



MASTER GARDENER
COLORADO STATE UNIVERSITY
EXTENSION

CMG GardenNotes #411

Water-Wise Landscape Design: Steps

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Principles of Water-Wise Landscaping

Planning and designing for water conservation, beauty, and utility. Beautiful, water saving gardens are not accidents. The most effective garden plans are comprehensive, include plant types and placement, intended use of the space, and maintenance.

Hydrozoning. How much water a plant will use is not always the same as how much it needs, and different plants have different needs. Design gardens with plants appropriate to our climate, grouped according to water need. No less important is following through on the design, watering the different hydrozones by water need rather than “setting and forgetting” an irrigation clock to water the whole yard evenly.

Watering efficiently with appropriate irrigation methods. Efficient irrigation includes attention to design, maintenance, and management.

Creating practical turf and non-turf areas. Water wise landscaping is not necessarily anti-turf, but rather matches the landscape design to the actual use of the site. This is a change from the typical landscape design where a little-used but high input lawn is the predominant feature.

- **Improving the soil.** Remember that soil improvement will be site specific and depends on the intended landscape type.
- **Mulching to reduce evaporation.** Mulch reduces evaporation greatly compared to bare soil. Understand how different mulch materials behave in the landscape and choose the best option for the site.
- **Maintaining with good horticultural practices.** Healthy plants are more tolerant of extreme conditions, including drought.

What Is Landscape Design?

Landscape design is a process, rather than just plunking down plants. For existing landscapes, let the design process guide the gradual evolution of the yard or garden to become more water wise.

Landscape design exists to create practical and pleasing outdoor living space, bringing the user's wants, needs, and values into the landscape. These will vary among people and families and will likely change.

Good landscape design recognizes the gardener's investment in time and dollars to install and maintain.

Landscape design is about **how the space will be used**. It is about the connections and "feelings" created with the space. Is the space for relaxation and healing, or for action? For many, gardening is a vehicle for spiritual and emotional connection and renewal. Consider:

"More than anything else, a garden is a portal, a passage into another world, one of your own thoughts and your own making; it is whatever you want it to be." (William Longgood.)

Paradise is from the ancient Greek word for an enclosed park, orchard, or pleasure garden. (Oxford English Dictionary.)

Landscape design and gardening are not the same. Being a good gardener does not make the individual a good designer, and good designers are not always good gardeners. But they are related. The best designers combine the art of designing with deep understanding of how plants grow.

Steps to Creating Water-Wise, Practical, and Pleasing Outdoor Living Space

1. **Site analysis** identifies opportunities and limitations of the property.
2. **End-user analysis** identifies landscape goals. Once landscape limitations and goals are identified, the design drawing begins. Design considerations should include line (how the eye is encouraged to move through a space), scale, balance, color, and texture.
3. **Delineate planted and hardscape areas**, creating outdoor rooms.
 - a. Define use of space using hydrozones.
 - Bubble drawings define hydrozones for efficient landscape irrigation.
 - Create practical turf and non-turf areas.
 - b. Refine spaces (lawn areas, flowerbeds, vegetable garden, patio, etc.) using a unified design style. Remember to keep design elements in scale with one another and neighboring structures, and imagine being in the space.
 - c. Refine preliminary design for efficient irrigation.
4. **Develop plant consideration lists** based on hydrozones.

Step 1. Site Analysis Identifies Opportunities and Limitations of the Property

Landscape maintenance professionals estimate that 90% of landscape maintenance problems arise from issues that could or should have been addressed with the site analysis. For most gardeners, site analysis is an ongoing process. Keep a garden journal, recording concerns and success for future reference. Use the questions below to guide a thorough site analysis.

Soil Tilth

- What is the soil texture (sandy, loamy, clayey)?
- How deep is the soil? Is it compacted?
- What is the soil pH, and does it contain free lime?
- What percentage of organic matter is in the soil?
- How are nutrient levels? Is the soil high in salts?

Grading and Drainage

- How quickly does water drain down through the soil profile?
- Does water drain off the property? Can the water be slowed, spread, or encouraged to infiltrate the soil? (Colorado law prohibits stopping the water, e.g., with a pond).
- Does water drain onto the property?
- Are portions of the property at risk for erosion?
- Are grading structures in use or needed?

[Figure 1]

- Are there any low spots or standing water?
- Do any slopes correspond to land use? Slopes greater than 10% are hard to walk on and require year-round plant cover to prevent erosion.

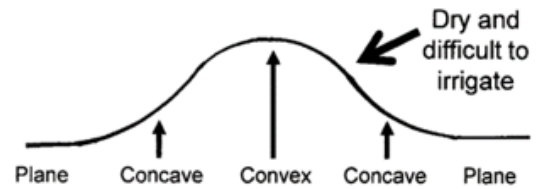


Figure 1. Berms are popular design elements that create different drainage and soil conditions in a small area.

