Using Technology to Reduce Water Use in the Landscape

Jon Peters – Director of Sales
Baseline Inc.

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IRRIGATION SOLUTIONS

Our Mission ~

We intend to forever change the way people water plants by providing the smartest, easiest, and most capable irrigation control products ever made.

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Our Commitment ~

Improved plant health and / or yield

&

Deliver dramatic reduction of water use

&

Simplify installation, maintenance and operation

Combining Cutting Edge Technology With Solid Agronomics

Innovating in water management for over 12 years

Two-Wire

Industry Leading Two-Way Communication

Soil Moisture Sensors

Durable, Sensitive, Reliable

Central Control

Flexible, Simple Accessible

Flow Management

Feature Rich, Easy to Program

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Agenda

- ***Water Management - The Basics***
- ***Current Controller Technology***
- ***Simplifying the challenge***
- ***Pro's and Con's of today's technology***
- ***There is more to irrigation than scheduling***

Glossary of terms - soil moisture content

***Saturation*:** The soil pores are filled with water and nearly all of the air in the soil has been displaced by water.

Field Capacity: The level of soil moisture left in the soil after drainage of the gravitational water.

***Maximum Allowed Depletion (MAD)*:** Desired soil moisture deficit at the time of irrigation.

Permanent Wilt Point: The minimal point of soil moisture the plant requires.

Oven Dry: When soil is dried in an oven, nearly all water is removed. This moisture content is used to provide a reference for measuring the other three soil moisture contents.

