

Golf Course Water Usage: Effective Policy and Effective Water Efficiency Strategies

Tim Cloninger- Agronomist- Staples Golf Design



Background

B.S. Agriculture- Turfgrass Science- University of Arizona. Worked at Turf Research Center for Dr. Kopec

Graduate Certificate- Geographic Information Sciences. Graduate Certificate- Water Policy

Golf Course Superintendent Shadow Creek 2011-2018. Assistant Superintendent in Las Vegas from 2004-2008.

Superintendent Eugene CC 2018-2022

Takeaways for Today

Benefits of Golf Courses.

Golf Course Water Use in Arizona.

Overview of ADWR water policy and SNWR water policy for Golf Course Water Usage.

Efficient use of water on golf courses.

Lake Mead

Hoover Dam's Arizona Side Spillway Flows Over in Fall of 83. Credit
Las Vegas Review Journal



MORE THAN
200,000

KIDS LEARN
LIFE LESSONS
THROUGH GOLF
ANNUALLY

\$6.0 Billion

ECONOMIC
ACTIVITY
GENERATED
BY THE
GOLF INDUSTRY

\$2.3 Billion

WAGES
EARNED
THROUGH
JOBS
SUPPORTED
BY THE GOLF
INDUSTRY

\$518 Million

TAX
REVENUES
GENERATED
BY THE
GOLF INDUSTRY

66,200

TOTAL JOBS
SUPPORTED
THROUGH THE
GOLF INDUSTRY


**ARIZONA ALLIANCE
FOR GOLF**

\$100 Million

ESTIMATED ANNUAL
CHARITABLE
CONTRIBUTIONS
FROM GOLF

16.6 Million

TOTAL
ROUNDS OF
GOLF PLAYED
EACH YEAR
IN ARIZONA

\$2.24 Billion

IN PREMIUM VALUE
GOLF-ADJACENT
PROPERTY

GOLF PROPERTY
SALE PRICES
**18-40%
HIGHER**

THAN NON-GOLF
PROPERTIES

2.4 Million

DOMESTIC OVERNIGHT
VISITORS TO ARIZONA
REPORT PLAYING GOLF
DURING THEIR VISIT

ON AVERAGE
GOLF TRAVELERS SPEND
2.9 Times More
THAN GENERAL TOURISTS

ALL GOLF
OPERATIONS
ACCOUNT
FOR ONLY

2%

OF DAILY
WATER USE

Benefits of Golf Courses

Reduces Urban Heat Island Effect.

Stormwater Management.

Provides Wildlife Habitat.

Restores Damaged Land Areas (mining sites).

Improves Air Quality.

Benefits of Golf Courses

Maricopa County, City of Phoenix and City of Tempe are partnering with urban forestry groups to achieve 25 percent tree canopy coverage

Existing golf courses effectively save future tree canopy programs an estimated \$500 million in publicly funded installation and maintenance costs. "Arizona Alliance for Golf"

"Our analysis suggests that golf courses provide the greatest amount of cooling as compared to other land uses." Researchers at the University of Minnesota quantified the ecosystem services provided by the 135 golf courses in the Twin Cities metropolitan area

<https://www.usga.org/content/usga/home-page/course-care/green-section-record/58/17/ecosystem-services-provided-by-golf-courses.html>

Stormwater Management



Arizona Golf Course Water Use

In 2017, there were 174 active golf courses in the PhxAMA: 94 were industrial users, while the other 80 (individual users) were served by municipal providers.

Golf courses in the PhxAMA used about 99,500 AF of water in 2017.

Approximately 47 percent of this use was groundwater; the balance of the use was comprised of direct use treated effluent, recovered treated effluent, surface water, Colorado River water and recovered Colorado River water.

2006- W/in AMAs Golf Used 125k AF, Agriculture- 1.85 million AF

Turf-related facilities that use any groundwater, regardless of whether they are industrial users or served by a municipal provider, must comply with a maximum annual water allotment based on the size and age of the facility ADWR 4th Management Plan.

ADWR Golf Course Water Policy

ADWR has regulated golf course water use since the First Management Plan was applied in 1985. Currently 54% of courses regulated by Annual Conservation Allotment.