Acceptable Slope

- Drainage swales, 2% to 10%.
- Driveways, 1% to 15%.
- Entrance walks, 1% to 4%.
- Patio-terrace, 1% to 2%.
- Planted banks, up to 33% with year-round plant cover to prevent erosion.
- Ramps (with railing), up to 15%.
- Steps (with railing), up to 50%.

Grading Structures

- Berms and retaining walls can be used to modify slopes and affect drainage.
- For stability, retaining walls and dry walls have specific design criteria.

[Figure 2] Contact the local building department for details on applicable local code requirements.

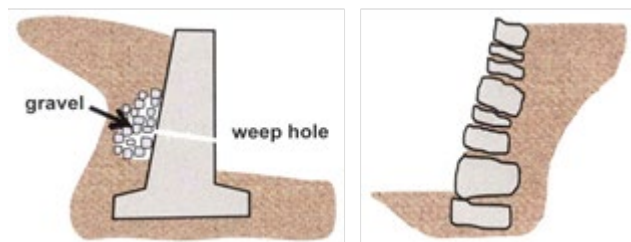


Figure 2. Retaining structures have specific design criteria. Refer to local city building codes for details.

Left: Retaining wall with weep hole.
Right: Dry wall.

Microclimates

- What is the garden aspect (e.g., north or south-facing) and shade patterns?
- What are the prevailing winds and air drainage?
- Does the landscape exacerbate temperature extremes (heat sinks, cold pockets)?

Existing Plant Materials

- What plants are currently in the landscape?
- What is their condition?
- Which will be kept?

The Extended Landscape

- Do any municipal codes or subdivision covenants apply?
- Do any views need to be framed or hidden?
- Can the landscape mitigate traffic noise or other neighborhood noise?
- Should the planned landscaping match the neighborhood landscape style?
- Have privacy and security been considered?

Natural Precipitation and Irrigation Potential

- In Colorado, natural precipitation varies greatly, from below seven inches per year to above 35 inches per year. What is the natural precipitation at your site?
- Colorado communities vary greatly in water resources. What is the situation in your community? Is water available for landscaping?

Opportunity or Constraint?



Figure 3. This spruce tree will be challenged by its planting location on the south side of a two-story building.

A thorough site analysis can help a gardener work with the conditions of the property to create a practical and pleasing landscape. Good design leverages growing conditions to create thriving gardens (rather than forcing an inappropriate design into a limiting site). [Figures 3, 4, and 5]



Figure 4. This crevice garden was installed to stabilize the slope of a drainage swale near a road, creating both a functional and aesthetically pleasing landscape.



Figure 5. This Yucca faxoniana (Eve's needle) is thriving in its unwatered, hot microclimate against the south side of the building.

Step 2. End-User Analysis Defines Goals for the Landscape

What is the landscape for? How will people relate to it? Will the space be extensively used by families? By individuals? Is it a space that will be viewed but not occupied?

What does the end-user want to “feel” when interacting with the landscape? Is it a setting of peace and relaxation, or a setting for activity? These questions should be answered before embarking on any design. Also consider:

Landscape Values: What are the interests and values that should be incorporated into the design? Should the garden be irrigated or non-irrigated, planted only with native plants, be a haven for pollinators, historically and/or culturally relevant, etc.?

Time: How much time can be dedicated to gardening activities?

Dollars: What financial resources will be invested in the landscape?

Rather than haphazardly filling a landscape with stuff, consider how people will relate to the landscape and design accordingly. [Figures 6 and 7]



Figure 6.
End-user analysis is about what people want and need in the landscape. This Steamboat Springs garden features a sitting area with fire pit designed for group conversation.

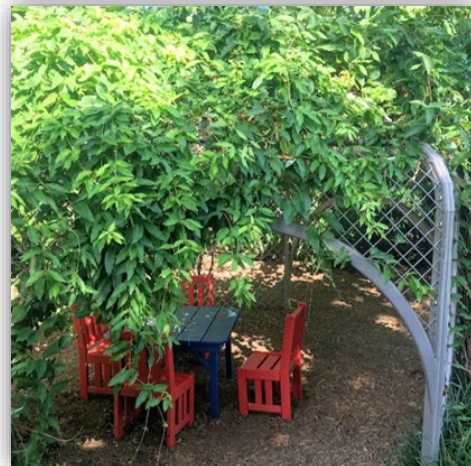


Figure 7.
This garden includes a living clubhouse for children.

Step 3. Delineate Planted and Hardscape Areas, Creating Outdoor Rooms

Planted areas of the landscape include all the plants (trees, shrubs, flowers, turf, vegetables, fruits, etc.). **Hardscape** comprises the non-living elements of the design (patios, decks, fences, water features, and lighting.)

