

DOES YOUR COURSE HAVE A DRINKING PROBLEM?

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Why We Conserve Water

- Utah is second only to Nevada in per capita water use
- Utah is also the second driest state in the nation
- Periodic drought is common
- Water Conservation Management Plans
 - ▣ HB 418 (1998) Each water retailer must prepare & adopt or update a water conservation plan.
 - ▣ HB 153 (1999) Water retailers are only those with more than 500 connections.

Tightening Water Supply

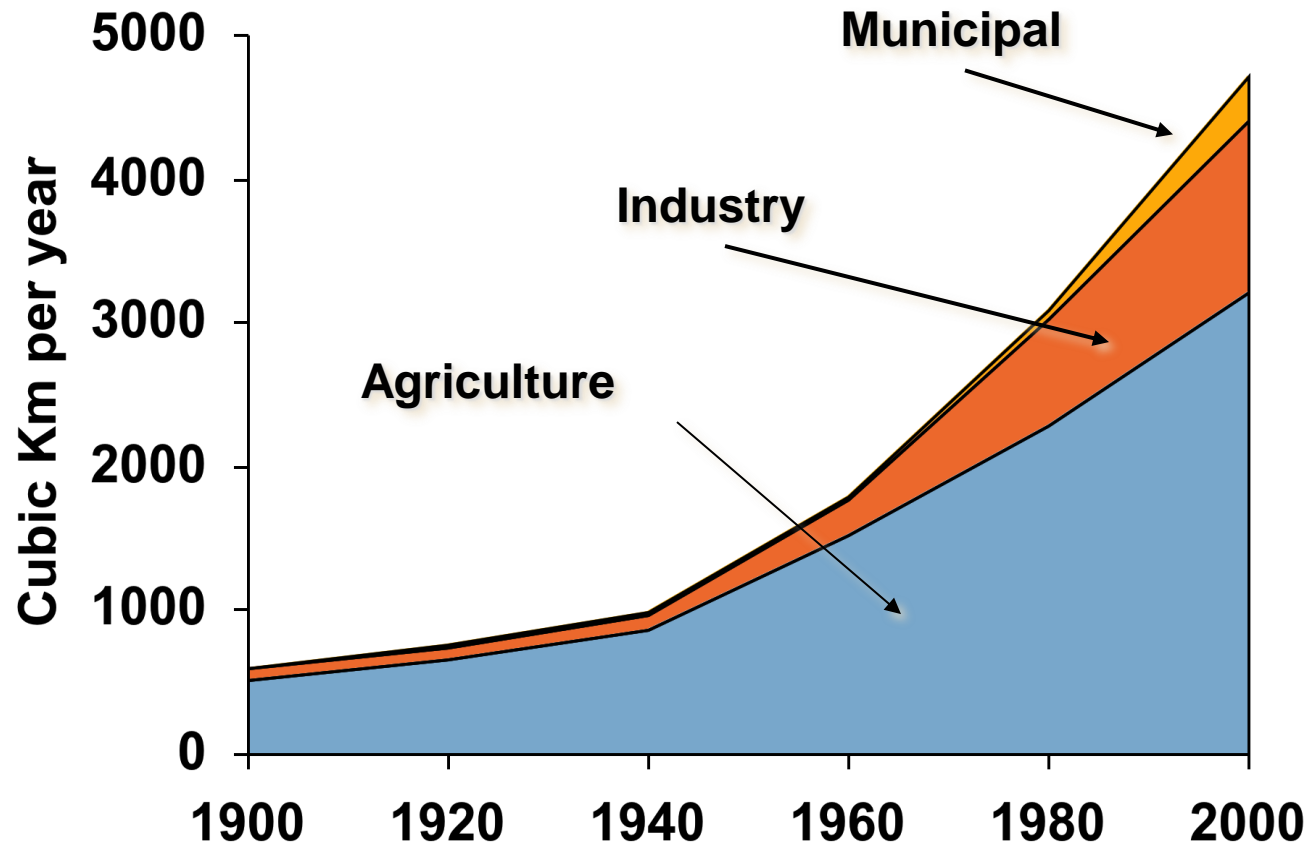
- Western rivers ‘tapped out’
- Decrease in federal funding for new supply sources
 - ▣ Federal construction spending down from 80% in 1960’s to less than 40% today
 - ▣ CUP Completion Act of 1992 - State of Utah is responsible for 35% of cost
- Other Water Stakeholders
 - ▣ Environment
 - ▣ Native Americans
 - ▣ Other nations

