

# Soil Moisture Monitoring at PVER2

CRTR  
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# Project Background/Need

- MSCP Habitat Conservation Plan:
  - Native vegetation.
  - Conservation measures → surface water or moist soils for riparian obligates (e.g. SWFL).
- Water Use:
  - Maximize irrigation efficiency → minimize volume of irrigation diversion.

# Unknowns

- Soil moisture requirements for native species?
- Irrigation distribution?
- Soil moisture abundance/distribution?
- Can monitoring and adaptive management:
  - Enhance habitat quality?
  - Reduce water diversion?

# Monitoring—Vegetation



# Assessing Habitat—Wildlife



Walters Camp ca. 1986



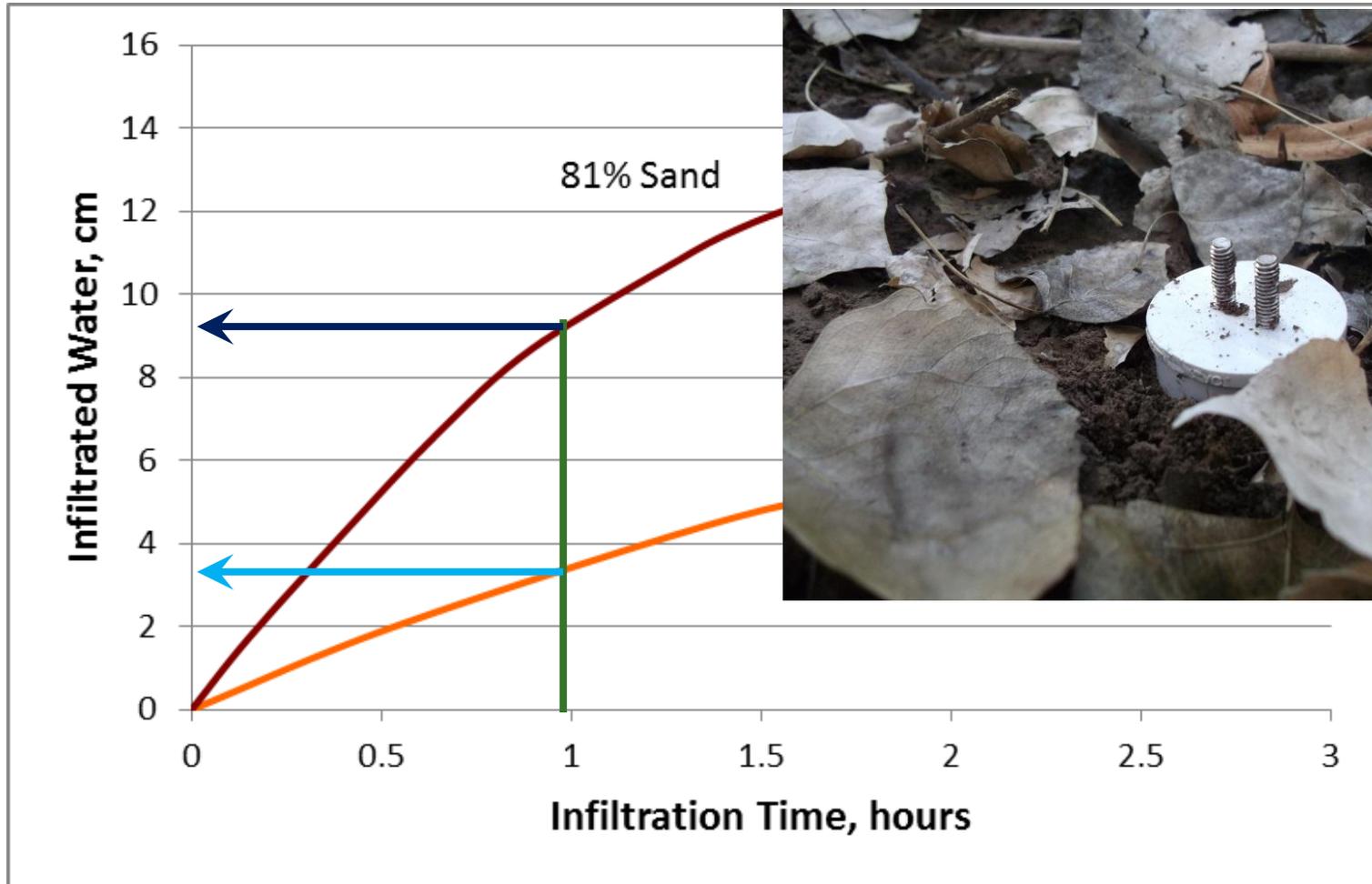
Pea Island NWR, NC, USA, 2000

# Irrigation Monitoring



# Infiltration Curves

## ■ Irrigation Sensors



# Monitoring—Soil Moisture?



# Soil Moisture Point Sampling Methods

## Manual Sampling/Lab Testing



## Handheld TDR Probe



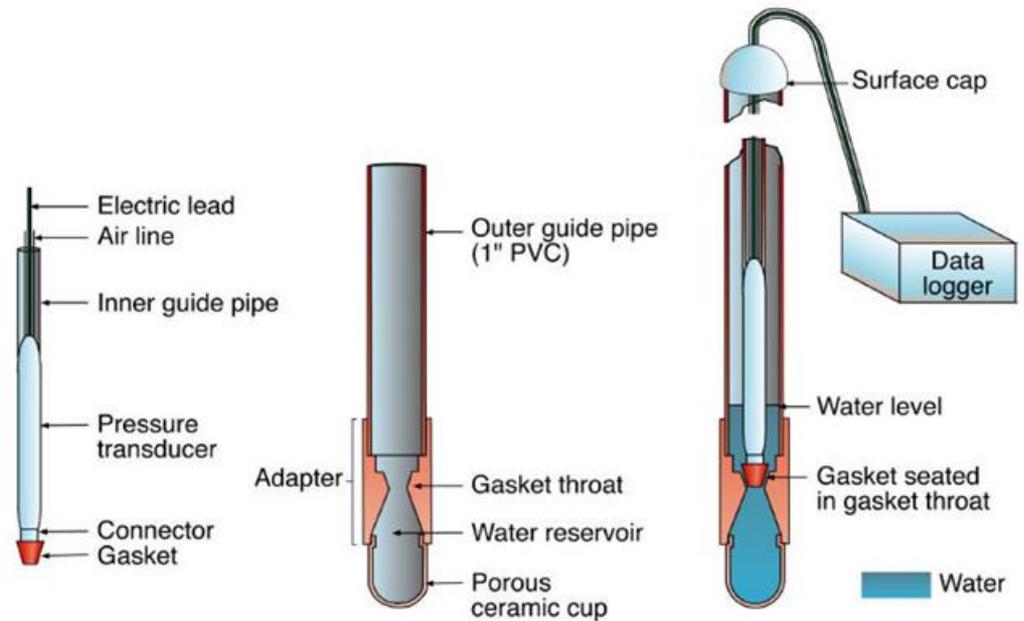
