TURFGRASS AND LANDSCAPE IRRIGATION AUDIT

Submitted by William Baker & Associates, LLC

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TURFGRASS AND LANDSCAPE IRRIGATION AUDIT

A water audit was conducted at a Coachella Valley park site, comprised of a turf area measuring 820 square feet, and a desert landscape encompassing 7,000 square feet. The grass canopy of the lawn is composed of hybrid bermudagrass over-seeded with perennial ryegrass. A twenty-five foot cork oak located in the lawn, allows one half of the lawn to receive full sun, and the other half collects only filtered light. When the audit was performed in late May, the mixture of grasses in full sun are 70% hybrid bermudagrass, and 30% perennial ryegrass. In contrast, the shaded portions has a predominance of perennial ryegrass (85%), and only a small amount of hybrid bermudagrass (15%).
The desert landscape contains eight different plant species throughout the bed. The plant ratio mix has six plants (75%) with low water needs (0.1 - 0.3), and two plants (25%) with moderate water requirements (0.4 – 0.6). Plants desiring low water amounts are aloe, red bird of paradise, red yucca, feathery senna, palo verde, and desert broom. Two plants with moderate water needs are trailing lantana, and rosemary. Both areas in the park are irrigated with potable water.

WILLIAM & BAKER
ASSOCIATES LLC

Turfgrass and Landscape Irrigation Audit

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TURFGRASS AND LANDSCAPE IRRIGATION AUDIT- OVERVIEW

Site Address: Coachella Valley Area City Park (Riverside County)

WUCOLS Region # 6 Sunset Zone 13: Average summer time temperatures range from 106 to 108 degrees Fahrenheit. Winters are short and mild, with frosts anticipated from December 1 to February 15.

Closest CIMIS Station: Palm Desert M.W.E.L.O. ETo 71.8"

Turfgrass Square Footage: 820 Landscape Square Footage: 7,000

Name	Office	Cell	Email

GENERAL SITE DESCRIPTION

City Park in Coachella Valley, County of Riverside, California

The turf area (Zone #22) has 15 Rainbird 1800 spray heads that consist of 12 part circle sprinklers and 3 full circle heads. The Rainbird nozzles were converted to Hunter MP 1000 Rotators and the uniformity increased from 54% to 68%. The infiltration rate of the soil is 0.46 in/hr., which is considered moderately slow, and the lower precipitation rate 0.62 in/hr. (MP rotator) compared to 2.04 in/hr. (Rainbird 1800) prevents less runoff onto the sidewalk.
The desert landscape (Zone #11) is irrigated with drip irrigation using BowSmith drip emitters that apply water at 0.6 in/hr. All of the drip piping is buried, and only one emitter per plant is exposed.

Both of the zones have 1" water meters down-stream of the valve, so accurate flow rates can be recorded for each valve. Turf zone #22, is supplied by a 1 ½" valve that has a base water flow of 8.0 gallons per minute, while the desert landscape zone #11, receives water from a 1" valve, and has a base water flow of 5.0 gpm. A central computer relays programmed information to a field clock, which activates a valve (via a clock station) to water a specific zone. The central computer uses historical evapotranspiration data from a local weather station to determine the amount of water needed daily.

