Section 639 Drilling Wells

639.1 Description

(1) This section describes drilling vertical holes of specified sizes in earth formation or rock formation, or both to the required depth; inserting casing pipe; placing liner pipe, if required; sealing casing with grout; placing pump, screen, and well platform; constructing well shelter; and test pumping.

639.2 Materials

639.2.1 General

(1) Furnish grade A, A-FA, A-S, A-T, A-IS, A-IP, or A-IT concrete conforming to 501 as modified in 716. Provide QMP for class III ancillary concrete as specified in 716.

(2) For grout use fine aggregate conforming to 501.2.5.3 and type I, IL, IS, IP, or IT cement.

(3) Furnish lumber and timber conforming to 507.2.2.

639.2.2 Well Casing Pipe

639.2.2.1 Upper Drillhole

(1) If using 8, 10, or 12-inch pipe temporarily in constructing the upper drillhole, use pipe of sufficient strength and weight to withstand driving operations. Use welded or threaded coupling joints with this pipe.

639.2.2.2 Lower Drillhole

(1) For casing the lower drillhole, use new steel casing pipe. Use pipe conforming to NR 812.17.

639.2.3 Liner Pipe

(1) For liner pipe use new steel pipe of sufficient strength and weight to structurally withstand driving operations. On this pipe, use welded joints and fit with standard type driving shoes. Use the length and diameter of liner pipe the engineer directs.

639.2.4 Pump

(1) Use a hand-operated metal drinking fountain type pump with a mounting base that accepts the casing pipe specified and conforms to the plan details. For the drop pipe use new zinc coated standard steel with a 1 1/4 inch inside diameter, unless the plans specify otherwise. Use a 7/16-inch diameter steel pump rod having 14 standard threads per one inch. For depths to the static water surface of 150 feet or less, use a cylinder with a 2-inch inside diameter, and for depths exceeding 150 feet, use a cylinder with an inside diameter of 1 11/16 inches.

(2) Provide cast iron floor drains conforming to the size and details the plans show.

639.2.5 Well Screen

(1) Provide a stainless steel screen of the specified diameter and conforming to NR 812.13 requirements.

639.3 Construction

639.3.1 Code, Permit, and Registration Requirements

(1) Perform work connected with drilling, driving, and outfitting a well according to NR 812, well construction and pump Installation, Wisconsin administrative code of the WDNR, division of environmental analysis and review.

(2) The contractor shall obtain permits, licenses, or other requirements needed to prosecute the work at its own cost and expense. Provide notices, pay fees, and comply with laws, ordinances, codes, and regulations bearing on the conduct of the work.

(3) Employ an engineer-approved well driller registered with the WDNR division of environmental analysis and review before starting drilling operations. The well driller shall produce satisfactory evidence of experience, capability, and equipment before performing any work.

(4) Use a pump installer registered with the WDNR division of environmental analysis and review to install the pump.

639.3.2 Geologic Formation

(1) The contractor shall save and deliver a sample of material taken from each 5 feet of drilling and at every change in formation, to the Wisconsin geological and natural history survey. The contractor shall also keep an accurate record of the top and bottom of each layer of formations penetrated.

(2) Provide daily written reports to the engineer beginning when the drilling equipment is erected and ending when the drilling equipment is removed. Include the following:

1. The nature of the materials encountered during drilling.
2. The work done during each day, including depth drilled, casing set, and water tests.
3. The depth-to-water level in the well at the beginning and end of each shift.

4. Other data the engineer may request for the record.

(3) Immediately advise the engineer of any circumstances that might alter well construction, or have any effect in determining if the drilling operations should change. If the contractor fails to keep the engineer informed, this may result in non-payment for items of work performed.

(4) Take the above-specified material samples every 5 feet and at each change in formation according to Wisconsin geological and natural history survey instructions.

(5) After completing a job sample, pack it in a box or bag, and mail or ship it express collect to the following address:

Wisconsin Geological and Natural History Survey
3817 Mineral Point Road
Madison, WI 53705-5100

(6) The contractor may obtain sample bags and tags at no cost by writing to the same address. Send the driller's log of the well at the same time. The driller's log shall include, in addition to a record of material encountered:

1. Data on size or sizes of hole.
2. Length and size of casing, including liner and screen.
3. Water level.
4. Results of pumping tests.

