

Conducting Irrigation Audits:



Essential and Easy to Do

DISCLAIMER

This Breakout Session Does Not Substitute For Training And Certifications Available From

- IRRIGATION ASSOCIATION [IA]
- AMERICAN SOCIETY OF IRRIGATION
CONSULTANTS [ASIC]
- Other Licensing And Certifying Organizations

Conducting Irrigation Audits Are Easier IF:

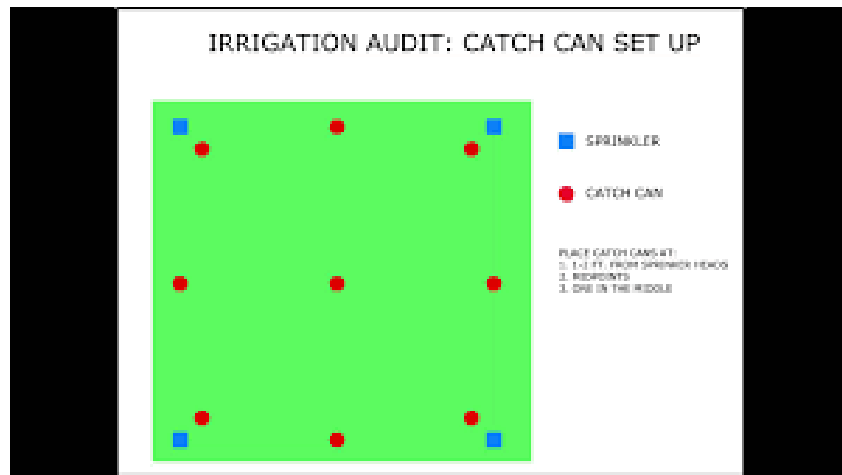
- The Irrigation System Is Designed To Use Water Efficiently
- The Irrigation System Is Installed To Meet The Design Criteria
- The Installed System Is New Or Has Been Managed Properly
- As Built Drawings And Specs Are Available

Auditing DU_{LQ}

- Wind Speed Less Than 5 mph
- Conducted In Normal Operating Conditions
- Pressure Test At Beginning And End For Each Zone Tested
- Uniform Catchment Devices - Minimum Of 24
- Record Location OF Sprinklers And Catchment Devices For Future Reference And Repeatability

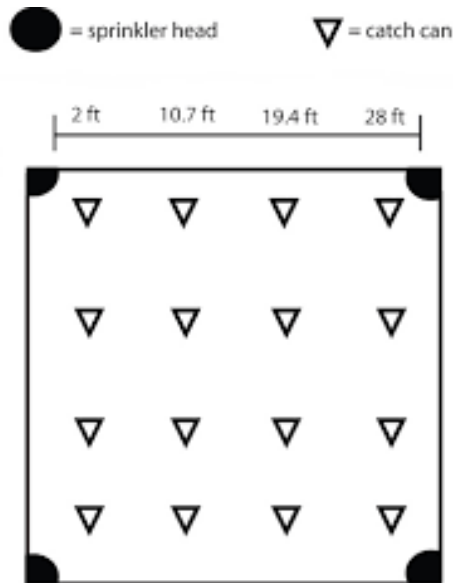
Catchment Device Layout Regular

- Fixed Sprays – Within 2' to 3' OF Heads And Halfway Between Heads



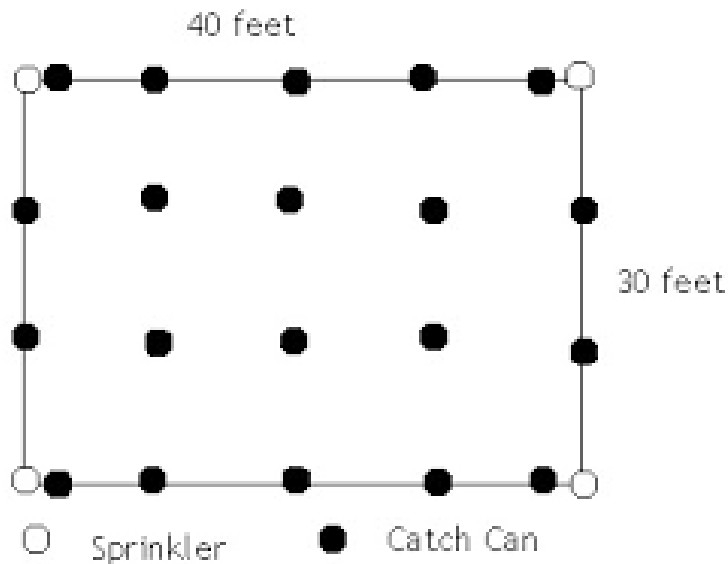
Catchment Device Layout Regular

- Rotors < 40' On Center – Within 2' To 3' Of Heads And Every Third Between Heads



