

# Wellhead Protection Section

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Missouri Geological Survey  
Geological Survey Program  
Wellhead Protection Section

# Trivia Questions

- What is the state mineral?

Galena

- What is the state fossil?

Crinoid

- What is the state rock?

Mozarkite

- What is the state's nickname? (Besides Show-Me State)

Cave State

# What We Do

We regulate the construction of most wells drilled in Missouri, to include:

- Water Wells
- Monitoring Wells
- Ground Source Heat Pump Systems
- Mineral Test Holes



# What We Do



We also regulate all work on:

- Pumps
- Pressure tanks
- Pressure switches
- Pipes from the well to the point of entry of the home or structure.

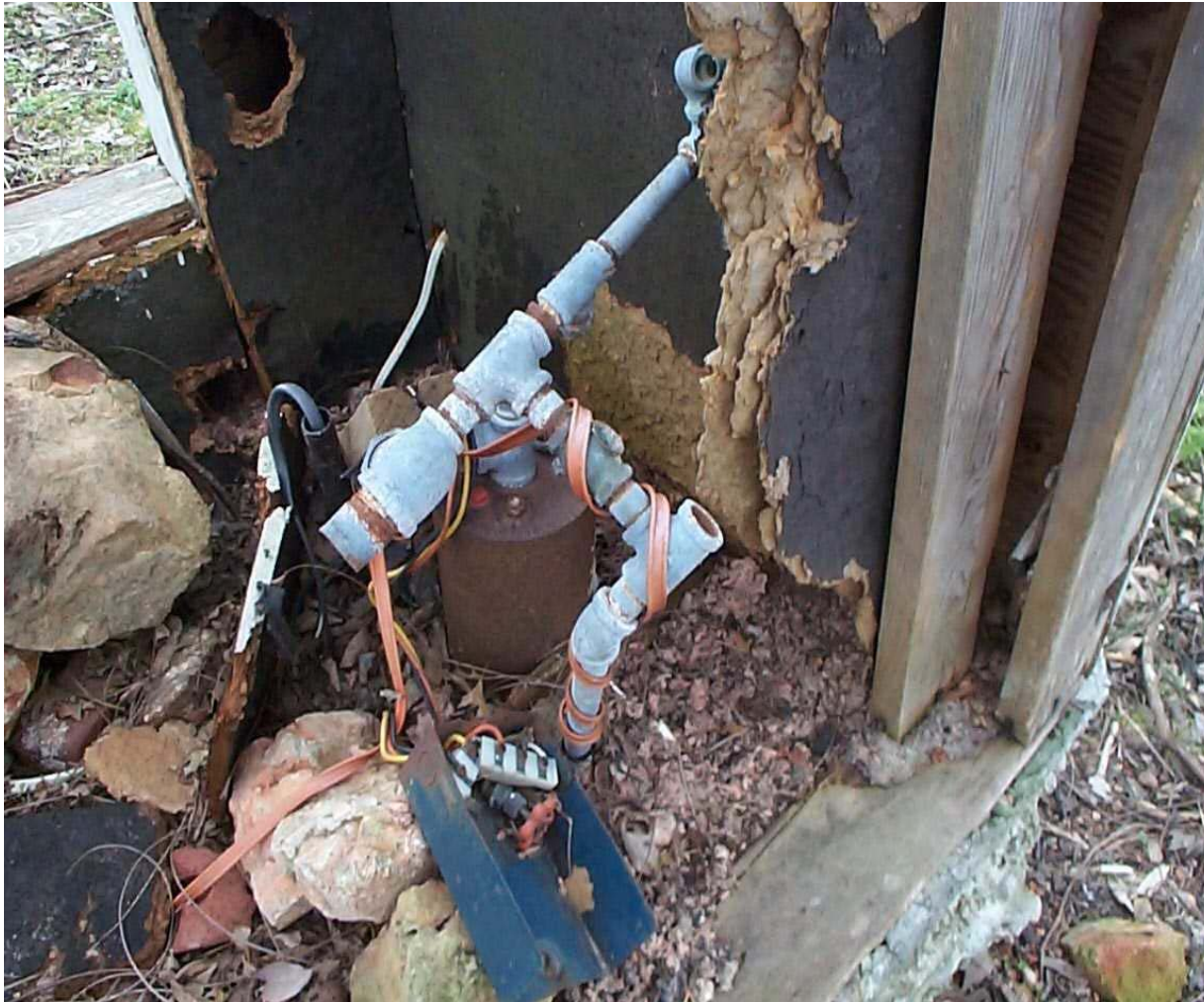


# What We Do

- Permit (license) Well Drilling and Pump Installation Contractors.
- Permit drill rigs, pump trucks and other service vehicles.



# What We Do



Regulate the proper plugging of abandoned wells.

# Water Well Driller's Act

Section 256.600-256.640 RSMo, authorizes the Missouri Well Construction Rules which are found in 10 CSR 23 Chapters 1-6 these rules regulate:

- Water wells
- Heat pump systems
- Monitoring wells
- Pump installation
- Test holes
- Permitting

[sos.mo.gov/adrules/csr/current/10csr/10csr.asp#10-23](http://sos.mo.gov/adrules/csr/current/10csr/10csr.asp#10-23)

# Processing Unit

- Data entry of all well records received
- Request missing information from well owners and/or contractors for well certification and/or registration
- Track abandoned wells
- Track public water supply notifications
- Track enforcement cases
- Handle testing and permitting of all apprentices and contractors



# Investigation and Remediation Unit

- Investigation of well concerns
  - Downhole camera investigations
  - Dye traces
- Conduct inspection of well sites
- Witness remediation of wells
- Review records for compliance with well construction rules
- Certification of wells
- Provide assistance with plugging abandoned wells





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# Bottom of Casing

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# Blockage

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# GENERALIZED GEOLOGIC MAP OF MISSOURI

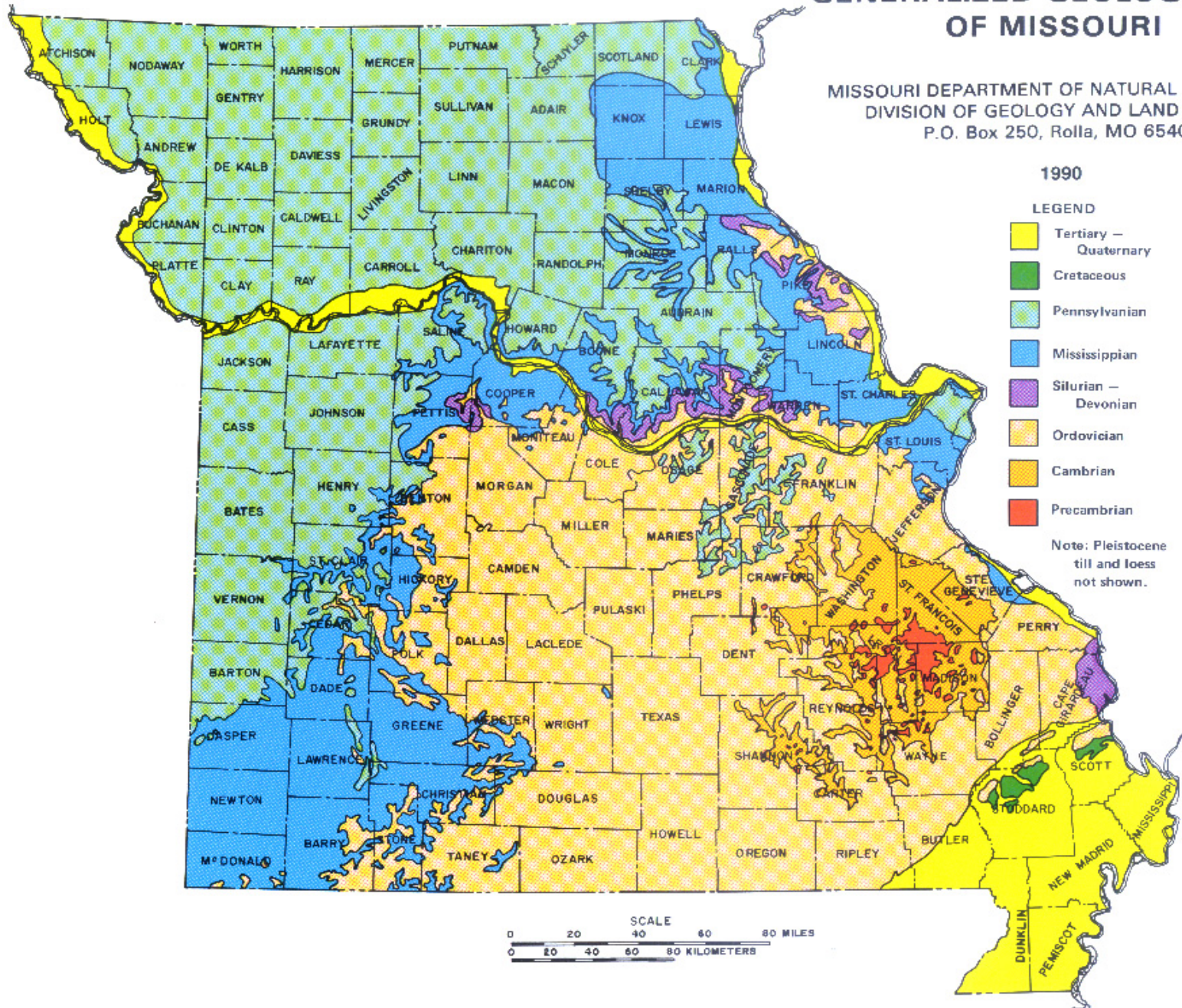
MISSOURI DEPARTMENT OF NATURAL RESOURCES  
DIVISION OF GEOLOGY AND LAND SURVEY  
P.O. Box 250, Rolla, MO 65401

1990

## LEGEND

- Tertiary – Quaternary
- Cretaceous
- Pennsylvanian
- Mississippian
- Silurian – Devonian
- Ordovician
- Cambrian
- Precambrian

Note: Pleistocene  
till and loess  
not shown.