Water Management With a Baseline System

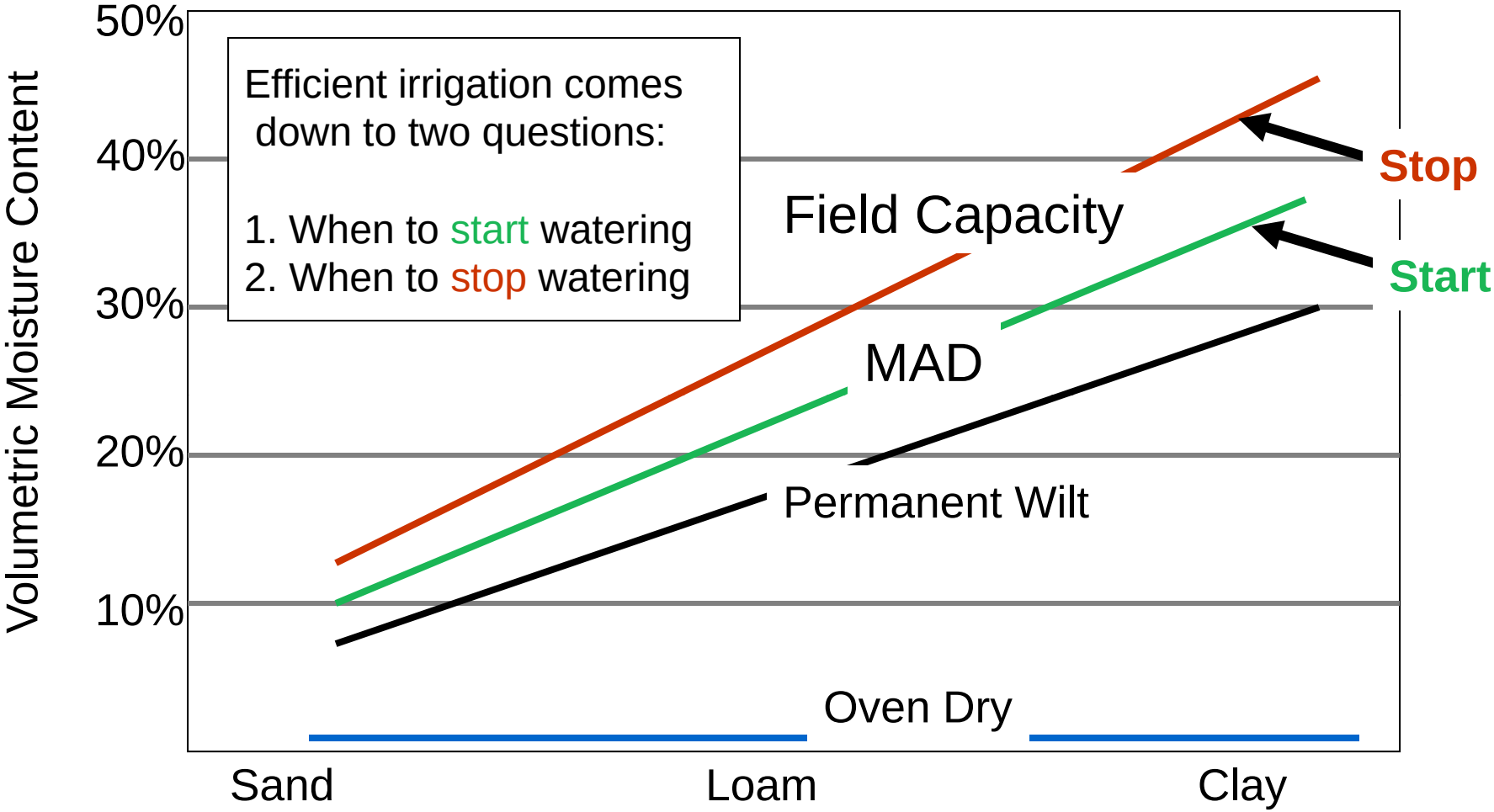
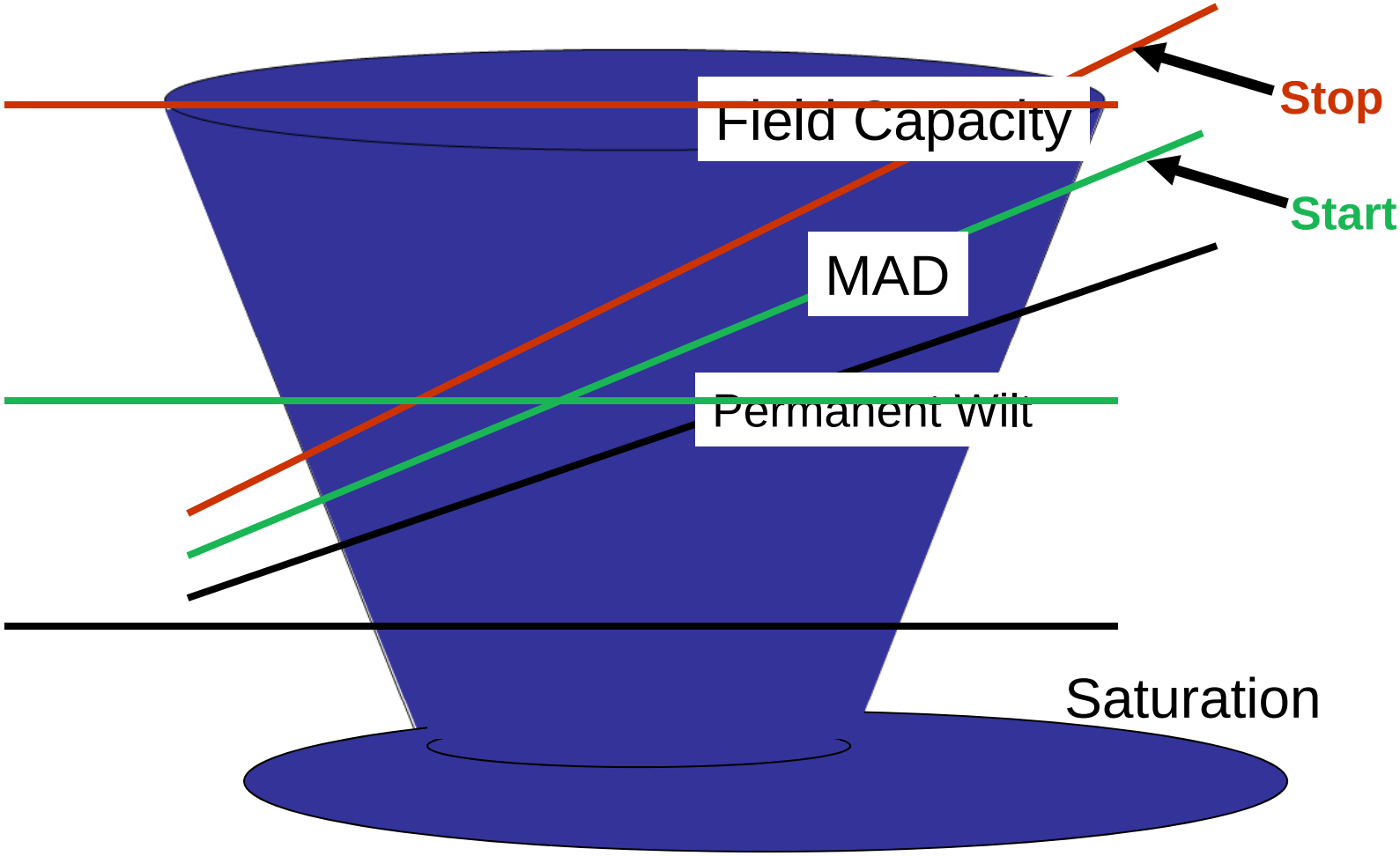


