

Water Management Techniques and Drought Emergency Planning

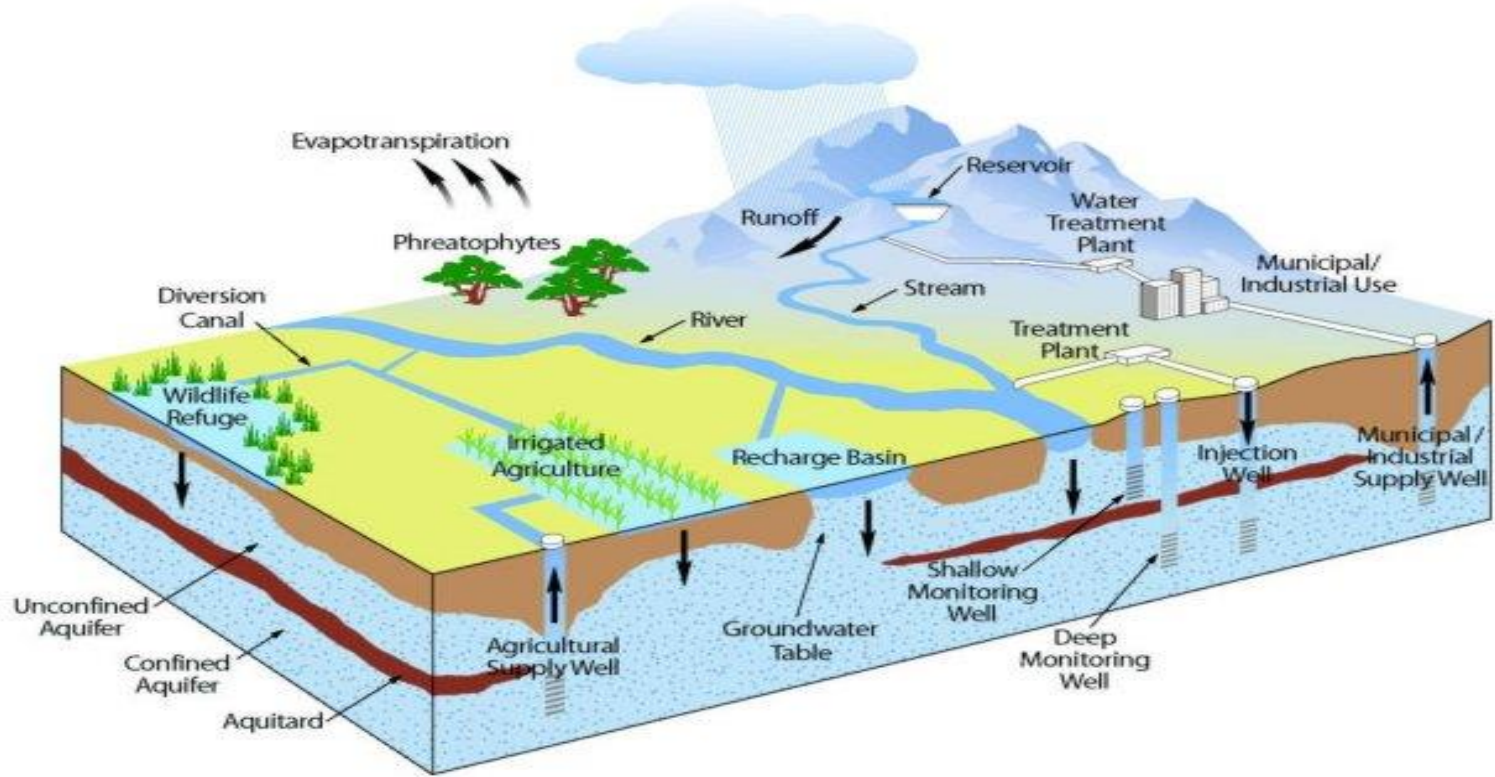
Paul Jacobs | USGA Agronomist

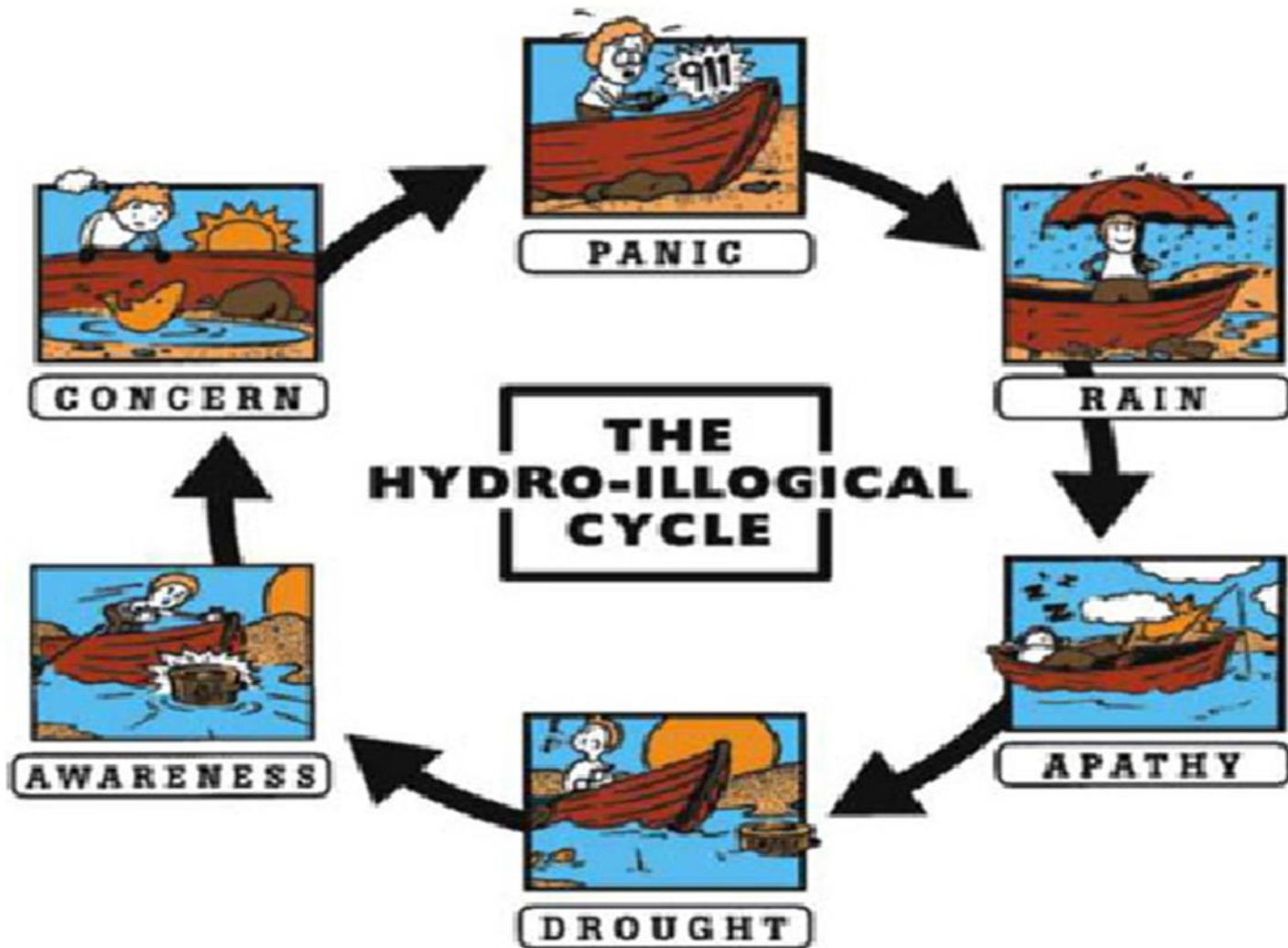


Developing a Water Management Plan

- Developing a Water Budget
- Developing a Drought Emergency Plan
- Irrigation System Scheduling & Operation
- Case studies & Best Management Practices

The Hydrological Cycle





Golf is a conspicuous user of water



However...

NATIONAL GOLF DAY 2018
APRIL 25

GOLF'S **NEW** ECONOMIC IMPACT
\$84.1 BILLION


8 OUT OF 10 GOLFERS PLAY AT PUBLIC ACCESS FACILITIES

75% 
OF GOLF COURSES ARE PUBLIC

\$38 **MEDIAN COST OF A ROUND**

WE ARE GOLF #NATIONALGOLFDAY

However...