Catchment Device Layout Regular

- Rotors > 40' On Center – Within 2' To 3' Of Heads And Every Fourth Between Heads



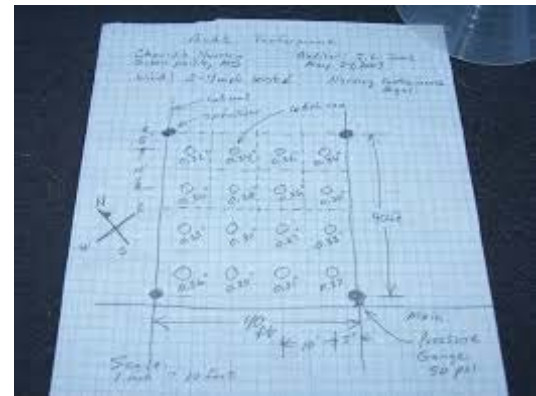
Catchment Device Layout Irregular

- Rotors – Uniform Grid 10' To 20' On Center
- Sprays – Uniform Grid 5' To 10' On Center



Auditing DU_{LQ}

- Document And Record The Following:
 - Sprinkler Locations
 - Sprinkler Spacing
 - Sprinkler Make, Model And Nozzle Size
 - Approximate Catchment Device Location
 - Catchment Readings
 - Test Run Time
 - Pressure Readings With Locations
 - Wind Speed Readings
 - Soil Types And Root Zone Depths
 - Date And Time Of Testing



Volume OF Water To Catch

- The Recommended Volume In Milliliters Should Be Approximately One And One-Half Times The Throat Area Of The Catch Device In Square Inches.
- Another Way To Say This Is:
If Your Catchment Device Is Straight Sided and Flat Bottomed, You Want To Capture At Least 1/10 Of An Inch Of Water.

Lets Catch Some Water



Now For The Math

CU and DU_{LQ}

- Christiansens's Uniformity Coefficient:

$$CU = 100 (1.0 - (\sum x \div mn))$$

- Distribution Uniformity Lower Quartile:

$$DU_{LQ} = 100(MQ1 \div M)$$

Math Simplified

1. Record Volumes From The Catchment Devices

13, 35, 40, 29, 39, 41, 45, 45, 30, 35, 47, 35, 79, 79, 50, 35, 17, 22, 28, 46, 67, 78, 42, 53

2. Add All The Volumes Together

$$13+35+40+29+39+41+45+45+30+35+47+35+79+79+50+35+17+22+28+46+67+78+42+53=1030$$

3. Find The Average Of All The Volumes

$$1030 \div 24 = 42.9$$

4. Add The Volumes Of The Highlighted Lower 25% Together

$$13+29+30+17+22+28=139$$

5. Find The Average Of The Volumes In The Lower 25% Of Volumes

$$139 \div 6 = 23.2$$

6. Divide the Average Of The Lower 25% By Average Of All Volumes

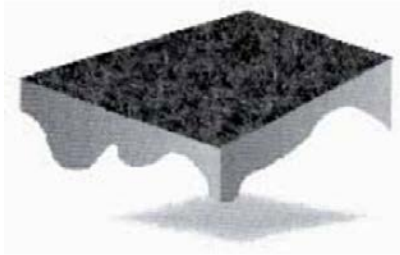
$$23.2 \div 42.9 = 0.54 \text{ Expressed AS A Percent Would Be A } DU_{LQ} \text{ OF } 54\%$$

So What Kind Of Uniformity Are We Looking For?

	Excellent	Very Good	Good	Fair	Poor
Fixed Spray	0.75	0.65	0.55	0.50	<0.40
Rotor	0.80	0.70	0.65	0.60	<0.50

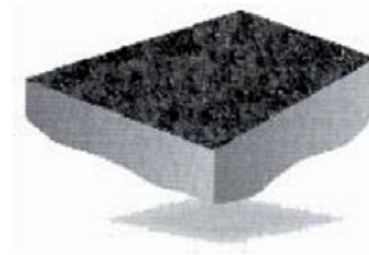
Auditing Results

Poor Design Ends With...

