering wells, and recovery wells are exempt from this standard if it conflicts with the purpose of the well.

13.9 Well Testing - For wells where water is put to beneficial use the pumping system shall be tested to determine the sustained production rate when the initial pump is installed or when a new pump is installed for a larger permitted pumping rate.

#### RULE 14 SAMPLING, MEASURING AND TEST-PUMPING

14.1 Well Owner's Knowledge - All sampling, measuring and test pumping shall be conducted only with the well owner's knowledge.

14.2 Measuring Devices - All measuring and sampling devices and equipment shall be cleaned, decontaminated and disinfected in accordance with Rule 16 prior to being inserted into any well.

14.3 Removal of Well Seal - Only the well owner or his agent shall remove a well seal. Whenever the seal is removed from a well being used for human consumption, the well shall be disinfected according to Rule 16.

14.4 Measuring, Sampling and Test Pumping - Engineers, geologists, or hydrologists or anyone directly employed by or under the supervision of an engineer, geologist or hydrologist may measure, sample or test-pump wells for scientific, engineering and regulatory purposes. Their activities shall be limited to measuring water levels, collecting water samples and the installation of pumps dedicated solely to scientific, engineering or regulatory purposes, provided this work complies with the standards in these Rules.

14.5 Protection from Contamination - If a well is equipped with an air line or water level sounding tube accessible without removing the well seal, then licensed contractors, engineers, geologists or hydrologists, or anyone directly employed by, or under the supervision of one of these individuals, may use these devices for sampling and measurement.

14.6 Lost Equipment - It is the responsibility of the person doing the testing, sampling or measuring to inform the well owner in writing of any equipment malfunction, equipment loss in the well or difficulties encountered.

## RULE 15 REPORTING REQUIREMENTS

15.1 Work Reports - Reports shall be submitted to the State Engineer which describe: where, when and how all wells have been constructed; the pumping equipment installed in water wells; and a description of how wells are plugged and abandoned.

15.1.1 Well contractors or private well drillers shall report where and when the well was drilled. They shall also describe the specifics of each well's construction and include a lithologic log of the geology and geophysical log if required by the permit. The report shall also contain detailed information from the well test in accordance with Rule 10.7.

15.1.2 Pump installation contractors and private pump installers shall submit a report when the permanent pump is originally installed that describes the pump, date of installation, its depth setting and results from the pumping system test pursuant to Rule 13.9.

15.1.3 Abandonment reports shall be prepared for each well that is plugged and abandoned. The report will describe by location or permit number the well that was plugged. A detailed description of how the well was abandoned including types of materials used and method of placement shall be reported.

15.2 Format of Reports - All work reports shall be submitted on forms provided by the State Engineer or may utilize computer generated permits which have been previously approved by the State Engineer. Incorporation of as-built drawings is encouraged, but shall be on sheets no larger than 8 1/2 x 11 inches. All of the applicable data requested on the form shall be accurately reported.

15.3 Timely Submittal - Work reports shall be submitted to the State Engineer within sixty (60) days after performing the work or within seven (7) days after the expiration of the permit, whichever is sooner.

15.4 Certification - All reports shall be signed and certified as to truthfulness by the well construction or pump installation contractor, private driller, or pump installer, professional engineer, or professional geologist who is responsible for work performed under his direction or supervision.

15.5 Unsanitary or Non-Compliant Conditions - All contractors repairing an existing well or pump shall report to the State Engineer any unsanitary or non-compliant conditions which he is unable to correct.

15.6 Copy of Report to Owner - A copy of all work reports shall be provided to the well owner.

15.7 Ground Water Quality Data - If ground water quality data for newly constructed wells are available to the well or pump installation contractor, he should submit a copy of that data to the State Engineer.

15.8 Reports for Monitoring and Observation Holes, Dewatering Wells and Test Holes - When reports are required for these types of structures, they shall at least describe where, when and how they were constructed. When they are abandoned they shall provide the same information required in Rule 15.1.3.

15.9 Data Confidentiality - In the event that the data provided contain trade secrets, privileged information, or confidential commercial, financial, geological, or geophysical data, the State Engineer shall deny the right of inspection of such data to any person and keep the data confidential pursuant to Section 24-72-204(3)(a)(IV), C.R.S. upon request of the applicant.

**RULE 16 MINIMUM DISINFECTION STANDARDS FOR WELLS**

16.1 Purpose - All materials installed in wells shall be thoroughly and carefully cleaned and disinfected to ensure that all disease carrying organisms are eliminated. Care should be exercised to make certain that all areas of the well including the filter pack come in contact with a solution containing enough available chlorine to completely destroy all harmful bacteria. Monitoring and observation wells constructed pursuant to regulatory or enforcement requirements, or where the use of a disinfectant may interfere with the purpose of the well, are exempt from this Rule.