Areas in the Landscape: Public, Private, and Utility

The public area (typically the front yard) is openly viewed by others. Homeowners' associations and cities often regulate what can and cannot be done in the public area of landscapes. [Figures 8, 9, and 10]

Figure 8. The public area is the portion of the yard in open view by others. It may have HOA or community standards that influence the design.

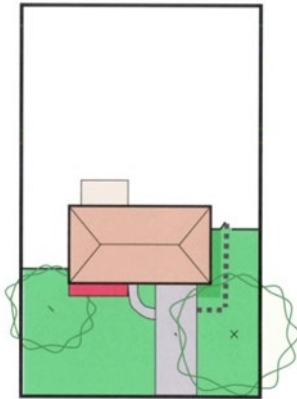


Figure 9. When the public area reflects community landscape standards it builds a welcoming and friendly feeling for the community and enhances neighborhood property values. The public area communicates about the family.



Figure 10. What does your front yard communicate?

The private area (usually the backyard) is not openly viewed by the public. [Figure 11] Being private space, it is designed to support the end-user's activities and interests, including:

- Cooking and eating spaces.
- Places to play and relax.
- Fruit, vegetable, and flower gardens.
- Water features or specialty gardens.

Utility areas serve specific functions such as storage and parking. Their function needs to be considered and incorporated into the landscape design.

- Garden shed, potting area, work area, compost, and trash bins.
- Storage, dog runs, additional parking for cars, boats, RVs.

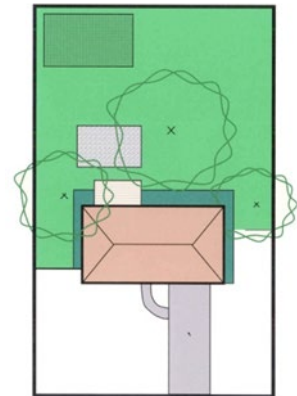


Figure 11. The private area is the primary outdoor living space.

Design Can Be Thought of As Creating Outdoor Rooms [Figure 12]

- What makes up the floor?
- What makes up the wall?
- What makes up the ceiling?

- Lines connect and define spaces (rooms).

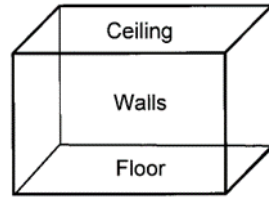


Figure 12. The landscape is an assortment of outdoor rooms designed for various activities. In design, pay attention to the floor coverings, wall features, and what makes up the ceiling.

Step 3a. Define Use of Space by Hydrozone

Bubble Drawings

Bubble drawings help define the **large scale use** (macro) of space. Bubble drawings help define identity, space allocation, and use. For example, a circle represents the location and approximate size of the patio. Other shapes identify the location and approximate size of lawn areas, the vegetable garden, flower beds, etc. [Figure 13]

Bubble drawings do not identify actual lines, beds, path, or individual plants. These will come in future steps in the design process. [Figure 14]

The bubble drawing step also defines hydrozones, which are areas with various levels of irrigation. [Figure 15]

Existing landscape elements that will not change (like an existing deck or large tree) should be on the plan before starting this step.

Do not move on too fast. Try lots of options before selecting the one to use as the basis for the design, and don't forget to inform your choices with the information gained in the site analysis.

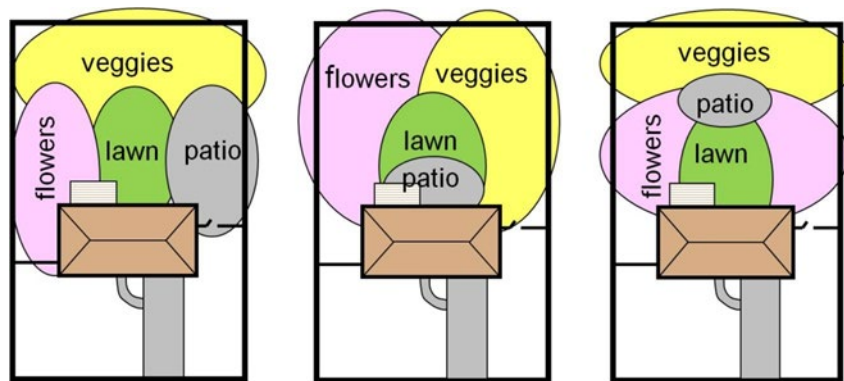


Figure 13. Examples of bubble drawings for a back yard with people space (patio and lawn), vegetable garden, and flower beds.

