Engineering Water for Sustainability and Productivity

ABE Department

University of Arizona

Background

- The ABE department has 17+ faculty members, 8 of which have Extension appointments. They include:
  - Ed Martin
  - Kitt Farrell-Poe
  - Steve Poe
  - Bob Freitas
  - Gene Giacomelli
  - Pedro Andrade
  - Mark Siemens
  - Don Slack

Question

How many people are somewhat familiar with the Agricultural Engineering Department at the U of A?

Trick Question, it is ABE – Agricultural and Biosystems Engineering Department

Please take a minute and fill out the ABE questionnaire – Pre-Test Side

What do we do?

- The ABE department is a joint department with degrees granted in both CALS and the COEM
- Administratively, we are associated with CALS

What are our programs/research areas

- Water Quality – thanks Kitt
- Water Resource Management
- Controlled Environment Agricultural Center
- Bio Energy – Plants need water too
- Water Sensors
- Food Safety (or lack thereof) using various degrees of water quality

CEAC – Greenhouse research and demonstration

Irrigation Water Use

Field Production

Hydroponic GH

Field Water Use

Tomato:
WUE = 14,000 kgH_2O/kg Yield

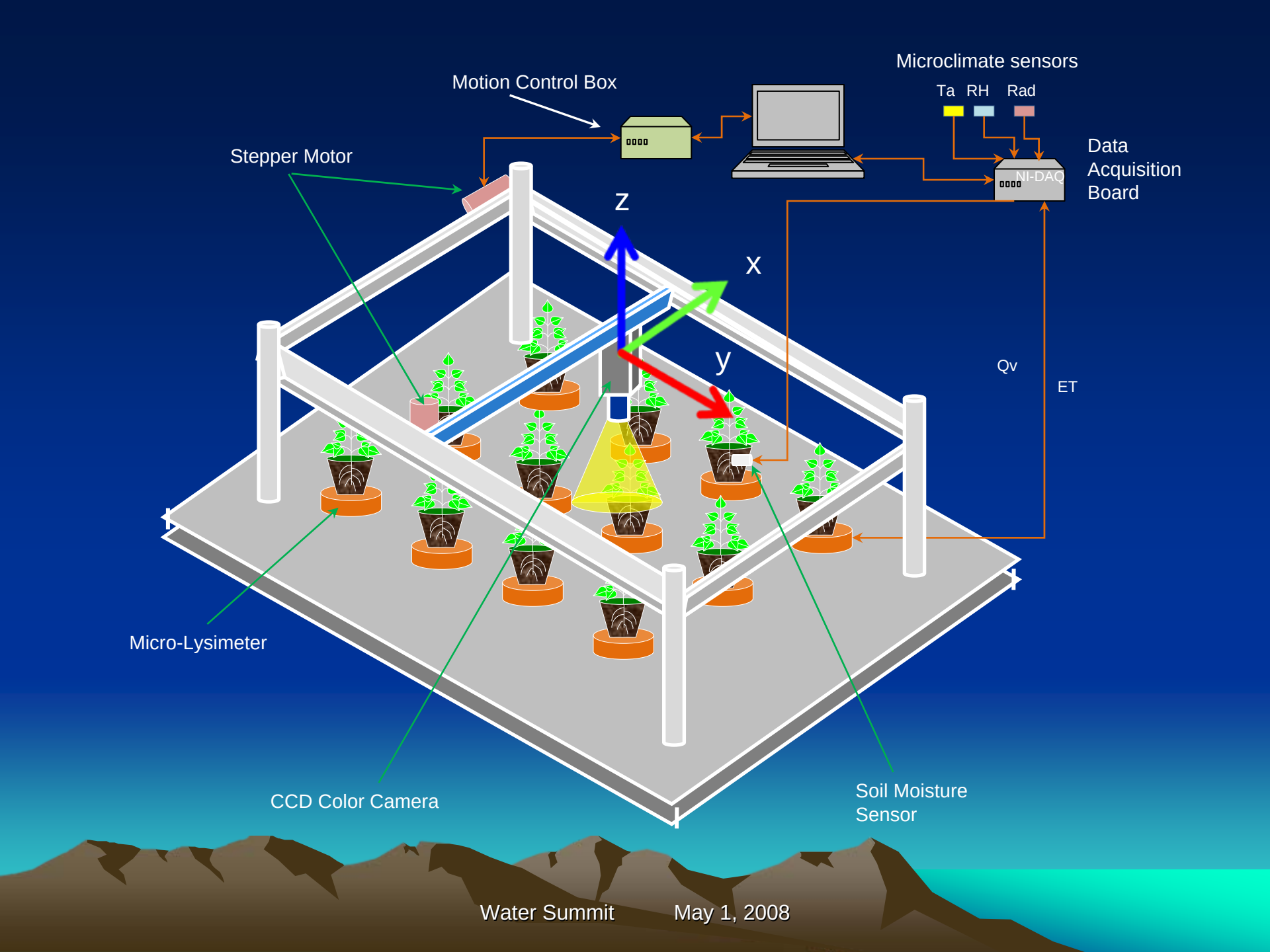
GH Water Use

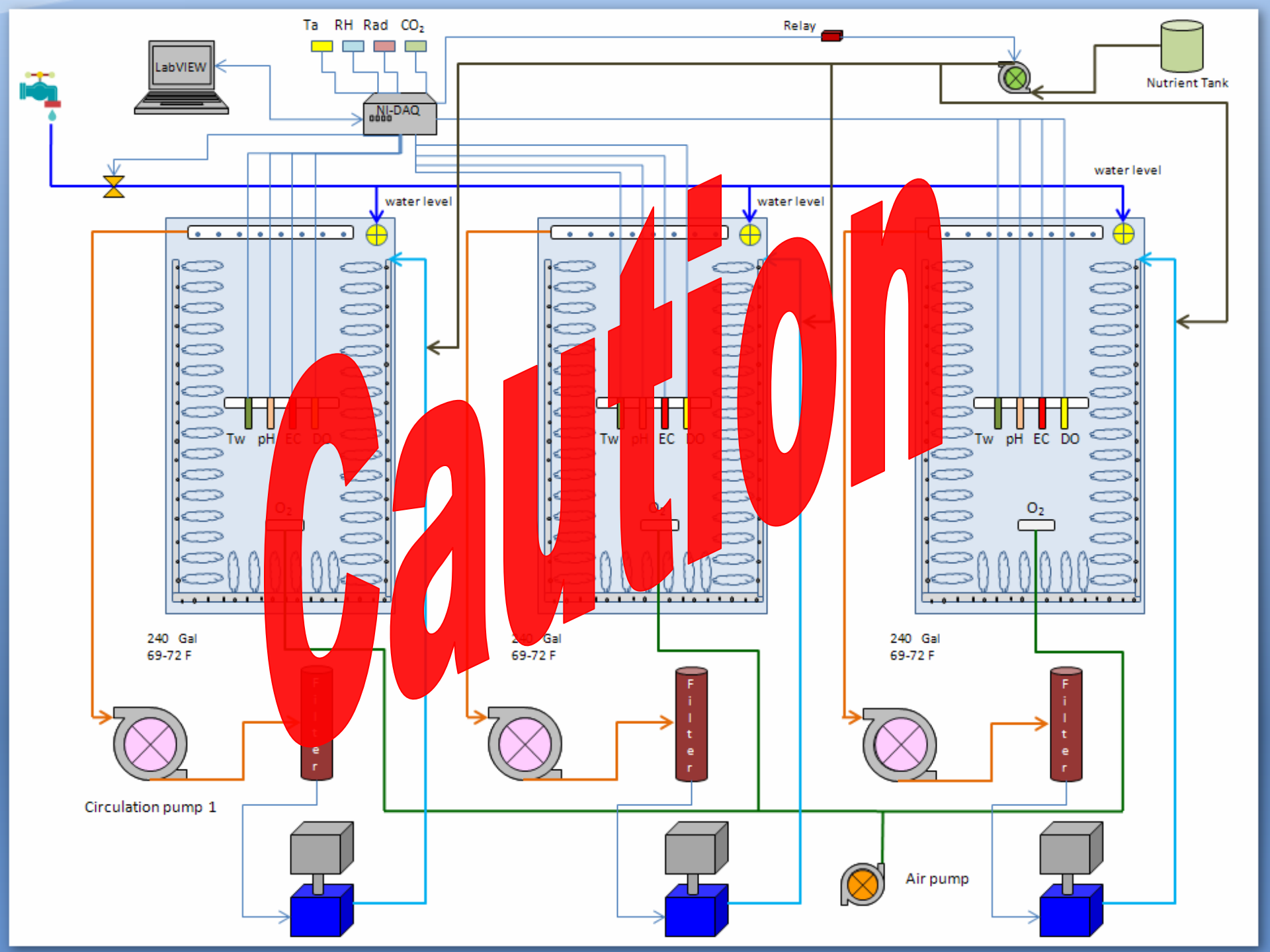
Tomato:
WUE = 2400 kgH_2O/kg Yield

Cucumber: WUE = 5-6x greater

Advantages of Greenhouse Crop Production

- **High productivity (10x or more for same area)**
- **High quality of crop**
- **Efficient use of solar, wind and thermal energy**
- **Efficient use of water (1/6 -1/2 use)**
- **Efficient use of agrochemicals**
- **Efficient use of insects (beneficial insects)**
- **Low impact to environment**
- **Better working environment**