# MISSOURI GROUND WATER

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## PRODUCTION REGIONS AND AQUIFERS

### GLACIAL DRIFT AND ALLUVIUM

Yield is normally 6-15 gpm (gallons per minute). Range 0-500 gpm. Bedrock aquifers generally yield mineralized water. Water should be treated for iron removal and chlorinated.

### PENNSYLVANIAN AND MISSISSIPPIAN LIMESTONE AND SANDSTONES

Yield 1-15 gpm to depth of 400 ± ft. Aquifers below 400 ft yield mineralized water.

Yield localized 1-10 gpm to depth of 450 ± ft. Aquifers below 450 ft yield mineralized water.

### CRETACEOUS SANDSTONES AND ALLUVIUM

Yield normally 1000+ gpm. Some wells flow. Cretaceous waters generally softer, lower temperature, and contain less iron than alluvial waters.

### ORDOVICIAN AND CAMBRIAN DOLOMITES AND SANDSTONES

Yield 15-500 gpm, depending on depth and formations penetrated. Local yields of as much as 1000 gpm in Springfield and Rolla areas. Yields of wells east of St. Francois Mt. region usually about 15 gpm. Water in deeper aquifers locally mineralized.

### CAMBRIAN AND PRECAMBRIAN ROCKS

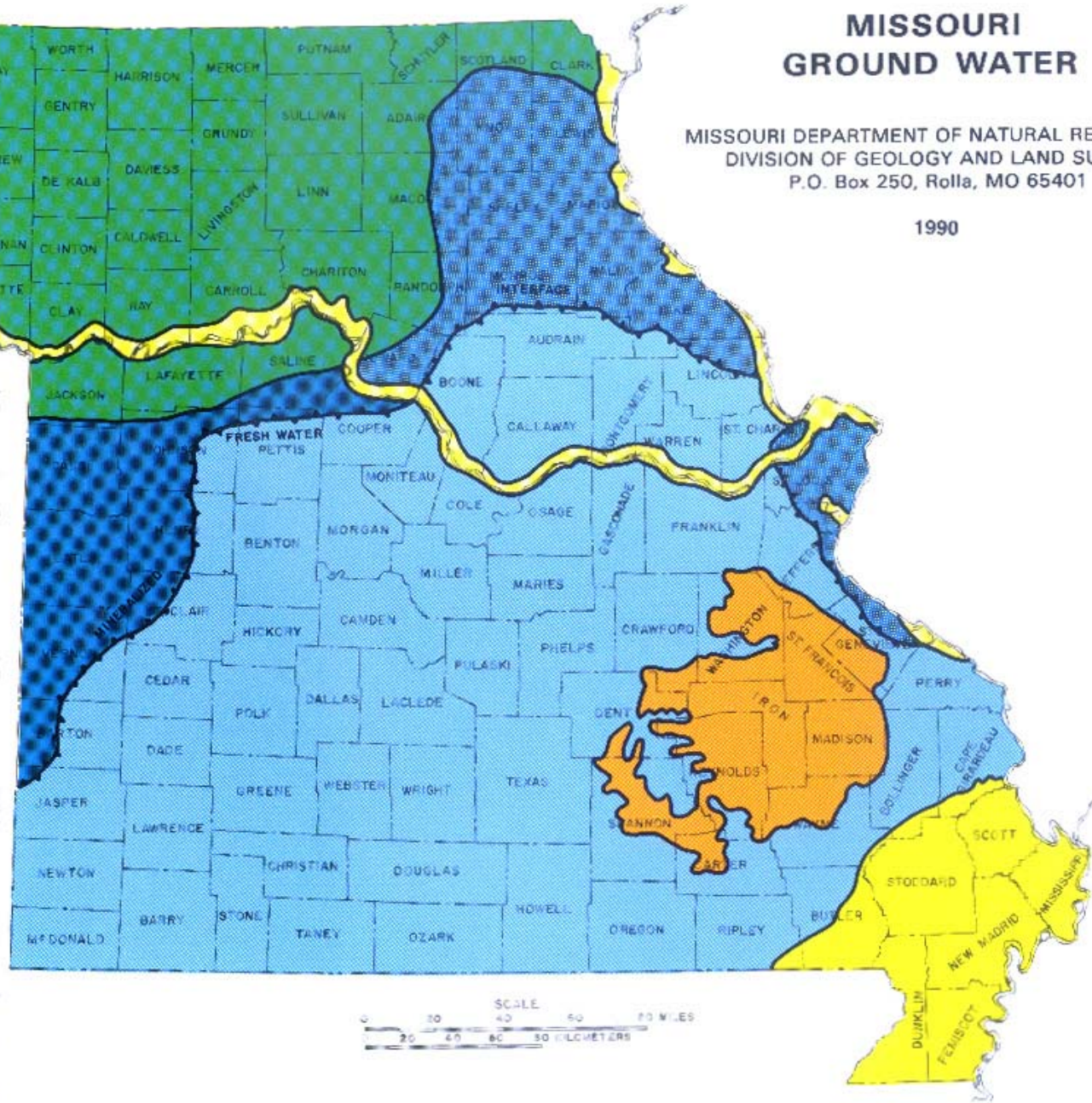
Yield is normally 45-50 gpm. Lemotte Sandstone in Potosi yields up to 300 gpm.

### ALLUVIUM (MISSOURI AND MISSISSIPPI RIVER VALLEYS)

Yield locally exceeds 1000 gpm. Water hard, with high iron content.

### FRESH WATER-SALT WATER TRANSITION ZONE

North and west of this "line," the more productive aquifers contain waters that are too high in total dissolved solids to be considered potable.

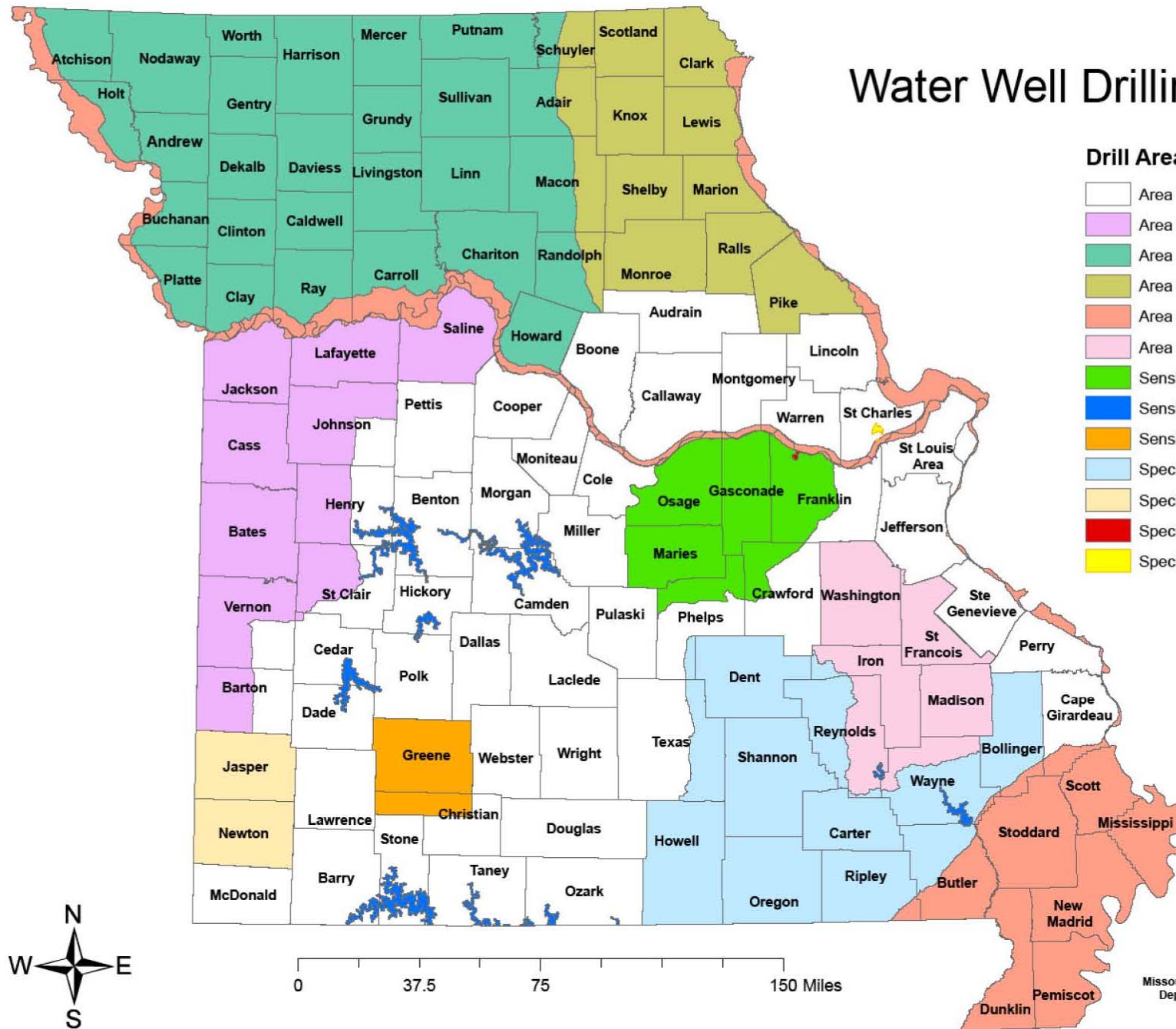




# Water Well Drilling Areas

## Drill Areas

- Area 1
- Area 2
- Area 3
- Area 4
- Area 5
- Area 6
- Sensitive Area A
- Sensitive Area B
- Sensitive Area C
- Special Area 1
- Special Area 2
- Special Area 3
- Special Area 4