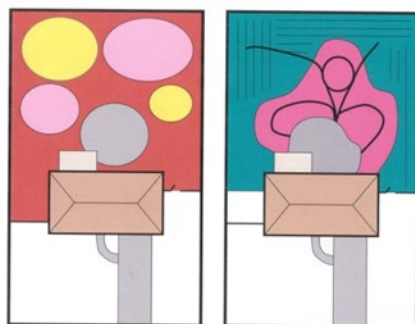


Figure 14. Bubble drawings use ovals that depict various uses and irrigation levels of the space.
Left: They need to fill the space, rather than leave large areas unidentified (red in the drawing).
Right: Bubble drawings do not identify the actual shape and line of the area; this will come in the next step.

Hydrozoning

Irrigation is applied to areas, not plant by plant. Even with a drip system, several plants are grouped on the same zone and receive water at the same rate. Hydrozoning groups plants with similar water needs, and then the gardener must actually irrigate each zone in the landscape to match the water needs.

When developing bubble drawings, factor in the irrigation needs (hydrozones). [Figure 15 and 16]

- Areas of routine irrigation – watered every two to four days.
- Areas of reduced irrigation – watered every four to fourteen days.
- Areas of limited irrigation – watered during dry spells once plants are established.
- Non-irrigated areas.

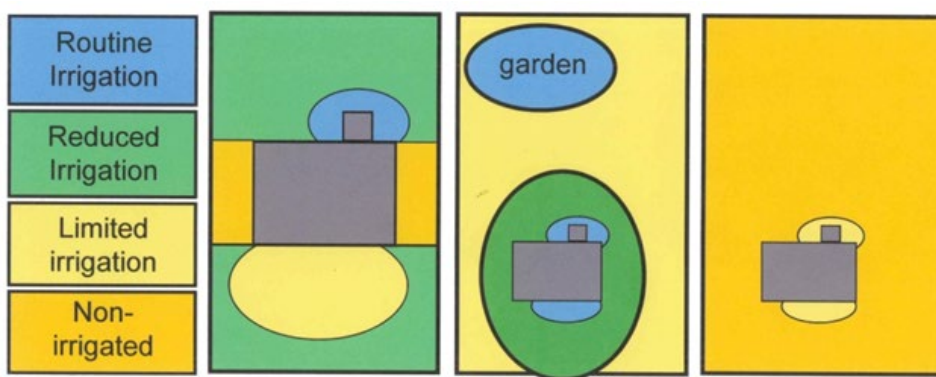


Figure 15. Examples of yards with various styles of hydrozones.

Left: Yard with reduced irrigated lawn in front and back, limited irrigation shrub and flower bed in front yard, routine irrigation flower bed around patio in back yard and non-irrigated side yards.

Center: Larger property with a patch of lawn in the front and back yard while much of the property has limited irrigation. Note that the high-water use garden would be better placed near the back door with the other high-water use plants.

Right: Yard is basically non irrigated with small, limited irrigation flowerbeds near house in front and back.

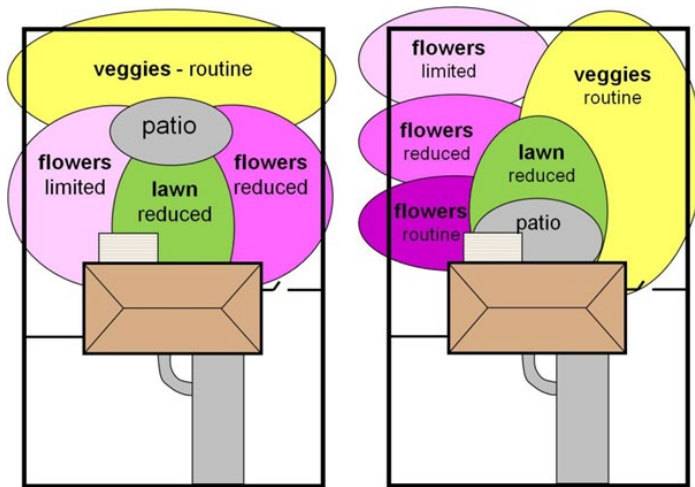


Figure 16. Examples of hydrozone bubble drawings. Note the multiple hydrozones for flowers.

Practical Turf

If recreation or gathering space is important for the final landscape, turf may be an appropriate choice. What turf type matches the landscape objectives for the site?

- For **high traffic areas** with lots of wear and tear, like ball fields, Kentucky bluegrass and turf-type tall fescue with regular irrigation are appropriate. While most home lawns are managed this way, few actually have the wear and tear to justify routine irrigation.
- Kentucky bluegrass and turf-type tall fescue are good choices for most **backyard play and gathering areas**. However, these spaces typically need less water and maintenance than public or heavily used lawns. Bermuda grass is a drought-tolerant option for lower elevations.
- Summer dormant Kentucky bluegrass or buffalograss can be used in **lower-traffic areas**.
- **Non-irrigated** sites with low foot traffic may be appropriate for buffalograss or blue grama grass. The quality of the lawn depends on the amount of rain the grass actually receives.

