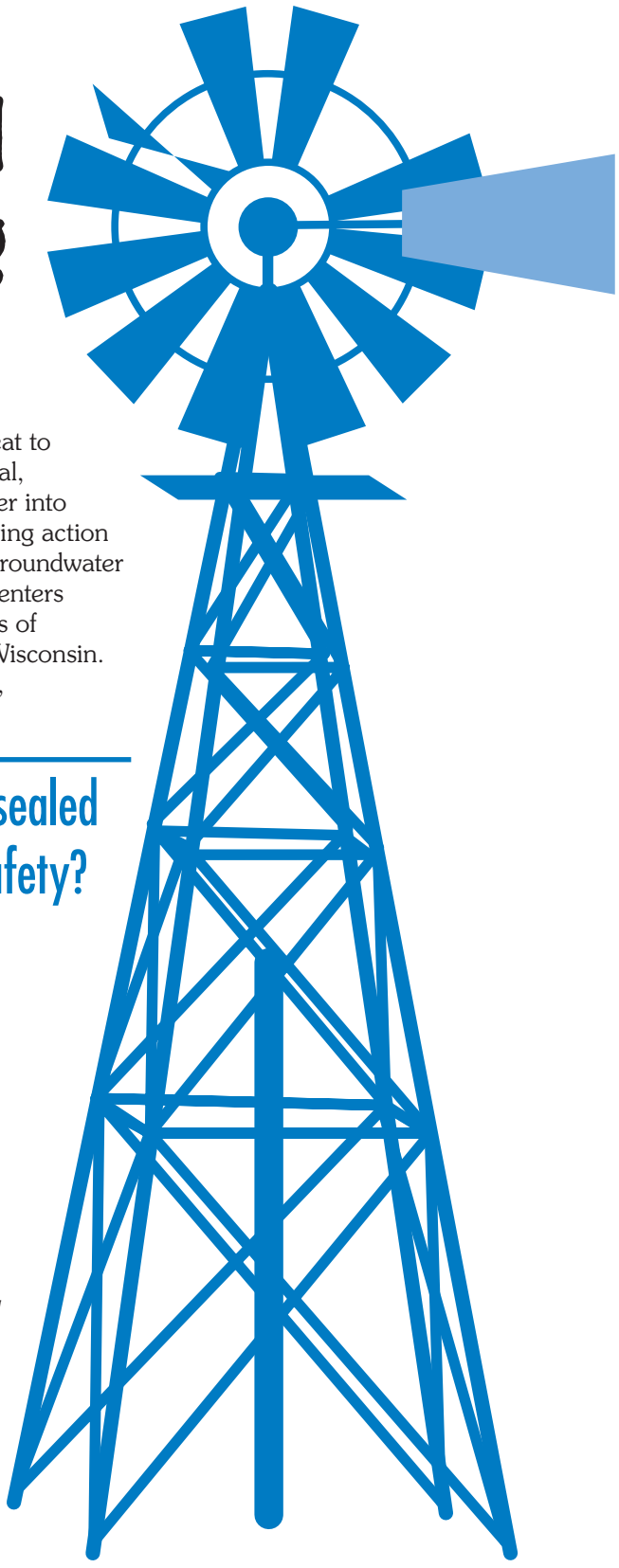
Answers to Your Questions on Well Filling and Sealing



Why are unused and improperly filled and sealed wells threats to groundwater?

Unused and improperly filled and sealed wells are a significant threat to groundwater quality. If not properly filled with impermeable material, unused wells can directly channel contaminated surface or soil water into groundwater. Water that gets into unused wells bypasses the purifying action that normally takes place in the upper layers of the soil. Because groundwater flows in soil and bedrock formations (aquifers), contamination that enters old wells can move to nearby drinking water wells. Many thousands of improperly filled and sealed wells are threatening groundwater in Wisconsin. Whenever you see an old deteriorating windmill in the countryside, there is likely an improperly filled and sealed well underneath.

How can unused and improperly filled and sealed wells threaten groundwater and personal safety?