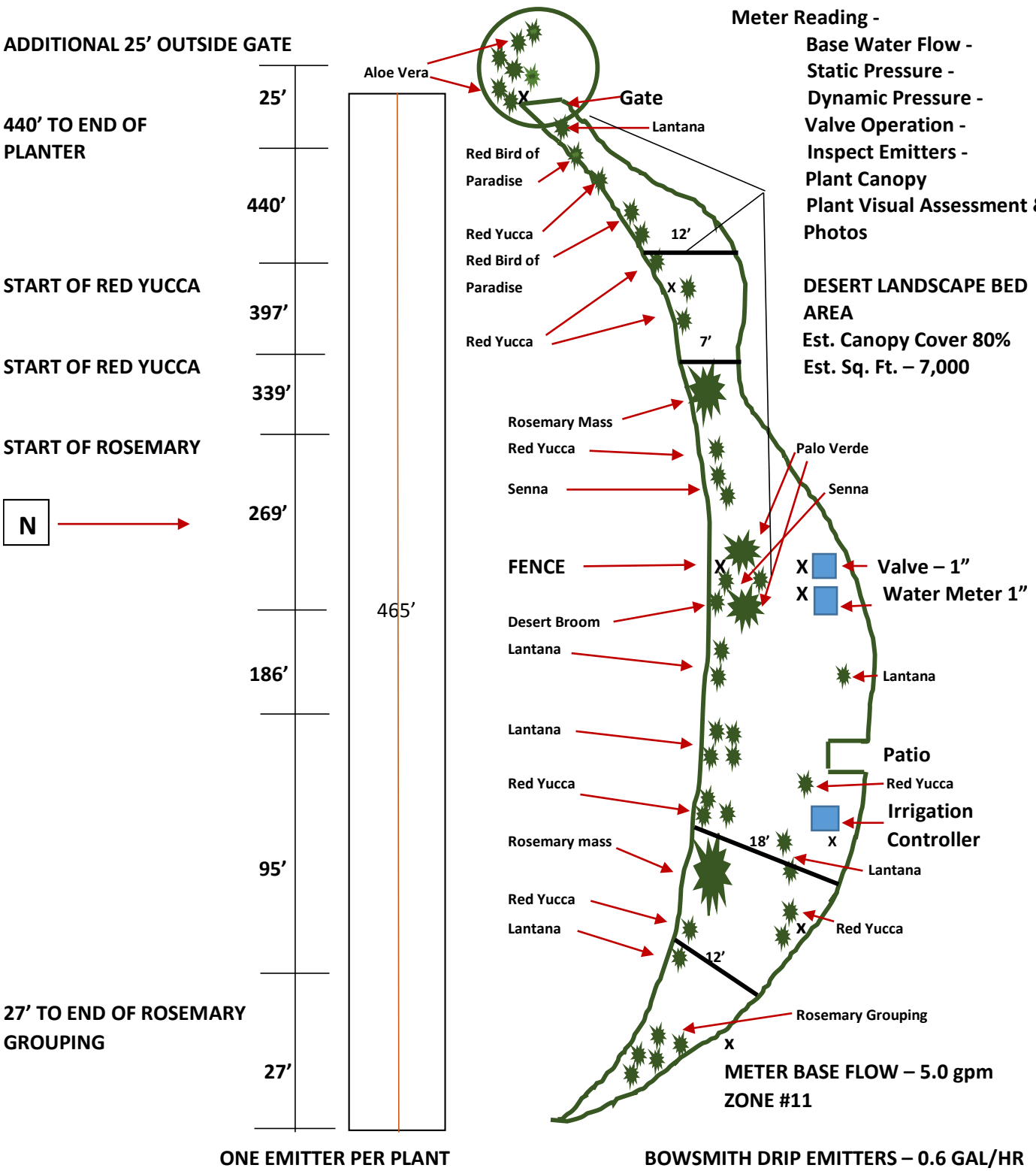
WATER AUDIT PROCEDURES

An initial visit to the park was done on May 16, 2016, meeting with the park maintenance staff. Zone #22, a small turfgrass area, was selected to conduct the water audit, and the following information was obtained:
1. Irrigation Controller # 405: Station: 22
2. The clock was activated and all 15 sprinklers were flagged. Each sprinkler was checked for proper operation, and adjustment.
3. A field test area data map was drawn. Sprinkler operating pressure, static pressure, dynamic pressure, and sprinkler head spacing was recorded.
4. A soil probe was inserted into the lawn to determine root depth, thatch layer buildup, organic matter accumulation, and the soil moisture content.
5. It was determined to use 36 catch devices throughout the lawn surface when performing the catch can test. Each catch location was recorded on the map.
6. An eight minute run time was used to collect water in the catch devices.
7. Water volumes were read and logged on the test area map.
8. The distribution uniformity and precipitation rate were calculated.
   Calculated Distribution Uniformity: 0.54 Calculated Precipitation Rate: 2.04 in/hr.
9. The irrigation controller and backflow information was documented.
10. The current water schedule for the turf zone was verified.
11. After discussing the poor sprinkler uniformity with the park supervisor, it was decided to retrofit the current spray nozzles with more uniform rotating nozzles.

On May 23, 2016, fifteen spray nozzles were retrofitted with 15 rotating nozzles. The following procedures were performed and the resulting information was collected:
1. The clock was activated and fifteen sprinklers were checked for proper operation, adjustment, and operating pressures.
2. A total of 36 catch devices were placed on the lawn surface and five separate columns were used to distribute all of the catch devices.
3. An eight minute run time was used to collect water in the catch devices.
4. Water volumes were read and logged on the test area map.
5. The distribution uniformity and precipitation rate was calculated.
   Calculated Distribution Uniformity: 0.68 Calculated Precipitation Rate: 0.62 in/hr.
6. An irrigation schedule was developed utilizing the plant water requirement, sprinkler performance, and soil-water properties.
7. Properly managing an irrigation schedule will incorporate the following scheduling factors.
   - The proper amount of water (considering weather and turf).
   - The proper frequency of irrigation (based on the soil's ability to store water and the intake rate of the soil).
   - The performance characteristics of the irrigation system (how quickly and evenly water is applied to the turfgrass).
   - The features of the irrigation controller and the characteristics of the site that determine appropriate program start times and maximum station run times without runoff.

CITY PARK, COACHELLA VALLEY AREA

RIVERSIDE COUNTY, CALIFORNIA



SITE CONDITIONS REVIEW – SPRAY WORKSHEET #1

Project Name	City Park	**Date**	5/16/2016
Address	Coachella Valley	**Candidate ID #**	69674
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Controller ID Name	CALSENSE/405				
Controller station(s) #	22				
Area/location	N.W. lawn				
Irrigated area	820 ft²	ft²	ft²	ft²	ft²
Plant material (all that apply)	WS				
Plant condition (choose one)	HQ				
Microclimate (choose one)	FS				
Soil category (choose one)	M				
Root depth	3.5 in.	in.	in.	in.	in.
Slope (choose one)	FLAT				
Compaction (Y/N	Yes				
Runtime until runoff	8 min.	min.	min.	min.	min.
Standing water (Y/N	No				
Hydrozone separation Y/N	Yes				

Abbreviation Key

Plant Materials
CS = Cool season turf
WS = Warm season turf
T = Trees
S = Shrubs
N = Native
GC = Groundcover

Soil Category
C = Coarse
MC = Moderately coarse
M = Medium
MF = Moderately fine
F = Fine

Slope
F = Flat
SL = Slight
Mod = Moderate
Stp = Steep

Plant Condition
LM = Low maintenance, stressed
TRD = Traditional, some stress, but generally good condition
HQ = High quality, majority are vigorously growing

Microclimate
FS = Full sun all day
PS = Part shade, less than 6 hrs of sun/day
SH = Full shade all day
EX = Extreme conditions (parking lots, south-facing glass or wall)

SPRINKLER SYSTEM REVIEW – SPRAY WORKSHEET #2

Project Name	City Park	**Date**	5/16/2016
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Abbreviation Key: S = Spray, fixed nozzle R = Rotor, including MSMT nozzles I = Impact X – Needs correction ✓ = Correction