What turf type matches the community's water supply?

Some communities lack the water resources for routine landscape irrigation. In Colorado, limited irrigation or completely unwatered landscapes may be the only practical options.

Step 3b. Refine Spaces Using a Unified Design Style

Using your bubble drawing, begin to define spaces, using a single design style in order to maintain garden coherence. [Figures 17 and 18]. For example:

- **Rectilinear style** has straight lines and right angles in square and rectangular shapes.
- **Curvilinear style** avoids straight lines and right angles using bold sweeping curves instead.
- **Angular style** uses straight lines but with a variety of angles and directions.
- The property line and the home style do not dictate the landscape style but can help inform it. Use features on the home as size references to keep garden elements in scale.

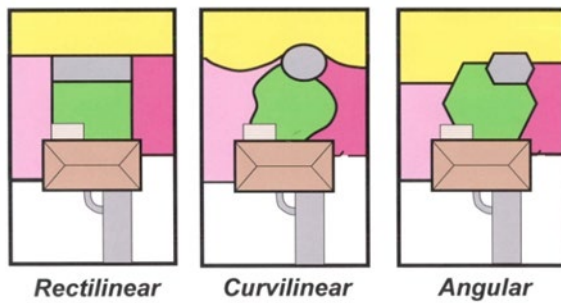
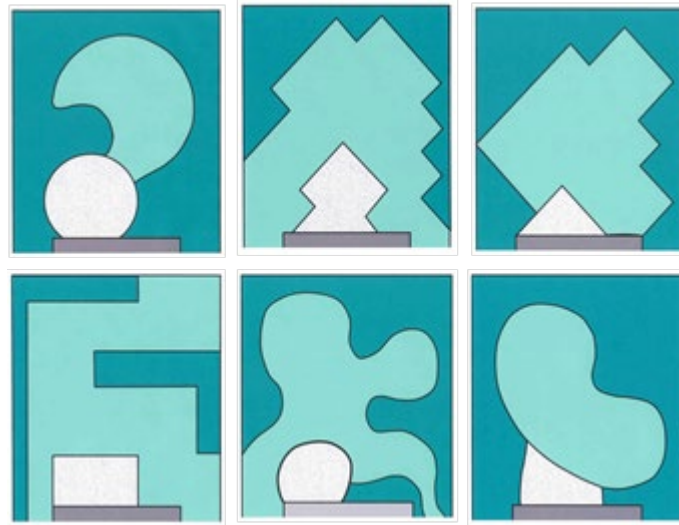


Figure 17. Examples of styles for a backyard with patio (gray), flower beds (pink), and vegetable garden (yellow).

Figure 18. Notice how lines connect and define space. The different styles bring various feelings to the site. Some are calming and relaxing whereas others suggest action.



Step 3c. Refine Preliminary Design for Efficient Irrigation

Efficiency in irrigation is based on uniformity of water delivery. If water is delivered unevenly in irrigation zones, some spots will be overwatered to keep the spots that receive less water green.

Sprinkler Irrigation: Design Criteria for Uniform Water Delivery

Uniformity of water delivery equals water savings.

1. Head-to-Head Coverage [Figure 19]

- Spray from each head must reach neighboring heads.
- Less than head-to-head coverage (while popular to reduce installation costs) significantly increases water use for the life of the system.

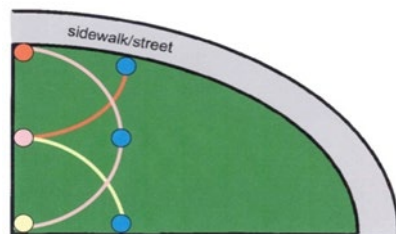


Figure 19. Head-to-head coverage is a minimum standard for water savings. Water from each head reaches the neighboring heads.

2. Water From the Edge Inward [Figure 20]

- Another standard for water savings is to water from the outside in.
- Edges cannot be efficiently watered from the center; the edge will be dry, and water will be wasted spraying into non-irrigated areas.

- Although lining irrigation zone edges with sprinkler heads requires more sprinkler heads with higher installation costs, it is a primary water saving technique, reducing water use.

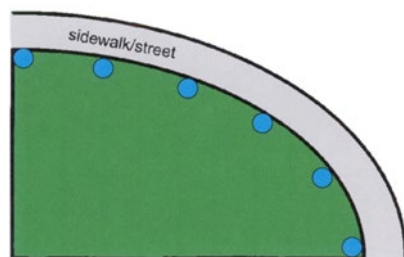


Figure 20. Another water saving standard is to line out the irrigated area from the non-irrigated area by watering from the outside inward.

