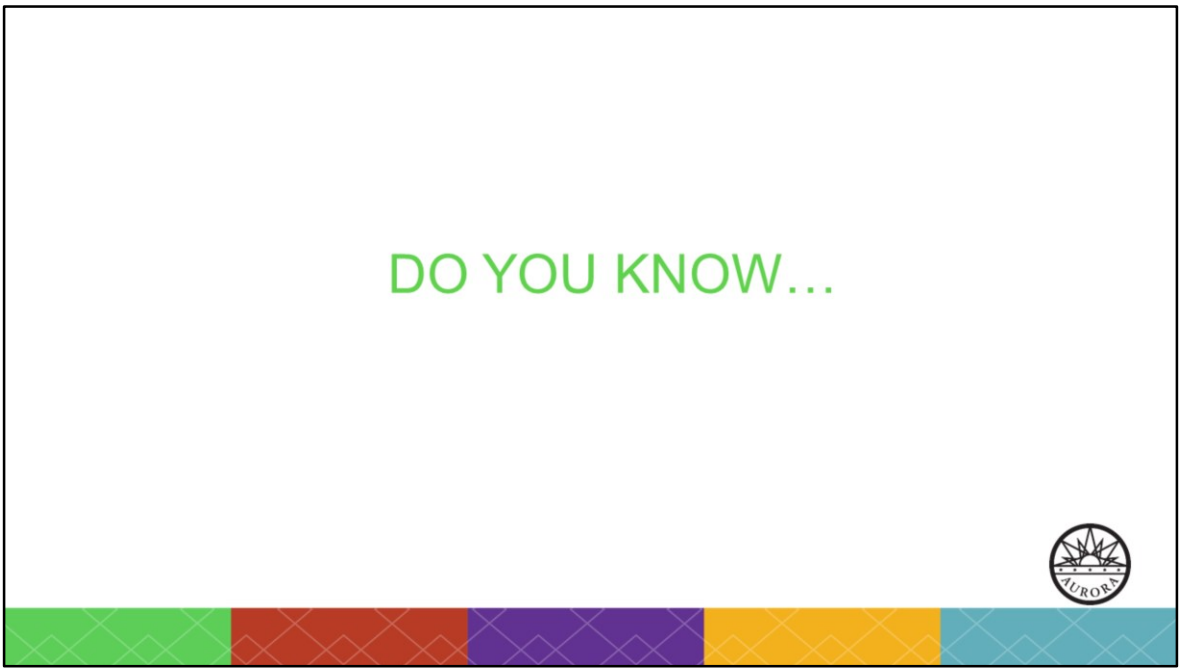


Where we get our water?

Where we store our water?
How much water our city uses per year?
What programs we offer?
How much water we have saved over the years?

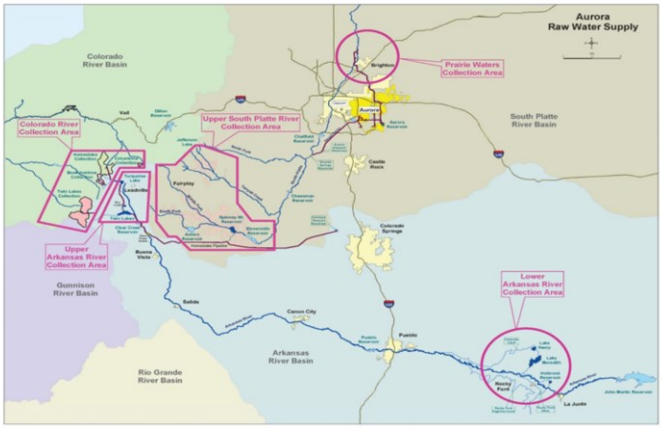
…where we get our water?

Colorado is a headwaters state, with the majority of the state's rivers beginning high in the Rocky Mountains as snowmelt. One of the benefits of living in a state that relies primarily on surface water is that unlike groundwater, surface water is a renewable water source.

One of the drawbacks is that precipitation levels vary greatly from year-to-year making the majority of the state's water supply relatively unpredictable – and highly prone to drought.

Do you know…

… where we store our water?

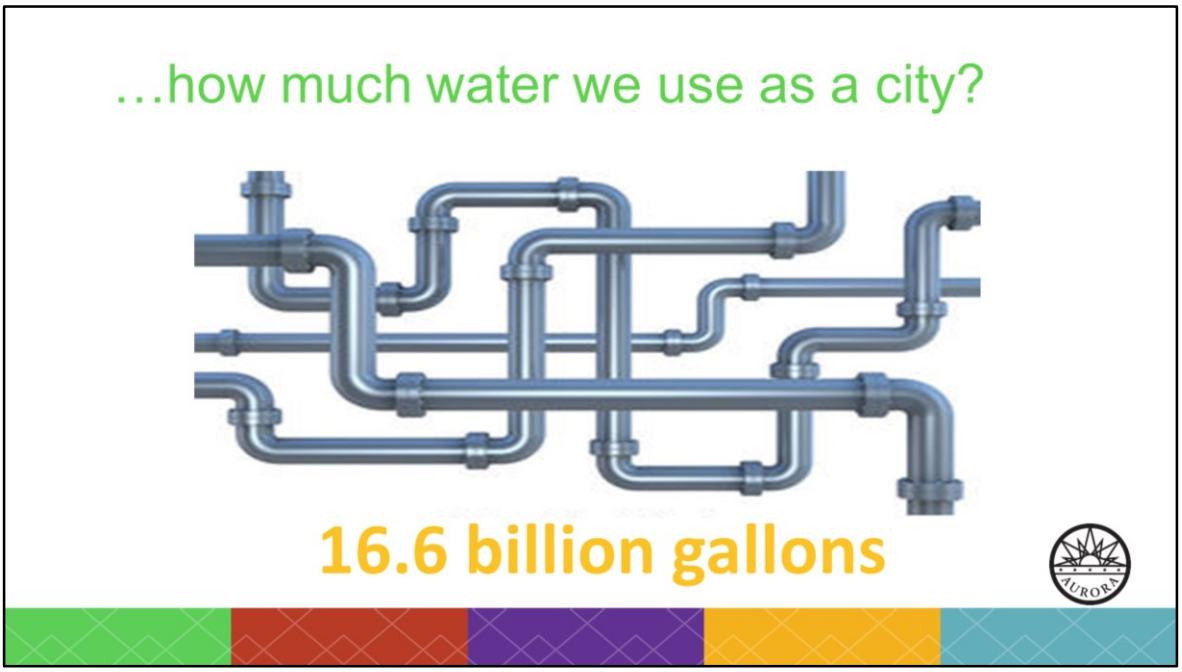


Aurora's water system starts nearly 180 miles away and includes the use of reservoirs, the natural river system, pipes, tunnels and pumps, all of which help us pull the water we own from our three river basins and deliver it to Aurora.

Aurora receives 25% of its water supply from the Colorado, 25% from the Arkansas and 50% from the South Platte river basins.

Homestake , Turquoise, Twin, Spinney Mountain, Jefferson, Strontia Springs, Rampart Quincy, Pueblo, Aurora , Meredith , Henry

Do you know how much water the city uses?



The average annual distribution for the past three years is 16.6 billion gallons annually. About half of that water is used outdoors. Aurora has a semi-arid climate, and our snow and rain levels are about half of the average annual precipitation for the United States, so it's important that we all do our part to help conserve water.

Do you know that we offer programs to help conserve water?

…we offer programs to help you save water and money?

INDOOR

Free indoor water assessment

Ultra-high-efficiency toilet rebate

Low-income water efficiency program

OUTDOOR

Free landscape designs and rebates

Free automatic sprinkler system assessments and rebates

Customize your watering schedule

Water conservation classes

Gardening and volunteering

Do you know how much water the conservation division has saved?

…how much water the conservation division has saved?

448 million gallons or 7.2 billion cups of water

Combined water savings for 2016, 2017, 2018

Be sure to check out our fliers at the end of class to see how Aurora Water can help you save water and money.

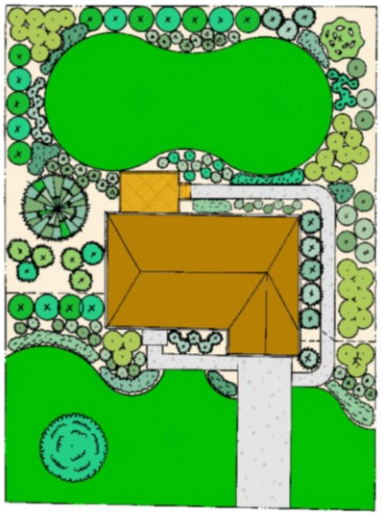
Sprinkler System Refresh

Overview

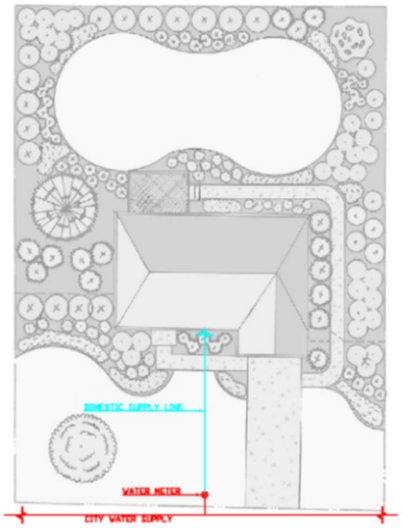
- The Parts of a Typical System
- Efficiency Definition & Factors
- Scheduling
- How Aurora Water Conservation Can Help

