www.ag.ndsu.edu/extension-aben/irrigation/water-spouts

water spouts

No. 321 May 2022

In this issue:

Upcoming

2022 NDSU Field Days

Details for the field day at each location listed below will be posted to their websites sometime in June.

July 11	**Central Grasslands Research Extension Center, Streeter**
July 12	**Hettinger Research Extension Center**
July 13	**Dickinson Research Extension Center**
July 13 & 14	**Williston Research Extension Center**
	July 13 – Dryland Tour at the Williston REC
	July 14 – Irrigated Tour at the Nesson Research and Development Farm
July 18	**Agronomy Seed Farm** Casselton
July 19	**Carrington Research Extension Center**
July 20	**North Central Research Extension Center, Minot**
July 21	**Langdon Research Extension Center**

Links to the website for each Research Extension Center can be found at: ndsu.edu/agriculture/ag-hub/research-extension-centers-recs.

Welcome

The 2022 water year (which started in October of 2021) began as a drought for much of the state, but fall rains, late winter snowstorms and spring rain events have taken most of the state out of the serious drought categories. However, the northwestern corner of North Dakota is still in drought. The cool, wet spring has delayed planting in many areas, but I am confident planting will be done in time for most areas. Fortunately, the water in the root zone of many fields has been recharged resulting in a good start for crop growth.

The irrigation workshop held last December in conjunction with the North Dakota Water Users Convention was well attended. It was a hybrid meeting in that some of the presentations used Zoom, but everything went very smoothly.

A presentation by Chris Bader, head of the Department of Water Resources (DWR) appropriation division, covered the impact of drought on aquifer levels. As of December, he showed that, generally, most aquifers were in good shape, but if the drought persisted, it could start to affect some aquifers. With the precipitation we have received since December, it is fair to say that many aquifers have been recharged to some extent. If you are curious about the water levels in the aquifers that supply your irrigation system, the Mapservice app on the DWR website will show the latest groundwater level readings. The website can be accessed at *https://mapservice.dwr.nd.gov*. In the Layers list on the right side, click on the folder for Water Resources, and then select the Ground/Surface Water Sites checkbox. In the middle of the list are the check boxes for Observation wells. By checking any of these, they will show up on the map. Selecting Ground/Surface Water Sites in the Active Layer in the upper right corner will allow you to select a well and look at water levels.

Have a great growing season, and remember to take care of your irrigation system. It is better to do required maintenance now to prevent breakdowns that could occur during the critical crop development and fruiting stages.

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NDSU | EXTENSION

Updated Extension Irrigation Publications and Irrigated Crop Budgets

A number of NDSU Extension publications have been revised and updated. You can access them on the Ag Hub website at *www.ndsu.edu/agriculture/ag-hub*. Type in "irrigation" in the search link and a list of the publications will be shown. Probably the most important is AE91 "Selecting a Sprinkler Irrigation System" because the investment for different types of sprinkler systems have been updated to 2022 costs.

Another important development is the availability of updated irrigated crop budgets. These hadn't been updated since 2014. They can be found online by searching "NDSU irrigated crop budgets." The budget tools are Excel spreadsheets, and the values in them are meant to be a guide with the expectation that the user will enter costs and yields from their operations.

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Electrical Safety is Important When Starting Your Irrigation System

The major components of your irrigation system have been sitting idle since last fall, and with the late spring snow storms, may have sustained some damage. It is always a good idea to visually check all the parts of your irrigation system before starting the pump or center pivot.

The most common problem at startup is rodents getting into electric control boxes and causing damage during the winter. The long cold winter and spring probably increased rodent nesting activity in electrical control boxes. The damage may result in chewed wires and control switches or corrosion caused by urine. If you don't look for this type of damage **before turning on the system,** some components could explode. You could be hurt if standing in front of the electric control box.

The freeze/thaw cycle during the fall, winter and spring, along with vibrations from the previous growing season, tend to loosen bolts, nuts or screws, especially on electrical components or wire fasteners. This can result in poor electrical connections or, worse, a wire touching either ground or another conductor.

As a precaution, before turning on any electric equipment, open all electric control panels (this includes pivot control panels and tower boxes) and look for any evidence of rodent damage and loose wires or connectors. Also, check electric motors and phase converters. If protective screens are missing, look for damage to exposed wires, rodent nests or missing parts. If there is rodent damage, look for the point of entry and plug it. I have seen several electric control boxes with mouse nests in them, and the point of entry was through the conduit from the motor. The screens on the electric motor had been removed and the mice entered the motor and followed the conduit into the control box. From the mouse's point of view, this was a perfect nesting situation.