3. Fill in with heads in square and triangle patterns. [Figures 21 and 22]

- For uniform water distribution, fill in heads in square or triangle patterns. The overlap gives the most uniform delivery and avoids dry spots.
- Adding an extra head to ensure coverage is preferable to rigorously following a geometric pattern.

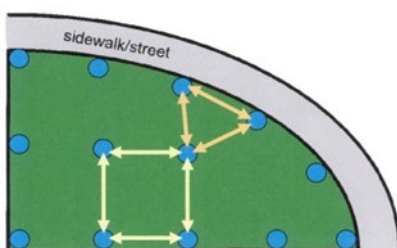


Figure 21. For uniform water delivery, fill in heads in square or triangle patterns.

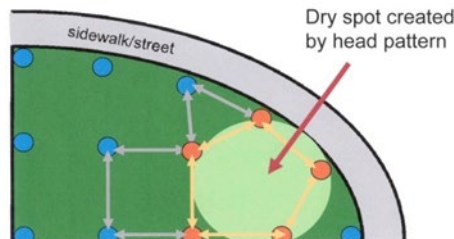


Figure 22. Irregularly shaped areas.

4. Use uniform type, brand, and style of heads in each irrigation zone.

- Different heads and nozzles have different precipitation rates so keeping them the same within zones keeps water application even.

5. Avoid sprinkler irrigation of small or irregularly shaped areas.

- In design, avoid creating small (less than about eight feet wide), irregularly shaped areas that will require irrigation. If such areas are unavoidable, design them for drip irrigation or hand-watering.

6. Use recommended water pressure.

- A mist cloud around a sprinkler head indicates excessive pressure, increasing evaporation, and total water usage.
- A pressure regulator is standard on drip systems. They can be retrofitted into the water line in older systems being converted from spray heads to drip.
- Most sprinkler heads in the home garden trade are designed to work at 30 to 40 psi, and generally do not have internal pressure regulators.
- Heads used on commercial/industrial properties may work with much higher pressures and these more expensive heads generally have a pressure regulator built into the head.
- Many cities deliver water at 30 to 40 psi. However much higher pressures are possible. With pressure above 80 psi, automatic valves may have trouble closing.

Typical Sprinkler Patterns [Figure 23]

- Full circles.
- Half circles giving a straight line.
- Quarter circles give a right angle for square corners.
- Adjustable arc (the angle can be manually set); however, these are less uniform in delivery.
- Other patterns (like strip head) lack good uniformity in water distribution.

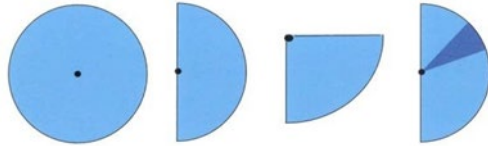


Figure 23. Sprinkler heads come in full circle, half circle, quarter circles, and adjustable arcs.

Fitting Sprinkler Patterns Into the Design

Spray heads are usually spaced at eight to fifteen-foot intervals depending on the nozzle. They have a high water delivery rate, up to two inches per hour, often leading to surface run-off.

Rotor heads are spaced at fifteen to forty-five or more foot intervals (depending on the nozzle and head type). They have a lower delivery rate, between 1/4 – 1/2 inch per hour.

A thirty foot by forty-five foot lawn area could have pop-up spray heads at fifteen foot intervals, with quarter heads in the corners, half heads along the sides and full circles in the center. **[Figure 24]**

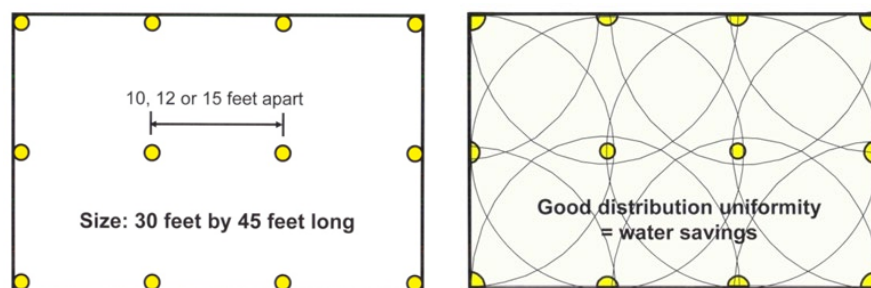


Figure 24.

Left: For this 30 foot wide by 45 foot long area, pop-up spray heads could be used at 15 foot centers.

Right: quarter heads would be placed in the corners, half heads along the sides and full circle heads in the center. With head-to-head coverage, this would give a good efficiency for water delivery.