Microclimate sensors
Ta RH Rad
Motion Control Box
Stepper Motor
Data Acquisition Board
NI-DAQ
z
x
y
Qv
ET
Micro-Lysimeter
CCD Color Camera
Soil Moisture Sensor


Ta
RH
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water level
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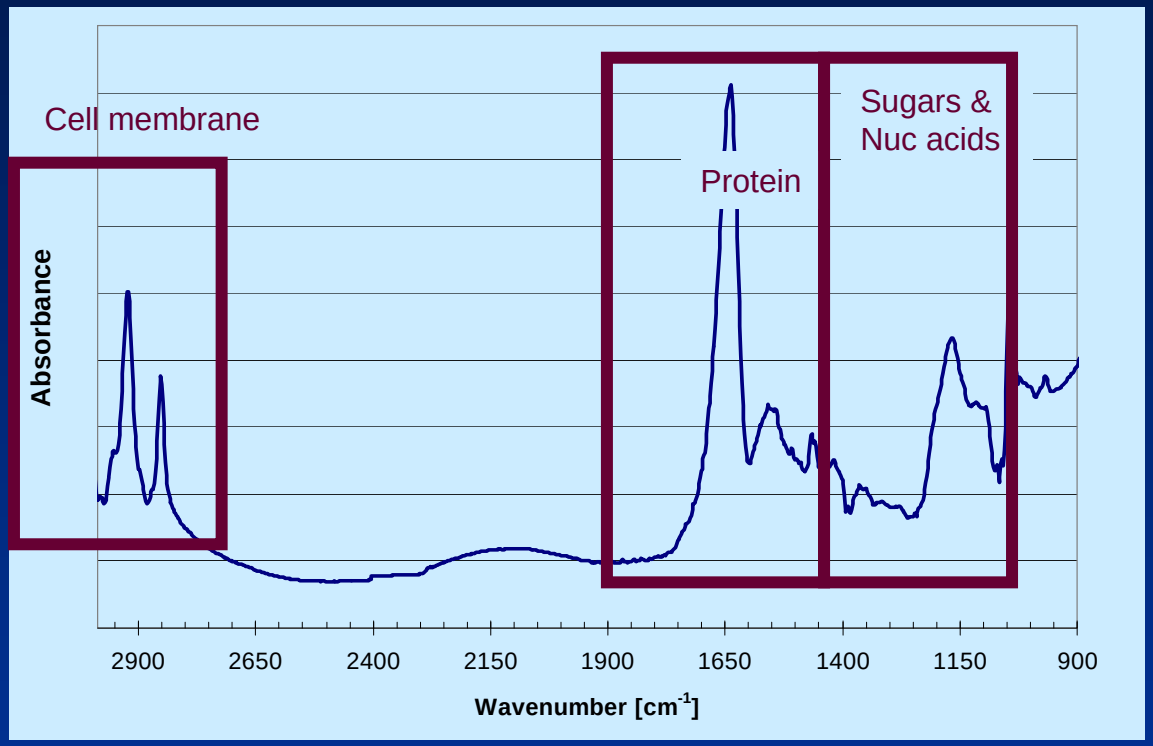
DO
O_2
240 Gal
69-72 F
240 Gal
69-72 F
240 Gal
69-72 F
Filter
Filter
Filter
Circulation pump 1
Air pump
Caution

Cell-based optical sensing of waterborne pathogens



Mark Riley, Ag. and Biosystems Engineering

- Infrared and Raman spectroscopy to quantify and characterize bacteria and viruses in drinking water.
- Non-invasive approach which can be automated for frequent measurements.
- Detection of 10 viral particles / mL in 4 hours.

Future directions of the Riley laboratory

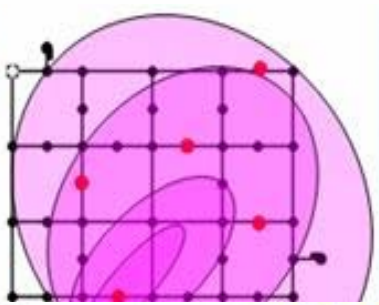
- Assist in the development of the sensor laboratory at the Water Village at ERL.
- Challenge and test commercial continual water quality monitoring devices including those utilized by Tucson Water.
  - Hach Event monitor, s::can system, and Jmar Biosentry
  - Laboratory will have a strong outreach component with activities and tours for K-12 and for undergraduate and graduate students