The Parts of a Typical System

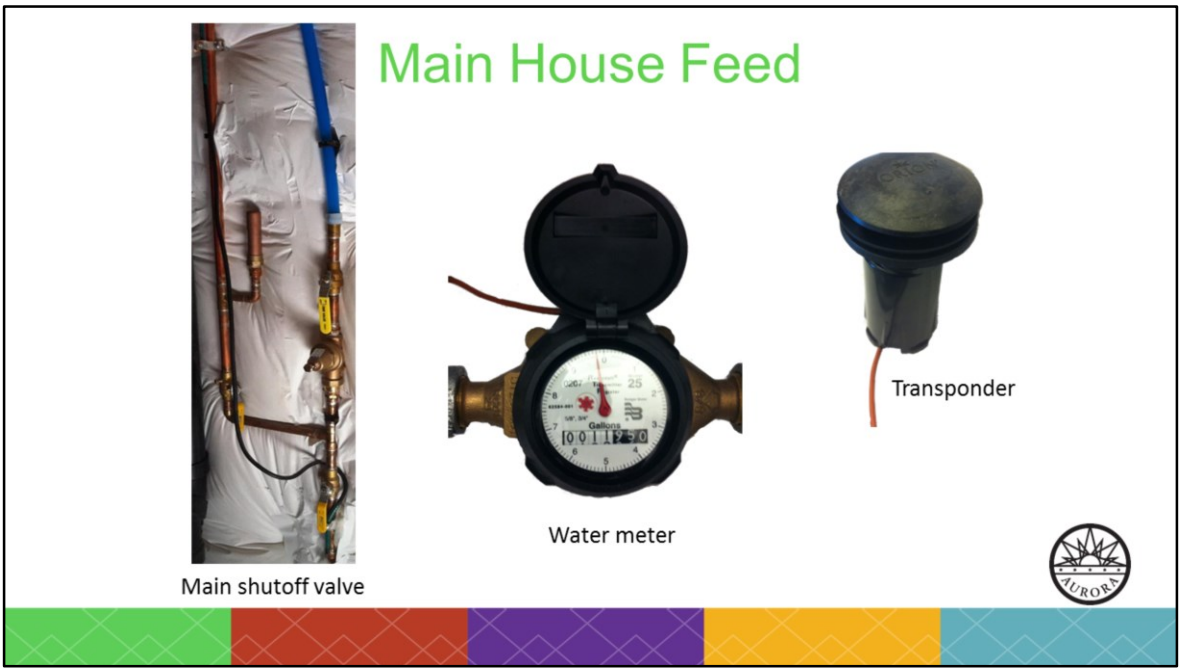
- Meter
- Main house feed
- Backflow preventer
  - PVB
  - RPPA
- Mainline
- Valves
- Lateral line
- Output devices
- Controller
- You!



An example of a typical house.



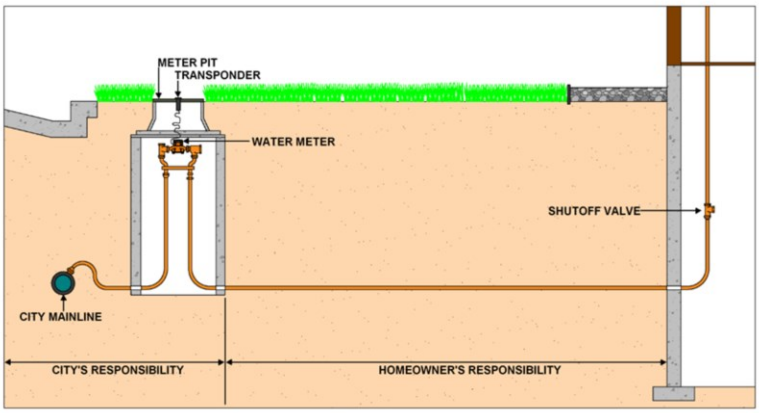
The main house feed is shown above. All of the red lines are those owned by the city. All of the blue lines are owned by the property owner.



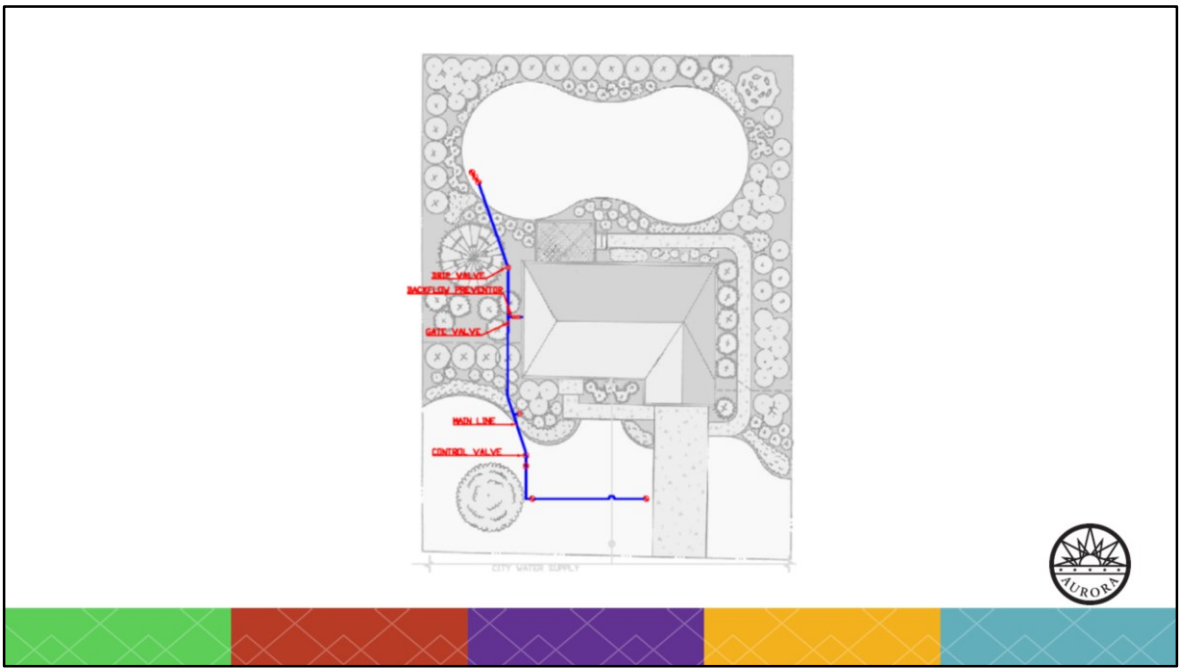
These are what all of those components look like. The **water meter** is owned by Aurora Water. It is located in a meter pit on your property. The meter pit is likely near your driveway. It's cylindrical with a circular lid. We do not recommend attempting to open your meter pit. A **transponder** resides in your meter pit, as well. It allows Aurora Water technicians to remotely check your meter.

The **main house feed** is a pipe that carries clean water into your home. It's usually made of Type-K copper. The **main shut-off valve** is located inside your home. It is often near your water heater.

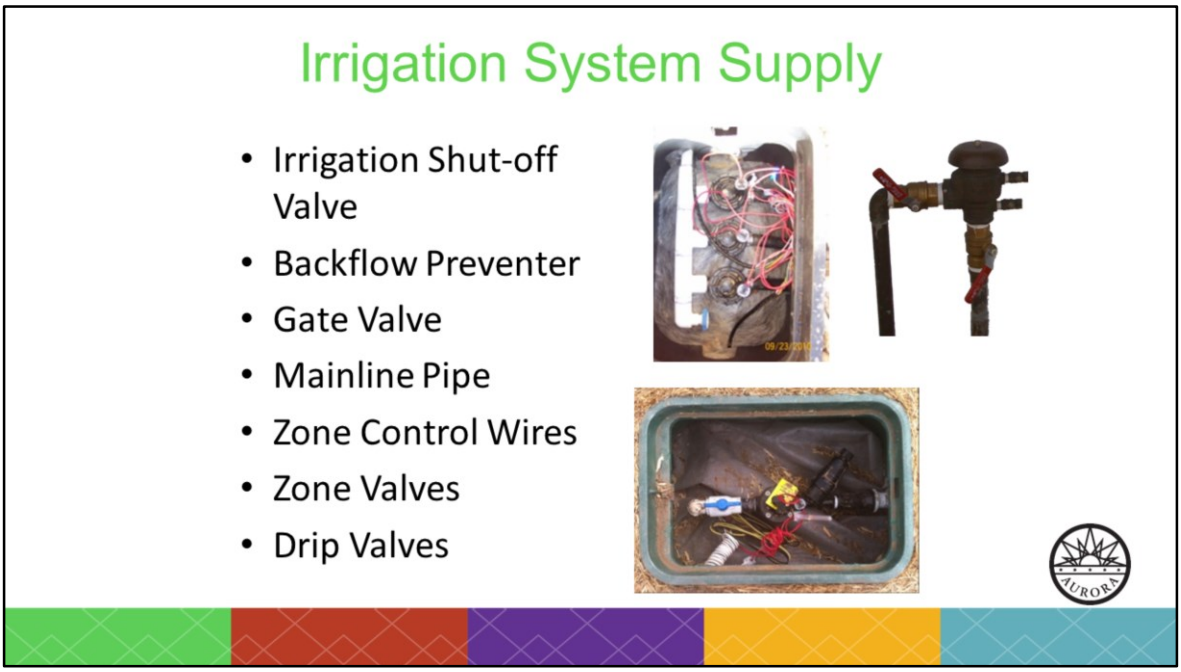
Main House Feed



You – the homeowner – own everything after the down-stream yolk, as shown here.



The **mainline** feeds your sprinkler valves and therefore is under constant pressure.