16.2 Disinfection Solution - Disinfection of wells shall be accomplished with chlorine or chlorine compounds. Other disinfecting agents may only be used upon written approval by the Board. A solution having a minimum concentration of 100 parts per million (ppm or mg/l) of total chlorine shall be used to disinfect a well. Dry disinfectants used in the preparation of solutions shall not be outdated and shall be full strength.

16.3 Placement - The disinfection solution shall be thoroughly mixed throughout the well. Agitation of the solution is best accomplished through use of a pump and recirculation. If no pump is available, a bailer, plunger or other approved method shall be used. The solution shall be circulated throughout the entire water system as it exists or is accessible.

16.4 Contact Time - The disinfection solution shall be in contact with the well, pump or distribution system for sufficient time to kill any harmful bacteria.

16.4.1 Decontamination of wells where a pump will not be installed in the immediate future can be accomplished by adding and mixing enough disinfectant to reach a concentration of at least 100 parts per million. That concentration shall be left in the well to await pump installation at a later date.

16.4.2 Following the installation of all pumps in a well it is necessary to disinfect the well, pump, and that part of the distribution system which is accessible. After placement, mixing and recirculation, the disinfectant solution shall remain undisturbed in the well and distribution system for as long as possible, but not less than three (3) hours, after which time the chlorine concentration shall be at least 25 ppm.

16.5 Flushing of Disinfectant - After disinfection of the entire well system and prior to the use of water, all the remaining disinfectant solution shall be thoroughly flushed from the well and water supply system and disposed of properly.

16.6 Test Equipment Disinfection - If the well will not be disinfected after completion of testing, all equipment inserted into wells for sampling, measuring and test pumping shall be disinfected for not less than fifteen (15) minutes by contact with a solution having a minimum concentration of 300 ppm total chlorine prior to inserting the equipment into the well.

16.7 Recommended Mixing of Disinfecting Solutions - One ounce of dry HTH or equal powder (70% available chlorine), dissolved in 52.5 gallons of water, makes a 100 ppm strength disinfectant solution. One cup of liquid household bleach (5% available chlorine) mixed in 31.2 gallons of water makes a 100 ppm strength disinfectant solution. Various proportions can be worked out using the following approximate quantities:

Approximate Amount of Dry Powder or Liquid Bleach Required  
To Make a 100 ppm Chlorine Solution

<u>Diameter of Water Column (Inches)</u>	<u>Volume of Water In 100 Feet of Column (Gals.)</u>	<u>Dry Powder 1) (Cups)</u>	<u>Liquid Bleach 2) (Cups)</u>
4	65.5	1/4	3
6	147	1/2	5
8	261	3/4	9
10	408	1	14
12	587	1 1/2	19

- 1) Volume of dry powder based on 70% available chlorine, shall be rounded up to the nearest 1/4 cup marking on a standard measuring cup.
- 2) Volume of liquid bleach based on 5% available chlorine, shall be un-scented, and shall be rounded up to the nearest full cup marking on a standard measuring cup.

**RULE 17            VARIANCES**

17.1 General - When the strict application of any provision of these Rules presents practical difficulties or unusual hardship, the Board may grant a variance for a specific instance including conditions necessary to protect the ground water and aquifers from contamination.

17.1.1 Any request for a variance shall be submitted in writing and shall be signed by the well owner or agent. Such request shall specify: the nature and reason for seeking the variance, the proposed construction

details, and special precautions that will be taken to protect the well from contamination.

17.1.2 The Board shall respond in writing to a variance request in a reasonable amount of time. It shall give reasons for its decision and may impose terms and conditions to protect public health and safety or prevent aquifer contamination.

#### **RULE 18 EMERGENCY**

18.1 In the event of an emergency, construction of replacement, monitoring and observation wells, or recovery wells may begin after verbal approval has been granted by the State Engineer. After-the-fact permit applications shall be submitted by the well owner within ten days after construction begins. The application shall include construction details of the well.

18.2 The well owner or his agent shall be responsible for securing a permit for the construction of any well for which verbal approval has been granted.

#### **RULE 19 SEVERABILITY**

19.1 If any portion of these Rules is found to be invalid, the remaining portion of the Rules shall remain in force and unaffected.

#### **RULE 20 REVISIONS**

20.1 The Board may revise these Rules in accordance with Section 24-4-103, C.R.S.

#### **RULE 21 STATEMENT OF BASIS AND PURPOSE INCORPORATED BY REFERENCE**

21.1 The Statement of Basis and Purpose of the Board of Examiners for the "Revised and Amended Rules and Regulations for Water Well Construction and Pump Installation" is incorporated by reference as part of these Rules.