Increasing Water Demand

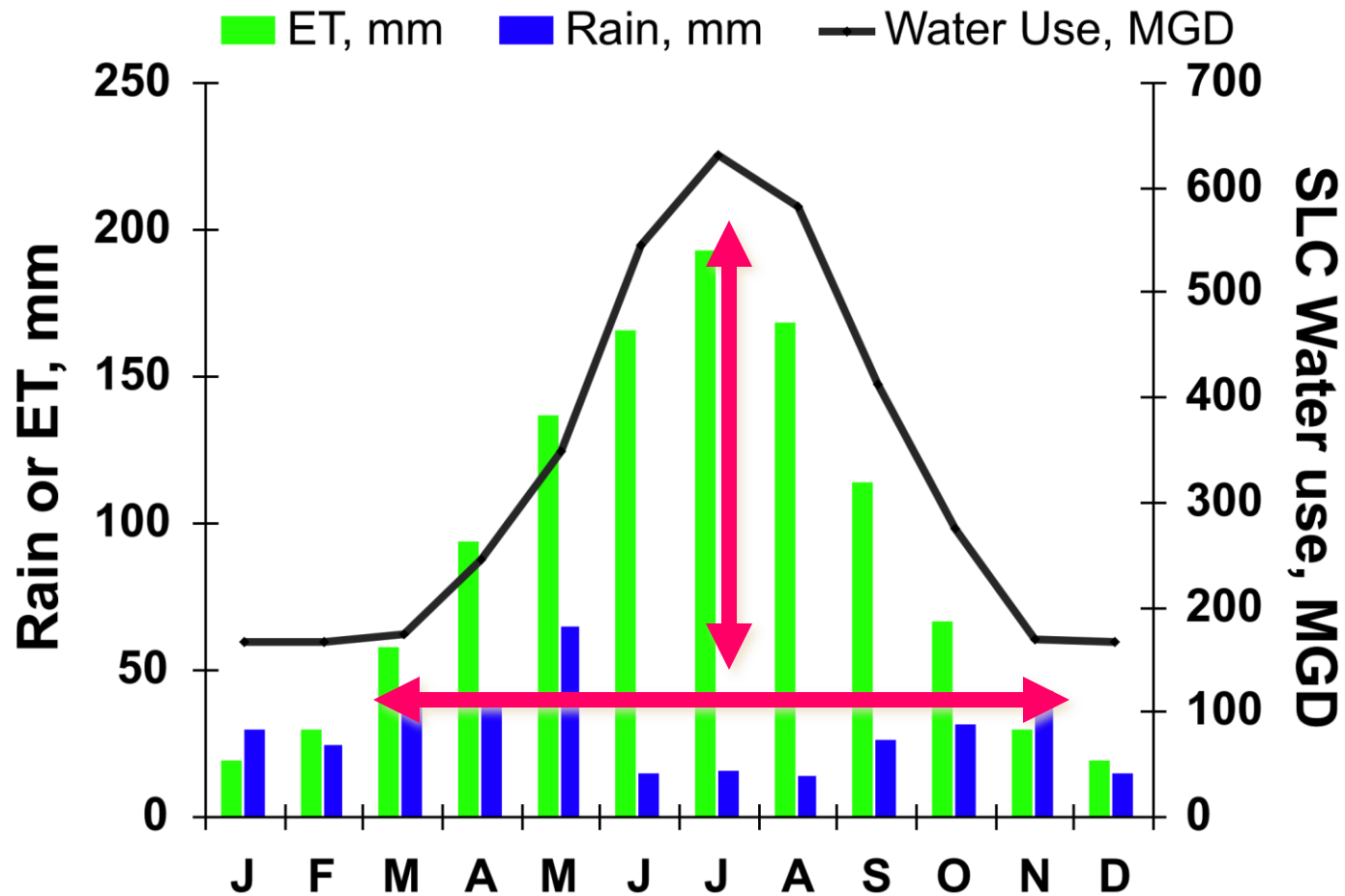
- Western population growth
 - ▣ West has grown by 32% over last 25 years
 - ▣ Next 25 years estimated growth at 27%
 - ▣ Mountain states
- Low-density land use
- Western water use
 - ▣ Third of the population, 47% of the freshwater withdrawals
 - ▣ 78% of consumptive water use