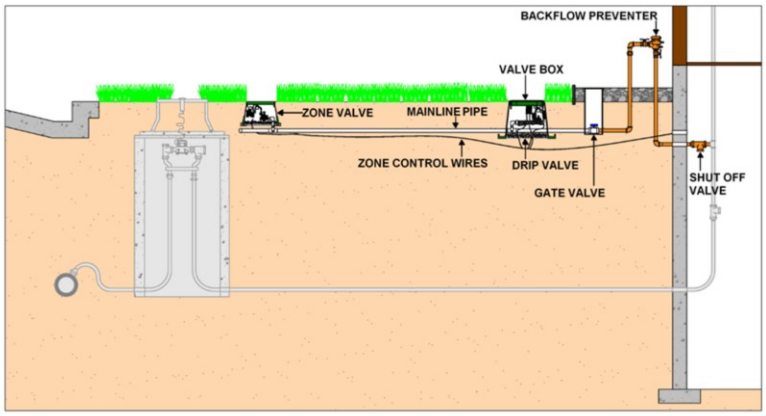
Valves separate your system into “Zones” or “Stations.” They come in multiple sizes, but for residential stick with ¾” or 1”. Valves receive a signal from the controller to “turn on”. They consist of four main parts: a Solenoid, a Diaphragm, the Flow Adjuster (on some models) and a Bleed screw.

Common Problems:

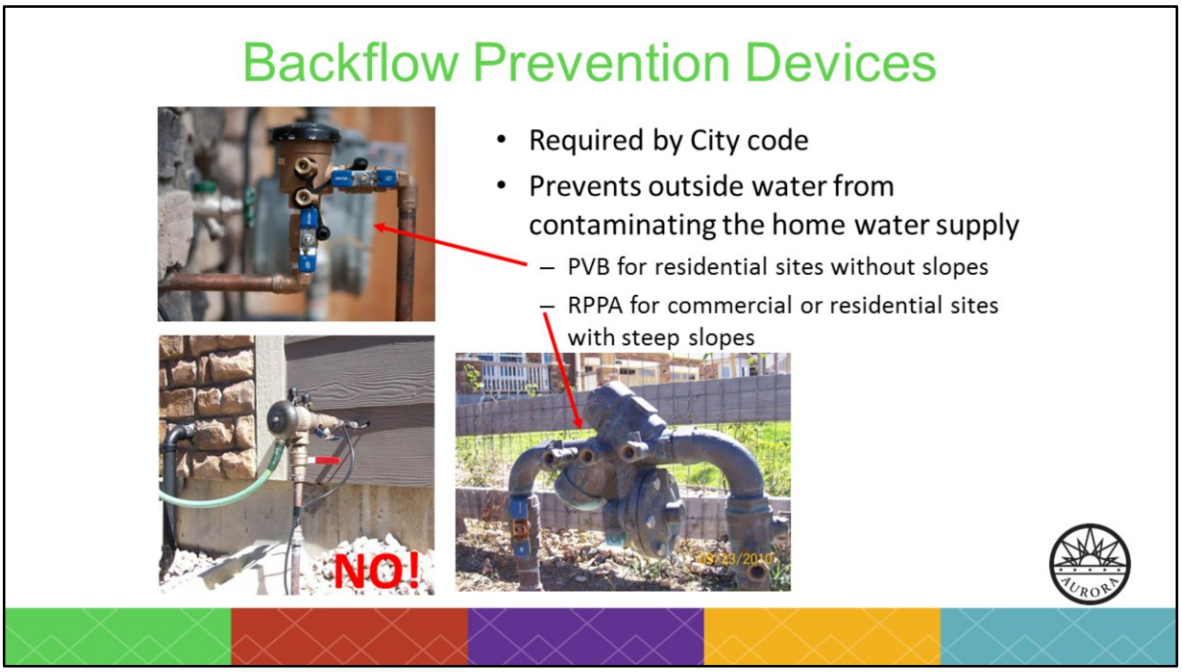
Valve won’t open: Typically an electrical problem not allowing the solenoid to release the water holding down the diaphragm.

Valve won’t close: Typically a mechanical problem or debris stuck under the diaphragm. You can purchase a diaphragm kit and repair just the inside.

Irrigation System Supply

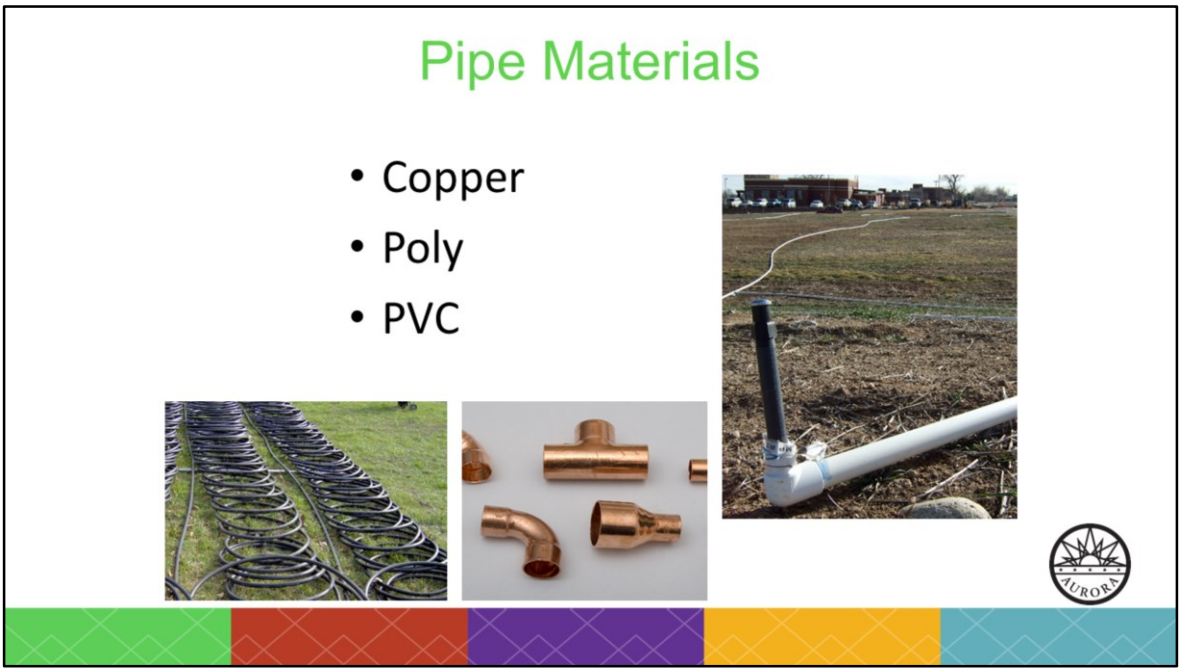


Here’s a diagram of the full system.



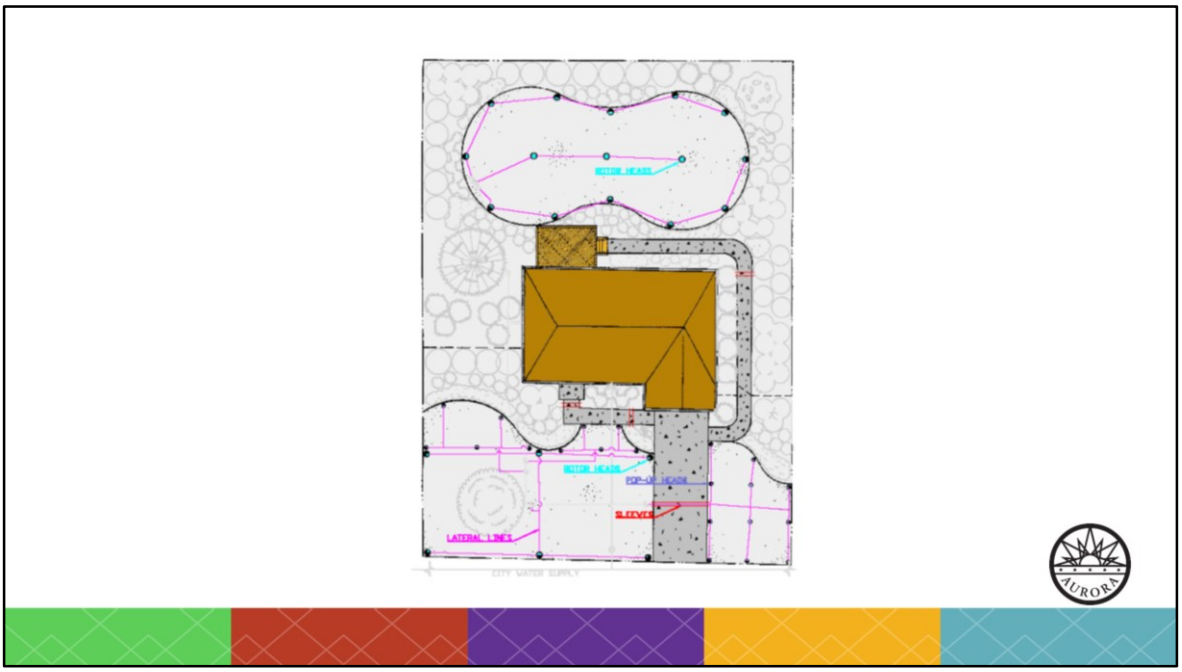
The **backflow preventer** is a device which ensures that used water cannot flow backwards into your building from your sprinkler system. It comes in two types. The first is a Pressure Vacuum Breaker (PVB). It's used in residences so that there's no back pressure. It should always be placed 12" higher than your highest output device. A Reduced Pressure Principal Assembly (RPPA) is used in commercial applications or if you have a large slope angling towards your house. It should always be placed 12" above finish grade. Backflow preventers cannot go in the ground, valve box, pit, etc. If you have any questions about what type of backflow preventer your property needs, please let us know!