- Contaminated surface water can enter a well if the casing pipe does not extend high enough above the ground surface and the well cap has been broken or removed; or if there are cracks or holes in the casing due to damage or deterioration with age.
- Contaminated surface water can seep down along the casing pipe of an improperly constructed well.
- Wells in low areas are sometimes illegally left open to drain surface water from heavy rainfall or snowmelt.
- Open wells offer tempting disposal receptacles for liquid and solid wastes. The disposal of any pollutant or wastewater in a well is prohibited by State codes.
- Large-diameter open wells, especially old dug wells, pose safety hazards for small children and animals. In recent years, there have been instances in Italy, Missouri and Kansas where children have fallen into wells. Although such occurrences are infrequent, they should never be allowed to happen.
- Improperly filled and sealed flowing wells can be a nuisance and may lower artesian pressure in neighboring wells.

When should wells be properly filled and sealed?

Wells must be properly filled when they are removed from service. Wells are removed from service for a number of reasons, including construction of a replacement well, destruction of the building being served, failure of the well to produce safe water, failure of the well to meet the Wisconsin's Well and Pump Code (NR812) standards, or when a community water system is extended into an area formerly served by individual private wells.

After wells are removed from service they are seldom used. They often get forgotten after a property transfer and, in time, may get covered by a parking lot or a building. Sometimes in this way all traces of old wells disappear. Such wells can cause groundwater contamination. In one recent case in Wisconsin, a house burned down over an improperly filled and sealed well located in the basement. The well provided a point of entrance into the aquifer and allowed ash-laden water to contaminate the neighbor's well.

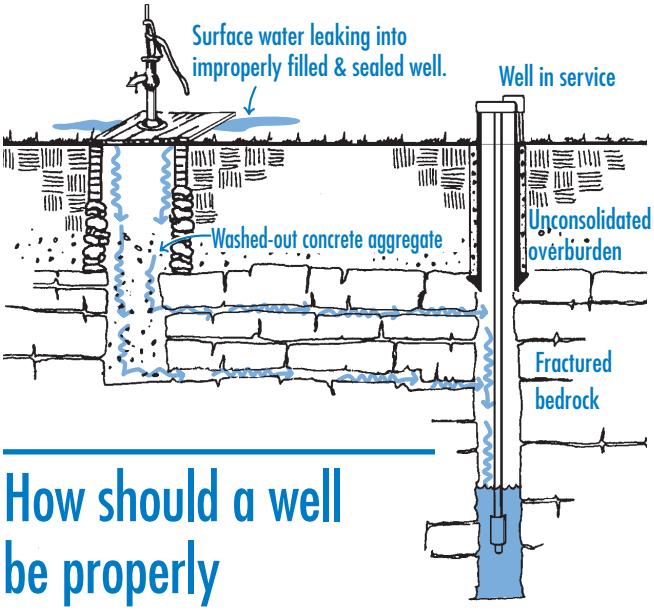
In another case, a buried well having only a stone set on the top of the open casing caused severe contamination of the drinking water pumped from another well on the same property. The unused well was near both an animal yard and a sewage absorption field and thus provided direct access for the entrance of contamination into the groundwater.

After a well gets covered, it is very difficult, if not impossible, to find it and determine if it's causing contamination. When new wells are constructed in an area with improperly filled and sealed wells, they may have to be cased much deeper or to alternate aquifers to provide safe water. These problems can be avoided by the proper filling and sealing of unused wells. Chapters NR811 and NR812, Wis. Adm. Codes, require proper permanent filling and sealing of unused wells.

Who can perform proper well filling and sealing work?

As of June 1, 2008, only licensed well drillers and pump installers may be hired to fill and seal wells. These contractors are familiar with correct filling and sealing materials and procedures, are knowledgeable about wells, and have access to the necessary equipment. It's usually more economical to fill and seal an old unused well at the same time the well driller is at the site constructing a new well.

Improperly filled and sealed well



How should a well be properly filled and sealed?

First determine the construction and condition of the well

The first step in proper well filling and sealing is to obtain information on the construction and condition of the well. Construction information is best obtained from the **Well Construction Report**, which date back to 1936.