Controller ID/Name	CALSENSE/405									
Controller Station #	22		First Test				22		Second Test	
Sprinkler type (choose one)	Rainbird 1800 #12 nozzle		5/16/16				Hunter MP 1000 Rotator		5/23/16	
Station flow	18.9	gpm		gpm		gpm	8.2	gpm		gpm
High pressure	60	gpm					60	psi		psi
Low pressure	50	gpm					55	psi		psi
Action Required (Place "x" for action needed, ✓ when completed)	X	✓	X	✓	X	✓	X	✓	X	✓
Broken pipes										
Missing/broken heads										
Missing nozzle										
Psi adjustment needed										
Clogged nozzle										
Heads not turning										
ARC misalignment							X	✓		
Low head drainage										
Leaking seals/fittings										
Spray deflected/blocked										
Sunken head										
Tilted heads										
Mismatched heads										
Spray/rotor separation										
Spacing uneven	X						X	✓		
Valve malfunction										
Observations on Maintenance Frequency										

On 5/16/2016, all sprinklers were operating correctly and in adjustment. One sprinkler is unevenly spaced at 5 feet, and will be plugged in the future. When the second test was conducted, 15 Rainbird nozzles were replaced with Hunter MP 1000 Rotators. All sprinklers were checked for operation, and nozzles were adjusted to correspond with the required arc alignment. The sprinkler unevenly spaced at 5' was capped.

WATER SOURCE AND SYSTEM DATA – SPRAY WORKSHEET #3

Project Name	City Park	**Date**	5/16/2016
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Water Source Data

Water Source (check one)									
✓	**Potable**		**Reclaimed**		**Well**		**Pond**		
	Other (explain)								
Backflow Device (check one)									
	None	✓	Reduced Pressure Assemble		Double Check Valve		Pressure Vacuum Breaker		Atmospheric Vacuum Breaker
Size		In.							
Other (explain)									
Pump or Pump Station (check one)									
✓	No		Yes						
		Maximum Flow		gpm					
		Pressure		psi					
Meter (check one)									
	No	✓	Yes						
			Size		In.				
			Units (check one	✓	gallons		Cubic feet		
			Static pressure	60		Psi (during scheduled irrigation window)			
			Dynamic pressure	50		Psi (during scheduled irrigation window)			

POC Flow Data **(use catalog data if non-metered sources exist)**

Meter Number	Station Number	Gallons (cf)	Beginning Readings	Ending Readings	Total	Beginning Time	Ending Time	Elapsed Time
		GAL	135,100	135,270	170	9:25 AM	9:33 AM	8 min

CONTROLLER FEATURES – SPRAY WORKSHEET #4

Project Name	City Park	**Date**	5/16/2016
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Manufacturer					**Central Control (check one)**				
CALSENSE					✓	Yes		No	
Model Number					**Weather Station (check one)**				
ET2000					✓	Yes		No	
Station Being Used					**Smart Controller**				
32					✓	Yes		No	
Station Run Time Range (min)									
The minutes are calculated based on the precipitation rate, the amount of ET, crop coefficients and the percent of ET. If ET is not used, a manual override can be programmed.									
Number of Programs					**Start Times/Program**				
7					6				
Calendar Days (check one)									
	7 days	✓	14 days		Other (explain)	7 day, 14 day, 20 day, or 28 day watering schedule capability			
Irrigation Interval (check options available)									
✓	Daily		Even/Odd		Custom (explain)	By selection or interval			
Rain Delay (maximum days)					**Skip Day Period (maximum days)**				
Until the usable rain is used up, there will be no irrigation					0 to 31 days				
Percent Adjust Options (check applicable)									
	Global	✓	By program	✓	By station	✓	By month		Seasonal

Sensors Installed (make & model)	
Rain	
Freeze	
Wind	
Temperature	
Flow	Provides protection for lateral and mainline breaks.
Soil Moisture	
Tipping bucket	
Notes:	

CONTROLLER SETTINGS – SPRAY WORKSHEET #5

Project Name	City Park	**Date**	5/16/2016
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Current Controller Settings

Program	Start Times				**Days On**													
	1	**2**	**3**	**4**														
A	**2 AM**				✓	**S**	✓	**M**	✓	**T**		**W**	✓	**T**	✓	**F**	✓	**S**
B						**S**		**M**		**T**		**W**		**T**		**F**		**S**
C	**5 AM**				✓	**S**	✓	**M**		**T**	✓	**W**		**T**	✓	**F**	✓	**S**
D						**S**		**M**		**T**		**W**		**T**		**F**		**S**

Program	**Station**	**Minutes**		**Program**	**Station**	**Minutes**		**Program**	**Station**	**Minutes**
A	2	9								
C	11	26								

Smart Controller Settings

Station	**Program**	**PR**	**DU**	**Plant Factor**	**Soil Type**	**Slope**	**Soil Moisture**