Missouri Department of Natural Resources  
Department of Environmental Quality  
Wellhead Protection Section  
Compiled by ITSD-DNR

# Types of Water Wells

Public Water Well

Community Water System

Non-community Water System

Multi-Family Well – 3 to 14 connections <70 GPM

Domestic Well – 1 to 3 connections <70 GPM

High Yield Well – >70 GPM

Unconsolidated – no casing point

Bedrock – casing point required

# What is an Abandoned Well

The law says, “A well that has not been in use for 2 years or longer **AND** is in such a state of disrepair that continued use for obtaining groundwater is impractical.”

OR

A well that presents a threat to the groundwater.

Any well that meets either of these criteria must be plugged or repaired.



# Pre-law (1987) Domestic Well





# Pre-law (1987) Domestic Well







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# Hand Dug Well





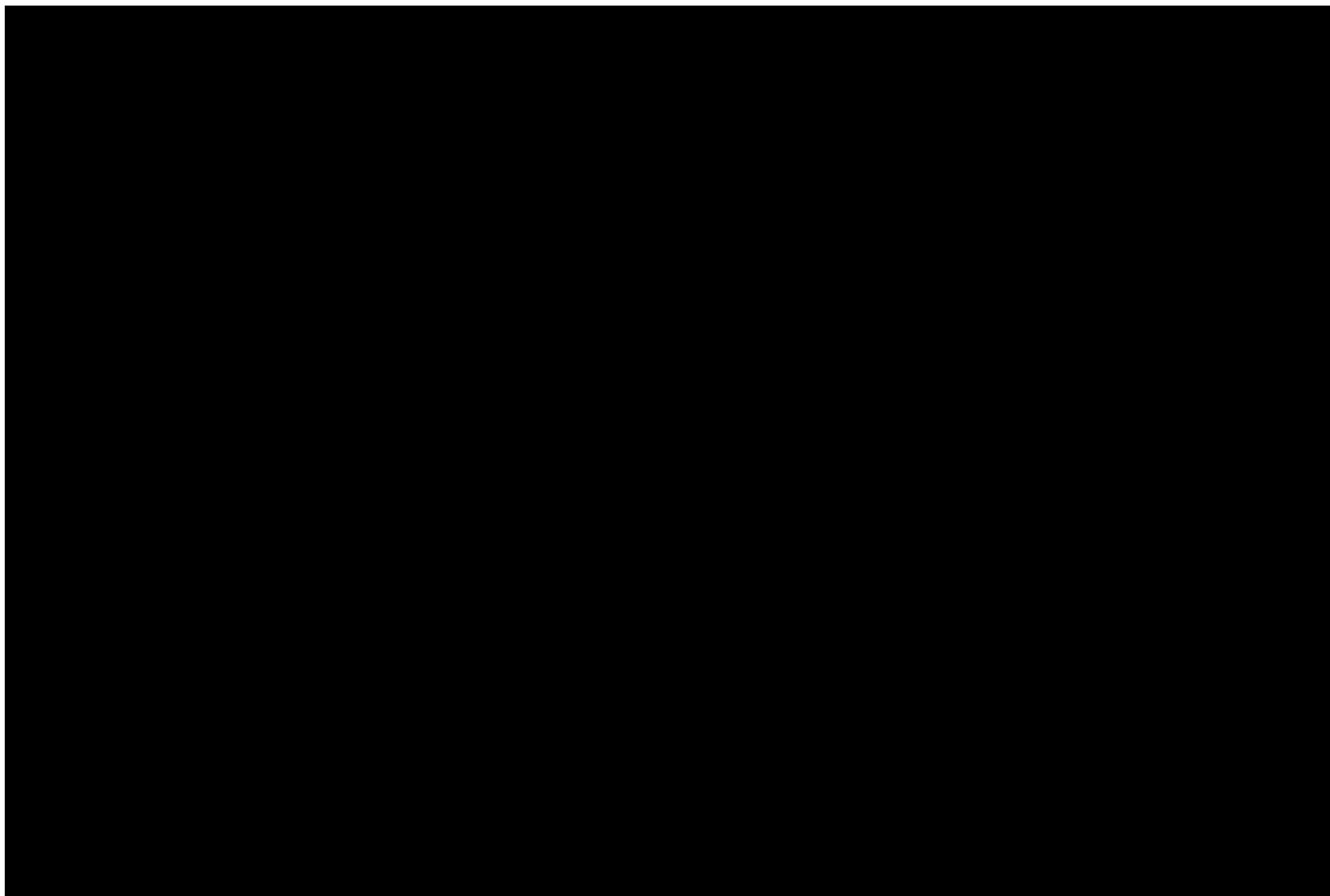


**According to the latest estimates, there are approximately 500,000 abandoned wells in Missouri.**



# Liner Collapse

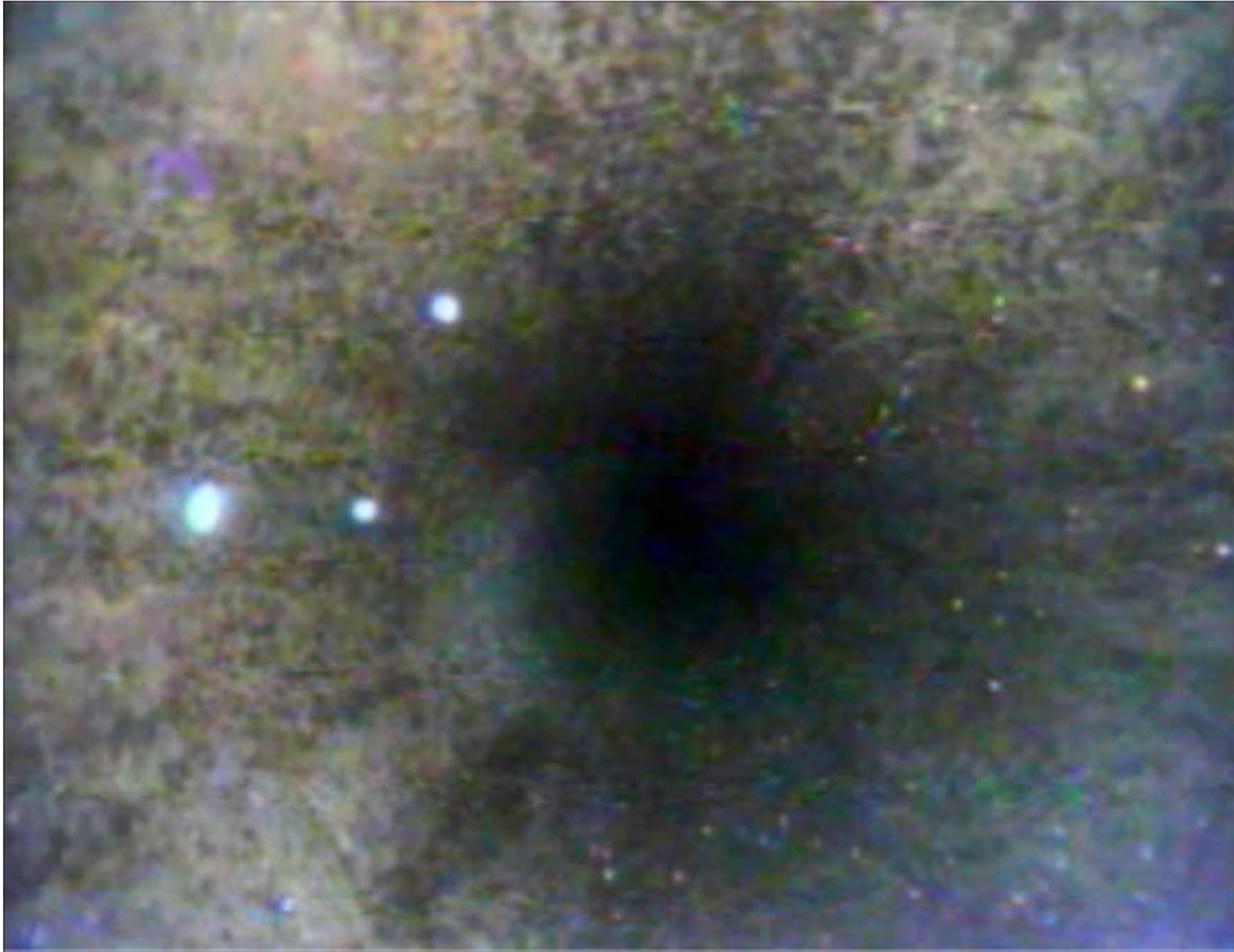
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# Leak





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# Blockage



# Why Plug Abandoned Wells?

- Abandoned wells can provide a conduit for contaminants into our groundwater resources.
- May cause harm to human health and safety.
- Abandoned wells are a potential liability to landowners.