Turf-Acreage Restrictions

Maximum Annual Water Allotment

ADWR Turf Acreage Restrictions

The plan limited new golf courses to 23.8 acre-feet of water per hole, which limits a golf course to no more than five acres of turf per hole at an application rate of 4.6 acre feet. For an 18 hole golf course this allows for only 90 acres of turf.

In Phoenix AMA- (95) 18 hole golf courses have been built since 1985

Avg. Size of Course in PHX AMA prior to 1985= 105 acres turf, post 1985 avg = 84 acres

Turf Acreage Restrictions



Maximum Annual Water Allotment

Phoenix AMA- 4th Management Plan- GC post 1984-
Max 90 acres

From 2023 until the first compliance date for any substitute requirement in the 5MP

<i>Type of Landscaping:</i>	<i>Application rate: (acre-feet per acre per calendar year)</i>
<i>1. Turf acres</i>	<i>4.75</i>
<i>2. Total water surface area</i>	<i>6.2</i>
<i>3. Low water use landscaped area</i>	<i>1.5</i>

Application Rate

“Based on research conducted at the University of Arizona Desert Turf Research Center (Brown, Gilbert, and Kopec, 1996) and 1988 to 1996 weather data from the Arizona Meteorological Network (AZMET) Tucson Station, high-quality turf with winter overseeding would need 4.5 to 5.2 acre-feet per acre year of applied water depending upon the weather conditions of that year, not including rainfall (ADWR, Third Management Plan- Tucson AMA, 2000).”

Different variables that occur in a research setting versus a real life golf course environment. In that study performed at The University of Arizona there was an average irrigation uniformity of 80% du. When decreased irrigation uniformity and water loss during watering is compounded with lower than average rainfall, the application rate of 4.6 acre feet for year-round quality turf is difficult to meet.

ADWR 5th Management Plan- 2025

TABLE 6-505-1

APPLICATION RATES FOR GOLF COURSES

From 2025 until the first compliance date for any substitute requirement established by the legislature

<i>Type of Landscaping:</i>	<i>Application rate: (acre-feet per acre per calendar year)</i>	<i>Limitation</i>
<i>1. Turf acres (Overseeded)</i>	6.035	<i>Up to and including 3.89 acres per hole</i>
<i>2. Turf Acres (Non-overseeded)</i>	4.36	<i>Between 3.89 and up to 5 acres per hole</i>
<i>3. Low water use landscaped area</i>	0.74	<i>Up to 1 acre per hole</i>
<i>5. Total water surface area</i>	6.2	<i>See footnote 1</i>

¹ *The number of acres of total water surface area in existence within the facility, shall be limited to an area calculated by multiplying the number of holes present within the facility during the year by 0.14 acre per hole, or the facility's total water surface area in existence prior to 1989, whichever is greater.*

ADWR 5th Management Plan

Legacy courses- Pre 1985: Capped to 90 acres of turf for allotment

"It is important to note that the allotment formula outlined below does not dictate how turf-related facilities are to use water within their facility. The facility manager has discretion on how to use the allotment within the facility". ADWR 5th Plan

"The allotment formula is intended to encourage efficient design, construction, water application, and to acknowledge limited overseeding practices." ADWR 5th Plan

SNWA Golf Course Water Policy

Water Policy adopted in 2003- Potable water regulated, not groundwater or effluent.

Water Budget- 6.3 AF per irrigated acre.

Golf Courses limited to 5 acres per hole, Only two new golf course built in Southern Nevada since 2003.

SNWA Water Smart Landscapes Rebate Program: Golf courses have converted 936 acres of turf to low water use landscape. (41 million in cash incentives)

SNWA Golf Course Water Policy

Beginning January 2024- Water Budget reduced from 6.3 AF to 4.0 AF per irrigated acre.

AB 356- Effective January 2027- Removal of all non-functional turf. (e.g. turf around clubhouses, entry ways)

Difficult to overseed at 4.0 AF per irrigated acre.

Many Las Vegas courses have bermudagrass challenges.