CATCH CAN LAYOUT – TEST AREA MAP – SPRAY WORKSHEET #6

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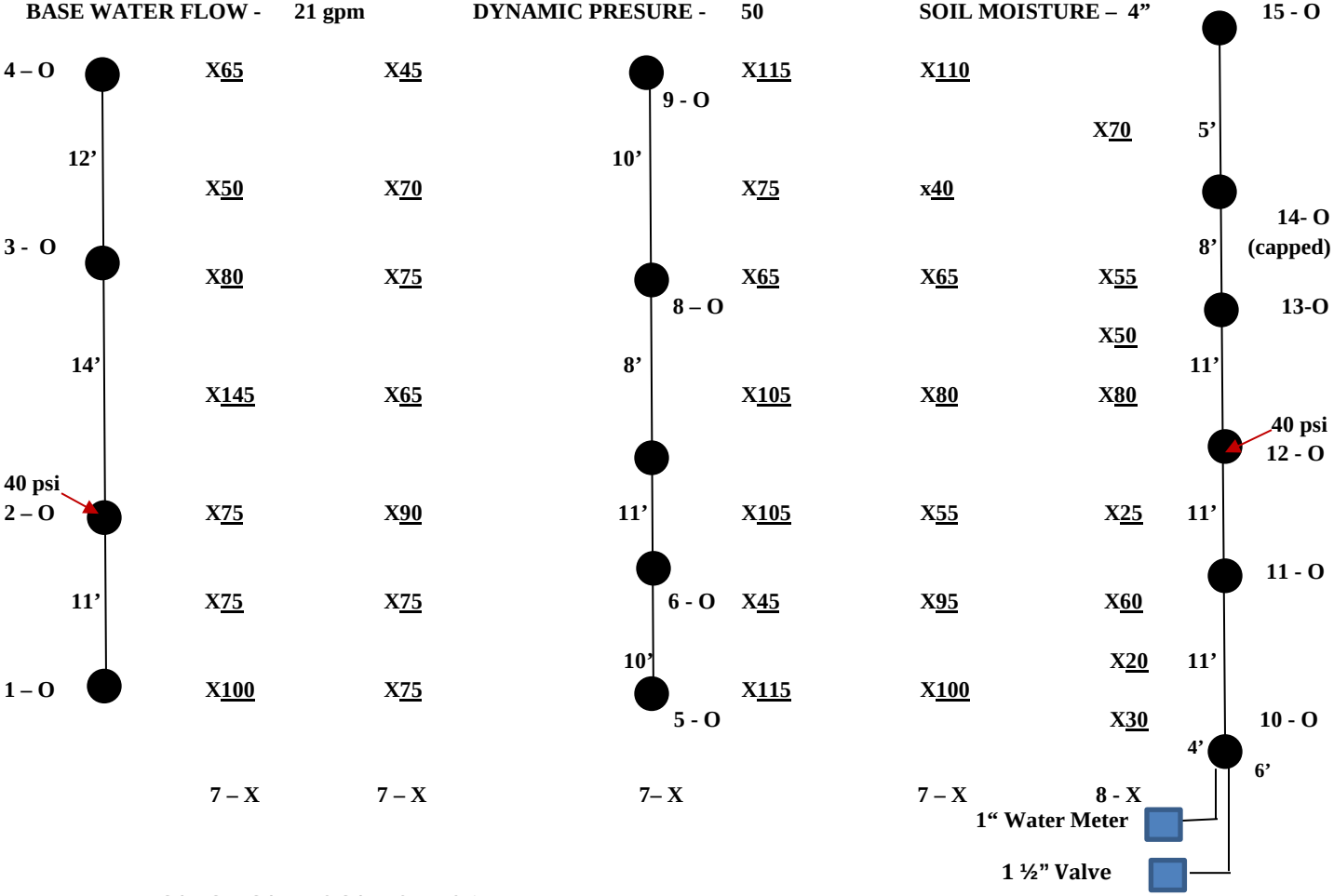
820 Sq. Ft. **CALSENSE**

Test Area/Station	TURF PROGRAM A		ZONE #22		TEMP.		
Test Run Time	8	**Min**	**Wind**	**calm**	**0 Mph**	**Pressure**	60 **psi**
Meter Start	135100		**Meter Stop**	135270		**Total**	170 Gals

****Indicate north and ALL audit area and sprinkler dimensions**
O = SPRINKLER – Record the location of each sprinkler and sprinkler spacing
X = CATCH DEVICE – Record the location of each catch device and catch amount
BASE WATER FLOW - 21 gpm
STATIC PRESSURE - 60
DYNAMIC PRESURE - 50
SOIL PROB DEPTH – 5”
ROOTS – 3.5”
THATCH – 1.5 “
OM – 2”
SOIL MOISTURE – 4”



X = CATCH CAN LOCATION 36

● = SPRINKLERS 1-15 – O

N

CATCH CAN LAYOUT – TEST AREA MAP – SPRAY WORKSHEET #6

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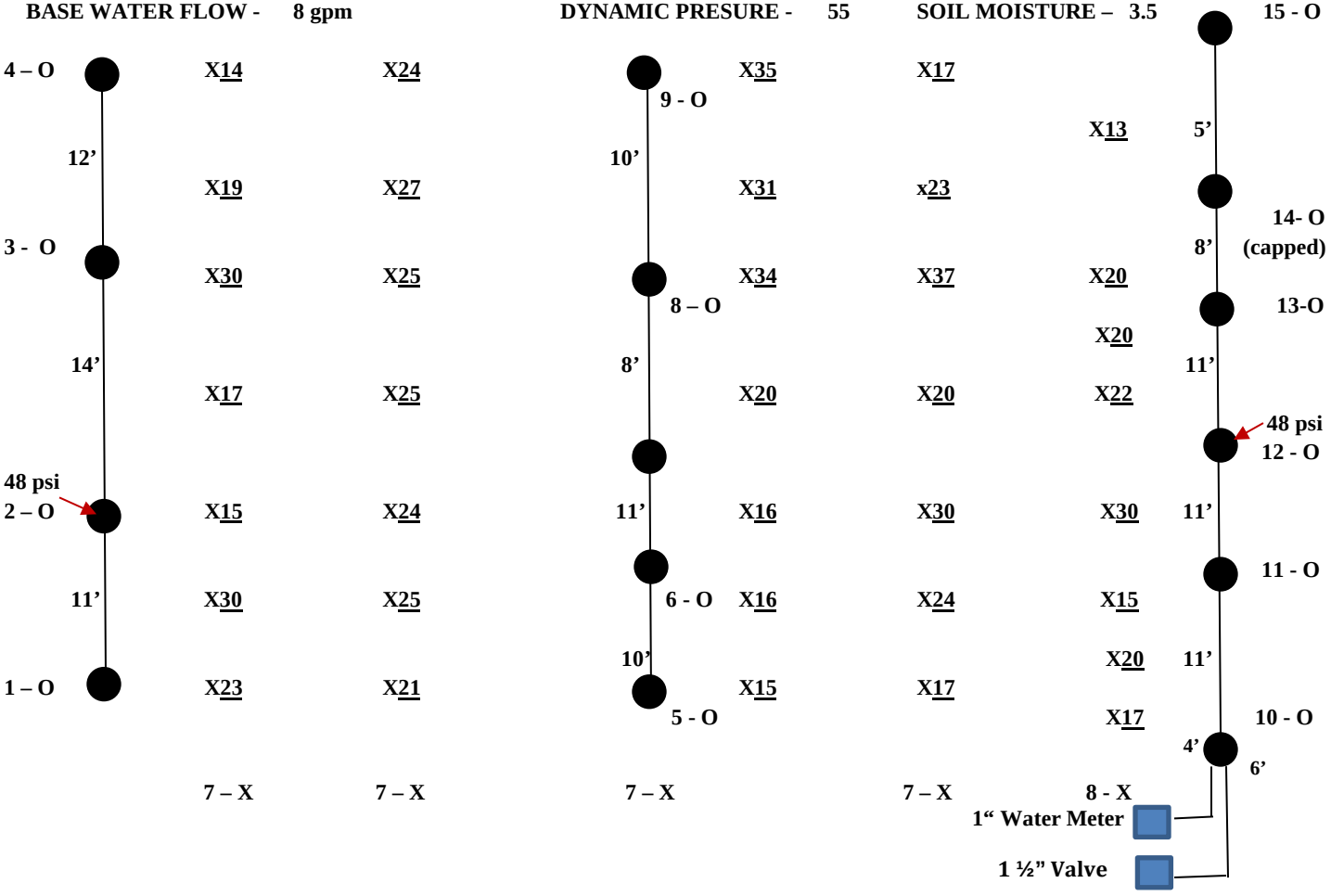
820 Sq. Ft. **CALSENSE**