IMPORTANT INFORMATION TO KNOW WHEN SEARCHING FOR A WELL CONSTRUCTION REPORT:

To find a report, you must furnish a legal description in terms of ¼ - ¼ Section, ¼ - Section, Section, Township and Range designations of the property where the well is located. It's also helpful if you can obtain the name of the well driller, the property owner or agent at the time of drilling, the approximate date of construction and the street address or lot number. You can look up Well Construction Reports in the **Well Construction Information System**. The chances of finding the report are greater with more information.

A site inspection will help you locate the well and see what condition it is in. You should determine if the well is easily accessible in the yard; or if it is in a pit or a basement. It's possible the top of the well is buried in the yard, in which case you may be able to find it using a metal detector.

During your inspection you can also check to see if the pump has been removed.

Clearing, filling and sealing the well

Before the well is filled and sealed, the pump and its associated piping, any ungrouted liner pipe, or other obstacles must be removed from the well. If debris has been thrown in the well, a well driller may have to first drill it out. After the well is cleared, it must be filled from the bottom up with neat cement grout, sand-cement grout, concrete or approved bentonite chips. Well drillers and pump installers are familiar with these materials and know how to calculate and place the proper volume of material.

The filling material must be placed through a conductor (tremie) pipe extending to the bottom of the well except when approved bentonite chips are used according to DNR instructions (see pages 4 and 5). Use of a conductor pipe will assure that the filling material won't be diluted by the water in the well and will not plug in the well part-way down. The bottom of the conductor pipe must be kept submerged in the material during filling, but may be pulled as the well is being filled.

Except when using bentonite chips, a well driller or pump installer may not just pour or dump the filling material into the well without the use of a conductor pipe because this could cause the filling material to become diluted or bridge in the well part-way down. If dilution occurs, the fill material will not be impermeable. If bridging occurs, the well will only get partially filled. An improperly filled and sealed well can be as much a threat to groundwater quality as an open well.

After properly filling and sealing the well from the bottom up, the filling material may terminate a few feet below the ground surface to allow the top of the casing to be cut off, if preferred. The casing may also be left in place. If the well discharged through a non-pressure conduit, the end of this conduit (in the basement) must be sealed watertight with a steel plate.

Flowing wells

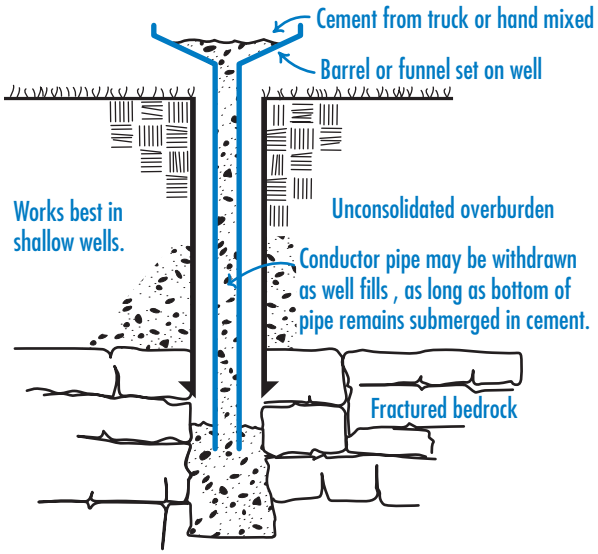
Flowing artesian wells that flow at high rates may require special techniques to reduce the flow before the well is filled and sealed.

Driven point (sand-point) wells

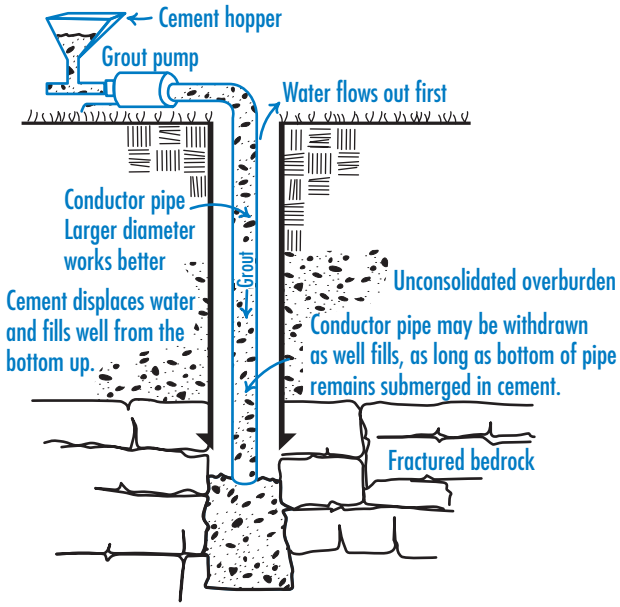
Driven point or jetted wells 3 inches or less in diameter must be filled with neat cement grout or bentonite pellets. Only licensed well drillers and pump installers are allowed to fill and seal driven point wells. Grout may be poured down the casing or pumped down through a conducter pipe.

