UTAH STATE CAPITOL GROUNDS
LANDSCAPE WATER USE ASSESSMENT

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Prepared by

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INTRODUCTION

This report contains an analysis of landscape water use for the Utah State Capitol grounds. It is being provided in response to a legislative request for this information.

The Capitol grounds crew requested and received a Water Check in July and August of 2018. It was provided through the Water Check program affiliated with the Center for Water Efficient Landscaping (CWEL) at Utah State University (USU) Extension. The Water Check program has been offered under contract with Metropolitan Water District of Salt Lake & Sandy since 2009 and delivered to customers in the Salt Lake City Department of Public Utilities (SLCDPU) service area as part of Utah's "Slow the Flow" initiative. The Utah State Capitol's Water Check report is contained in the Appendix.

More recently, the WaterMAPS™ (Water Management Analysis and Planning Software) team, also part of CWEL at USU Extension, was asked to provide an estimate of the "capacity to conserve" water applied to landscapes at the Capitol. The WaterMAPS™ program currently has a collaborative USU Extension Water Initiative project with SLCDPU to analyze landscape water use for residential locations within its service area. The WaterMAPS™ team worked with SLCDPU in preparing this requested Utah State Capitol landscape water use analysis, relying on information and meter data that they prepared and provided. In this report, we focus on presenting the methodology and results of the WaterMAPS™ analysis for the Utah State Capitol grounds. The analysis looks at landscape water use from 2010-2018 in order to identify recent patterns and potential opportunities for efficiency and conservation savings.

Summary of Key Findings

- Land cover classification of aerial multispectral imagery shows that irrigated landscaped area on the Utah State Capitol grounds is 69% turfgrass, 29% trees and shrubs, and 2% beds and planters containing sparse vegetation consisting of mostly woody plants and perennials with some annuals.
- Reference evapotranspiration (ET_o) relevant to the Capitol grounds for 2010-2018 shows high seasonal and monthly variability. Compared to the 30-year average ET_o for 1978-2008, the 2010-2018 period exhibits a general increase in ET_o, yet landscape irrigation still exceeds plant need.
- WaterMAPS™ analysis for 2010-2018 demonstrates:
  - average annual capacity to conserve water applied to the Capitol grounds is 38%;
  - annual capacity to conserve ranged from 23% (in 2011 and 2014) to 52% (in 2012);
  - the Capitol grounds are not overwatered in the early spring and only half the time in late fall, but irrigation exceeds the peak season plant water need nearly every year;
  - the highest periods of inefficiency generally occur in August and September, when ET_o declines but water use is not cut back to appropriately track reduction in plant water need;
  - irrigating to meet plant water need determined by actual ET_o can yield water savings;
  - a weather station on the Capitol grounds and other irrigation infrastructure investments would aid the grounds crew in irrigating to meet plant water need.

- The Water Check report (Appendix) points to strategies for increasing landscape water use efficiency on the present Utah State Capitol grounds through maintenance, repair and operation of the existing irrigation systems. Implementation of an optimized irrigation schedule would be enhanced with investments in irrigation system improvements, such as installing weather-based controller and soil-moisture sensor technologies.
- For 2010-2018, the difference in depth inches needed to water existing turfgrass compared to beds and planters is approximately 34%. Additional water conservation could be achieved through transitions in plant material, either to new varieties of turfgrass requiring much less water or to more area in beds and planters, if such transitions are accompanied by appropriate irrigation to meet lower plant water need.

List of Abbreviations

Capitol	Utah State Capitol
CWEL	Center for Water Efficient Landscaping
ET_o	Reference evapotranspiration
LIR	Landscape Irrigation Ratio
SLCDPU	Salt Lake City Department of Public Utilities
USU	Utah State University
WaterMAPS™	Water Management Analysis and Planning Software

Glossary

Aerial Multispectral Imagery: natural color imagery produced by sensors mounted on aerial vehicles that contains red (R), green (G), blue (B) and near infrared (NIR) bands and that is used for land cover classification

Evaporation: the process that occurs when water changes from a liquid to a gaseous state (vapor)

Evapotranspiration (ET): the process by which water is transferred from the land to the atmosphere by evaporation from the soil and other surfaces and by transpiration from plants. *See:* https://water.usgs.gov/edu/watercycleevapotranspiration.html

Land Cover Classification: the processing of aerial multispectral imagery in order to classify the land surface into types of cover, including impervious surfaces (e.g., concrete, asphalt, sidewalks, parking lots), different types of vegetation, water, and other features

Landscape Irrigation Ratio (LIR): the ratio of the amount of water actually used on a particular urban landscape divided by the estimated amount of water that a landscape needs to be healthy, as calculated by WaterMAPS™

Reference (crop) evapotranspiration (ET_o): the evapotranspiration rate from a reference surface, not short of water, generally a hypothetical grass reference crop with specific characteristics

Transpiration: the process by which moisture is carried through plants from roots to microscopic pores in the plant's leaves (stomata), where it changes to vapor and is released to the atmosphere

METHODOLOGY

This section describes the methodology involved in conducting the USU WaterMAPS™ analysis of the Utah State Capitol grounds.

Overview of WaterMAPS™

Background. WaterMAPS™ is a custom water demand management software tool developed by an inter-disciplinary team of USU researchers for the purpose of promoting urban landscape water conservation. Project-based and legislative funding through the USU Extension Water Initiative have supported its development and application. The tool identifies urban properties with irrigated landscapes that have the greatest "capacity to conserve" water so that conservation programs and information can be directed and tailored to water users at those locations. It also helps water suppliers assess the effectiveness of conservation program delivery by monitoring site-specific and service-area-wide changes in landscape water use efficiency over time.

The WaterMAPS™ team has provided technical assistance to water suppliers in support of urban water demand management, conservation programming, and water planning and policy decisions. WaterMAPS™ was developed as an analytic and public information tool to help property managers, municipalities, water districts, and managers of pressurized secondary irrigation systems better understand patterns of landscape water use. Water applied to landscapes constitutes approximately 65-75% of urban residential water demand in the United States West. Urban landscapes contribute to the health of urban environments and their residents, yet they are often watered in excess of the actual water needs of the vegetation. Increasing landscape water use efficiency offers one of the greatest opportunities for reducing urban water demand in order to manage scarce water supplies in the context of aridity, drought, and climate variability.

Approach. WaterMAPS™ promotes water use efficiency on existing urban landscapes. The approach takes into account the high degree of variability in urban parcels and people's landscaping choices. Classification of aerial imagery that characterizes landscape plant material is used to calculate landscape water need for each individual urban property using local weather data. Landscape water need is compared to the amount of metered water used for landscape irrigation in order to assess appropriateness of watering practices. WaterMAPS™ enables these assessments to be conducted for an entire service area, produces landscape water use information for delivery to water users (Endter-Wada et al., 2013), and directs conservation programs to locations where most needed.

The WaterMAPS™ approach recognizes people are generally willing to conserve water and are motivated to do so for a variety of reasons. "Innocent overwatering" occurs when people do not know how much water their landscape actually needs in the context of weather variability and when they face site-specific constraints to efficiency. Conserving water applied to landscapes is more difficult than conserving water used indoors because it involves the interaction of soils, plants, irrigation systems and human behavior in a changing environment. Landscape water conservation is a process involving actions of change, monitoring, adjustment, and reinforcement over time. WaterMAPS™ provides actionable information to water managers and users to support the urban water conservation process.

WaterMAPS™ Processes and Methods

WaterMAPS™ integrates water meter data with property records, weather data, and landscape classifications into one database, then calculates and geographically displays Landscape Irrigation Ratios (LIRs) (Figure 1). Options embedded in its analytic framework allow the user to make various assumptions (e.g., to include parking strips outside property boundaries as part of the irrigated landscaped area) and to use different time frames (e.g., a billing period, an irrigation season) in calculating these site-specific LIRs.

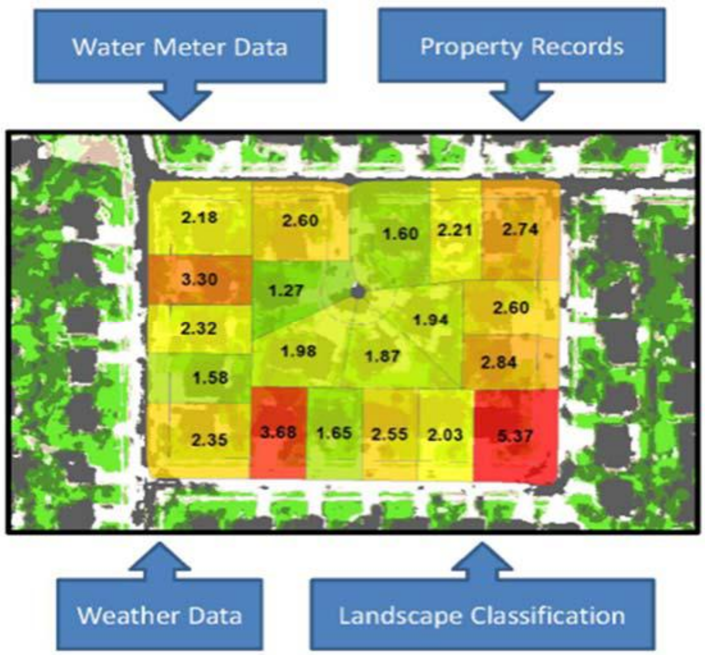

Figure 1. ***Data integration for calculating Landscape Irrigation Ratios (LIRs)***

LIRs identify "capacity to conserve" water applied to urban parcels of land. The ratios are produced through dividing the amount of water actually used on a particular landscape by the estimated amount of water that landscape needs to be healthy. Through standardizing the calculations per unit of landscaped area, the LIRs eliminate differences in water use due to parcel size, thereby enabling parcels to be compared to one another on a measure of efficiency (Figure 2). Landscape water use is estimated from analysis of municipal or water provider meter or billing data that subtracts estimated indoor water use.

Landscape water need is estimated from the classification of remotely-sensed airborne multispectral imagery and localized reference evapotranspiration (ET_o) rates modified to account for the varying water needs of different types of landscape plant material at each location (e.g., turfgrass, trees and shrubs, sparse vegetation). LIRs can be categorized and labeled (e.g., as efficient, acceptable, inefficient, or excessive) to provide an indication of the appropriateness of landscape water use to meet landscape water need (Figure 2).

LIR = (per unit of landscaped area)

Landscape Water Use *estimated*
(derived from analysis of municipal or water provider meter data)

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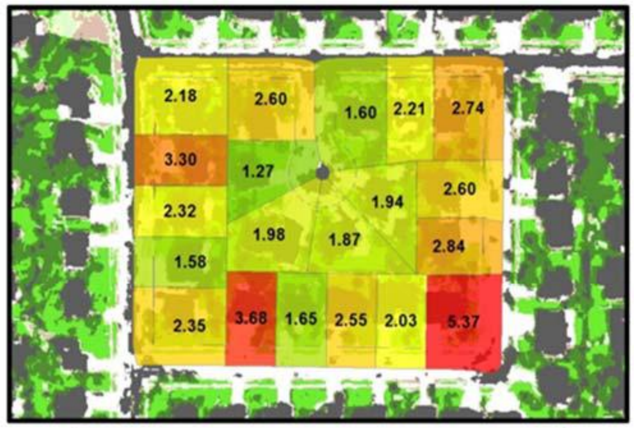
Landscape Water Need *estimated*
(derived from the classification of remotely-sensed airborne multispectral imagery and localized reference ET_o rates modified by relevant landscape correction factors and irrigation system inefficiencies)



LIR less than 1	=	Efficient
Between 1 and 2	=	Acceptable
Between 2 and 3	=	Inefficient
Greater than 3	=	Excessive

Figure 2. ***Using Landscape Irrigation Ratios (LIRs) to identify capacity to conserve***

The next section describes the specific aerial imagery, land cover classification, parcel data, meter data, and weather data that was acquired and processed for use in the WaterMAPS™ analysis for the Utah State Capitol grounds.

Database Acquisition and Processing for Utah State Capitol Grounds Analysis

Aerial Multispectral Imagery. Four-band National Agriculture Imagery Program (NAIP) aerial imagery that was collected in 2016 was utilized in the Utah State Capitol campus WaterMAPS™ analysis. The aerial imagery was downloaded from the Utah Automated Geographic Reference Center (AGRC; https://gis.utah.gov/) and processed in ESRI ArcMap 10.6. NAIP aerial imagery is acquired during the agricultural growing season under the direction of the United States Department of Agriculture (USDA) Farm Service Agency. It is acquired at a one-meter ground sample distance within a horizontal accuracy that matches within six meters of photo-identifiable ground control points (USDA, 2011). The spectral resolution of NAIP aerial imagery is natural color, meaning there are red (R), green (G), and blue (B) bands. However, beginning in 2006, some states began to acquire an additional near infrared (NIR) band, making NAIP aerial imagery a four-band multispectral product. The addition of a NIR band provides for greater visual interpretation and digital analysis (USDA, 2012).

