Trends & Technology in Golf Water Management

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1. Trends… Perception or reality in irrigation design
   • Can a 4 row system be cheaper than a 3 row?
2. Technology in Golf Water management
   • Benefits and options available today
     • Sprinklers
     • Field Hardware
     • Central control system
Perception.... Or... reality?
Perceptions about the Irrigation Systems - True or False?

- If you have fewer sprinklers, you will use less water
- A “better” irrigation system has to cost more € and be expensive
- Manufacturers and Irrigation Designers always over-design the system
- Environmentalists believe that “All Golf Courses” waste water

• How would each group judge or perceive the points above?
  - Golf Courses
  - Architects
  - Manufacturers and Irrigation Designers
  - Environmentalists and Public Opinion

Let’s look at some “Simple Maths” that may help us better explain and understand some of the incorrect perceptions and...Why Designing with hard line irrigation on grassing boundaries is trending in American Society of Golf Course Architects

Let’s create realistic parameters (yes, every course and situation is different…)
- Look at a “Typical” golf hole and extrapolate into an 18 holes golf course
- Use real values for water quantities and all costs
- Review a design 3 row coverage plan with quantities and costs
- The same for a 4 row system
- Compare the 2 options and draw conclusions

Data used in the following example
- (all real life from a real example)

<table>
<thead>
<tr>
<th>Water Application Requirement</th>
<th>7mm / Day</th>
<th>49mm / Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annualized Factor – Water Requirement</td>
<td>32% or 283.707 m³</td>
<td></td>
</tr>
<tr>
<td>Water Costs</td>
<td>0,60€ per m³</td>
<td></td>
</tr>
<tr>
<td>Electricity Costs</td>
<td>11¢ per kW-Hr</td>
<td></td>
</tr>
<tr>
<td>Contractor price to add a sprinkler (average)</td>
<td>€400 all in (fitting, wiring, pipe, etc..)</td>
<td></td>
</tr>
</tbody>
</table>
The Simple Math
“Typical” Golf Hole

- About this “Typical” par 4 hole…

<table>
<thead>
<tr>
<th>Length</th>
<th>360 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greens</td>
<td>680 m²</td>
</tr>
<tr>
<td>Roughs</td>
<td>8,400 m²</td>
</tr>
<tr>
<td>Fairways</td>
<td>9,000 m²</td>
</tr>
<tr>
<td>Tees</td>
<td>1,200 m²</td>
</tr>
<tr>
<td>Native Area</td>
<td>6,000 m²</td>
</tr>
<tr>
<td><strong>Total Area</strong></td>
<td><strong>19,280 m² (1,93ha)</strong></td>
</tr>
</tbody>
</table>

- Let’s get it to an 18 holes equivalent

<table>
<thead>
<tr>
<th>Length</th>
<th>6,570 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greens</td>
<td>12,240 m²</td>
</tr>
<tr>
<td>Roughs</td>
<td>151,200 m²</td>
</tr>
<tr>
<td>Fairways</td>
<td>162,000 m²</td>
</tr>
<tr>
<td>Tees</td>
<td>21,600 m²</td>
</tr>
<tr>
<td>Native Area</td>
<td>108,000 m²</td>
</tr>
<tr>
<td><strong>Total Area</strong></td>
<td><strong>347,040 m² (34,7 ha)</strong></td>
</tr>
</tbody>
</table>

* - Does not include Native Area, as it represents the desired irrigated area
This “Typical” golf hole

- Total Sprinklers = 69
- Simple – all **full circle** sprinklers
- Water needed to apply 7mm on this hole **within the grassing line** of 1,93ha is 135,1m³
- The **overspray** outside the grassing line is in red
- The outer rows throwing outward need to have effective coverage for approx. **60%** of their radius, (as is single row radius)
- The **overspray area in red** is around 0,31ha and uses 21,7m³ during a normal 7mm water cycle… **wasted**
The outer rows need to be watered more to make up for the pattern inefficiency 1.7/1.2 = 42%

This will provoke a wet and dry turf across the hole.

