The Pressures of Proper Pump Selection

by Luke Frank

Pump station end-users should consult with a manufacturer's representative to select a pump that meets all their application needs.

Water for large turf areas comes from a variety of sources these days: municipal systems, storage ponds, wells and rivers or some combination. Regardless of the source(s), seldom is water available at pressures sufficient to irrigate large expanses of parks, athletic fields or resort grounds in the limited watering windows grounds managers are expected to deal with.

Pumps and pumping systems are important to delivering safe, sufficient flow and pressure to a large irrigation system. Proper selection of pumps is the basic foundation of an efficient pump station. Even the best pump controls can't manage excess power consumption resulting from improper pump selection.

Pick Your Pump

Generally, if you can procure a water source, you can efficiently deliver it to your irrigation system. Today, five basic types of pumps are used to deliver still greater flows and pressures demanded of modern grounds managers and their irrigation systems:

1.) Centrifugal pumps lift water from lakes or wells and are used as primary irrigation water suppliers. Centrifugal pumps can lift water, but suction/lift capacities vary. These pumps tend to be "loud" because of high motor and pump RPM.

2.) Centrifugal pumps with positive suction pressure are used as pressure boosters from above-ground reservoirs. They also tend to be a bit noisy.

3.) Vertical turbine pumps also are primary irrigation water suppliers, lifting water from lakes, wells or rivers and boosting pressure into irrigation systems. These stealthy pumps, using multiple stages, can run at lower RPMs and are considerably quieter.

4.) Submersible pumps used as primary water suppliers lift water from lakes, wells or rivers and also are quieter.

5.) Vertical turbine barrel pumps are used as high-pressure boosters from above-ground reservoirs in pipelines.

Pump station end-users should consult with a manufacturer's representative to select a pump that meets all their application needs. Photo courtesy: FloBoy Pumping Systems.

Efficient Operation, Lower Flows

An irrigation system operating at the lowest possible cost must use pumps with a high efficiency at minimal flow rates. To maximize efficiency, constant-speed systems use multiple pumps of various sizes. Variable-speed drives use fewer but larger pumps, with the drive reducing pump speed to match any reduced flow requirements.

By selecting pumps with flat curves, less energy is required at reduced flow rates for either constant-speed or VFD systems. Generally, there is little difference in energy requirements between constant-speed and VFD stations, when equipped with properly selected flat-curve pumps. Proper pump selection means lower power costs.

Irrigation Controls and Efficiency

Many computer-controlled irrigation systems include a flow-manager feature, which enables sprinkler valves to activate out of normal operating sequence. A total flow "ceiling" is entered into the computer which allows as many sprinklers to operate as possible to meet, but not exceed, this flow ceiling. During an irrigation cycle, each sprinkler valve will be activated for its total runtime as programmed into the computer, but it might not operate in the programmed sequence. The effect is to maximize the time in which the pumping station operates at peak efficiency, while also closing the watering window.

Some watering at reduced flow rates is still necessary, but flow-manager systems significantly reduce flow imbalances and wear-and-tear on systems.

Selecting Pump Stations

No single type of pump station is best for every application, nor is there a single manufacturer that can meet every customer's needs. Each site is unique in its character, so engineering

the "ultimate" pump station takes a team approach. Those responsible for the cost, design, manufacturing, performance, installation, and maintenance must work together to make the best station selection. Following are the roles for those involved in the specification process:

Owner, Architect, Consultant

- Determine first that there is adequate water available for the irrigation system.
- What and where are the water sources—wells, lakes, municipal water, streams or a combination of sources? Will recycled water be used and what is its quality?
- Determine the availability of power sources to the pump station. Where are they located on the site and what are their costs?
- Determine the site requirements at the pump station's location. Does it need to be enclosed and what type of enclosure complements the site? What about noise? Should it be accessible for servicing?
- What type of stations are needed? Working with the owner, the irrigation consultant will determine whether there's adequate water, the type and location of the stations and the power or fuel to be used.
- What about the irrigation management personnel and their input?
- Establish pressure and flow rates, and the irrigation cycle times those rates require during high and low seasonal demands.
- Identify special filtration or fertigation injector equipment needs.
- Specify maximum station power at flow rates of 25 percent, 50 percent, 75 percent and 100 percent.
- Select and specify stations that can be provided within the budget.

Grounds Manager, Irrigation Personnel

- Ensure the pump station(s) will be easy to maintain.
- What spare parts should be kept?
- Preventive maintenance schedules and considerations.
- What service is available from the manufacturer and local consultants; how quickly can service personnel respond; and what are the service providers' charges?

Installation Contractor

- Understand site preparation requirements.
- Formulate plan to immediately notify all parties of any construction schedule changes.
- Coordinate pump station delivery, installation, start-up, and calibration.

Manufacturer

- Integrate input from owner, architect, irrigation consultant, irrigation management personnel and contractor to design, build, deliver (on time) and install a station within a budget.
- Provide comprehensive and easily understandable installation, operation and maintenance manuals to help with preventive maintenance schedules and troubleshooting procedures.
- Promptly respond to and satisfy operators' requests for after-sales assistance.
- Provide a local service capability and inventory of spare parts for both preventive maintenance and emergency repairs.

• Maintain communication with station operators regularly after the sale. Advise owners and operators of new developments that might improve station performance or lower operHating costs.

A Little History

Used to be that large turf areas (100-plus acres) were sprinkler irrigated, dragging cumbersome hoses and sprinklers around the site. Many of these early irrigation systems used municipal water supplies with adequate pressure to operate the sprinklers. Unfortunately, the coverage was anything but uniform, labor expenses were high and turf quality was "spotty."

As grounds managers began punching in quick-coupler systems, sprinkler uniformity and turf quality improved dramatically, but irrigators began demanding more water at higher operating pressures to attain the desired coverage in a shorter watering window. Pumps were added to boost pressures and add valves to an irrigation set. As the price of municipal water steadily rose, alternate sources of irrigation water were developed, like wells and surface water. In order to transport water from these newer sources, pumps were required. Thus evolved the large-scale use of pumps and ultimately pump controls that we use today.

Out of Control

As systems grew larger with several different controllers and irrigation cycles, the pump start system became unwieldy, because of the added expense of extensive wiring needed for each satellite controller to "communicate" with the pump station.

Consequently, irrigation control systems were developed that enabled pumps to activate on a small pressure drop in the irrigation system, maintain a constant system pressure using main control valves over a wide range of flow rates, and stop pumps as the flow decreased. The need to wire controllers to the pump was eliminated, and irrigation system mainlines were kept under pressure ready to deliver spot water at any time. The system minimized pipeline breaks resulting from water hammer and pump cycling. These systems are still installed and used successfully today.

Variable speed pumping systems appeared on golf courses nearly 30 years ago. These early systems were very expensive, and not very efficient. About 15 years ago, new technology emerged—the variable-frequency drive (VFD)—and quickly became cost competitive. Numerous pump station manufacturers developed and marketed VFDs. Early claims regarding efficiency and power cost savings helped these systems gain wide acceptance with owners, operators, and irrigation designers. Another appealing feature was the ability of some VFD control systems to accelerate a pump to its operating RPM gradually, reducing starting pressure spikes on the irrigation piping system. With improved VFD drives and fewer equipment failures from pressure surges, VFD systems are as reliable as constant-speed units.

There are numerous considerations important to the selection of pumping stations. Have a comprehensive understanding of your site, your sources and your personnel before you begin to "shop." Proper pump selection creates kinder, gentler irrigation systems performing at peak efficiencies. Use the team approach and share in the glory.