Chart for explanation purposes only

Water Management With a Baseline System



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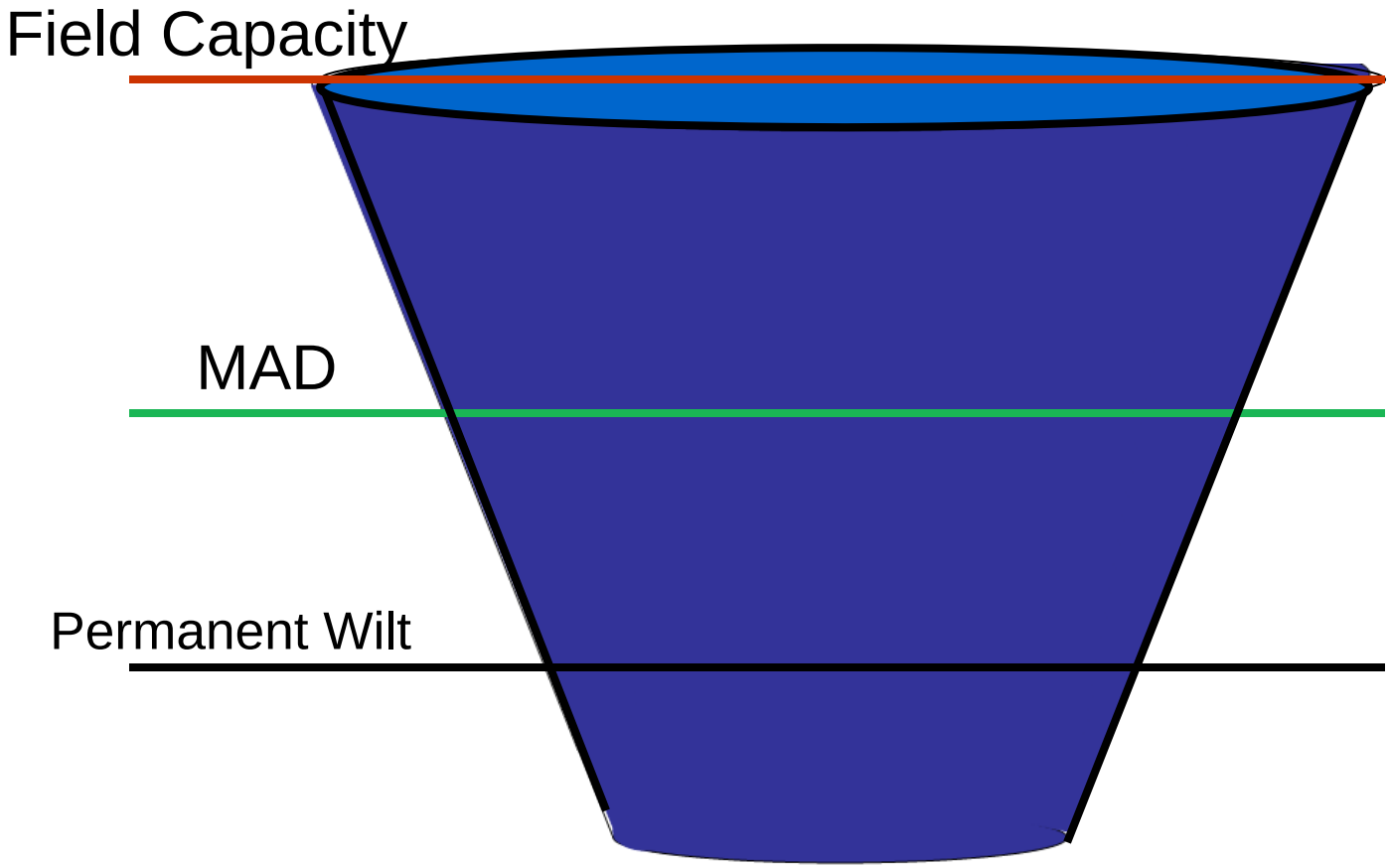

