EBMUD Landscape Advisory Committee

General Meeting

with feature presentation on

Finding Irrigation Leaks

Lindsay Kinsler and Kristin Bowman

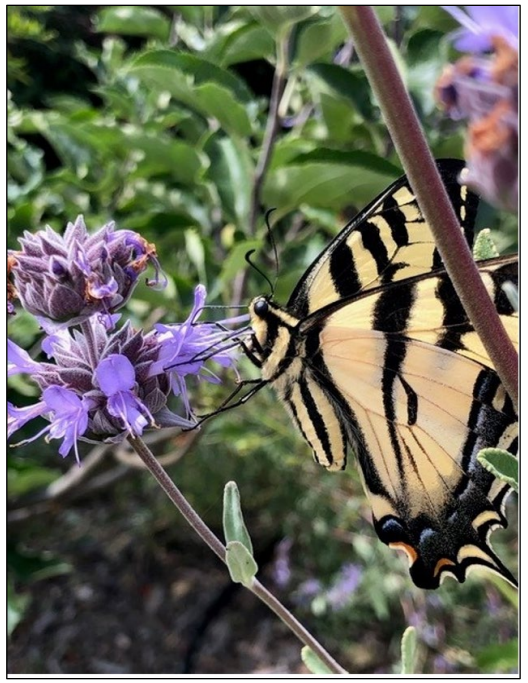
EBMUD Water Conservation Division

May 22, 2024

Announcements

Upcoming events

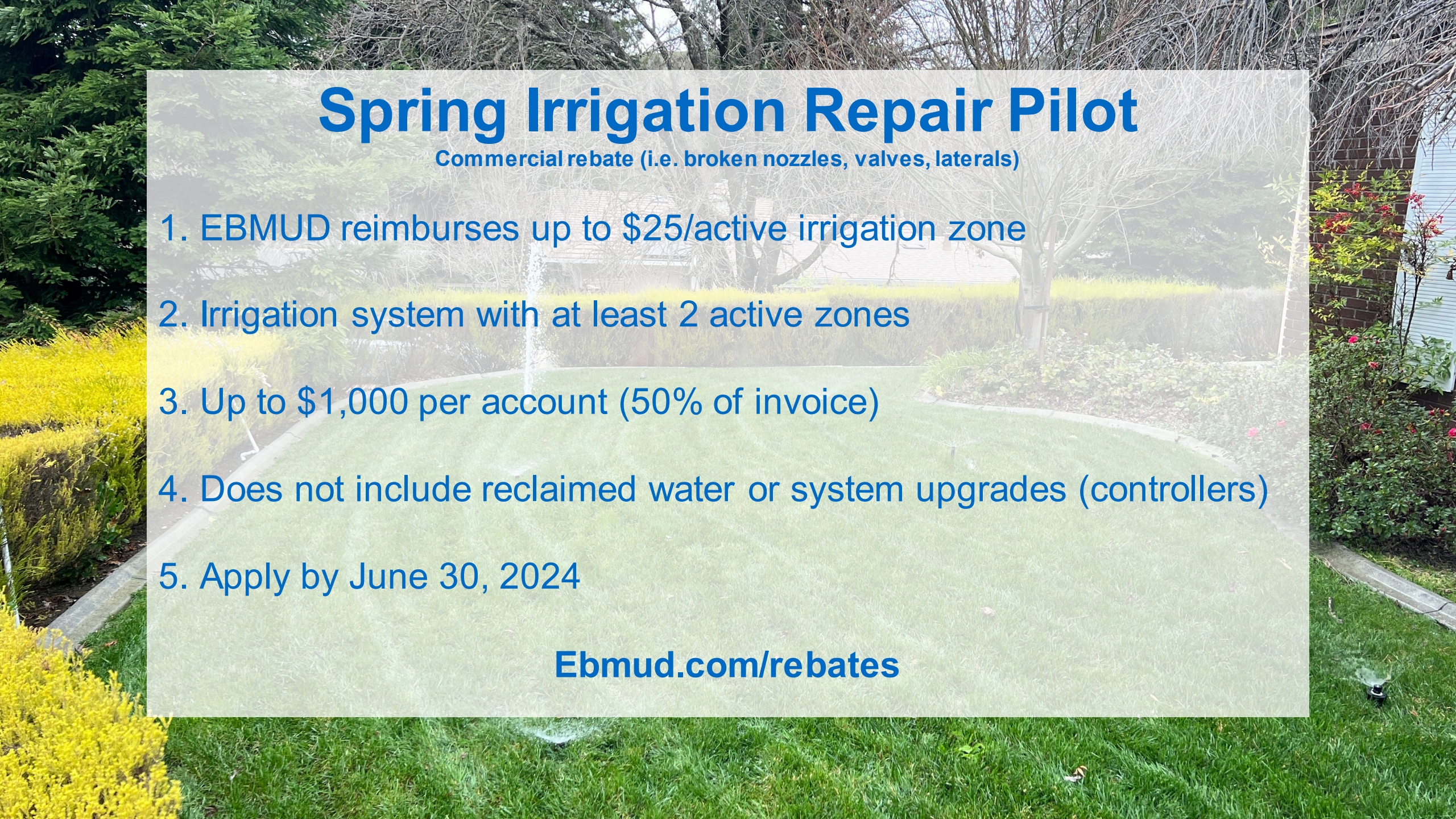
- June 1, City of Lafayette Sheet Mulching Workshop (9:30am -11:30am)
- June 6, Irrigation Leak Detection In-Person Workshop (10am-12:15pm), Walnut Creek
- July 26, Pacific Horticulture Futurist Design Awards application due
- Sept 10, CNPS Landscaper Certification Program (Spanish) nine-session course
- Sept 12, ReScape New Heat Qualification Training



Lawn Conversion Payback calculator – coming soon!
CalScape 2.0 - Upload nursery and landscape professional profiles

Landscape rebates

- **New -** All rebates issued as a check
- **New** - Up to $20,000 for commercial properties
- **New -** Irrigation Flow Sensor rebate – up to $250
- **New** – Spring Irrigation Repair



