American Society of
Irrigation Consultants

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The Design and Performance of Reliable Irrigation Systems Using Fusible PVC® Pipe

Bob Walker, P.E.

VP Technical Development & Standards

Underground Solutions, Inc.

ASIC

Pipe & Plastics Background

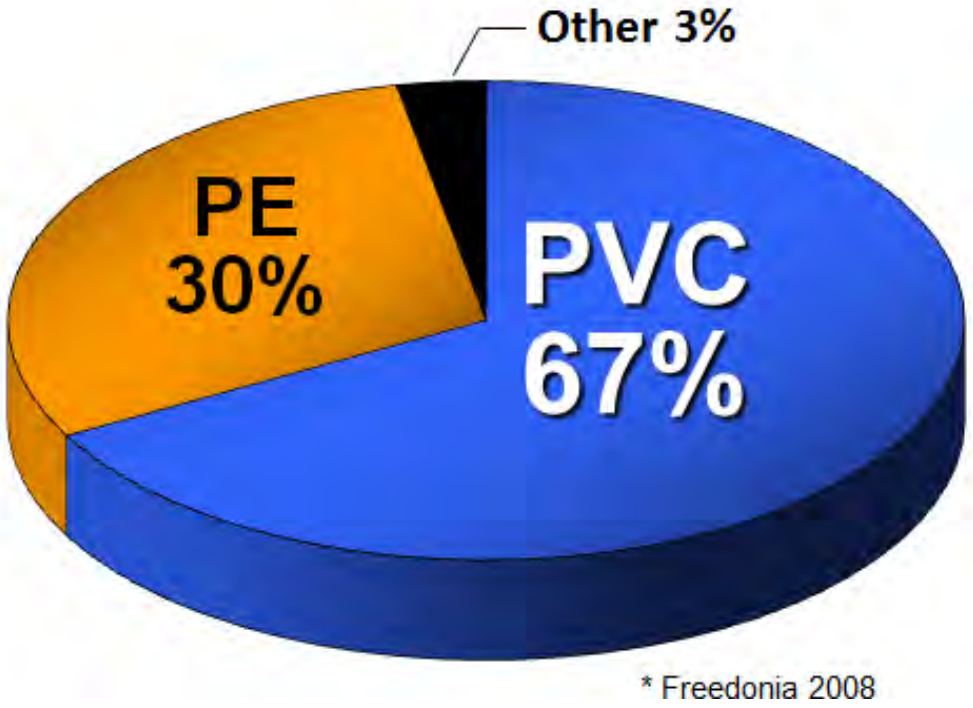
- *My background and experience with plastic pipe span over 35 years as does my work with ASTM and AWWA as a standards committee volunteer.*
- *Prior to UGSI, I was the Executive Director for the PVC pipe industry association - Uni-Bell.*
- *I am an appointed member of the Plastic Pipe Institute's Hydrostatic Design Stress Board and have served on the Board for 30+ years.*

"I'm going to say just one word, son...PLASTICS."

What are the two most commonly specified plastic pipe materials?

PVC & PE are the two most widely used plastic pipe materials

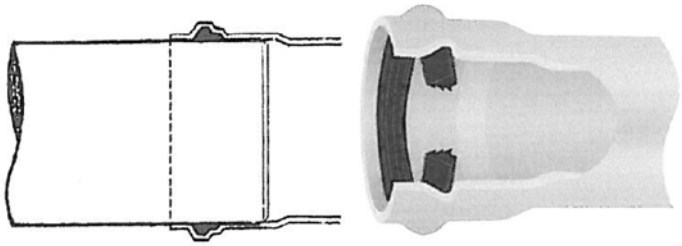
- *The major markets for **PVC** pipe include pressurized water distribution and transmission, pressurized sewer mains, gravity-flow sanitary sewers, DWV plumbing, conduit, and both turf and agricultural irrigation.*
- *The major markets for **PE** pipe include natural gas distribution, pressurized gas and oil, industrial, mining, drainage, conduit, water service lines and distribution.*



