

## Scope

Conserva Irrigation promotes irrigation system efficiency through proper design, matched precipitation rates, and modern spray technology. In particular, Conserva recommends Toro® Precision™ Spray Nozzles (PSN) paired with high-quality spray heads as a means of reducing water waste while maintaining healthy landscape coverage.

This study was conducted to:

- Evaluate irrigation performance under real-world conditions in the North Houston market
- Compare distribution uniformity and water usage between existing spray nozzles and Toro Precision Spray Nozzles
- Measure the impact of increasing spray head height from 4 inches to 6 inches

## Methodology

A single spray zone containing 13 spray heads was selected for evaluation. Nine heads were installed in a rectangular spacing pattern in the main lawn area, with four additional heads serving a narrower strip between the sidewalk and street. (see appendix for layout configuration)

The original configuration consisted of 4-inch spray heads equipped with a mixture of fixed-pattern and adjustable spray nozzles. Head spacing, arc settings, and visible coverage were inspected prior to testing. Two heads were raised to ensure an unobstructed spray above turf height.

A total of 24 catch cups were installed throughout the zone to measure applied water depth. Cups were placed approximately 2 feet from each spray head and at midpoint locations between heads. Due to physical constraints, three catch cups were placed in the sidewalk strip area. The catch-cup layout is shown in the attached diagram.

Each test followed the same procedure:

- Water meter reading recorded at the start
- Zone operated for a 5-minute cycle without interruption
- Water meter reading recorded at completion
- Individual catch-cup volumes recorded in milliliters (mL)

# Distribution Uniformity Study

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## Distribution Uniformity Calculation

Distribution Uniformity was calculated using the Lower Quarter method defined as:

$$DU = \frac{Avg\ LQ}{Avg\ total} \times 100$$

Avg LQ = average of the lowest 25% of catch measurements

Avg Total = average of all the catch measurements.

With 24 catch cups, the lowest six measurements were used to calculate the Lower Quarter Average (LQ) (see tabulated measurements in Appendix)

## Test Configurations

- **Test #1 (Baseline):** Existing 4" spray heads with mixed fixed and adjustable nozzles
- **Test #2:** Same heads with Toro Precision Spray Nozzles installed
- **Test #3:** 6" spray heads installed, using the same Toro Precision Spray Nozzles as Test #2

**Results Summary** (see calculation details in Appendix)

Test	DU	Water Used (5 min)
Test #1	0.30	86.3 gallons
Test #2	0.55	52.5 gallons
Test #3	0.64	50.9 gallons

### Interpretation

- The baseline configuration exhibited poor distribution uniformity (DU = 0.30), indicating that a large portion of applied water failed to reach the driest areas of the landscape.
- Replacing existing nozzles with Toro Precision Spray Nozzles increased DU to 0.55, an 80% relative improvement, while reducing water usage by approximately 40%.
- Increasing spray head height from 4 inches to 6 inches further improved DU to 0.64, representing a 113% relative improvement over the original configuration. Total water usage remained approximately 40% lower than the baseline condition.

### What This Means in Practical Terms

- **Test #1:** Of 86 gallons applied, approximately 26 gallons effectively reached the areas most in need of water.
- **Test #2:** Of 53 gallons applied, approximately 29 gallons reached the driest areas.
- **Test #3:** Of 51 gallons applied, approximately 33 gallons reached the driest areas.

These results demonstrate that modern spray nozzle technology and proper spray head height significantly improve irrigation performance, delivering more usable water to the landscape while substantially reducing overall water consumption.