Land Cover Classification. The NAIP aerial imagery for the Utah State Capitol campus was classified using an object-based image analysis software package called Trimble eCognition. In object-based image analysis software packages, a process called segmentation is used to group spectrally similar pixels of an image into image objects. Segmentation is an efficient means of partitioning aerial imagery into meaningful objects and it is useful for aggregating the high levels of detail contained with high-resolution imagery, such as NAIP aerial imagery (Lang, 2008).

Once a remotely-sensed image is segmented into meaningful image objects, a set of knowledge-based classification rules are defined in order to assign each segment to a specified class (Xiaoxia et al., 2005). Specifically, rules about object properties, such as segment geometry, tone, texture, and contextual associations, are applied to classify the segments of the image (Addink et al., 2012). Segment geometry is a combination of shape and size; tone indicates the spectral properties of an individual band; texture refers to the frequencies of change in tones and their resulting spatial arrangements; and contextual associations refer to relationships with neighboring image objects (Blaschke et al., 2014; Weng, 2012).

The image objects, or segments, for the aerial imagery of the Utah State Capitol campus were assigned to one of five classes using a variety of spectral-, spatial-, and context-based rules. To determine the most appropriate threshold values for each rule, values were iteratively adjusted and executed to identify optimal threshold values. The five classes include impervious surfaces (e.g., concrete, asphalt, sidewalks, parking lots), grass/turf, trees/shrubs, sparse vegetation (e.g., planter beds), and water (i.e., central fountain). After the aerial imagery was classified into five discrete classes, the results were manually edited using the editing tools in eCognition to improve accuracy.

Parcel Data Preparation. Parcel polygon shape files for the Utah State Capitol campus were provided by SLCDPU. Since the polygon boundaries excluded parking strips and other rights-of-way maintained by the Capitol grounds crew, a non-overlapping buffering routine was developed to expand the parcels by up to 10 meters in areas not included in a parcel. These buffers allowed for addition of tree canopies overlying streets or turf parking strips in the total irrigation area calculation.

Meter Data Preparation. The SLCDPU provided raw meter data for January 2009 through December 2018. The Capitol campus has two dedicated landscape irrigation meters and seven other meters that serve buildings and possibly help maintain landscapes. The data included the account numbers, service numbers, meter reading dates, and the consumption amounts. Monthly data were used for the calculation of landscape irrigation ratios (LIRs) for the years 2010-2018. The difference between the current monthly reading and the previous monthly reading resulted in the numerator (gallons of landscape water used) of the LIR calculation. Outdoor water use for a summer (on dual meters) was determined by averaging the monthly water use for the two winters bracketing that summer and subtracting that average from the monthly summer use. Because the irrigation-only meters were in use each year from March to October, winter months were considered to be November through February.

Weather Data Preparation. The Utah Climate Center (UCC) API V2 was used to obtain reference evapotranspiration (ET_o) data for each monthly date range over the time period 2009-2018 for the Utah State Capitol location (determined through its latitude and longitude). For UCC's data processing documentation, see: https://wiki.logansw.com/display/UCCA/Daily+Sum+V2. Ideally, the ET_o date range would match that of the meter readings, but this was not possible for all meters because they were not all read on the same days. The water usage from the two irrigation-only meters dwarfed the usage of the other meters, however, so the date ranges from those two meters were used. Data were not available for all dates in question. In those cases, a 30-year average was used instead (see: https://wiki.logansw.com/display/UCCA/Thirty+Year+Average+V2). Rainfall was not subtracted from the amount of water needed for irrigation, making the LIR calculations a little more generous from the water user point of view (so, for example, the behavior of turning sprinklers off during rain will lower the LIR).

WATERMAPS™ RESULTS FOR UTAH STATE CAPITOL GROUNDS

Capitol Grounds Landscape. Results of the land cover classification for the Utah State Capitol grounds are shown in Figure 3. The Capitol grounds consist of several different parcels as shown in black lines outlining their boundaries. Identifying the various parcels was important for determining the total landscaped area and finding all of the SLCDPU meter data connected to the Capitol grounds. For this analysis, all of the data for landscaped areas and for outdoor water use were combined to provide a WaterMAPS™ analysis for the Capitol grounds as a whole.

Figure 3. ***Utah State Capitol grounds landscape classification with parcel boundaries shown in black lines***

Table 1 shows the number of square feet in the three classes from Figure 3 that represent irrigated landscaped area within the parcel boundaries and in the parking strips and tree overhang onto streets. The table indicates that of the 939,441 total square feet of landscaped area at the Utah State Capitol grounds, 69% is turfgrass (light green in Figure 3), 29% is trees and shrubs (dark green in Figure 3), and 2% is planters and beds (yellow areas within the parcel boundaries and parking strips in Figure 3 consisting of beds with woody plants, perennials and some annuals).

Table 1. ***Utah State Capitol Grounds landscape classification***

	Area (sq. ft.)			
Location	**Turfgrass**	**Trees/Shrubs**	**Planters/Beds**	**Total**
Parcel	600,474.9	219,788	15,607	835,871
Park-strip	47,081.3	55,908	581	103,570
Total	647,556.2	275,696	16,189	939,441

Reference Evapotranspiration. Figure 4 shows the 30-year average irrigation season reference evapotranspiration (ET_o) for 1979-2008, then shows the actual annual irrigation season ET_o for each year from 2010-2018. However, actual ET_o data were missing for October 2011, October 2012, June 2013, August 2013, and August 2018. Missing data were substituted with averages from the corresponding month for the 30-year period prior to that year (e.g., the average ET_o for October 1982-2011 was substituted for the missing actual ET_o data for October 2012). This substitution generally resulted in a lower ET_o estimate. The effect of this data substitution is most consequential for interpretations of plant water need in August 2018, which was the driest and third hottest irrigation season on record. This caveat concerning missing data applies to estimates of plant water need in the subsequent figures that include those five months.

Figure 4 illustrates the seasonal variability of ET_o through time, as well as a general increase in ET_o over the past decade. Peaks in ET_o occur at different times during the irrigation season, depending on the weather experienced each year. This ET_o variability creates challenges for irrigating landscapes efficiently, and illustrates why a set irrigation schedule that does not vary between years or within seasons is likely to result in either water waste or insufficient watering at any particular point in time. This variability is the reason smart controllers and other irrigation technologies have been developed to assist people in watering to meet plant water need as determined by actual ET_o.

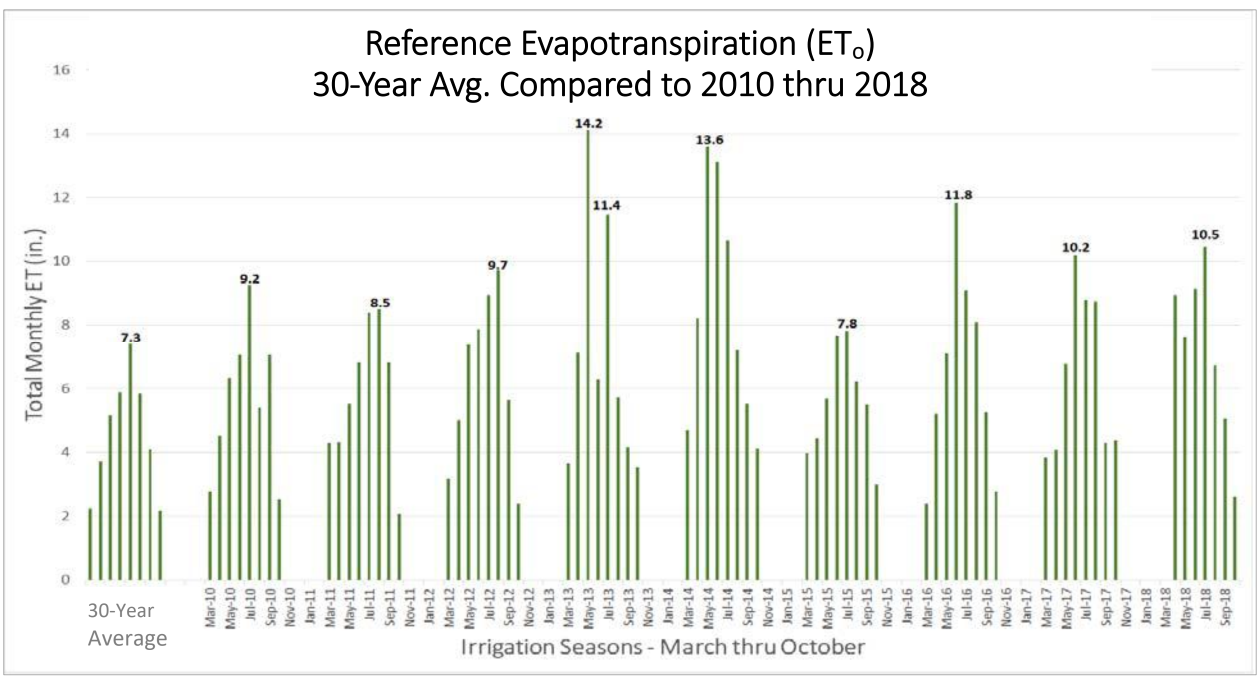


Figure 4. Capitol grounds e*vapotranspiration (ET_o) 30-year average compared to annual ET_o for 2010-2018*

Water Need for Plant Types. To determine the water needs of different types of plant material, ET_o is modified by appropriate plant factors. Following the ANSI/ASBE standard adopted by the American Society of Agricultural and Biological Engineers (2015) and best practices recommended by the Irrigation Association for estimating urban landscape water demand (Kjelgren et al., 2016), we used the following plant factors for this analysis: 0.8 for turfgrass; 0.6 for trees and shrubs; and, 0.5 for the spare vegetation mix of woody plants, perennials, and some annuals that occurs in the Capitol planter beds. These plant factors incorporate scientific research documenting differences in water needs between categories of plants in order for them to remain healthy.

Figures 5-7 show the estimated plant water need for these three plant categories each year from 2010-2018 in relation to the 30-year average (displayed in the left-hand column of each figure). Supplemental irrigation is described in normalized depth units; e.g., any given area of turfgrass is estimated to require the indicated inches of irrigation annually. These figures show that plant water needs in 2010-2018 are higher than the 30-year period prior to the past decade in relation to the increases in reference evapotranspiration (ET_o) that were illustrated in Figure 4.