For detailed information on backflow prevention, check out this handbook: http://media.wattswater.com/F-F-CCCH.pdf



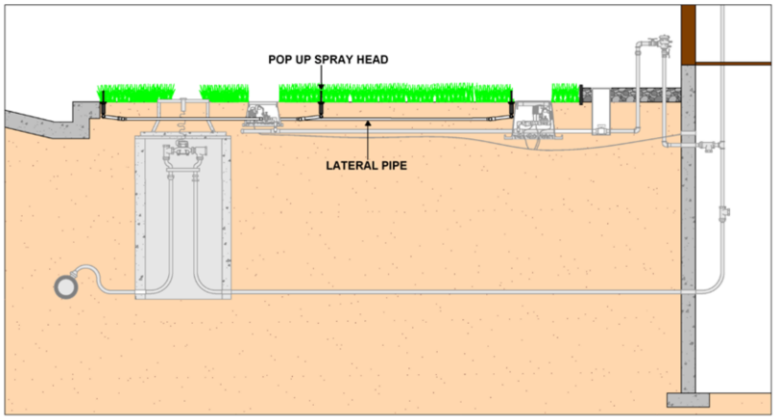
Main house feeds and your **backflow preventer** are almost always made with copper.

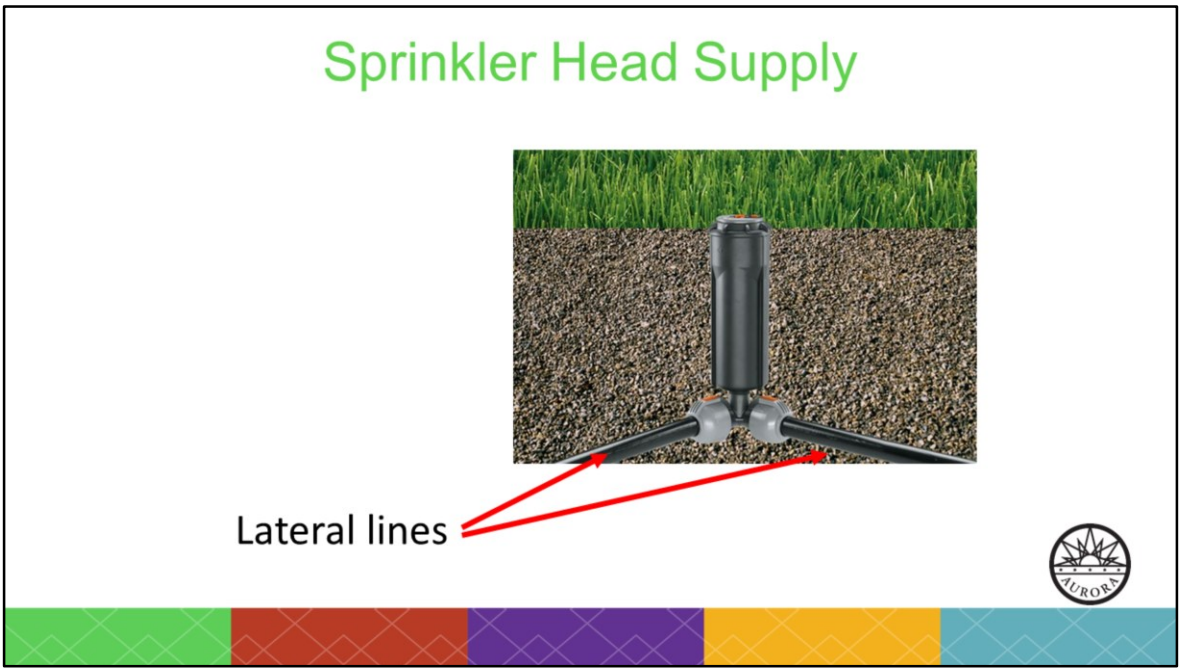
Mainlines are usually made of Poly Vinyl Chloride (PVC) or Polyethylene. PVC comes in SCH 40 or Class 200. It's more rigid and is either welded or put together with threaded fittings. Polyethylene (Poly) has a maximum strength of 80 PSI. It's flexible and is put together with compression fittings with ring clamps. Either type of pipe will work; professionals' choices are based on personal preference. Some say Poly is less prone to freezing. If you blow them out correctly and thoroughly, neither should freeze.



Sprinkler lateral lines and heads example.

Sprinkler Head Supply





Lateral lines carry water from your valves to your output devices (sprinklers). These can be PVC or Poly pipe (again, it's you're preference). Lateral lines are only under pressure when the valve is open.

Output Devices

- Rotor
- Impact
- Pop-Up
- Rotator (Rotary)
- Bubbler

Output devices aka sprinkler heads. Sprinklers can be adjusted NO MORE than 25% of their specified radius. We will go over how to adjust each sprinkler/nozzle type.

Precipitation Rate

The quantity of water applied, measured in inches per hour (in/hr) or gallons per hour (gph)

Rotor	0.70 – 1.50 in/hr
Impact	0.50 – 1.10 in/hr
Pop-up	1.50 – 3.0 in/hr
Rotator	0.50 – 0.80 in/hr
Bubbler	0.50 – 2.00 gph
Drip Emitters	0.50 – 2.00 gph

Pop-ups are typically the least efficient, as their small droplet size cause wind drift and their high precipitation rate can cause runoff with improper soil compaction.

Rotors can be very efficient if the system is designed by a qualified irrigation designer and they are used for spaces appropriate in size. Rotors in small spaces will never be efficient.

Rotator (aka Rotary) nozzles can be the most efficient if used in areas of correct size. They have a large droplet size and a very low precipitation rate. However, if you try to put rotators in small spaces with less than 12’ radii, they will struggle.

Why is there a large range for each type? Brands, models, head spacing and pressure all play a part in the equation.

Rotors are meant for larger areas, at least 16’ wide. Unless you have a LARGE yard, you should not have rotors. Aurora city code requires CV but not PRS and a 4” minimum height. They’re very hard to design with to reach matched precipitation unless you are trained. Each nozzle number stands for gallons per minute, so you have to match the nozzle with the arc you intend to throw. At the same time, each nozzle also dictates distance, so it can become confusing trying to get everything to line up and still be efficient.

They distribute water in a single stream that rotates back and forth. The precipitation rate is typically half the output of a pop-up spray head. Run times typically double that of pop-up heads.

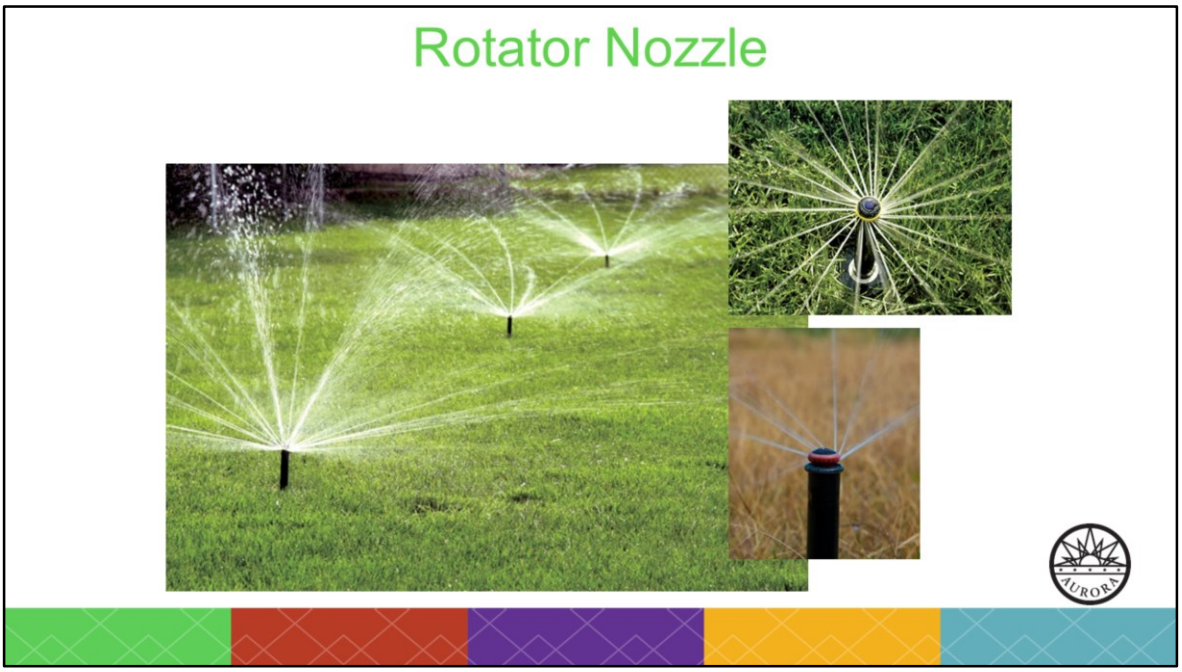
Adjusting rotors requires a brand specific adjustment tool. You are essentially adjusting a set screw down to obstruct the spray pattern. The flow doesn’t change, and screwing it down too far will distort the pattern to the point that wind drift is excessive. Again, never adjust it down more than 25%.

Impact Heads

Impact heads are used for large areas, usually 40’ or wider. They distribute water in a thick stream. You typically see them on golf courses and estate-sized lawns. Their precipitation rate is similar to a rotor head. Run times are typically double or more than that of pop-up heads

Pop-ups are a standard sprinkler that you see most often. Pop-up sprinklers spray water in a “fan” pattern. They’re usually used in smaller areas – 15’ or narrower. Aurora city code requires PRS and CV. The nozzles are designed to operate at 30 PSI for a standard spray. For rotating nozzles, they’re designed to operate at 30-40 PSI. Pop-ups are sold at different sizes which determine the height of the spray. We require a minimum height of 4” for turf, 6” along curbs, and 12” in beds.

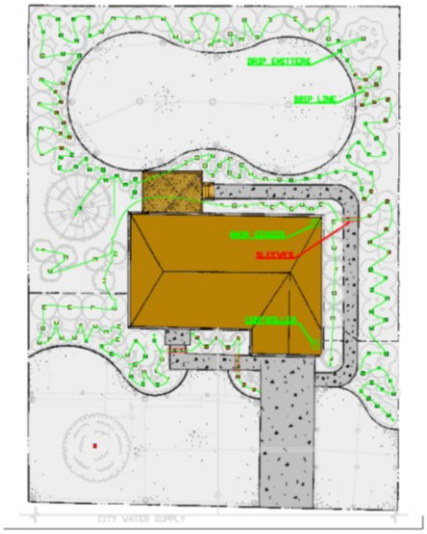
Their precipitation rate is typically double the output of a rotor head.