Review of the Two Policies

ADWR encouraged efficient water use design starting in 1985, before the golf construction boom (80s,90s)

ADWR has stayed relatively consistent with the turf allotment number, tight number, but has allowed credit system. Encouraged water savings w/ turf allotment.

SNWR was late to enforce turf acreage restrictions, paid for turf reduction.

SNWR drastically reducing allotment number, golf courses in trouble.

SNWR allotment number is based on acreage, efficiently designed courses in tighter spot.

Southern Nevada



Bermudagrass Decline- Southern Nevada

Water Efficiency- What we can do now

1. Bermuda grass or warm season turf
2. Overseed/Non-Overseed
3. Irrigation Efficiency and Management
4. Future Savings

Bermudagrass



Several years after
successful transitions,
sodding program.



Poor bermudagrass after
transition

Bermudagrass

Need a strong stand of bermudagrass to go non-overseed, transition.

Spring Transition has improved with better cultural practices. Earlier transition back to bermudagrass is better for water efficiency.

Overseed/Non Overseed?



Non Overseed?

Challenges: Potential lost revenue from tourist golfers, difficult to play off in winter, need excellent base of a hybrid bermudagrass for best results.

Positives: Potential water reduction between 10-20%, savings on maintenance budget, no closure for fall overseeding period.