Area of outer 40% of radius is **overspray** and waste.

Grass line requiring design irrigation coverage – min 60% of radius.

Area of 8 m section is 179 m² per sprinkler section.

The outer rows need to be watered more to make up for the pattern inefficiency 1.7/1.2 = 42%

This will provoke a wet and dry turf across the hole.

Area of outer 40% of radius is **overspray** and waste.

Grass line requiring design irrigation coverage – min 60% of radius.
• This “18-hole Equivalent” golf course
  – Total Sprinklers = 1242
  – Simple – all full circle sprinklers
  – Water needed to apply 7mm on the entire course within the grassing line of 34.7 ha is 2.429 m³
  – The overspray area is 5.58 ha and uses 390.6 m³ during a normal 7mm water cycle
  – On this 18H, we are wasting 390.6 m³ of water every irrigation cycle!
Simple Irrigation

4 Row system, part circle sprinklers on grassing boundaries

- This “Typical” golf hole with 4 Row
  - Total Sprinklers = 84
  - Combination of full and part circle sprinklers
  - Water needed to apply 7mm on this hole within the grassing line of 1,93 ha is 135,1 m³
  - There is NO more overspray due to part circles irrigating just up to the grassing line

- This “18-hole Equivalent” golf course
  - Total Sprinklers = 1.512…. (270 more)
  - Water needed to apply 7mm on the entire course within the grassing line of 34,7 ha is 2.429 m³
  - Saves up to 390,6 m³ per day during a full normal water cycle, and the electricity to pump it
## Comparisons
### 3 Row vs. 4 Row

<table>
<thead>
<tr>
<th></th>
<th>3 Row</th>
<th>4 Row</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigated Area</td>
<td>34.7 ha</td>
<td>34.7 ha</td>
</tr>
<tr>
<td>Water per 7mm cycle</td>
<td>2819.6 m³</td>
<td>2429 m³</td>
</tr>
<tr>
<td>Additional Sprinkler Costs</td>
<td>None</td>
<td>*Requires Analysis</td>
</tr>
<tr>
<td>Annualized Wasted water</td>
<td>45.622 m³</td>
<td>None</td>
</tr>
<tr>
<td>Annualized Wasted Electricity</td>
<td>18.248 kwh</td>
<td>None</td>
</tr>
<tr>
<td>Pump Station Cost Savings</td>
<td>None</td>
<td>*Requires Analysis</td>
</tr>
<tr>
<td>Mainline Pipe Size Reduction</td>
<td>None</td>
<td>*Requires Analysis</td>
</tr>
<tr>
<td>Mainline Fitting Reduction</td>
<td>None</td>
<td>*Requires Analysis</td>
</tr>
<tr>
<td>Annual Water Savings ($)</td>
<td>None</td>
<td>-€27,372</td>
</tr>
<tr>
<td>Annual Electrical Savings ($)</td>
<td>None</td>
<td>-€2,007</td>
</tr>
<tr>
<td>Total Net 1st Year Cost Δ</td>
<td>None</td>
<td>71,776</td>
</tr>
<tr>
<td>Annual Saving (Payback years)</td>
<td>None</td>
<td>29.379 (3.6 years)</td>
</tr>
</tbody>
</table>

* Each situation requires a professional to analyze all system and water requirements to determine if pump and pipe sizing changes may be possible.
Conclusions
Selecting a 4 Row system in this case has benefits for all

• 270 more sprinklers, cost 108K€ more but in 3,6 years would actually result in net savings
  – If applying over 7mm, higher water price, reducing pipe or pump, the payback will be less than 2 years.

• In 10 years, they would have saved 185.790€ and continue saving 29.379€ per year.
  – 10 years – Over 456,000 m³ of water saved
  – 10 years – 182.000 kW-Hr of electricity saved

• Higher uniform coverage across the entire grassed area will result in (1) better turf aesthetics, (2) optimized playing conditions and (3) improved agronomic health

• NO overspray into native (1) maintains the desired architectural look, (2) reduces native overgrowth and (3) reduces the associated maintenance costs
Effective vs. Ineffective Coverage

3 Row system – causes scalloped grass lines

4 Row system – full width coverage – great turf!
Conclusions

Designing with hard line irrigation on grassing boundaries

What did we learn?