- 2 million American jobs with \$55 Billion (R770 billion) in wage income
- 1 out of 75 jobs in the US impacted by the golf industry
- Approx. 143,000 charity events, raising \$4 billion (R56 billion) annually
- Approx. 24 million Americans play 455 million rounds annually at the nation's 15,000-plus facilities
 - 75% of these facilities are public or municipal
 - 80% of golfers play on public courses

AND!

- Golf courses in America averaged 2,300,000 acrefeet per year.
 - Approx. 2,000,000 billion gallons per day
- According to US Geological Survey, approximately 408 billion gallons of water per day are withdrawn in the U.S.
- **GOLF = 0.5% of total water use in U.S.**

Implement and communicate Best Management Practices

- Superintendents are environmental stewards
- Golf courses are some of the most efficient users of water

Issue 1: Drought, water restrictions, limited water supply



San Luis Reservoir - 2014

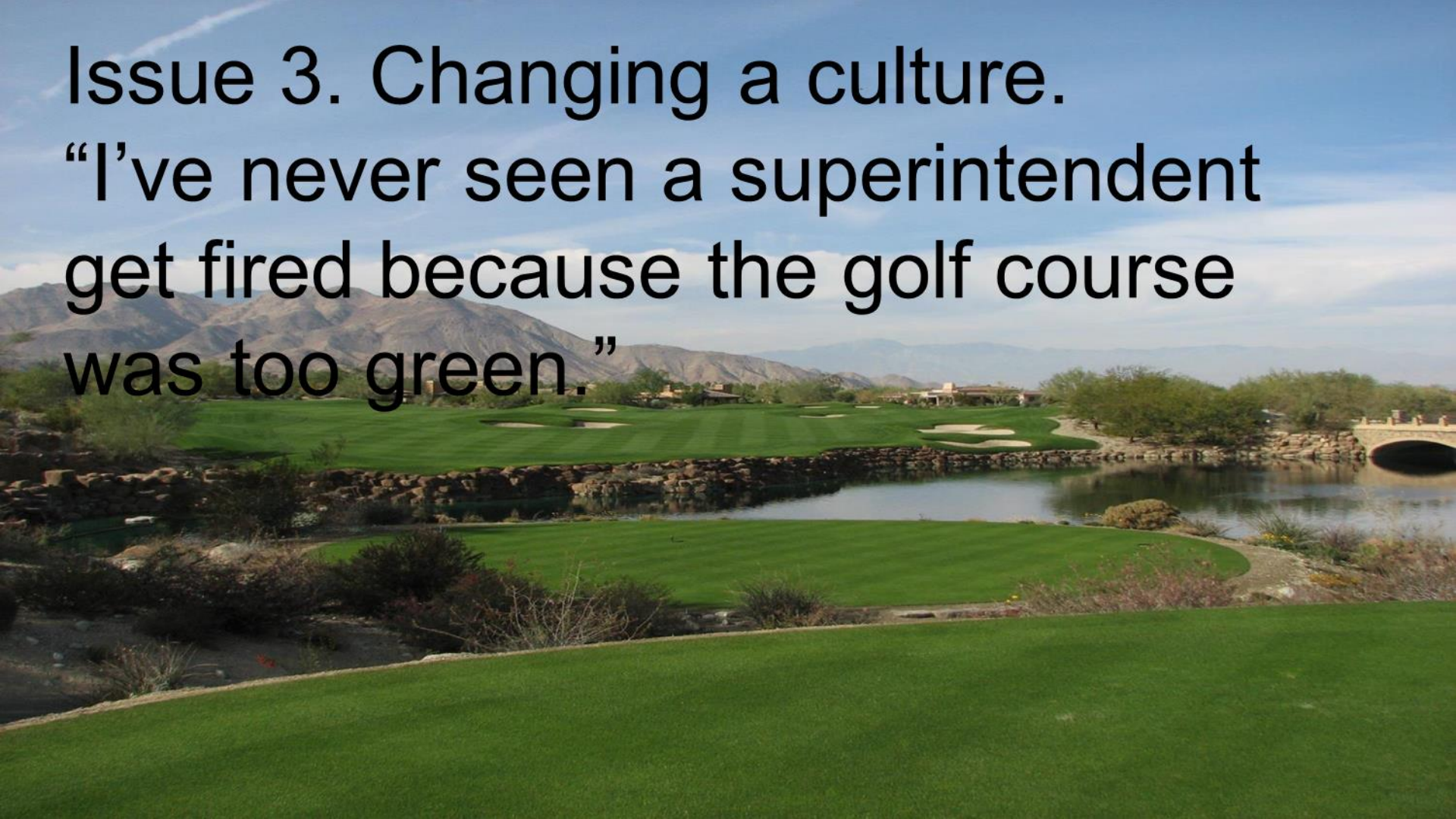
Issue 2: Water Quality

- Watershed protection



Issue 3. Changing a culture.

“I’ve never seen a superintendent get fired because the golf course was too green.”



Golf's Use of Water:

- Golf is a conspicuous user of water.
- Water for food and family, or water for fun?
- Responsible use of a valuable resource.
- Impact of water use on playability.
- Monitoring leads to awareness and better management.

Six questions every golf facility should be able to answer



1. Do we have a dependable source of water, both now and in the future? Could that situation ever change?



2. Is our irrigation system capable of applying water as efficiently as possible? Are we taking advantage of technology to improve irrigation efficiency?



3. Do we have an irrigation management plan that efficiently manages current water resources?



4. What is our plan for dealing with drought and mandatory water cut-backs?



5. Is our facility taking the proper steps to prevent run-off and protect water quality in the watershed?



6. Have we effectively communicated to our golfers the importance of conserving water and how our efforts will impact the appearance and playing quality of the golf course?



Why do you need a water budget?