# Soil Moisture Sensors

## Water Content



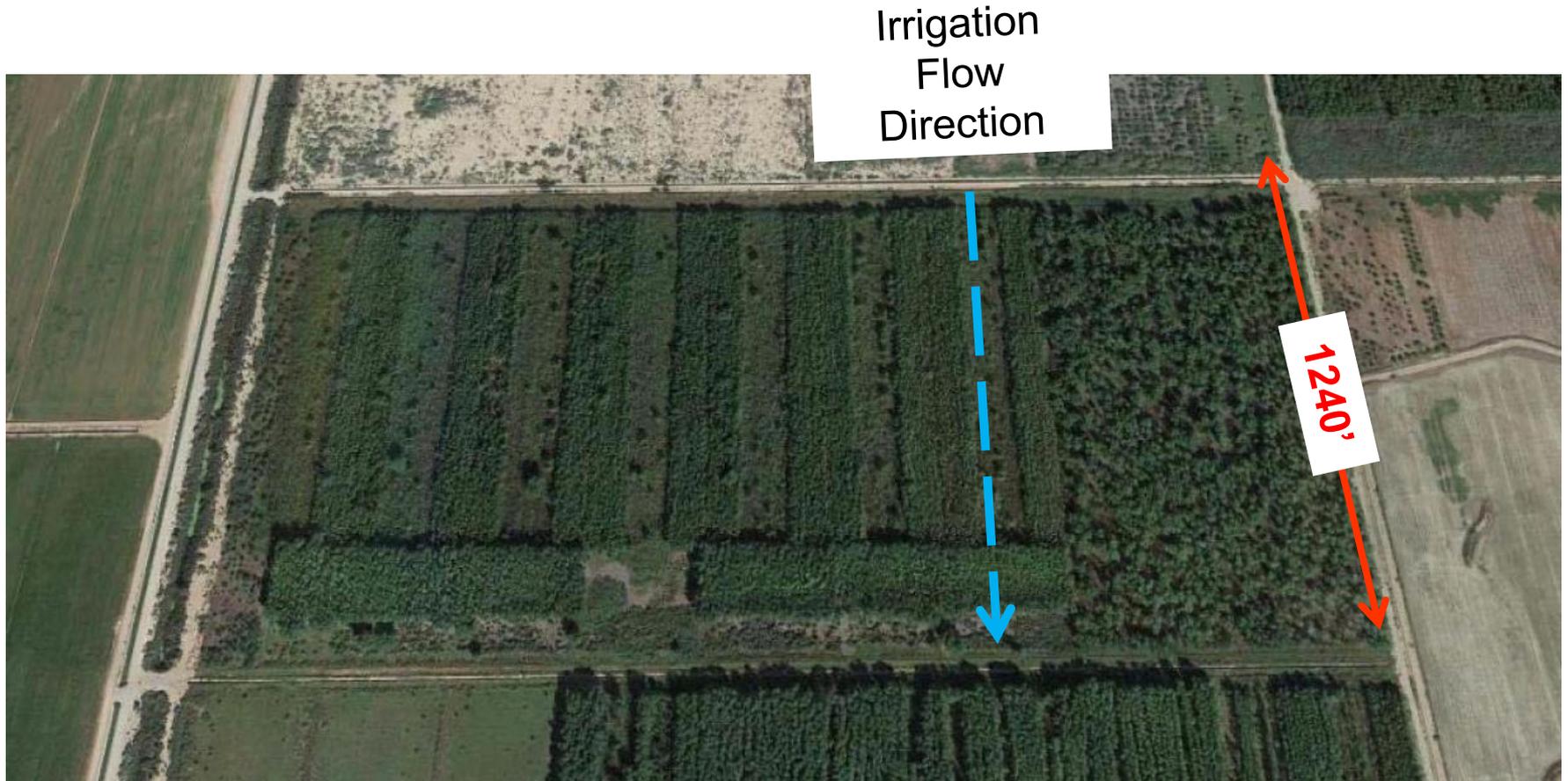
## Soil Water Potential

### Internal Design of the Advanced Tensiometer

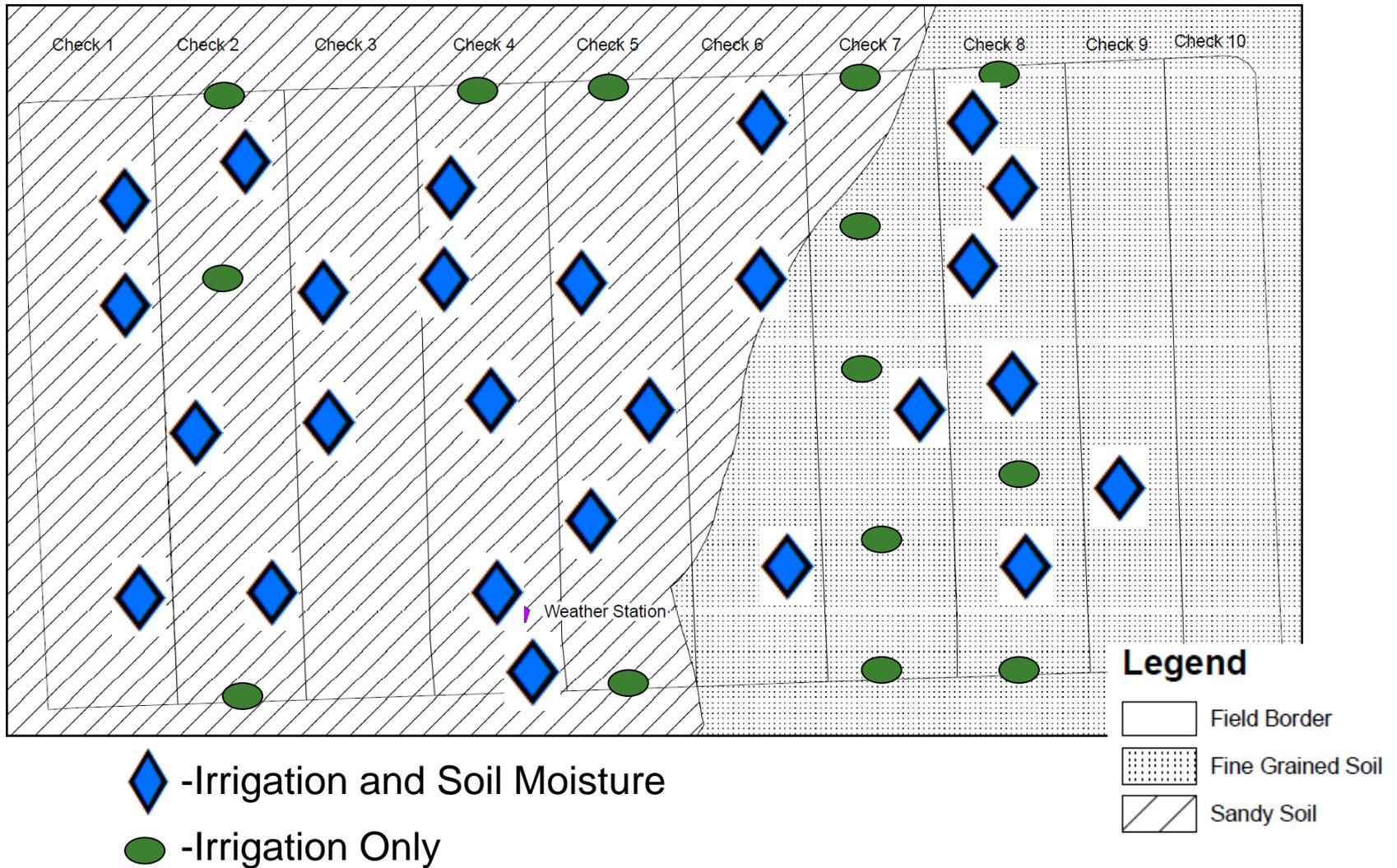


Y97 0590

# Palo Verde Ecological Reserve Phase 2 Pilot Project—*the 15-minute version...*



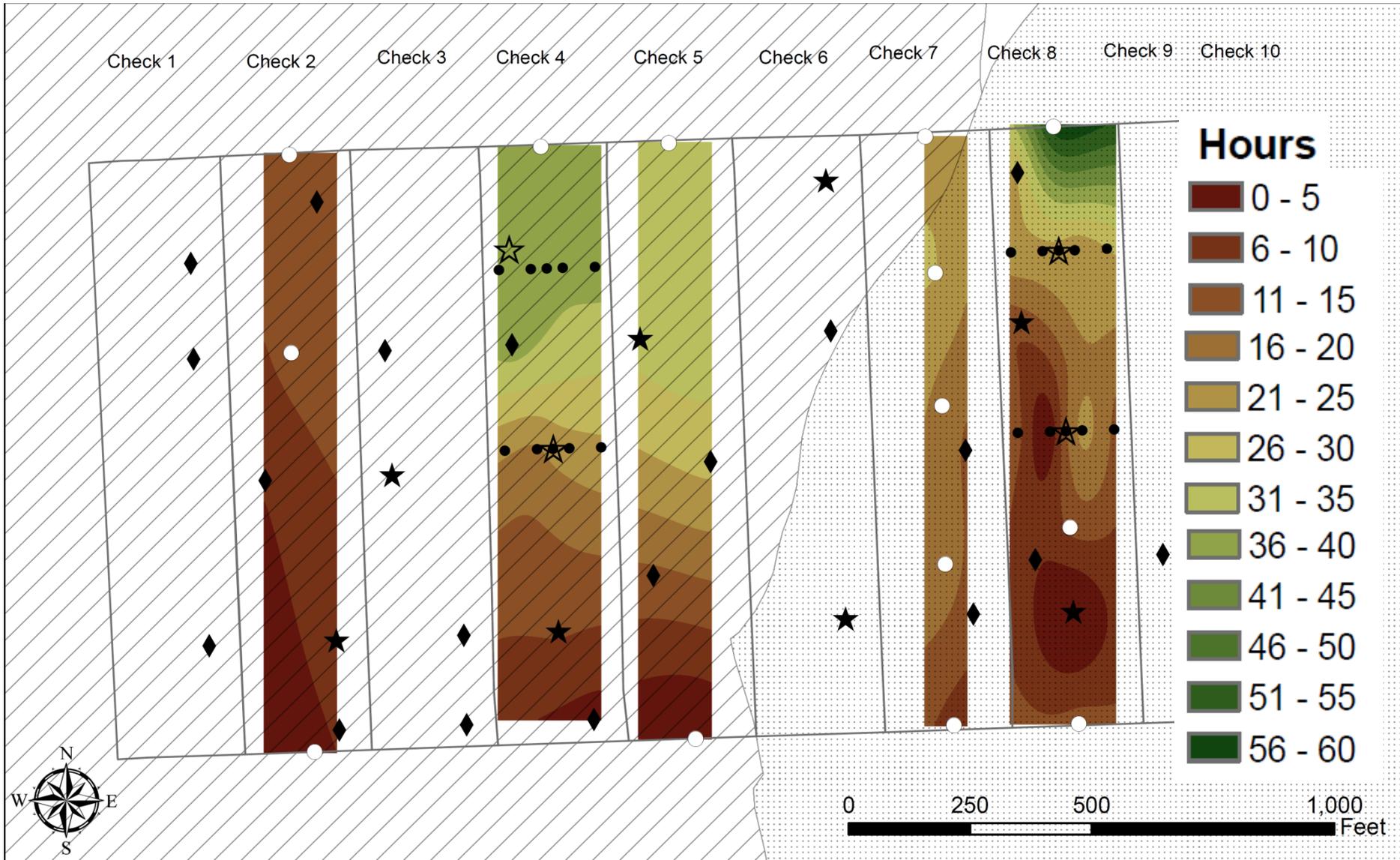
# Monitoring Layout



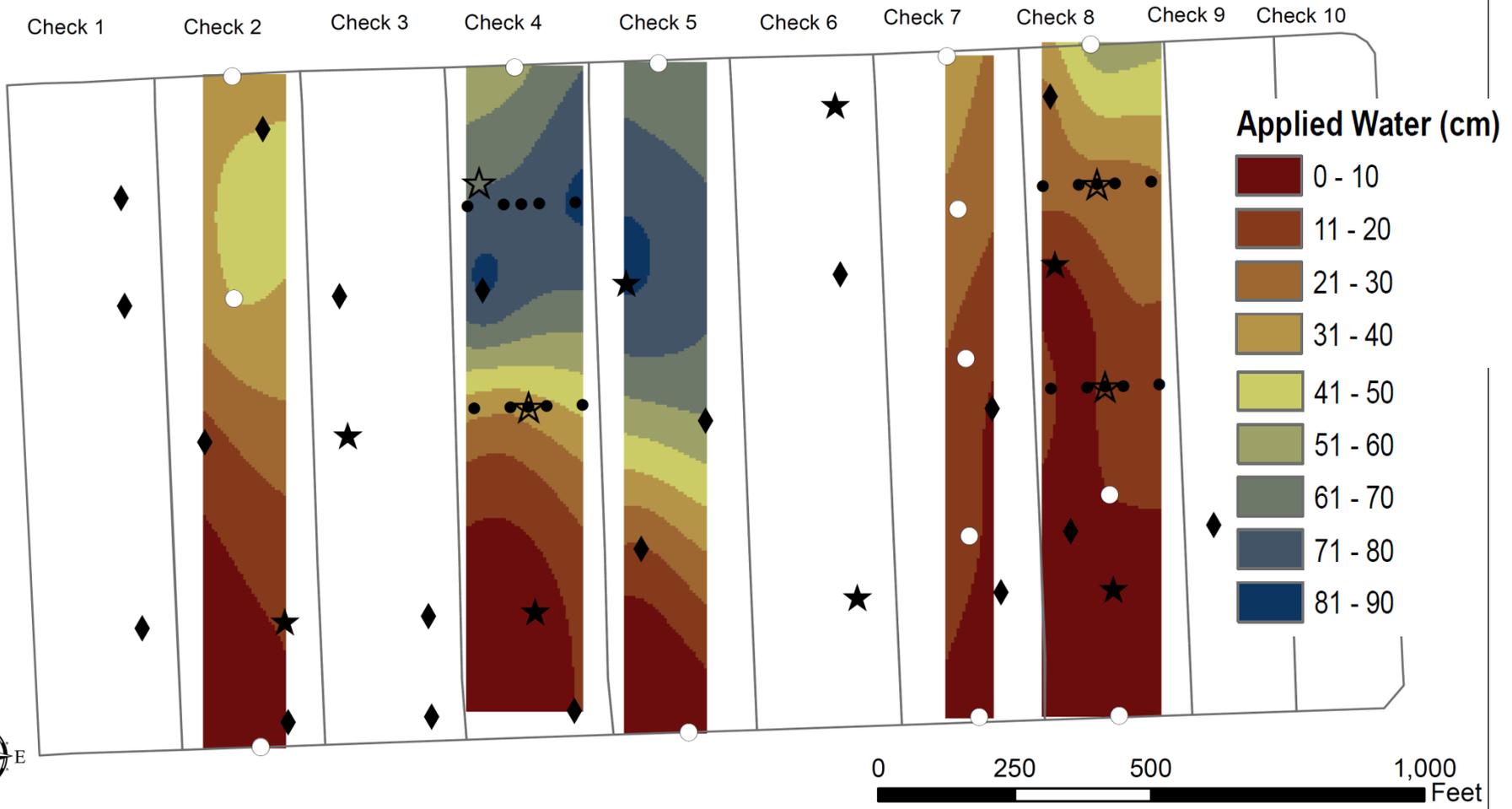
# Irrigation Monitoring Goals

1. Determine irrigation distribution.
    - When, how much (depth of water applied, total water volume), evenness (irrigation efficiency).
  2. Quantify the presence of surface water.
    - When is irrigation present?
- Example: June 30-July 2, 2013 Irrigation Event

# Irrigation Duration: 6/30-7/2/13



# Applied Water: 6/30-7/2/13



# Irrigation Summary Statistics:6/30-7/2/13

| Check | Surface Soil Sand Fraction, % | Irrigation Flow Rate, cfs | Average Applied Water, cm | Average Applied Water, in | Applied Water, acre-feet |
|-------|-------------------------------|---------------------------|---------------------------|---------------------------|--------------------------|
| 8     | 47                            | 1.7                       | 8                         | 3.3                       | 2.1                      |
| 7     | 50                            | 2.2                       | 14                        | 5.5                       | 3.4                      |
| 4     | 63                            | 3.3                       | 39                        | 15.3                      | 9.5                      |
| 2     | 69                            | 6.2                       | 25                        | 9.7                       | 6.1                      |
| 5     | 70                            | 4.4                       | 48                        | 19.0                      | 12.0                     |