A **rotator** (also known as rotary) is a nozzle that can replace existing nozzles on pop-up heads. They apply water at a rate slow enough that the most soils can absorb it without runoff (0.35-0.53 inches/hour), which reduces or entirely eliminates the chance of runoff and water waste.

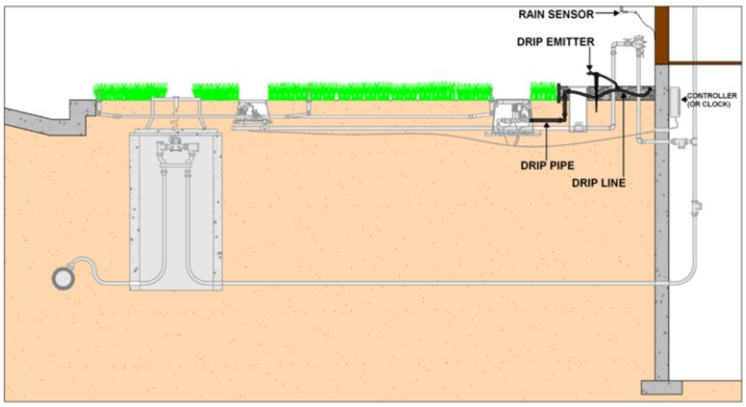
Again, rotator nozzles can be the most efficient if used in areas of correct size. They have a large droplet size and a very low precipitation rate. However, if you try to put rotators in small spaces with less than 12’ radii, they will struggle.

For pop-ups and rotators you can use a small standard screwdriver and turn the screws on the top of the nozzle to change the radius. You can never increase the radius over the specified distance, and adjust it a maximum of 25% when reducing the radius. If you need to throw less than 25% of the specified radius you will need to change the nozzle.



Drip system layout example.

Drip Emitter & Sensors

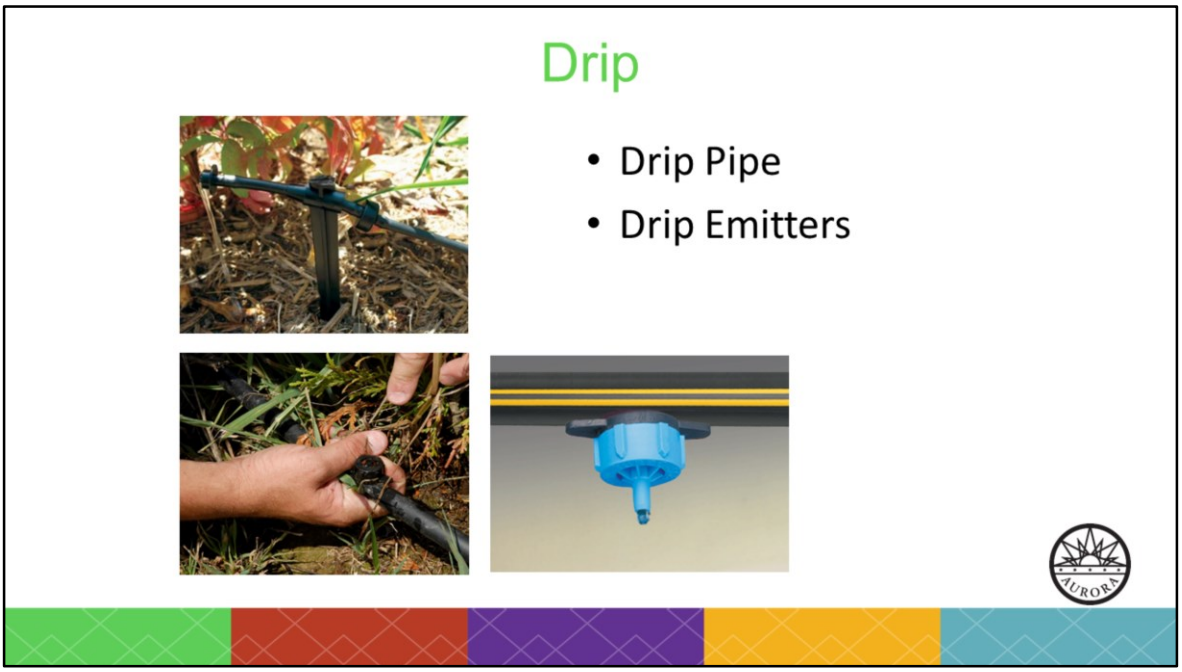


Drip Types

- Drip line
  - Emitters
  - Micro-Spray
- Bubblers
- Subsurface irrigation (inline drip)
- Soaker Hose

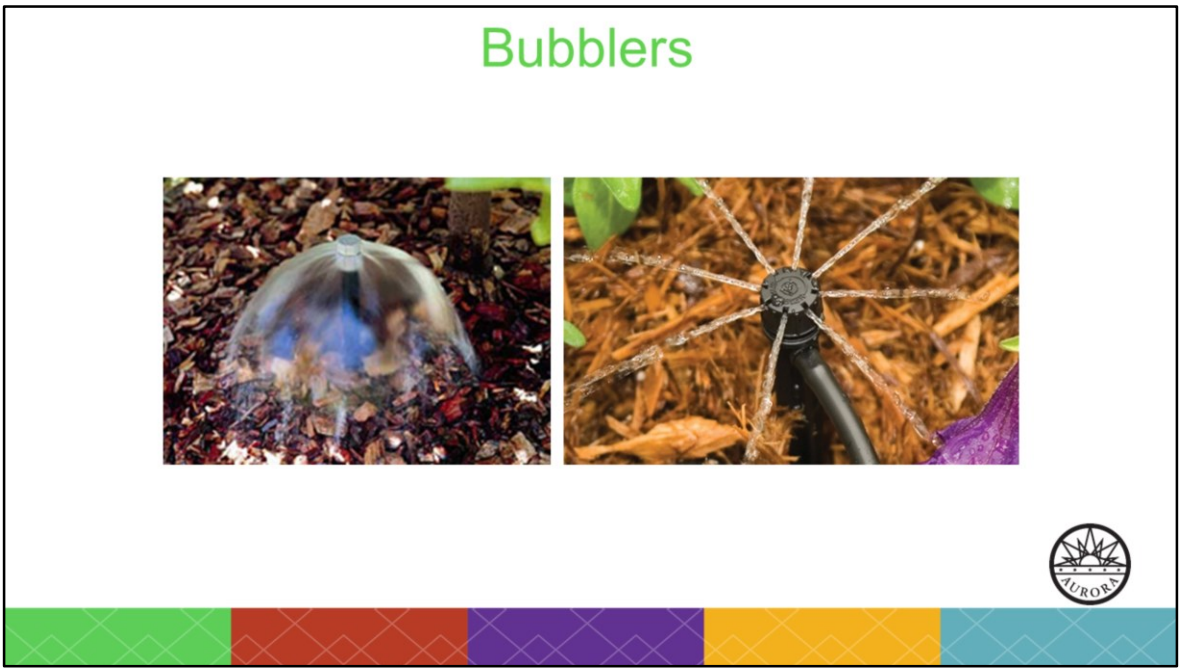
Drip irrigation is defined as a subsurface, low-volume system that applies water in gallons per hour. Drip types include pressure compensating emitters, bubblers, micro-sprays, micro-spray pop-ups, inline drip and soaker hose. Drip is efficient because the water is dripped directly over a plant's root system or planting area.

Compared to conventional sprinkler systems, drip irrigation systems are simple to design, inexpensive, and easy to install. It's also pretty easy to convert an existing sprinkler zone of pop-up heads to drip using a converter head.



Emitters can be punched directly into a poly drip line or they can be placed at the end of thinner “spaghetti” poly tubing to extend directly to a specific plant. Micro-spray emitters can also be staked to the end of spaghetti tubing. They have the advantage of spraying water a little higher off the ground, often about 4-8”.

Emitters are usually color coded according to their drip rate. The blue emitter above, for example, emits 0.5 gph. Colors vary by brand. Emitters on a single zone do not have to be the same type, that is, dripping at the same rate. Because they’re all on the same zone, however, they will have the same run time.



Bubblers are a type of nozzle that emit water above ground in an umbrella shape. The range is smaller than a micro-spray. Bubbler are used because they soak the ground from above, are easily seen and they can water multiple, densely-planted plants at once. Bubblers do have a much higher output rate, so you'll need to adjust your run times accordingly.

Subsurface Irrigation

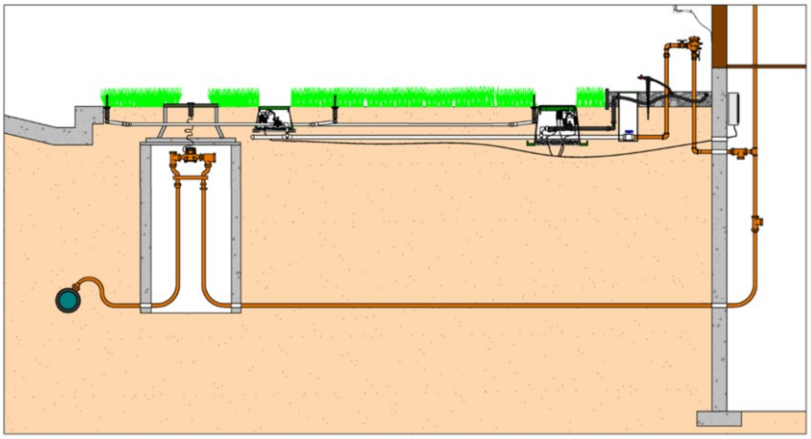
Subsurface irrigation, or inline drip, is tubing that applies water under the soil surface at a slow rate. These drip lines have hole-like emitters every 12”

What it does:

- Reduces evaporation
- Increases uniformity
- Reduces runoff potential
- 0.60-0.90 gallons per hour per emitter

A soaker hose is a type of drip pipe typically made from recycled rubber that water emits along the entire length tube. It works best on flat ground. It's an inexpensive option. Because the entire length is pervious, water goes out but also soil or other matter can go in. Because of this propensity for clogging, it should be used in lengths of 50' or less. Soaker hoses should not be buried, but should rest on top of the soil but under mulch.