Many driven point wells terminate in pits or in the basements of buildings. Since April 10, 1953 such well locations have been prohibited by the Wisconsin's Well and Pump Code. If your well was constructed after this date, the well does not comply and must be properly filled and sealed except when the DNR approves its continued use.

Gravity method for well filling and sealing



Pumped method for well filling and sealing

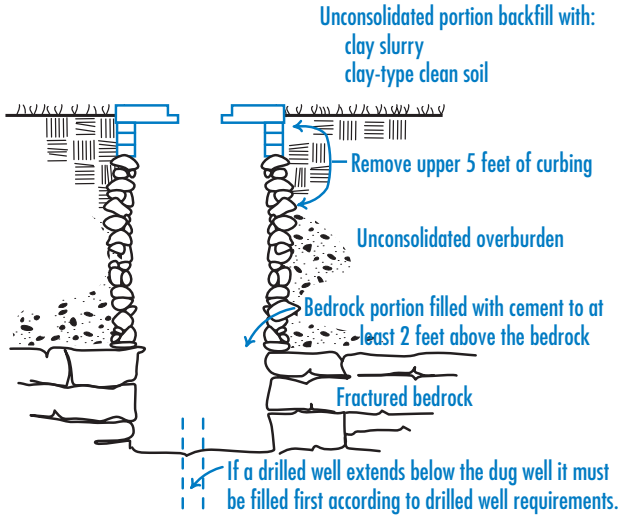


Dug wells

To properly fill and seal a dug well, a well driller or pump installer must first remove the well cover and remove any piping or debris before filling the well. (If a drilled well extends below the dug well it must be filled first.) The dug well must be filled and sealed with clean clay, silt, clean native clay or silt-type soil free of organic material (if compacted), concrete, sand-cement grout or bentonite chips. If the dug well penetrates partially or completely into bedrock, the well must be filled with concrete or sand-cement grout to a point at least two feet above the top of the bedrock. The top 5 feet of curbing of the dug well must be removed to allow for a good contact between the filling material and the soil. Rock curbing may be caved into the dug well while the well is being filled if it's done in a manner to prevent plugging of the filling material part-way down; or this step may also be done near the end of the filling and sealing procedure.

If the dug well is less than 18 inches in diameter, a conductor (tremie) pipe must be used to place the filling material, except when bentonite chips or pellets are used or when clean clay or silt or clean native soil is used and the well is 25 feet deep or less. For very deep or large diameter dug wells, alternate materials may be allowed.

Dug well filling and sealing



Well pits

When a pit well is unused, the pit structure must also be filled and sealed. To properly fill and seal a well pit, perforate or knock in at least one wall, break up or perforate the floor, and then fill the pit with clean native clay, silt, or clean native soil. If the pit is a subsurface pump room (alcove) connected to the building foundation, the pit does not have to be filled.

Well filling and sealing using bentonite chips

In Wisconsin approved bentonite chips may be used to fill wells and drillholes. The chips may be used for both sand and gravel formation wells and bedrock wells. They may only be used for wells & drillholes meeting the following specifications.

- Larger than 3 inches in diameter.
- Not more than 500 feet deep.
- Not more than 350 feet of water standing in the well or drillhole.

Bentonite chips may also be used to fill dug wells.