World Fresh Water Use



Landscape Water Consumption

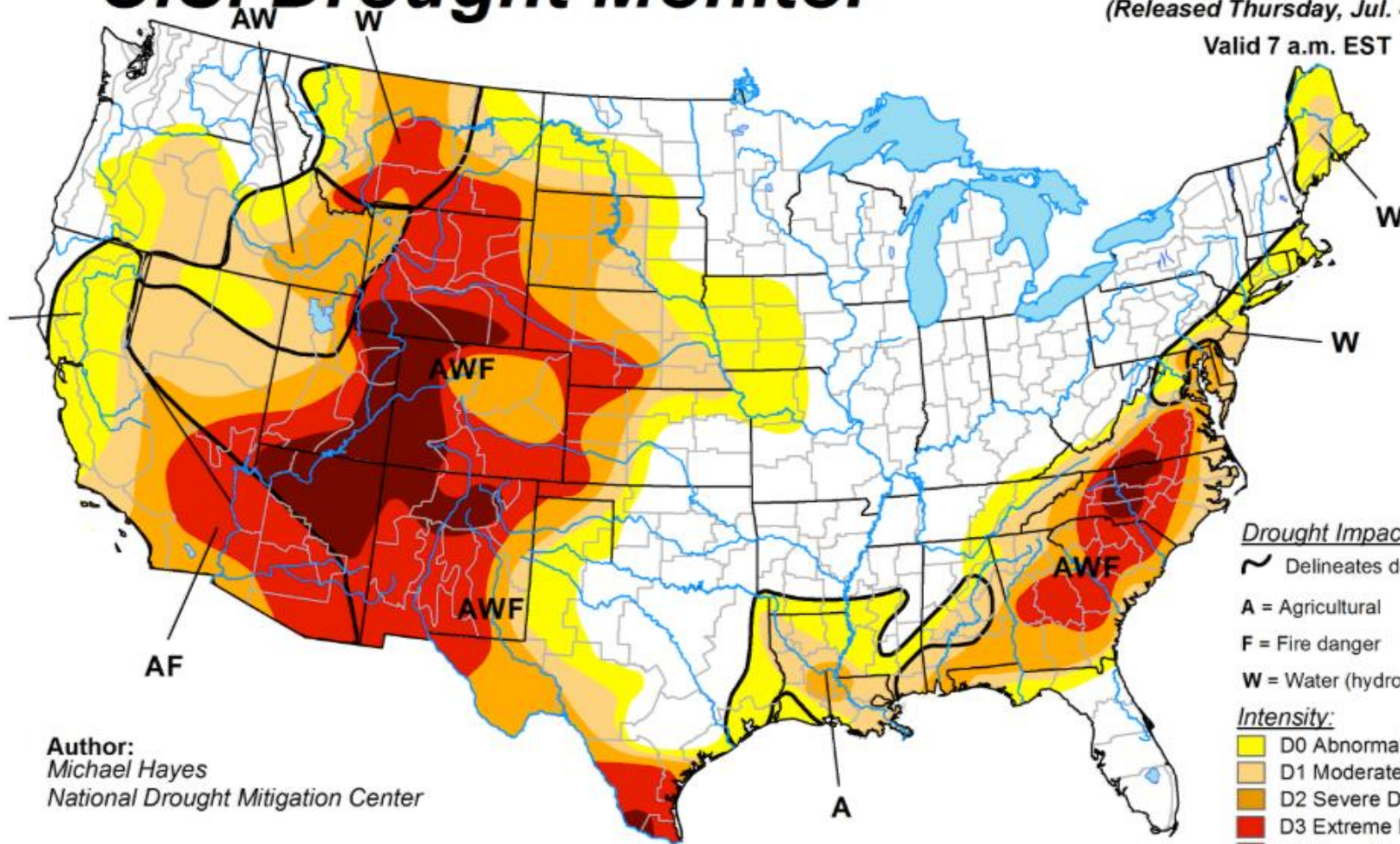


U.S. Drought Monitor

July 2, 2002

(Released Thursday, Jul. 4, 2002)

Valid 7 a.m. EST



Author:
Michael Hayes
National Drought Mitigation Center

Drought Impact Types:

~ Delineates dominant impacts

A = Agricultural

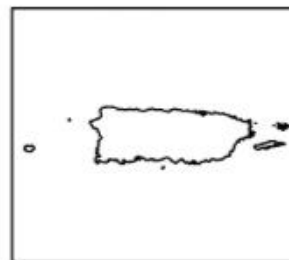
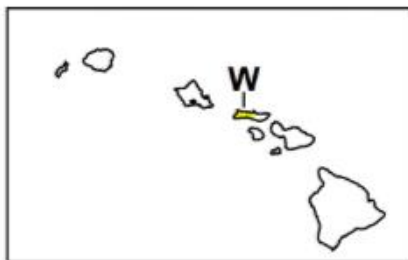
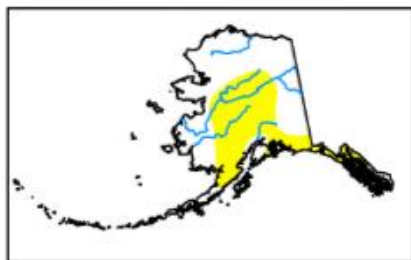
F = Fire danger

W = Water (hydrological)

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.