Test Area/Station	TURF PROGRAM A		ZONE #22		TEMP.		
Test Run Time	8	**Min**	**Wind**	**calm**	**0 Mph**	**Pressure**	60 **psi**
Meter Start	136960		**Meter Stop**	137020		**Total**	60 gpm

****Indicate north and ALL audit area and sprinkler dimensions**
O = SPRINKLER – Record the location of each sprinkler and sprinkler spacing
X = CATCH DEVICE – Record the location of each catch device and catch amount

BASE WATER FLOW - 8 gpm
STATIC PRESSURE - 60
DYNAMIC PRESURE - 55

SOIL PROB DEPTH – 5”
ROOTS – 3.5”
THATCH – 1.5”
OM – 2”
SOIL MOISTURE – 3.5



X = CATCH CAN LOCATION 36

● = SPRINKLERS 1-15 - O

N

SPRINKLER MEASUREMENTS – TEST AREA MAP – SPRAY WORKSHEET #6

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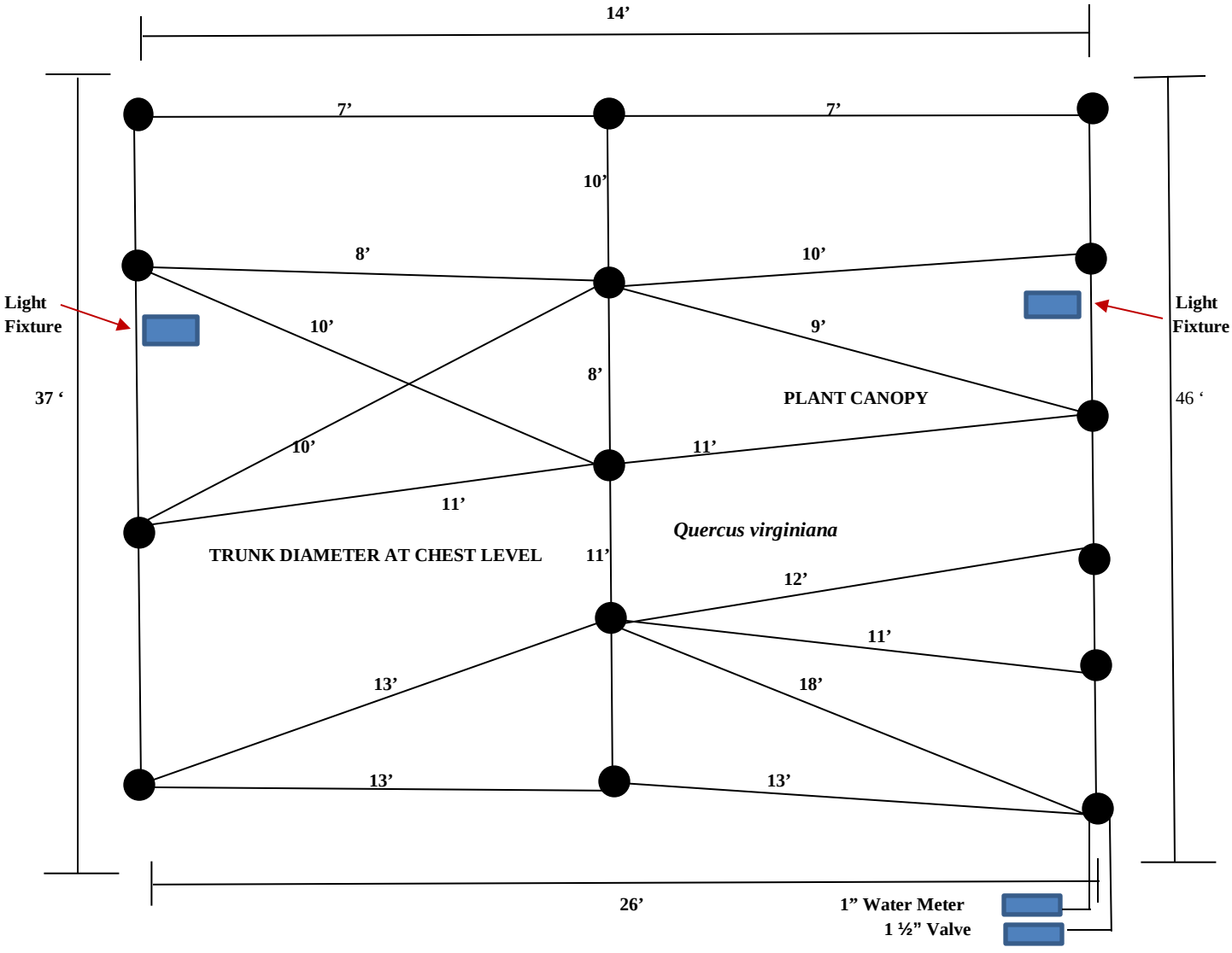
820 Sq. Ft. **CALSENSE**