• **The Bad News** - The problems, extra costs and waste caused by inefficient design can be a lot worse than anyone realizes

• **The Good News** - The savings with good and effective irrigation design can result in significantly more efficient irrigation system savings, and save €1,000’s in on-going operational costs

• Help your GC customers make better choices up front

• Show them how more uniform coverage across the entire grassed area will result in (1) better turf aesthetics, (2) optimized playing conditions and (3) improved agronomic health

• **NO overspray** into native (1) maintains the desired architectural look, (2) reduces native overgrowth and (3) reduces the associated maintenance costs

• Show the environmentalists that properly designed irrigation systems can save over 45,000 m³ of water / yr., and over 18,000 kWh / yr.

• It is the equivalent maths to do from 2 to 3 rows being on hard line irrigation
Technology in golf water management

- Sprinkler
- Field hardware
- Central system
• Water is the 21° century oil
• Water will be allocated/priced by priority
• Golf industry are the lowest priority
• Saving water is important to show good citizenship to a hostile public opinion
• Saving water is a matter of design, technology and usage
Golf Water Management

Design should be sustained by technology, technology is useless if it’s not easy to use
Technology in Golf irrigation go a long way...

The Toro “Sea Serpent” (circa 1925)...

Great innovation back then
The oldest with the latest technology
Sprinklers
The importance of sprinklers

• You design the best golf courses

• We make sure sprinklers can fit your design, adapt flexibly to it, like a glove.
Sprinklers

Features to look for:

‒ Wider nozzle selection

‒ Nozzle Trajectory options

‒ Full / part circle in one

Benefits to have:

‒ Complete coverage, same sprinkler throughout course

‒ Site flexibility, against wind, slopes

‒ Adaptable to all sites
Sprinklers

Features to look for:

- Higher pop-up
- Pressure selection
- Ratcheting Riser
- Stainless Steel components

Benefits to have:

- Tall grasses, sprinklers sunken,
- Elevation flexibility, cost reduction
- Start anywhere, easy golf maintenance
- Durability, low cost ownership
Sprinklers

Features to look for:

‒ Nozzle base Clutching
‒ Less Dwell time at arc ends
‒ Solenoids with Low Voltage & High Surge
‒ Complete accessibility

Benefits to have:

‒ Hot Spot Watering, reduce hose use and maintenance cost
‒ ↑ Uniformity, water savings
‒ ↓ Consumption ↑ Protection, smaller cables… savings
‒ Easy maintenance, lower cost of ownership…
Field Hardware Control system
There are several types of field hardware and we need to ask:

- Do I have the latest technology to better irrigate my course?

- The field Hardware is made of electronic components

- Why having the latest TV and smart phone and not the latest golf water technology on your course?
  - Today, Who has an Iphone 3 launched as the best on June 2009, 8 years later?

- Every day new capabilities, features, aspects that provides new benefits and savings like
  - Run Time to the second, diagnostics at sprinklers level, sensor capabilities, etc…

Manufacturers have to provide the best options to make sure that the system fits the course requirements and not the opposite
The main questions of life