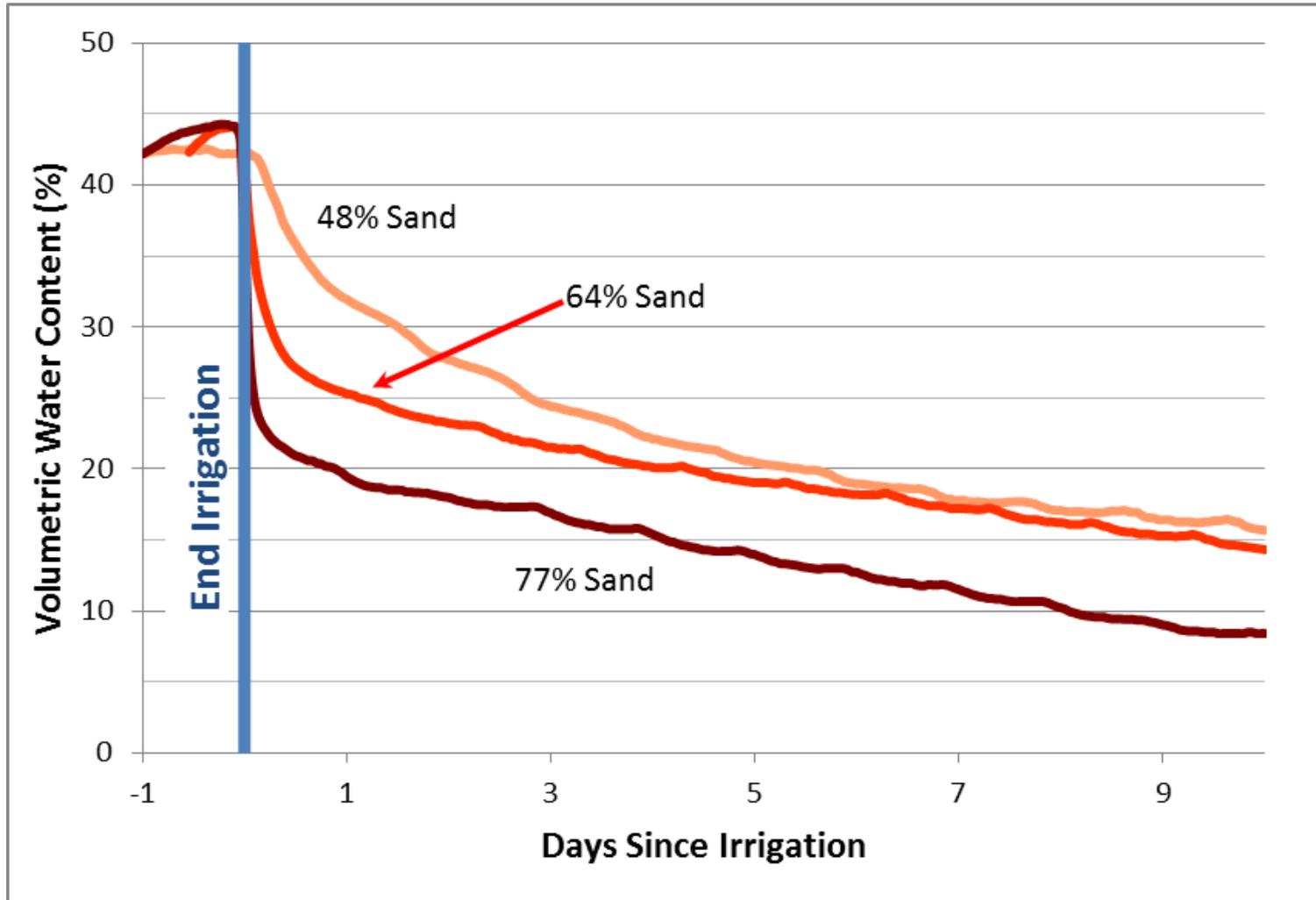
-More water required in 5 than 2, despite higher flow rate!

-More water required in 4 than 2, because of higher flow rate.