Spring Irrigation Repair Pilot

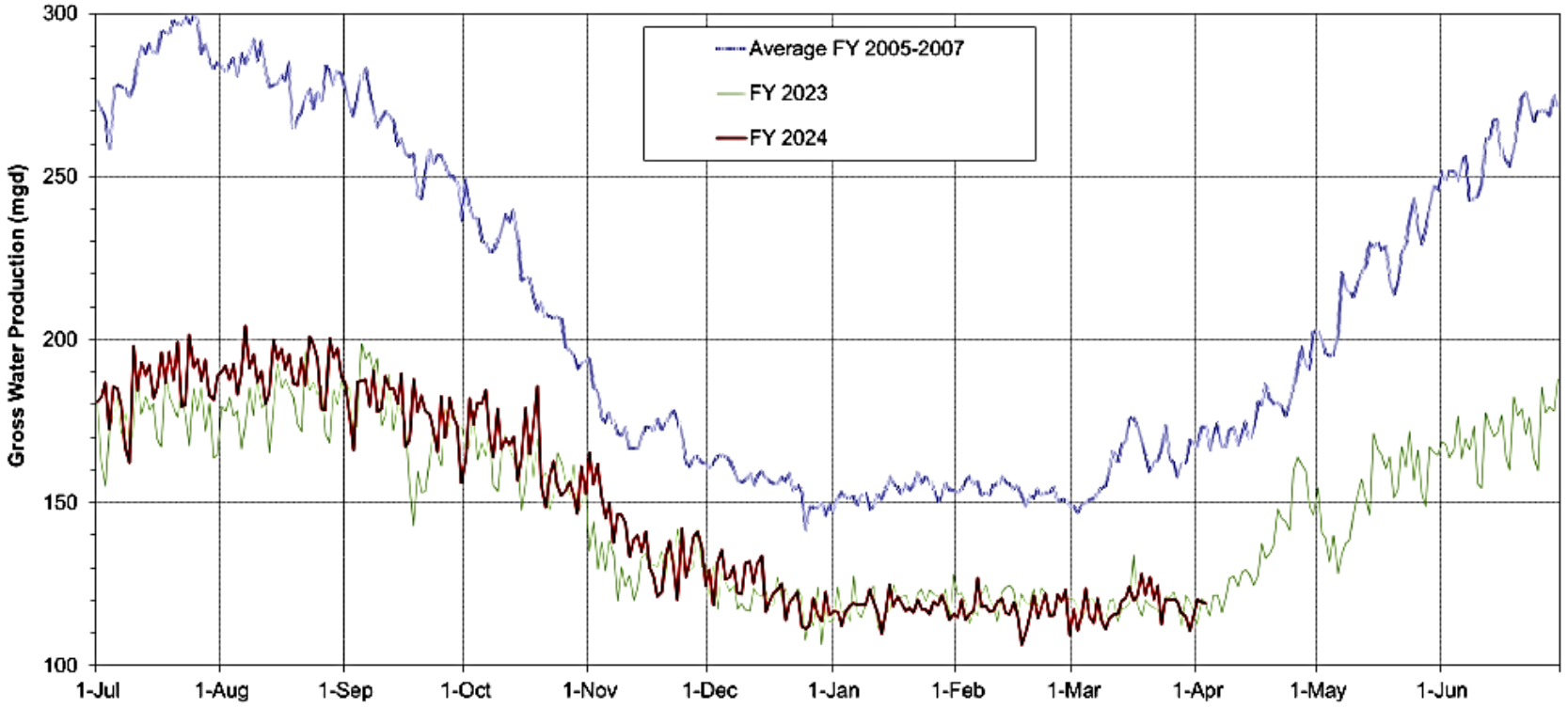
Commercial rebate (i.e. broken nozzles, valves, laterals)

1. EBMUD reimburses up to $25/active irrigation zone
2. Irrigation system with at least 2 active zones
3. Up to $1,000 per account (50% of invoice)
4. Does not include reclaimed water or system upgrades (controllers)
5. Apply by June 30, 2024

Ebmud.com/rebates

EBMUD Water Supply Update

- Storage: 94% full; 112% percent of average
- Precipitation levels: Mokelumne River Watershed 90% of average. Total System Demand: 161 MGD
- Statewide drought emergency (2022) still in place through June 2024.
  Prohibits irrigating commercial non-functional turf with drinking water.
- AB 1572 – permanently prohibits watering non-functional turf starting with municipalities in 2027.



Water Conservation Culture

Small changes, big splash

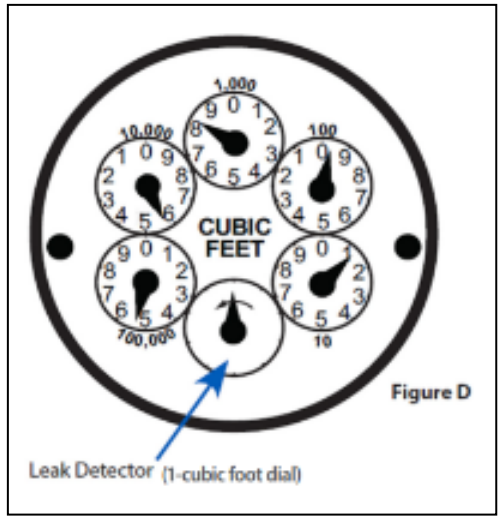
Overview – Finding Irrigation Leaks

- Meter reading and flow rates: Standard and Automatic Metering Infrastructure (AMI)
- Interpreting AMI data to find leaks
- Irrigation Zone – designed vs actual flow rate
- Leak detection tools
- Steps to detect leaks
- Case studies
- Summary
- Trivia & Dopamine
- Q and A

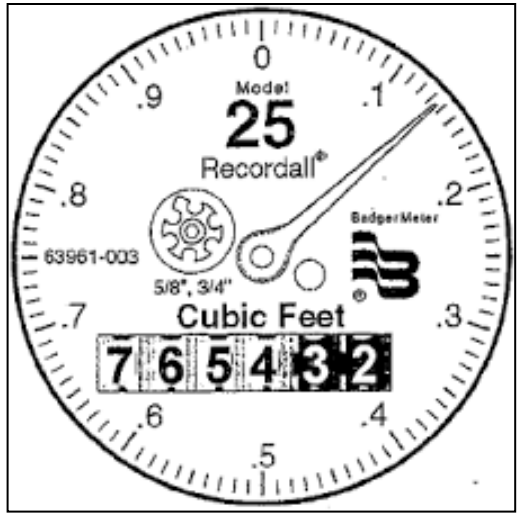
Meter Basics - How to Read

- Records how much water you use.
- Four types of registers: round dial, digital, solid state, compound.