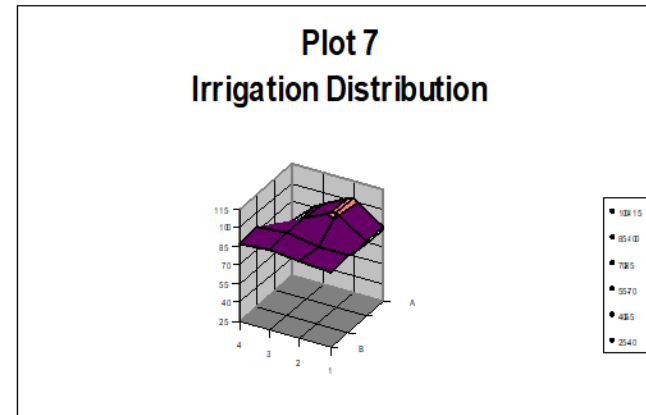
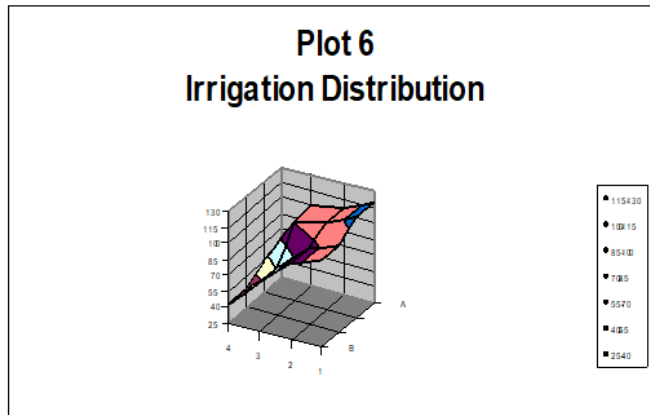


Low Uniformity

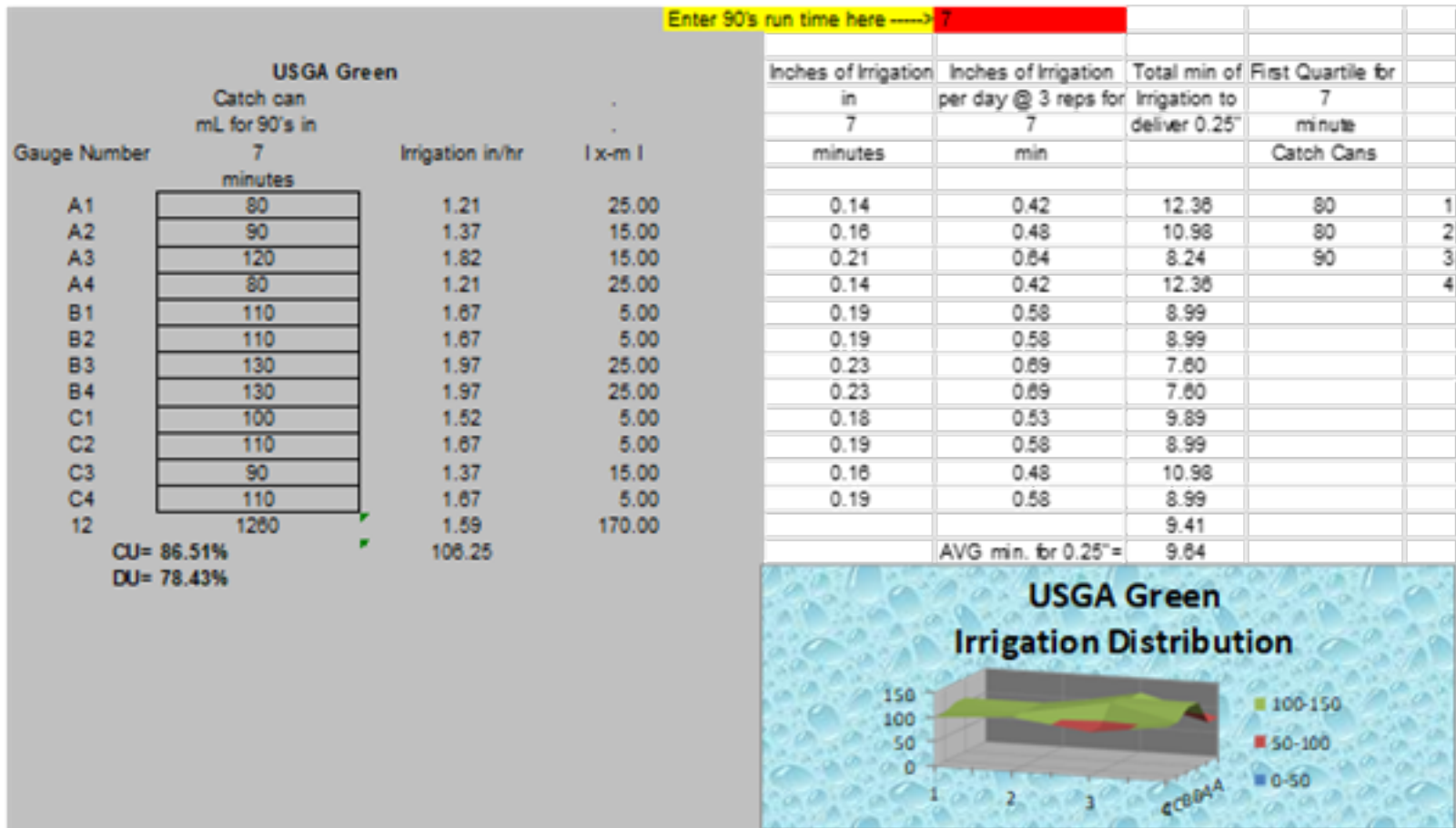
Good Design Ends With...



