In this issue:

- Bismarck Irrigation Workshop – Dec. 8
- Williston Irrigation Workshop – Dec. 15
- Fall Irrigation Checklist
- How is Your Irrigation Well Performing?
- Index of 2016 Articles

Bismarck Irrigation Workshop – Dec. 8

The workshop will be at the Bismarck Ramkota Hotel in conjunction with the North Dakota Water Users Association’s annual convention on Dec. 7, 8 and 9. The NDSU Extension Service, North Dakota Irrigation Association and North Dakota Water Users Association sponsor the workshop. The convention will include an irrigation and water products exposition.

Workshop topics will include unmanned aerial systems for agriculture, soil moisture measurement systems, irrigation feasibility studies in the McClusky Canal area, an update on new North Dakota Agricultural Weather Network (NDAWN) features, research updates from the Oakes and Nesson Valley sites, status of irrigation permits and water resources.

Williston Irrigation Workshop – Dec. 15

An irrigation workshop is scheduled for Dec. 15 in the Ernie French Center at the NDSU Williston Research Extension Center. The workshop, along with a sponsored lunch and break, is free of charge, with registration at the door. Contact Kelly Stehr or Tyler Tjelde at 701-774-4315 or kelly.stehr@ndsu.edu for more information.

Fall Irrigation Checklist

- Chlorinate the well.
- Drain pipes, valves, tanks and centrifugal pumps.
- Check all gearboxes on center pivots for moisture accumulation, lubricate all fittings, check the water drain valve on each span, remove and clean the system end cap, drain all water-carrying lines and drain the booster pump case.
- Protect pump-out risers and other equipment from livestock.
- Close or cover any openings that might invite rodent entry.
- Check all motor and pump openings to see that they are screened properly to keep rodents out.
- Lubricate all pump and motor bearings and shafts.
- Lock the control box in the “off” position.
- Spray electrical contacts with contact cleaner to displace dirt and moisture and prevent corrosion.
- Replace panel door seals if hard or broken to keep moisture and dust out.
- Check the level of oil in the reservoir and change if discolored.
- Loosen the packing gland if used.
- Loosen any belts.
- Remove the flow meter and pressure gauges and cover the holes.
- Store gated and straight pipe so they can drain.
- Inspect the gaskets in portable pipes.
- Park the center pivot into or with the prevailing wind (northwest or southeast).
- Winterize stationary engines.

Tom Scherer, 701-231-7239
NDSU Extension Agricultural Engineer
Thomas.Scherer@ndsu.edu
How is Your Irrigation Well Performing?

During the last few growing seasons, rainfall has been timely and of the right amounts, and the water levels in most aquifers are high. Consequently, pumping hours on the well(s) supplying the irrigation system have been greatly reduced.

However, that doesn’t mean the well screens have not been affected. They may be plugging slowly, but you won’t notice this until you see lower aquifer water levels in response to more pumping during dry periods.

To keep your well in good working condition, it should be chlorinated properly every year, and if it’s an older well, it may need redevelopment.

I often hear irrigators say they don’t want to pay for the cost of development because it doesn’t help with well performance. This may be a true statement if the well was poorly developed at the time of construction. However, if the well was properly developed, it will have less drawdown, save on pumping costs and have less trouble supplying water during high water use periods. As energy costs increase, anything that reduces the drawdown in a well will pay big dividends in the future.

A well provides access to the aquifer where the water is located. During pumping, if a well is functioning properly, the water from the aquifer will enter the well screen with the lowest possible amount of restriction. Anything that restricts the flow of water into the well can affect energy costs and flow rate by increasing the drawdown.

The drawdown is the difference between the static water level and the pumping water level, Figure 1. From a hydraulic point of view, drawdown is the head (pressure) required for water to flow into the well. The greatest amount of drawdown occurs within a few feet of the well, where the velocity is the greatest.

Most irrigation wells are constructed with a rotary drilling rig that uses a high-viscosity fluid (often called a drilling mud) to keep the borehole open during the drilling process. Although necessary, the drilling mud seals the borehole and often penetrates into the surrounding aquifer formation. In addition to the drilling mud, the rotary drilling process also smears the borehole surface, which compacts the natural material around the borehole.

The most common drilling mud uses bentonite, natural clay mined in Montana and Wyoming.

If left in place after construction, the drilling mud will seal part of the aquifer and increase the drawdown.

After the casing and screen are set in the borehole, removing the drilling mud left in the aquifer formation, Figure 2, is very important. This process is called well development. This is even more important with gravel-packed wells because the gravel pack is a barrier to removing the drilling mud.

Several methods are available for developing a well. In order of effectiveness as well as cost, they are airlift pumping with agitation, surging and jetting. Development is also very important after a well has been rehabilitated.