Test Area/Station	TURF PROGRAM A		ZONE #22		TEMP.		
Test Run Time		**Min**	**Wind**		**Mph**	**Pressure**	**psi**
Meter Start			**Meter Stop**			**Total**	

****Indicate north and ALL audit area and sprinkler dimensions**
O = SPRINKLER – Record the location of each sprinkler and sprinkler spacing
X = CATCH DEVICE – Record the location of each catch device and catch amount



CATCH CAN TEST – SPRAY WORKSHEET #7

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Test Area/Station	N.W. LAWN/ZONE 22				
Catch Device Area (A_{CD})	16.5	$in.^2$	Test Run Time (t_R)	8	min

Catch Device Volumes: All values and calculations must be completed on this page; auditing software is not acceptable for use in determining these values.

#1	100	#13	70	#25	80	#37		#49		#61		#73	
#2	75	#14	**45**	#26	65	#38		#50		#62		#74	
#3	75	#15	115	#27	**40**	#39		#51		#63		#75	
#4	145	#16	**45**	#28	110	#40		#52		#64		#76	
#5	80	#17	105	#29	**30**	#41		#53		#65		#77	
#6	**50**	#18	105	#30	**20**	#42		#54		#66		#78	
#7	65	#19	65	#31	60	#43		#55		#67		#79	
#8	75	#20	75	#32	**25**	#44		#56		#68		#80	
#9	75	#21	115	#33	80	#45		#57		#69		#81	
#10	90	#22	100	#34	**50**	#46		#58		#70		#82	
#11	65	#23	95	#35	**55**	#47		#59		#71		#83	
#12	75	#24	55	#36	70	#48		#60		#72		#84	
Sub Total	970	**Sub Total**	990	**Sub Total**	685	**Sub Total**		**Sub Total**		**Sub Total**		**Sub Total**	

Total Catch Volume	2,645	**Total Low Quarter**	360
Average Volume	73.47	**Average Low Quarter**	40

Calculate Distribution Uniformity (show work)

$$DU_{LQ} = \frac{\text{avg catch in low quarter}}{\text{avg catch volume}}$$

$$= \frac{40 \text{ mL}}{73.47 \text{ mL}}$$

$$= 0.54$$

Calculate Net Precipitation Rate (show work)

$$PR_{net} = \frac{3.66 \times V_{avg}}{T_r \times A_{CD}}$$

$$= \frac{3.66 \times (73.47 \text{ mL})}{(8 \text{ min}) \times 16.5 \text{ in}^2}$$

$$= 2.04 \text{ in/Hr}$$

CATCH CAN TEST – SPRAY WORKSHEET #7

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Test Area/Station	N.W. LAWN/ZONE 22				
Catch Device Area (A_{CD})	16.5	in.²	Test Run Time (t_R)	8	min

Catch Device Volumes: All values and calculations must be completed on this page; auditing software is not acceptable for use in determining these values.

#1	23	#13	27	#25	20	#37		#49		#61		#73	
#2	30	#14	24	#26	37	#38		#50		#62		#74	
#3	**15**	#15	**15**	#27	23	#39		#51		#63		#75	
#4	**17**	#16	**16**	#28	17	#40		#52		#64		#76	
#5	30	#17	**16**	#29	17	#41		#53		#65		#77	
#6	19	#18	20	#30	20	#42		#54		#66		#78	
#7	**14**	#19	34	#31	**15**	#43		#55		#67		#79	
#8	21	#20	31	#32	30	#44		#56		#68		#80	
#9	25	#21	35	#33	22	#45		#57		#69		#81	
#10	24	#22	**17**	#34	20	#46		#58		#70		#82	
#11	25	#23	24	#35	20	#47		#59		#71		#83	
#12	25	#24	30	#36	**13**	#48		#60		#72		#84	
Sub Total	268	**Sub Total**	289	**Sub Total**	254	**Sub Total**		**Sub Total**		**Sub Total**		**Sub Total**	

Total Catch Volume	811	**Total Low Quarter**	138
Average Volume	22.53	**Average Low Quarter**	15.33

Calculate Distribution Uniformity (show work)

$$DU_{LQ} = \frac{\text{avg catch in low quarter}}{\text{avg catch volume}}$$

$$= \frac{15.33 \text{ mL}}{22.53 \text{ mL}}$$

$$= 0.68$$

Calculate Net Precipitation Rate (show work)

$$PR_{net} = \frac{3.66 \times V_{avg}}{T_r \times A_{CD}}$$

$$= \frac{3.66 \times (22.53 \text{ mL})}{(8 \text{ min}) \times 16.5 \text{ in}^2}$$