High Uniformity



Spread Sheets Can Help



Is That All?

No

I Over Simplified The Catchment Device Statement, “The Recommended Volume In Milliliters Should Be Approximately One And One-Half Times The Throat Area Of The Catch Device In Square Inches.”

But

You Need An Accurate Precipitation Rate Using Your Milliliter Measurements.

Precipitation Rate Math

$$PR_{net} = \frac{3.66 \times V_{avg}}{t_R \times A_{CD}}$$

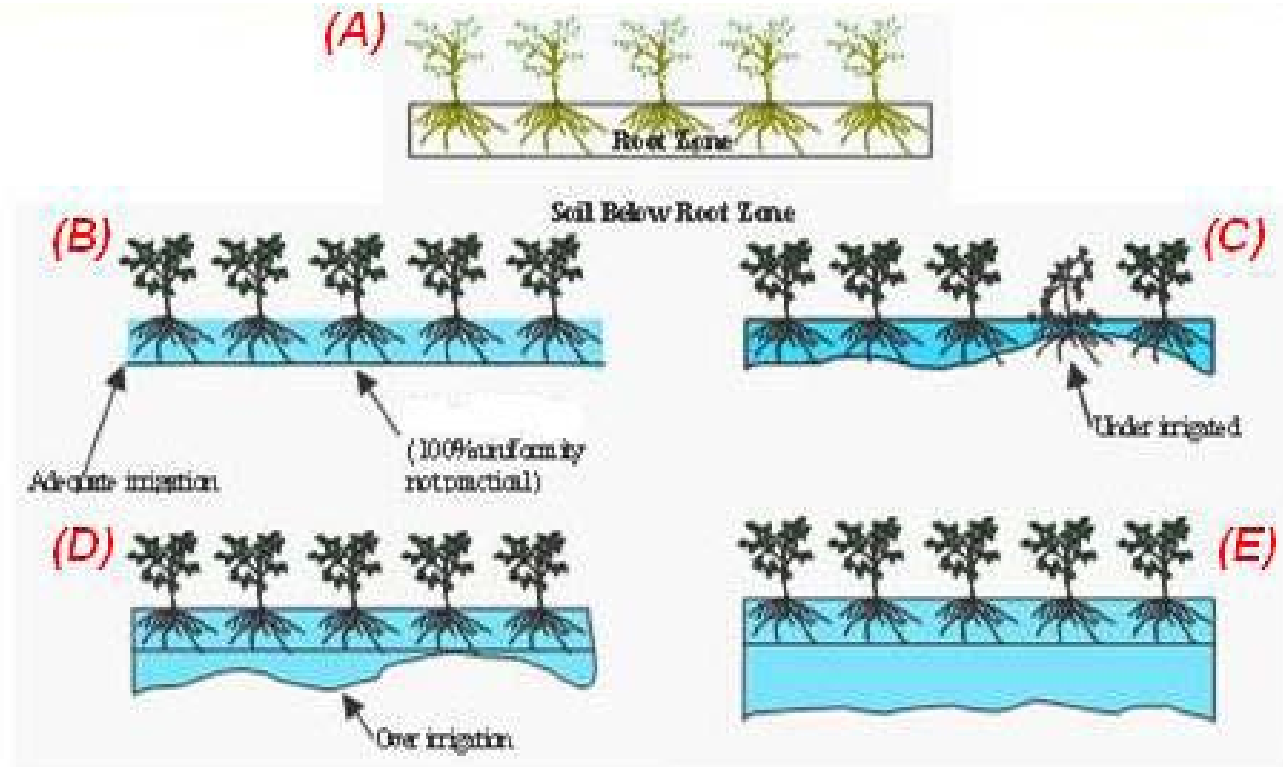
PR_{net} = Station Precipitation Rate {in./h}

V_{avg} = Average Catch Volume For Station {ml}

t_R = Testing Run Time {min}

A_{CD} = Catch Device Throat Area {in.²}

Tying DU_{LQ} and Pr_{net} Together



Design Considerations

- Earth – Soil Type And Profile, Slopes
- Wind – Prevailing Wind And Direction
- Fire – Exposure: Sun/Part Shade/Full Shade
Seasonal Variation
- Turf And Bedding Selections
- Hardscape Features