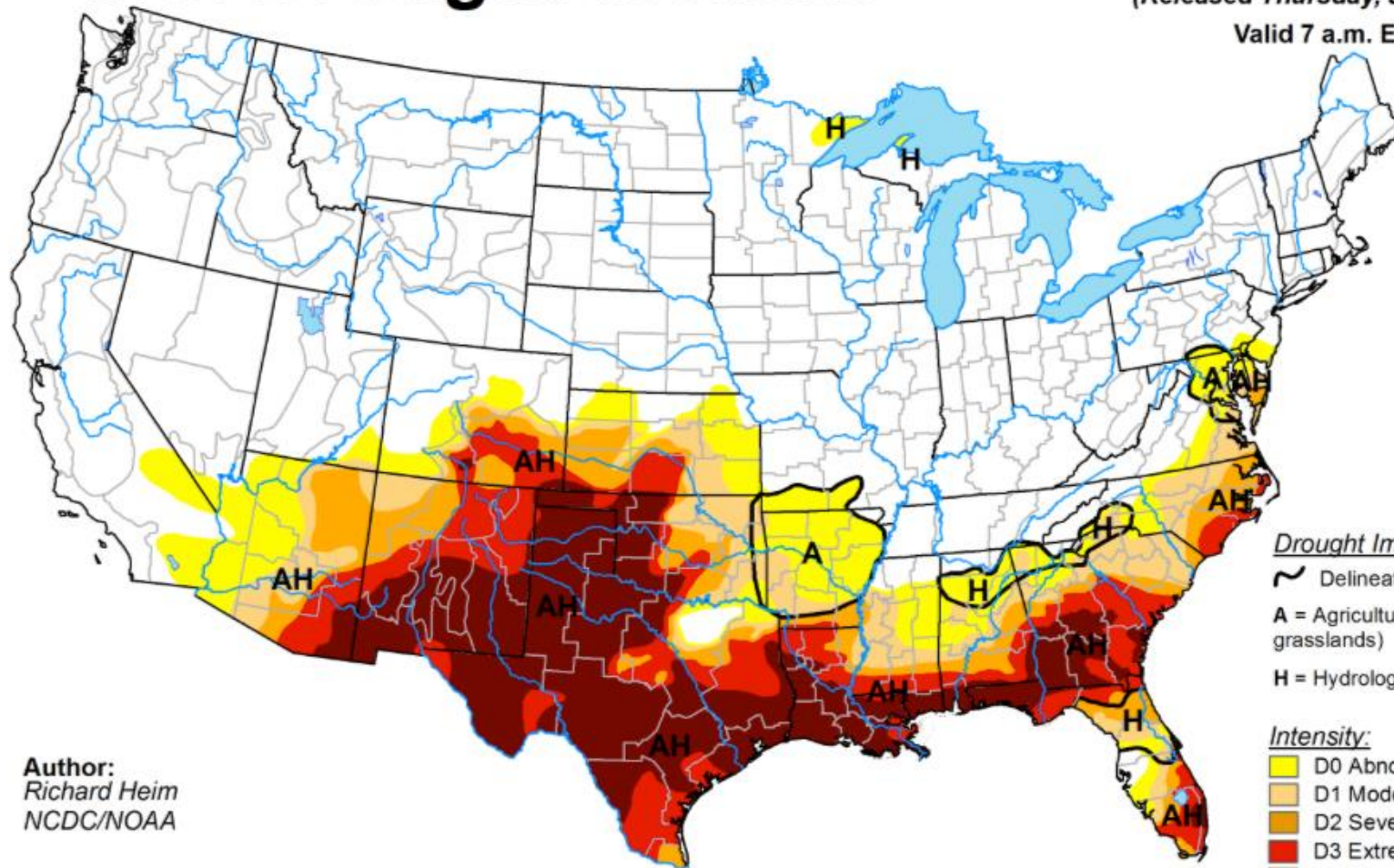
<http://droughtmonitor.unl.edu/>

U.S. Drought Monitor

July 5, 2011

(Released Thursday, Jul. 7, 2011)

Valid 7 a.m. EST



Author:
Richard Heim
NCDG/NOAA

Drought Impact Types:

~ Delineates dominant impacts

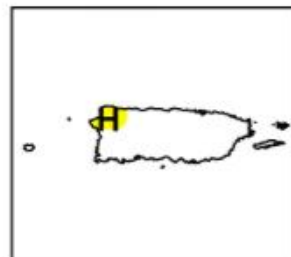
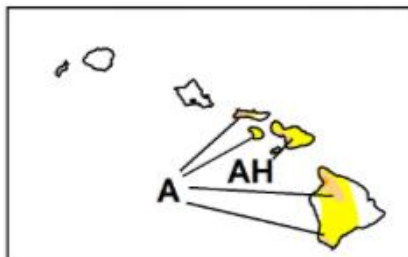
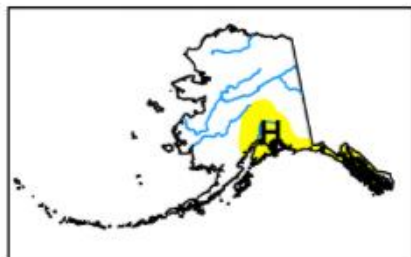
A = Agricultural (crops, pastures, grasslands)

H = Hydrological (water)

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.