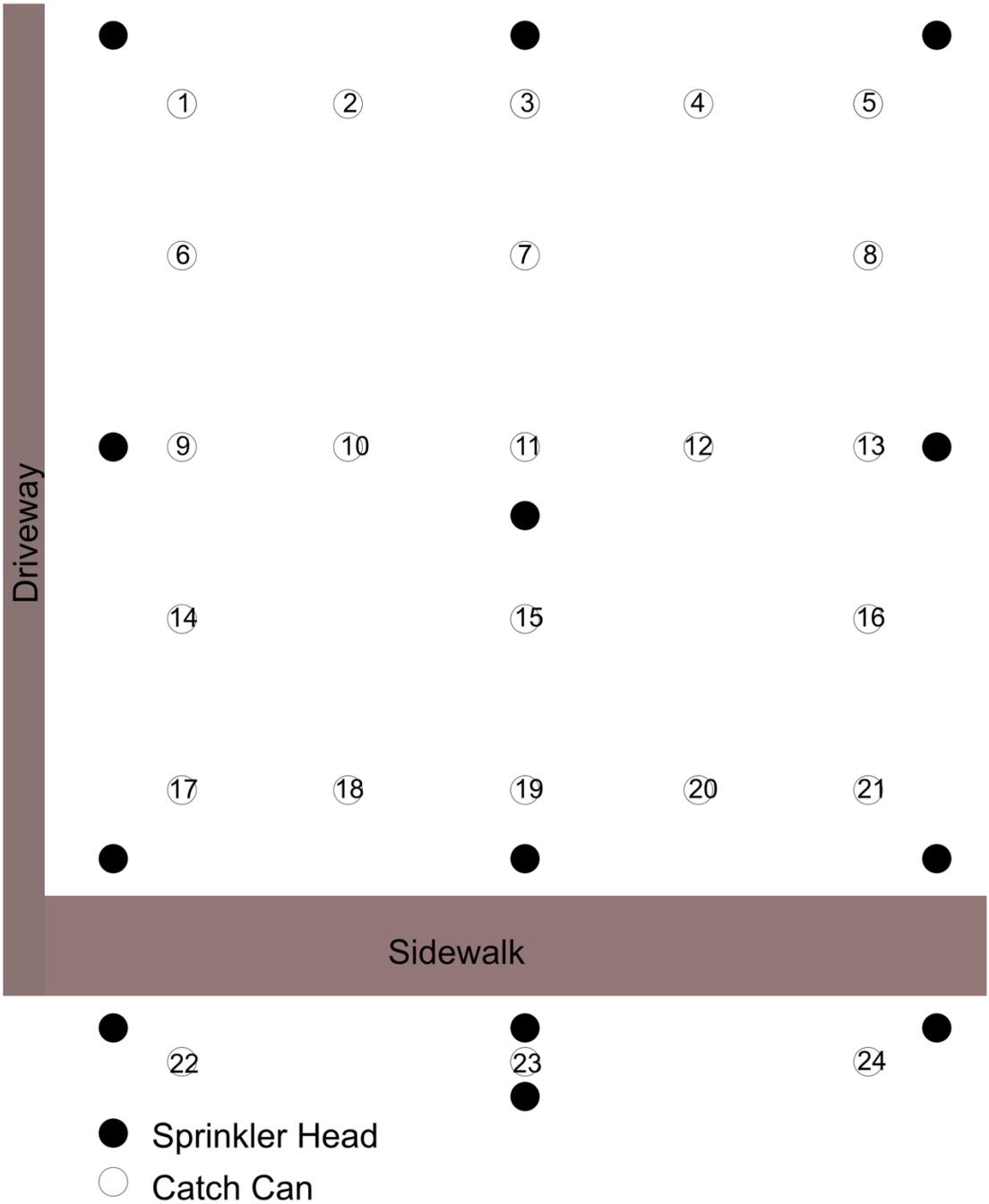
*Disclaimer: Results reflect the performance of the tested zone under the specific conditions present at the time of testing. Results may vary based on system design, pressure, spacing, and site conditions.*

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## APPENDIX

### Zone and Catch Can Layout



Test

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## Catch Can Results (mL)

Test 1		Test 2		Test 3	
Can#	ml	Can#	ml	Can#	ml
1	45	1	16	1	20
2	20	2	20	2	25
3	45	3	25	3	20
4	25	<b>4</b>	<b>15</b>	<b>4</b>	<b>19</b>
5	25	5	25	5	24
<b>6</b>	<b>7</b>	6	25	6	25
7	36	7	20	7	25
<b>8</b>	<b>3</b>	<b>8</b>	<b>15</b>	8	20
<b>9</b>	<b>9</b>	<b>9</b>	<b>9</b>	<b>9</b>	<b>14</b>
10	17	10	28	10	33
11	15	11	24	11	20
12	30	<b>12</b>	<b>15</b>	12	25
<b>13</b>	<b>3</b>	<b>13</b>	<b>7</b>	<b>13</b>	<b>19</b>
14	50	14	20	14	35
<b>15</b>	<b>9</b>	15	15	<b>15</b>	<b>19</b>
16	30	16	15	<b>16</b>	<b>15</b>
17	20	<b>17</b>	<b>5</b>	<b>17</b>	<b>7</b>
18	25	18	20	18	25
<b>19</b>	<b>10</b>	19	20	19	22
20	33	20	15	20	20
21	17	21	20	21	20
22	25	22	20	22	22
23	35	23	54	23	55
24	10	24	35	24	50

Note: Lower Quarter readings were based on the lowest values in 6 catch cans (24 cans x 25% = 6). These are highlighted in bold.

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### Test Results

#### Test #1 Results

Lower Quarter Average = 6.83 ml

Total Average = 22.67 ml

$$DU = \frac{6.83}{22.67} = 0.301$$

Water meter reading @ start :  
181003.4

Water meter reading @ end:  
181089.7

Total water used: 86.3 gallons.

#### Test #2

Lower Quarter Average = 11.00 ml

Total Average = 20.13 ml

$$DU = \frac{11.00}{20.13} = 0.547$$

Water meter reading @ start:  
181089.7

Water meter reading @ end:  
181142.2

Total water used: 52.5 gallons

#### Test #3

Lower Quarter Average = 15.5 ml

Total Average = 24.13 ml

$$DU = \frac{15.5}{24.13} = 0.642$$

Water meter reading @ start:  
181178.4

Water meter reading @ end:  
181229.3

Total water used: 50.9 gallons