Round Dial
Read is 55891.0



Digital Read is 765432.135

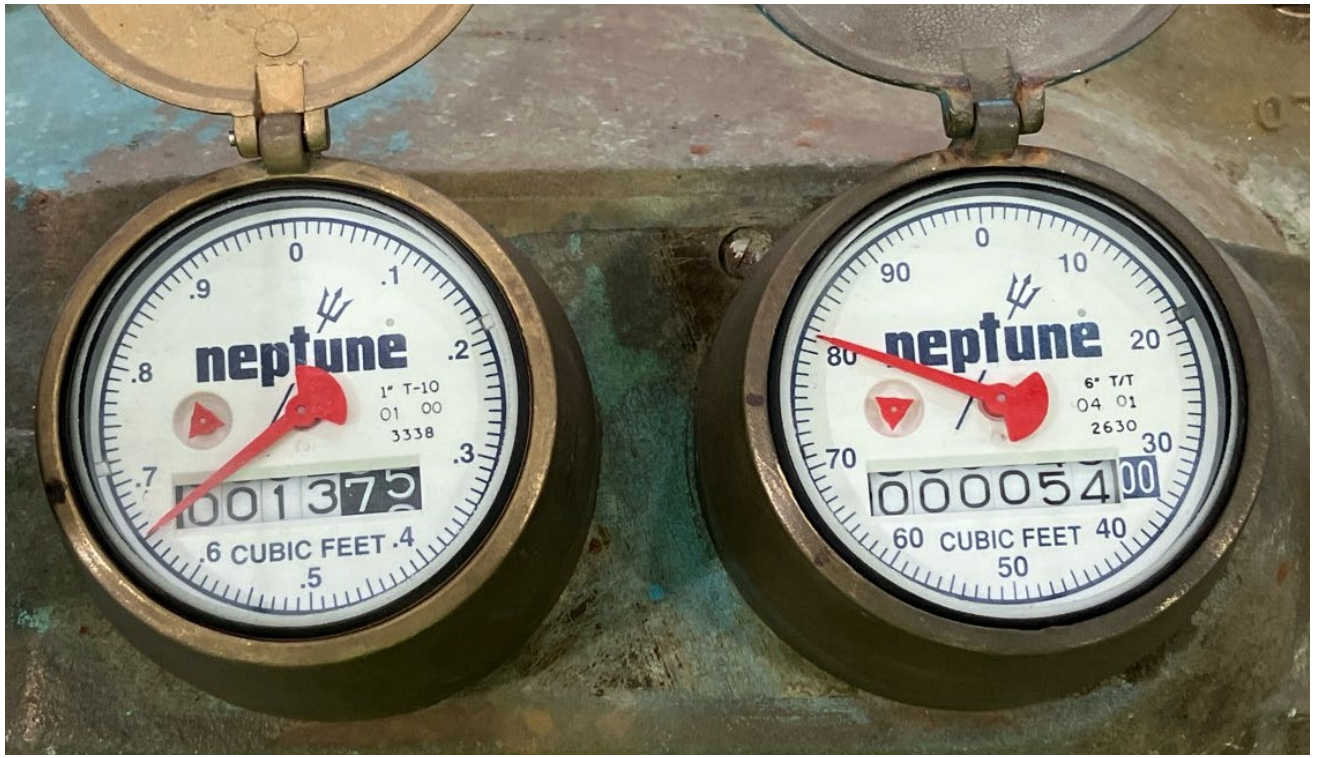


LCD Read is 008116.935

Compound Meters - How to Read

Small Dial Read is 001375.65

Large Dial Read is 000005481.5



Calculating GPD Flow Rate From Meter Reading

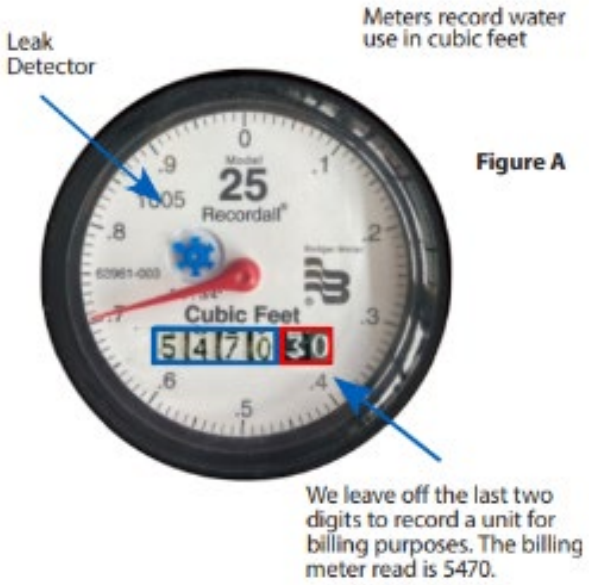


Figure A

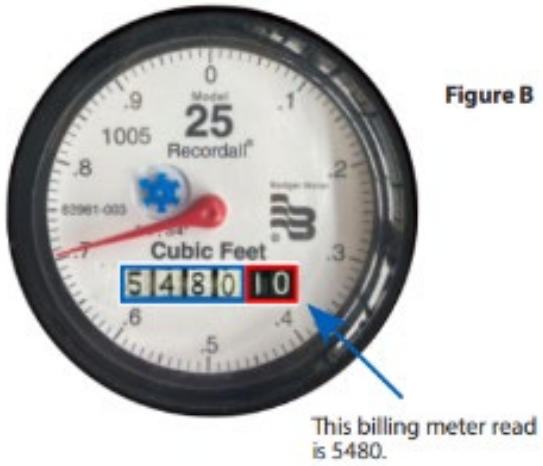


Figure B

21 days later

1) Write down numbers on meter dial

- Fig A: 547030, Fig B:548010

2) Subtract first reading from second

- 548010 - 547030= 980 cubic feet (cf)

3) Convert to gallons

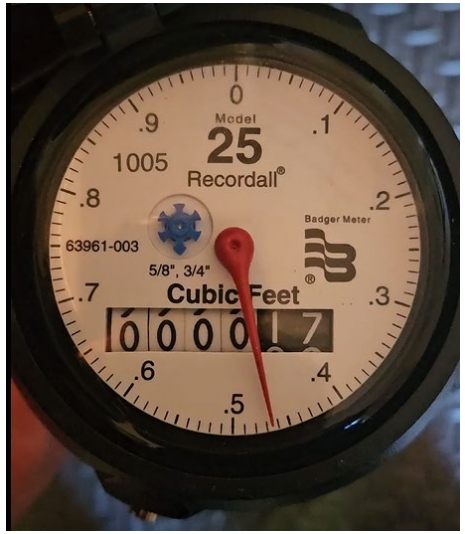
- 980 cf x 7.48 = 7,330 gallons (gal)

4) Determine gallons used by dividing the total gallons used by the time between readings

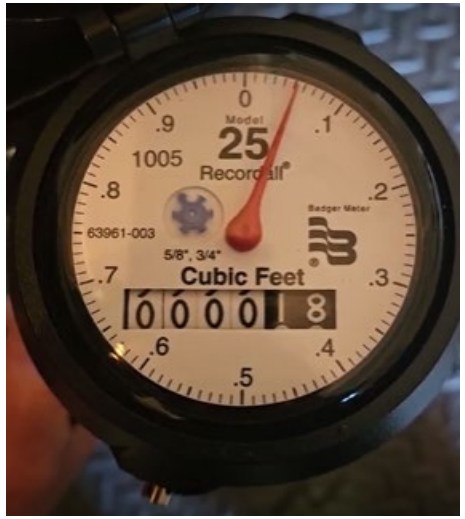
- Example above 21 days between readings: 7,330 gal/21 days = 349 gallons per day (gpd)

What is the GPM Flow Rate for this meter?

Start read



End read



Meter starting read 000017.46 CF

Meter ending read 000018.05 CF

Consumption (18.05-17.46) = 0.59 CF

0.59CF X 7.48 gal/CF = 4.41 gallons (gal)

Run time 32 Seconds (sec)

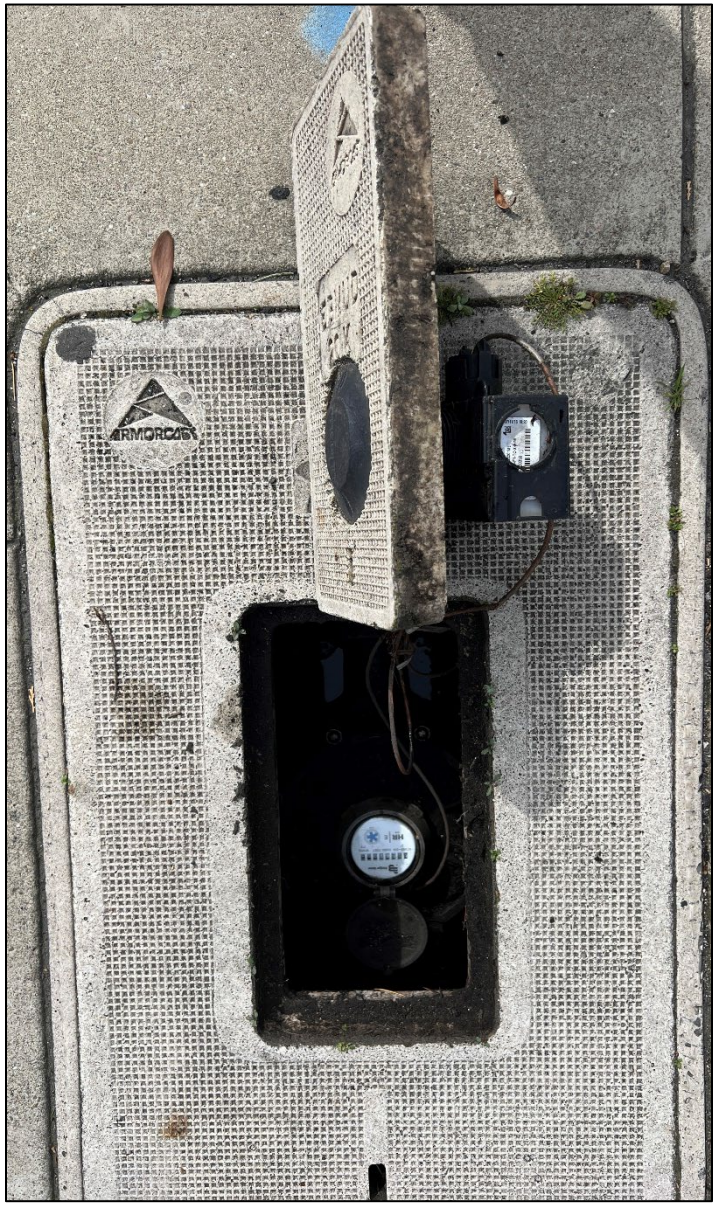
Flow rate 4.41 gal/ (32 sec) = 0.138 gal/sec