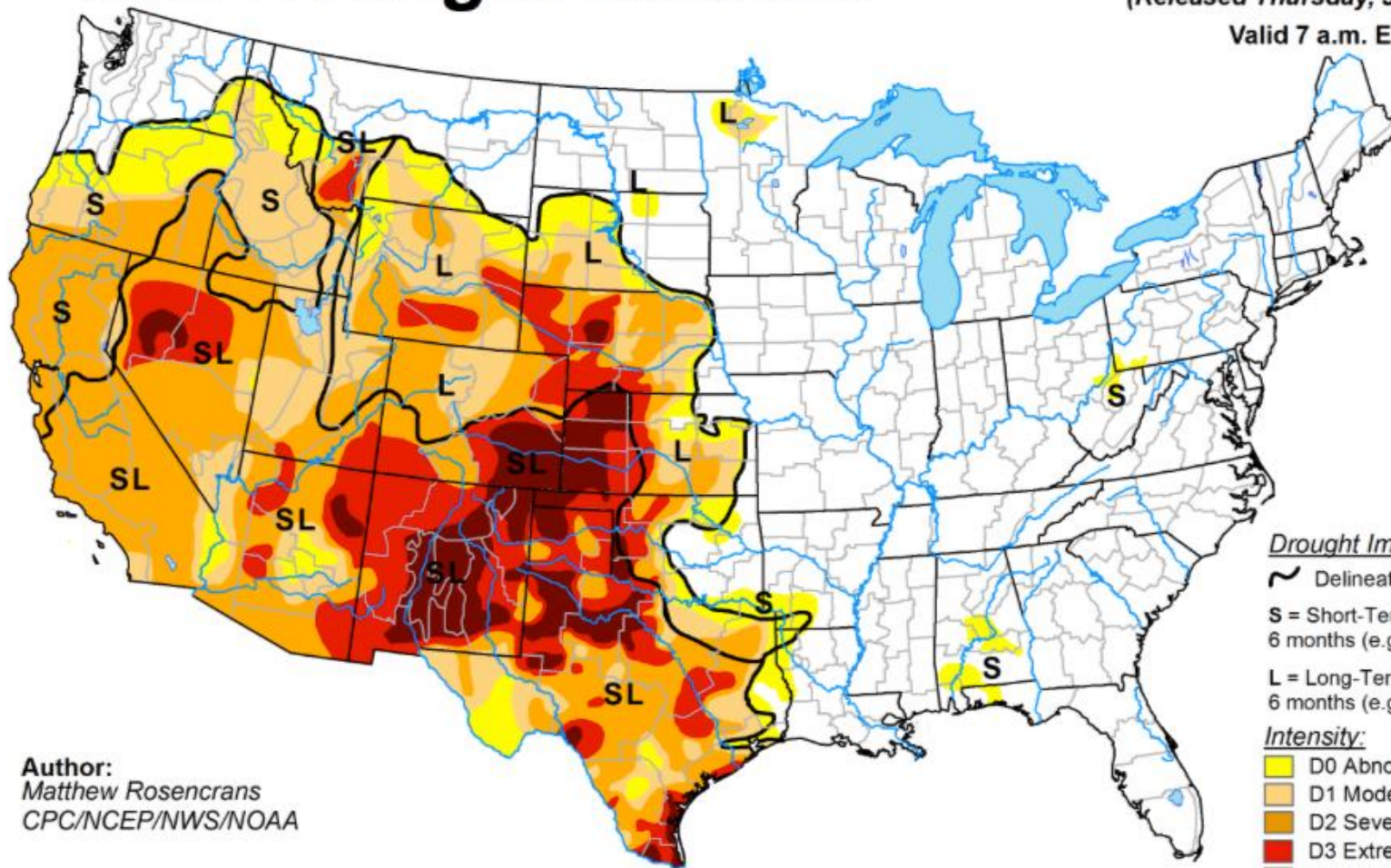
<http://droughtmonitor.unl.edu/>

U.S. Drought Monitor

July 2, 2013

(Released Thursday, Jul. 4, 2013)

Valid 7 a.m. EST



Author:
Matthew Rosencrans
CPC/NCEP/NWS/NOAA

Drought Impact Types:

~ Delineates dominant impacts

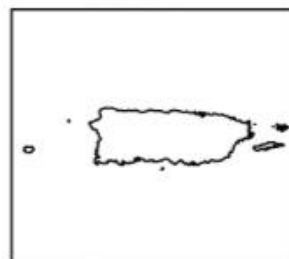
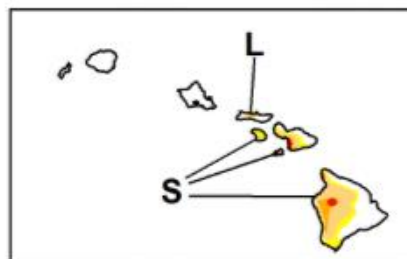
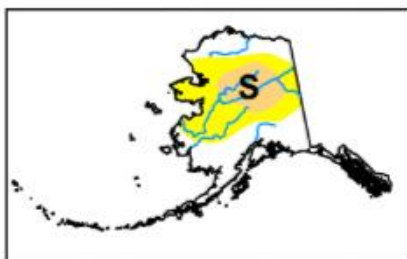
S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)

L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

Intensity:

- Yellow D0 Abnormally Dry
- Light Orange D1 Moderate Drought
- Orange D2 Severe Drought
- Red D3 Extreme Drought
- Dark Red D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.



<http://droughtmonitor.unl.edu/>

What Can be Achieved?

- Improved water use efficiency resulting in:
 - Economic,
 - Water supply,
 - Peak demand,
 - Water quality,
 - Energy,
 - Plant health, and
 - Environmental benefits



A wide-angle photograph of a golf course green during the 'golden hour' of sunset. The green is a vibrant, well-maintained grass, sloping gently from the foreground towards the background. In the mid-ground, a line of mature, dark green trees stands against the bright sky. To the right, a calm body of water reflects the low sun, which is partially obscured by the trees, creating a strong lens flare and illuminating the scene with a warm, golden light. The overall atmosphere is peaceful and scenic.

Why This Study?

Golf courses are highly visible...

- Expansive turf areas
- Irrigating frequently
- Often during the day
- Perception of waste