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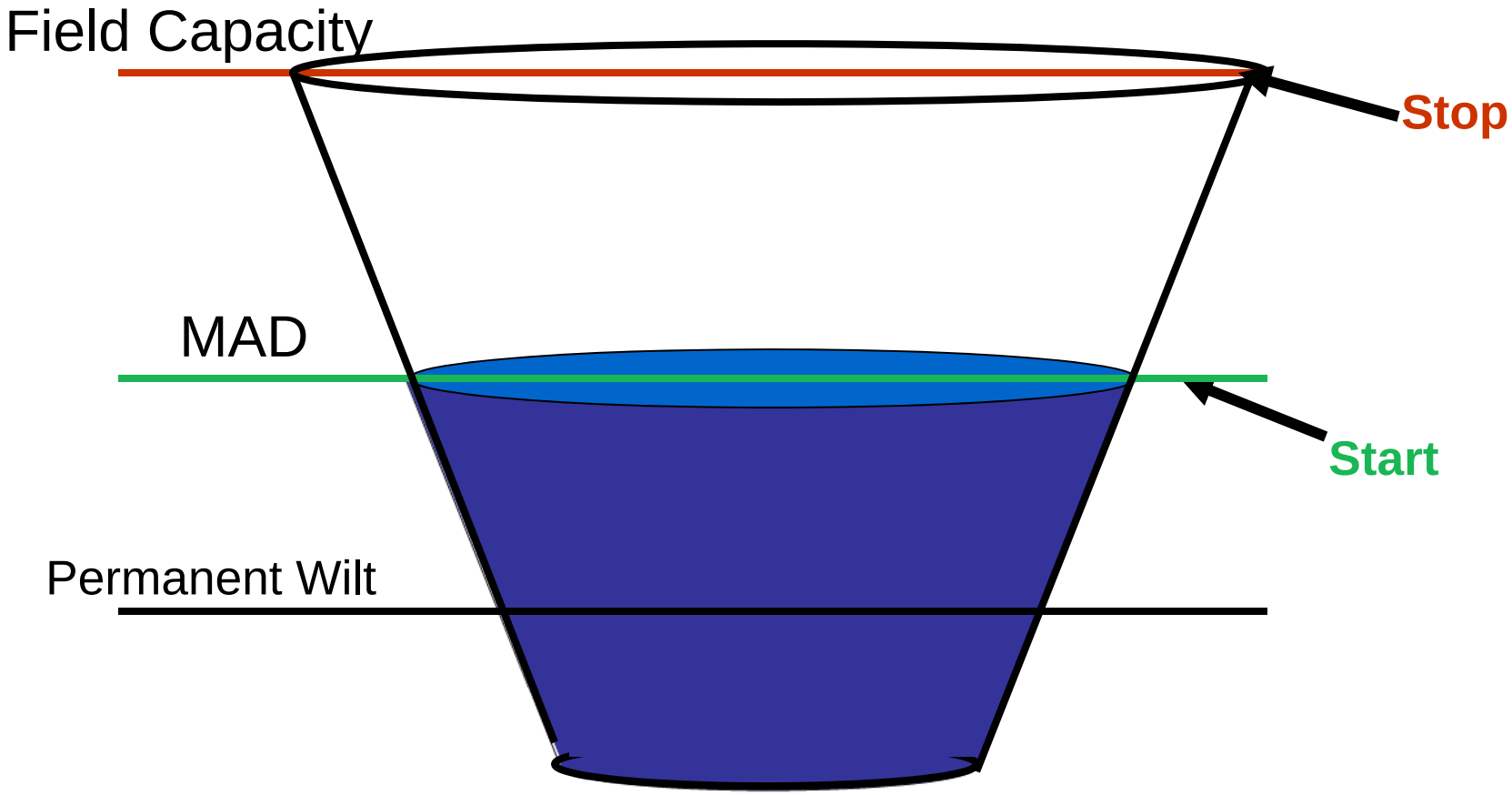