0.138 gal/sec * 60 sec/Minute =
8.28 gallons per minute (GPM)

(CF) X 7.48 X 60/(sec) = GPM

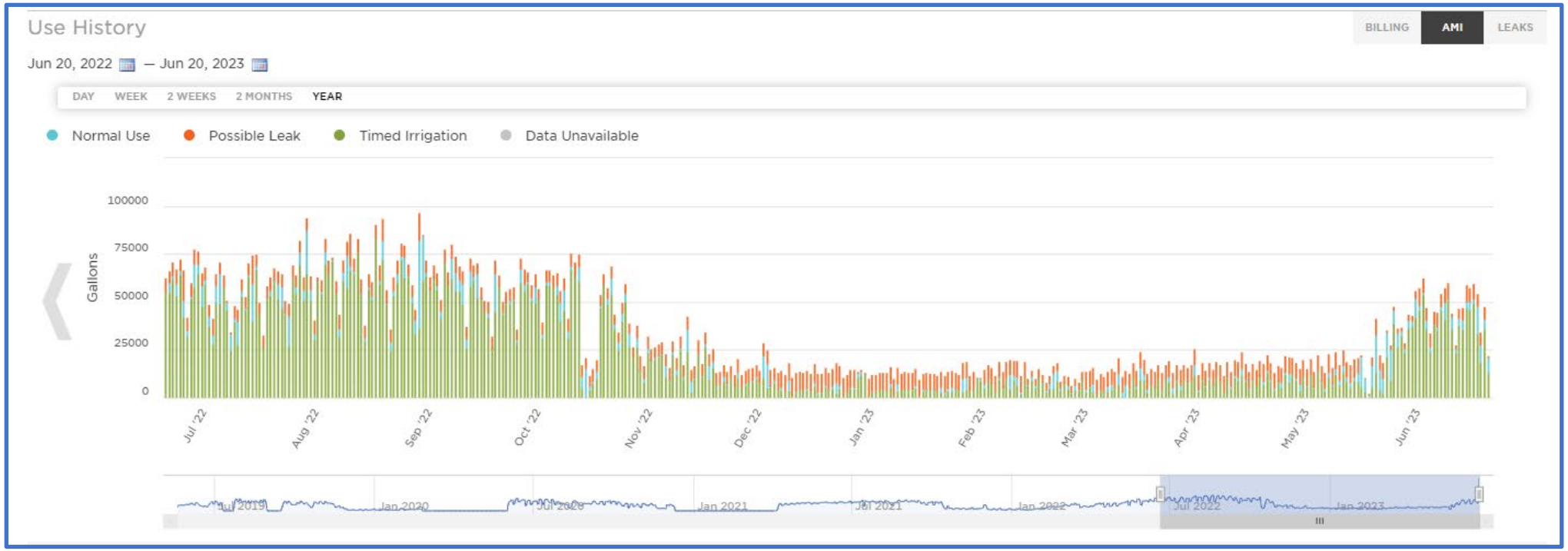
AMI Meter Basics – Online Water Use Data

- **AMI** stands for **Advanced Metering Infrastructure**
- Uses electronic communication to read meters remotely
- Helps identity leaks as soon as the begin
- Additional computer algorithms designed to find leaks
- Ability to observe unexpected or problematic use
- Provides automated alerts and bill forecasting
- My Water Report - EBMUD online portal



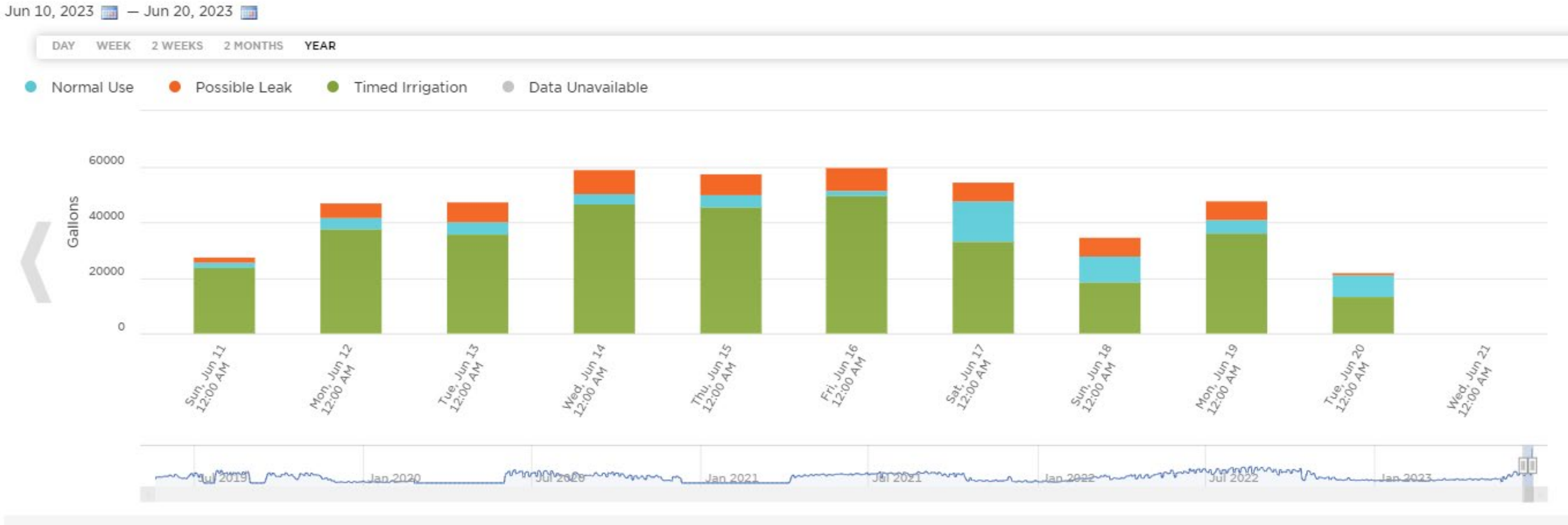
What Does AMI Provide?

- Hourly, Daily, Monthly and Yearly Data
- Identification of continuous use, irrigation use, and/or high daily use
- Ability to observe unexpected or problematic use
- Automated alerts and bill forecasting



Breakdown of Usage Type – 2-week period

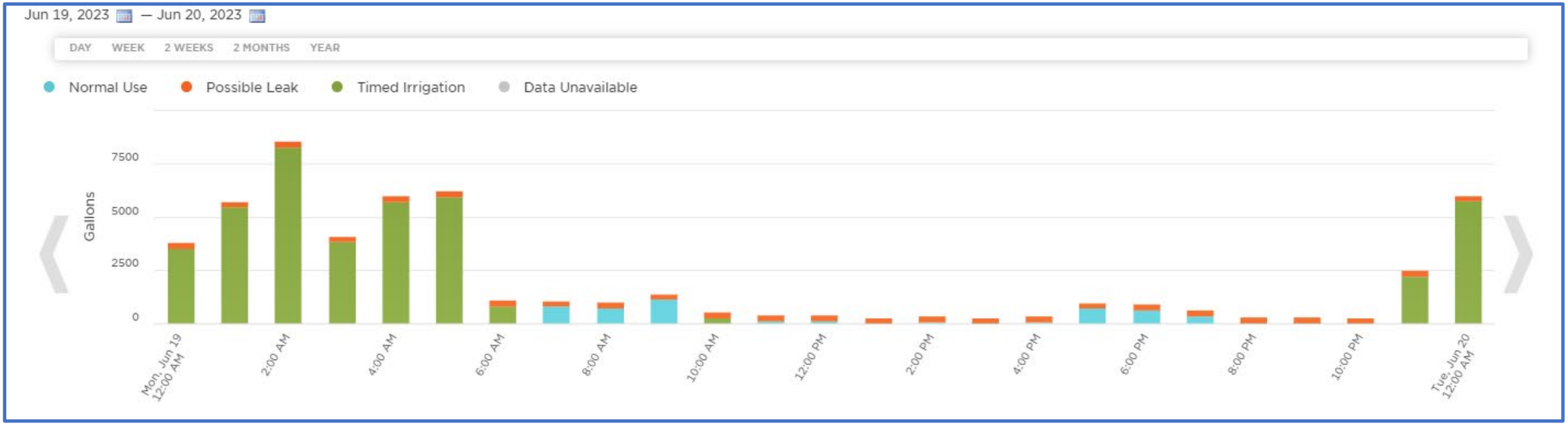
Multi-use account



Why is AMI Useful to Find Big Leaks?