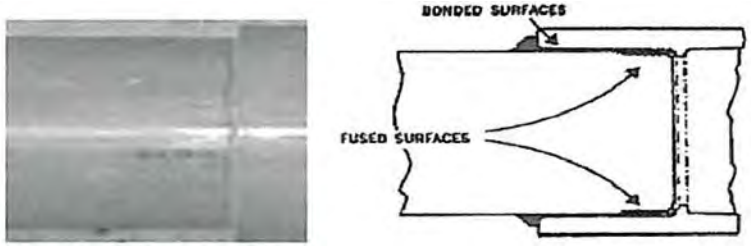
* Freedonia 2008

Property	Specification	PVC		HDPE	
Compound Cell Class	ASTM D1784 for PVC ASTM D3350 for HDPE	12454 (PVC1120)	12364	445474 (PE4710)	344464 (PE3408)
Min. Tensile Strength (psi)	ASTM D638	7,000	6,000	3,000	3,000
Hydrostatic Design Basis At 73ºF (psi)	ASTM D2837	4,000	na	1,600	1,600
Min. Modulus of Elasticity (psi)	ASTM D638	400,000	440,000	120,000	110,000
Specific Gravity	ASTM D1505	1.40	1.46	0.95	0.94
Fracture Toughness (psi-in$^{0.5}$)	ASTM D5045	2,500 – 3,500	na	3,500 – 5,000	1,800 – 2,400
Hardness (Rockwell)	ASTM D785	117		52	
Coefficient of Linear Expansion (In./In. deg F)	ASTM D696	0.3 x 10^{-4} 0.36 in./ 100ft./ 10°F		1.2 x 10^{-4} 1.44 in./ 100 ft./ 10°F	

