water spouts

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http://www.ext.nodak.edu/extnews/spouts/

Greetings

A new irrigation season is about to begin. Can you believe that 35 years have passed since the first issue of *Water Spouts* was printed? Irrigation continues to be developed in North Dakota. This year, the state will have more than 260,000 acres of controlled irrigation, and the interest in ethanol could spur much more development. Center pivots are used on over 80 percent of the irrigated land and many obtain their water from wells.

Groundwater chemistry can change through time. The mineral content in irrigation well water should be checked periodically (every five to eight years). If you haven't had your well water analyzed for several years, this summer would be a good time to collect a sample and send it to a laboratory. The Soil and Water Environmental Laboratory at NDSU will do a soil/water compatibility analysis for $35. A copy of its irrigation water sample information sheet has been included with this issue of *Water Spouts*.

I am always looking for announcements of irrigation-related events, field days or other news, so if you hear of any in the region, please send me a copy of the announcement and I will include it in *Water Spouts* this summer.

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Carrying Capacity of Pipes

As the price of electricity and diesel fuel increase, most irrigators are looking for ways to reduce the amount of energy used for pumping water. Lowering sprinkler pressure and reducing friction loss in pipelines will reduce pumping energy. In the last 10 years, the sprinkler systems on many center pivots have been converted to low pressure. Lower pressure translates directly to lower energy.

However, many irrigation systems have undersized pipes for a variety of reasons. The most common reason may be that energy was not a big concern in the past, and selecting a smaller pipeline reduced the capital investment cost at the time of installation, especially if the pipeline was long. Now friction loss in these pipelines may be affecting energy costs significantly and even may affect the amount of water that can be delivered to the far end of the pipeline.

As water moves through a piping system, energy is lost because of friction with the pipe wall, change in flow direction (elbows, tees, etc.) or constrictions (valves, pipe reducers, etc.) Anything that causes turbulence will increase the friction loss. The amount of friction increases with the square of the velocity. This means if the velocity in a pipeline doubles, the pressure drop increases four times. This is the reason that engineers recommend a maximum water velocity of 5 feet per second in the pipeline. Therefore, undersized pipe for a desired flow rate will have greater friction loss and reduced pressure at the delivery point.

When selecting or replacing pipe, many irrigators have trouble determining the carrying capacity of pipes. Carrying capacity is based on the *area* of the inside of a pipe, and is calculated using the diameter squared times a constant of 0.785. Table 1 shows the relationship in carrying capacity among different pipe diameters. For instance, the difference in carrying capacity of a 6-inch-diameter pipe is 2.25 times greater than a 4-inch-diameter pipe. The fact that increasing the diameter 2 inches will result in this large a difference can seem confusing. Here is another way to look at Table 1 – note that you need four 4-inch-diameter pipes to equal the carrying capacity of one 8-inch pipe or that the carrying capacity of two 10-inch pipes is *less* than one 15-inch pipe.

Carrying capacity of a pipe also affects the operation of centrifugal pumps that have suction pipes. Suction pipes should be at least one pipe diameter greater than the

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Table 1. Difference in carrying capacity due to change in pipe diameter. For example, a 12-inch pipe has 1.44 more carrying capacity than a 10-inch pipe.

Increasing this pipe diameter →	To this diameter →	Increases the capacity by a factor of
(inches)	(inches)	
4	6	2.25
4	8	4.00
6	8	1.78
6	10	2.78
6	12	4.00
8	10	1.56
8	12	2.25
8	15	3.52
10	12	1.44
10	15	2.25
12	15	1.56

discharge pipe. Many irrigation pumping plants near surface water bodies have suction pipes that are the same size as the discharge pipe. This contributes to higher friction loss and may even lead to cavitation of the impeller. Selecting the right size suction line to match flow rate and lift can improve pump performance significantly. Increasing the suction pipe diameter will increase the weight in the pipe and will increase the volume of water needed to prime the pump as shown in Table 2. For example, increasing the diameter of a suction pipe from 8 to 10 inches will increase the weight of water in the pipe about 122 pounds per 10-foot section. The volume of water needed to fill the suction pipe to prime the pump will increase about 15 gallons per 10-foot section.

Table 2. Volume and weight of water in 10 feet of pipe for various diameters.

Pipe diameter	Volume of water in 10 feet of pipe	Weight of water in 10 feet of pipe	Flow rate when velocity is 5 ft/s
(inches)	(gallons)	(lbs)	(gallons per min)
4	6.5	54	195
6	14.7	122	440
8	26	217	780
10	41	339	1,220
12	59	488	1,760
15	92	762	2,780

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Irrigated Crop Budgets Have Been Updated

Projected budgets for irrigated crops in North Dakota have been updated for the upcoming growing season. The budgets were prepared to be a source of information for producers, lenders and others who have a need for estimating the costs of growing irrigated crops. Separate crop budgets have been developed for the western, central and eastern portions of the state. Crops covered in the budgets are alfalfa, alfalfa seeding, corn grain, corn silage, dry beans, malting barley, soybeans and spring wheat.