Methodology

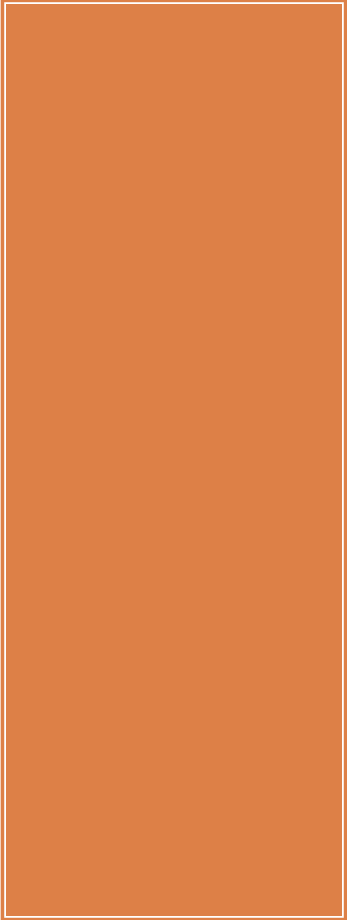
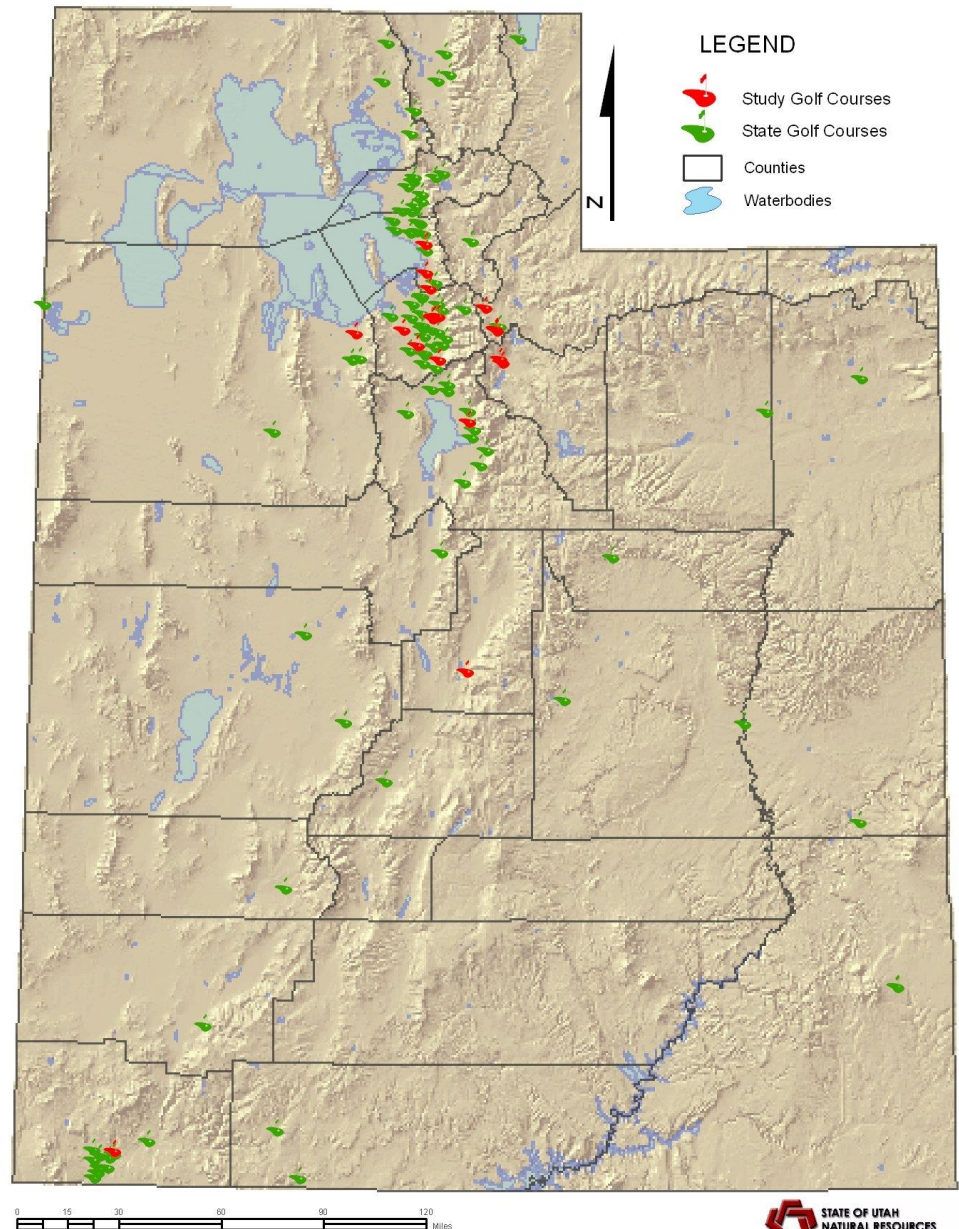
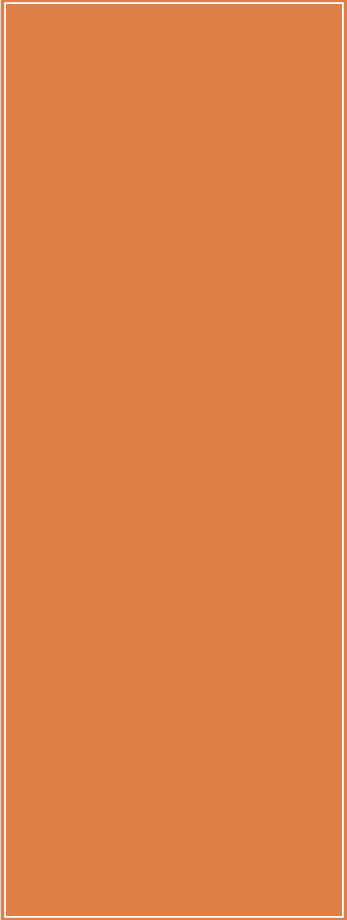
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- ❑ Study was requested by the Utah Golf Course Superintendents Association
 - ❑ Data was collected for the 2000-2003 irrigation seasons
 - ❑ 39 courses returned surveys including information on landscaped area, water use, and irrigation practices
 - ❑ Not all golf courses have metered water

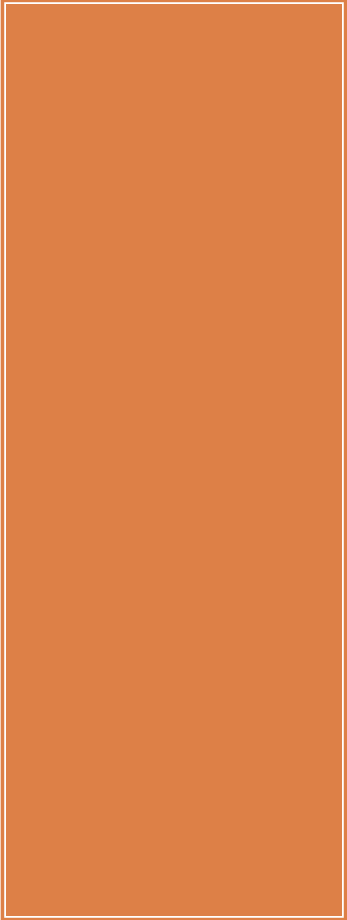
Figure 1
Golf Course Irrigation
Efficiency Study Sites