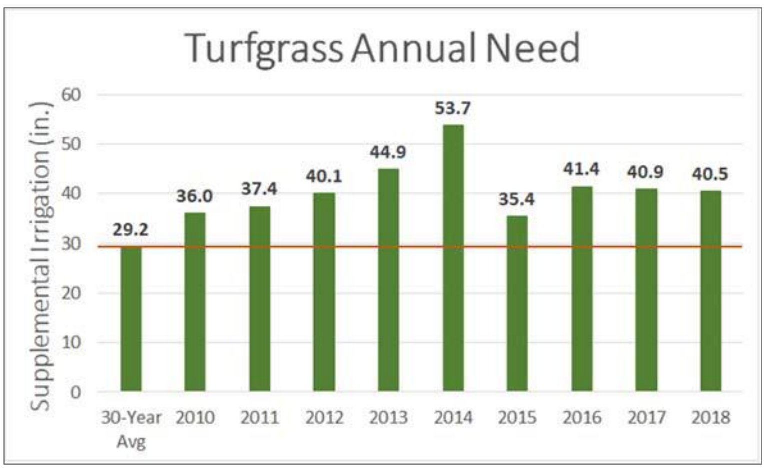


Figure 5. *2010-2018 annual turfgrass water need adjusted for Utah State Capitol localized ET_o compared to 30-year average*

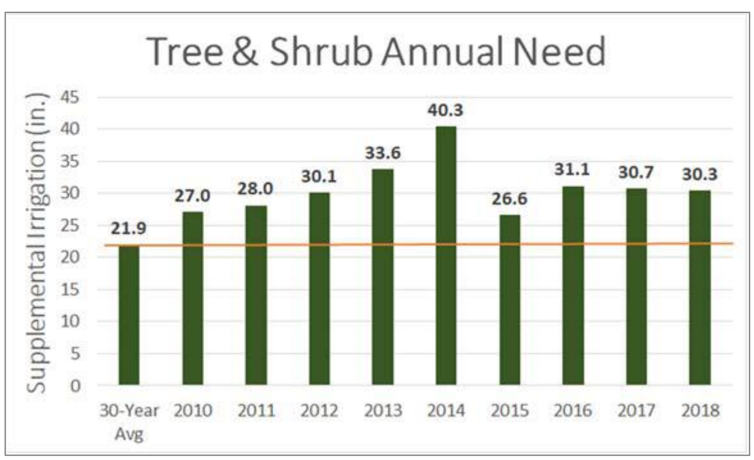


Figure 6. *2010-2018 annual tree and shrub water need adjusted for Utah State Capitol localized ET_o compared to 30-year average*

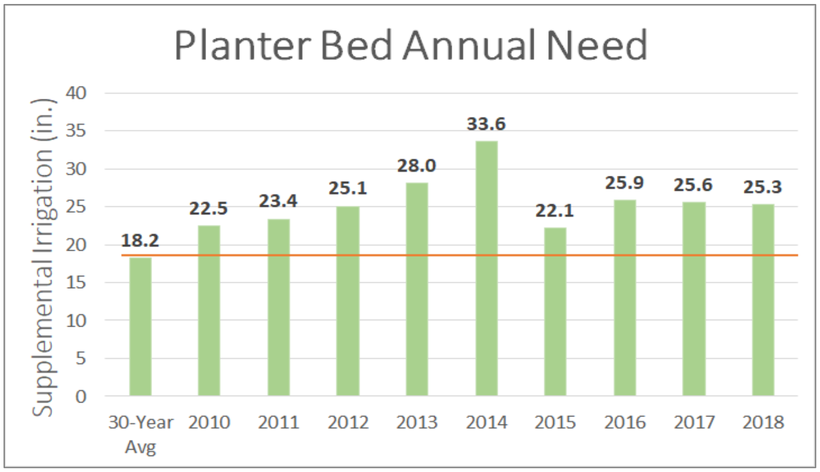


Figure 7. ***2010-2018 annual planter bed water need adjusted for Utah State Capitol localized ET$_o$ compared to 30-year average***

Annual Landscape Water Use. Figure 8 shows the Utah State Capitol grounds WaterMAPS™ analysis of annual landscape water use compared to landscape water need and the corresponding LIRs for 2010-2018 and the nine-year average (red box). This analysis reveals that there was an average capacity to conserve water applied to the Capitol grounds over that time period of 38% (LIR of 1.6). Annual capacity to conserve ranged from 23% (LIR of 1.3 in 2011 and 2014) to 52% (LIR of 2.1 in 2012). Significant water savings can be achieved by working to more closely align landscape watering to plant water need (in relation to ETo) on an annual basis.

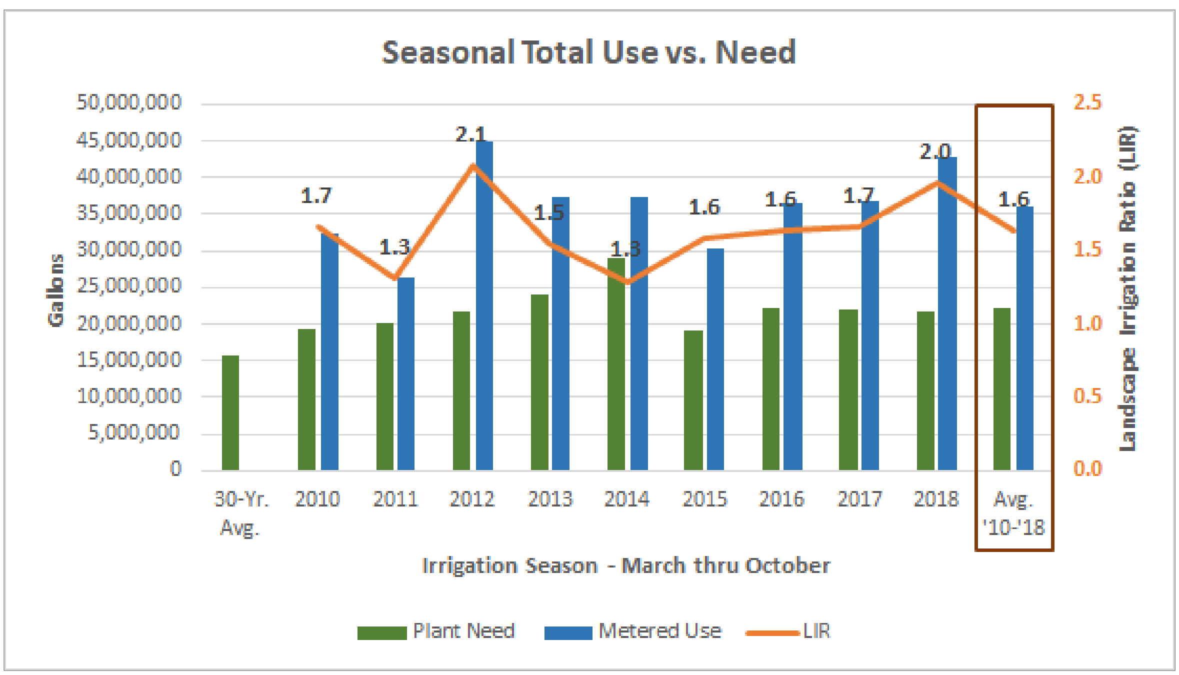


Figure 8. ***WaterMAPS™ annual analysis, 2010-2018, for Utah State Capitol with the nine-year average in red box. Plant water need (green bars) is compared to metered water use (blue bars) and the calculated LIR for each year is displayed in numbers above orange bar. Plant water need of the Capitol grounds based on the 30-year average (1979-2008) ET$_o$ is shown in the left-hand column.***

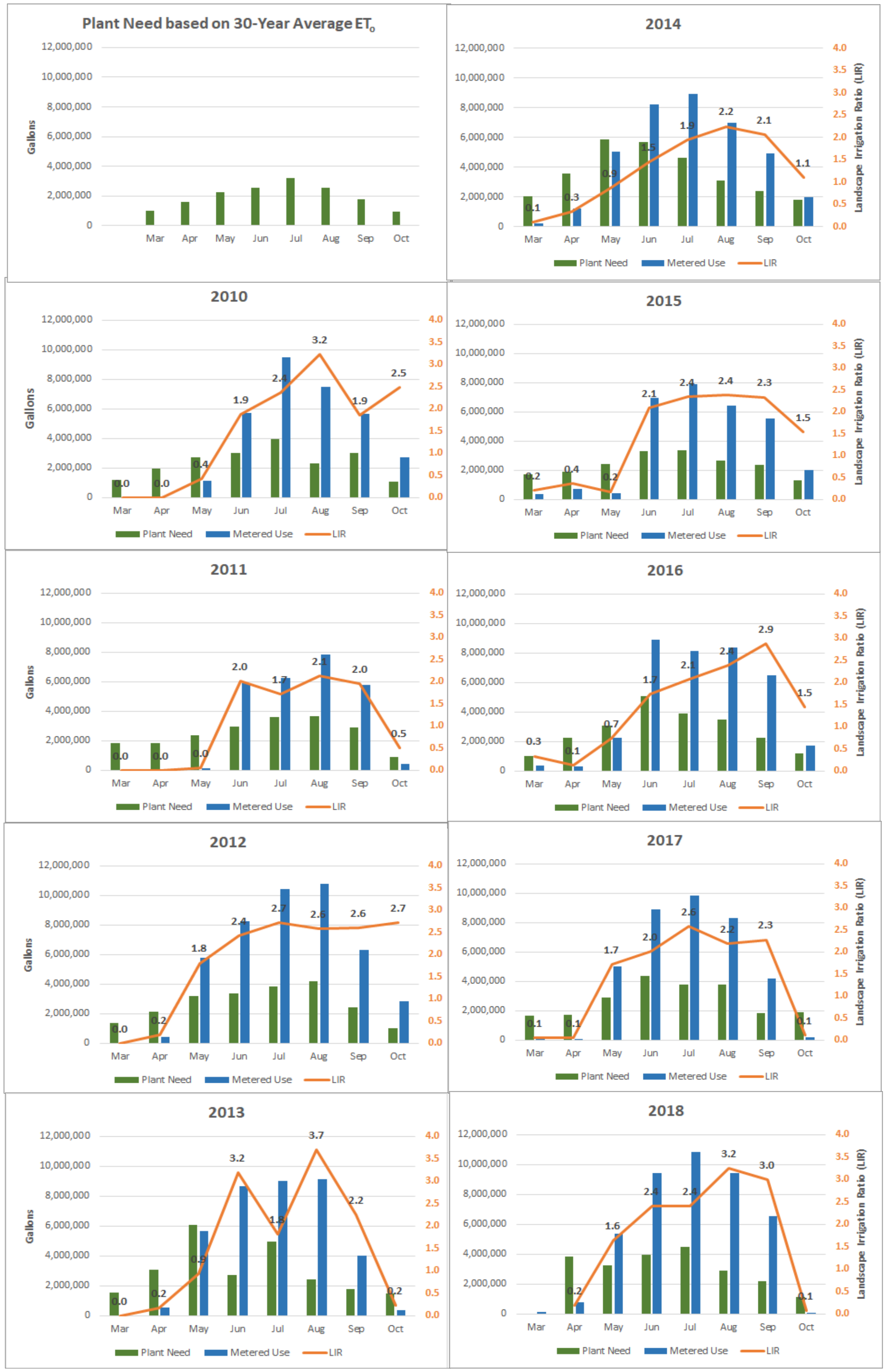


Figure 9. ***WaterMAPS™ monthly analysis for Utah State Capitol by year (2010 – 2018) with reference to 30-year average (1979-2008) ET$_o$ -based plant water need. Each annual panel shows plant water need (green bars) compared to metered water use (blue bars) with LIRs (orange lines and numbers).***

Monthly Landscape Water Use. Figure 9 goes into greater detail by displaying the WaterMAPS™ irrigation season monthly analysis. For each year from 2010-2018, monthly plant (water) need is determined using actual ET_o values for that year.[1] Monthly metered (water) use is determined from the actual meter data provided by SLCDPU. The "30-year average" panel (top left) uses the average ET_o for 1979-2008 to determine landscape water need and provides a reference point for comparison. The likely effect of using the 30-year average in conducting the analysis would be to lower the estimated plant (water) needs and increase the LIRs.[2] Our use of actual ET_o data in the WaterMAPS™ analysis for 2010-2018[3] (which lowers the LIRs) increases confidence in the results showing that overwatering is occurring and that obtaining water savings is feasible.

Figure 9 further illustrates the point that water savings can best be achieved by focusing on times when significant overwatering occurs. As seen in these graphs, the Capitol grounds are not overwatered (relative to plant need) in any March or April or in five of the ten Octobers. However, irrigation exceeds the peak season plant water need nearly every year (the peak varies in terms of when it occurs[4]). Additionally, the highest LIRs generally occur in the late summer, mostly in August and September, when ET_o declines but water use is not cut back to appropriately track the reduction in plant water need. Water savings to be gained when the LIRs are between 2 and 3 are in the range of 50-67%, assuming the goal is to efficiently meet plant water need with an LIR of approximately 1 (where water use is the same as water need).

Capacity to Conserve Water Applied to the Capitol Landscape. The WaterMAPS™ analysis shows there is significant capacity to conserve water applied to the Utah State Capitol grounds at particular times. There are annual irrigation seasons, and months within those seasons, when landscape irrigation is closer to appropriately meeting the existing plant water need (when LIRs are closer to 1) than at other times (when LIRs are over 2). This pattern suggests that attention should focus on when and how landscape irrigation practices could change in order to achieve greater efficiency and yield water savings over time. The ability to further refine irrigation adjustments on a weekly or daily basis, analyze landscape water use, and monitor conservation savings would be enhanced with Capitol grounds infrastructure investments in dedicated landscape meters (some of the meters included indoor and outdoor use) and a weather station on the Capitol grounds that would provide very site-specific ET_o data.