And finally, here are all of the components together.



And here’s a cut-through view.

What is an "Efficient" Sprinkler?

According to the Irrigation Association:

- Drip/micro-spray = 80% of the water gets to where it is needed
- Rotor = 70% of the water gets to where it is needed
- Pop-up spray = 55% of the water gets to where it is needed

According to Aurora Water:

All head types = 70% of the water gets to where it is needed

Get efficient!

1. Find problems
2. Fix problems
3. Know what you have
4. Know what you need
5. Compare usage

Dead Broke

Problem #1 is broken or misdirected sprinklers.

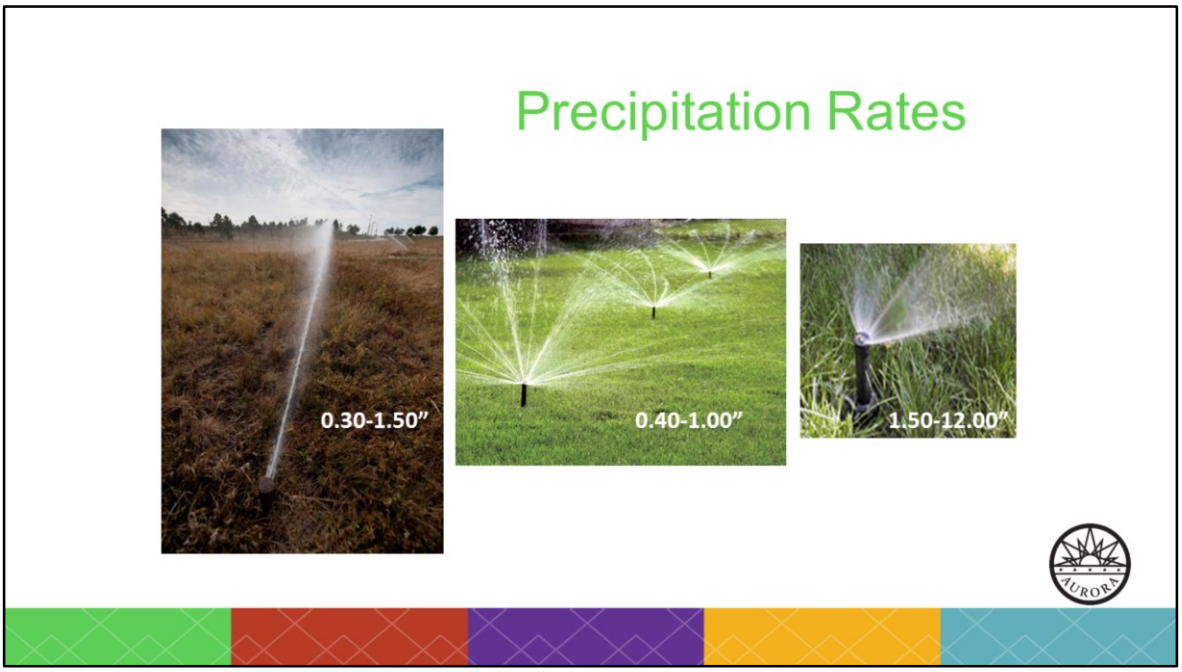
Problem #2 is sprinklers obstructed by plants or structures.

Common obstructions include your mailbox, lamp poles and ornamental grasses or shrubs.

Mixed Zones

Problem #3 is mixed sprinkler types on the same zone.

Rotors, pop-ups, micro sprays & drip all have different precipitation rates. You cannot mix any of these in the same irrigation zone.

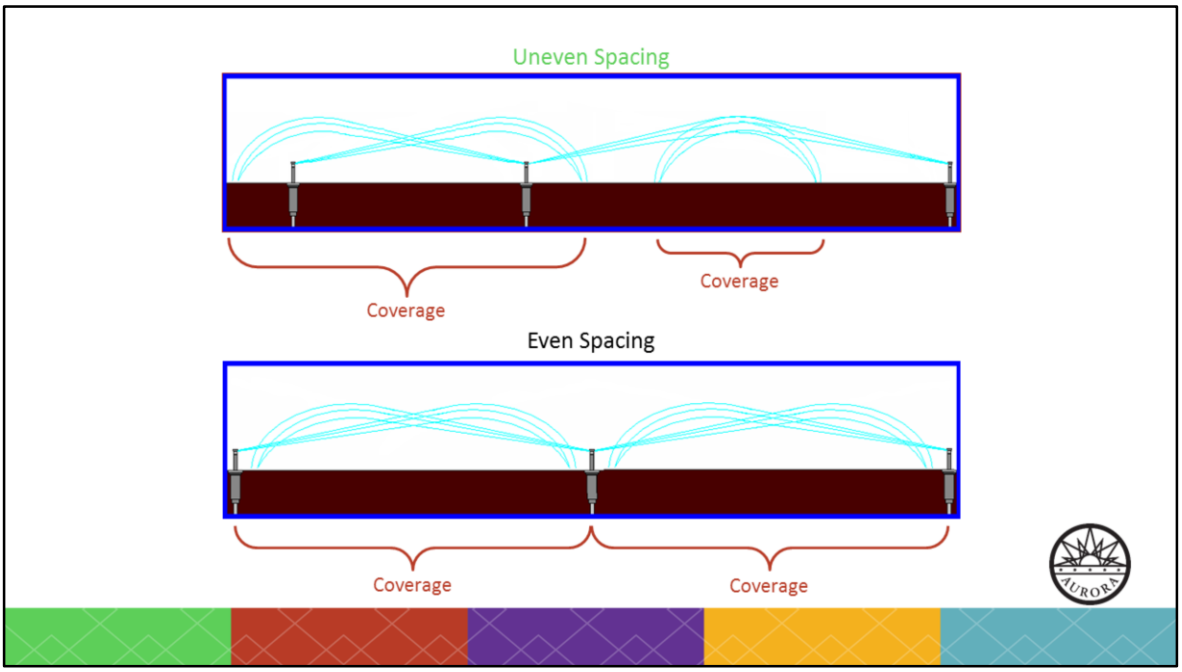


Problem #4 is unmatched precipitation rates.

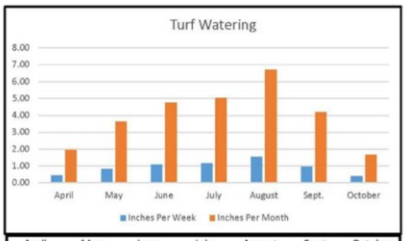
Each head’s different precipitation rates means that they’re putting out different amounts of water. For a homogenous area – like a turf lawn – that means an uneven distribution of water and unhealthy plants.

Problem #5 is incorrect water pressure.

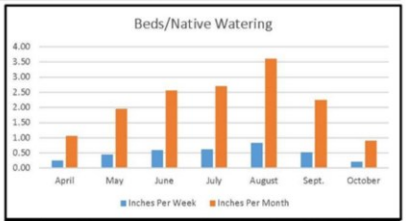
Spray heads typically work best at 30psi, rotor heads have a wider range, about 20-80psi. When your system's water pressure is higher than the head's rating, it will cause the water to be emitted in tiny droplets and form a mist. These tiny droplets are less likely to reach the soil and your plants' roots because of wind and evaporative loss.



Problem #6 is improperly spaced sprinklers. Your goal is to water the area as evenly as possible.



	April	May	June	July	August	Sept.	October
Inches Per Week	0.45	0.84	1.10	1.16	1.55	0.97	0.39
Inches Per Month	1.96	3.64	4.76	5.04	6.72	4.2	1.68
% of Annual Water Need	7%	13%	17%	18%	24%	15%	6%



	April	May	June	July	August	Sept.	October
Inches Per Week	0.24	0.45	0.59	0.62	0.83	0.52	0.21
Inches Per Month	1.05	1.95	2.55	2.7	3.6	2.25	0.9
% of Annual Water Need	7%	13%	17%	18%	24%	15%	6%

Problem #7 is setting an improper schedule.

Each zone must be programmed in the spring based on plant needs. Aurora Water recommends that you adjust your controller or “clock” every month according to plant needs and weather.

Here’s an example of watering schedules for two different zones: turf and beds/native. Notice how water needs go up to a peak in August and then descend through October. Generally in Aurora, nothing needs to be watered before April or after October. Sometimes April is wet enough or cold enough that systems shouldn’t be turned on until May.

You can easily conduct the outdoor sprinkler audit yourself. Aurora Water has tools that can help. We'll rent you a Water Smart Reader (only a $30 deposit) that helps you watch your water use in real time. Or come to our next DIY Sprinkler System class in-person and pick up all of the tricks.