$$= 0.62 \text{ in/Hr}$$

SOIL MOISTURE IRRIGATION SCHEDULE – SPRAY WORKSHEET #8

Project Name	City Park	**Date**	5/23/2016
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	Plant Water Requirement	**Value**		**Units**	**Source**
A.	Hydrozone type	WST			Field observation
B.	Reference Period		1	days	
C.	Reference ET (ETo)		0.28	In.	Weather data
D.	Landscape coefficient (KL)		0.60		KT x Kd x Kmc
	1) Turf or plant factor (Kt or Kp)	0.6			Charts and tables
	2) Vegetation density factor (Kd)	1			Charts and tables
	3) Microclimate factor (Kmc)	1			Charts and tables
E.	Landscape ET (ETL)		0.17	In.	C x D
F.	Average daily ETL)		0.17	In.	E ÷ B
	Sprinkler Performance	**Value**		**Units**	**Source**
G.	Precipitation rate (PR)		2.04	In./hr	Audit or calculation
H.	Distribution uniformity (DULQ)		0.54	decimal	Audit or estimate
I.	Scheduling multiplier (SM)		1.38		Table or equation
	Soil Moisture "Bucket"	**Value**		**Units**	**Source**
J.	Soil category	Sandy Loam			Field observation
K.	Available water (AW)		0.09	In./in	Charts and tables
L.	Root zone depth		3.5	In	Field measurement
M.	Plant available water (PAW)		0.32	In.	K x L
N.	Management allowable depletion (MAD)		.50	decimal	50% for landscapes
O.	Allowable depletion (AD)		0.16	In.	M x N
	Scheduling Parameters	**Value**		**Units**	**Source**
P.	Irrigation interval		1	days	O ÷ F (round down)
Q.	Water to apply		0.17	In.	F x P
R.	Lower boundary		5	min	(Q ÷ G) x 60 (round down)
S.	Upper boundary		7	min	(R x I) (round up)
T.	**Selected Run Time**		6	min	Management decision
U.	Determine cycle starts (Choose method A or B)				
	a. Observed time to runoff		12	min	Field observation
OR	b. Site conditions		1	cycles	Based on site conditions
	1) Soil category		Coarse = 1, Medium = 2, Fine = 3		
	2) Slope		Flat = 0, Slight = 1, Moderate = 2, Steep = 3		
	3) Compaction		No = 0, Yes = 1		
	4) Sprinkler type		Rotor = 0, Spray = 1		
	Scheduling Summary	**Value**		**Units**	**Source**
	Water to be applied		0.17	In.	Line Q
	Interval		1	days	Line P
	Cycle starts per day		1		(Line T ÷ U-a or U-b) (round up)
	Minutes per cycle		6	min	Line T ÷ Cycle starts

*Must be expressed as an integer.

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	Plant Water Requirement	**Value**		**Units**	**Source**
A.	Hydrozone type	WST			Field observation
B.	Reference Period		1	days	
C.	Reference ET (ETo)		0.28	In.	Weather data
D.	Landscape coefficient (KL)		0.60		KT x Kd x Kmc
	4) Turf or plant factor (Kt or Kp)	0.6			Charts and tables
	5) Vegetation density factor (Kd)	1			Charts and tables
	6) Microclimate factor (Kmc)	1			Charts and tables
E.	Landscape ET (ETL)		0.17	In.	C x D
F.	Average daily ETL)		0.17	In.	E ÷ B
	Sprinkler Performance	**Value**		**Units**	**Source**
G.	Precipitation rate (PR)		0.62	In./hr	Audit or calculation
H.	Distribution uniformity (DULQ)		0.68	decimal	Audit or estimate
I.	Scheduling multiplier (SM)		1.24		Table or equation
	Soil Moisture "Bucket"	**Value**		**Units**	**Source**
J.	Soil category	Sandy Loam			Field observation
K.	Available water (AW)		0.09	In./in	Charts and tables
L.	Root zone depth		3.5	In	Field measurement
M.	Plant available water (PAW)		0.32	In.	K x L
N.	Management allowable depletion (MAD)		.50	decimal	50% for landscapes
O.	Allowable depletion (AD)		0.16	In.	M x N
	Scheduling Parameters	**Value**		**Units**	**Source**
P.	Irrigation interval		1	days	O ÷ F (round down)
Q.	Water to apply		0.17	In.	F x P
R.	Lower boundary		16	min	(Q ÷ G) x 60 (round down)
S.	Upper boundary		20	min	(R x I) (round up)
T.	**Selected Run Time**		16	min	Management decision
U.	Determine cycle starts (Choose method A or B)				
	c. Observed time to runoff		12	min	Field observation
OR	d. Site conditions		1	cycles	Based on site conditions
	5) Soil category		Coarse = 1, Medium = 2, Fine = 3		
	6) Slope		Flat = 0, Slight = 1, Moderate = 2, Steep = 3		
	7) Compaction		No = 0, Yes = 1		
	8) Sprinkler type		Rotor = 0, Spray = 1		
	Scheduling Summary	**Value**		**Units**	**Source**
	Water to be applied		0.17	In.	Line Q
	Interval		1	days	Line P
	Cycle starts per day		2		(Line T ÷ U-a or U-b) (round up)
	Minutes per cycle		8	min	Line T ÷ Cycle starts

*Must be expressed as an integer.

PROCEDURAL STEPS FOR A WATER AUDIT CONDUCTED BY WBA STAFF

Preparing the Test Area Data and Map

Measuring Area for Placement of Catch Cans

Placement of catch cans

Pressure Gauge

Water Meter

Irrigation

Measuring catch can water

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COMPREHENSIVE SOIL ANALYSIS

Sample Description - Sample ID	Half Sat % / TEC	pH / Qual Lime	ECe dS/m	NO_3-N ppm	NH_4-N ppm	PO_4-P ppm	K ppm	Ca ppm	Mg ppm	Cu ppm	Zn ppm	Mn ppm	Fe ppm	Organic % dry wt.	Lab No.
	Sufficiency Factors														
Site Soil	22	7.1	1.2	54	6	43	158	1353	134	2.2	9.3	4	48		07897
	80	None		1.4		1.6	1.1	1.0	0.7	2.1	2.3	0.4	1.2		

Saturation Extract Values						SAR	Gravel %		Percent of Sample Passing 2 mm Screen					USDA Soil Classification	Lab No.
									Sand			Silt	Clay		
Ca meq/L	Mg meq/L	Na meq/L	K meq/L	B ppm	SO_4 meq/L		Coarse 5 - 12	Fine 2 - 5	Very Coarse 1 - 2	Coarse 0.5 - 1	Med. to Very Fine 0.05 - 0.5	.002-.05	0-.002		
7.7	1.7	3.7	0.5	0.08	2.9	1.7	4.8	7.3	8.5	16.2	51.6	17.8	5.8	Loamy Sand	07897