Additional Conservation Savings. In addition to locating water savings in the practices used to irrigate the existing Utah State Capitol grounds landscape, transitions in plant material could achieve additional water conservation goals. For example, a look back at Figures 5 and 7 shows the difference in the 2010-2018 range of depth inches needed to water turfgrass (35.4 to 53.7 inches) compared to planter beds (22.1 to 33.6 inches). Additional water conservation savings of approximately 34% (the difference) could be obtained with a transition of plant material from

[1] Except for the 5 months (Oct. 2011, Oct. 2012, June 2013, August 2013 and August 2018) when 30-year average data was substituted for missing data.
[2] This effect likely accounts for the high LIRs in the 4 months of Oct. of 2012, June and Aug. of 2013, and Aug. of 2018 where 30-year average data was substituted for missing data.
[3] Except in the 5 months (see footnote 1) where a 30-year average was substituted for missing data. These 5 out of 72 total months are 6.9% of the months represented in Figure 9.
[4] Peak season demand for 2013 is hard to determine due to substituted June data.

turfgrass to planter beds if that transition is accompanied by appropriate irrigation to meet the lower plant water need. As an alternative, high water use turfgrass could be replaced with new varieties of turfgrass requiring much less water, again assuming the transitioned landscape would be appropriately irrigated.

WATER CHECK SUMMARY OF RESULTS

During the 2018 irrigation season, the Capitol grounds crew requested a Water Check. The Water Check was provided through the Water Check program affiliated with USU Extension's Center for Water Efficient Landscaping (CWEL). The Water Check program was offered under contract with Metropolitan Water District of Salt Lake & Sandy to Salt Lake City Department of Public Utilities (SLCDPU) customers as part of the city's conservation programs to reduce SLC's water footprint and provide customers with a meaningful and effective learning experience. The complete Water Check report for the Utah State Capitol grounds is contained in the Appendix to this report.

Water Check teams conducted the landscape irrigation evaluation July 30, 2018 through August 31, 2018. Program services included an on-site evaluation of the landscape and irrigation system to identify design flaws and maintenance issues, catch-cup tests on representative turfgrass irrigation zones to determine distribution uniformity and precipitation rates, soil texture characterization, turfgrass root depth evaluation, water pressure measurements, and landscape and property area measurements. The data were used to create a customized irrigation schedule and provide a set of site-specific repair and maintenance recommendations. Members of the Capitol grounds crew accompanied the Water Check team, taking note of issues and initiating repairs in response to the information provided.

The Capitol grounds have 939,441 square feet of landscaped area, including parking strips and tree canopy identified in the WaterMAPS™ classification of aerial imagery and analysis. Onsite irrigation is operated by 8 controllers and includes 251 active irrigation zones. Table 2 provides a summary of the "Test Results" tables in the Water Check report (Appendix).

Precipitation rate is a measure of how much water is being applied to the landscape, measured in inches per hour. Different sprinkler systems and sprinkler heads can have varying precipitation rates. This rate determines how many minutes to run the sprinklers in order to apply the recommended amount of water (1/2 inch of water total per irrigation).

Distribution Uniformity (DU) describes a sprinkler system's ability to apply water evenly over the landscape. Because no system is ever completely uniform (100%), some areas of the landscape will receive more or less water than others. Uniformity can be improved through proper maintenance, adjustments and repairs to the system noted in the "Water Conservation Action Items" table of the Water Check report (Appendix). DU is measured as a proxy of efficiency; however, it does not consider management actions. It describes functional efficiency of the irrigation system. Table 2 shows that DU varies widely throughout the Capitol grounds irrigation system, which partially accounts for variation in appearance of the landscape at certain times during the irrigation season.

Table 2. ***Water Check Catch-cup Test Summary***

Test	No. Zones Tested	Avg.	Range	
			Min.	Max.
Precipitation Rate (in./hr.)	66	1.6	.64	3.3
Distribution Uniformity (%)	66	59	42	76
Dynamic Pressure (psi)	62	76	30	115

Dynamic Pressure is the water pressure measurement made while water is moving through a sprinkler head and each type of sprinkler head has a specific range of pressures at which optimal performance is achieved. In general, spray heads are specified to operate between 15 and 30 pounds per square inch (psi) and rotor heads are specified to operate between 50 and 100 psi. Table 2 shows that water pressure varies widely throughout the Capitol grounds with 66% of the zones tested running at a higher pressure than recommended for the associated sprinkler head type. This situation can result in evaporative loss due to high-pressure misting and increases overspray beyond the area to be irrigated. High pressures can also increase the precipitation rates and make it more difficult to prevent run-off from the many sloped areas of the Capitol grounds. Pressure regulation is an important component of an effective water conservation strategy and is recommended.

Soil texture and turfgrass root depth determine how water should be applied and how frequently irrigation is required. If water is applied faster than the soil is able to absorb it, water will run off and be wasted. Heavy soils (such as clay) absorb water very slowly, whereas sandy soils can absorb it very quickly. Watering schedule are often adjusted to maximize the amount of water absorbed into the root zone by breaking the total watering time into smaller “cycles”; e.g., dividing 15 minutes total watering time into 3 applications of 5 minutes each to allow the water to soak in between applications. Additionally, soil texture can affect how many days can be skipped between irrigations. Heavier soils, such as clay, “hold” the water more tightly, keeping water in the soil longer than lighter soils. The Water Check found that the Capitol grounds are primarily comprised of clay loam soil (Appendix).

Ideally, turfgrass roots should have a depth of at least 6 inches to make best use of moisture in the soil profile. Deep, infrequent watering, can encourage roots to grow deeper. As turfgrass roots grow deeper and access more water and nutrients, grasses are healthier and better able to tolerate temperature and water stress. The Capitol grounds turfgrass roots ranged from 2 to 6 inches (Appendix).

Water Check Summary. In sum, the Water Check identified several strategies for increasing landscape water use efficiency through maintenance, repair and operation of the existing irrigation systems used on the Utah State Capitol grounds. An optimized irrigation schedule was also provided to grounds managers. Investments in irrigation infrastructure improvements could aid the efforts of the Capitol grounds crew to water more efficiently, such as installing the latest weather-based controller and soil moisture sensor technologies to help optimize irrigation scheduling.

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We express appreciation to Metropolitan Water District of Salt Lake & Sandy's for financial support of the Water Check program. This support has made possible the delivery of Water Checks to locations throughout the Salt Lake Valley for many years and has been a key strategy in furthering Utah's water conservation goals.

We also would like to thank the Utah State Capitol facilities and grounds managers, particularly Rick Clawson and Andy Marr. We appreciate their water conservation interest and efforts, including their assistance to the team that performed the 2018 Water Check, their responsiveness to the team's findings, and their attention to the difficult task of maintaining this large landscape and irrigation in system in a highly visible and used public space.

APPENDIX

Water Check Report for Utah State Capitol Grounds

Conducted in August 2018

Prepared by

Water Check Program

Center for Water Efficient Landscaping (CWEL)

Utah State University

Date of Water Check: July 30, 2018

Rick Clawson
350 State St.
Salt Lake City, UT 84111

Thank you for participating in the Water Check program. This free-to-you service is sponsored by your water provider and the Metropolitan Water District of Salt Lake and Sandy.

A series of evaluations have been performed on your landscape and sprinkler system. We have determined how much water your sprinklers apply over time (precipitation rate), and how evenly that water is being applied (distribution uniformity). We have also evaluated your water pressure, soil texture and grass rooting depth.

Recommended Watering Schedule

Current System run times have been calculated based on your catch cup test results. For each irrigation zone, a description of that zone along with a total run time is listed. We have also determined how many minutes each zone should run for each start time (or cycle).

Optimized System describes the difference between how much water you'll need to apply with your current system (total min/day), and how much water you could apply if you follow the recommendations and make the repairs described in this report.

Using this irrigation schedule, the total number of minutes you run each zone will not change throughout the season. Only the number of number of days per week will change.

Controller 1: make/model unspecified, E

Zone	Plants	Sprinkler Type	CURRENT SYSTEM			OPTIMIZED SYSTEM		
			Starts per Day	Min per Start	Total Min per Day	Starts per Day	Min per Start	Total Min per Day
1	turf	rotor	3	21	62	3	16	48
2	turf	rotor, spray	-	-	-	-	-	-
3	turf	spray	-	-	-	-	-	-
4	turf	spray	-	-	-	-	-	-
5	turf	spray	3	7	21	3	6	17
6	turf	rotor	4	12	47	4	11	44
7	turf	rotor	4	12	47	4	11	44
8			-	-	-	-	-	-
9	turf	rotor	2	24	48	2	19	38
10	turf	rotor	3	18	55	3	15	45
11	turf	spray	3	18	55	3	17	51
12	turf	rotor	3	7	20	3	5	15
13	turf	rotor	3	6	17	3	5	14
15	other	spray	3	21	63	3	21	63
16	turf	rotor	-	-	-	-	-	-
17	shrubs	spray	2	13	26	2	12	24
18	turf	rotor	2	9	17	2	7	14
20	shrubs	drip	-	-	-	-	-	-
21	turf	spray	3	9	27	3	8	25
23	turf	spray	-	-	-	-	-	-
24	turf	spray	-	-	-	-	-	-
25	turf	rotor	-	-	-	-	-	-
26	turf	rotor	-	-	-	-	-	-
27	turf	spray	3	8	23	3	7	21
28	other	drip	-	-	-	-	-	-
29	turf	spray	-	-	-	-	-	-
30	turf	spray	-	-	-	-	-	-
31	turf	spray	-	-	-	-	-	-
32	other	drip	-	-	-	-	-	-

Controller 2: make/model unspecified, F

Zone	Plants	Sprinkler Type	CURRENT SYSTEM Starts per Day	CURRENT SYSTEM Min per Start	CURRENT SYSTEM Total Min per Day	OPTIMIZED SYSTEM Starts per Day	OPTIMIZED SYSTEM Min per Start	OPTIMIZED SYSTEM Total Min per Day
1	turf	spray	4	17	68	4	14	56
2	turf		3	17	51	3	17	51
3	turf	spray	2	19	37	2	19	37
4	turf	rotor	2	19	37	2	17	34
5	turf	spray	-	-	-	-	-	-
6	turf	spray	-	-	-	-	-	-
7	turf	rotor	-	-	-	-	-	-
8	turf	rotor	3	9	27	3	8	24
9	turf	spray	-	-	-	-	-	-
10	shrubs	drip	-	-	-	-	-	-
11	turf	rotor	-	-	-	-	-	-
12	turf	spray	-	-	-	-	-	-
13	turf	spray	-	-	-	-	-	-
14	turf	rotor	-	-	-	-	-	-
15	turf	rotor	-	-	-	-	-	-
16	turf	rotor	-	-	-	-	-	-
17	turf	spray, drip	-	-	-	-	-	-
18	turf	spray	-	-	-	-	-	-
19	shrubs	spray	-	-	-	-	-	-
20	shrubs	rotor	-	-	-	-	-	-
21	shrubs	rotor	-	-	-	-	-	-
22	turf	rotor	-	-	-	-	-	-
23	turf	spray	-	-	-	-	-	-
24	turf	spray	-	-	-	-	-	-
25	turf	spray	-	-	-	-	-	-
26	turf	spray	-	-	-	-	-	-
27	shrubs	drip	-	-	-	-	-	-
28	turf	rotor	2	19	37	2	17	34
29	turf	spray	-	-	-	-	-	-
30	turf	spray	-	-	-	-	-	-
31	turf	rotor	2	26	51	2	23	45

Zone	Plants	Sprinkler Type	CURRENT SYSTEM Starts per Day	CURRENT SYSTEM Min per Start	CURRENT SYSTEM Total Min per Day	OPTIMIZED SYSTEM Starts per Day	OPTIMIZED SYSTEM Min per Start	OPTIMIZED SYSTEM Total Min per Day
32	turf	spray	-	-	-	-	-	-

Controller 3: make/model unspecified, G

Zone	Plants	Sprinkler Type	CURRENT SYSTEM Starts per Day	CURRENT SYSTEM Min per Start	CURRENT SYSTEM Total Min per Day	OPTIMIZED SYSTEM Starts per Day	OPTIMIZED SYSTEM Min per Start	OPTIMIZED SYSTEM Total Min per Day
1	turf	rotor	4	12	46	4	9	36
2	turf	rotor	-	-	-	-	-	-
3	turf	rotor, spray	-	-	-	-	-	-
4	turf	spray	-	-	-	-	-	-
5	turf	spray	-	-	-	-	-	-
6	turf	rotor	-	-	-	-	-	-
7	turf	rotor	-	-	-	-	-	-
8	shrubs	spray	-	-	-	-	-	-
9	turf	spray	3	9	26	3	7	21
10	turf	spray	3	9	26	3	8	25
11	turf	spray	3	9	26	3	8	25
12	turf	spray	4	6	26	4	5	21
13	turf	spray	-	-	-	-	-	-
14	turf	spray	-	-	-	-	-	-
15	turf	spray	4	6	26	4	5	21
16	turf	spray	-	-	-	-	-	-
17			-	-	-	-	-	-
18	turf, shrubs	spray, drip	-	-	-	-	-	-
19	turf	spray	-	-	-	-	-	-
20	turf	spray	-	-	-	-	-	-
21	turf	spray	-	-	-	-	-	-
22	turf	spray	-	-	-	-	-	-
23	turf	spray	-	-	-	-	-	-