- Easier to understand water usage, leaks vs. expected use
- Additional computer algorithms designed to find leaks
- Easier to communicate why you think there is a leak
- Identify start, stop and flow rate of leak
- Leaks can be long term and slowly grow
- Alerts if new leaks begin or existing leaks get worse
- Establish goodwill with staff and customers

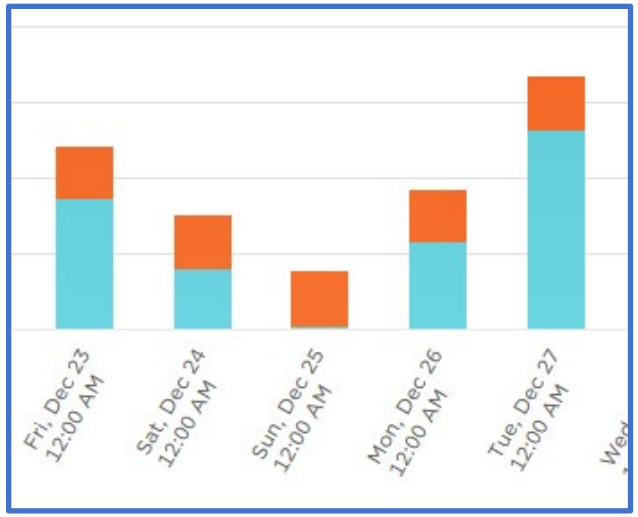
Finding Leaks Using AMI – hourly water use data



Leaks are identified by continuous use, or use when you don't expect it

Questions to Ask?

- Should there be 24-hour usage the same every day or could there be a leak?
- Is there a day where usage should be low, or they don't irrigate? Do we see usage on Christmas and July 4th?
- Why winter is as high as summer use?
- Does the usage match the irrigation budget/expected usage?
- How much is usage trending up?
- Were there previous leaks on site?



Test Your Knowledge

Questions

and

Time to get your calculator

Irrigation Zone Flow - Designed Flow Rate/Emitter

8 Series MPR

10° Trajectory

Nozzle	Pressure psi	Radius ft.	Flow gpm	■ Precip In/h	▲ Precip In/h
8F	15	5	0.74	2.85	3.29
	20	6	0.86	2.30	2.66
	25	7	0.96	1.89	2.18
	30	8	1.05	1.58	1.82
8H	15	5	0.37	2.85	3.29
	20	6	0.42	2.25	2.59
	25	7	0.47	1.85	2.13
	30	8	0.52	1.56	1.81
8Q	15	5	0.18	2.77	3.20
	20	6	0.21	2.25	2.59
	25	7	0.24	1.89	2.18
	30	8	0.26	1.56	1.81

Standard Nozzle

Inline Drip

TECHLINE CV® General Guidelines

	TURF												SHRUB AND GROUND COVER											
	Clay Soil			Loam Soil			Sandy Soil			Coarse Soil			Clay Soil			Loam Soil			Sandy Soil			Coarse Soil		
Emitter Flow	0.26 GPH			0.4 GPH			0.6 GPH			0.9 GPH			0.26 GPH			0.4 GPH			0.6 GPH			0.9 GPH		
Emitter Interval	18"			12"			12"			12"			18"			18"			12"			12"		
Lateral (Row) Spacing	18"	20"	22"	18"	20"	22"	12"	14"	16"	12"	14"	16"	18"	21"	24"	18"	21"	24"	16"	18"	20"	16"	18"	20"
Burial Depth	Bury evenly throughout the zone from 4" to 6"												On-surface or bury evenly throughout the zone to a maximum of 6"											
Application Rate (inch/hour)	0.19	0.17	0.15	0.30	0.27	0.25	0.98	0.84	0.73	1.48	1.27	1.11	0.19	0.16	0.14	0.30	0.26	0.23	0.73	0.65	0.59	1.11	0.99	0.89
Time to Apply ½" of Water (minutes)	80	89	97	50	55	61	15	18	20	10	12	13	80	93	106	50	58	66	20	23	26	13	15	17

Following these maximum spacing guidelines, emitter flow selection can be increased if desired by the designer. 0.9 GPH flow rate available for areas requiring higher infiltration rates, such as coarse sandy soils.
NOte: 0.4, 0.6, and 0.9 GPH are nominal flow rates. Actual flow rates used in the calculations are 0.42, 0.61, and 0.92 GPH.

MP ROTATOR PERFORMANCE DATA

MP1000
Radius: 8' to 15'
Adjustable Arc and Full-Circle
Maroon: 90° to 210°
Lt. Blue: 210° to 270°
Olive: 360°

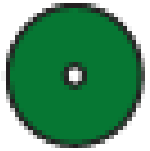
Arc	Pressure PSI	Radius ft.	Flow GPM	Flow GPH	Precip in/hr ■	Precip in/hr ▲
90°	25	--	--	--	--	--
	30	12	0.17	10.2	0.45	0.52
	35	13	0.19	11.4	0.43	0.50
	40	14	0.21	12.6	0.41	0.48
	45	14	0.23	13.8	0.45	0.52
	50	15	0.25	15.0	0.43	0.49
	55	15	0.27	16.2	0.46	0.53
180°	25	--	--	--	--	--
	30	12	0.34	20.4	0.45	0.52
	35	13	0.38	22.8	0.43	0.50
	40	14	0.42	25.2	0.41	0.48
	45	14	0.44	26.4	0.43	0.50
	50	15	0.50	30.0	0.43	0.49
	55	15	0.51	30.6	0.44	0.50
210°	25	--	--	--	--	--
	30	12	0.40	24.0	0.46	0.53
	35	13	0.45	27.0	0.44	0.51
	40	14	0.49	29.4	0.41	0.48
	45	14	0.51	30.6	0.43	0.50
	50	15	0.57	34.2	0.42	0.48
	55	15	0.59	35.4	0.43	0.50
270°	25	--	--	--	--	--
	30	12	0.48	28.8	0.43	0.49
	35	13	0.53	31.8	0.40	0.46
	40	14	0.63	37.8	0.41	0.48
	45	14	0.67	40.2	0.44	0.51
	50	15	0.72	43.2	0.41	0.47
	55	15	0.75	45.0	0.43	0.49
360°	25	--	--	--	--	--
	30	12	0.69	41.4	0.46	0.53
	35	13	0.77	46.2	0.44	0.51
	40	14	0.84	50.4	0.41	0.48
	45	14	0.88	52.8	0.43	0.50
	50	15	0.98	58.8	0.42	0.48
	55	15	1.01	60.6	0.43	0.50