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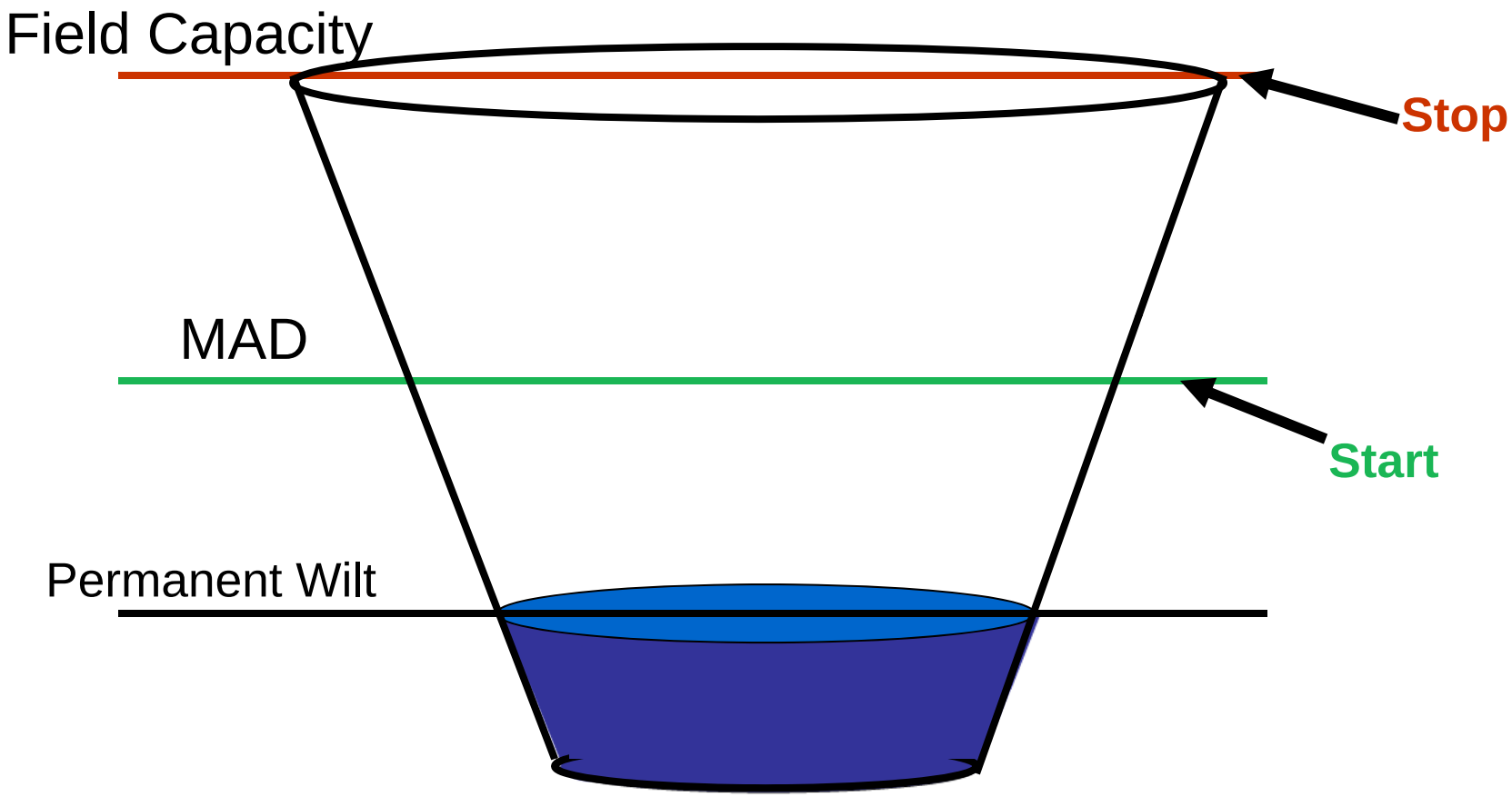