# What does the law require to plug a well?

The first step is to determine the type of well being plugged.





# **Unconsolidated Material Irrigation Well**

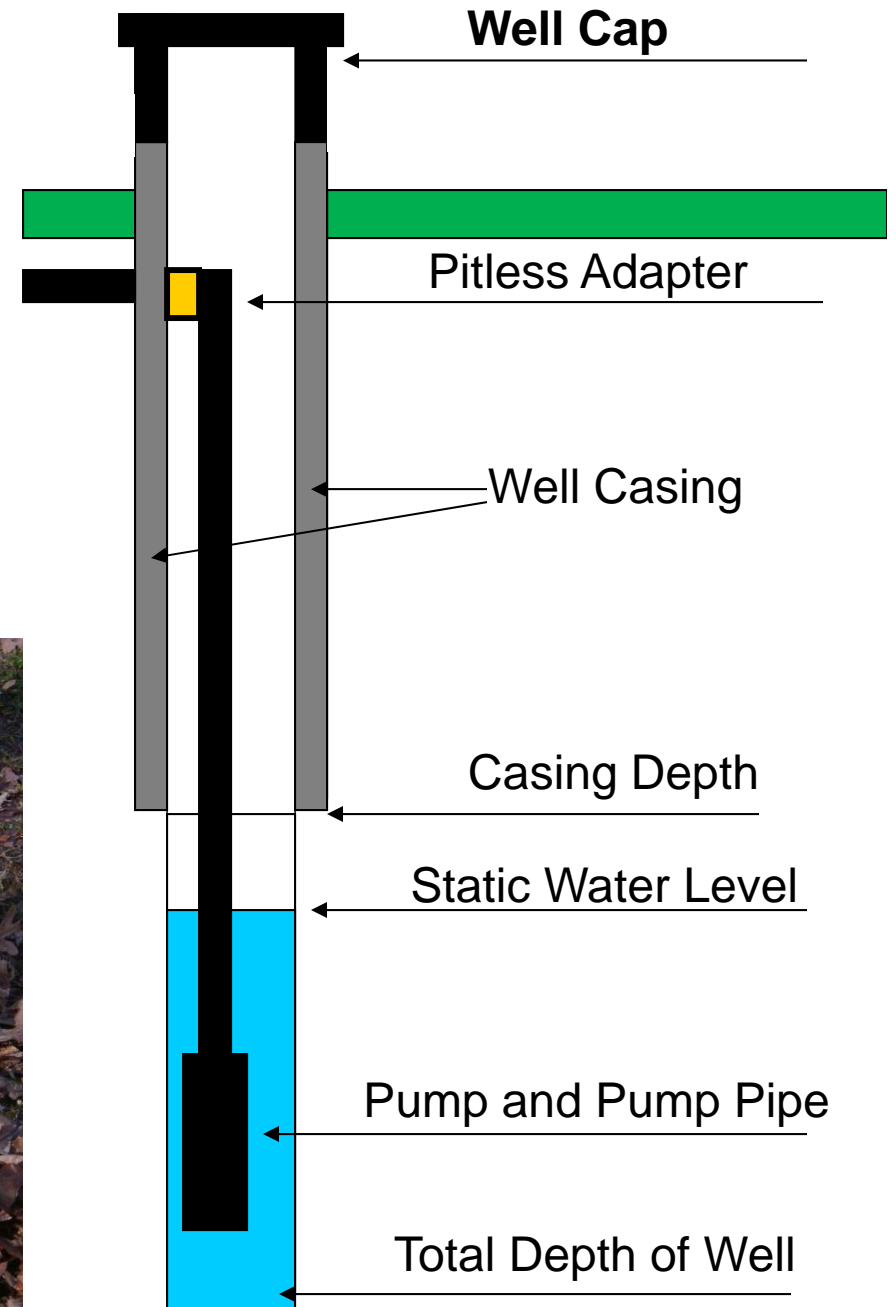


## **Pilot Well for Public Water District**





# Typical Well Construction for a Domestic Well



## Well Seal



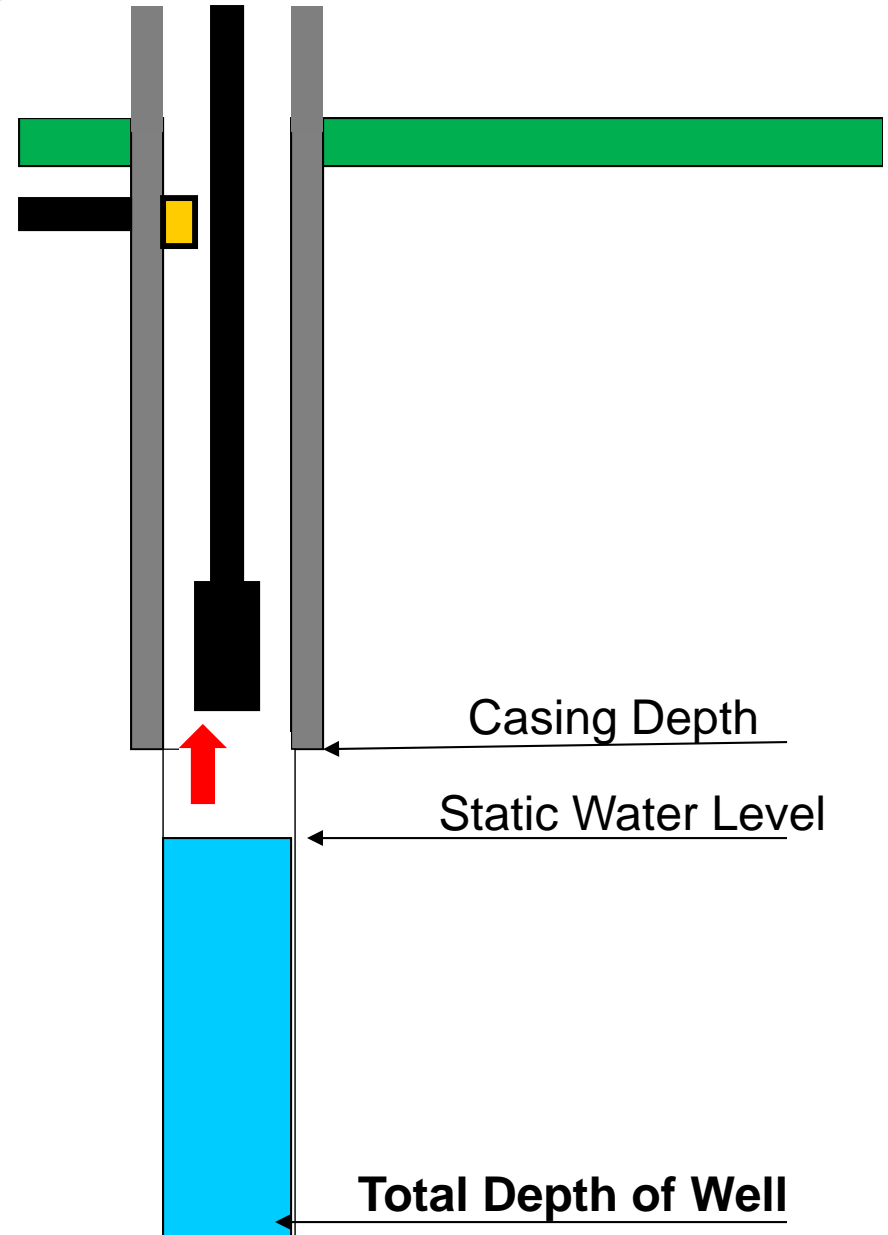


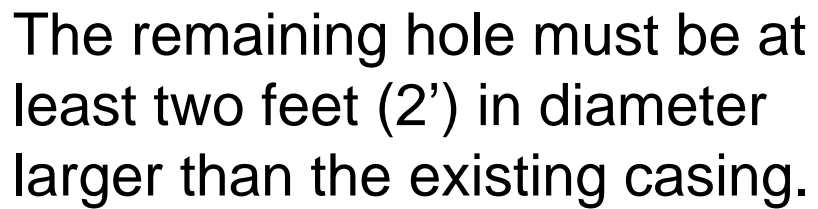
# Step 1



Remove the pump, pipe and debris from the well. Any liner must be removed.

Be sure to note the casing depth, static water level and the total depth of the well.