639.3.3 Water Sampling and Testing

(1) Immediately after completing the well, collect water samples in conformance with the procedure stated in NR 812.22 and submit the samples in bottles furnished by the laboratory for bacteriological and nitrate analysis, and for iron and manganese, turbidity and hardness determination to:

State Laboratory of Hygiene
465 Henry Mall
Madison, WI 53706

(2) The contractor shall indicate in the remarks section of the data sheet accompanying the sample bottles that a copy of the report be forwarded to the engineer on the project and sent to the:

State Department of Natural Resources
Environmental Analysis and Review
101 South Webster Street
PO Box 7921
Madison, WI 53703

639.3.4 Precautions to Take

(1) Take precautions to prevent contaminated or polluted water, or other pollutants such as gasoline from entering the drill hole during construction of the well and following completion.

(2) If the well becomes contaminated or polluted during construction or upon completion, due to contractor neglect, at no cost to the department, perform work or supply casings, seals, sterilizing agents or other materials necessary to eliminate the contamination or pollution.

(3) Exercise extreme care in performing the work to prevent caving in or breaking down the strata overlying the one that is producing the water. Obtain the engineer's approval of the contractor's method of developing, pumping, or bailing the well, until producing water substantially free of silt or sand, and until the turbidity is less than 5 on the silica scale described in Standard Methods of Water Analysis. Upon completing the well, provide and secure a screwed, flanged, or welded cap to the top of the well casing.

(4) Between placing the protective well casing and grouting the well, seal the annular space between the inner casing and the larger outer casing with a temporary plug to prevent the entry of foreign material.

(5) If the contractor fails to construct the well to the depth specified, or the depth the engineer orders, or if the well is abandoned because of loss of tools or from any other cause, for example, poor well alignment, construct another well at an adjacent engineer-approved location. Fill the abandoned hole with concrete as specified for abandoning pipes and structures in 204.3.3.

(6) Take the necessary precautions to protect trees and structures at the site from damage by and during the operations.

639.3.5 Drilling Well Holes

(1) Ensure that holes drilled through earth formations are the required size, and extend from the ground surface to underlying rock formation, or to the depth the engineer directs. Drill each hole with a fully

dressed bit the proper size to accommodate driving the corresponding well casing pipe concurrently with drilling operations. If drilling holes through rock formation use a fully dressed bit, the proper size to produce the required drilled hole size.

(2) If the driller considers it necessary to blast in the drill hole, if drilling through formations containing boulders, discuss the problem with the engineer before any shooting or blasting. Perform blasting work using a licensed blaster.

(3) Furnish potable water for drilling operations.

639.3.6 Alignment

(1) Align the well so that the pump proper and its accessories function and operate free of any trouble that might occur from a misaligned well casing. Drill the well so that the centerline does not deviate from a straight line more than the following distance per 100 feet of pump setting depth, plus 25 percent: for a 4-inch well, 4 inches; for a 6-inch or larger well, 6 inches.

(2) If the engineer judges the well alignment unsatisfactory at any time, because of a condition in excess of that above, then correct the condition before proceeding with the drilling. If the hole is misaligned and correction is not possible or practicable, drill a new hole.

(3) During well construction, furnish the labor, tools, and equipment required for making alignment tests, and make these tests when the engineer directs.

639.3.7 Well Casing

(1) Ensure that the well casing when in place is watertight from top to bottom. If driving into unconsolidated material or through it to a seat in rock, as opposed to setting in place in a larger drilled hole, fit the casing with an engineer-approved standard driving shoe. During grouting operations, remove the outer temporary casing used to construct the upper drill hole unless the engineer allows otherwise.

639.3.8 Well Screen

(1) Fit the lower end of the well casing pipe, if specified, with the required well screen. Install the well screen in a way that allows removing the screen later.