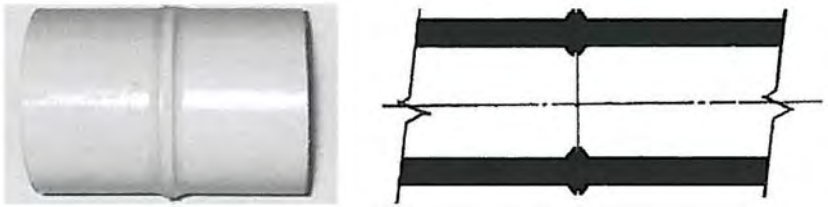
PVC and PE Pipe Joining Methods



PVC Pipe *– Bell and spigot with compression gasket seal*

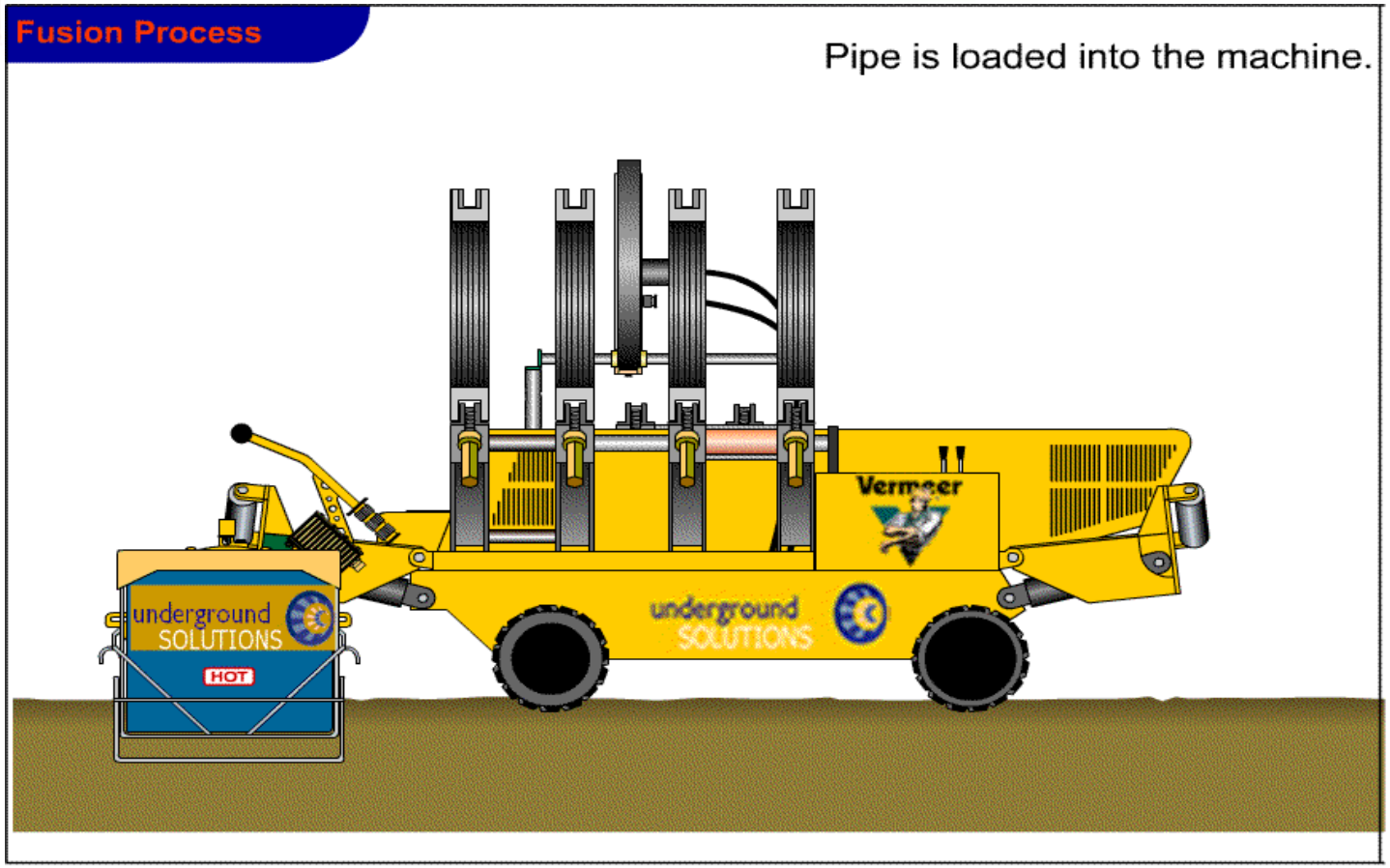


PVC Pipe *– Socket or twin socket coupler and spigot with solvent cement*



PE Pressure Pipe *- Thermal butt-fusion*

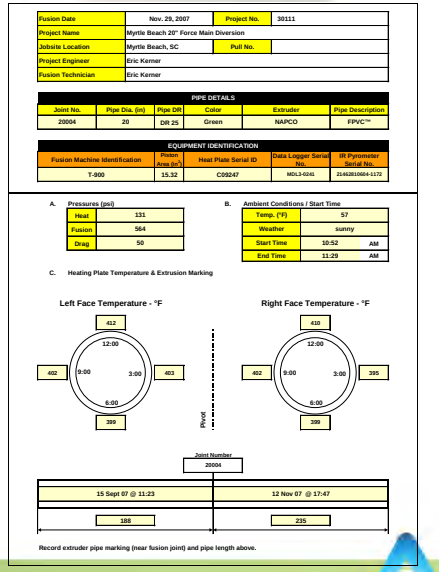
What is Fusible PVC® pipe?



Internal and External Bead Removal is Optional – friction losses are negligible ('C'-factor of 150) and are significantly less than mechanically joined pipe (i.e. for 8" DR18 with 1000gpm in a length of 1000LF, flow loss is 0.173 gpm and a head loss of 0.013 ft) and pipe tensile strength is not impaired (extra material in bead)

Fusion Process Is Tightly Controlled

- *Qualified fusion technicians are trained and retrained every year by Underground Solutions*
  - *Initial 3 day course*
- *Fusion equipment must meet minimum company standards to be approved for PVC fusion*
- *Data loggers record critical fusion data for each joint*
  - *Provide real time feedback on joint integrity*
  - *Provide record of entire project for proof of system integrity*
- *Fusion conditions logged by technician and "as-built" fusion joint record is developed for owner as necessary*



Fusion Date	Nov. 29, 2007	Project No.	30111
Project Name	Myrtle Beach 20" Force Main Diversion		
Jobsite Location	Myrtle Beach, SC	Pull No.	
Project Engineer	Eric Kerner		
Fusion Technician	Eric Kerner		

PIPE DETAILS

Joint No.	Pipe Dia. (in)	Pipe DR	Color	Extruder	Pipe Description
20004	20	DR 25	Green	NAPCO	FPVC™

EQUIPMENT IDENTIFICATION

Fusion Machine Identification	Power Area (in²)	Heat Plate Serial ID	Data Logger Serial No.	IR Pyrometer Serial No.
T-900	15.32	C09247	MDL3-0241	2146281004-1172