Zone	Plants	Sprinkler Type	CURRENT SYSTEM			OPTIMIZED SYSTEM		
			Starts per Day	Min per Start	Total Min per Day	Starts per Day	Min per Start	Total Min per Day
24	turf	spray	-	-	-	-	-	-

Controller 4: make/model unspecified, D

Zone	Plants	Sprinkler Type	CURRENT SYSTEM			OPTIMIZED SYSTEM		
			Starts per Day	Min per Start	Total Min per Day	Starts per Day	Min per Start	Total Min per Day
1	turf	rotor, spray	2	26	52	2	23	46
3	turf	spray	-	-	-	-	-	-
4	turf	spray	-	-	-	-	-	-
5	turf	spray	-	-	-	-	-	-
6	turf	rotor	-	-	-	-	-	-
7	turf	spray	-	-	-	-	-	-
8	turf	rotor	-	-	-	-	-	-
9	turf	rotor	-	-	-	-	-	-
10	turf	rotor	-	-	-	-	-	-
11	turf	rotor	-	-	-	-	-	-
12	turf	rotor	4	8	31	4	6	24
13	turf	spray	2	9	18	2	9	17
16	turf	rotor	3	19	57	3	16	47
17	turf	rotor	2	29	57	2	24	47
18	turf	rotor	3	10	31	3	8	24
19	turf	spray	-	-	-	-	-	-
20	turf	spray	-	-	-	-	-	-
21	turf	spray	-	-	-	-	-	-
22	turf	rotor	4	7	28	4	6	25
23	turf	spray	3	6	18	3	5	15
24	turf	rotor	3	12	36	3	10	29
25	turf	spray	-	-	-	-	-	-
26	turf	spray	-	-	-	-	-	-

Zone	Plants	Sprinkler Type	CURRENT SYSTEM			OPTIMIZED SYSTEM		
			Starts per Day	Min per Start	Total Min per Day	Starts per Day	Min per Start	Total Min per Day
27	turf	rotor	4	12	49	4	10	38
28	turf	spray	4	13	53	4	11	43
29	turf	rotor	3	18	53	3	17	52
30	turf	rotor	-	-	-	-	-	-
31	turf	spray	-	-	-	-	-	-
32	turf	spray	-	-	-	-	-	-

Controller 5: make/model unspecified, C

Zone	Plants	Sprinkler Type	CURRENT SYSTEM			OPTIMIZED SYSTEM		
			Starts per Day	Min per Start	Total Min per Day	Starts per Day	Min per Start	Total Min per Day
1	turf	rotor	4	7	29	4	7	29
2	turf	spray	-	-	-	-	-	-
4	turf	rotor	-	-	-	-	-	-
5	turf	rotor	3	10	29	3	10	29
6	turf	rotor	4	8	32	4	8	31
7	turf	rotor	4	8	32	4	8	31
8	turf	rotor	4	9	35	4	8	33
11	turf	rotor	4	5	20	4	4	16
14	turf	spray	-	-	-	-	-	-
16	turf	spray	-	-	-	-	-	-
17	turf	rotor	4	12	46	4	9	36
18	turf	rotor	4	12	46	4	9	36
19	turf	rotor	4	13	50	4	10	39
20	turf	rotor	4	13	50	4	10	39
21	turf	rotor	-	-	-	-	-	-
22	turf	spray	4	5	21	4	5	20
23	turf	spray	-	-	-	-	-	-
25	turf	spray	-	-	-	-	-	-

			CURRENT SYSTEM			OPTIMIZED SYSTEM		
Zone	Plants	Sprinkler Type	Starts per Day	Min per Start	Total Min per Day	Starts per Day	Min per Start	Total Min per Day
26	turf	rotor	-	-	-	-	-	-
27	turf	spray	-	-	-	-	-	-
28	turf	spray	-	-	-	-	-	-
29	turf	rotor	-	-	-	-	-	-
30	turf	spray	-	-	-	-	-	-
31	turf	rotor	-	-	-	-	-	-
32	turf	spray	3	8	23	3	6	19

Controller 6: make/model unspecified, A

			CURRENT SYSTEM			OPTIMIZED SYSTEM		
Zone	Plants	Sprinkler Type	Starts per Day	Min per Start	Total Min per Day	Starts per Day	Min per Start	Total Min per Day
1	shrubs	spray	-	-	-	-	-	-
2	other	drip	-	-	-	-	-	-
3			-	-	-	-	-	-
4	other	drip	-	-	-	-	-	-
5	shrubs	spray	-	-	-	-	-	-
6	shrubs	spray	-	-	-	-	-	-
7	other	drip	-	-	-	-	-	-
8	shrubs	spray	-	-	-	-	-	-
9	other	drip	-	-	-	-	-	-
10	shrubs	drip	-	-	-	-	-	-
11	shrubs	drip	-	-	-	-	-	-
12	shrubs	spray	-	-	-	-	-	-
13	turf	spray	-	-	-	-	-	-
14	turf	spray	4	6	24	4	5	20
15	turf	spray	-	-	-	-	-	-
16	turf	spray	4	6	24	4	6	23
17	turf	spray	-	-	-	-	-	-

Zone	Plants	Sprinkler Type	CURRENT SYSTEM			OPTIMIZED SYSTEM		
			Starts per Day	Min per Start	Total Min per Day	Starts per Day	Min per Start	Total Min per Day
18	turf	spray	-	-	-	-	-	-
19	turf	spray	-	-	-	-	-	-
20	turf	spray	3	8	23	3	6	19

Controller 7: make/model unspecified, B

Zone	Plants	Sprinkler Type	CURRENT SYSTEM			OPTIMIZED SYSTEM		
			Starts per Day	Min per Start	Total Min per Day	Starts per Day	Min per Start	Total Min per Day
1	turf	spray	-	-	-	-	-	-
3	turf	rotor	4	9	35	4	8	33
4	turf	rotor	4	14	57	4	12	47
5	turf	spray	-	-	-	-	-	-
6	turf	spray	4	4	18	4	4	15
7	turf	rotor	4	9	35	4	8	33
8	turf	rotor	-	-	-	-	-	-
9	turf	spray	4	14	57	4	13	53
10	turf	spray	3	6	18	3	5	16
11	turf	spray	-	-	-	-	-	-
12	turf	spray	-	-	-	-	-	-
13	turf	spray	-	-	-	-	-	-
14	turf	rotor	4	9	38	4	8	34
15	turf	rotor	4	10	41	4	10	40
16	turf	spray	2	11	22	2	9	18
17	turf	spray	-	-	-	-	-	-
18			-	-	-	-	-	-
20	turf	spray	2	14	28	2	12	24
21	turf	rotor	-	-	-	-	-	-
22	turf	spray	-	-	-	-	-	-
23	turf	spray	-	-	-	-	-	-

Zone	Plants	Sprinkler Type	CURRENT SYSTEM Starts per Day	CURRENT SYSTEM Min per Start	CURRENT SYSTEM Total Min per Day	OPTIMIZED SYSTEM Starts per Day	OPTIMIZED SYSTEM Min per Start	OPTIMIZED SYSTEM Total Min per Day
25	turf	spray	-	-	-	-	-	-
26	turf	spray	-	-	-	-	-	-
27	turf	rotor	-	-	-	-	-	-
28	turf	rotor	-	-	-	-	-	-
29	turf	spray	-	-	-	-	-	-
30	turf	spray	-	-	-	-	-	-
31	turf	spray	-	-	-	-	-	-

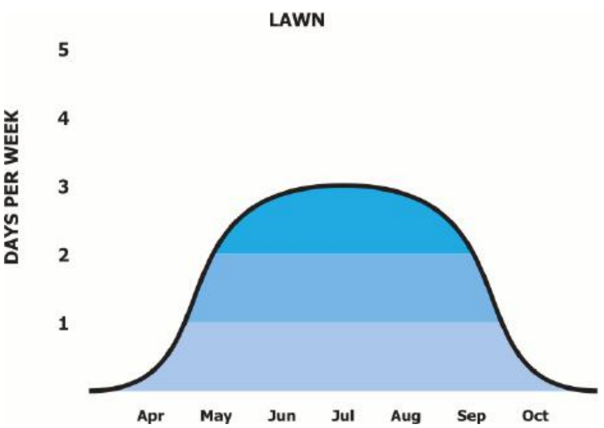
Controller 8: Kn, H

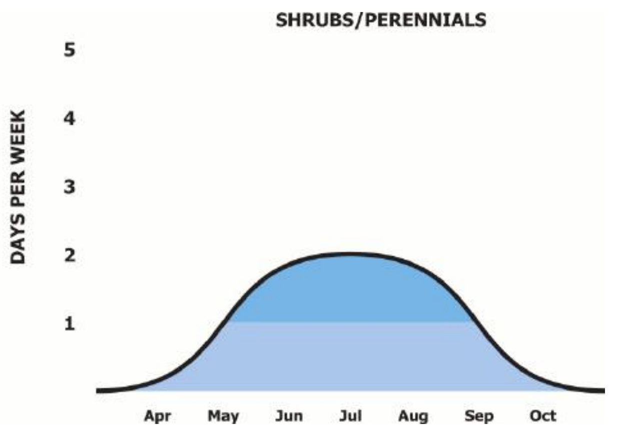
Zone	Plants	Sprinkler Type	CURRENT SYSTEM Starts per Day	CURRENT SYSTEM Min per Start	CURRENT SYSTEM Total Min per Day	OPTIMIZED SYSTEM Starts per Day	OPTIMIZED SYSTEM Min per Start	OPTIMIZED SYSTEM Total Min per Day
1	turf	spray	-	-	-	-	-	-
2	turf	spray	3	6	18	3	6	18
3	turf	spray	3	6	18	3	6	18
4	turf	spray	-	-	-	-	-	-
5	turf	spray	3	6	19	3	6	19
6	turf	spray	3	8	24	3	7	22
7	turf	spray	3	7	21	3	6	18
8	turf	spray	3	7	20	3	6	19
9	turf	spray	3	6	18	3	6	17
10	turf	spray	-	-	-	-	-	-
11	turf	spray	3	7	21	3	6	17
12	turf	spray	3	4	13	3	4	11
13	turf	rotor, spray, drip	-	-	-	-	-	-
14	shrubs	spray	-	-	-	-	-	-
15	shrubs	spray	-	-	-	-	-	-
16	shrubs	spray	-	-	-	-	-	-
17	shrubs	spray	-	-	-	-	-	-

Zone	Plants	Sprinkler Type	CURRENT SYSTEM			OPTIMIZED SYSTEM		
			Starts per Day	Min per Start	Total Min per Day	Starts per Day	Min per Start	Total Min per Day
18	shrubs	spray	-	-	-	-	-	-
19	shrubs	spray	-	-	-	-	-	-
20	shrubs	spray	-	-	-	-	-	-
21	shrubs	spray	-	-	-	-	-	-
22	shrubs	spray	-	-	-	-	-	-
23	shrubs	spray	-	-	-	-	-	-
27	shrubs	spray	-	-	-	-	-	-
28	shrubs	spray	-	-	-	-	-	-
29	shrubs	drip	-	-	-	-	-	-
30			-	-	-	-	-	-
31	shrubs	spray	-	-	-	-	-	-
32			-	-	-	-	-	-
33			-	-	-	-	-	-
34	turf	spray	3	6	19	3	6	18
35			-	-	-	-	-	-
36	turf	spray	2	12	24	2	10	20
37	turf	spray	3	5	16	3	5	16
38	turf	spray	-	-	-	-	-	-
39	turf	spray	3	10	30	3	8	25
40	turf	spray	3	5	14	3	5	14
41	turf	spray	3	5	14	3	5	14
42	turf	spray	3	5	16	3	5	15
43			-	-	-	-	-	-
44	turf	spray	-	-	-	-	-	-
45	turf	spray	-	-	-	-	-	-
46			-	-	-	-	-	-
47			-	-	-	-	-	-
48			-	-	-	-	-	-

DAYS PER WEEK—SAND							
Plant Type	Apr	May	Jun	Jul	Aug	Sep	Oct
Lawns and Annuals	*	2	3	3	3	2	*
Shrubs/Perennials	*	1	2	2	2	1	*