If a flowerbed were to be added to the area, blocked spray would create a dry area around the bed and a very wet planting bed from the intercepted water. In water-wise design, avoid blocking sprinkler delivery with flowers and shrubs. **[Figure 25]**

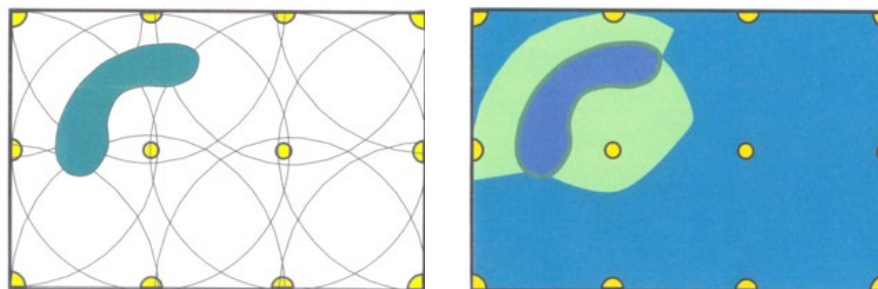


Figure 25. Adding a flower or shrub bed to this sprinkler layout will interfere with water distribution.

In water-wise landscaping design, irrigation design must be considered. If modifying an existing landscape, overlay the sprinkler layout onto the design. Then adjust the lines of the design, irrigation lines or bed lines, for an efficient irrigation layout of each hydrozone. [Figure 26, 27, 28 and 29]

Remember:

- Head-to-head coverage.
- Water from the zone edge inwards.
- Place heads in square and triangle patterns.

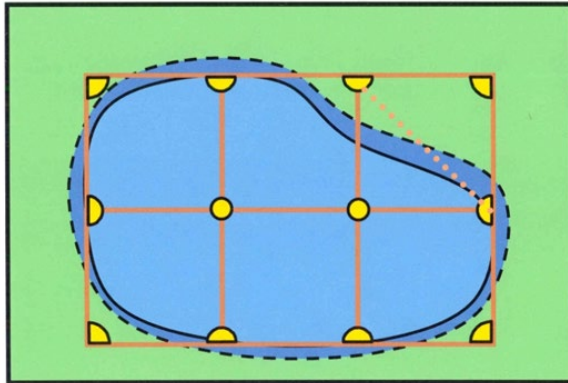


Figure 26. To walk the talk of being water wise, adjust the line in the preliminary design for improved irrigation efficiency. In the drawing the blue area represents a lawn that will be sprinkler irrigated surrounded by a mixed flower shrub beds with drip irrigation. The original line is indicated with the dotted line. Then the sprinkler grid pattern was over-laid. With head-to-head coverage, note that some lawn areas are outside of the water delivery zone. Sliding the heads out to compensate will significantly increase water use with the lack of head-to-head coverage. A better solution is to move the line inside the sprinkler delivery pattern. As redrawn, this minor adjustment could reduce water use by 30 to 50%!

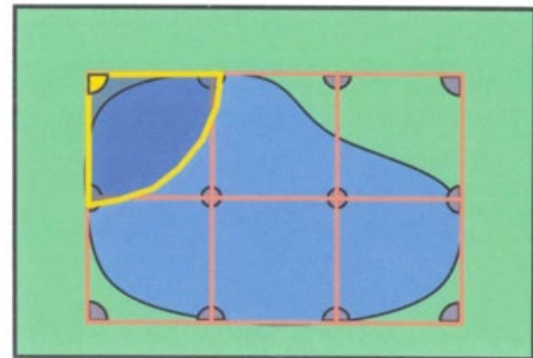
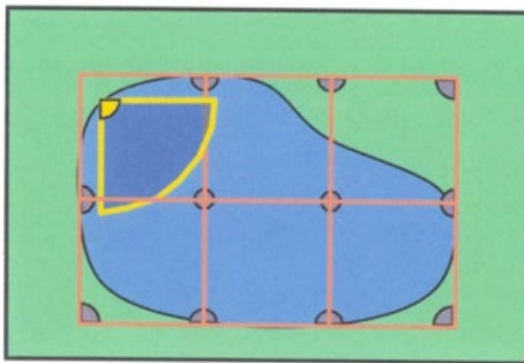


Figure 27.

In small areas, notice how the sprinkler heads must stay on the grid lines. Plant materials along the edge of the lawn area must be kept short to allow for water delivery and must be tolerant of the water levels given the lawn.

Left: If the head is moved into the edge of the lawn (blue area), it creates coverage problems along the edge.

Right: As drawn, the final head placement is given.

