

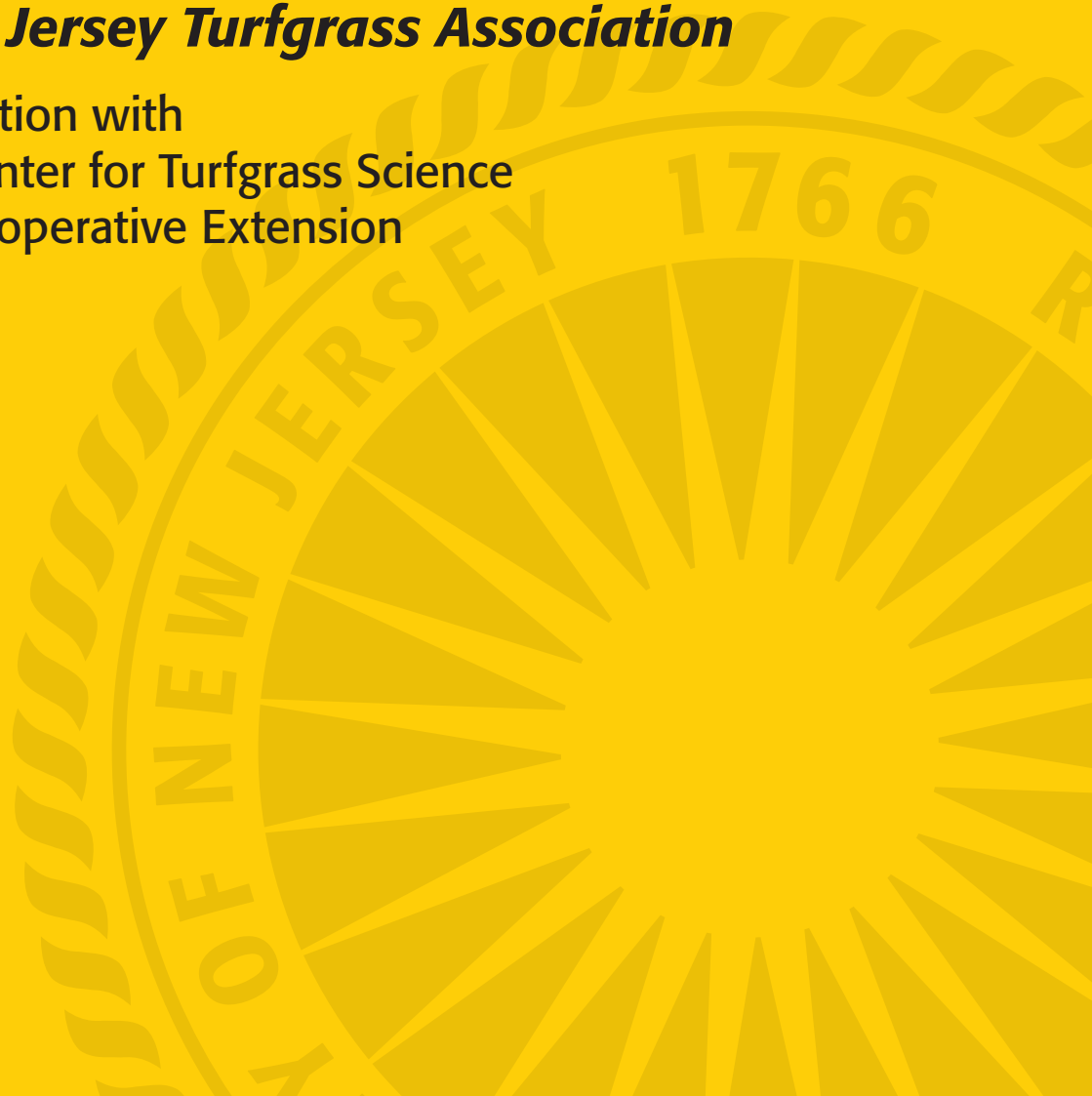
RUTGERS

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This publication includes lecture notes of papers presented at the 2012 GREEN EXPO Turf and Landscape Conference. Publication of these lectures provides a readily available source of information

covering a wide range of topics and includes technical and popular presentations of importance to the turfgrass industry.

This proceedings also includes research papers that contain original research findings and reviews of selected subjects in turfgrass science. These papers are presented primarily to facilitate the timely dissemination of original turfgrass research for use by the turfgrass industry.

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Dr. Ann Brooks Gould, Editor
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CHANGING TECHNOLOGIES IN IRRIGATION SYSTEMS TO HELP SAVE WATER AND MONEY

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Despite the economic issues with golf over the last few years, golf course irrigation manufacturers are continuing to invest in and develop new technologies that improve the performance and operation of golf course irrigation systems. For many years the research focus was on sprinkler enhancements that included improved uniformity and various changes to functionality. Of late, new technologies don't necessarily involve equipment components, but ancillary items that help golf course irrigation systems operate easier or more efficiently.