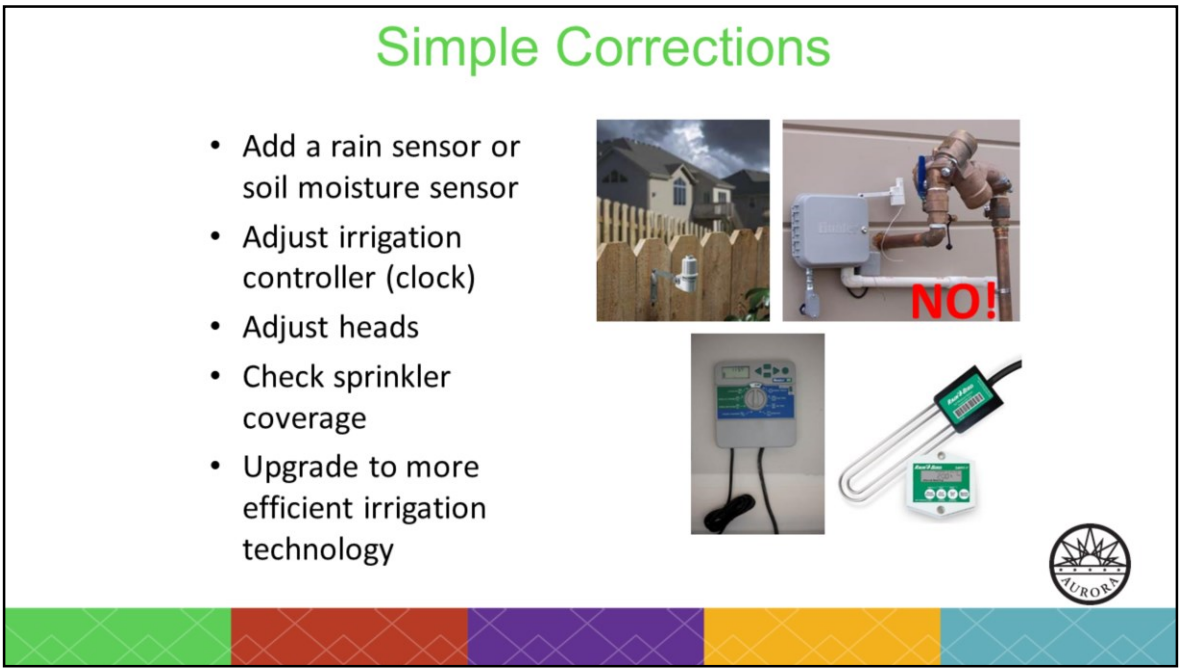
You can also have Aurora Water come out to inspect your sprinkler system at no cost. Call us at 303-739-7195 to schedule yours. We'll put together a report with recommendations on how to improve your system. We'll check your:

- Soil Type
- Precipitation rate
- Distribution uniformity
- Water pressure
- Turf root depth
- Landscape size & total water use

What to Do Next

Is your sprinkler system up to snuff?

- If No…
  - Repair
  - Replace
  - Redesign
  - Remove
- If Yes…
  - Schedule for maximum efficiency
  - Maintain

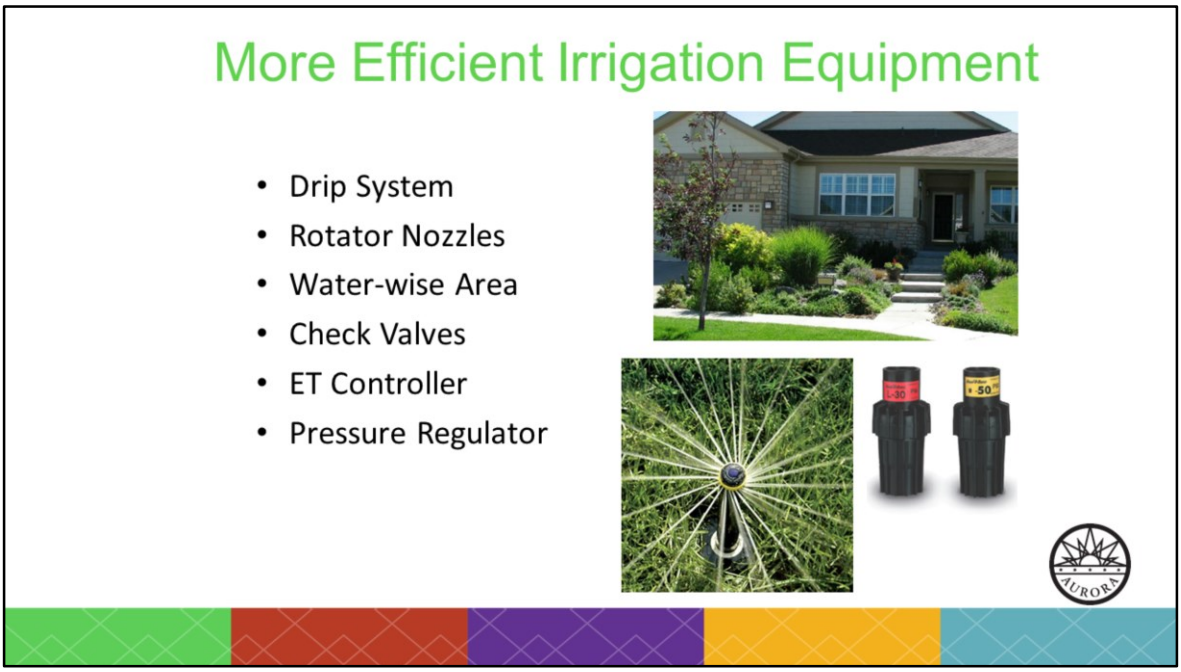


A **rain sensor** automatically shuts off your sprinkler system when it rains. For accurate readings, they must be installed out in the open on a fence post or on the roof. They should not be installed right next to the house or under eaves. They must be installed with the sensor facing up.

A **soil moisture sensor** has even more control over your sprinkler system. When the sensor detects dry soil, the next scheduled watering cycle is allowed. If your soil moisture level is high, the next watering cycle is suspended.

You can adjust your head nozzle spray pattern in two ways.

1. Nozzle radius adjustment: For pop-ups and rotators, use a standard screwdriver to turn the screws on the top of the nozzle to change the radius (distance the water reaches) of the spray. The radius cannot be increased over the head's specified distance, but it can be reduced by up to 25%. For rotors, a brand-specific adjustment tool is required. You are essentially adjusting a screw to obstruct the spray pattern. The flow doesn't change, and screwing it down too far will distort the pattern and create excessive wind drift. Again, never adjust it down more than 25%.
2. Nozzle arc/direction adjustment: To adjust the direction of pop-ups, simply turn on your system and grab the stem and twist it in the direction you need. The ratcheting feature inside the head will click as you turn it. Some are tight, so use a rag to help you grip the stem. If you need to adjust the arc angle on a regular pop-up spray nozzle you will need to replace the nozzle with one of the correct arc. Rotator nozzles are adjustable. You may need to ratchet the stem to set the left or right edge, then you can grab the base of the nozzle while turning the top. For rotors, use the brand-specific tool again. Each head is different, so look up your brand's instructions online.



Drip is arguably the most efficient way to water your plants. But they're not practical for existing turf lawns. The most common efficient pop-up head is the rotator nozzle which sprays larger droplets that are less likely to evaporate before reaching the soil. Rain Birds HE VAN adjustable spray nozzle has also been tested and verified as very efficient by the stat of California.

Another great way to reduce your water use is by converting a portion of lawn or other high-water-use plant material to **water-wise landscape**.

Check valves save water by eliminating low head drainage from spray heads located at the base of slopes or hillsides.

An **ET Controller** makes real-time adjustments to the watering schedule based on hourly weather information.

Pressure regulators adjust pressure (usually adjust it down) in your system so that your heads won't mist.

Controller Adjustment

For example, trimming 2 minutes off of a system with 6 zones

Assumptions:

- 2 runs a day
- 3 days a week
- 8 gpm per zone

Savings:

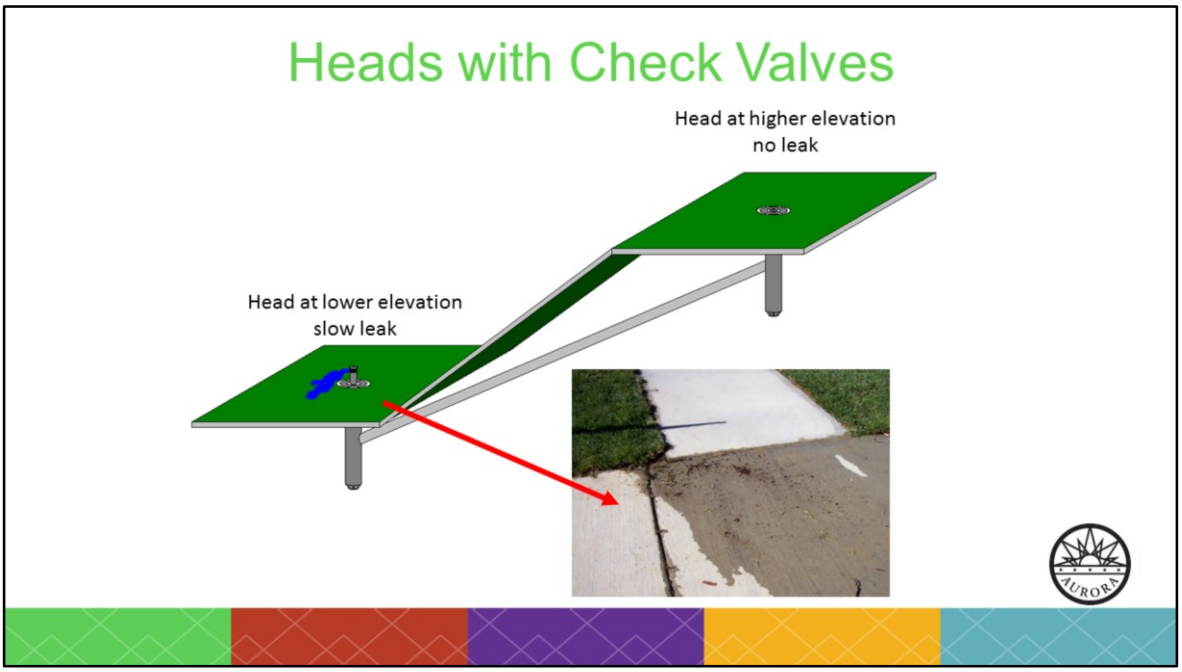
- 96 gallons per run
- 192 gallons per day
- 576 gallons per week
- 2,304 gallons per month

Controllers are NOT the brains of the system. You are. They will only do what you program them to do using the three basic features: Start days, start times and run times. A fancy sprinkler system is only as good as its programming. A controller program designates watering settings for a single zone or a group of zones. A controller can typically run up to 3 programs. Everything on a program will have the same start days and the same start times, but can have zone-specific run times. Use programs to separate areas like turf from water-wise landscapes, as you will want different amounts of watering for those zones.