The diagram shows a cross-section of a well. A vertical grey line represents the casing. To the left of the casing, there is a green rectangular area and a black rectangular area. To the right of the casing, there is a green rectangular area. A yellow square is located on the casing. An arrow points from the text 'Dig around the casing to remove the top three feet (3') of casing.' to the top of the casing. Two horizontal lines with arrows pointing to the casing indicate the 'Casing Depth' and the 'Static Water Level'. The 'Total Depth of Well' is indicated by a horizontal line with an arrow pointing to the bottom of the casing.

**Dig around the casing to remove the top three feet (3') of casing.**

**Casing Depth**

**Static Water Level**

**Total Depth of Well**

**Dig around the casing to remove the top three feet (3') of casing.**

## Casing Depth

## Static Water Level

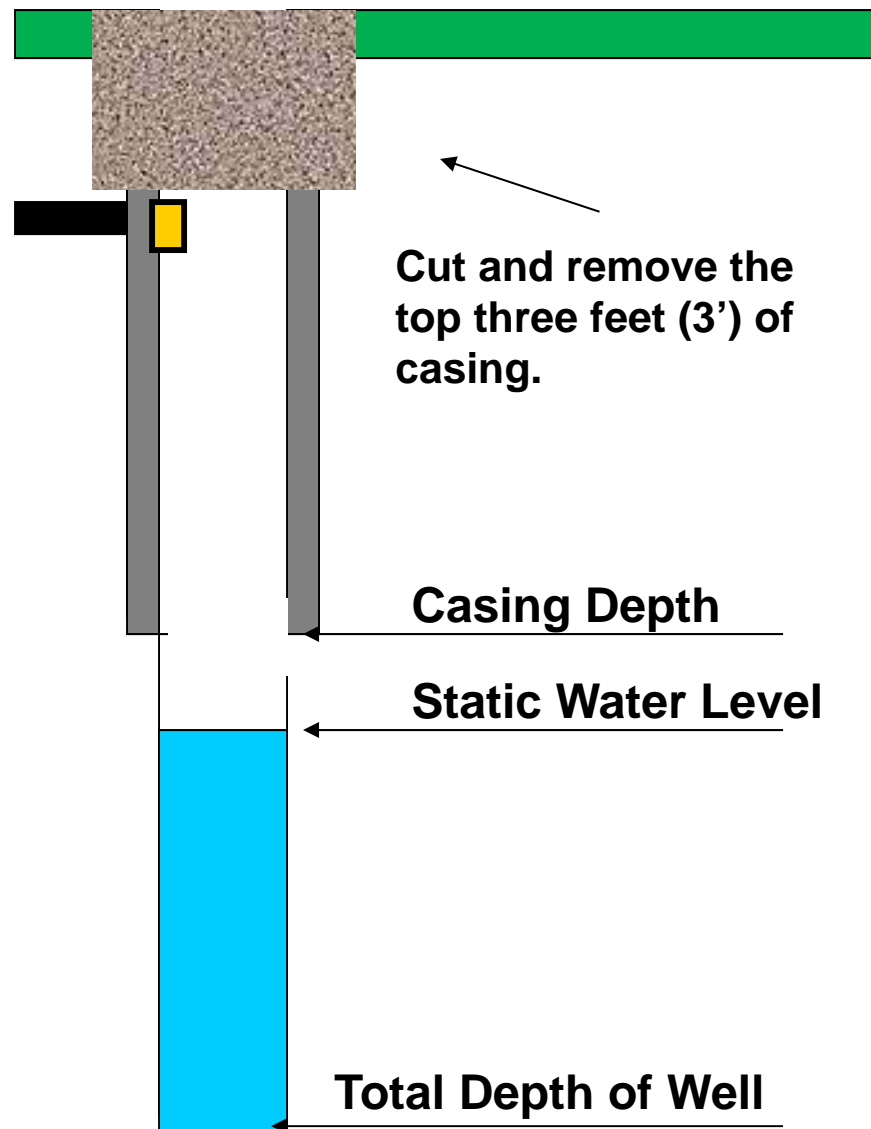
## Total Depth of Well



## Step 3



Cut the casing.







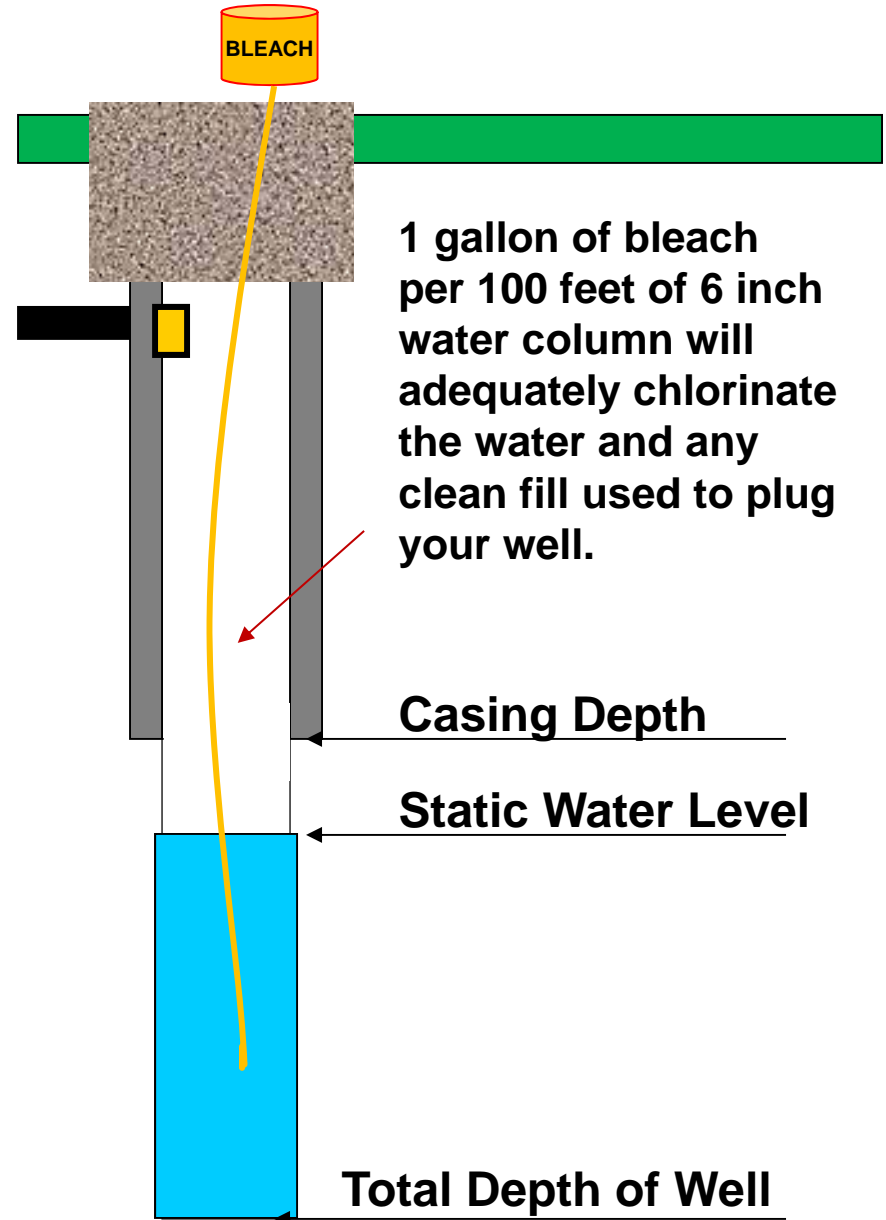
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## Step 4

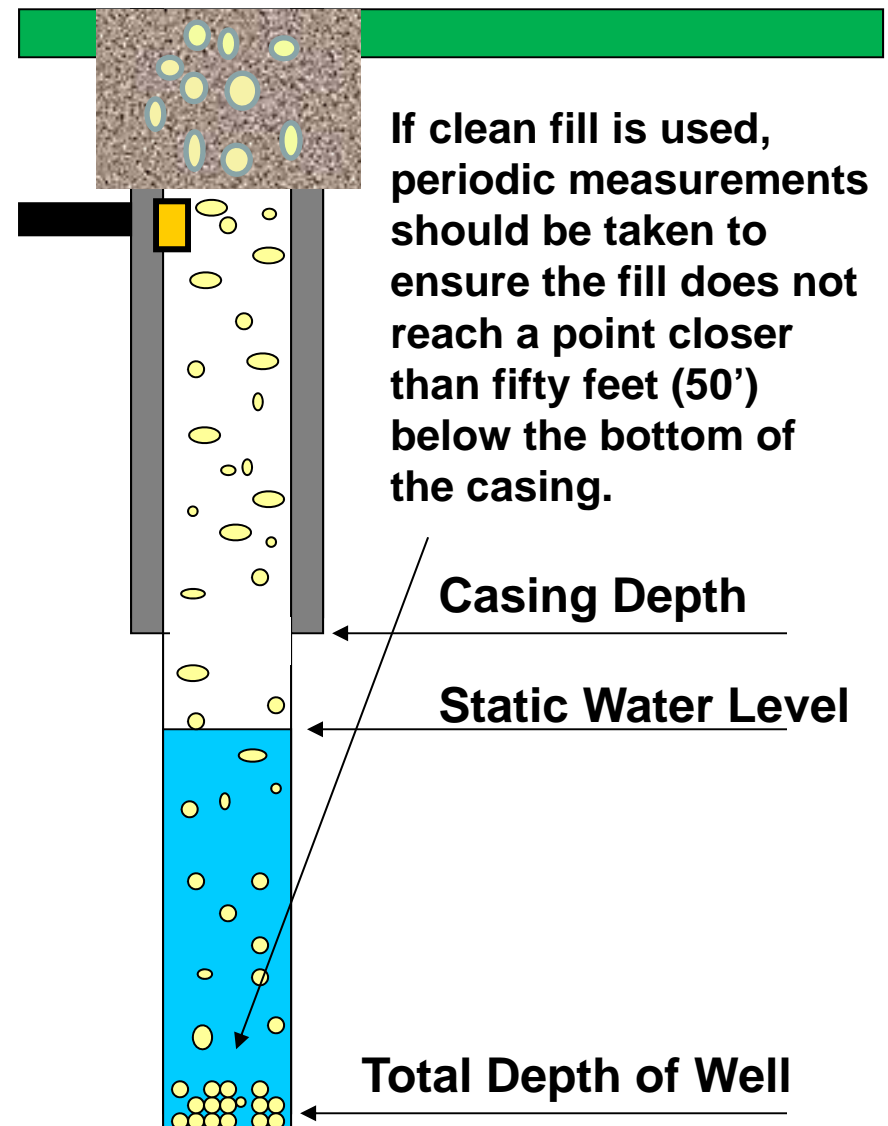
If there is water in the well, add chlorine to bring the concentration to at least one hundred (100) ppm. If there is no water in the well, disinfect any fill material as it is being placed into the well.