(2) Submit a selected sample of the water bearing formation to be developed, to the screen manufacturer for mechanical analysis and its recommendation of a size of screen slot openings and length of screen necessary to allow the well to produce the required yield capacity. The contractor shall not use a screen less than 3 feet long, unless the engineer approves. Furnish a copy of the manufacturer's report or recommendation to the engineer.

639.3.9 Liner Pipe

(1) If a caving formation occurs in drilling in rock, seal it by driving a liner pipe fitted with a driving shoe into the rock to at least 10 feet above the caving zone. Then extend a drill hole, the same diameter as the liner pipe, below the liner pipe to the depth necessary to produce the required quantity of water.

639.3.10 Grouting

(1) Mix a neat cement grout by methods, and to a consistency, the engineer approves, using not more than 5 1/2 gallons of clean water per sack of cement. The contractor shall not use admixtures in the cement grout.

(2) Place this grout in the annular space between the inner well casing and the outer casing, or the casing and the hole where the casing does not extend the entire depth of the hole. If using a liner pipe, then fill the annular space between the liner and the casing to the top of the liner pipe.

(3) Place the grout by using a pressure method the engineer approves, with a pump designed for the purpose, forcing the grout from the bottom upward toward the surface. Continuously place this grout until the annular spaces are filled.

(4) Provide standby grout placing equipment in case the original equipment fails. Use standby equipment that provides gravity placement of grout with a pipe or tremie in the annular space between the casings.

(5) With the engineer’s approval, and if applying through a conductor pipe that extends to the placement point, the contractor may use concrete grout, consisting of cement, sand, and water in a proportion of one sack cement, to an equal volume of dry sand, and 5 1/2 gallons of water, instead of neat cement.

639.3.11 Test Pumping

(1) Upon reaching a water bearing formation that appears capable of producing the desired yield, the engineer may direct conducting pumping tests to determine if the water supply is satisfactory, and to establish the well depth.

(2) Provide a pump capable of pumping the specified gallons per minute to the discharge point against a free discharge and capable of continuous operation for the specified test period. Make provisions for throttling the pumping rate in order to determine water level data at various pumping rates.

(3) Furnish suitable and adequate equipment for making volumetric measurements of water pumping rates. Furnish electric probes or other engineer-approved means to measure static and dynamic water levels to the nearest 1/10 of a foot.

(4) Before conducting a pumping test, clear the well of cuttings and determine the well depth and static water level.

(5) Begin test pumping at a low rate and gradually increase it in a way that allows measuring the dynamic water level at various discharge increments. Take measurements of the dynamic water level at discharge increments the engineer specifies. At each increment, hold the pumping rate constant during measurement of the water level and rate of discharge.

(6) Maintain the specified pumping rate for the specified test period to determine if the well conforms to contract provisions.

(7) If the engineer deems the well adequate, make measurements of the dynamic water level at higher discharge rates as the engineer designates.

(8) If at any point during the test pumping the engineer determines the water supply is inadequate, discontinue test pumping, and the engineer will deem a unit of test pumping complete. The engineer will direct any further drilling and subsequent test pumping.

(9) Transport water pumped from a well during a test period or at any time during the contractor's operations to a place where it causes no damage.

639.3.12 Pump and Well Platform

(1) Construct the concrete platform at the prepared well site as the plans show. Mount the pump on the well casing according to plan details.

639.3.13 Wayside Well Shelter

(1) Construct the wayside well shelter with the materials and as the plans show.

639.3.14 Cleaning Up Operations

(1) Upon completing well drilling operations and placing materials for the well, pump, and related facilities; clean the well by bailing to remove cuttings from the drill hole; clear the site of debris, excess materials and equipment; and perform any necessary ground leveling work required to restore the site.

(2) Disinfect the well as required by the Wisconsin well construction and pump installation code NR 812.41.

639.3.15 Welding

(1) Perform welding conforming to AWS D 1.1, Structural Welding Code - Steel.

639.4 Measurement

639.4.1 Drilled Holes

(1) The department will measure the Drill Hole in Earth and Drill Hole in Rock bid items by the linear foot of vertical depth of hole acceptably completed.

639.4.2 Well Casing Pipe

(1) The department will measure the Well Casing Pipe bid items by the linear foot acceptably completed. The department will measure the casing pipe for the lower drill hole from the upper cutoff point to the bottom of the driving shoe. The department will not measure the outer temporary casing used to construct the upper drill hole for payment.