Non Overseed- Tif Tuf



Alta Mesa CC- Tif Tuf non overseeded in early January

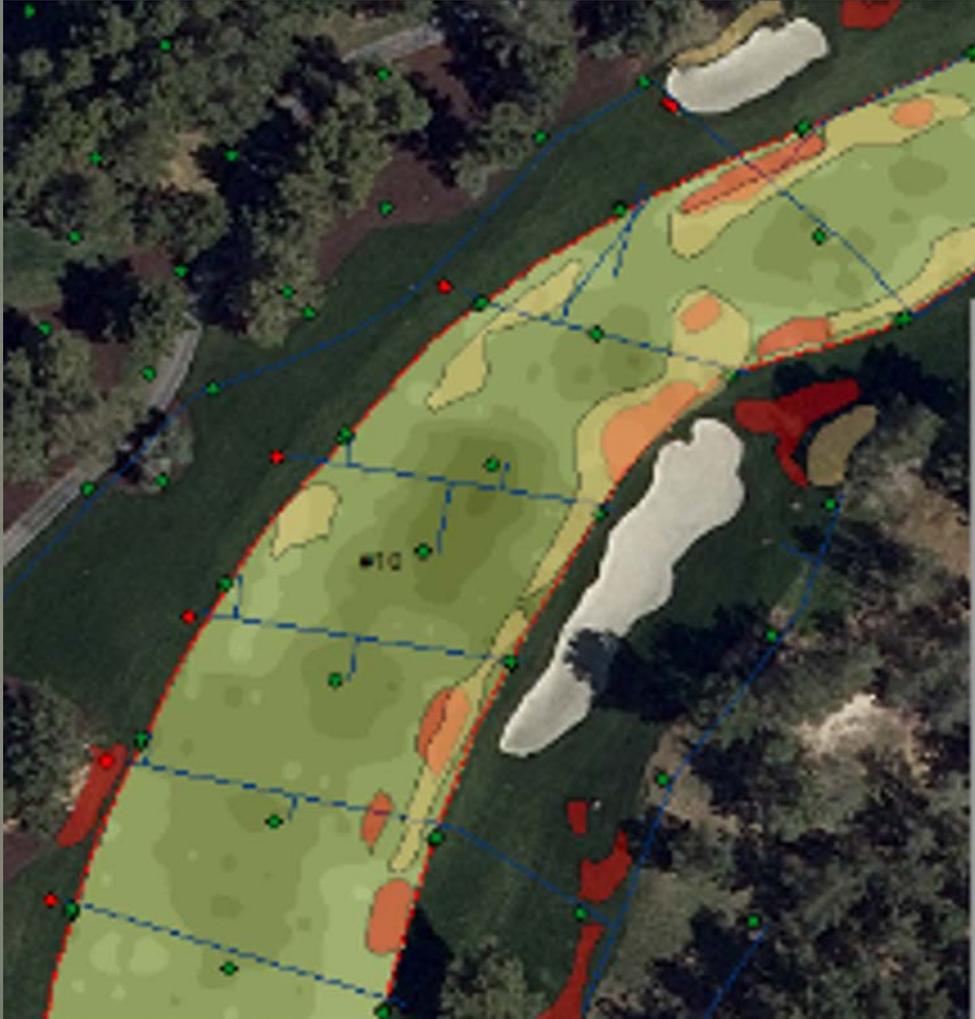
Irrigation Efficiency

New System with better uniformity can save 10-30% water. Systems older than 20 years lose efficiency, management of the system important, can save w/ upgrades.

Superintendents motivated to save water: firm conditions, cost of water, environmental stewardship.



Irrigation Efficiency



Irrigation Management

New Tools- Soil Moisture Sensors- In ground and handheld

New Tools- Soil Moisture mapping via satellite

Central Control System- Improved software, more control

Weather stations- Et, change crop coefficient throughout the year. Use combination of weather station and soil moisture sensing.

Irrigation Management- Soil Moisture Sensors

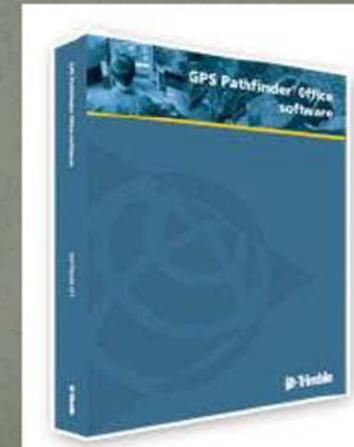
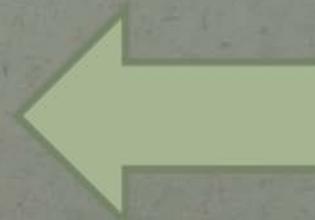
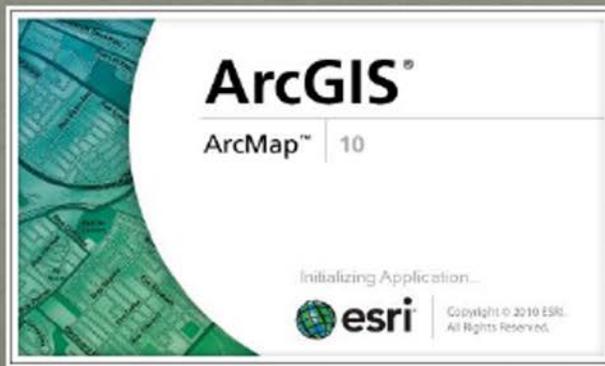


Above: Pogo Moisture Meter, Below: Spectrum Moisture Meter.