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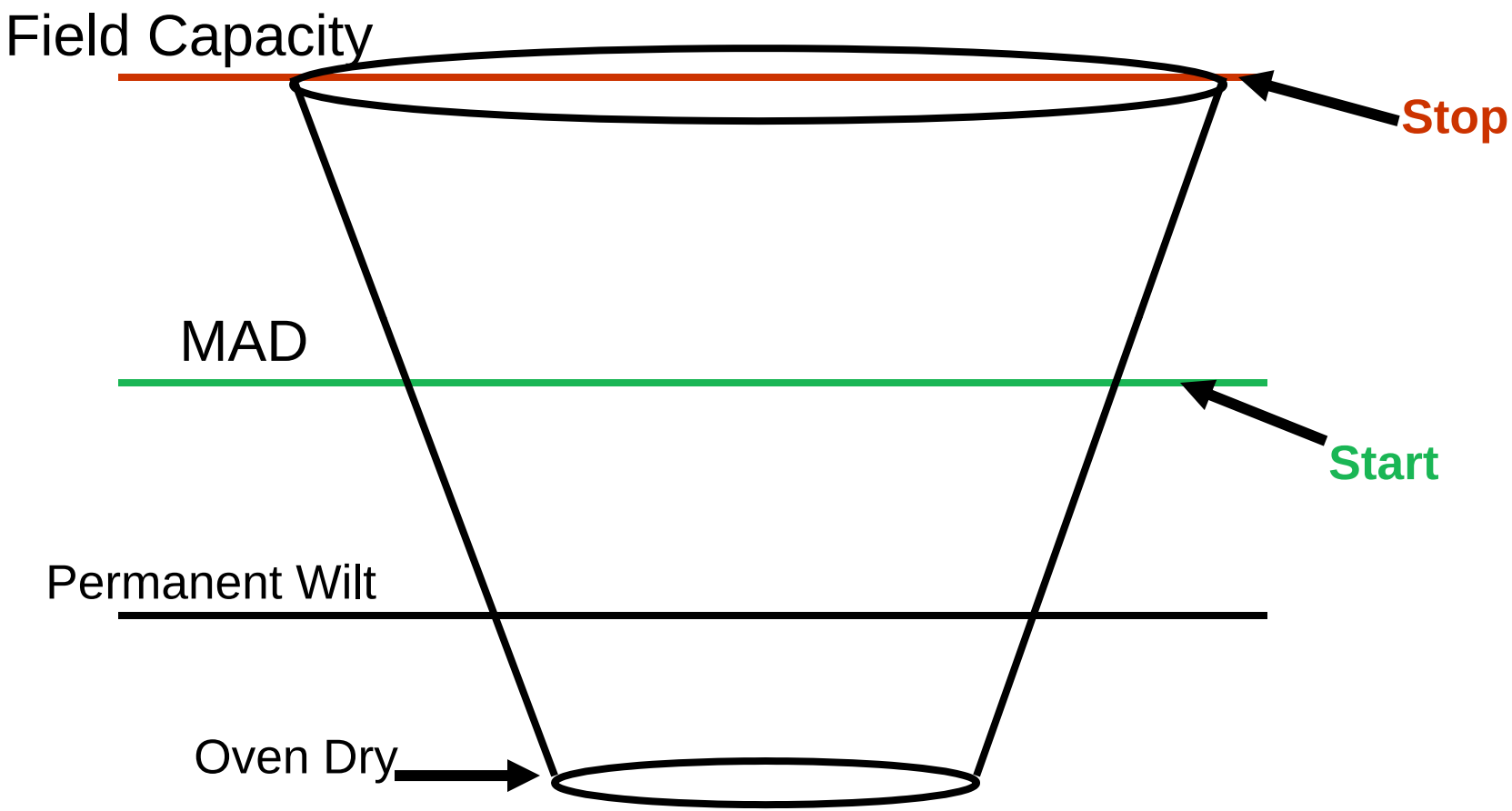