- How much water does your golf facility need?
- Does your golf facility use water efficiently?
- Can you verify it?

Water Budget Formula

- $[(E_{to} \times K_c) - R_e] \times LA \times 27,154$
- E_{To} = reference evapotranspiration
- K_c = crop coefficient for type of grass
- R_e = effective rainfall (50% of actual)
- LA = landscape area
- 27, 154 = conversion inches to gallons

Information Needed

- Evapotranspiration rate (ET_o) at the location.
- Average monthly rainfall.
- Type of turf being irrigated.
- Total irrigated acreage of the golf course.

Water Budget Calculations for Golf Courses

Proposed vs. Actual

Click on the link below to find historic ET, enter monthly values in cells below:

ET o Monthly values are calculated automatically.

Enter average rainfall per month. For historic rainfall averages, visit one of the links below.

This is an adjustment; some amount of rainfall runs off the surface.

A Net ET of 0

or below indicates that monthly rainfall exceeds

water loss by ET.

The adjustment factor for bermudagrass is 0.7. Visit link below for more details.

Enter the amount of irrigated acreage.

A proposed water budget is calculated automatically. The information in this spreadsheet is based upon Birmingham, AL ET and historical rainfall on a property with 104.5 irrigated acres.

[ET by Zip Code](#)

[US Climate Data](#)

[Weatherdb](#)

[Understanding ET Adj Factor](#)

	ET _o Daily ^w	ET _o Monthly	Aver Rainfall inches	Effective Rainfall ^z	Net ET	ET Adj Factor ^x	Landscape Area ^y	Water Budget Proposed (gal) ^z	Actual Use	Actual Rainfall
JAN	0.04	1.24	4.8	2.4	0.0	0.7	104.50	0		
FEB	0.06	1.68	4.5	2.3	0.0	0.7	104.50	0		
MAR	0.11	3.41	5.2	2.6	0.0	0.7	104.50	0		
APR	0.13	3.90	4.4	2.2	0.5	0.7	104.50	1,546,488		
MAY	0.15	4.65	5.0	2.5	0.8	0.7	104.50	2,142,383		
JUN	0.17	5.10	4.0	2.0	1.6	0.7	104.50	4,455,021		
JUL	0.16	4.96	4.8	2.4	1.1	0.7	104.50	3,041,900		
AUG	0.15	4.65	3.9	2.0	1.3	0.7	104.50	3,646,307		
SEP	0.13	3.90	3.9	2.0	0.8	0.7	104.50	2,213,323		
OCT	0.09	2.79	3.4	1.7	0.2	0.7	104.50	675,347		
NOV	0.06	1.80	4.8	2.4	0.0	0.7	104.50	0		
DEC	0.04	1.24	4.5	2.2	0.0	0.7	104.50	0		
Total	1.29	39.32	53.3	26.7	6.2			17,720,768 gal	0	0
								54.38 AC	0	AC/FT