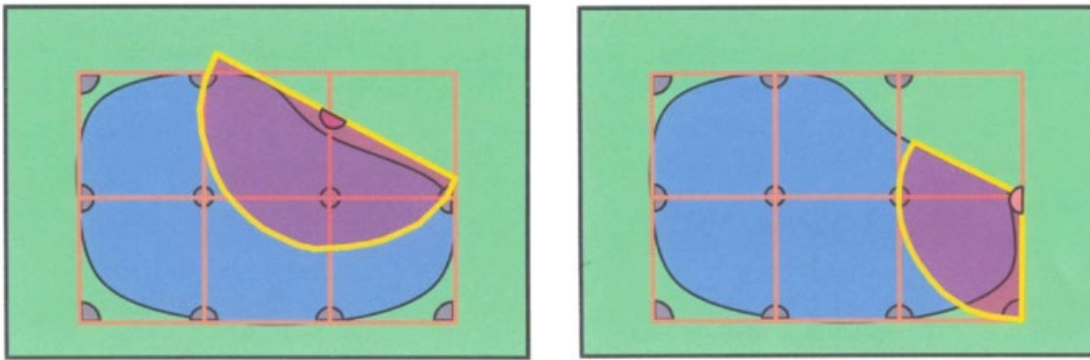


Figure 28. As drawn, the sprinkler head in the upper right hand corner could be eliminated. Drawing left and right show adjustments in placement and arc of adjacent heads. Note: For head-to-head coverage in this small area, all heads stay on the grid line. As drawn, the final head placement is given below in **Figure 29**, left.

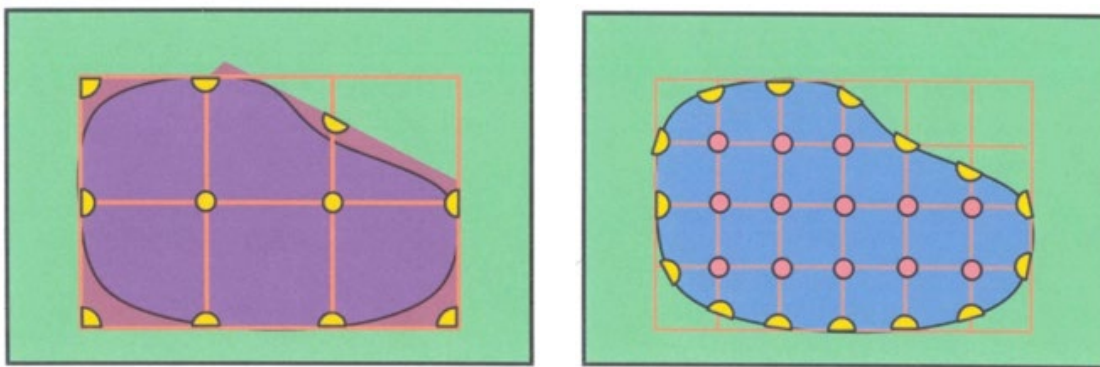


Figure 29.

Left: Illustration of sprinkler layout for a lawn area 30 by 45 feet with pop-up spray heads at 15-foot intervals. Notice how heads stay on the grid line. The head in the upper right corner was eliminated with adjustments made in placement and arc of neighboring heads. Notice the overspray of the sprinkler system on the edges of the flower/shrub bed. Any plant materials in this area would be low ground cover types and acceptable to the watering level of the lawn.

Right: Illustration of sprinkler layout for a 60 by 90 foot lawn area with pop-up spray heads at 15-foot centers.

Rotor heads: In the large 60 by 90-foot lawn area, rotor heads could be used at 30-foot spacings. With rotor heads, the layout would be like the illustration on the left.

Step 4. Develop Plant Consideration Lists

Plant materials need to be identified by water needs so they can be grouped into hydrozones. Flexibility in the design process at this point allows for the consideration of exciting new plants, not previously known or grown. Flexibility will also be needed when the desired plants are not available or are of poor quality.

Water-Wise Landscaping in Colorado's Semi-Arid Climate

Beautiful gardens do not require irrigation beyond the establishment phase. Neither does irrigation guarantee a beautiful garden. Carefully choosing site-adapted plants based on the site analysis will maximize water savings. [Figure 30]

Even xeric plants need rain and/or irrigation during establishment. Gardens with limited or no irrigation are more closely linked to the weather, thriving in years with heavy rainfall and remaining more modest in dry years.



Figure 30. Xeriscaping does not need to be a rock pile. This roadside garden in Littleton receives no supplemental irrigation whatsoever.

CMG GardenNotes on Water-Wise Landscape Design

- #410, *Water-Wise Landscape Design: References and Review Material.*
- #411, *Water-Wise Landscape Design: Steps.*
- #412, *Water-Wise Landscape Design: Selecting Turf Options.*
- #413, *Water-Wise Landscape Design: Principles of Landscape Design.*

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Colorado State University no discrimina por motivos de discapacidad y se compromete a proporcionar adaptaciones razonables.

Office of Engagement and Extension de CSU garantiza acceso significativo e igualdad de oportunidades para participar a las personas quienes su primer idioma no es el inglés.

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