MASTER GARDENER
COLORADO STATE UNIVERSITY
EXTENSION

*CMG GardenNotes #268*

# Irrigation Management Worksheet:
# Lawn In-Ground Sprinkler System Check-UP

Name: ___________________

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This activity is a check-up on an in-ground lawn sprinkler system. If you don't have access to an in-ground sprinkler system for the activity, please contact the instructor for an alternative activity.

To complete the irrigation check-up, you will need the following items:

- 6, identical straight-sided, flat bottom cans or cups (do not use tuna or other short cans)
- Watch
- Ruler
- Colored flags or other marking tools (screwdrivers or sticks) to mark sprinkler heads by zone (helpful)
- Calculator
- Screwdriver and/or soil probe

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## Why do an irrigation check-up

**For most residents, attention to irrigation efficiency has the greatest potential for water conservation of all the principles of water wise landscaping.** In the typical home yard, extra attention to irrigation system design, maintenance, and management will reduce water use by 20% to 70%; 40% being average.

The purpose of a lawn irrigation check-up is a systematic evaluation of the irrigation system design, maintenance, and management. It will identify areas where adjustments will make a minor or major impact on water conservation and lawn quality. Run times for each sprinkler zone will be calculated based on the precipitation rate of each zone.

The check-up is only a tool to help the gardener identify where the system is working adequately and where adjustments need to be made. Actual water conservation comes as findings are incorporated.

**Note: Carry out a normal watering the day before doing the check-up.**

## Step 1 – Visually evaluate the lawn

### 1. How does the lawn look?

- ☐ Green (high input lawn)
- ☐ Green (moderate input lawn)
- ☐ Green (low input lawn)
- ☐ Dry spots: _____% of lawn
- ☐ Dry/Dormant

- ☐ Thick
- ☐ Thin

- ☐ Weed free
- ☐ Few weeds
- ☐ Weedy

### 2. Soil conditions

1. Stick a screwdriver in the ground to get a sense about soil compaction. The ease or difficulty at which the screwdriver can be pushed into a <u>moist</u> soil gives a grasp of soil compaction.

2. If possible, use a soil probe to get a sense on soil texture, compaction, soil layers, rooting depth, and thatch layer. Note: On compacted or rocky soil, it may impossible to push a soil probe into the soil. On extremely compacted soils, it may even be impossible to push a screwdriver into the soil.

- Soil compaction
  - ☐ Little to no compaction (screwdriver/probe readily goes in)
  - ☐ Moderate compaction (screwdriver/probe hard to push in)
  - ☐ Severe compaction (screwdriver/probe extremely difficult to impossible to push in)
  - ☐ Aeration needed to increase infiltration

- Soil texture
  - ☐ Coarse texture (sandy)
  - ☐ Moderate texture (loamy)
  - ☐ Fine texture (clayey)

- Soil profile
  - ☐ Changes in soil texture evident
  - ☐ Hardpan layer
  - ☐ Evidence of drainage problems (such as surface pooling)

- Thatch layer
  - ☐ Less than 1/2 inch
  - ☐ Greater than 1/2 inch
    - ☐ Aeration needed to manage thatch

- Runoff potential
  - ☐ Low potential
  - ☐ High potential (use cycle and soak application)
    - ☐ Due to slope
    - ☐ Due to soil conditions (compaction and clayey soils)
    - ☐ Due to heavy thatch

3. **Current irrigation pattern**

- During the summer (July/August) the lawn is typically watered ____________________ (days) for ____minutes
- During the typical July/August weather, the lawn can go ____ days between irrigation before getting dry.
    - Multiply the number of days (maximum) between summer irrigations by 0.20 to estimate the water holding capacity for the soil and rooting depth at this site. This is the maximum amount of water to apply per irrigation.
    - **___ days x 0.20 inches = _____ inches per irrigation (maximum)**

4. **Notes**

## Step 2 – Current Controller Settings

Record current settings from the controller including watering days, start time(s) and run times. Note Precipitation rates and inches applied may be calculated later. This will be used to document water saving potential from the check-up.

Controller is set for ___________________ (month).

| **Table: Step 4 – Current Setting and Inches Applied** | | | | | | |
|---|---|---|---|---|---|---|
| **Zone** | **Zone Identity** | **Watering day(s)** | **Start time(s)** | **Run time** | **Precipitation Rate** | **Inches Applied** |
| **1** | | | | | | |
| **2** | | | | | | |
| **3** | | | | | | |
| **4** | | | | | | |
| **5** | | | | | | |
| **6** | | | | | | |

## Step 3 – Identify and Evaluate Irrigation Zones

A. Identify the location of each sprinkler head in each zone (a group of sprinkler heads that come on at the same time). Using difference colors of landscape flags or other marking devices (like screwdriver or stick pushed in the ground near each head) is helpful. Sprinklers may need to be turned on to find and identify sprinkler heads by zone.