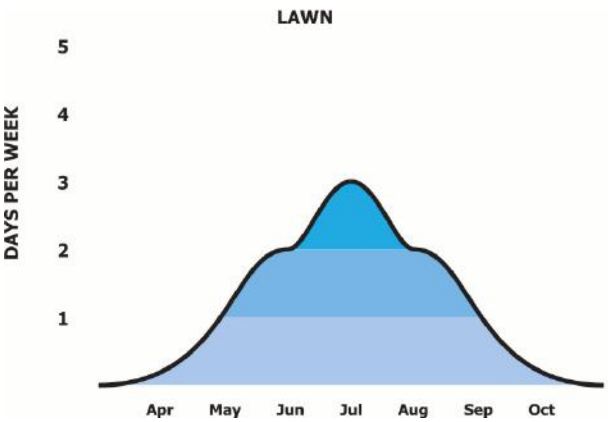
* As needed

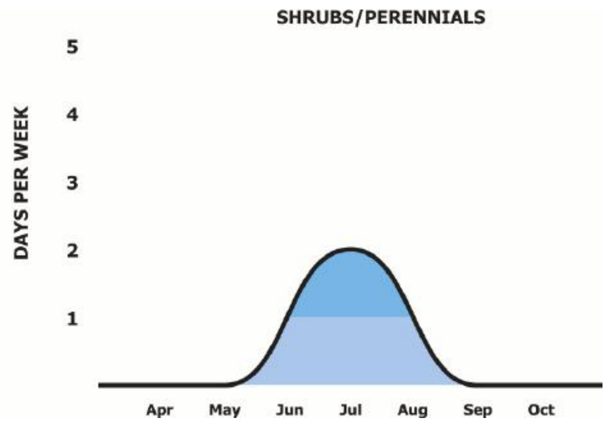




DAYS PER WEEK—SANDY LOAM/LOAM/CLAY LOAM							
Plant Type	Apr	May	Jun	Jul	Aug	Sep	Oct
Lawns and Annuals	*	1	2	3	2	1	*
Shrubs/Perennials	*	*	1	2	1	*	*

* As needed





Recommendations for Your Landscape and Sprinkler System

Landscapes and irrigation systems require routine care and maintenance. As a result, there are several common problems that may be found during a typical Water Check. We have identified these issues by irrigation zone and made recommendations for repairs for your property.

You have multiple controllers. In the lists below, “ctl. 1” and “C1” refer to the “make/model unspecified, E”, “ctl. 2” and “C2” refer to the “make/model unspecified, F”, “ctl. 3” and “C3” refer to the “make/model unspecified, G”, “ctl. 4” and “C4” refer to the “make/model unspecified, D”, “ctl. 5” and “C5” refer to the “make/model unspecified, C”, “ctl. 6” and “C6” refer to the “make/model unspecified, A”, “ctl. 7” and “C7” refer to the “make/model unspecified, B”, and “ctl. 8” and “C8” refer to the “Kn, H”.

WATER CONSERVATION ACTION ITEMS		
Controller/Zone	Sprinkler System Items	Landscape Items
Ctl. 1 #1	broken head, low head drainage, blocked head(s), wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 1 #2	broken head, mismatched heads, blocked head(s), sunken head(s), tilted head(s)	-
Ctl. 1 #3	clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 1 #4	broken head, clog, low head drainage, overspray, sunken head(s), tilted head(s)	-
Ctl. 1 #5	broken head, clog, overspray, sunken head(s), tilted head(s)	-

WATER CONSERVATION ACTION ITEMS		
Controller/Zone	Sprinkler System Items	Landscape Items
Ctl. 1 #6	broken head, wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 1 #7	blocked head(s), sunken head(s), tilted head(s)	-
Ctl. 1 #8	broken head, broken nozzle, clog, low head drainage, misaligned head(s), overspray, sunken head(s), tilted head(s)	-
Ctl. 1 #9	wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 1 #10	broken head, broken valve, sunken head(s), tilted head(s)	-
Ctl. 1 #11	broken head, broken nozzle, clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 1 #12	broken valve, overspray, sunken head(s), tilted head(s)	-
Ctl. 1 #13	coverage issues	-
Ctl. 1 #15	broken nozzle, broken pipe, clog, misaligned head(s), tilted head(s)	-
Ctl. 1 #16	-	-
Ctl. 1 #17	broken head, misaligned head(s), wrong spray pattern, overspray, tilted head(s)	-
Ctl. 1 #18	sunken head(s), tilted head(s)	-
Ctl. 1 #20	broken nozzle	-
Ctl. 1 #21	misaligned head(s), overspray, sunken head(s), tilted head(s)	-
Ctl. 1 #23	broken head, misaligned head(s), wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 1 #24	clog, misaligned head(s), blocked head(s), overspray, sunken head(s), tilted head(s)	-
Ctl. 1 #25	sunken head(s), tilted head(s)	-
Ctl. 1 #26	blocked head(s), tilted head(s)	-
Ctl. 1 #27	broken head, broken nozzle, clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 1 #28	-	-
	broken nozzle, misaligned head(s), wrong spray pattern,	

Ctl. 1 #29	**WATER CONSERVATION ACTION ITEMS**	-
Controller/Zone	Sprinkler System Items	Landscape Items
	overspray, sunken head(s), tilted head(s)	
Ctl. 1 #30	broken nozzle, clog, sunken head(s)	-
Ctl. 1 #31	broken nozzle, low head drainage, blocked head(s), wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 1 #32	-	-
Ctl. 2 #1	broken nozzle, broken pipe, wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 2 #2	wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 2 #3	sunken head(s), tilted head(s)	-
Ctl. 2 #4	sunken head(s), tilted head(s)	dry spots
Ctl. 2 #5	wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 2 #6	clog, misaligned head(s), overspray, sunken head(s), tilted head(s)	-
Ctl. 2 #7	broken head, sunken head(s), tilted head(s)	-
Ctl. 2 #8	sunken head(s), tilted head(s)	-
Ctl. 2 #9	wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 2 #10	-	-
Ctl. 2 #11	sunken head(s)	-
Ctl. 2 #12	broken nozzle, clog, wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 2 #13	overspray, sunken head(s), tilted head(s)	soil compaction
Ctl. 2 #14	broken head, sunken head(s)	-
Ctl. 2 #15	broken head, broken pipe, sunken head(s)	-
Ctl. 2 #16	wrong spray pattern, sunken head(s), tilted head(s)	-
Ctl. 2 #17	broken nozzle, clog, wrong spray pattern, sunken head(s), tilted head(s)	-
Ctl. 2 #18	broken nozzle, sunken head(s), tilted head(s)	-
Ctl. 2 #19	-	-

WATER CONSERVATION ACTION ITEMS		
Controller/Zone	Sprinkler System Items	Landscape Items
Ctl. 2 #20	-	-
Ctl. 2 #21	-	-
Ctl. 2 #22	broken pipe, overspray, sunken head(s), tilted head(s)	-
Ctl. 2 #23	clog, tilted head(s)	-
Ctl. 2 #24	broken head, clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 2 #25	clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 2 #26	overspray, sunken head(s), tilted head(s)	-
Ctl. 2 #27	-	-
Ctl. 2 #28	blocked head(s), overspray, sunken head(s)	-
Ctl. 2 #29	broken head, broken nozzle, wrong spray pattern	-
Ctl. 2 #30	broken head, clog, wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 2 #31	wrong spray pattern, sunken head(s), tilted head(s)	-
Ctl. 2 #32	broken head, clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 3 #1	overspray, sunken head(s), tilted head(s)	-
Ctl. 3 #2	coverage issues, blocked head(s), sunken head(s), tilted head(s)	-
Ctl. 3 #3	broken nozzle, clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 3 #4	clog, wrong spray pattern, overspray, sunken head(s)	-
Ctl. 3 #5	broken head, clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 3 #6	blocked head(s), overspray, tilted head(s)	-
Ctl. 3 #7	blocked head(s), sunken head(s), tilted head(s)	-
Ctl. 3 #8	broken head, broken nozzle, clog	-
Ctl. 3 #9	broken nozzle, overspray, sunken head(s), tilted head(s)	-
Ctl. 3 #10	broken nozzle, overspray, tilted head(s)	-
Ctl. 3 #11	clog, low head drainage, overspray, sunken head(s), tilted head(s)	-
Ctl. 3 #12	clog, overspray, sunken head(s), tilted head(s)	-

WATER CONSERVATION ACTION ITEMS		
Controller/Zone	Sprinkler System Items	Landscape Items
Ctl. 3 #13	broken nozzle, wrong spray pattern, sunken head(s), tilted head(s)	-
Ctl. 3 #14	sunken head(s), tilted head(s)	-
Ctl. 3 #15	overspray, sunken head(s), tilted head(s)	-
Ctl. 3 #16	clog, sunken head(s), tilted head(s)	dry spots
Ctl. 3 #17	-	-
Ctl. 3 #18	broken nozzle, mismatched heads, overspray, sunken head(s), tilted head(s)	-
Ctl. 3 #19	overspray, sunken head(s), tilted head(s)	-
Ctl. 3 #20	broken nozzle, low head drainage, wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 3 #21	low head drainage, wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 3 #22	broken head, clog, wrong spray pattern, overspray, tilted head(s)	-
Ctl. 3 #23	clog, misaligned head(s), overspray, sunken head(s), tilted head(s)	-
Ctl. 3 #24	broken head, overspray, sunken head(s), tilted head(s)	-
Ctl. 4 #1	broken head, clog, coverage issues, mismatched heads, blocked head(s), wrong spray pattern, sunken head(s), tilted head(s)	-
Ctl. 4 #3	broken head, overspray, sunken head(s), tilted head(s)	-
Ctl. 4 #4	overspray, sunken head(s), tilted head(s)	-
Ctl. 4 #5	coverage issues, wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 4 #6	broken head, sunken head(s), tilted head(s)	-
Ctl. 4 #7	clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 4 #8	-	-
Ctl. 4 #9	overspray, sunken head(s)	-
Ctl. 4 #10	-	-
Ctl. 4 #11	overspray	-

WATER CONSERVATION ACTION ITEMS		
Controller/Zone	Sprinkler System Items	Landscape Items
Ctl. 4 #12	clog, sunken head(s)	-
Ctl. 4 #13	overspray, sunken head(s), tilted head(s)	-
Ctl. 4 #16	coverage issues, sunken head(s)	dry spots
Ctl. 4 #17	broken pipe, blocked head(s), wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 4 #18	overspray, sunken head(s)	-
Ctl. 4 #19	clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 4 #20	broken nozzle, broken pipe, clog, wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 4 #21	broken nozzle, clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 4 #22	overspray, sunken head(s)	-
Ctl. 4 #23	clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 4 #24	sunken head(s), tilted head(s)	-
Ctl. 4 #25	broken nozzle, clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 4 #26	overspray, sunken head(s), tilted head(s)	-
Ctl. 4 #27	misaligned head(s), wrong spray pattern, overspray, sunken head(s)	-
Ctl. 4 #28	overspray	-
Ctl. 4 #29	overspray, sunken head(s), tilted head(s)	-
Ctl. 4 #30	sunken head(s), tilted head(s)	-
Ctl. 4 #31	clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 4 #32	broken head, broken nozzle, overspray, sunken head(s), tilted head(s)	-
Ctl. 5 #1	broken head, blocked head(s), sunken head(s), tilted head(s)	-
Ctl. 5 #2	clog, wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 5 #4	blocked head(s), overspray, tilted head(s)	-
	blocked head(s), wrong spray pattern, overspray, sunken head(s),	

WATER CONSERVATION ACTION ITEMS

Controller/Zone	Sprinkler System Items	Landscape Items
Ctl. 5 #5	tilted head(s)	-
Ctl. 5 #6	blocked head(s), sunken head(s), tilted head(s)	-
Ctl. 5 #7	sunken head(s), tilted head(s)	-
Ctl. 5 #8	blocked head(s), sunken head(s), tilted head(s)	-
Ctl. 5 #11	blocked head(s), wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 5 #14	clog, wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 5 #16	broken head, broken nozzle, overspray, sunken head(s), tilted head(s)	-
Ctl. 5 #17	overspray, sunken head(s)	-
Ctl. 5 #18	sunken head(s)	-
Ctl. 5 #19	broken head, sunken head(s)	-
Ctl. 5 #20	sunken head(s)	-
Ctl. 5 #21	broken pipe, overspray, sunken head(s), tilted head(s)	-
Ctl. 5 #22	overspray, sunken head(s), tilted head(s)	-
Ctl. 5 #23	blocked head(s), overspray, sunken head(s), tilted head(s)	-
Ctl. 5 #25	broken head, broken nozzle, clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 5 #26	sunken head(s), tilted head(s)	-
Ctl. 5 #27	broken nozzle, clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 5 #28	broken head	-
Ctl. 5 #29	-	-
Ctl. 5 #30	clog, overspray, sunken head(s), tilted head(s)	mulch needed
Ctl. 5 #31	overspray, sunken head(s), tilted head(s)	-
Ctl. 5 #32	-	-
Ctl. 6 #1	broken nozzle, clog, overspray, tilted head(s)	-