# Step 5



Fill the well from total depth of fifty feet (50') below the bottom of the casing with clean fill such as gravel, sand or other approved fill material.





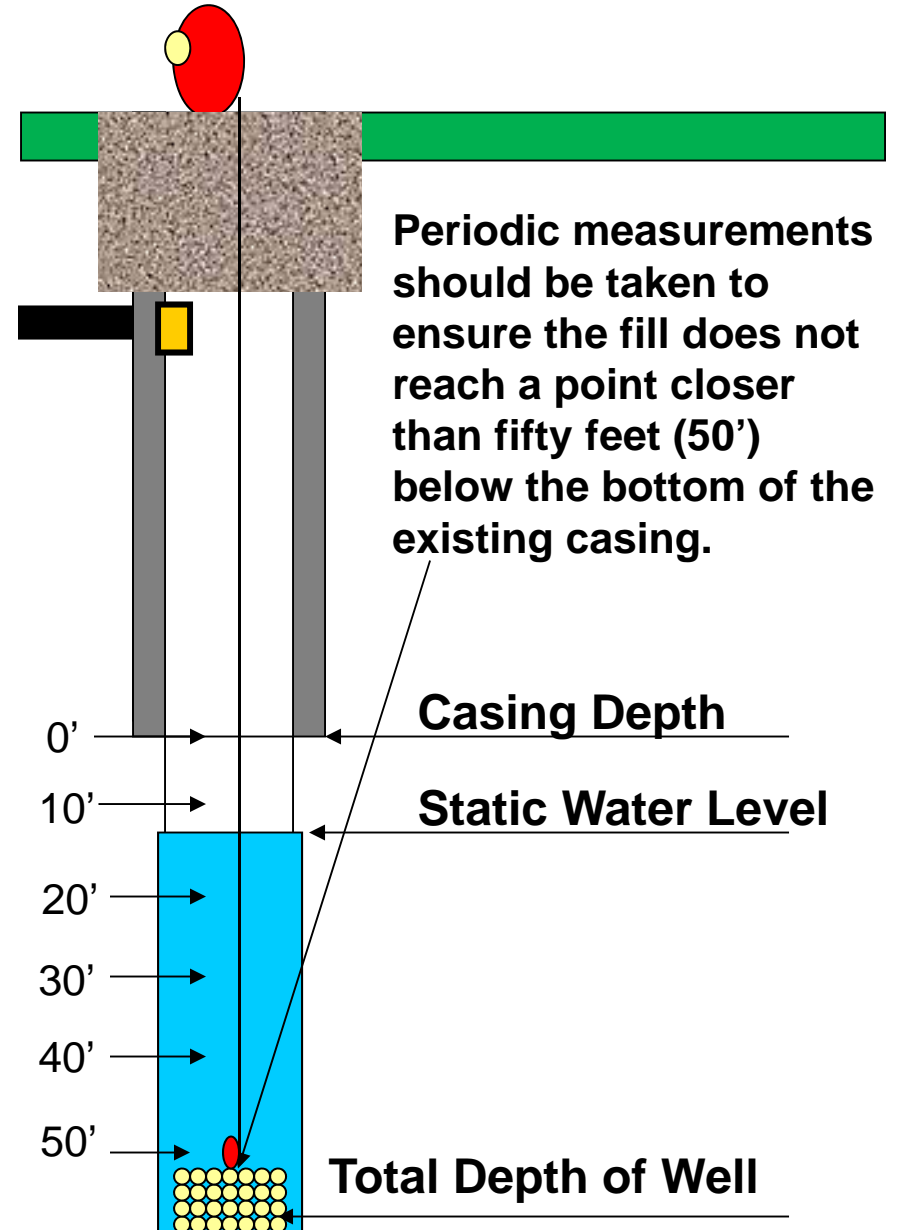


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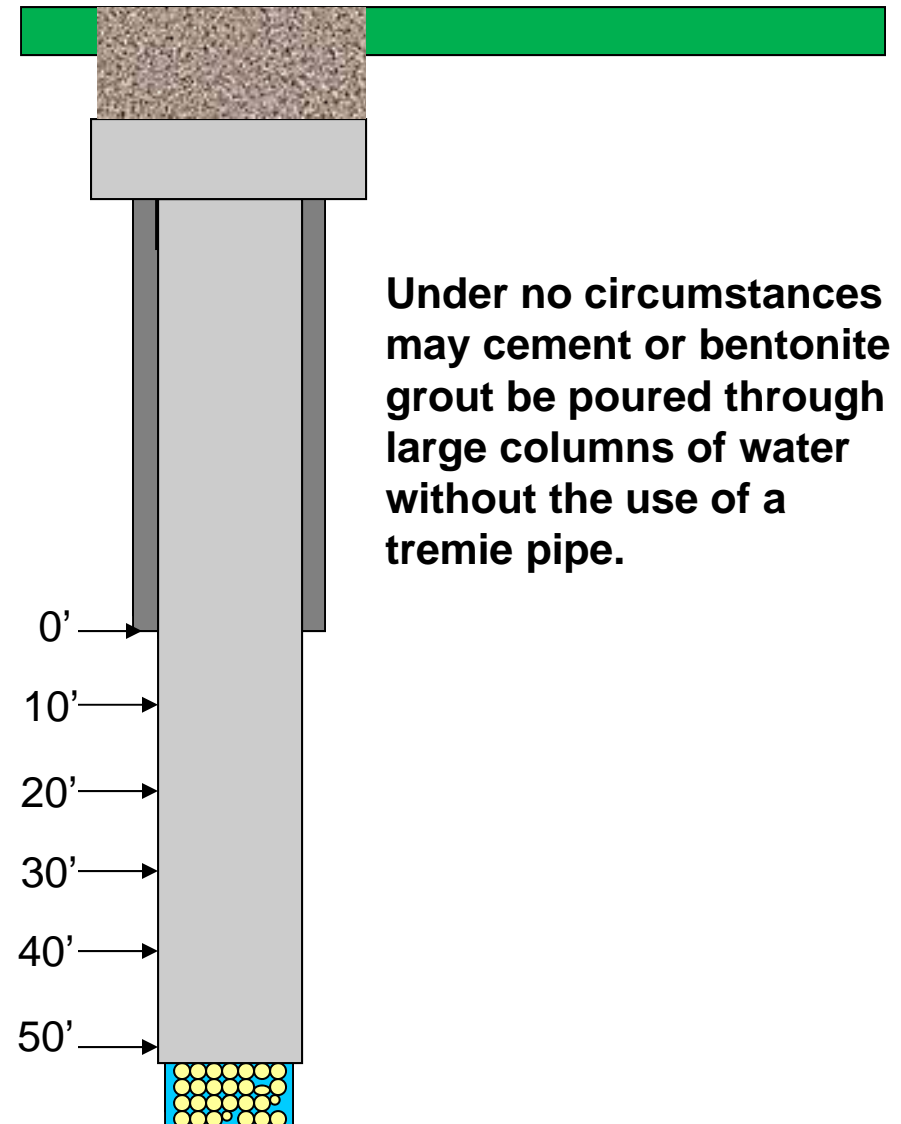
If fill is placed above this point, removal of fill material may be required.

## Step 6



## Step 7

Place neat cement or bentonite from a point fifty feet (50') below the bottom of the casing to two feet (2') from the surface making sure the grout extends into the excavated area at least one foot (1').