Reasons for having a water budget

- Estimate the total amount of water needed for irrigating the golf course.
- Establishes a benchmark for comparing estimated water use with actual water use.
- Gives an indication of the efficiency of the irrigation system and how accurately programming decisions are being made.

Drought Emergency Planning

1. Secure an accurate map
2. Determine irrigated turf acreage
3. Calculate water budget
4. Create a prioritized list

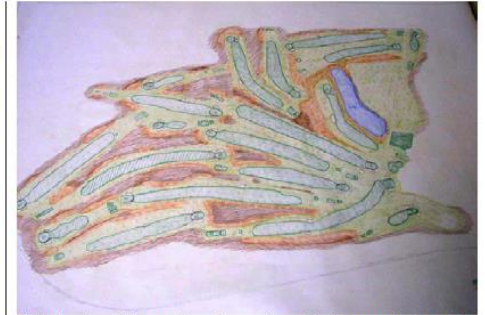
Developing a Drought-Emergency Plan

A step-by-step guide to help your golf facility prepare for mandatory water restrictions.

BY PATRICK GROSS

It's 100°F outside and you just received notice that water delivery to the golf course will be reduced by 30 percent in the coming weeks. What are you going to do now? Like it or not, drought emergencies and mandatory water cutbacks are a recurring situation at many golf facilities, even in relatively high rainfall areas of the United States. In some parts of the country, lack of rain for six to eight weeks can put significant pressure on water supplies and trigger a drought emergency. Planning for a drought emergency is not a pleasant situation for golf facility owners, superintendents, or golfers. Effectively preparing for the situation is best done well in advance when you are not in the middle of an emergency, which allows for more effective planning and communication between course officials and golfers.

Water regulations and drought-emergency ordinances are often written so they can be applied broadly to all customers. This often comes in the form of a percentage water reduction that is imposed on customers. Typically, this is done in a phased approach mandating customers to cut back 10, 20, 30, 40 percent or greater as subsequent drought emergency levels are reached. The concept of developing a drought-



A simple color-coded map of the golf course is an effective communication tool to show golfers where water will be reduced in case of a drought emergency.



An accurate map of the golf course property is an

Drought Emergency Planning



Golf Course Area	Priority Level
Putting Greens	1
Putting Green Surrounds	2
Fairways	3
Teeing Grounds	4
Primary Rough	5
Landscape Areas	6
Practice Range	7
Secondary Rough	8