B. Evaluate the following hydrozone layouts

| **Step 3. Irrigation Zones** | OK – Concept incorporated | Minor – Benefits received with minor adjustments or implementation | Major – Benefits received with major adjustments or implementation | Not applicable to site |
|---|---|---|---|---|
| **Irrigation Zones** | | | | |
| 1. Lawn zones separate from flower and shrub bed zones | | | | |
| 2. Lawn areas zoned by irrigation demand (i.e., high input, moderate input, and low input areas on separate irrigation zones) | | | | |
| 3. Zone by exposure (i.e., extreme exposures, full sun, partial shade, full shade, and slopes on separate irrigation zones) | | | | |
| 4. Drip or bubblers used in flowerbeds, shrub beds, small fruits, and vegetable gardens | | | | |
| 5. Design avoids sprinkler irritation on small, irregular shaped areas (generally areas less than 10 feet wide) | | | | |

C. If design does not meet this criteria, consider upgrading the irrigation system.

D. Notes:

## Step 4 – Evaluate sprinkler performance

Turn on sprinklers and evaluate sprinkler performance as outlined below, repeating steps for each zone.

### A. Design criteria for even water distribution

1. **Head to head coverage** – Does the water from each head reach neighboring heads? [*The Science of Gardening*, page 620]

| Table 4a1 – Head to Head Coverage | | | | | | |
|---|---|---|---|---|---|---|
| Zone | 1 | 2 | 3 | 4 | 5 | 6 |
| Yes = OK | | | | | | |
| NO = adjustments needed* | | | | | | |

* In some situations adjusting heads or changing nozzles may correct the problem. In other situations, the system design may need to be up-graded for water conservation.

2. **Lined-out –** Are sprinkler heads "lined-out" along the edge of non-irrigated areas (watering form the outside in)? [*The Science of Gardening*, page 620]

| Table 4a2 – Lined-out | | | | | | |
|---|---|---|---|---|---|---|
| Zone | 1 | 2 | 3 | 4 | 5 | 6 |
| Yes = OK | | | | | | |
| NO = upgrade needed* | | | | | | |

* If no, consider upgrading the sprinkler system for improved water conservation.

3. **Head layout –** Are sprinkler heads arranged in triangle and square patterns, avoiding pentagon patterns? [*The Science of Gardening*, page 621]

| Table 4a3 – Head Layout | | | | | | |
|---|---|---|---|---|---|---|
| Zone | 1 | 2 | 3 | 4 | 5 | 6 |
| Yes = OK | | | | | | |
| NO = upgrade needed* | | | | | | |

* If no, consider upgrading the sprinkler system for improved water conservation.

4. **Zone uniformity** – Are all head in a zone the same brand and type?

| **Table 4a4 – Zone Uniformity** | | | | | | |
|---|---|---|---|---|---|---|
| Zone | 1 | 2 | 3 | 4 | 5 | 6 |
| Yes = OK | | | | | | |
| NO = adjustments needed* | | | | | | |

* In some situations, replacing heads may correct the problem. In other situations, the system design may need to be up-graded for water conservation.

5. **Pressure –** Is there a mist cloud around sprinkler heads? [The Science of Gardening, page 621]

| **Table 4a5 – Pressure / Mist Cloud** | | | | | | |
|---|---|---|---|---|---|---|
| Zone | 1 | 2 | 3 | 4 | 5 | 6 |
| Yes = OK | | | | | | |
| NO = adjustments needed* | | | | | | |

* A mist cloud indicates excessive pressure. Lower pressure to conserve water. In some situations, this may involve installation of an in-line pressure regulator.

6. **Notes/Comments**

## B. Maintenance criteria for even water distribution

1. **Delivery arc –** For each head does the delivery angle need adjustments (to avoid spraying the sidewalk, driveway, or other areas outside the zone)? [*The Science of Gardening*, page 621]

| **Table 4b1 – Delivery Arc** | | | | | | |
|---|---|---|---|---|---|---|
| Zone | 1 | 2 | 3 | 4 | 5 | 6 |
| No = OK | | | | | | |
| Yes = adjustments needed | | | | | | |
| Identify heads needing adjustments | | | | | | |

2. **Vertical adjustment** – Do heads need adjustment to vertical (straight up and down)? [*The Science of Gardening*, page 622]

| **Table 4b2 – Vertical adjustment** | | | | | | |
|---|---|---|---|---|---|---|
| Zone | 1 | 2 | 3 | 4 | 5 | 6 |
| No = OK | | | | | | |
| Yes = adjustments needed* | | | | | | |
| Identify heads needing adjustments | | | | | | |

* Heads off vertical will distort the delivery pattern. Adjust to vertical to conserve water.