Air Lift Pumping and Agitation

Airlift pumping forces compressed air through an airline to the bottom of the well, Figure 3. As air bubbles rise, they create a surging effect that carries water and fines out of the well. Airlift pumping is alternated with short periods of no pumping, which forces water out into the formation to help break up sand bridging around the screen. Well development

Figure 2. Side view of the materials just outside the well screen for a naturally developed and gravel pack well.
is only effective if the water is deep enough in the well to get the surging action.

**Mechanical Surging**

Surging alternately forces water into and out of the formation through the well screen openings, Figure 4. A pistonlike tool moves up and down in the well to create the surging action. The surging of the water through the well screen loosens the mud and fines in the borehole and draws them into the well to be removed by pumping or bailing.

Surging is especially suited to cable tool drilling. While common for bridge or louvered well screens, surging is not very effective with very deep wells (in excess of 200 feet) or those with multiple screens.

**Jetting**

The best well development method is high-pressure water jetting with simultaneous pumping, Figure 5. High-velocity water jets through the screen and gravel pack into the formation to loosen and break down the fine materials. The jetting tool rotates slowly as it is moved up and down inside the well screen. Pumping at the same time removes the loosened sand and mud that enters the well screen. The jet stream can be directed at any part of the formation around the well for selective development.

Cage-wound screen is best for jetting because it's design allows the jet to impinge directly on the gravel pack or borehole. Well screens that use louvered or bridge openings do not respond to this type of development because the opening design interferes with the jet of water. Jetting is often the most costly development method.

**Redevelopment of Older Wells**

As water flows into a well, it carries minerals with it. With use, these minerals can build up on the formation materials near the well screen because that is where the water velocity is the greatest.

This may sound counter-intuitive, but some minerals will precipitate at the high velocities. Through time, the deposition of minerals can encrust the screen and formation, which increases the resistance to flow of water into the well.

By adding a weak acid to the well and combined it with agitation, these mineral deposits can be dissolved and removed. By combining water jetting with acid, the well can be redeveloped and often can be brought back almost to production when the well was new.

**Caution:** This method should be used only on stainless steel and plastic screen. Some older iron screens are susceptible to acid and may collapse.

**Tom Scherer, 701-231-7239**
NDSU Extension Agricultural Engineer
Thomas.Scherer@ndsu.edu
For more information on this and other topics, see www.ag.ndsu.edu

NDSU encourages you to use and share this content, but please do so under the conditions of our Creative Commons license. You may copy, distribute, transmit and adapt this work as long as you give full attribution, don’t use the work for commercial purposes and share your resulting work similarly. For more information, visit www.ag.ndsu.edu/agcomm/creative-commons.

County commissions, North Dakota State University and U.S. Department of Agriculture cooperating.

North Dakota State University does not discriminate on the basis of age, color, disability, gender expression/identity, genetic information, marital status, national origin, public assistance status, race, religion, sex, sexual orientation, or status as a U.S. veteran. Direct inquiries to: Vice Provost for Faculty and Equity, Old Main 201, 701-231-7708 or Title IX/ADA Coordinator, Old Main 102, 701-231-6409.

This publication will be made available in alternative formats for people with disabilities upon request, 701-231-7881.

**Index of 2016 Water Spouts Articles**

**May 2016**

Ever Heard of the Agricultural Water Year? Tom Scherer

NDSU Potato Blightline to Operate in 2016, Gary Secor

Irrigated Potato Cultivar Trials, Andy Robinson

Summer Water Tours – North Dakota Water Education Foundation

**June 2016**

Project Safe Send – Disposal of Pesticides, Jeremiah Lien

Irrigation Scheduling – Start Preparing Now, Tom Scherer

Thinking About a New Irrigation System? Dave Franzen

Maintaining Air/Vacuum Release Valves, Tom Scherer

Summer Water Tours – North Dakota Water Education Foundation

**July 2016**

Oakes Irrigation Research Site Field Day Aug. 18, Kelly Cooper

The Impact of an Extra Inch of Irrigation Water, Tom Scherer

Irrigation Scheduling and Small Rainfall Events, Dean Steele

Water Use of Irrigated Crops, Tom Scherer

Summer Water Tours – North Dakota Water Education Foundation

**August 2016**

Northern Plains Potato Grower Association Field Day, Andy Robinson

Last Summer Water Tour, ND Water Education Foundation

Mobile Drip Irrigation Projects at Kansas State University, Danny Rogers

We Quickly Are Approaching the Last Irrigation, Tom Scherer

**September 2016**

Bismarck Irrigation Workshop Dec. 8

Does Your Irrigation Well Need to be Chlorinated? Tom Scherer

The Pressure Gauge is an Important Indicator of Irrigation System Performance, Tom Scherer

Some Suggestions for Before and After Fall Harvest, Tom Scherer

**October 2016**

Upcoming Irrigation Workshops

Fall Irrigation Checklist, Tom Scherer

How is Your Irrigation Well Performing? Tom Scherer