A. Pressures (psi)

Heat	131
Fusion	564
Drag	50

B. Ambient Conditions / Start Time

Temp. (°F)	57	
Weather	sunny	
Start Time	10:52	AM
End Time	11:29	AM

C. Heating Plate Temperature & Extrusion Marking

Left Face Temperature - °F

Right Face Temperature - °F

Pivot

Joint Number
20004

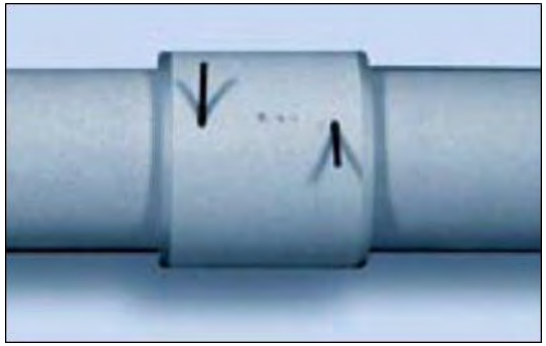
15 Sept 07 @ 11:23	12 Nov 07 @ 17:47
188	235

Record extruder pipe marking (near fusion joint) and pipe length above.

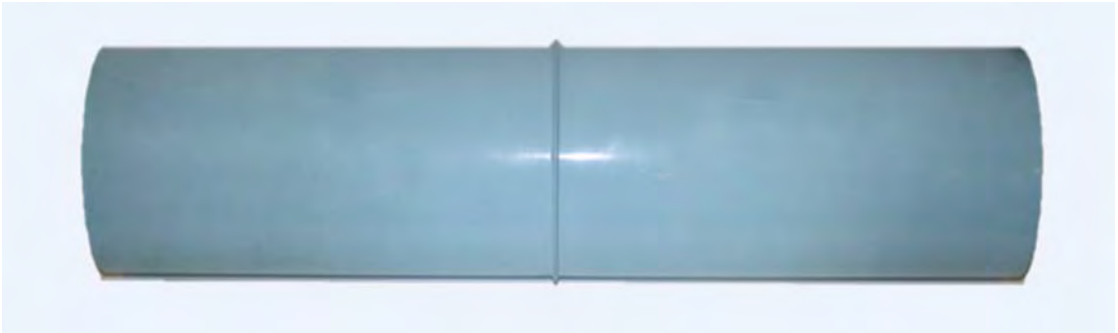
Advantages Over Mechanically Restrained Joints

Barrel = 13.2”
Bell = 16.75”
Restraining
Hardware = 19.45”

Bulldog™ Restraint
Barrel = 13.2”
Bell = 16.13” DR 18,
16.97” DR 14



Certa-Lok™
Barrel = 13.2”
Bell = 15.83”

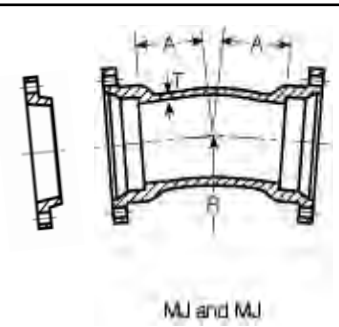


Barrel and Fused Joint Have Consistent O.D. = 13.2”

Standard Fittings & Mechanical Connections Can Be Used with Fusible PVC® Pipe

Connecting to Fittings

Mechanical Joint Fittings:



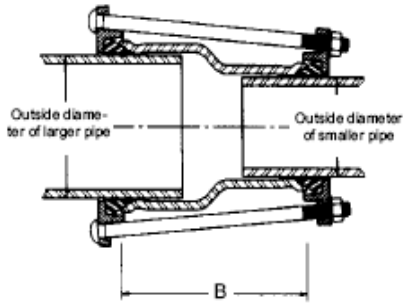
MJ and MJ

Flanged Joint Fittings:

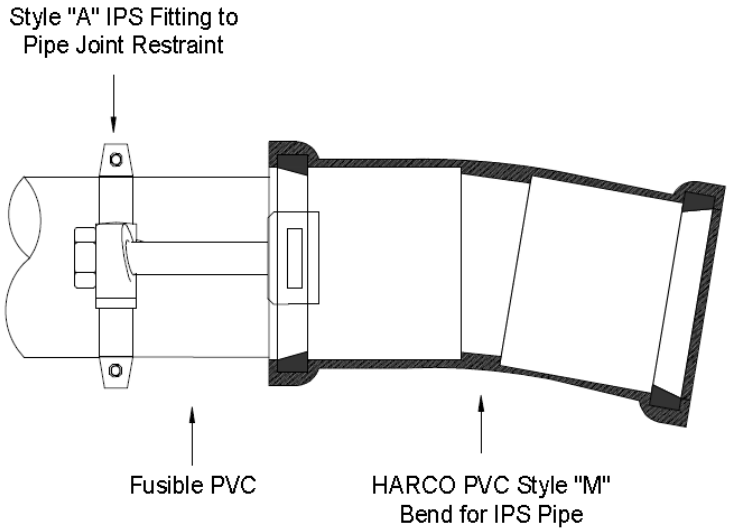
Connecting to Pipe

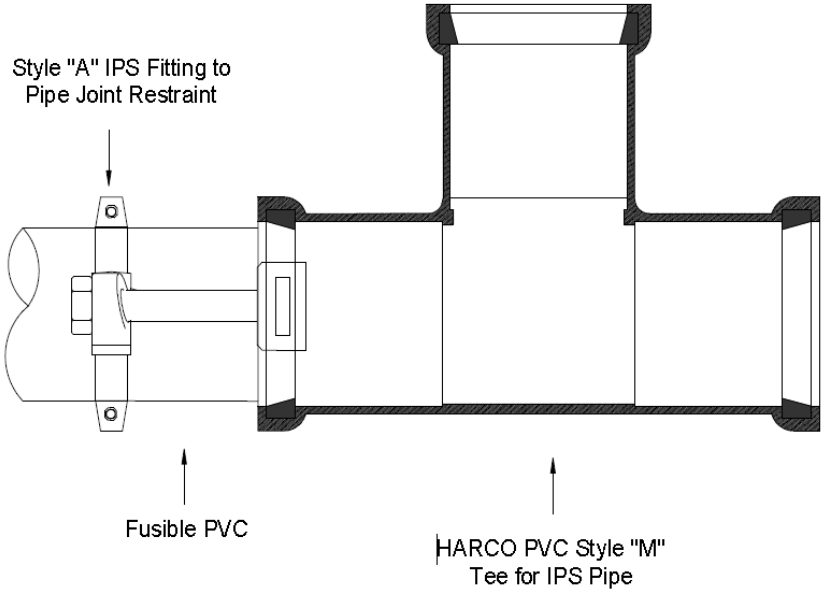
Same Piping Size:

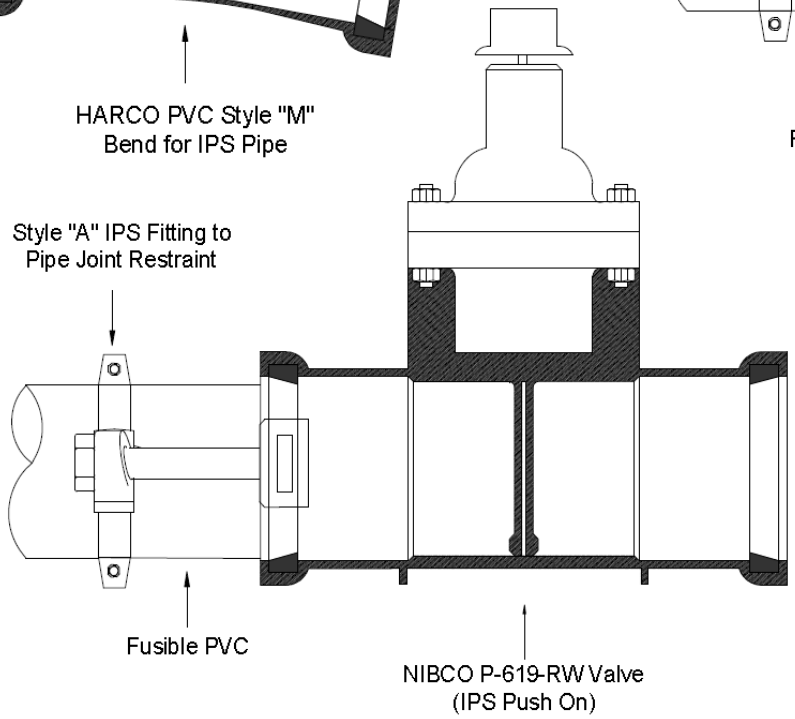
Different Piping Size:



Fusible PVC® Pipe Irrigation Fitting Details







Disneyworld Animal Kingdom Irrigation Project

4,280' of 4, 6, & 8"

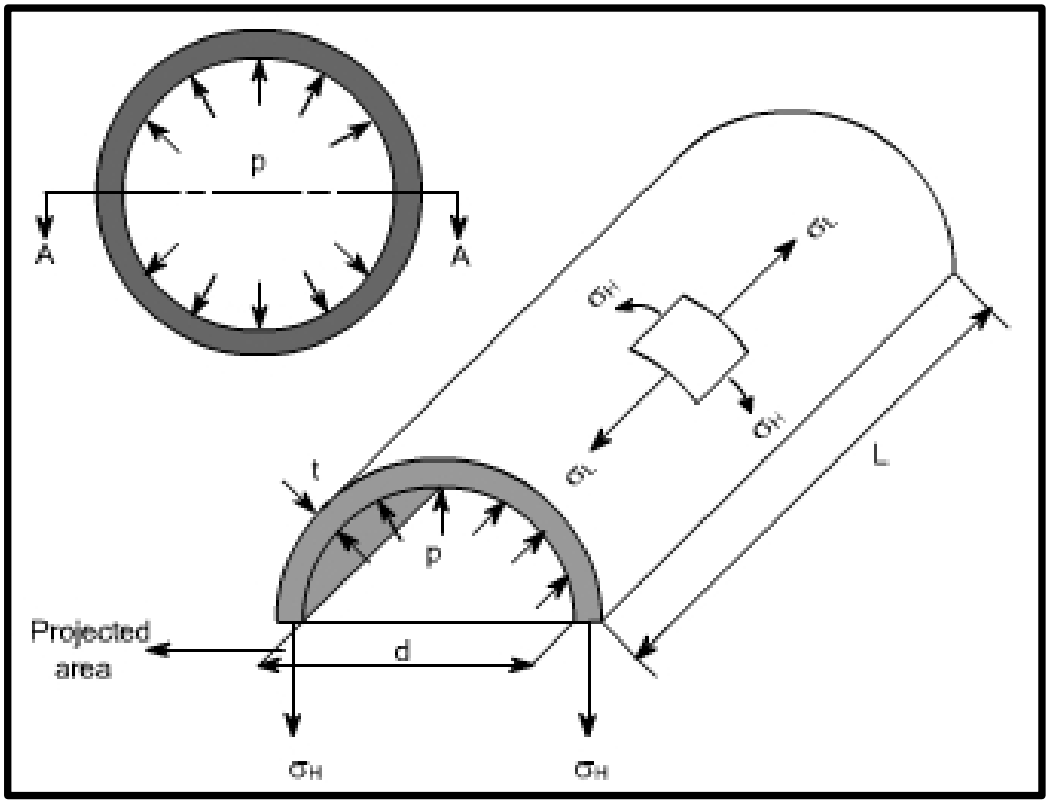
Fusible PVC® Pipe: Available Dimensions

Product	Sizes (Nominal OD)	DIPS or IPS or Schedule	Dimension Ratios (DR)	Uses	Colors
FPVC®	4" – 36"	DIPS, IPS, or Schedule	DR 14, 18, 21, 25, 26, 32.5, 41, 51* and Sch.40, Sch.80	Non-Potable Water or Potable Water Applications not in C900/C905 Dimensions	Blue, Purple, Green, White, Grey
Fusible C-900®	4" – 12"	DIPS	DR 14, 18, 25	Potable Water AWWA C900	Blue
Fusible C-905®	14" – 36"	DIPS	DR 14, 18, 21, 25, 32.5, 41, 51*	Potable Water AWWA C905	Blue