SPRINKLERS

Sprinkler innovations over the last few years include part/full sprinklers in one, higher pop up heights, and adjustable trajectories. Along with these improvements in sprinklers, the turf coverage of modern irrigation system has changed. In single row systems, centers of fairways become wet in an attempt to irrigate the rough. In double row systems the rough and fairways are watered together even though they have different water requirements. Triple row is only slightly better. Many systems now include 5-rows in fairways with a set of part circle sprinklers installed at the fairway/rough line with one sprinkler watering just rough and one just watering fairways. The 5-row system is critical during drought restrictions saving valuable amounts of water. Installing the extra sprinklers does not cost as much as you think, only 10 to 15% more.

SENSORS

Soil sensing is not new to irrigation, but over the last few years has gained a great deal of attention in the golf market. Today's sensors not only measure

soil moisture but also measure temperature and salinity. These soil sensors can be used in a number of ways to make direct comparisons and to document the trending of soil moisture, temperature, and salinity among different golf course features or among similar features on different holes. On the same feature, such as a green, you can compare sun and shade areas or high and low areas. You can also compare different time periods, the same time periods, or different days, weeks, or months. The comparisons and trending options are the same for salinity and temperature as for soil moisture. You also have the ability to look at all three parameters at the same time. Results can be displayed by line graphs, bar graphs, or dials.

The benefit of soil sensors is both improved water management and turf playability. Sensors accomplish this in a number of ways:

- maintain an optimum plant/water balance
- manage labor costs by helping time syringe events
- better manage reclaimed or lower quality water
- better time fertilizer and pesticide applications to improve effectiveness
- monitor temperature for key applications
- ensure long term sustainability/repeatability

Other soil sensor uses include: self-diagnostics, troubleshooting irrigation failures, effects of venting, effects of snow insulation and green cooling, and educating green committees, boards, and members. Sensors can also be used to show the effectiveness of rainfall and flushing. The soil sensors can communicate back to the central computer control system and are interactive with the irrigation programming much like a weather station, but through a wireless

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network that has been set up throughout the golf course to read the sensors. The exciting part is that once this wireless network is set up throughout the golf course, who knows what else will be able to be measured, monitored, and communicated with that same wireless network in the future. All the sensor information can also be accessed through your desktop computer or some smart devices.

The irrigation control system is not the only component that has increased sensing abilities. Pump stations with their improvements in technology allow you to now sense parameters such as pH, turbidity, flow, wet well levels, pump house and control panel temperatures, and electrical use per pump and the pump system as a whole. New magnetic flow meters are much more accurate than the old paddle wheel type and allow for more accurate interaction with other irrigation system components. Keep in mind that a weather station is also a collection of sensors, although not a new technology. What is new, however, is software that provides the ability to read and react to the individual weather station sensors and not just obtain an evapotranspiration reading. With all of these new technologies there is not only the ability to react to what the sensor is measuring, but automatically make a change and/or send a notification with a number of different technologies to notify you of what is going on, remotely.

REMOTE CONTROLS

Remote control of irrigation systems using radios has been around for decades. In 2012, radios for any use, including irrigation, became an issue with the FCC's mandatory change to narrow band frequencies and the concurrent enforcement of licensing requirements. The use of radios as remotes is now out, and original smart phone software, such as Rain Bird MI and NSN Connect, is pretty much considered obsolete. Using PC Anywhere or similar software to log into and look at your office computer is a distant memory. Now there are smart devices. Smart devices and their various apps allow you to do almost anything remotely. Tablets and smart phones provide much faster connections to your pump station or irrigation computer and at the same time provide more information and are less expensive. With a smart device it is just like standing in front of your pump station control panel or sitting at your central computer. With smart devices you can see more and do more than ever before, remotely.

MONITORING

Not only do smart devices and the internet give you the ability to remotely control your irrigation and pump systems from any location, but they also give you the ability to monitor them. New monitoring softwares are internet based and therefore allow you to have access to a lot more information than in the past. This can be fortunate or unfortunate; you might have your vacation interrupted by an alarm automatically sent to you from your pump station or irrigation central computer. With these interactive based controls you can monitor flow, pressure, water level, booster pump inlet pressure, what pumps are on and off and when they ran, injection pumps, and weirder things such as pump station control panel temperature or building temperature.