3. **Height** – Is nozzle releasing water above grass height? [*The Science of Gardening*, page 622]

| **Table 4b3 – Height** | | | | | | |
|---|---|---|---|---|---|---|
| Zone | 1 | 2 | 3 | 4 | 5 | 6 |
| Yes = OK | | | | | | |
| No = adjustments needed* | | | | | | |
| Identify heads needing adjustments | | | | | | |

* When water doesn't clear grass height, distribution pattern may be distorted. Raise head.

4. **Worn Nozzles**– Look at the fan created by the water spray for each head. Is it uniform around the arc? This is rather difficult to evaluate by line of sight. [*The Science of Gardening*, page 622]

| **Table 4b4 – Worn Nozzles** | | | | | | |
|---|---|---|---|---|---|---|
| Zone | 1 | 2 | 3 | 4 | 5 | 6 |
| Yes = OK | | | | | | |
| No = adjustments needed* | | | | | | |
| Identify heads needing adjustments | | | | | | |

* Replace worn nozzles to improve distribution pattern.

5. **Replace leaky valves –** In the irrigation valve, the rubber diaphragm that actually turns water on and off ages over time. Valves that do not shut-off completely need the diaphragm or entire valve replaced. [*The Science of Gardening*, page 622]

| **Table 4b5 – Leaky Valves** | | | | | | |
|---|---|---|---|---|---|---|
| Zone | 1 | 2 | 3 | 4 | 5 | 6 |
| Valve not leaking = OK | | | | | | |
| Valve leaking = needing replacement | | | | | | |

6. **Evaluate dry spots** – If the zone has a dry spot, place some cans on the dry spot and on the green areas. After running the sprinkler for their normal time, compare the amount of water received in each can. [*The Science of Gardening*, page 622]

| **Table 4b6 – Evaluate Dry Spot** | | | | | | |
|---|---|---|---|---|---|---|
| Zone | 1 | 2 | 3 | 4 | 5 | 6 |
| No dry spots | | | | | | |
| Dry spot(s) receiving less water than the green areas[1] | | | | | | |
| Dry spot(s) receiving similar amounts of water as green areas[2] | | | | | | |

[1] When the amount of water received in dry area cans is significantly less than the green area cans, poor water distribution is a primary contributor. Evaluate irrigation design and maintenance issue.

[2] When the amount of water received in both the green area cans and dry area cans is similar, the problem is not directly related to sprinkler performance. Evaluate other growth factors, including soil compaction, thatch, run-off, insect or disease problems, etc.

**Adjusts identified in step 4 need to be performed before continuing to step 5.**

## Step 5 – Perform precipitation rate (catch can) test

Perform a precipitation rate test (catch can test) for each zone, recording the precipitation rates in **Run Time Table.** [*The Science of Gardening*, page 631]

### Precipitation Rate (Catch Can Test)

To do the calculations you will need 6 identical, straight-sided, flat bottom, cans or coffee mugs such as soup cans, fruit or vegetable cans, or coffee cans. (Do not use short cans like tuna cans as they are too shallow and water may splash out.) You will need a ruler, a watch, and paper/pen to record your findings.

**Steps**

a. Place 6 identical, straight-sided, flat bottom cans or coffee mugs randomly around the area between sprinkler heads in the zone.
b. Turn on the sprinklers for exactly 10 minutes.
c. Pour all the water into one can.
d. With a ruler, measure the depth of the water in the can. This is your precipitation rate in inches per hour.
e. Write down the rate for each zone in **Table: Step 8**
f. Repeat steps 1-5 for each irrigation zone.

Note: if the amount of water in some containers is significantly more or less than others, it indicates that the system is poorly designed or head(s) are malfunctioning.

| **Table 5 – Precipitation Rate** | | | | | | |
|---|---|---|---|---|---|---|
| 1. Zone | 1 | 2 | 3 | 4 | 5 | 6 |
| 2. Precipitation Rate (inches/hour) | | | | | | |

# Step 6 – Calculate system run times for each zone

## A. Working down through the table, calculate the run time per irrigation.

| **Table 6a – Run Times** | | | | | | |
|---|---|---|---|---|---|---|
| **Zone** | **1** | **2** | **3** | **4** | **5** | **6** |
| **1. Historical Summer ET** amount of water to apply | 1.5”/week | | | | | |
| **2. Precipitation Rate – inches/hour** from catch can test, Table 5, Row 2 | | | | | | |
| **3. Run time per week (July/August)** Based on Precipitation Rate for the zone (line 3), look this up from Table 50-2 (page 612) or Table 52-1 (page 632). | | | | | | |
| **4. Number of irrigations/week** Refer to Step 1-3 above | | | | | | |
| **5. Run time per irrigation** Convert the ***Run Time per Week*** (line 4) to ***Run Time per Irrigation*** using table 50-3 (page 612) or Table 52-2 (page 633) | | | | | | |

## B. Adding Cycle and Soak

Most clayey and/or compacted soils cannot absorb water as quickly as sprinklers apply it. Many clayey soils, typical of the Front Range, absorb about ¼ inch of water per hour. Therefore, the most effective watering schedule on these soils would be to set each zone to deliver no more than ¼ inch per cycle with multiple cycles. For example, if the lawn is to have ½ inch of water, set controller to apply ¼ inch and cycle back an hour later to apply the second ¼ inch. If the lawn was to have ¾ inch, set the controller to apply ¼ inch per cycle with 3 cycles.