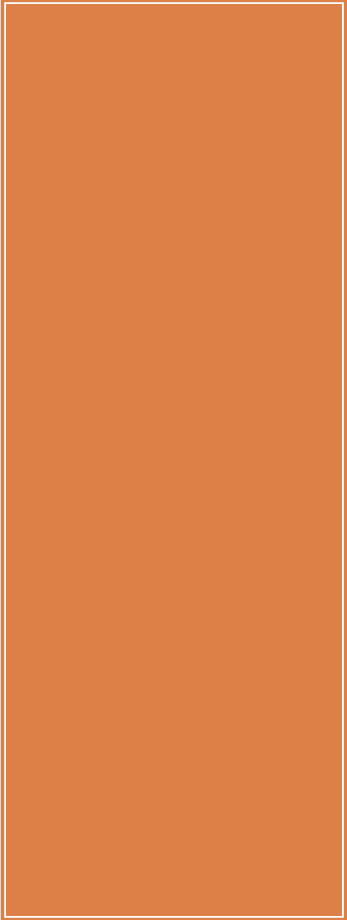
Survey Questions

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- ❑ Total irrigated area, broken down into tee boxes, greens, roughs, fairways, practice areas, non-turf landscaping
 - ❑ Water system information including source information and water delivery
 - ❑ On-site weather data or other weather data
 - ❑ Water audit information
 - ❑ Existing water conservation practices

Survey Questions

- 
- Water use details
 - ▣ Monthly use, both potable and non-potable
 - ▣ If not monthly, other time period
 - ▣ Measured or estimated
 - ▣ Course irrigation or other facilities
 - Total number of watering days

Study Information

- 
- Golf course irrigation efficiency
 - Total water use
 - Landscaped area
 - Weather data
 - ▣ Reference evapotranspiration (ET)

Reference ET

- A standard measurement of environmental parameters that effect the water use of plants, usually measured in inches per day, week, month or year
 - ▣ Solar radiation
 - ▣ Wind speed and direction
 - ▣ Temperature
 - ▣ Relative humidity



Campbell Scientific, Inc.

ET Calculations

- Standardized ASCE reference ET equation for ETo
- Turf $ET = ETo \times \text{crop coefficient}$

Monthly Crop Coefficients						
April	May	June	July	Aug	Sept	Oct
.35	.75	.8	.8	.75	.7	.53

Golf Course Irrigation Efficiency-2000

	Potential ETc (AF)	Net ETc (AF)	ETc (inches)	Net ETc (inches)	Metered Delivery (AF)	Metered Delivery (inches)	Area (acres)	% Irrigation Efficiency
Coral Canyon	345.5	326.7	52.5	49.6	436.8	66.3	79.1	75
The Country Club	474.0	353.9	30.7	23.0	540.0	35.0	185.0	66
Jeremy Ranch	248.7	190.8	21.6	16.6	270.1	23.5	138.0	71
Westride Golf Club	435.6	325.2	30.7	23.0	605.0	42.7	170.0	54

Golf Course Irrigation Efficiency-2001

	Potential ETc (AF)	Net ETc (AF)	ETc (inches)	Net ETc (inches)	Metered Delivery (AF)	Metered Delivery (inches)	Area (acres)	% Irrigation Efficiency
Coral Canyon	333.5	324.6	50.6	49.3	420.2	63.8	79.1	77
The Country Club	440.6	361.1	32.0	26.3	640.0	46.5	165.0	56
Jeremy Ranch	248.4	208.6	22.1	18.6	284.8	25.4	134.7	73
Westride Golf Club	453.9	372.1	32.0	26.3	641.0	45.2	170.0	58

Golf Course Irrigation Efficiency-2002

	Potential ETc (AF)	Net ETc (AF)	ETc (inches)	Net ETc (inches)	Metered Delivery (AF)	Metered Delivery (inches)	Area (acres)	% Irrigation Efficiency
Coral Canyon	242.9	227.3	36.9	34.5	448.4	68.1	79.1	50.7
The Country Club	431.2	361.1	31.4	26.3	645.0	46.9	165.0	56.0
Homestead Golf Club	255.9	196.3	26.0	19.9	318.3	32.3	118.3	61.7
Wingpoint e	398.2	333.5	31.4	26.3	374.4	29.5	152.4	89.1