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The Cost to Pump Water Keeps Increasing

Electricity and diesel fuel are the most common energy sources for pumping irrigation water in North Dakota. Currently, the price of farm-delivered diesel fuel is around $5 per gallon, and it is not certain the price will drop by the end of the irrigation season. If you currently use a diesel-powered pump for irrigation, it could pay to consider converting to an electric powered pump.

Figures 1 and 2 show the costs of pumping one acre-inch of water with a high-, medium- and low-pressure pumping plant for a wide range of fuel costs. An acre-inch is 27,500 gallons of water, which is the amount of water required to cover one acre to a depth of one inch. To apply an inch of water to the land under a standard quarter section center pivot requires about 128 acre-inches of water. These graphs were developed for center pivot sprinkler systems that obtain water from wells. The energy to power the center pivot (whether electric or hydraulic) has been included in the pumping costs.

The high-pressure system assumes a 50-foot lift in the well and 100 pounds per square inch (psi) of pressure at the pump. The medium-pressure system assumes a 50-foot lift in the well and 70 psi of pressure at the pump. The low-pressure system assumes a 50-foot lift in the well and 40 psi at the pump. The statewide average irrigation cost for off-peak electric power is about 7 cents per kilowatt-hour (KWH) and regular power rates are about 10 cents in North Dakota when adjusted to include the energy charge, the demand charge and/or annual charges. The current price for farm-delivered diesel fuel is about $5 per gallon. A comparison of pumping costs are shown in Table 1.

Table 1. Cost to pump an acre-inch of water (27,500 gallons) at 800 gallons per minute for low-, medium- and high-pressure center pivot pumping plants.

	Electric		Diesel
Pressure at Pump	**Off-Peak** ($0.07/KWH)	**Regular Rates** ($0.10/KWH)	**@ $5.00 per gallon**
Low	$1.40	$2.00	$7.00
Medium	$2.04	$2.91	$9.96
High	$2.67	$3.82	$12.93

Figure 1. Electric pumping costs for a high-, medium- and low-pressure irrigation pumping plant. The two arrows show the pumping costs for 7 and 10 cent per KWH electricity on a low- and medium-pressure pumping plant are $2 and $3 per acre-inch, respectively.

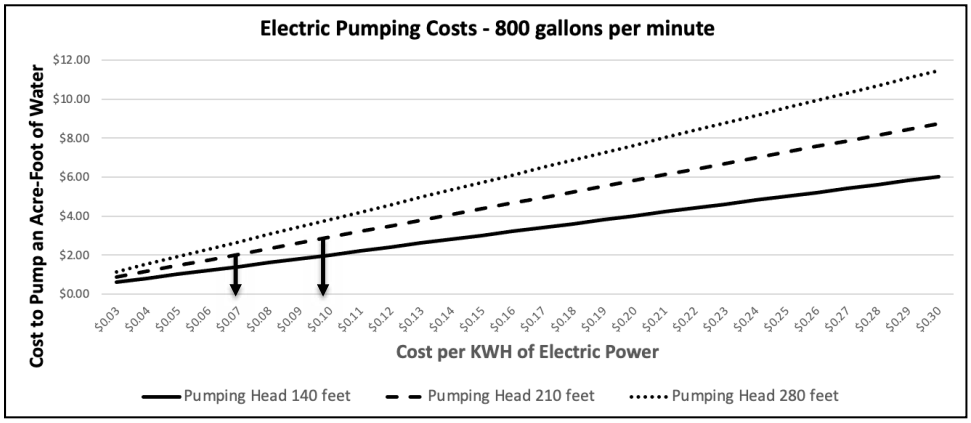
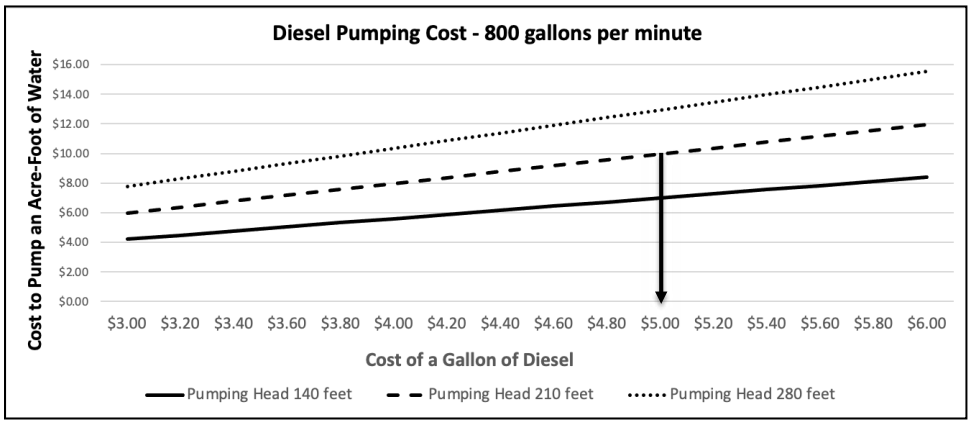