Soak and cycle is particularly helpful on slopes to avoid wasteful surface runoff.

Use Table 50-4 (page 613) or Table 52-3 (page 633) to determine if Cycle and Soak is desired.

| **Table 6b – Cycle and Soak** | | | | | | |
|---|---|---|---|---|---|---|
| **Zone** | **1** | **2** | **3** | **4** | **5** | **6** |
| 1. **Need for *Cycle and Soak*?** Yes/No | | | | | | |
| 2. **Run Time Per Irrigation** from Table 6a, Line 65 | | | | | | |
| 3. **Number of cycles** from Table 50-4 (page 613) or Table 52-3 (page 633) | | | | | | |
| 4. **Run Time Per Cycle** Divide ***Run Time per Irrigation*** (line 2) by ***Number of Cycles*** (line 3) | | | | | | |

# Step 7 – Start time(s)

## a. Determine the first start time

Most communities suggest nighttime irrigation, between 9 p.m. and 9 a.m. Winds are typically less in the early morning, and evaporation loss will be lower. However, many communities experience peak water use from 4 to 6 a.m. as many sprinklers come on, so remember that the irrigation window is 9 to 9, not just 4 in the morning.

Enter your first start time into Table **7–Start Time(s), row 1**

**b. Adding additional start times for Cycle and Soak (if needed)**

1. Add all the Run Time per CYCLE together.
2. **Cycle Time** – Round this up to the next ¼ or ½ hour (depending on what start time intervals are used in your controller start options). This is the time to run through all the zones. Add this to **Table 7-Start Time(s), Rows 2 and 4** below. Or add 1 hour if the total run time is less than 60 minutes.
3. Add this to the first start time for the second start time. Record your second start time in **Table 7-Start Times) Row 3, Start Time 2**.
4. Likewise, if a third cycle is needed, add this to the second start time to get the third start time. Record this in **Table 7-Start Times) Row 5, Start Time 2**.

| **Table 7 – Start Time(s)** | |
|---|---|
| **1. Start time 1** | |
| 2. Total cycle time | |
| **3. Start time 2** (if needed) [add line 1 to line 2] | |
| 4. Total cycle time | |
| **5. Start time 3** (if needed) [add line 3 to line 4] | |

## Step 8. Set the Controller for July/August Run Time

1. Set the run times for each zone as listed in **Table 6a, line 6** if Cycle and Soak is not used, or **Table 6b, line 4** if Cycle and Soak is used.

2. Set the start time(s) as given in Table 7-Start Time(s)

## Step 9. Seasonal Adjustment

A simple way to adjust for the season is to use the *Percent Key* found on most controllers.

- For Late April and early October, set the percentage to 50%
- For May/June and September, set the percentage to 67%

An alternative method is to repeat Step 6 to 8 for the spring/fall season.

## Step 10. Fine-Tune to Match Site Specific Needs

These textbook figures are a good start point in irrigation management. However, any scheduling method will need fine-tuning to match the actual water need of the site based on the exposure, wind, heat, and shade. This is done by careful observation of the lawn.

- **When adjusting all zones**, the *Percent Key* on most controllers makes an easy method to fine-tune for the actual site by adjusting the percentage up/down in 10% increments, as needed. It can also be done by adjusting the run time of each zone up/down in 10% increments, as needed.

- **When adjusting a single zone**, adjust the run time for that zone up/down in 10% increments, as needed.

In the typical summer weather, if the lawn starts to become dry between irrigations, increase the run time in 10% increments, as needed. By experience, it is easy to fine-tune each irrigation zone. In multiple days of unseasonably hot weather, dry spots should begin to pop up if the controller if precisely fine-tuned. In unseasonably hot weather, if dry spots do not pop up, the lawn is being overwatered. Cut back the time in 10% increments, as needed to fine-tune each zone.

The following guidelines may help you understand some needs for adjustments:

- In full shade (not under a large tree), water use (ET) could be 30% less.
- In hot and/or windy sites, water use (ET) could be 20% to over 50% higher.
- In the rooting area of large shade trees, water use (ET) could be 30% to 50% higher.

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Revision: Kurt M. Jones, Chaffee County Extension Director (9/2017).



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