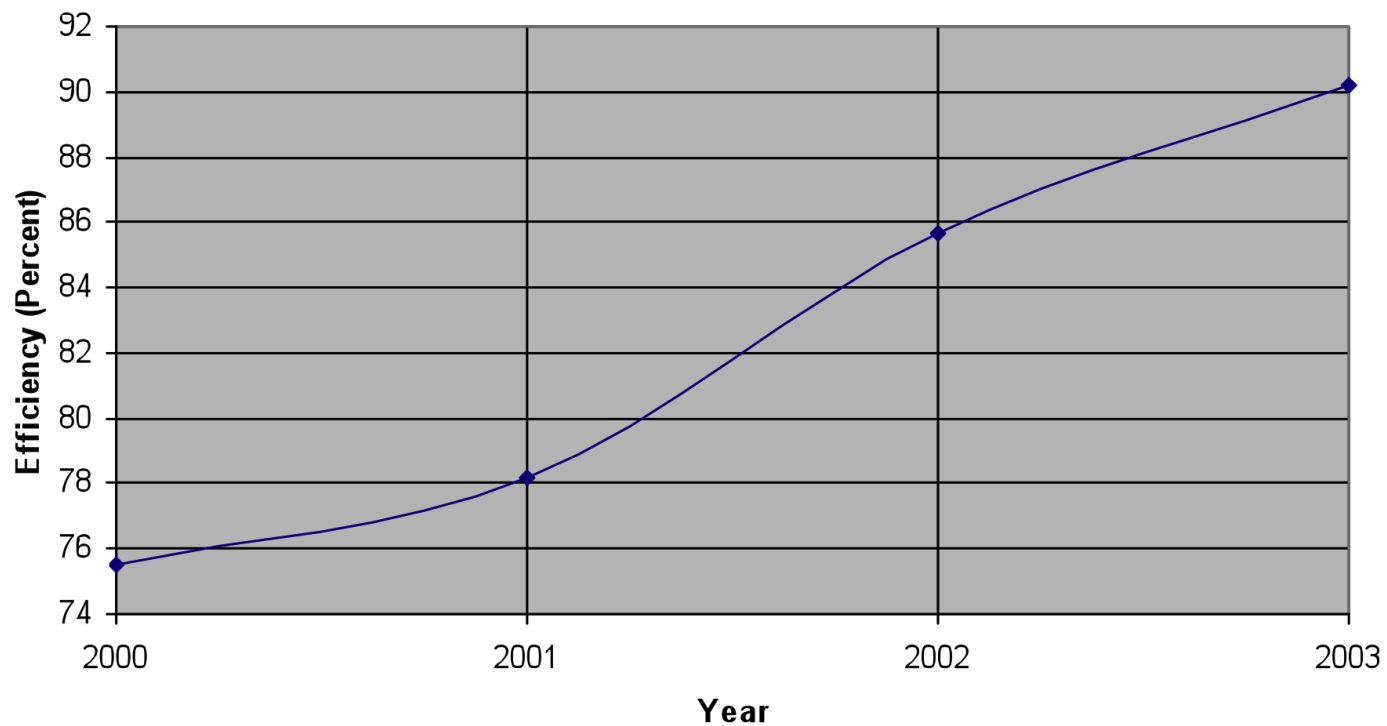
Golf Course Irrigation Efficiency-2003

	Potential ETc (AF)	Net ETc (AF)	ETc (inches)	Net ETc (inches)	Metered Delivery (AF)	Metered Delivery (inches)	Area (acres)	% Irrigation Efficiency
Coral Canyon	276.6	262.7	42.0	39.9	433.9	65.9	79.1	60.6
The Country Club	434.9	354.8	31.6	25.8	632.0	46.0	165.0	56.1
Homestead Golf Club	256.2	202.9	26.0	20.6	260.9	26.5	118.3	77.8
Wingpoint e	401.7	327.6	31.6	25.8	298.1	23.5	152.4	109.9

Summary Water Data

	Potential ETc (AF)	Net ETc (AF)	ETc (inches)	Net ETc (inches)	Metered Delivery (AF)	Metered Delivery (inches)	Area (acres)	% Irrigation Efficiency
2000		3522.6	29.4	22.5	4739.3	30.6	1879.5	77.76
2001		4738.8	29.2	24.3	6146.4	31.6	2343.7	81.37
2002	5640.7	4676.2	30.3	25.1	5458.4	29.3	2234.0	85.7
2003	5705.8	4665.2	30.6	25.1	5172.3	27.8	2234.0	90.2
All Years	11346.4	9341.4	30.5	25.1	10630.7	28.6	2234.0	87.9

Mean Annual Golf Course Efficiency



Summary Findings

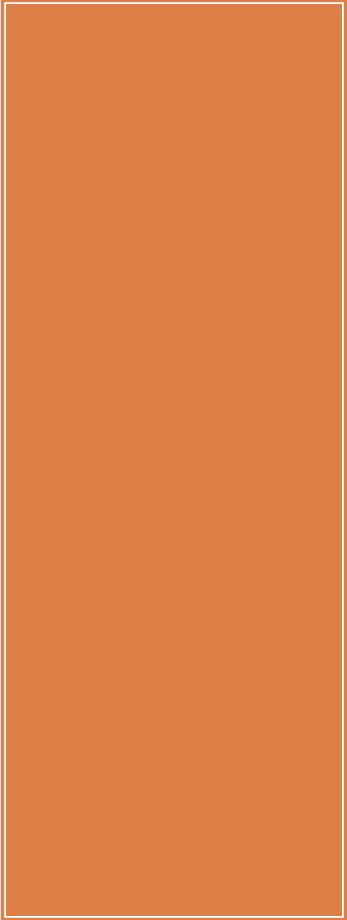
- On average, courses irrigated 31.1 inches in 2000-2001
- On average, courses irrigated 28.6 inches in 2002-2003
- 80% efficient in 2000-2001
- 88% efficient in 2002-2003




Residential Water Use

- Residential water use studies have shown average application rates of 45-50 inches of water to landscapes annually
- This equates to approximately 50% irrigation efficiency
- Despite intensive media campaigns, system distribution uniformities hover around 50%

Conclusions

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- Golf course irrigation efficiency-for those courses that participated in the study-is higher than residential irrigation efficiency
 - Superintendents' knowledge of turf requirements and effective system design has led to efficient and wise use of water resources

A landscape photograph of a golf course. In the background, a large, rugged rock formation rises against a blue sky with scattered white clouds. The middle ground shows a lush green golf course with several sprinklers active, spraying water in arcs. The foreground is filled with a pile of large, dark, rounded rocks. The text "Thank you very much for your attention.....questions?" is overlaid in white, bold, sans-serif font in the center of the image.

**Thank you very much for your
attention.....questions?**

Kelly Kopp