*(Note: Bentonite chips may **not** be used to fill wells or drillholes filled with drilling mud or clay slurry and may **not** be used for small diameter driven point wells. Bentonite chips come in two basic size ranges (¼" - ⅜" and ½" - ¾" chips). The ¼" - ⅜" chips should be used for 4-inch diameter wells. Bentonite chips are irregularly shaped pieces of sodium bentonite clay that look very much like crushed limestone. They should not be confused with pellets or tablets which are not allowed).*

Well drillers and pump installers must follow these procedures when using bentonite chips:

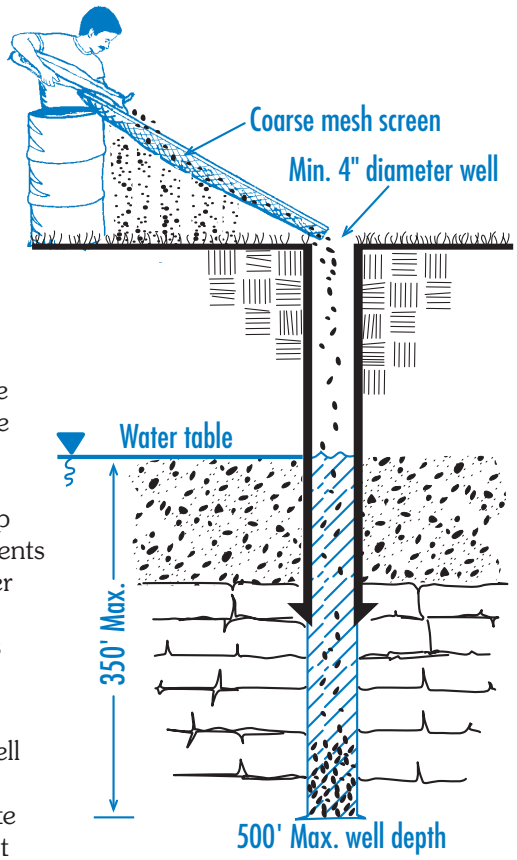
1. Determine the construction details of the well or drillhole including at least the:
   a. Well or drillhole diameter, by simply measuring the inside diameter of the well casing pipe or drillhole; and
   b. Well or drillhole depth, by lowering a weighted line down to the bottom. (Make sure the weight is securely attached).
2. Remove the pump, pump piping and any other material obstructions or debris in the well or drillhole that could prevent complete filling and sealing.
3. Calculate the volume of the well or drillhole to determine the number of bags of chips that will be required by using:
   a. The attached Table I page 5; OR
   b. The formula:

$$\frac{\pi r^2 h}{0.69\ ft^3/bag}$$

   π = pi = 3.14
   r = well radius (in feet)
   h = well depth (in feet)
   0.69 = number of ft^3 filled by one 50 lb. bag

(Remember: Divide the well radius (in inches) by 12 to get the radius in feet.)

4. Fine particles and dust contained in the bags of bentonite chips must not be allowed to enter the well. This is prevented by pouring the bentonite chips out of the bag such that they tumble under their own weight down across a coarse-mesh screen 2 to 3 feet in length. This allows the dust to fall through the screen onto the ground. The screen should be formed into a U-shape like a rain gutter. One end of the screen should be placed on the top of the well casing while the other end is supported at a steep angle. Removal of the dust prevents bridging of the chips at the water table. Do not push or pull the chips down across the screen as this will only create more dust.
5. Pour the bentonite chips across the screen into the top of the well at a rate not faster than about 3 minutes per bag. Pour at this rate so bridging of the chips does not occur – the chips must fall all the way to the bottom of the well. (Do not use a conductor-tremie pipe). Check well periodically with weighted line for possible bridging of chips.



6. Make sure the well "accepts" the entire number of bags calculated to fill it. If it doesn't, bridging may have occurred. The point of bridging must be broken so the bentonite chips will fall to the bottom. If the bridge cannot be broken, the well may have to be drilled out and re-filled with neat cement grout.
7. If the standing water in the well does not rise to the surface during the filling procedure, clean, uncontaminated water must be poured down into the well (through the chips) until water rises up to the top of the well and stays there. The chips will then swell and create an impermeable plug in the well.