High Efficiency Nozzle

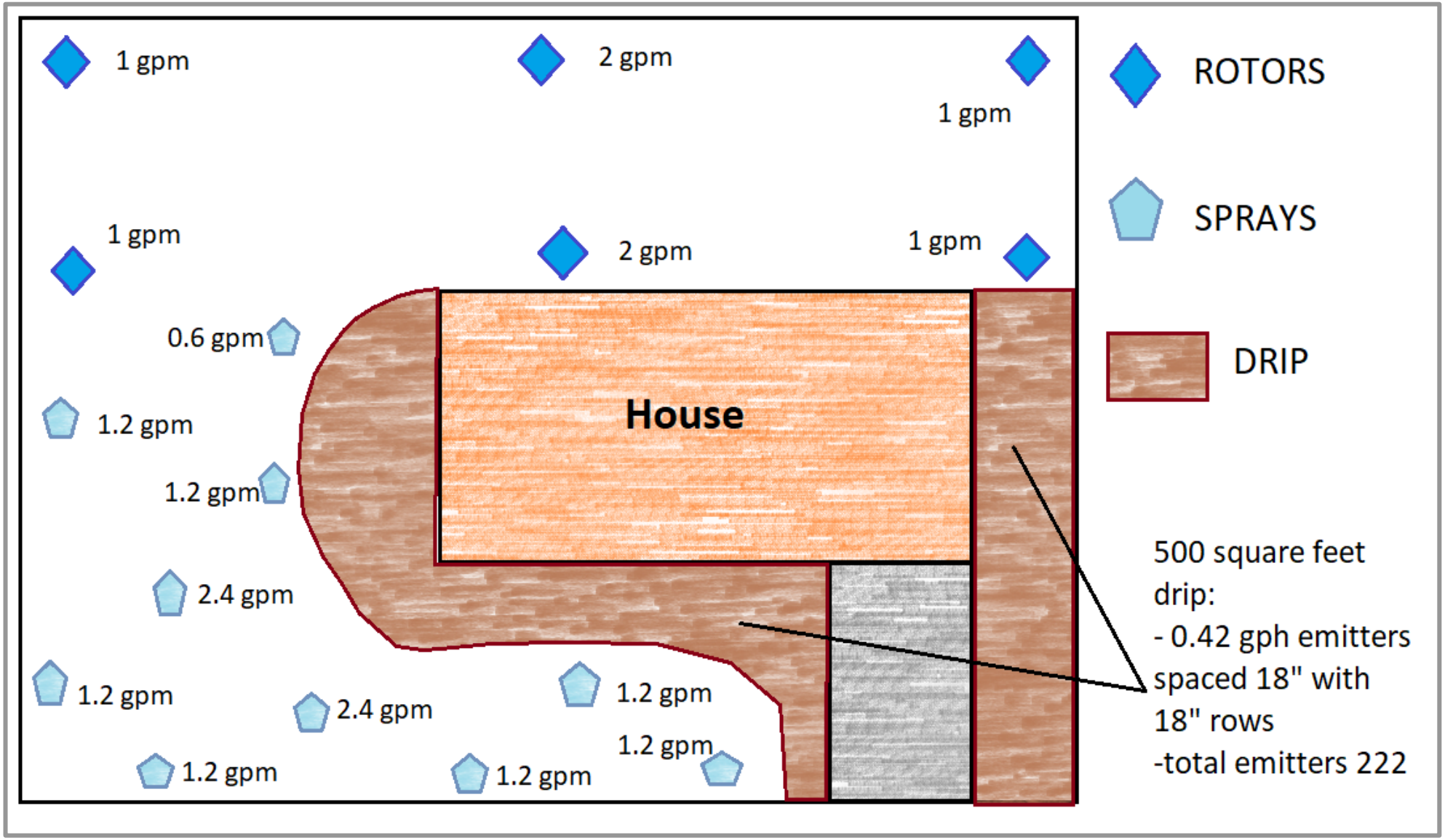
Irrigation Zone Flow- Designed Flow Rate

8 Series MPR

10° Trajectory

Nozzle	Pressure psi	Radius ft.	Flow gpm	Precip In/h	Precip In/h
8F 	15	5	0.74	2.85	3.29
	20	6	0.86	2.30	2.66
	25	7	0.96	1.89	2.18
	30	8	1.05	1.58	1.82
8H 	15	5	0.37	2.85	3.29
	20	6	0.42	2.25	2.59
	25	7	0.47	1.85	2.13
	30	8	0.52	1.56	1.81
8Q 	15	5	0.18	2.77	3.20
	20	6	0.21	2.25	2.59
	25	7	0.24	1.89	2.18
	30	8	0.26	1.56	1.81

Irrigation Zone Flow Rate - Exercise



Zone 1: Rotors

What is the total designed flow rate for this zone?

8 gallons per minute

Zone 2: Sprays

What is the total designed flow rate for this zone?

13.8 gallons per minute

Zone 3: Drip

What is the total designed flow rate for this zone?

1.55 gallons per minute

Actual vs. Designed Irrigation Flow Rates

Find the actual zone flow:

Flow rate formula: **cubic feet (cf) x 7.48 x 60/seconds = GPM**

Using the flow rate formula calculate the existing flow rate for each zone:

Zone	Start (cf)	Stop (cf)	Consumption (cf)	Time (secs)	GPM
1	1001564.1	1001565.8	1.7	90	8.5
2	1001565.8	1001571.4	5.6	90	27.9
3	1001571.4	1001572.9	1.5	600	1.12

Now compare the designed flow versus the actual flow

Zone	Design (gpm)	Actual (gpm)	Status
1	8	8.5	Good
2	13.8	27.9	Leak present
3	1.55	1.12	Low flow

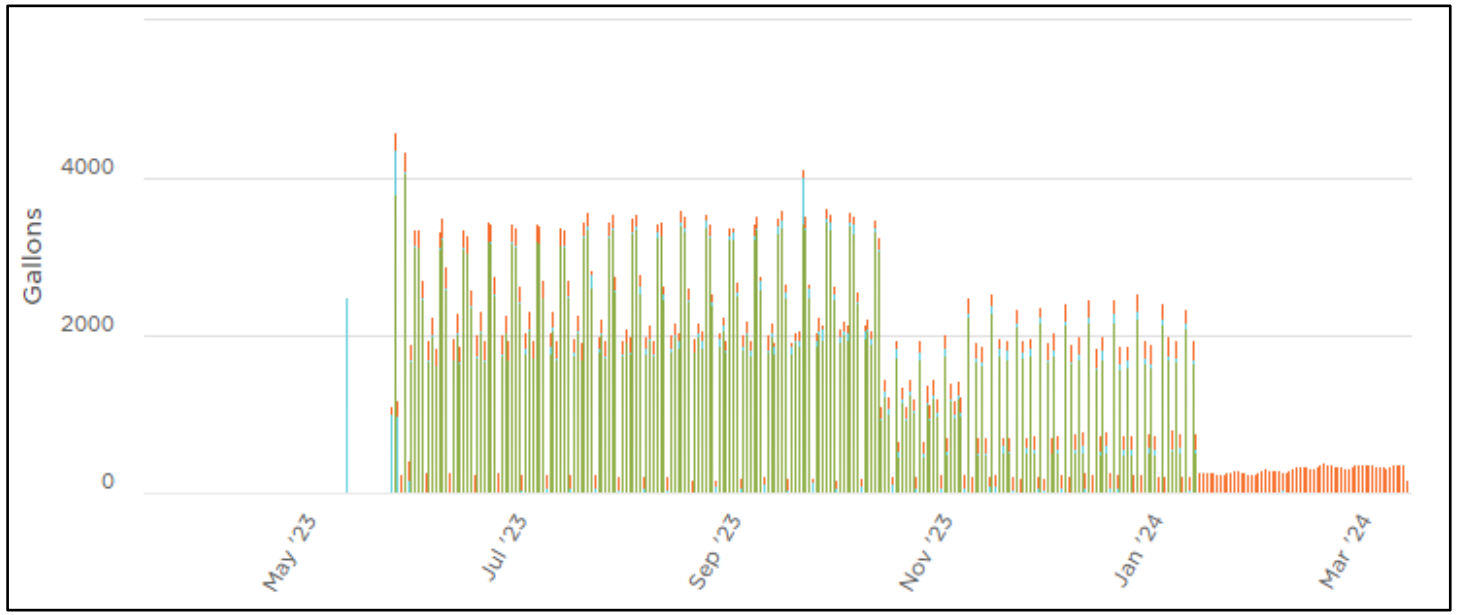
What do you observe?