For example, you might set program A to water only the flowerbed areas with micro-sprays twice a day. Program B might be used to water the lawn areas with pop-up heads two or three days a week. Program C could be used to water plants or shrubs with a drip system a couple of times per week.

In the slide example, trimming 2 minutes off of a system could save up to 2,304 gallons per month.

Pay attention to Aurora Water Conservation recommended run times. We use real weather data to make our recommendations. You can find them here: https://www.auroragov.org/LivingHere/Water/Residential/WateringTimes/index.htm



Each sprinkler replaced with a sprinkler with a built-in check valve will save approximately 250 gallons per year.

Assumptions:
- 2 run times per day
- Runs 3 days/week
- 26 weeks per season

Examples of pop-up heads with built-in check valves:
- Rainbird: 1800-SAM-PRS
- Hunter: Pro Spray PROS-PRS30
- Toro: 570Z-PRX
- HIT: 900-CKV-PRD

Heads with Pressure Regulators

Current PSI	Gal/Yr Saved per Head Changed Out
35	173
40	325
45	476
50	628
55	758
60	887
65	1,017
70	1,147

One 15-foot 180° regular sprinkler replaced with a with built-in pressure regulator sprinkler could save hundreds of gallons of water per year.
Assumptions:

- Run time of 15 minutes per day
- Runs 3 days/week
- 26 weeks per season

Examples of models with pressure regulating heads:

- Rainbird: 1800-SAM-PRS
- Hunter: Institutional Spray
- Toro: 570Z-PRX
- HIT: 900-CKV-PRD

Irrigation Rebate Program

- The city offers rebates for upgrading inefficient components to new higher efficiency components
- Irrigation rebate is in addition to Water-wise Rebate amount
- To be eligible for an irrigation rebate you must first have a free irrigation system audit conducted by Aurora Water. Call 303.739.7195 to get request your free audit!

More Tips for Efficient Irrigation

- Regularly check for leaks, broken heads and other problems.
- Make sure your maintenance contractor is certified, insured, experienced and reputable.
- Water when it's dark outside. Program your controller for after the sun has gone down or before it's come up. In Aurora, watering is not allowed between 10 am and 6 pm.
- Avoid watering pavements and other non-landscape areas.

More Tips for Efficient Irrigation

- Water shaded areas less than sunny areas.
- Use drip irrigation to water trees and shrubs.
- To eliminate runoff, use cycle & soak scheduling.
- Develop a separate drip watering schedule for trees, shrubs and flower beds.
- Aerate in the spring and fall to loosen soil and reduce runoff.

The “cycle and soak” method is the most efficient watering method. It consists of running a zone once, letting the water soak in for 45 minutes, and letting it run again. For example, if your lawn needs a total of 10 minutes of water on a given day, set your program to run for 5 minutes at 5:30 a.m. and again for 5 minutes at 6:15 a.m.

Proper Irrigation Scheduling

- Don't "set it and forget it."
- Get to know your system in detail.
- Give yourself some slack. It will take time and effort to manage your yard properly.

Know What You Have

Learn the following:

- Area in turf
- Area in beds
- Percent coverage of the shrub beds
  - Shrubs vs. Mulch
- Area in native

Different plant materials have different water needs. Research what your plants need to be healthy.

City of Aurora has an irrigation ordinance that requires the following:

- 28” per square foot of turf per year
- 15” per square foot of beds per year
- Adjustment for current weather conditions

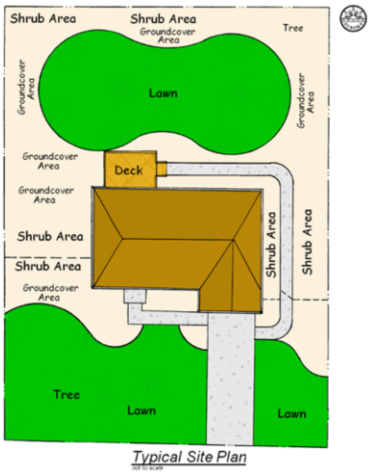
We recommend that garden beds get 15” of water over the course of the season, z-zones (aka areas with plant material that don’t need any sprinkler water after established) get 0”, Turf lawns get 28” and native grass areas get 5”.

Convert Inches to Gallons

Gallons per Year for:

- Turf
  - (Area) x 0.623 x (Recommended Inches)
- Beds
  - (Area) x (Percent Coverage) x 0.623 x (Recommended Inches)
  - An average landscape bed area will be 50-60% covered

Know What You Have



Area in lawn area = 3,000 sf

Area in beds area = 3,200 sf

Bed Area = 50% covearge

Let's go back to our earlier example.

The number of gallons per year for this yard:
Turf = 3,000 sf X 0.623 X 28"= 52,332
Beds = 3,200 sf X 0.50 X 0.623 x 15"= 14,952
Total Watered Area = Turf + Beds = 52,332 + 14,952 = 67,284

How Efficient is Your Watering?

STEP 1

Lawn Area		square feet	X	28	X	0.623		=		gallons
Bed Area		square feet	X	15	X	0.623	X	=		gallons
							shrub coverage %			

STEP 2

Lawn Area		gallons	Gallons Used in Previous Year		gallons
+ Bed Area		gallons	- Gallons Recommended		gallons
Total Recommended		gallons	Difference		

You can check your current watering efficiency using this simple method.

Instructions:
Enter numbers into the colored boxes and follow the math to figure out how you're doing with watering your landscape. To find your "Gallons Used in Previous Year," add up all of your usage from last year's bills. To figure out how much of that used outdoors, subtract your average winter monthly usage from all months. For example, if you average 3,000 gallons per month indoors (look at December, January and February's usages), take 3,000 gal x 12 months = 36,000 gal. Subtract 36,000 gallons from your total gallons used over the year. This will give you your outdoor usage for the year.

Worksheet Example

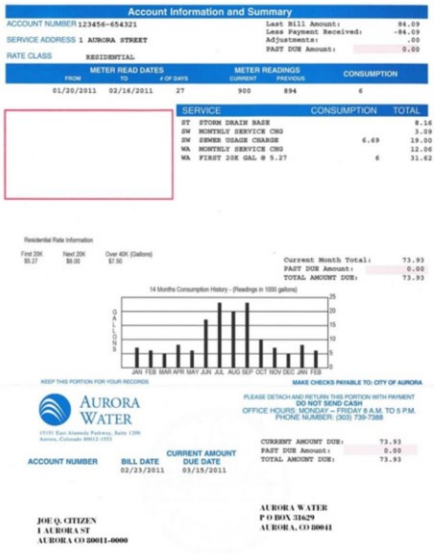
STEP 1

Lawn Area	1,300	square feet	X	28	X	0.623		=	22,677 gallons
Bed Area	400	square feet	X	15	X	0.623	X 0.6 (shrub coverage %)	=	2,243 gallons

STEP 2

Lawn Area	22,677	gallons	Gallons Used in Previous Year	34,000	gallons
+ Bed Area	2,243	gallons	- Gallons Recommended	24,920	gallons
Total Recommended	24,920	gallons	Difference	9,080	

In this example, you would be overwatering by 9,080 gallons per year!



Account Information and Summary

ACCOUNT NUMBER 123456-654321
SERVICE ADDRESS 1 AURORA STREET
RATE CLASS RESIDENTIAL

Last Bill Amount: 84.09
Less Payment Received: -84.09
Adjustments: .00
PAST DUE Amount: 0.00

METER READ DATES FROM	TO	# OF DAYS	METER READINGS CURRENT	PREVIOUS	CONSUMPTION
01/20/2011	02/16/2011	27	900	894	6

SERVICE		CONSUMPTION	TOTAL
ST	STORM DRAIN BASE		8.16
SW	MONTHLY SERVICE CHG		3.09
SW	SEWER USAGE CHARGE	6.69	19.00
WA	MONTHLY SERVICE CHG		12.06
WA	FIRST 20K GAL @ 5.27	6	31.62

Residential Rate Information

First 20K	Next 20K	Over 40K (Gallons)
$5.27	$6.00	$7.50

Current Month Total: 73.93
PAST DUE Amount: 0.00
TOTAL AMOUNT DUE: 73.93

14 Months Consumption History - (Readings in 1000 gallons)

KEEP THIS PORTION FOR YOUR RECORDS

MAKE CHECKS PAYABLE TO: CITY OF AURORA

AURORA WATER

PLEASE DETACH AND RETURN THIS PORTION WITH PAYMENT
DO NOT SEND CASH
OFFICE HOURS: MONDAY – FRIDAY 8 A.M. TO 5 P.M.
PHONE NUMBER: (303) 739-7388

ACCOUNT NUMBER	BILL DATE	CURRENT AMOUNT DUE DATE
	02/23/2011	03/15/2011

CURRENT AMOUNT DUE: 73.93
PAST DUE Amount: 0.00
TOTAL AMOUNT DUE: 73.93

JOE Q. CITIZEN
1 AURORA ST
AURORA CO 80011-0000

AURORA WATER
P O BOX 31629
AURORA, CO 80041

Compare to your Usage

Track your usage on your water bill to make sure you're staying within your goal!

Next Steps

- Conduct an audit or request one at 303-739-7195.
- Make necessary repairs, replacements, redesigns and adjustments.
- When you turn on your system in late spring, program your controller correctly.
- Update your controller every month.
- Take more Water Conservation classes. Register online at www.auroragov.org/waterclasses.
- Take the survey we'll send you after class.

Thank You

Water Conservation Office
Hotline 303-739-7195
conservation@auroragov.org