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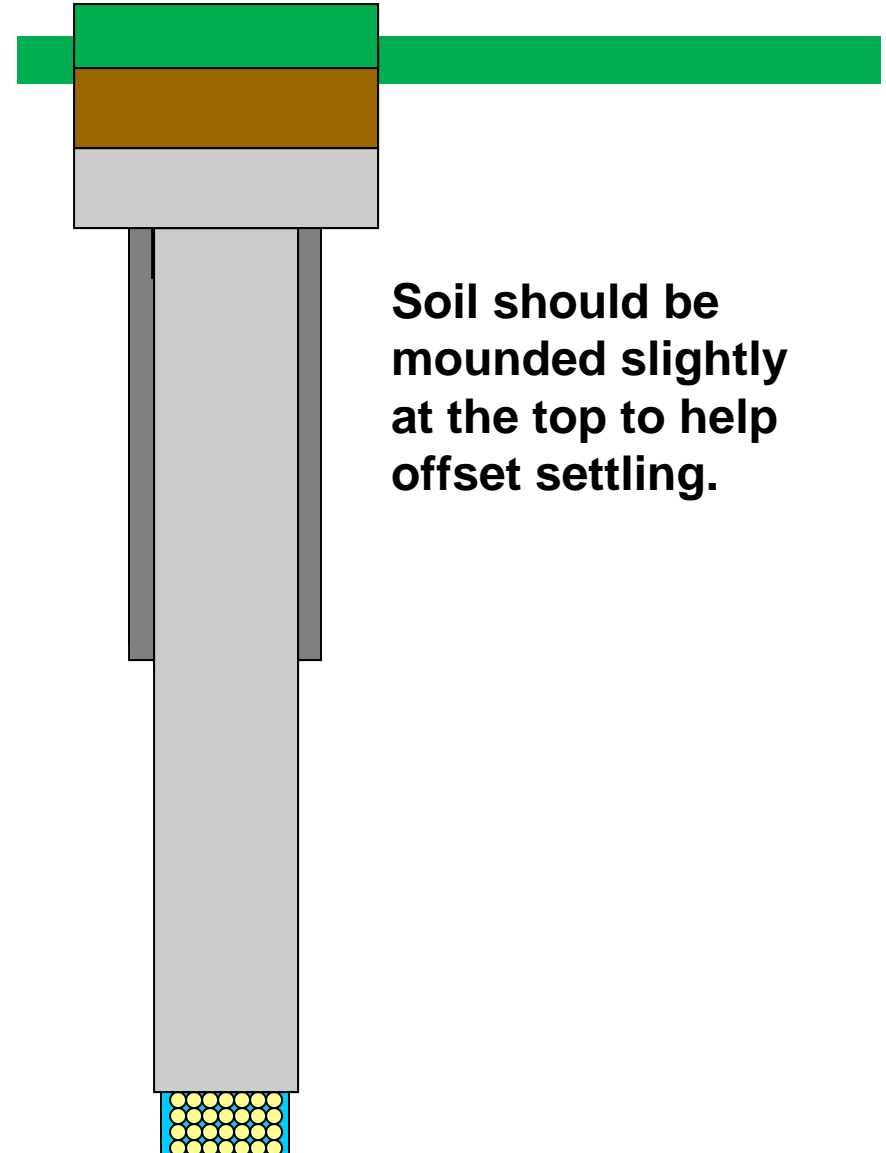




## Step 8



In an agricultural or yard setting the plug must terminate two feet (2') below the finished surface grade and the remaining hole filled with soil. In other settings, the remaining hole may be filled with clean fill if the well site is to be paved.





# Step 9

Complete and submit the  
Well Plugging Registration  
Record.

MISSOURI DEPARTMENT OF NATURAL RESOURCES GEOLOGICAL SURVEY PROGRAM WELL PLUGGING REGISTRATION RECORD		FOR OFFICE USE ONLY	
NOTE: FOR MONITORING WELLS, USE MONITORING WELL PLUGGING REGISTRATION FORM 780-2161		REF NO.	ENTERED
		REGISTRATION NO.	CHECK NO.
		ROUTE	APPROVED
			DATE
<b>OWNER INFORMATION</b>			
NAME		TELEPHONE NUMBER WITH AREA CODE	
MAILING ADDRESS		CITY	STATE
			ZIP CODE
PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED (IF DIFFERENT THAN MAILING ADDRESS)		CITY	
<b>LOCATION INFORMATION</b>			
Lat. _____		COUNTY	_____
Long. _____		Section _____	Township _____ N Range _____ E W
<b>PLUGGING INFORMATION</b>			
FORMER USE OF WELL		WELL CERTIFICATION OR REFERENCE NUMBER (IF KNOWN)	WELL NUMBER
<input type="checkbox"/> Domestic <input type="checkbox"/> Hand dug <input type="checkbox"/> Heat pump <input type="checkbox"/> High yield bedrock <input type="checkbox"/> High yield unconsolidated		ORIGINAL DRILLER (IF KNOWN)	DATE ORIGINALLY DRILLED (IF KNOWN)
<input type="checkbox"/> Pilot hole <input type="checkbox"/> Multi-family <input type="checkbox"/> Public water supply well (plugging letter required)		DEPTH OF THE WELL	LENGTH OF CASING
COST SHARE <input type="checkbox"/> Yes <input type="checkbox"/> No		FT.	IN.
DATE WELL PLUGGED OR EXCAVATED		CASING CUT OFF BELOW GROUND SURFACE	TYPE OF CASING
<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Yes, to what depth _____ ft. <input type="checkbox"/> No, state reason below* <input type="checkbox"/> Removed	<input type="checkbox"/> Steel <input type="checkbox"/> Concrete <input type="checkbox"/> Plastic <input type="checkbox"/> Fiberglass <input type="checkbox"/> Other _____
WELL ABANDONED DUE TO CONNECTION TO A MUNICIPALITY OR RURAL WATER SUPPLY DISTRICT <input type="checkbox"/> Yes <input type="checkbox"/> No		REMARKS/REASON WELL WAS PLUGGED	
If yes, provide the name of the municipality or water district below:			
<b>GROUT INFORMATION (GROUT MATERIAL MUST EXTEND AT LEAST 50 FEET BELOW CASING FOR DOMESTIC/MULTI-FAMILY WELLS)</b>			
INSTALLATION METHOD		MATERIAL USED	
<input type="checkbox"/> Gravity <input type="checkbox"/> Tremie <input type="checkbox"/> Tremie pumped <input type="checkbox"/> Reverse tremie		CEMENT <input type="checkbox"/> Type I <input type="checkbox"/> Type II <input type="checkbox"/> Type III BENTONITE <input type="checkbox"/> Chips <input type="checkbox"/> Granular <input type="checkbox"/> Pellets <input type="checkbox"/> Slurry	
		AMOUNT USED	
		Number of sacks _____	
		Pounds per sack _____ or cubic yards _____	
		Gallons of water/sack _____	
<b>FILL MATERIAL INFORMATION (FILL MATERIAL MAY NOT BE USED IN PLACE OF GROUT)</b>			
MATERIAL USED		AMOUNT USED	
<input type="checkbox"/> Gravel <input type="checkbox"/> Ag-lime <input type="checkbox"/> Sand <input type="checkbox"/> Other _____		<input type="checkbox"/> Tons _____ <input type="checkbox"/> Cubic yards _____	
		DEPTH TO TOP OF FILL FROM SURFACE	
		FT.	
		WELL CHLORINATED BEFORE PLUGGING	
		<input type="checkbox"/> Yes <input type="checkbox"/> No	
		AMOUNT USED FOR CHLORINATION	
		<input type="checkbox"/> Gallons _____ <input type="checkbox"/> Pounds _____ <input type="checkbox"/> Tablets _____	
I hereby certify that the well herein described was plugged in accordance with Department of Natural Resources requirements. (All fields must be completed but only one signature is required.)			
PRIMARY CONTRACTOR OR WELL OWNER (WELL OWNER MAY ONLY PLUG DOMESTIC OR HAND DUG WELLS)		PERMIT NUMBER	DATE
WELL OR PUMP INSTALLATION CONTRACTOR		PERMIT NUMBER	DATE
WELL OR PUMP INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)		PERMIT NUMBER	DATE

MO 780-1603 (11-16)

FEE - \$60 FOR PUBLIC WATER SUPPLY, HIGH YIELD AND HEAT PUMP WELLS ONLY. ALL WELL TYPES ARE SUBJECT TO LATE FEE SCHEDULE.  
SEND COMPLETED FORM TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, MISSOURI GEOLOGICAL SURVEY, WELLHEAD PROTECTION SECTION,  
PO BOX 250, ROLLA, MO 65402. PHONE: 573-368-2165 FAX: 573-368-2317 EMAIL: [wells@dnr.mo.gov](mailto:wells@dnr.mo.gov)  
RECORD (AND FEE) MAY BE SUBMITTED ONLINE: [dnr.mo.gov/mowells](http://dnr.mo.gov/mowells)

# Reverse Tremie Method







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# Who Can Plug a Well?

- Hand Dug Wells and Bored Wells < 80 feet  
Landowner or any person not hired for compensation.
- Bedrock Wells and Unconsolidated Material Wells  
Any permitted contractor regardless of permit type.
- Monitoring Wells and Mineral Test Holes  
Contractor must have a monitoring well permit.

# Primary Contracting or On-site Supervision

Section 256.607 states;

“ Any (person) who is acting as a primary contractor in the construction, alteration, major repair or abandonment of any well shall be required to obtain a permit...”

10 CSR 23-1.090 states;

“...Restricted permits are issued to persons who only contract the work specific to the type of permit requested or to primary contractors and on-site drilling supervisors...”