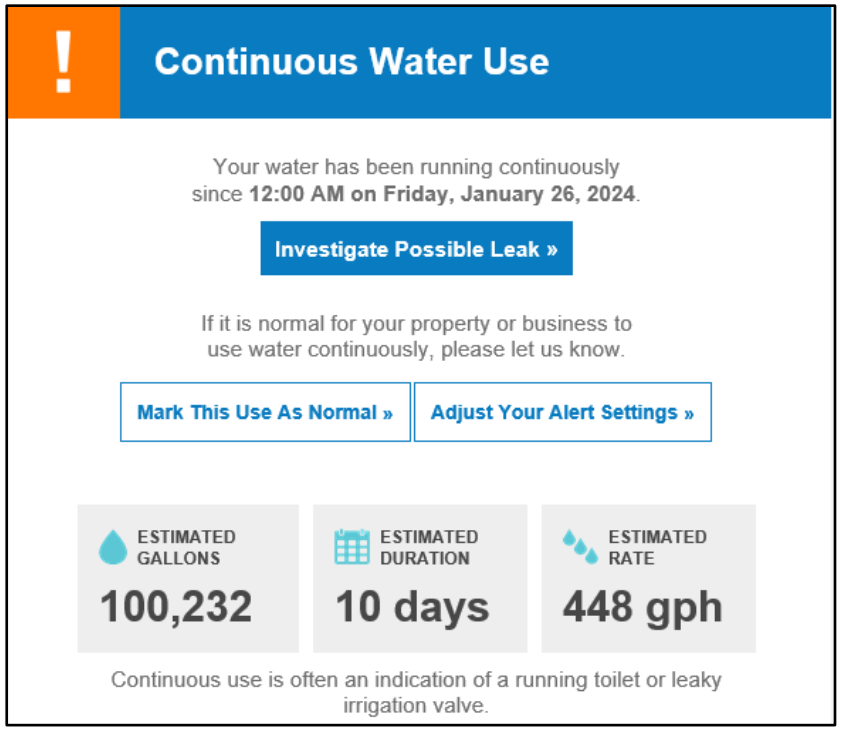
Common Irrigation Issues Leading to Water Loss

- Main and lateral line breaks
- Stuck or weeping valves
- Broken sprinkler heads
- Leaking quick couplers and/or hose bibs
- Improper programming on controller/forgotten battery operated controllers

AMI and Irrigation

- Identify usage patterns to compare with irrigation schedules
- Can detect new leaks or spikes in the system usage
- Identifies continuous usage (scheduling issue or leak)
- Provides you start, stop and flow rate of suspected leak
- Leak threshold can be set by customer

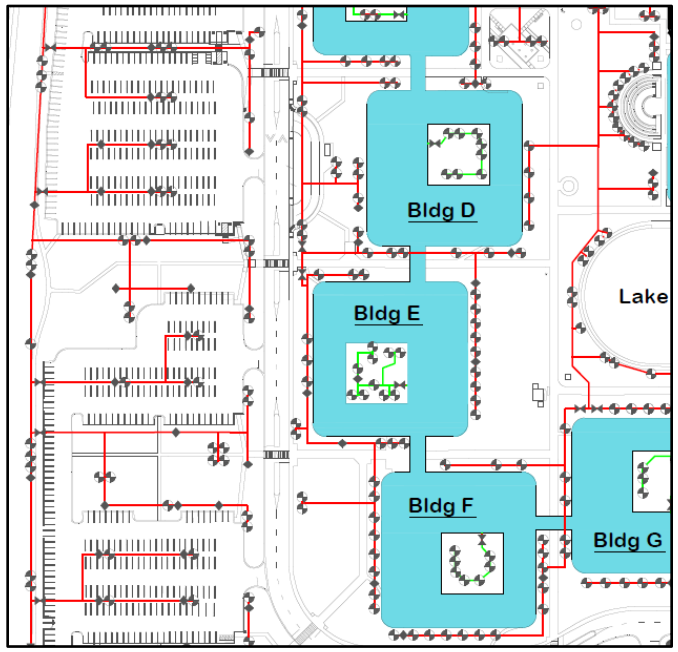


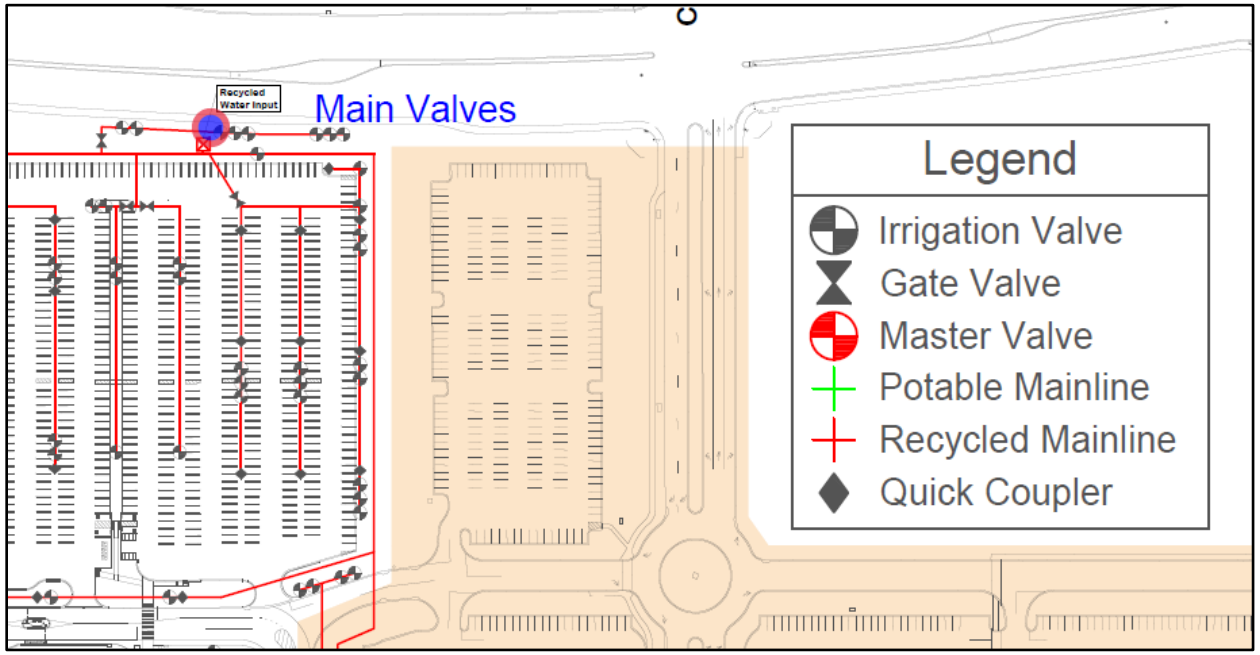


Customer Examples

Large Commercial Office Park

- AMI leak alerts began at **74 gph/1,776** gpd and grew to **897 gph/21,528** gpd (with intermittent larger spikes)
- Complex irrigation system with multiple central control units (CCUs) and over 35 controllers
- Investigations found "**ghost" programming** on controllers not connected to central control unit.
- Multiple leaks also located and repaired by using site map with labeled isolation valves