Table I - Method for determining the number of 50 lb. bags of bentonite chips to fill a well

Hole size and volume table

Hole diameter inches	Hole volume (ft3/foot)	Pounds bentonite chips to fill 1 ft	Feet filled by one bag bentonite chips	Bags bentonite chips to fill 100 Ft
4	0.087	6.3	7.9	12.6
4-½	0.110	7.9	6.3	15.8
5	0.136	9.8	5.1	19.6
5-½	0.165	11.9	4.2	23.8
6	0.196	14.1	3.5	28.2
6-½	0.230	16.6	3.0	33.2
7	0.267	19.2	2.6	38.4
7-½	0.307	22.1	2.3	44.2
8	0.349	25.1	2.0	50.2
8-½	0.394	28.4	1.8	56.8
9	0.442	31.8	1.6	63.6
9-½	0.492	35.4	1.4	70.8
10	0.545	39.2	1.3	78.4
11	0.660	47.5	1.1	95.0
12	0.785	56.5	0.89	113.0
15	1.227	88.3	0.57	176.6
18	1.767	127.2	0.39	254.4
20	2.182	157.1	0.32	314.2
25	3.409	245.4	0.20	490.8
30	4.909	353.4	0.14	706.8

Table C - Acceptable materials and methods for well filling and sealing

	Well type	Materials								Methods
		Clean clay or silt or clean native soil	Approved bentonite chips ◆	Bentonite pellets ◆	Neat cement grout ■	Concrete ▲	Sand-cement grout	Bentonite-sand slurry w/min. mud wt. 11 lbs/gal	Chlorinated, sand-free pea gravel	
Unconsolidated formation wells	Driven-Point (sand-point) wells & drillholes ≤ 3″ diameter	No	No	Yes	Yes	No	No	No	No	Cement grout may be poured without using a conductor ◉ pipe
	Wells & drillholes > 3″ diameter	No	Yes, provided well is 4″ minimum diameter & 500′ maximum depth	Yes, provided well is 4″ minimum diameter & 500′ maximum depth	Yes	Yes	Yes	Yes, provided top 5′ filled with neat cement grout, sand-cement grout or concrete	● Yes, but in depths below 250′	Conductor ◉ pipe required except when bentonite chips or pea gravel is used
	Dug wells ○	Yes (top 5' of curbing must be removed following filling)	Yes	Yes	Yes	Yes	Yes	No	No	Conductor ◉ pipe not required unless well is ≤+18″ diameter
Bedrock wells	Bedrock wells not extending through Maquoketa Shale	No	Yes, provided 4" minimum diameter & 500' maximum depth	Yes, provided 4″ minimum diameter & 500′ maximum depth	Yes	Yes	Yes	No	● Yes, but in depths below 250'	Conductor ◉ pipe required except when bentonite chips or pea gravel is used
	Bedrock wells extending through Maquoketa Shale	No	Yes in top 500' & for 40' plugs at top & bottom of Maquoketa Shale contact surfaces	Yes in top 500′ & for 40′ plugs at top & bottom of Maquoketa Shale contact surfaces	Yes	Yes	Yes	No	● Yes, in depths below 250', but not at Maquoketa Shale contact surfaces	Conductor ◉ pipe required except when bentonite chips or pea gravel is used
	Dug wells ○	Yes, but only in unconsolidated portion of well	Yes	Yes	Yes	Yes	Yes	No	No	Conductor pipe required only for placement of grout or concrete; or if well is ≤+18″ diameter
	Well pits	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Must perforate floor & 1 wall of pit

◆ *Bentonite chips may only be used for wells **not** deeper than 500 feet and having **not** more than 350 feet of standing water in them. The chips must be poured across a coarse mesh screen such that excess dust does not enter the well. Pour rate should not be faster than 3 min. per 50 lb. bag to prevent bridging.*

■ *Neat cement grout and sand-cement grout must have a density of at least 15.2 lbs per gallon*

▲ *When concrete is used, the gravel size may not exceed ⅓ the inside diameter of the conductor pipe used.*

◉ *The terms conductor pipe and tremie pipe are synonymous. The bottom of the pipe must remain submerged in the grout throughout the filling procedure. Conductor pipe must be metal pipe, thermoplastic pipe rated for at least 160 psi or rubber-covered hose reinforced with braided fiber or steel and rated for at least 300 psi.*

● *40' Impermeable plugs shall be provided at each bedrock formation change. [See s. NR 812.26(6)(e)]*

○ *The top 5 feet of dug well curbing must be knocked out to provide a soil contact with the filling material.*

Clean clay or silt or clean native soil means low permeability soil material, free of organic humus or any other contamination.