Sea or? Mountain

Tea or? Coffee

Satellite or? Decoder

And the winner is….? The one that best suits the course….
<table>
<thead>
<tr>
<th>Satellite Advantages</th>
<th>2-Wire Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Easier to troubleshoot and maintain</strong>&lt;br&gt;Because the main components and wire connections are above ground, satellites can be diagnosed quickly and fixed easily.</td>
<td><strong>Lower overall initial purchase cost</strong>&lt;br&gt;Equipment and labor costs are lower than satellite systems.</td>
</tr>
<tr>
<td><strong>Watering back up in case of PC or communication failure</strong>&lt;br&gt;If the signal to the central computer is lost, satellites will continue to operate with 100% of their flow managed watering capability.</td>
<td><strong>No visible components on the course</strong>&lt;br&gt;All parts are buried underground, decreasing the risk of potential damage from vandalism, flooding or equipment collisions.</td>
</tr>
<tr>
<td><strong>More efficient surge protection</strong>&lt;br&gt;All stations operate from a satellite, allowing ground rods/plates to be located at a single point near every controller for best protection.</td>
<td><strong>Installs and expands quickly</strong>&lt;br&gt;With lower power requirements and direct burial, crews can easily splice and install additional stations for added coverage.</td>
</tr>
<tr>
<td><strong>Ideal for construction and grow-in</strong>&lt;br&gt;Pedestals can operate without a computer connection, allowing for immediate irrigation upon installation.</td>
<td><strong>Uses low voltage</strong>&lt;br&gt;Decoders need less power to operate, eliminating the need for high voltage cables on the course and specialized electricians for installation or repair.</td>
</tr>
<tr>
<td><strong>No need for special equipment to water</strong>&lt;br&gt;Maintenance crews can easily irrigate the course from the pedestal faceplate or switches without the need to use specialized devices or software.</td>
<td><strong>Uses less wire</strong>&lt;br&gt;Two-wire communication protocol can save up to 40% of wiring costs.</td>
</tr>
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2-Wire Technology

New 2-wire technology systems features and benefits:

• Continuous Two-way Communication
• Real Time Diagnostics and Voltage Tests
• Vandal and flood resistant
• Allow for sprinkler expansion by tapping into the cable as needed
• Use low voltage, reducing the installation requirements
• No visible elements or boxes on the golf course
• Normally, it will be the lower cost alternative, less cable
• All accessible depending on the sprinklers selection
Satellite technology

New technology system features and benefits:

• Continuous Two-way Communication
• Real Time Diagnostics and Tests
• Watering back-up, never lost in case of central issue
• Easy maintenance and troubleshooting
• Easy to access and irrigate from satellite
• Easy construction, and ideal for grow in
• Run time to the second, sensor capabilities, etc…
Satellite vs Decoder… and Sat+dec

Even a 3rd option

Satellite + decoders or Smart Hub

Sat + dec or Smart Hub

<table>
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<th>Feature</th>
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<td>If the signal to the Lynx is lost, satellites will continue to operate with 100% of their flow managed watering capability.</td>
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Field hardware options

2-wire...decoder system

Satellite system

Sat + Dec or Smart Hub system

Know the specs and benefits and depending on many factors such as site requirements, client, contractor, superintendent, consultants, etc... you can identify the best solution for the course
Central control
New technologies requires new platforms
Centrals integrated, communicated and easy to use

All should be accessible at one click away
Connectivity

• In today’s world, how easy is it to do something, it is as important as being able to do it

• Everyone uses the phone/table for EVERYTHING

• And I mean EVERYTHING!

WE want to Integrate irrigation management seamlessly with the instrument we always have with us and we know the best
• We have Smartphones

• We can have smart golf courses
Mobile/Tablet operations application:

- Connect with the central software directly...
- Have multiple users operating heads at the same time
- Access to your system from wherever you have data access
- Make your life easy

Operations...
- Course report
- Manual irrigation
- Water plan adjust
- Scheduled activity
- Alerts
- Command log
- Diagnostics
- Etc....

Each user log’s in
• Should be accessible via Android or iOS user mobile devices
• All apps will require proper internet coverage
• It is like:
  o Lynx App Barcode
  o Lynx App handheld
  o Lynx App Map

We want easy Remote Access Using Apps

Turn Off Stations
*862 [Course] ppp[Program] [hh[Hole]] [st[Stn]]+1

*86200101

1  2  3
4  5  6
7  8  9

Last Command: 4

2-1-9 10RO4
New technology easy to use

Let’s irrigate a sprinkler close to my feet

Stay with me…it will only take a couple of hours…

Really?
A complete golf course

You design the course, suppliers provide solutions

Support & After sales service, local

Weather station

Central control

Soil sensor

Pump station

Satellite o decoders

Smart Phone / Hand Held

Sprinkler
THANK YOU