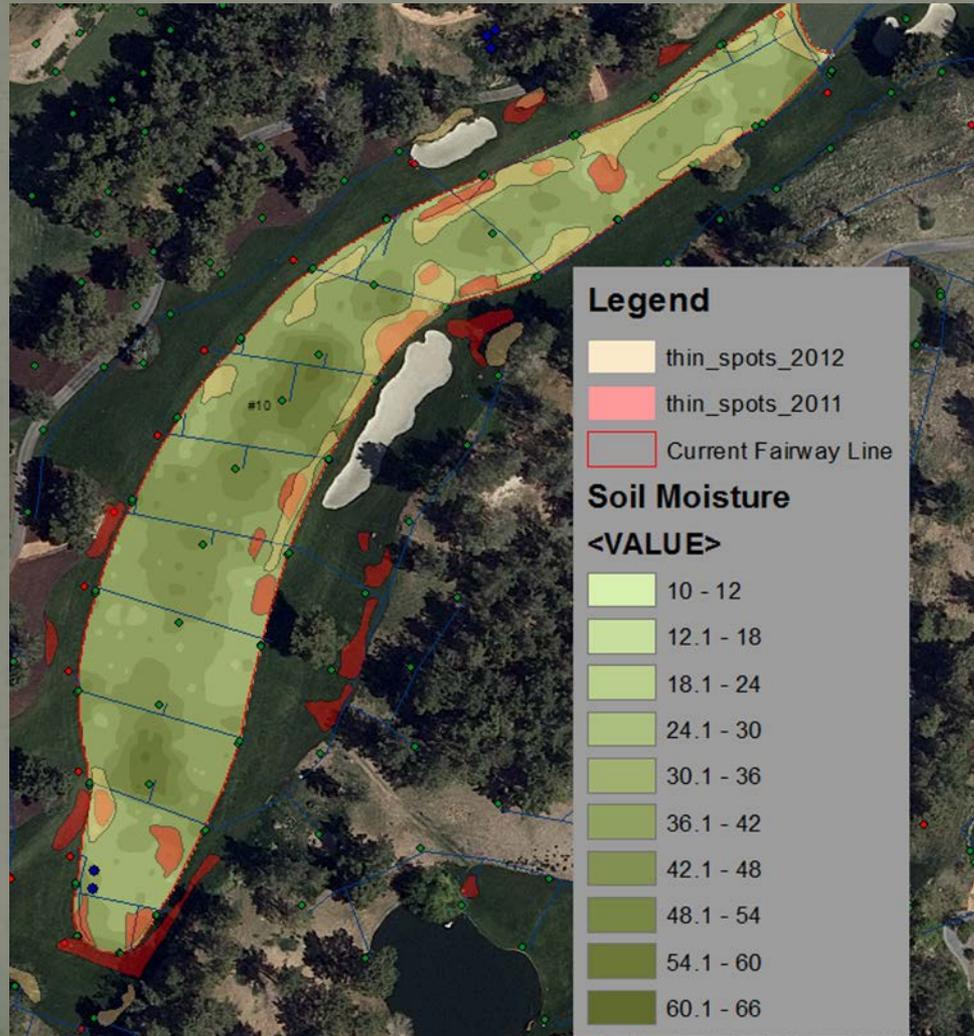
Spiio In ground moisture sensor



Mapping Soil Moisture Fairway

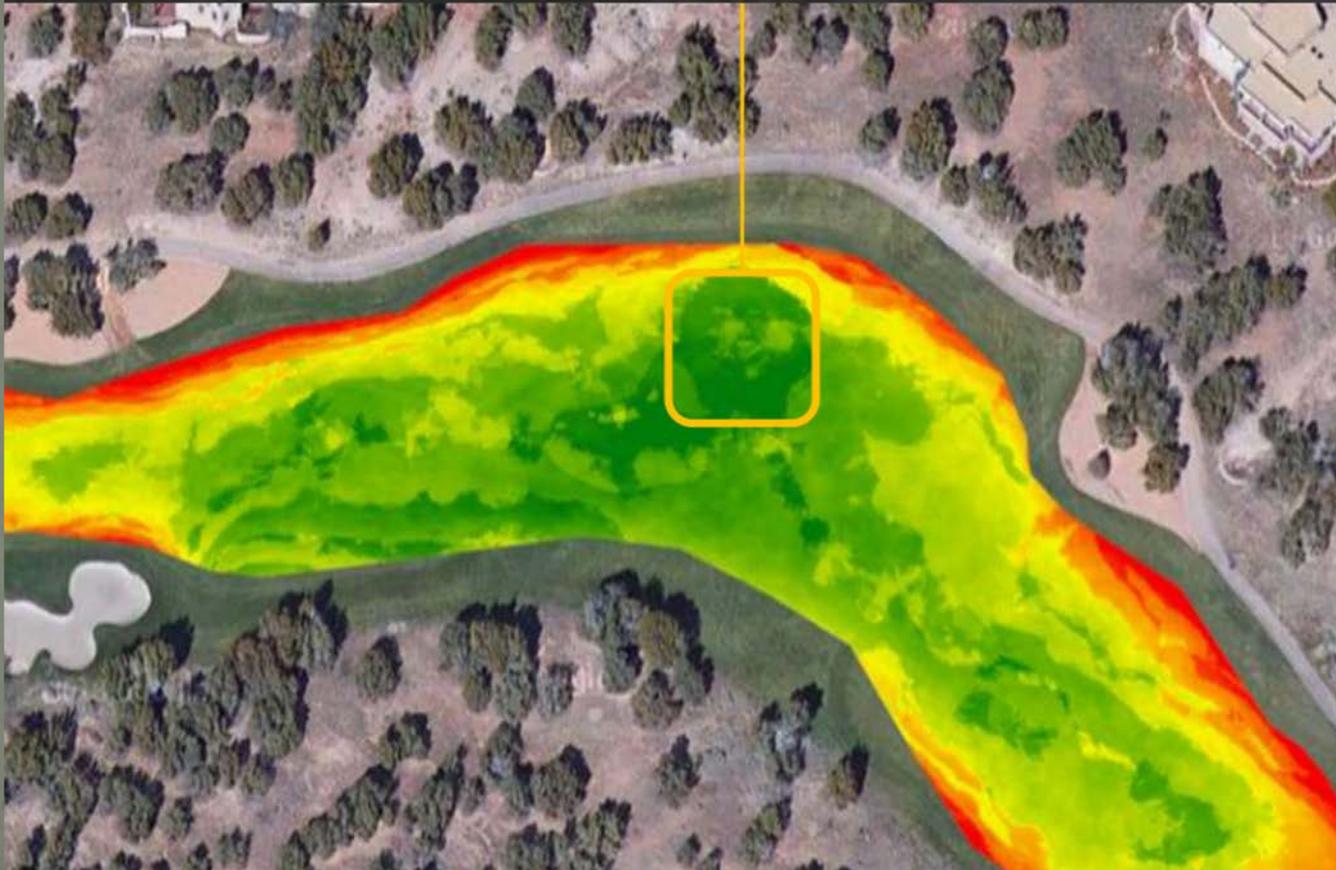


GIS Analysis- Multiple Layers



Soil Moisture Sensing- Satellite

Overwatering of a newly installed sprinkler.



Future Savings

New Drought Tolerant Turfgrass- Tif Tuf bermuda, zoysia grass: Potential 10-20 savings over existing bermudas.
Challenges: Difficult for a clean conversion, expensive, limited availability of sod.

Drip Irrigation- In-Line subsurface drip irrigation:
Potential savings 50-80%

Challenges: expensive to install, not proven on a large scale golf course

Bermudagrass- Drought Tolerance

2010 USDA Trials Shows grass 1-YEAR after abandonment



Future Savings

Irrigation Strategies for water conservation

Do we have the tools?

STRATEGY	EXPECTED WATER SAVINGS %	CURRENT RATE OF ADOPTION* % SW (U.S.)
DRIP IRRIGATION OF TURF	50-80	-
REDUCE IRRIGATED ACREAGE	10-30	51 (30)
CONVERT TO DROUGHT-TOLERANT TURFGRASS	25-30	13 (22)
REDUCE WINTER OVERSEEDING	10-15	-
IN-GROUND SOIL-MOISTURE SENSORS	>10	8 (6) **
UPGRADE AND ADJUST THE IRRIGATION SYSTEM	5-10 (each)	15-48 (12-31)
WETTING AGENTS/GROWTH REGULATORS	5-15	92 (96)

*Source: GCSAA. 2022. Golf course environmental profile: Phase III, Volume I: water use and management practices on U.S. golf courses. <www.gcsaa.org/environment/golf-course-environmental-profile>.

**Even hand-held soil-moisture sensors only have an adoption rate of 54% in the SW (49% in the U.S.).

Drip Irrigation

Irrigation Strategies for water conservation

Subsurface Drip Irrigation

Sprinklers are inherently inefficient to irrigate isolated round tee-boxes

Water is loss outside the turf



The Club at Las Campanas, Santa Fe, New Mexico

Drip Irrigation

Irrigation Strategies for water conservation

Success

- No visible differences compared to overhead irrigation
- Water use was substantially reduced (50-80%)
- Significant reduction in out-of-play vegetation management (no overspray)
- Less incidence of disease (\$ spot)
- Fewer germination of weeds (poa annua)
- Less soil compaction
- Can irrigate anytime even during play



Questions?

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