WATER CONSERVATION ACTION ITEMS		
Controller/Zone	Sprinkler System Items	Landscape Items
Ctl. 6 #2	-	-
Ctl. 6 #3	broken head, broken nozzle, clog, overspray, tilted head(s)	-
Ctl. 6 #4	-	-
Ctl. 6 #5	broken nozzle	-
Ctl. 6 #6	overspray	-
Ctl. 6 #7	-	-
Ctl. 6 #8	broken head, tilted head(s)	-
Ctl. 6 #9	-	-
Ctl. 6 #10	overspray, sunken head(s), tilted head(s)	-
Ctl. 6 #11	broken pipe	-
Ctl. 6 #12	broken nozzle, overspray	-
Ctl. 6 #13	broken head, wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 6 #14	broken nozzle, overspray, sunken head(s), tilted head(s)	-
Ctl. 6 #15	broken head, broken nozzle, overspray, sunken head(s), tilted head(s)	-
Ctl. 6 #16	clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 6 #17	broken head, overspray, sunken head(s), tilted head(s)	-
Ctl. 6 #18	broken head, broken nozzle, overspray, sunken head(s)	-
Ctl. 6 #19	broken nozzle, broken pipe, clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 6 #20	clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 7 #1	broken head, sunken head(s), tilted head(s)	-
Ctl. 7 #3	sunken head(s), tilted head(s)	-
Ctl. 7 #4	sunken head(s), tilted head(s)	-
Ctl. 7 #5	broken nozzle, clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 7 #6	overspray, sunken head(s), tilted head(s)	-

WATER CONSERVATION ACTION ITEMS		
Controller/Zone	Sprinkler System Items	Landscape Items
Ctl. 7 #7	wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 7 #8	sunken head(s), tilted head(s)	-
Ctl. 7 #9	broken nozzle, overspray, sunken head(s), tilted head(s)	-
Ctl. 7 #10	overspray, sunken head(s), tilted head(s)	-
Ctl. 7 #11	broken head, wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 7 #12	clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 7 #13	overspray, sunken head(s), tilted head(s)	-
Ctl. 7 #14	blocked head(s), overspray, sunken head(s), tilted head(s)	dry spots
Ctl. 7 #15	wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 7 #16	clog, wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 7 #17	broken head, overspray, sunken head(s), tilted head(s)	-
Ctl. 7 #18	-	-
Ctl. 7 #20	overspray, sunken head(s), tilted head(s)	-
Ctl. 7 #21	sunken head(s), tilted head(s)	-
Ctl. 7 #22	broken head, overspray, sunken head(s), tilted head(s)	-
Ctl. 7 #23	broken head, overspray, sunken head(s), tilted head(s)	-
Ctl. 7 #25	clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 7 #26	clog, wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 7 #27	broken pipe, blocked head(s), overspray, sunken head(s), tilted head(s)	dry spots
Ctl. 7 #28	broken head, overspray, sunken head(s), tilted head(s)	-
Ctl. 7 #29	overspray, sunken head(s), tilted head(s)	-
Ctl. 7 #30	broken head, broken nozzle, clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 7 #31	broken head, overspray, sunken head(s), tilted head(s)	-

WATER CONSERVATION ACTION ITEMS		
Controller/Zone	Sprinkler System Items	Landscape Items
Ctl. 8 #1	broken valve	-
Ctl. 8 #2	overspray, sunken head(s), tilted head(s)	-
Ctl. 8 #3	clog, blocked head(s), overspray, sunken head(s), tilted head(s)	-
Ctl. 8 #4	broken valve	-
Ctl. 8 #5	clog, sunken head(s), tilted head(s)	-
Ctl. 8 #6	wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 8 #7	broken nozzle, overspray, sunken head(s), tilted head(s)	-
Ctl. 8 #8	sunken head(s), tilted head(s)	-
Ctl. 8 #9	broken nozzle, tilted head(s)	-
Ctl. 8 #10	-	-
Ctl. 8 #11	wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 8 #12	misaligned head(s), overspray, sunken head(s), tilted head(s)	-
Ctl. 8 #13	broken head, clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 8 #14	broken nozzle, overspray	-
Ctl. 8 #15	overspray	-
Ctl. 8 #16	broken nozzle, clog	-
Ctl. 8 #17	-	-
Ctl. 8 #18	broken head, broken nozzle, wrong spray pattern, overspray	-
Ctl. 8 #19	overspray	-
Ctl. 8 #20	broken nozzle	-
Ctl. 8 #21	broken head	-
Ctl. 8 #22	clog	-
Ctl. 8 #23	broken head	-
Ctl. 8 #27	broken head, overspray, sunken head(s), tilted head(s)	-
Ctl. 8 #28	clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 8 #29	-	-

WATER CONSERVATION ACTION ITEMS		
Controller/Zone	Sprinkler System Items	Landscape Items
Ctl. 8 #30	-	-
Ctl. 8 #31	broken head, broken nozzle, clog	-
Ctl. 8 #32	-	-
Ctl. 8 #33	-	-
Ctl. 8 #34	sunken head(s), tilted head(s)	-
Ctl. 8 #35	overspray, sunken head(s), tilted head(s)	-
Ctl. 8 #36	overspray, sunken head(s), tilted head(s)	-
Ctl. 8 #37	overspray, sunken head(s), tilted head(s)	-
Ctl. 8 #38	broken head, overspray, sunken head(s), tilted head(s)	-
Ctl. 8 #39	wrong spray pattern, overspray, sunken head(s), tilted head(s)	-
Ctl. 8 #40	overspray, sunken head(s), tilted head(s)	-
Ctl. 8 #41	clog, overspray, sunken head(s), tilted head(s)	-
Ctl. 8 #42	overspray, sunken head(s), tilted head(s)	-
Ctl. 8 #43	broken head, overspray, sunken head(s), tilted head(s)	-
Ctl. 8 #44	-	-
Ctl. 8 #45	broken head	-
Ctl. 8 #46	-	-
Ctl. 8 #47	-	-
Ctl. 8 #48	-	-

For detailed information on these items please visit http://cwel.usu.edu/watercheck.

Zone Notes and Photos

Specific notes or photos taken of the zones in your system are shown below. If a zone does not appear in the list below, then it did not have any notes or photos.

Controller 1

#6 - E6

4th from N end broken

#15 - E15

100psi

#27 - E27

35 psi

Controller 2

#4 - F4

100psi

#5 - F5

45 psi

#7 - F7

110 psi

#9 - F9

Zone doesn’t shut off properly

#11 - F11

100 psi

#14 - F14

90 psi

#15 - F 15

90 psi

#16 - F16

100 psi

#19 - F19

Shut off

#20 - F20

Shut off

#21 - F21

Shut off

#23 - F23

40 psi

#29 - F29

90 to 100 psi

#31 - F31

98 psi

Controller 3

#1 - G1

80 psi

#2 - G2

90 psi

#3 - G3

40 psi

#4 - G4

47 psi

#5 - G5

42 psi

#8 - G8

100 psi

#11 - G11

Many clogged heads, 37 psi

#16 - G16

Only half zone coming on

#17

Nothing coming on

#18 - G18

Runs together with zone 17

#20 - G 20

Zone 19 on the map, 40 psi

#21 - G21

zone 20 on the map

#22 - G22

Zone 21 on the map, several broken heads, 49 psi

#23 - G23

On zone 22 on the map, 32 psi

#24 - G24

Zone 23 on the map

Controller 4

#1 - D1

Runs together with what is D2 on the map, 75 psi

#8 - D8

Runs on zone 10 N on the , 100 psi

#9 - D9

Turns on zone11 on the map,100 psi

#10 - D10

Shut off due to pipe repairs

#11 - D11

Runs what is zone 10 on the map, 90-115 psi

#12 - D12

75-90 psi

#13 - D13

80 psi

#16 - D16

60 psi

#17 - D17

120 psi

#18 - D18

115 psi

#22 - D22

105 psi

#24 - D24

110 psi

#25 - D25

P strip along 300 N

#27 - D27

115-125psi

#28 - D28

50 psi

#29 - D29

115 psi

#30 - D30

115 psi

Controller 5

#1 - C1

98psi

#5 - C5

102 psi

#6 - C6

110 psi

#7 - C7

95 psi

#8 - C8

100 psi

#11 - C11

105 psi

#16 - C16

40 psi

#17 - C17

105 psi

#18 - C18

110 psi

#20 - C20

105 psi

#21 - C21

75 psi, big leak!

#22 - C22

42 psi

#23 - C23

38 psi, several heads come on on zones 16 and 23!

#25 - C25

45 psi

#26 - C26

75-90 psi

#29 - C29

Does not turn on

#30 - C30

45 psi

#31 - C31

95 psi

Controller 6

#3 - A3

War memorial

#10 - A10

Turns on C15 on the map

#17 - A17

3 broken heads

Controller 7

#3 - B3

100 psi

#4 - B4

83 psi

#7 - B7

100 psi

#8 - B8

105 psi

#10 - B10

55 psi

#14 - B14

100 psi

#15 - B15

50-75 psi

#16 - B16

45 psi

#18 - B18

Nothing turns on

#20 - B20

90 psi

#21

85 psi

#22 - B22

90 psi

#27 - B27

75 psi

#28 - B28

80 psi

#29 - B29

90 psi

Controller 8

#1 - H1

Very low pressure due to bad valve

#4 - H4

Zone turns on, then off again immediately

#5 - H5

44 psi

#10 - H10

Zone doesn’t turn on

#27 - H27

I4 on map

#28 - H28

I3 on map

#29 - H29

I6 on map

#31 - H31

I1 on map

#34 - H34

I10/11 on map

#35 - H35

I12 on map

#36 - H 36

I3 triangle on map

#37 - H37

I13 on map

#38 - H38

I14 on map

#39 - H39

I15 on map

#40 - H40

I16 on map

#41 - H 41

I18 on map

#42 - H42

I19

#43 - H43

I28

#44 - H44

I31

#45 - H45

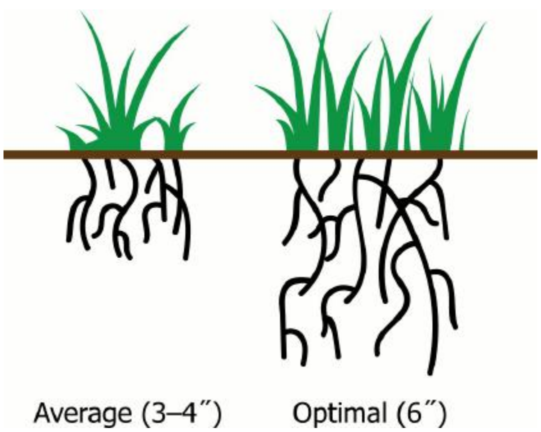
I21/22

TEST RESULTS						
Zone	Head Type	Precipitation Rate	Distribution Uniformity	Dynamic Pressure	Soil Type	Root Depth
C1 #5, C1 #12	rotor, spray	2.15 in/hr	52%	70 PSI	clay loam	4"
C1 #8, C1 #9	rotor	0.88 in/hr	54%	100 PSI	loam	4"
C1 #10, C1 #11	rotor, spray	0.74 in/hr	60%	90 PSI	clay loam	4"
C1 #6, C1 #7	rotor	0.75 in/hr	71%	80 PSI	clay loam	4"
C1 #1	rotor	0.69 in/hr	47%	85 PSI	loam	4"
C1 #15	spray	1.08 in/hr	59%	115 PSI	clay loam	4"
C1 #13, C1 #15, C1 #17	rotor, spray	0.82 in/hr	72%	110 PSI	clay loam	5"
C1 #21	spray	1.81 in/hr	65%	46 PSI	loam	4"
C1 #21	spray	1.47 in/hr	62%	100 PSI	clay loam	4"
C1 #27, C1 #28	spray, drip	1.77 in/hr	60%	100 PSI	clay loam	5"
C1 #20	drip	1.67 in/hr	62%	35 PSI	clay loam	4"
C1 #13, C1 #17, C1 #18	rotor, spray	2.31 in/hr	60%	110 PSI	loam	
C2 #1, C2 #4	rotor, spray	0.67 in/hr	50%	105 PSI	clay loam	6"