Infiltration Rate = .46 inches/hour

Very Slow	<0.06
Slow	0.06 – 0.20
Moderately Slow	0.20 – 0.60
Moderate	0.60 – 2.00
Moderately Rapid	2.00 – 6.00
Rapid	6.00 – 20.00
Very Rapid	>20.00

Sufficiency factor (1.0=sufficient for average crop) below each nutrient value. N factor based on 200 ppm constant feed. SAR = Sodium adsorption ratio. Half Saturation %=approx field moisture capacity. Nitrogen(N), Potassium(K), Calcium(Ca) and Magnesium(Mg) by sodium chloride extraction. Phosphorus(P) by sodium bicarbonate extraction. Copper(Cu), Zinc(Zn), Manganese(Mn) & Iron(Fe) by DTPA extraction. Sat. ext. method for salinity (ECe as dS/m),Boron (B), Sulfate(SO_4), Sodium(Na). Gravel fraction expressed as percent by weight of oven-dried sample passing a 12mm(1/2 inch) sieve. Particle sizes in millimeters. Organic percentage determined by Walkley-Black or Loss on Ignition.

* LOW , SUFFICIENT , HIGH

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IRRIGATION WATER

Sample Id : **Water**

CATIONS		mg/L	meq/L
Sodium	Na	31	1.35
Calcium	Ca	48	2.40
Magnesium	Mg	11	0.91
Potassium	K	3	0.08
Ammonium	NH_4	0	0.00
	NH_4 - N	0	
SUM OF CATIONS			**4.74**

ANIONS		mg/L	meq/L
Chloride	Cl	41	1.15
Sulfate	SO_4	91	1.90
	S	30	
Bicarbonate	HCO_3	126	2.07
Carbonate	CO_3	0	0.00
Nitrate	NO_3	22	0.35
	NO_3 - N	5	
Phosphate	PO_4	2	0.06
	P	1	
SUM OF ANIONS			**5.53**

Hydrogen Ion Activity	pH	7.5	
Equilibrium Reaction	pHc	6.43	
Electrical Conductivity	ECw	0.50	dS/m
Total Dissolved Solids	TDS	320	mg/L
Adj Na Adsorption Ratio	SARadj	1.08	
Sodium Adsorption Ratio	SAR	1.05	

Copper	Cu	0.06	mg/L
Zinc	Zn	0.05	mg/L
Manganese	Mn	0.01	mg/L
Iron	Fe	0.42	mg/L
Boron	B	0.14	mg/L
Fluoride	F	0.27	mg/L
Aluminum	Al	0.47	mg/L
Molybdenum	Mo	0.04	mg/L

mg/L = parts per million parts water meq/L - milliequivalents per liter
TDS calculated by ECw * 640

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IRRIGATION WATER

Sample Id : **Water**

WATER ANALYSIS INTERPRETATION, AGRICULTURAL

Potential Problem	Units	Test Result	Degree of Restriction on Use					
			Criteria			Graphical Results		
			None	Slight to Moderate	Severe	None	Slight to Moderate	Severe
Salinity								
ECw[1]	dS/m	0.50	< 0.7	0.7 - 3	> 3			
Specific Ion Toxicity								
Sodium (Na)[1]								
Surface irrigation	SARadj	1.08	< 3	3 - 9	> 9			
Sprinkler irrigation[2]	meq/L	1.35	< 3	3 - 6	> 6			
Chloride (Cl)[1]								
Surface irrigation	meq/L	1.15	< 4	4 - 10	> 10			
Sprinkler irrigation[2]	meq/L	1.15	< 3	3 - 5	> 5			
Boron (B)[1]	mg/L	0.14	< 0.7	0.7 - 3	> 3			
Fluoride (F)[1]	mg/L	0.27	< 1	1 - 5	> 5			
Clogging of Drip Systems or Unsightly Residues								
Iron (Fe)[3]	mg/L	0.42	< 0.3	0.3 - 1.5	> 1.5			
Manganese (Mn)[3]	mg/L	0.01	< 0.2	0.2 - 1.5	> 1.5			
pH - pHc[4]		1.07	<= 0	> 0				
Reduced Water Infiltration[5] **(Based on ECw and SAR values)**		2.16	< 4	4 - 10	> 10			
Alkalinity								
Bicarbonate (HCO3)[6]	meq/L	2.07	< 2	2 - 8.5	> 8.5			
Potential Low Nutrient Issues (Soilless media)[7]								
Sulfur	mg/L	30	> 48	48 - 20	< 20			
Magnesium	mg/L	11	> 10	10 - 4	< 4			
Boron	mg/L	0.14	> 0.3	0.3 - 0.05	< 0.05			

1. Crop tolerance to salinity, sodium, chloride, boron and fluoride varies widely. Most tree crops are sensitive to sodium and chloride while many annual crops are not. Soil conditions, irrigation method and climate must be considered.
2. Leaf burn from foliar and root absorption will be enhanced under conditions of : low humidity, high temperature and high air movement .
3. Elevated iron in combination with sulfides or tannins can result in bacterial slimes that can clog drip systems. Removal of iron and manganese often involves oxidation (aeration or chlorination) followed by filtering.
4. Positive pH - pHc (saturation index) values indicate the potential for calcium and magnesium carbonate precipitates that might impair efficiency of irrigation systems with small orificed parts and/or may leave unsightly lime deposits on leaves. Problems can be reduced by mineral acid addition.
5. Infiltration problems are most likely when water with low ECw and/or high SAR adj. is used on mineral soils containing some silt and clay. Evaluation of infiltration problems should include analysis of both irrigation water and soil-water extracts. Treatment may involve injecting gypsum into the water or applying gypsum to the soil surface.
6. Bicarbonate when excessive may result in difficulty in controlling soil pH and may impair root assimilation of minor elements.
7. Sulfur, magnesium and /or boron may become limiting if not supplied by soil or fertilizer. Use soil and leaf analysis to confirm need.

Comments :