Figure 2. Diesel pumping costs for a high-, medium- and low-pressure irrigation pumping plants. The arrow shows that with farm-delivered diesel fuel at $5 per gallon, it will cost $6.50 to pump an acre-inch of water through a low-pressure irrigation system. For the medium-pressure system, the cost of pumping is $10 per acre-inch of water.



For the last 10 years, the annual statewide average of pumped water per acre of irrigated land has been about 10 acre-inches. For a medium-pressure system, the additional pumping cost using diesel on a per acre basis is about $70 and $79 compared to regular and off-peak electricity, respectively. For a typical center pivot irrigating about 128 acres, the annual difference in pumping cost between diesel and electric would be about $8,960 at regular power rates and $10,110 with off-peak electric rates. These huge differences in pumping costs make it economical to change from diesel engines to electric motors.

Diesel or Electric Power?

Due to the large motor sizes (25 to 100 horsepower), three-phase electricity is the preferred power source for pumping irrigation water. The reason many irrigators originally installed diesel engines instead of electric motors was the cost of access to three-phase power. The cost of access to three-phase power may still be too high even with the large energy cost differential between electric and diesel. Many electric suppliers have programs to help reduce the cost of installing three-phase line including cost-share and multi-year power use contracts.

Single-phase electricity can be used for pumping irrigation water, but it must be converted to three-phase power. To do this requires the purchase of phase converters or a variable frequency drive (VFD). In addition, there will still be line extension charges for the single-phase power. Some electric suppliers are very leery of using single-phase power lines for irrigation pumping loads at certain locations on the distribution system, so it is very important to visit with them and discuss your plans.

In addition to the line extension charges, you have to factor in the cost of an electric motor, electric shutoff and control panels along with labor. Additional costs could involve phase conversion equipment, transformers and underground line installation. Of course, there is some salvage value for the diesel engine, fuel tank and other parts.

Other factors to consider are the reliability of electricity, not having to maintain the diesel engine (changing oil and filter every 150 hours) and whether or not you can live with controlled (off-peak) electric service. If you are considering changing from diesel to electric, plan to visit both your electric supplier and irrigation dealer.

If connecting to electricity is too expensive, here are some options to reduce pumping energy requirements. First, reduce pressure requirements. Check with your irrigation dealer to see if you can install a lower-pressure sprinkler package. For example, at a pumping rate of 800 gallons per minute (gpm), a 10-pound psi reduction at the pump will reduce pumping power by 6.5 horsepower. This would save about one third of a gallon of diesel per hour. Second, improve the efficiency of the diesel engine. If your diesel is more than 15 years old, upgrading to a newer model can improve fuel use by 10% to 25%. Third, maintain your well. Partially plugged well screens increase drawdown, which increases pumping energy requirements. Fourth, plug all leaks in the pipeline and on the pivot. Leaks put water where you don't want it.

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North Dakota Water Education Foundation – Summer Water Tours

Access to substantial quantities of clean water is important for the developments within North Dakota, and the best way to learn about water projects is to see them in person via a tour.

These tours provide a firsthand look at North Dakota's critical water issues. Registration is $20 per person and includes tour transportation, meals, refreshments, informational materials and a one-year subscription to North Dakota Water magazine.

Tours offered are:

- June 15 – **Devils Lake: Shaping the Community** (tour begins and ends in Devils Lake)
- June 30 – **Western Area Water Supply: Powering Industry with Water** (tour begins and ends in Williston)
- July 13 – **From Grey Water to Great Water** (tour begins and ends in Fargo in conjunction with the Joint Summer Meeting)
- July 19 – **Getting Water Where It Needs to Go** (tour begins and ends in Grafton)
- July 21 – **Where Water West Begins** (tour begins and ends in Dickinson)
- August 3 – **Water Supply for North-Central North Dakota** (tour begins and ends in Minot)

For more information about each tour, visit *https://ndwater.org/events/summer-water-tours/* or send a check made out to NDWEF and mail to PO Box 2254, Bismarck, ND 58502. Please indicate which tour or tours you want to attend and include the number of people. For more information give us a call or send an email.

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