Today's water management tools

- **Manual / Hand Watering**
- **Standard Timers**
- **C**

According to the IA web site –

Smart sprinkler controllers reduce outdoor water use by monitoring and using information about site slope, soil, plant type, and more), and applying the right amount of water based on those factors—not too much and not too little—to maintain healthy growing conditions.

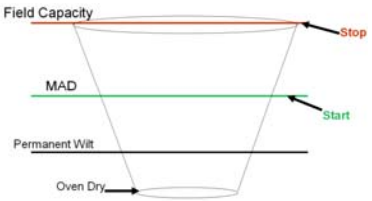
Do we need a controller in order to water smart ?

- Frequency Domain Reflectometry (FDR)
- Tensiometers

Today's water management tools

- **Manual / Hand Watering**
- **Standard Timers**
  - Historical calculations
- **Climatology / Weather driven controllers "ET"**
  - On site weather stations
  - Off site weather stations
- **Soil Moisture sensor driven controllers**
  - Electrical Resistance Granular Matrix
  - Electrical Conductivity Probes
  - Time Domain Transmission (TDT)
  - Frequency Domain Reflectometry (FDR)
  - Tensiometers

Today's water management tools



Measuring what's in the bucket

- **Manual / Hand Watering**
- **Standard Timers**
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Getting back to basics

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Weather Based Controllers

Weather Based Systems –
The common method used in irrigation management is to estimate ET by using an equation that uses weather data combined with evaporation data.

The weather data can be from on or off site sensors or from historical averages

Penman-Monteith equation for a leaf

$$\lambda E = \frac{\Delta Q_n + \rho C_p \left[e_s(T) - e \right] r_a^{-1}}{\Delta + \gamma \left(1 + \frac{r_c}{r_a} \right)}$$

UC, Davis

Weather Based Controllers

*Evapotranspiration [ET] - Combination of water transpired from vegetation and evaporated from the soil and plant surfaces.