#### **RULE 22 EFFECTIVE DATE**

21.1 These Rules shall become effective on August 1, 1988.

## TABLE 1

## Acceptable Grouts

**Neat Cement:** a slurry of cement and water in a ratio not to exceed seven (7) gallons of water per 94 pound sack of cement.

**Cement-Bentonite:** a slurry of cement, bentonite and water. The amount of bentonite added shall not exceed 8% bentonite per dry weight of cement. The volume of additional water used in preparing these slurries is limited to three quarters (0.75) of a gallon per 94 pound sack of cement for each 1% of bentonite added.

**Cement-Sand:** a slurry of cement, sand and water. The amount of sand added shall not exceed 140 pounds for each 94 pound sack of cement. Not more than seven (7) gallons of water per 94-pound sack of cement shall be used in the preparation of these slurries. These slurries should be used where extra strength or bulk is required.

**Concrete:** a slurry of cement, sand and gravel aggregate. The amount of aggregate added shall not exceed 400 pounds for each 94 pound sack of cement. Not more than seven (7) gallons of water per 94-pound sack of cement shall be used in the preparation of these slurries. These slurries should be used where extra strength and bulk is required and the annular space allows the placement of the slurry.

**Bentonite Grout:** a slurry of bentonite clay and water. A uniform slurry density of 9.4 pounds per gallon shall be achieved prior to placement of the grout. The density shall be measured using a "mud balance". This slurry shall not be used to grout the outermost casing of a well. This grout shall not be used to grout the top twenty (20) feet below land surface.

**Bentonite Solids:** solid granular bentonite may be used as grout material only in saturated zones. The bentonite shall be placed directly into the appropriate interval. If the bentonite is dropped into the hole, its placement shall subsequently be verified. This grout shall not be used to grout the outermost casing of the well.

Prior to the use of other grout materials a written request shall be submitted to and written approval obtained from the Board.

**TABLE 2. MINIMUM LICENSE AND PERMIT REQUIREMENTS FOR WELLS**

Type of Well	Depth of Well			
	Does Not Penetrate Through A Confining Layer		Penetrates Through A Confining Layer	
Water Wells	License 1)	Permit	License	Permit
Monitoring and observation wells and recovery wells 2)	No License	Permit	Special License 1)	Permit
Monitoring and observation holes and dewatering wells 2)	No License	Notice	Special License	Notice
Test Holes 3)	No License	No Notice	Special License	Notice

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- 1) Licensed contractor may do work requiring special license or no license and special licensed contractor may do work requiring no license.
- 2) Monitoring and observation wells and holes shall not be converted into producing water wells unless originally constructed by a well construction contractor. Monitoring and observation holes shall be abandoned within one (1) year (see Rule 12.2.3).
- 3) Test hole requirements also apply to cathodic protection, grouting, percolation, pier and piezometer holes, horizontal drains, and sump pumps. Test holes shall not remain open more than ninety (90) days (see Rule 12.3.2).

FIGURE 1: MINIMUM DISTANCE OF A WELL FROM A SOURCE OF CONTAMINANTS  
(See Rule 10.2.2)