Plastic Pressure Pipe Design

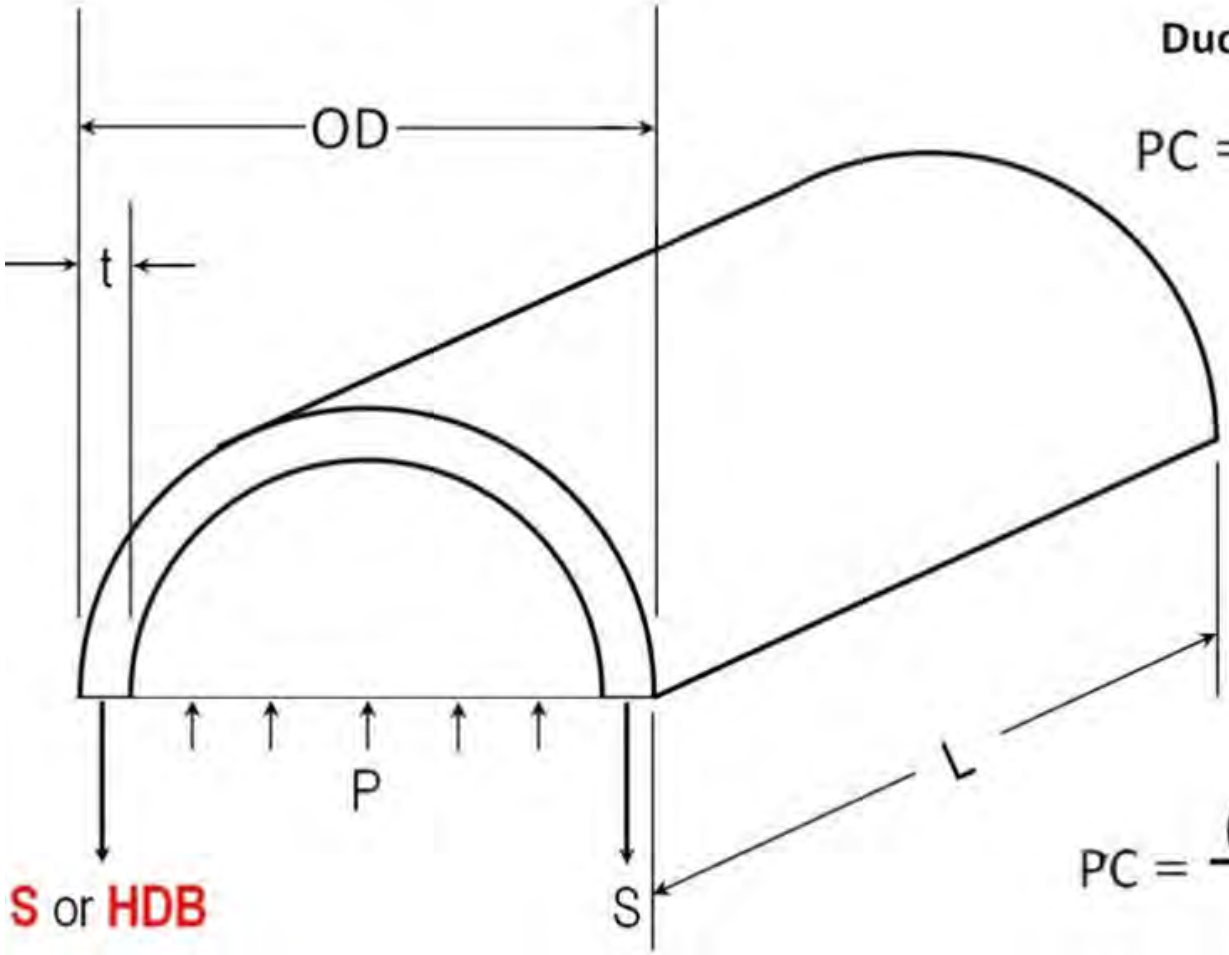
The key to long-life performance for plastic pipe is stress management.

Pressure Pipe Stress Diagram



Sustained Stress Capacity = HDB

(Hydrostatic Design Basis)