Drought Emergency Plan Example

Table 6
Sample worksheet to calculate a total 20-percent water reduction in July

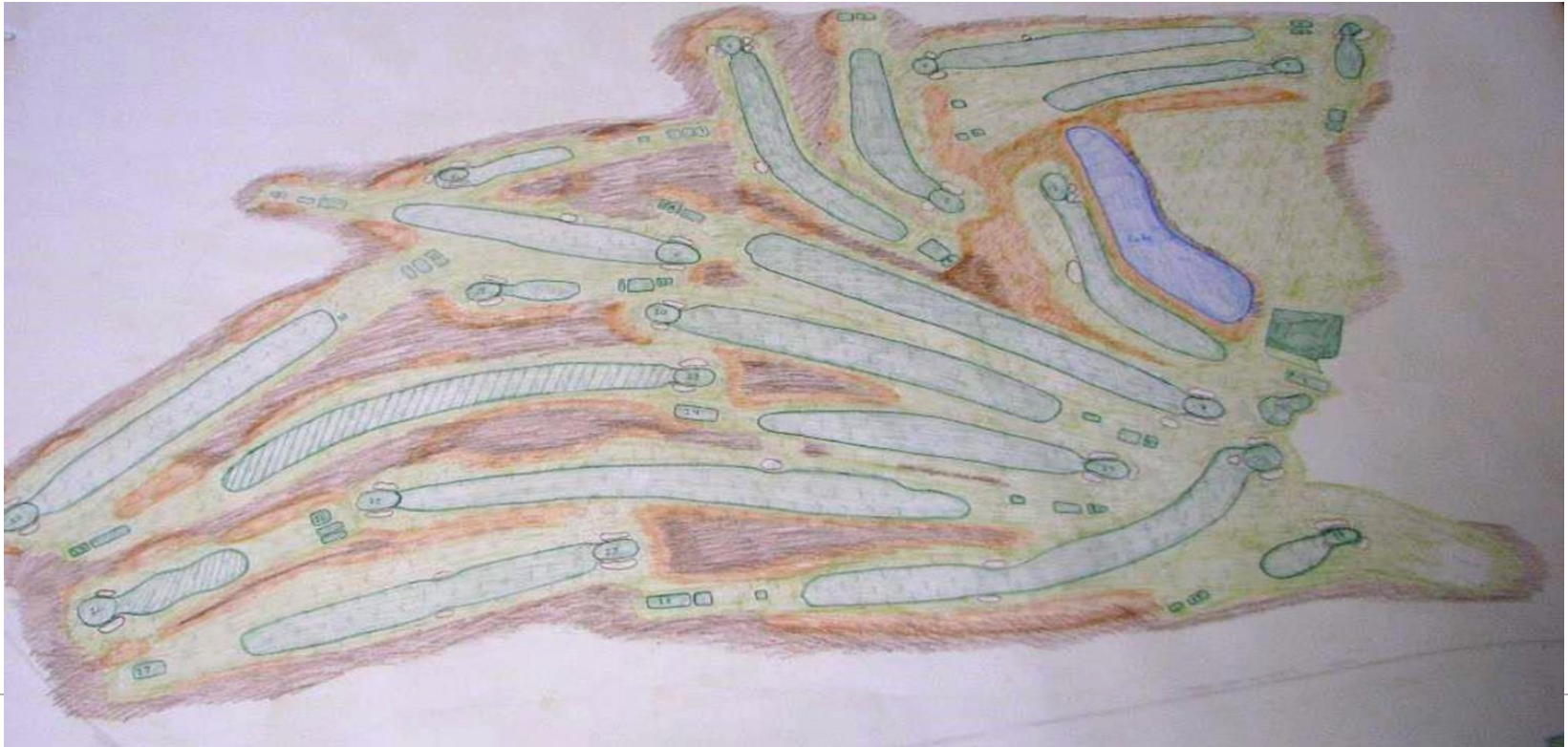
Area description	Priority level	Avg. water use (gal.) in July	Percent Reduction	Water saved (gal.)
Green complexes	1	323,242	0 %	—
Teeing grounds	3	242,430	0 %	—
Fairways	2	1,616,206	0 %	—
Primary rough	4	3,555,654	22 %	782,243
Secondary rough/ out-of-play areas	7	1,373,775	45 %	618,198
Practice range	6	808,103	35 %	282,836
Landscape areas	5	161,620	30 %	14,545
Total		8,081,030	(target: 1,616,206)	1,697,882

USGA Drought Emergency Spreadsheet

Sample Drought Emergency Plan Spreadsheet

Size of Turf and Landscape Areas				
Area Description	Total Area (Square Feet)	Total Area (Acres)	Total Acreage	Percentage of Total Area
<i>Enter Names Below</i>	<i>Enter Either Square Feet OR Acres</i>			
Putting green complexes			0.00 ✓	#DIV/0!
Teeing grounds			0.00 ✓	#DIV/0!
Fairways			0.00 ✓	#DIV/0!
Primary rough			0.00 ✓	#DIV/0!
Secondary rough			0.00 ✓	#DIV/0!
Practice range			0.00 ✓	#DIV/0!
Landscape areas			0.00 ✓	#DIV/0!
User defined area #1			0.00 ✓	#DIV/0!
User defined area #2			0.00 ✓	#DIV/0!
User defined area #3			0.00 ✓	#DIV/0!
Acreage Totals	0.00	0.00	0.00 ✓	#DIV/0!

What does a targeted reduction look like?



USGA Innovation Through Technology



USGA

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