TEST RESULTS						
Zone	Head Type	Precipitation Rate	Distribution Uniformity	Dynamic Pressure	Soil Type	Root Depth
C2 #8	rotor	1.39 in/hr	65%		clay loam	5"
C2 #3, C2 #9, C2 #11	rotor, spray	0.00 in/hr	0%		loam	3"
C2 #2		2.01 in/hr	59%	45 PSI	loam	
C2 #28, C2 #3, C2 #4	rotor, spray	0.97 in/hr	68%	93 PSI	loam	4"
C2 #31, C2 #2	rotor	0.73 in/hr	65%	95 PSI	loam	4"
C3 #1	rotor	0.93 in/hr	48%		loam	4"
C3 #9, C3 #10, C3 #11	spray	1.53 in/hr	62%	37 PSI	loam	3"
C3 #9, C3 #12, C3 #15	spray	1.80 in/hr	42%	45 PSI	clay loam	4"
C3 #18	spray, drip	1.61 in/hr	54%	95 PSI	loam	4"
C4 #1	rotor, spray	0.82 in/hr	56%	75 PSI	loam	3"
C4 #16, C4 #17	rotor	0.71 in/hr	59%	110 PSI	loam	4"
C4 #23	spray	2.58 in/hr	47%	110 PSI	loam	5"
C4 #22	rotor	1.36 in/hr	64%	105 PSI	clay loam	5"
C4 #12, C4 #18	rotor	1.36 in/hr	56%	100 PSI	loam	3"
C4 #13	spray	2.17 in/hr	61%	80 PSI	loam	5"
C4 #27, C4 #28	rotor, spray	0.88 in/hr	43%	80 PSI	clay loam	4"
C4 #29	rotor	0.64 in/hr	73%	115 PSI	sand	4"
C4 #24	rotor	1.15 in/hr	57%	110 PSI	loam	3"
C5 #17, C5 #18	rotor	0.93 in/hr	44%	105 PSI	clay loam	6"
C5 #11	rotor	2.03 in/hr	57%	45 PSI	clay loam	2"
C5 #1, C5 #5	rotor	1.14 in/hr	76%		clay loam	3"
C5 #6, C5 #7	rotor	1.07 in/hr	71%	100 PSI	clay loam	4"

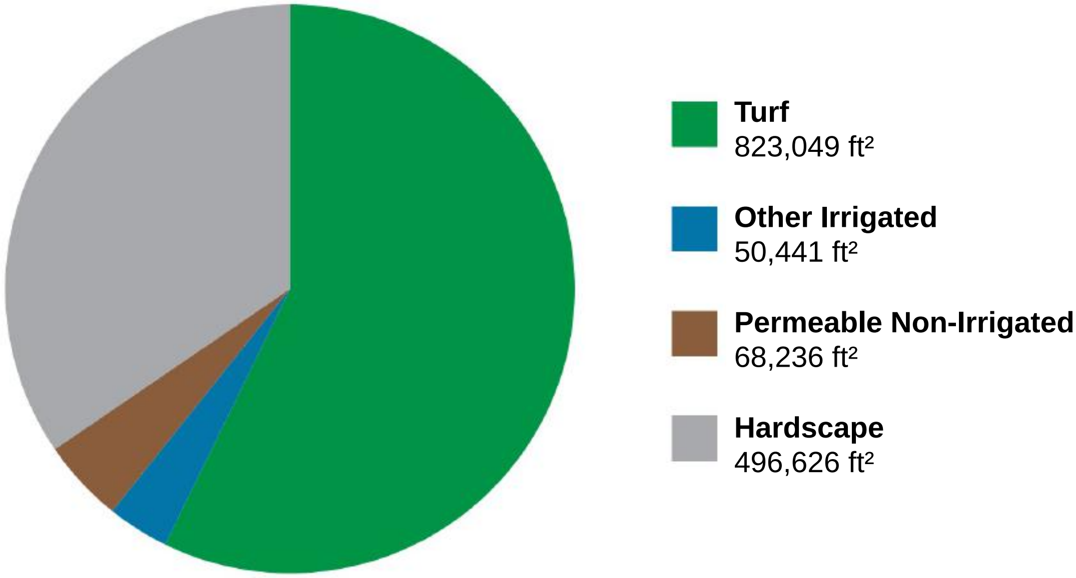
TEST RESULTS						
Zone	Head Type	Precipitation Rate	Distribution Uniformity	Dynamic Pressure	Soil Type	Root Depth
C5 #8	rotor	1.00 in/hr	70%	100 PSI	clay loam	3"
C5 #22	spray	1.84 in/hr	64%	42 PSI	clay loam	6"
C5 #32	spray	1.97 in/hr	45%		clay loam	5"
C5 #19, C5 #20	rotor	0.86 in/hr	49%	100 PSI	clay loam	5"
C6 #16	spray	1.61 in/hr	63%	90 PSI	clay loam	3"
C6 #14	spray	1.89 in/hr	45%	55 PSI	clay loam	3"
C6 #20	spray	2.00 in/hr	51%	60 PSI	loam	3"
C7 #3, C7 #7	rotor	0.65 in/hr	65%	75 PSI	clay loam	3"
C7 #4, C7 #9	rotor, spray	0.71 in/hr	58%	83 PSI	clay loam	3"
C7 #10	spray	2.29 in/hr	59%	44 PSI	clay loam	3"
C7 #14	rotor	0.98 in/hr	66%	100 PSI	clay loam	6"
C7 #15	rotor	0.83 in/hr	72%	100 PSI	clay loam	4"
C7 #16	spray	2.04 in/hr	53%	45 PSI	loam	4"
C7 #20	spray	1.54 in/hr	56%	85 PSI	loam	5"
C7 #6	spray	2.42 in/hr	55%	97 PSI	clay loam	5"
C7 #3, C7 #7	rotor	1.02 in/hr	70%	100 PSI	clay loam	4"
C8 #2, C8 #3	spray	2.02 in/hr	68%	45 PSI	clay loam	2"
C8 #6	spray	1.70 in/hr	59%	55 PSI	clay loam	2"
C8 #5	spray	2.01 in/hr	63%	45 PSI	clay loam	3"
C8 #7	spray	2.05 in/hr	56%	65 PSI	clay loam	2"
C8 #11	spray	2.23 in/hr	50%	95 PSI	clay loam	3"
C8 #8	spray	2.02 in/hr	59%	43 PSI	clay loam	2"
C8 #9	spray	2.15 in/hr	63%	39 PSI	clay loam	3"

TEST RESULTS						
Zone	Head Type	Precipitation Rate	Distribution Uniformity	Dynamic Pressure	Soil Type	Root Depth
C8 #12, C8 #13	rotor, spray, drip	3.31 in/hr	53%	85 PSI	clay loam	3"
C8 #36	spray	1.91 in/hr	47%	30 PSI	loam	2"
C8 #34	spray	2.12 in/hr	59%	70 PSI	clay loam	3"
C8 #35, C8 #37	spray	2.35 in/hr	67%	35 PSI	clay loam	3"
C8 #38	spray	0.00 in/hr	0%	30 PSI	clay loam	3"
C8 #43		2.35 in/hr	61%	50 PSI	clay loam	3"
C8 #42	spray	2.44 in/hr	61%	40 PSI	clay loam	3"
C8 #39	spray	1.50 in/hr	52%	60 PSI	clay loam	3"
C8 #40, C8 #41	spray	2.61 in/hr	65%	38 PSI	clay loam	3"



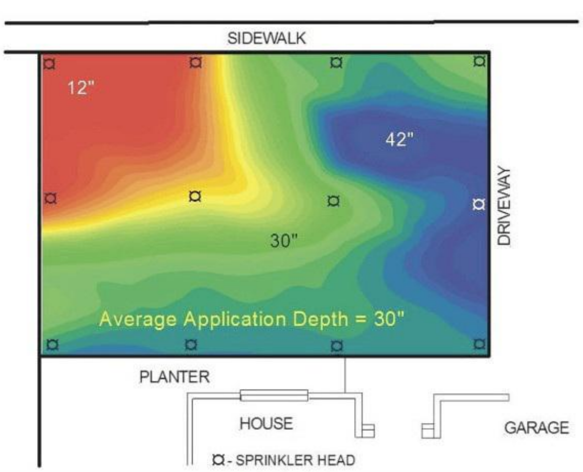
The roots of your grass secure the plants in the soil and take up water and nutrients to support plant growth and development. The depth of the roots relates directly to how much soil moisture they can reach, and the deeper they grow the better.

YOUR PARCEL MEASUREMENT: 1,438,351 ft²

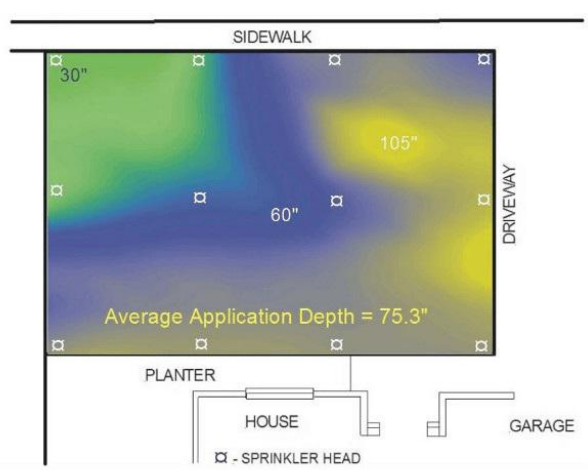


Distribution Uniformity

Distribution uniformity describes how evenly irrigation water is applied to your landscape and is expressed as a percentage with 100% representing perfectly even application. Of course, nothing is perfect and we would not ever expect to measure a distribution uniformity of 100% in an actual landscape. However, distribution uniformities of 75% for spray heads and 80% for rotors are achievable and would be considered excellent. If measured distribution uniformities are less than 50% for spray heads and 55% for rotors, scheduling irrigation becomes inefficient and repairs should be made to improve uniformity.



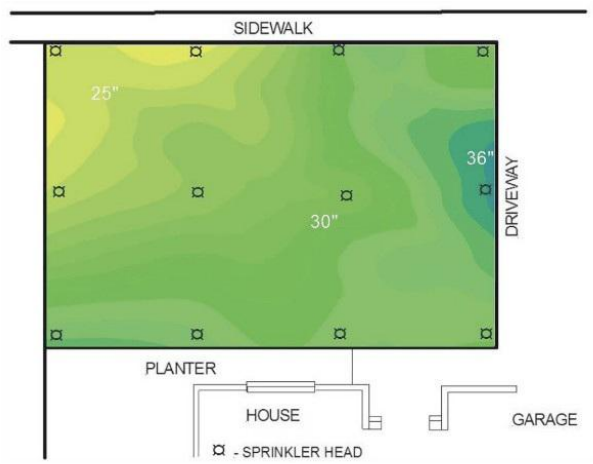
DU=50%



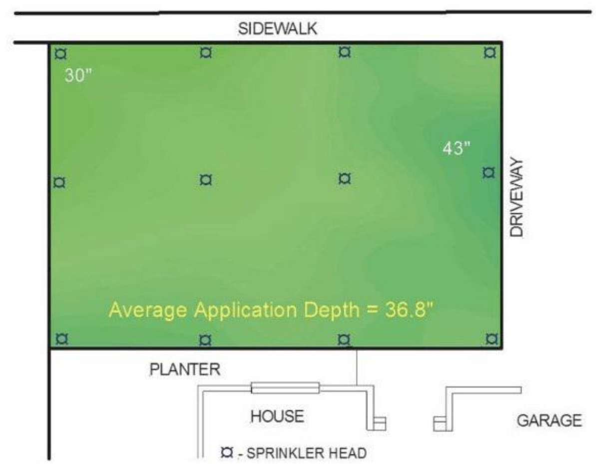
DU=50%

Avg. Depth=30"
Min. Depth=12"
Max. Depth=42"

Avg. Depth=75"
Min. Depth=30"
Max. Depth=105"



DU=85%
Avg. Depth=30"
Min. Depth=25"
Max. Depth=36"



DU=85%
Avg. Depth=37"
Min. Depth=30"
Max. Depth=43"

Additional Information You Requested

For more landscape information, please contact your local extension office at https://extension.usu.edu/locations.

Irrigation Assistance

If you choose to have a contractor do repairs and/or maintenance on your sprinkler system, please consult http://qwelutah.com for a list of irrigation specialists and contractors who are certified Qualified Water Efficient Landscapers.