Probably the most interesting technological development for golf course irrigation systems is software that allows the various equipment on the golf course to interact and communicate. This interaction includes pump stations, moisture sensors, and the irrigation controls. In the past, these three systems operated independently; today's integration allows for lots of new and exciting possibilities as the different components talk to each other. For example, moisture sensors can now dictate run times; they can control when the sprinklers go on or off (not that you may want that, but they have the capability). In addition, if you have a large leak, the ability of the irrigation system to talk to the pump station may determine that too much water is being pumped and the irrigation system will shut off. If there is still flow, the pump station will then shut itself off, all very quickly or as you program it to react.

Integration actually goes much further than improved remote control or monitoring. Depending on the system purchased, the pump station can learn from the irrigation system that the flow is about to change and the pump station can anticipate that change before the pump station flow meter or pressure transducer senses it. This ability operates your systems to use both water and energy more efficiently. Improved power efficiency includes being able to have different pressure set points at different times of the day, such as one for irrigating and one for hand watering. Energy efficiency also allows for specific pumps to be shut off during certain periods of the day or year to lower electrical costs and to make sure you don't trigger peak demand charges.

MISCELLANEOUS

Irrigation controllers have gone from mechanical to solid state to decoder/two wire. Improvements in control system have introduced several new innovations which include decoder in head and decoder and solenoid together in one integrated component. With these newer technologies, the systems have also become more sensitive to power surges and lightning. Grounding requirements have become more specific and the days of one rod and a grounding clamp to protect equipment has been replaced with a grid pattern consisting of a rod and plate connected with an exothermic connection. The use of copper shield wires has also become common practice to protect wiring.

Lately, irrigation nozzles from the major manufacturers have not changed that much, but the third party replacement nozzle business is alive and booming. Third party brass nozzles replace existing plastic nozzles in older sprinklers to improve their uniformity. Older sprinklers from the 70s and 80s were not manufactured to have high water application uniformities. If you replace your older nozzles with specifically engineered replacement nozzles, the uniformity can be greatly improved and at a much lower cost than buying new sprinklers. In some areas such as California, nozzle replacement has been accelerated by the availability of rebates for golf course nozzle changes from the water purveyors.

A not so exciting technology, but a very useful one, is the new DBR/Y waterproof wire connector. In the past, you had to use one connector for smaller wires (yellow) and a different connector for larger wires (red); the DBR/Y connector has both the red and yellow sizes as one connector. The connector itself is not only better, but it is less expensive than either the DBY and DBR connectors alone. Surge arrestors have also been improved by technology. All irrigation controllers should have surge arrestors on the 120/220 volt power supply. Surge arrestors are sacrificial devices and will stop working over time due to wear. In the past the problem has been that you could not tell when it had sacrificed its ability to provide protection. New surge arrestors have a light that shines green when the arrestor is protecting and shines red when it is worn out. Now you know when the device has surpassed its useful life and needs to be replaced.

SAVING WATER/SAVING MONEY

All of the new irrigation technologies have the ability to save water if they are properly implemented and managed. Almost all new technologies developed today are designed to help save water. The amount of water saved with each technology will be dependent on your irrigation practices and water management style/mind set. If you are going to save water you will have to manage it. If you are going to manage your water use, then you need to measure it. This includes measuring all of your different water sources, as well as your pumping point. Keep in mind that studies show that the number one determining factor in how much water a golf course irrigation system uses is the superintendent.

Costs of potable water continue to rise especially in urban areas, as much as 200% in the last 10 years. Costs for non-potable water are starting to occur and are often disguised as registration fees. Some superintendents think it is nobody's business how much water their irrigation system uses. Others are concerned that if they report their use it will be cut or they will be charged for it. Currently, there are very few places that charge for ground or surface water, but in 5 years or 50 years time there will most likely be a cost associated with using ground and/or surface water in many areas of the country. All of the new technologies discussed have a cost associated with them as does improved maintenance. You need to determine if the costs associated with the improvements offset the costs of water, electricity, and labor. They probably will not, but there are a lot of intangibles that improved technology will provide.

TECHNOLOGY, BUT...

You can always invest in technology and reap its benefits, but you will benefit only if your base irrigation system is in good shape. Technology alone cannot fix an irrigation system that is poorly designed, installed, or maintained. Issues such as sprinklers being too low, too high, not at grade, or installed on slopes will waste water quickly. Inconsistent rotation speeds will throw off the best of schedules. Improper operating pressure affects the sprinkler throw and therefore coverage as well as precipitation rate and uniformity, all of which affect efficiency and therefore water use. New technologies such as soil sensors can save water,

labor, and money when properly implemented. New sensors can also provide information that you may not otherwise be aware of, other than soil moisture. Integration software combined with monitoring and remote control can make your life much easier and operate your equipment more efficiently even when you are not there. You need to decide if that's a good thing or a bad thing for your golf course.