Clay or Bentonite-sand slurry means a mixture having the minimum ratio of 50 pounds of native clay or approved bentonite mixed with 100 gallons of water (from a known safe and uncontaminated source) and 10-25% sand by volume of the slurry such that a mud weight of at least 11 lbs./gal. is achieved.

Neat Cement Grout means a mixture of cement and water in the proportion of one bag of Portland cement (94 lbs.) meeting ASTM C 150, Type I or API-10A, Class A standard; and 5 to 5.5 gallons of water from a known safe and uncontaminated source. Powdered bentonite may be added up to ratio of 5 pounds per 94-pound bag of cement provided 1.3 gallons of water are added for each 2 pounds of bentonite added.

Concrete (sand-cement) grout means a mixture of cement, sand and water in the proportion of one bag of Portland cement (as described above), a cubic foot of dry sand and 5 to 5.5 gallons of clean water from a known safe and uncontaminated source.

Concrete means a mixture of cement, water, sand and gravel in the proportion of one bag of Portland cement (as described above), an equal measure of gravel (by weight or by volume) and not more than 5.5 gallons of water from a known safe and uncontaminated source. A commercially-prepared mix may be used provided the mix has at least 6 bags of cement per cubic yard.

Approved chipped and pelletized bentonite products Primarily used for driven point wells with casing 3 inches in diameter or less.

Conductor (tremie) pipe used for well filling and sealing shall be any of the following:

1. Metal pipe,
2. Rubber-covered hose reinforced with braided fiber or steel and rated for at least 300 psi, or
3. Thermoplastic pipe rated for at least 160 psi including:
    a. polyvinyl chloride (PVC),
    b. chlorinated polyvinyl chloride (CPVC),
    c. polyethylene (PE),
    d. polybutylene (PB), and
    e. acrylonitrile butadiene styrene (ABS)

Must I report the well filling and sealing to the DNR?

Yes. When groundwater contamination investigations are undertaken, it's important to know the location of active, unused and former wells. Further, this information is important documentation for property transfers. Well Filling and Sealing Reports must be used to report how the well was filled and sealed and document that the well no longer exists. The licensed person performing the well filling and sealing work must complete and submit the form **online**.

What administrative rules cover well filling and sealing?

NR 812.26 governs proper filling and sealing of private water supply wells. NR141, Wis. Adm. Code, governs the proper abandonment of monitoring wells. NR 811.17, has rules for abandonment of community wells.

Where can I obtain additional information?

Find more information on our webpage about **Wells** and **Well Filling and Sealing**. Find further information on **drinking water supplies and groundwater quality**. Also check the **UW Extension**.

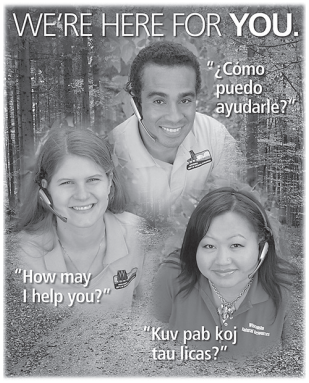
Contact Us

Customer Service Staff are here to assist you.

How may we help you?

Call Toll Free 1-888-WDNRINFO (1-888-936-7463)
or **Contact Us**.
Click on one of the following options:

- **Chat** with customer service.
- **Call** a representative.
- **Email** your question.



Toll free hotlines
Violation Hotline:

Call or Text
1-800-847-9367
Confidentially report suspected wildlife, recreational and environmental violations.

Emergency Spill Hotline:

1-800-943-0003 phone

Bilingual Services are available
Drinking Water & Groundwater Program

101 S. Webster
P.O. Box 7921
Madison, WI 53707-7921
(608) 266-1054

Find more information on our webpage about **Drinking Water**

WISCONSIN DEPT. OF NATURAL RESOURCES

PUB-DG-016 2020

PRINTED ON RECYCLED PAPER

This document is intended solely as guidance and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. Any regulatory decisions made by the DNR in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.

This brochure was revised by the Wisconsin Department of Natural Resources with assistance from the Education Subcommittee of the Groundwater Coordinating Council.