**ET is very difficult to measure, the best method is to use a lysimeter, however as lysimeters are difficult and expensive to construct and as their operation and maintenance require special care, their use is limited to specific research purposes.

***Both Weather based and Soil Moisture based control products use ET they just get the data from different places

* Definition Courtesy of the Irrigation association

** Food and Agriculture Organization of the United Nations

*** Brent Meacham, IA Education Foundation

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How does weather data become ET?

Evaporation data

+

Weather data

= (Algorithm that converts weather data into an accurate estimate of evaporation)

+

Crop coefficient
(+ or – from E)

= PET (How much water potentially could have evaporated if the water is present.)

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Remotely collected climate data

Current data from off site weather stations is collected then distributed to the site

Benefits

- No physical maintenance
- Reduction in non peak water use
- Most rely on high quality collection equipment
- Can adjust for rapid weather swings

Challenges

- Monthly fees
- Usable rainfall is estimated (not part of ET)
- Does not deal well with micro climates
- Accuracy depends on input variables

On site climatological data

On site weather sensors are used to make irrigation decisions

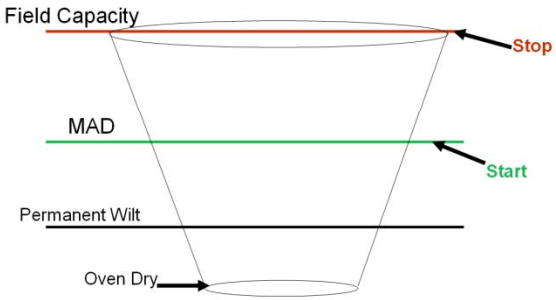
Benefits

- Specific on site climate information
- The more sensors the more accurate i.e. temp, wind, solar, evaporation
- Reduction in non peak water use
- Can have plant health benefits
- Can adjust for rapid weather swings

Challenges

- Require regular maintenance
- Usable rainfall is estimated (not part of ET)
- Accuracy relies on sensitivity of the sensors and number and accuracy of variables

Current commercially available methods for measuring the amount of water in the soil "Bucket"



Soil Moisture Sensing –
Placing a sensor or multiple sensors in the soil within the plants root zone that directly measure the amount of water in the soil.

There are several different types moisture sensors,
*Electrical Resistance Granular Matrix, Electrical Conductivity, Frequency Domain Reflectometry (FDR), Tensiometers, and Time Domain Transmission (TDT).

*List Courtesy of – Bureau of Reclamation Weather and Soil Moisture Based Landscape Irrigation Scheduling Devices Technical Review Report – 3rd Edition

Soil moisture sensors based irrigation control -

Using on site soil moisture data to make irrigation decisions

- Electrical Resistance Granular Matrix
- Electrical Conductivity Probes
- Time Domain Transmission (TDT)
- Frequency Domain Reflectometry (FDR)
- Tensiometers

Soil moisture sensor driven controller - On site weather, plant and soil data

An accurate soil moisture sensor measures the effect of many variables plant type, plant health, plant fertility. plant water use efficiency, effective / available rain fall, on site weather conditions

A soil moisture sensor is only half of the system

Benefits

- Specific climate information from a location on the site
- Reduction in non peak water use
- Major plant health benefits
- Can adjust for rapid weather swings
- No maintenance

Challenges

- Discontinuous technology
- Sensor placement / burial

Other Important Water Management Tools

- **Distribution Uniformity:** Putting water on as evenly as possible across the irrigated area.
- **Flow Management and Monitoring:** Learn flow, single zone flow shut down, multiple flow meters, low & high flow monitoring.
- **Intelligent Soak Cycling:** Maximizing infiltration while minimizing evaporative loss and water window impact.
- **Intuitive User Interface:** On screen instructions, detailed messages, flexible central options.
- **Remote Access:** Control with any modern internet enabled device.

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Thank You

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