Printed copies of the budget reports are available at county offices of the NDSU Extension Service. Electronic forms can be found on the Web at *www.ext.nodak.edu/extpubs/ecguides.htm*. The electronic forms include a printable version and an Excel spreadsheet.

The budgets were prepared from the perspective of the landowner. The land charge is based on average rent for dryland. In addition, land taxes are charged based on an average value for the region. The investment in irrigation equipment, well and piping is recaptured apart from the land.

These budgets account for full economic opportunity costs of land, machinery and machinery housing. Labor and management are not included. Therefore, the bottom line represents the return to labor and management. Labor and management become the residual claimants of profit or loss and, as a result, are negative for some projected budgets.

Farm program payments (direct and countercyclical) are not included in the budgets. These payments are tied to historic farm program base acres and payment yields, not to the current crop. They are an important component of overall farm profitability, but have very little impact on the selection of crops to produce or the comparative profitability of those crops. Loan deficiency payments and marketing loan gains affect crop profitability and, therefore, crop selection if the expected market price is below the loan rate. However, the projected prices are at or above the loan rate for all program crops in these budgets.

The ownership cost is handled the same as machinery investment. A 10 percent residual value is assumed, with the balance of the investment depreciated during its full, useful life. Useful life varies by component, but averages about 20 years for the total irrigation system. Straight-line depreciation is used. Interest on average annual investment is charged at 5 percent.

Electricity rates used for irrigation reflect off-peak or controlled electric rates, plus demand and other charges for all crops.

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Be Safe When Starting Your Irrigation System

If we have a dry spring, many irrigation systems are going to be started earlier than normal. The major components of your irrigation system have been sitting idle since last fall and may have sustained some damage. Visually checking all the parts of your irrigation system before starting the pump or center pivot always is a good idea.

Electrical Safety

The most common problem at startup is rodents getting into electric control boxes during the winter. The damage may result from rodents chewing on 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 you are standing in front of the electric control box.

Another problem is loose bolts, nuts or screws, especially on electrical components or wire fasteners. The freeze/thaw cycle during the fall, winter and spring, along with vibrations from the previous growing season, sometimes can cause bolts, nuts and screws to loosen. This can result in poor electrical connections or worse – a wire touching either the 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, 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 you find 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.

Pipelines

Filling pipelines can be another major problem when irrigation pumps are turned on for the first time in the spring. Pipelines, especially those that go through low areas or over hills, should be filled very slowly. This means setting the shut-off valve at the pump site so it is about one-quarter open when the pump is turned on. Then gradually open the valve as the pipeline becomes full. That may take a little more time, but it could save you some money.

Filling the pipeline slowly allows air to move to the high point of the pipeline and leave through an air relief valve. Filling slowly also prevents pipeline damage from water hammer. Irrigation dealers commonly are called to repair a ruptured pipeline because it was filled too fast. The damage may have been caused by ice in the pipe or a large flow of water hitting an elbow or tee in the pipeline.

Spring is always a busy time of the year, and sometimes getting the irrigation system ready is easy to forget.

Here is a checklist to help get your irrigation system running smoothly:

- ❑ Open and check electric control panels for rodents or damage before starting the irrigation system.
- ❑ Check all motor openings to see if they are properly screened to keep out rodents.
- ❑ Measure and record the static water level in all wells.
- ❑ Visually inspect the piping system, especially aboveground pipe.
- ❑ Check all air-release valves to make sure they are working.
- ❑ Fill pipelines slowly; make sure all the air is out of the system.
- ❑ Replace any broken or old pressure gauges.
- ❑ Check the sprinkler system for damage.
- ❑ Make sure all portable aluminum or PVC pipe sections have gaskets installed.
- ❑ Check gearboxes on center pivot towers for water accumulation. Drain water and replace with oil.
- ❑ Check the tire pressure on center pivots.
- ❑ With the center pivot running, visually check each sprinkler head to make sure it is working properly.

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Water Spouts: An Irrigation Newsletter for 35 Years

Water Spouts is a monthly newsletter published seven times a year each month from April through October. The purpose of this newsletter is to provide you with information to help better manage irrigation systems and water resources. The NDSU Irrigation Task Force tries to select topics for each issue that provide current information you can use. The task force consists of the following individuals:

- *Tom Scherer*, Extension agricultural engineer
- *Mike Liane*, Extension area irrigation agent
- *Dwain Meyer*, professor, forage management
- *Blaine Schatz*, director, Carrington Research Extension Center
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- *Larry Cihacek*, associate professor, Soil Science Department

At the end of each *Water Spouts* article, the author's name, telephone number and e-mail address are listed. If you have any questions about any article, please contact the author by whatever means is convenient. If you prefer, contact me for help. If you want to look at past issues of *Water Spouts*, they are available on the Internet at the address shown at the top of this newsletter (under the pumps).

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