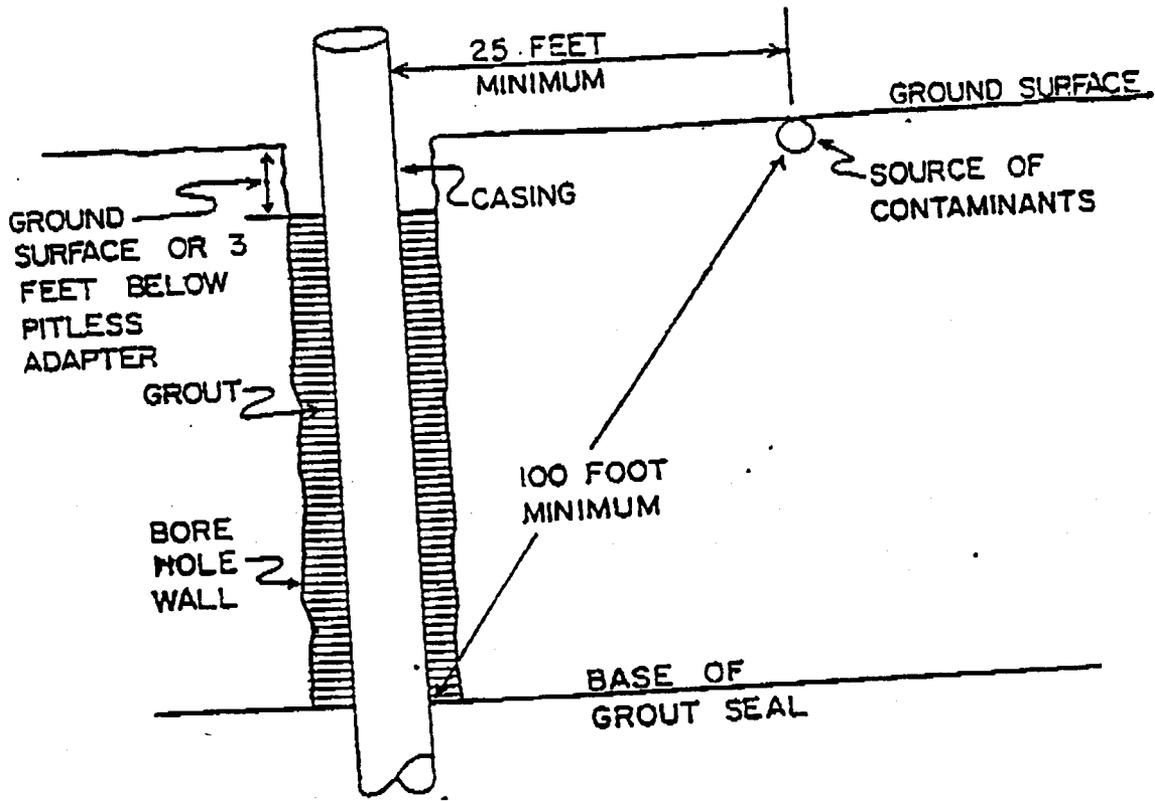
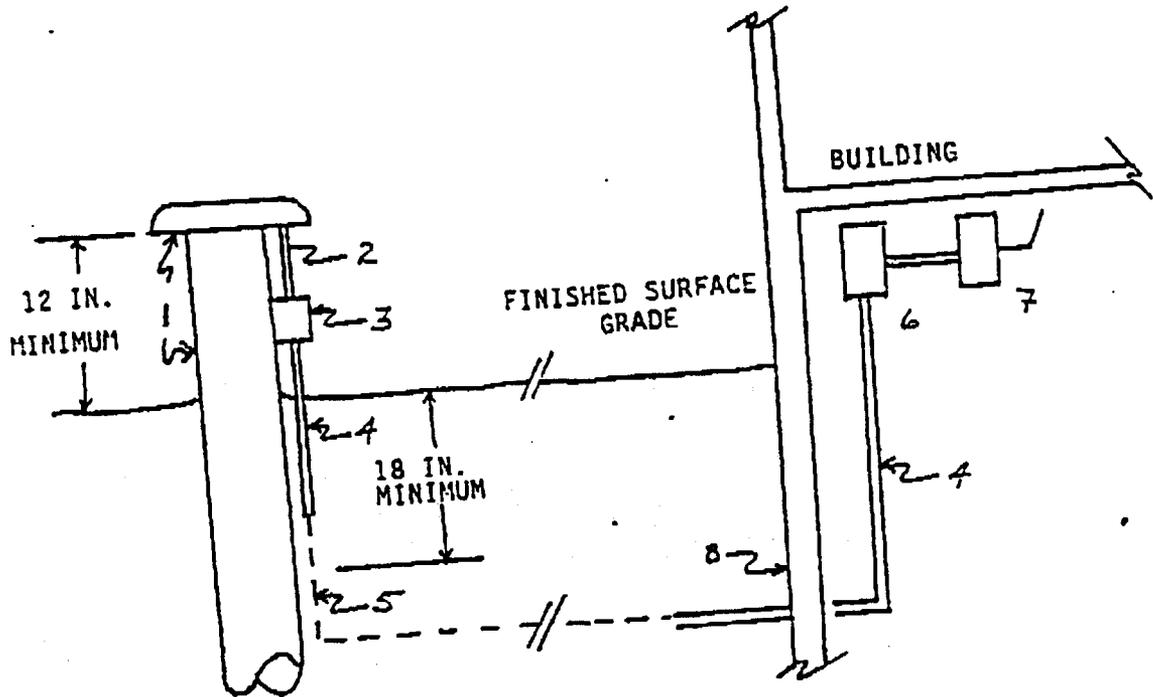


FIGURE 2: REQUIREMENTS FOR ELECTRICAL WIRING TO THE WELL  
(See Rule 13.5.1)



- Legend -

1. Steel well casing with well seal.
2. Metal nipple.
3. Well head junction box - approved weatherproof box (can be FS box or bell box).
4. Approved electrical conduit - rigid metal or rigid non-metallic (Article 346-347).
5. All conductors shall be installed as approved by the Colorado State Electrical Board. Only those conductors listed as being suitable for direct burial in the earth may be buried without conduit.
6. Pump controller box, if necessary.
7. The electric disconnect and the electric power shall be furnished and installed by a licensed electrical contractor or homeowner with proper permits and inspection.
8. Building foundation - all wiring through or under foundation or under concrete floor to be in approved electrical conduit (NEC 300).