Site map with valves and main line path

Flowmeters, Submeters, and Flow Sensors

Flowmeter

Monitor flow through app or to controller, can be installed on meter or in-line

Submeter

Water meter dedicated to irrigation with leak detector

Flow Sensor

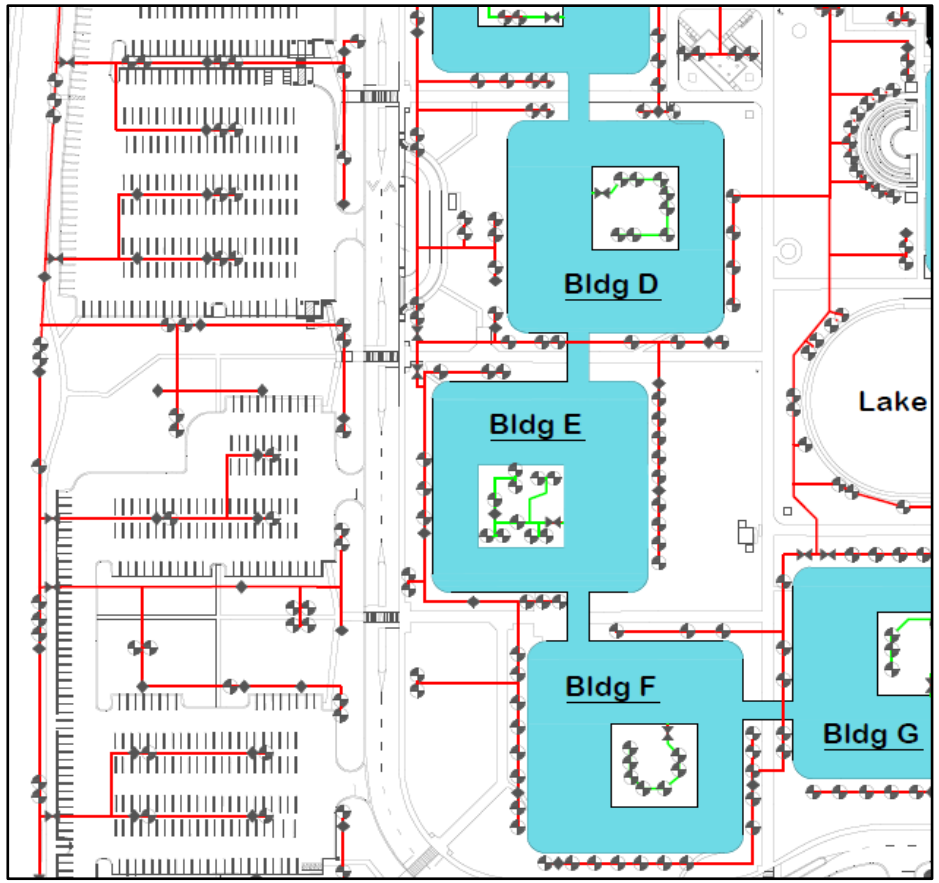
Monitor flow through device installed in-line on irrigation mainline that communicates to controller

Tools for Leak Detection

- Wire tracer or valve locator
- Acoustic listening devices
- PVC pipe

Tools for Leak Detection

- Chlorine testing kit
- Site maps (preferably as-builts)



What steps do you take to find irrigation leaks?

In the Field - Leaks Detection Process

Step 1: Quantify the leak

- Measure water loss using meter reads and timed intervals to get gallons per minute

Step 2: Rule out other usage

- Eliminate bathrooms, pools, water features, etc. or close off fill valves for devices

Step 3: Survey property

- Locate backflow, controller, and any potential battery-operated controllers on valves
- Walk areas looking for wet spots, weedy areas, water going into drains
- Use chlorine test for wet spots to determine if water is from provider
- Check site for valve box locations

Step 4: Check Irrigation Control Valves

- Close flow control on each valve to identify any stuck/leaking valves (confirm flow using meter)
- Look for signs of seepage from spray heads or drip
- Check valve box for battery operated controllers
- Check any quick couplers for leaks

Identifying Irrigation Leaks

Step 5: Trace Mainline

- Follow main line path looking for signs of leaks; weedy patches, wet areas, etc.
- Wire trace the common irrigation wire to locate main line if needed, if wire tracing not available follow valve boxes

Step 6: Isolate the Mainline

- Close isolation valves on the mainline starting with one closest to the meter
- Check the meter each time an isolation valve is closed
- If the leak stops, open the isolation valve and close the next downstream valve to narrow down leak location

Step 7: Listen for the Leak

- Use acoustic listening devices to listen for audible signs of leaks along the main line or valves
- If listening devices are not available, use a piece of PVC pipe to listen for water movement

Step 8: Consult Leak Detection Services

- If all attempts fail use 3rd party leak detection service
- Leak detection services use either compressed air or helium to pinpoint leaks

Customer Examples

Municipal Customer

- Customer requested **site visit** for troubleshooting water issue in bio-swale May 2023
- Site visit led to discovery that the meters for the **2 accounts were looped** (meters interconnected)
- Customer maintenance staff provided **irrigation plans** with main line locations and isolation valves
- Closed a series of isolation valves to isolate multiple main line leaks for repairs

Customer provided "As-Builts" with closed isolation valves

"As-Builts" marking suspected main line leak

Summary

- Calculate irrigation zone flow rate and compare to designed/expected zone flow rate to determine if there is a leak or blockage.
- Use AMI hourly, daily, monthly and yearly date to evaluate water consumption. Use AMI leak alerts to catch leaks early.
- Use site maps, survey the property, use acoustic devices, wire tracing, and chlorine tests to check for leaks.
- Sign up for June 6 Irrigation Leak Detection (in-person) **ebmud.com/rsvp**
- Take advantage of EBMUD's new rebates including **Spring Irrigation Repair ebmud.com/rebates**
- **EBMUD Water Conservation Culture - Small changes, big splash!**

Trivia & Dopamine

8 Series MPR

10° Trajectory

Nozzle	Pressure psi	Radius ft.	Flow gpm	■ Precip In/h	▲ Precip In/h
8F	15	5	0.74	2.85	3.29
	20	6	0.86	2.30	2.66
	25	7	0.96	1.89	2.18
	30	8	1.05	1.58	1.82
8H	15	5	0.37	2.85	3.29
	20	6	0.42	2.25	2.59
	25	7	0.47	1.85	2.13
	30	8	0.52	1.56	1.81
8Q	15	5	0.18	2.77	3.20
	20	6	0.21	2.25	2.59
	25	7	0.24	1.89	2.18
	30	8	0.26	1.56	1.81

Q and A

Thank you!

Lindsay.Kinsler@ebmud.com
Kristin.Bowman@ebmud.com

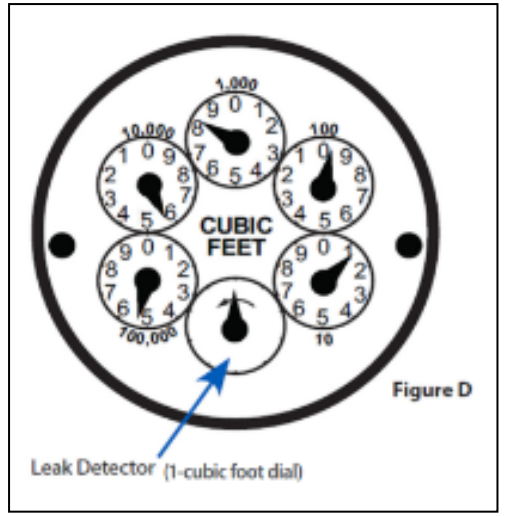


Figure D