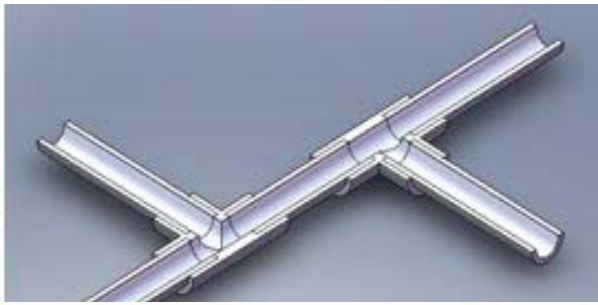
Water Resource Engineering
Chris Choi

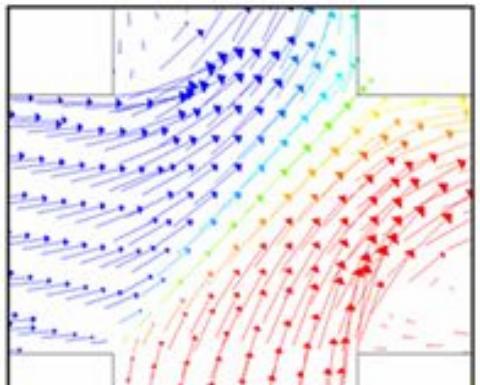
- Feasibility of Monitoring Biological Agents in Water Distribution and Collection System
- Role of Irrigation Methods on Microbial Food Safety
- Subsurface Drip Irrigation using Effluent in Arid Lands
- Transport Phenomena of Pollutants and Pathogens

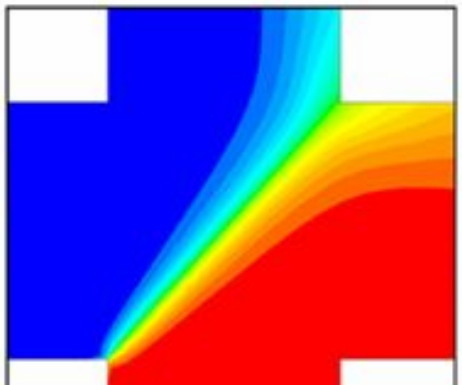
Water Village

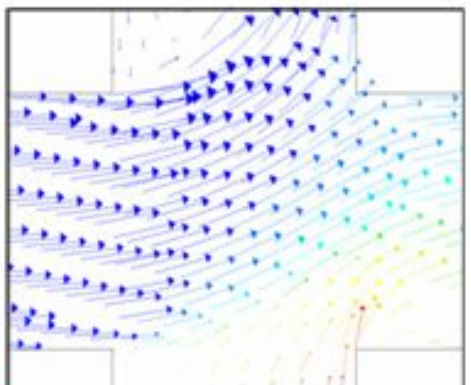
Water Distribution Network Laboratory

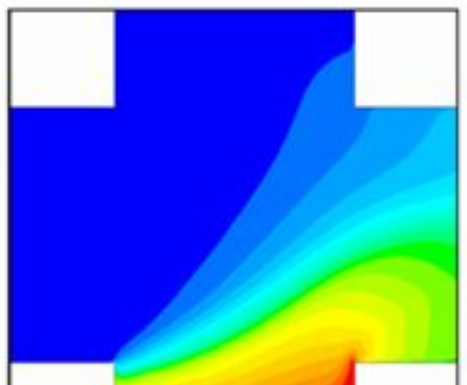












Water Resource Engineering
Peter Waller

- Development of tables and computer programs for timing and management of urban landscape irrigation systems.
- Assessment of water and nitrogen stress in agriculture with remote sensing, in-situ sensors, and crop models.
- Research and education program in landscape irrigation

Water Resource Engineering

- Irrigation Scheduling
- Irrigation Water Management
- Water Conservation
- Crop Water Use
- Soil and Water Quality
- Everything else – mainly Ag. Related

Water Resource Engineering

Traditionally, Ag. Engineers in the water area worked on irrigation systems – mainly designing and large scale irrigation systems for use on the farm.

Such as large center pivot systems

Or drip irrigation systems

Or the traditional solid set systems


And even the simple (but still
requiring design work)
surface irrigation system

Water Resource Engineering

But, we are getting into other areas as well…


EMU OIL


GATION MANAGEMENT
ATER MEASUREMENT
J. Pegelow, L. Clark & D. Slack
The University of Arizona
OTHER TOOLS
AVAILABLE FOR
IN-FIELD
MEASUREMENTS
• SOIL SAMPLING
• SOIL TENSION
• ELECTRICAL RESISTANCE
• NEUTRON PROBE
• FONTOR
DELIVERY SYSTEM
MEASUREMENTS
• WEIRS
• FLUMES
• ULTRASONIC METERS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10in. 18T
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KCl
KOH
Fisher Scientific

Post-Test

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