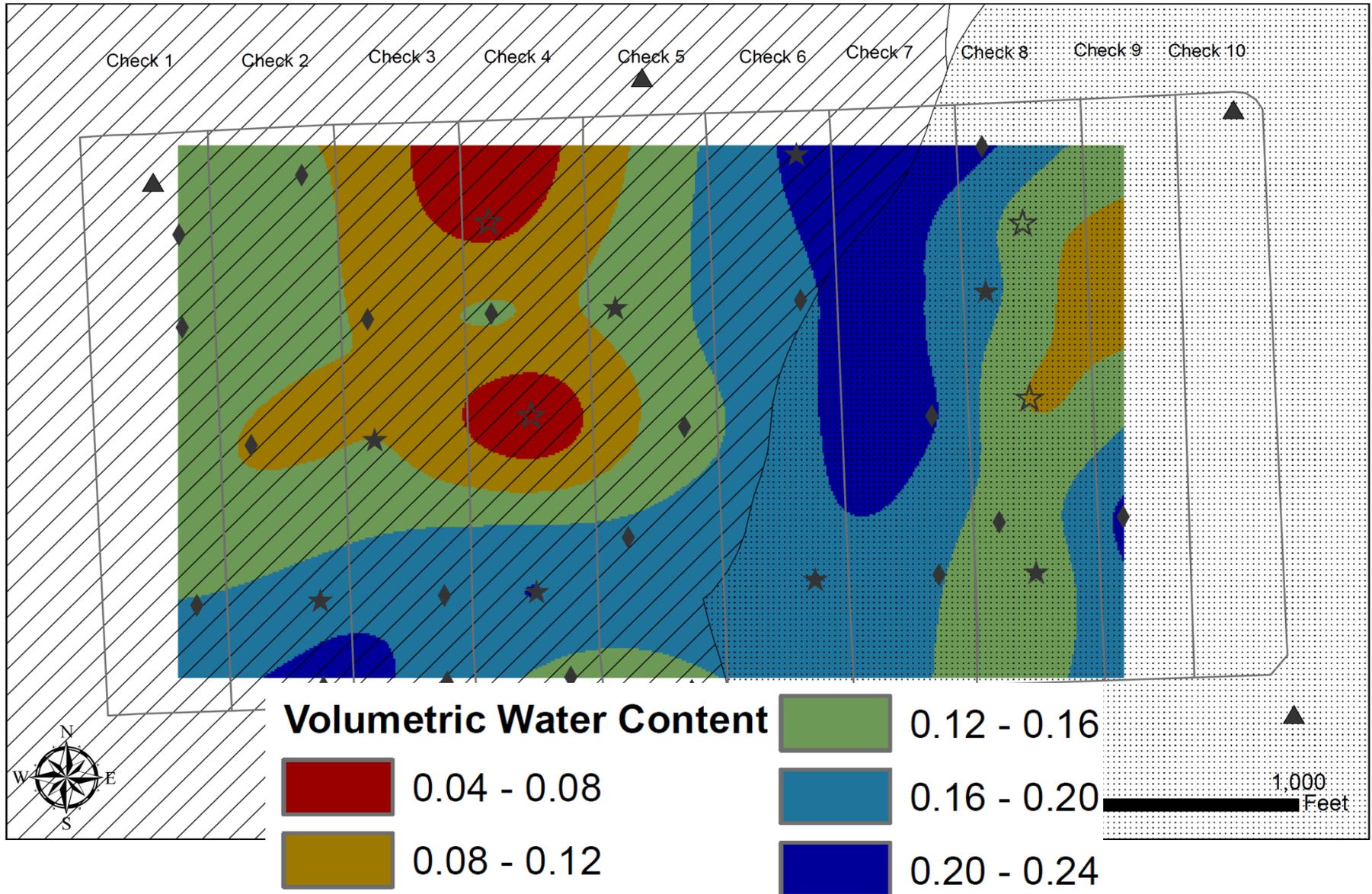
# Soil Moisture Monitoring Objectives

1. Quantify surface soil moisture.
  - A key habitat quality characteristic for riparian obligate birds.
2. Determine amount and distribution of plant-available water.
  - And how related to soil characteristics and irrigation distribution.

# Surface Soil Moisture Following July 2012 Irrigation



# Mean Surface Water Content—2013 Nesting Season



# Soil Moisture Monitoring Conclusions

- Rapid drainage of sandy soils.
- Finer soils retain more moisture, even with less applied water.
- Management options:
  - Restoration designs according to soil distribution.
  - Partition more water to finer soils to enhance surface soil moisture.

# Applications

## ■ Irrigation Monitoring

- Determine irrigation distribution to obtain baseline data.
- Use results to inform management decisions.
  - Alter site layouts, increase/decrease flow rates, longer/shorter irrigation duration.
- Monitor success of alternate management actions.

## ■ Soil Moisture Monitoring

- Quantify soil moisture in known habitat.
- Manage to maintain target soil moisture and vegetation.

# Monitoring—Soil Moisture!



Where's the  
peanut butter?

# Large-Scale Monitoring Options

- Low-density/dispersed monitoring at all sites?
- Targeted monitoring in representative areas?
- Remote sensing with ground-truthing?
- Monitoring at vegetation locations, nest sites, etc., to facilitate habitat analysis.

# Habitat by Design



# Not by Accident



Clear water,  
and a roost  
with a view.

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