639.4.3 Well Screen

(1) The department will measure Well Screen by the linear foot acceptably completed, from the bottom of the driving shoe to the lower end of the screen.

639.4.4 Grout for Sealing Well Casing

(1) The department will measure Grout for Sealing Well Casing by the cubic foot acceptably completed.

639.4.5 Pump and Well Platform

(1) The department will measure Pump and Well Platform as each individual unit acceptably completed.

639.4.6 Wayside Well Shelter

(1) The department will measure Wayside Well Shelter as each individual shelter acceptably completed.

639.4.7 Test Pumping

(1) The department will measure Test Pumping, performed at the engineer's direction, as each individual unit acceptably completed. The depth of the well, as the engineer determines, whether shallower or deeper, will not constitute basis for the contractor to claim additional compensation.

639.5 Payment

639.5.1 General

(1) The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
639.0100 - 0199	Drill Hole in Earth (inch)	LF
639.0500 - 0599	Drill Hole in Rock (inch)	LF
639.1000 - 1099	Well Casing Pipe (inch)	LF
639.1700	Well Screen	LF
639.2100	Grout for Sealing Well Casing	CF
639.2500	Pump and Well Platform	EACH
639.3000	Wayside Well Shelter	EACH
639.4000	Test Pumping	EACH

639.5.2 Drilled Holes

(1) Payment for the Drill Hole in Earth and Drill Hole in Rock bid items is full compensation for providing materials required for drilling, including temporary casing pipe for upper drill hole; for providing water necessary for drilling holes; for drilling, blasting, alignment, and making alignment tests; for removing temporary casing; for procuring licenses and permits; for collecting and delivering samples of drilling to the Wisconsin geological and natural history society; for collecting and delivering water samples to the state laboratory of hygiene; for disposing of excavated material; and for record keeping and reporting.

(2) If the contractor fails to construct the well to the depth specified, or the depth the engineer orders, or if the well is abandoned because of loss of tools, or from any other cause such as poor well alignment, and the engineer directs the contractor to drill in another location the department will not make further payment until the new well progresses to the point in construction beyond that which the previous well was abandoned, only then will the department pay as provided here. The department will not make additional compensation for filling the abandoned hole with concrete, according to the requirements for abandoning wells and structures specified in 204.3.3. The department will include costs of materials, labor, and equipment involved in blasting or shooting operations in the price bid for other items, and will not pay for work done and materials used in the abandoned hole.

639.5.3 Well Casing Pipe

(1) Payment for the Well Casing Pipe bid items is full compensation for providing materials, including pipe and driving shoes; for handling, hauling, welding, driving, placing, and cutting off casing; for disinfecting the well; and for disposing of surplus materials, including pumped water.

(2) The department will pay for providing the liner pipe as extra work.

639.5.4 Well Screen

(1) Payment for Well Screen is full compensation for providing materials; and for handling, hauling, and installing screen.

639.5.5 Grout for Sealing Well Casing

(1) Payment for Grout for Sealing Well Casing is full compensation for providing materials; and for mixing and placing grout.

639.5.6 Pump and Well Platform

(1) Payment for Pump and Well Platform is full compensation for providing materials; for providing material for and grading mound at well site; for placing and finishing concrete; for installing pump, fittings, and fixtures; and for cleaning up the well site and disposing of debris and surplus materials.

639.5.7 Wayside Well Shelter

(1) Payment for Wayside Well Shelter is full compensation for providing and erecting materials; for excavating and backfilling; and for cleaning up the site and removing debris and surplus material.

639.5.8 Test Pumping

(1) Payment for Test Pumping is full compensation for performing the required testing.

(2) The department will include costs of obtaining, preserving, and transmitting geologic, water samples, and records including materials, labor, equipment, transportation, and incidentals in the unit prices for bid items.

(3) The cost of clean-up operations, including site restoration, is included in the unit prices for bid items.

(4) The department will not pay for contract time while awaiting test results on required water samples unless other contract operations are in progress in the same time.