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# Drilled Well







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# Drilled Well







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# Drilled Well







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# Bored Well







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# Hand Dug Well







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# Hand Dug Well







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# Leak





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# E. coli





# Cistern

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## How Can We Help You?

Provide guidance on how to properly plug an abandoned well.

- Site visit to determine the total depth, static water level, casing depth.
- Provide a list of materials required to plug the well.
- Work with you and/or well owner to assure well is properly plugged.



# Online Assistance

[dnr.mo.gov/mowells](http://dnr.mo.gov/mowells)

This is a database to search for wells that have been submitted to the department (since November 1987). You may also search for well drillers or pump installers who are permitted with the department.

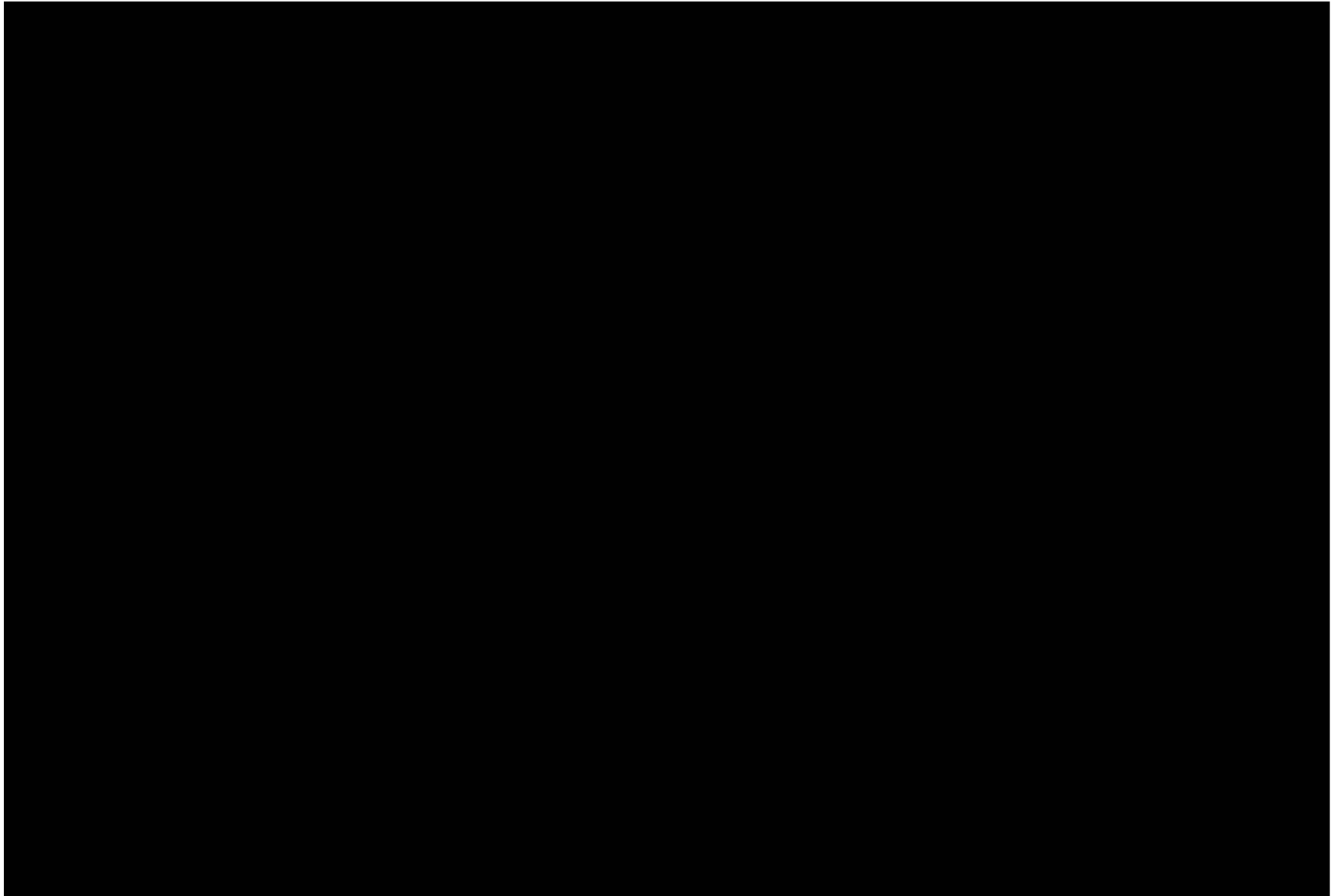
This site also includes a section for:

- Submitting well and pump records
- Submitting reconstruction records
- Submitting plugging records
- Renewing permits
- Registering rigs and service vehicles
- Taking online test for restricted permits.
- Searching for well and pump installation contractors



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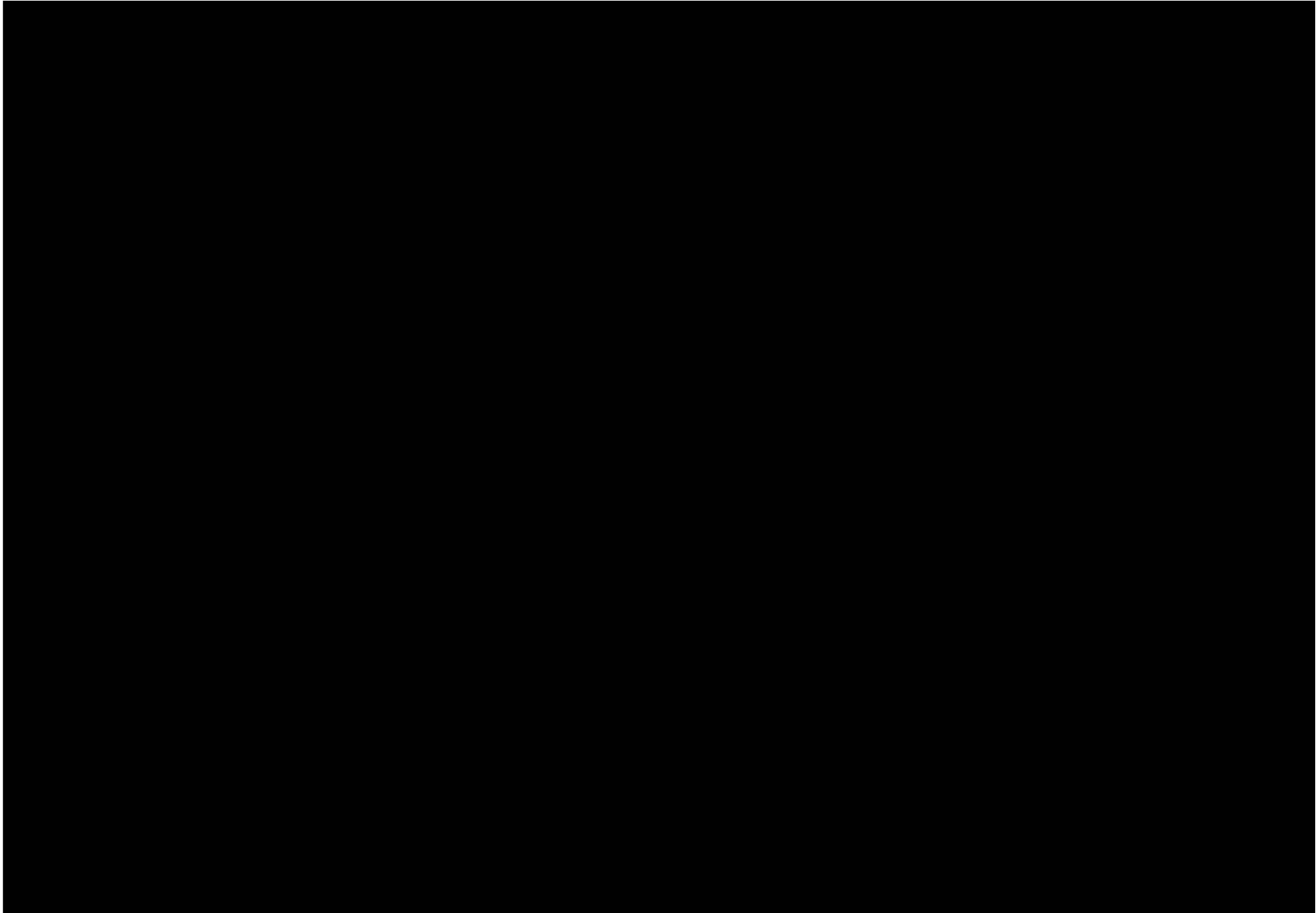
# Crawfish







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## **Phone Numbers**

Wellhead Protection Section – 573-368-2165

Wellhead Protection Section Fax – 573-368-2317

MoDNR Toll-Free Number – 800-361-4827

## **Website**

[dnr.mo.gov/geology/geosrv/wellhd/wellsanddrilling.htm](http://dnr.mo.gov/geology/geosrv/wellhd/wellsanddrilling.htm)

## **Forms**

[dnr.mo.gov/forms/#WellheadProtection](http://dnr.mo.gov/forms/#WellheadProtection)



**Questions?**

**Thank you!**



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# Monitoring Well





# Wellhead Protection Drilling Areas

## Effective June, 2007