Ductile Iron & Steel

$$PC = \frac{(2)(S \div SF)(t)}{(OD - t)}$$

HDB

PVC = 4,000 psi

PE = 1,600 psi

PVC & PE

$$PC = \frac{(2)(HDB \times DF)(t)}{(OD - t)}$$

Property	Specification	PVC		HDPE	
Compound Cell Class	ASTM D1784 for PVC ASTM D3350 for HDPE	12454 (PVC1120)	12364	445474 (PE4710)	344464 (PE3408)
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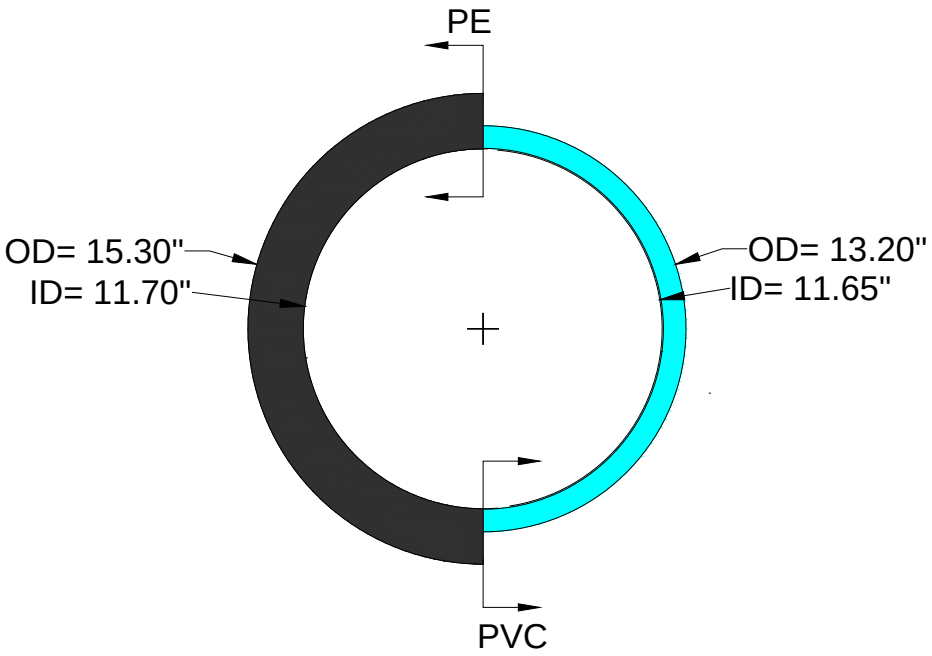
Coefficient of Linear Expansion (In./In. deg F)	ASTM D696	0.3 x 10^{-4} 0.36 in./ 100ft./ 10°F		1.2 x 10^{-4} 1.44 in./ 100 ft./ 10°F	

Material & Installation Savings

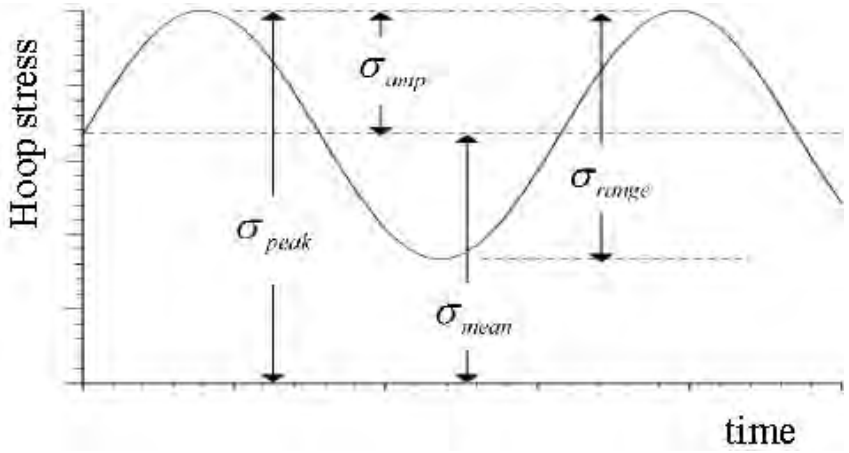
Efficiencies with Fusible PVC® Pipe



12" ID	12" PVC DR 18 SF = 2.0	14" PE DR 9 SF = 2.0	Δ
Pressure Rating (PSI)	235	200	+15%
ID (inches)	11.65	11.70	-0.5%
OD (inches)	13.20	15.30	-16%
Volume per Foot (ft^3)	0.95	1.28	-26%
Wall Thickness (inches)	0.73	1.80	-59%
Weight (lbs./ft.)	19.05	31.64	-40%

Design for Pressure Fluctuations

- ***The relationship between pressure fluctuations and fatigue failure is a function of three variables:***
  - ***Hoop Stress Amplitude***
  - ***Mean or Average Hoop Stress***
  - ***Cycle Frequency***



- ***Fatigue failure of PVC pipe has been thoroughly investigated***
- ***Those investigations have produced quantitative design methods to prevent premature fatigue failures.***

Cyclic Pressure Design Chart for PVC

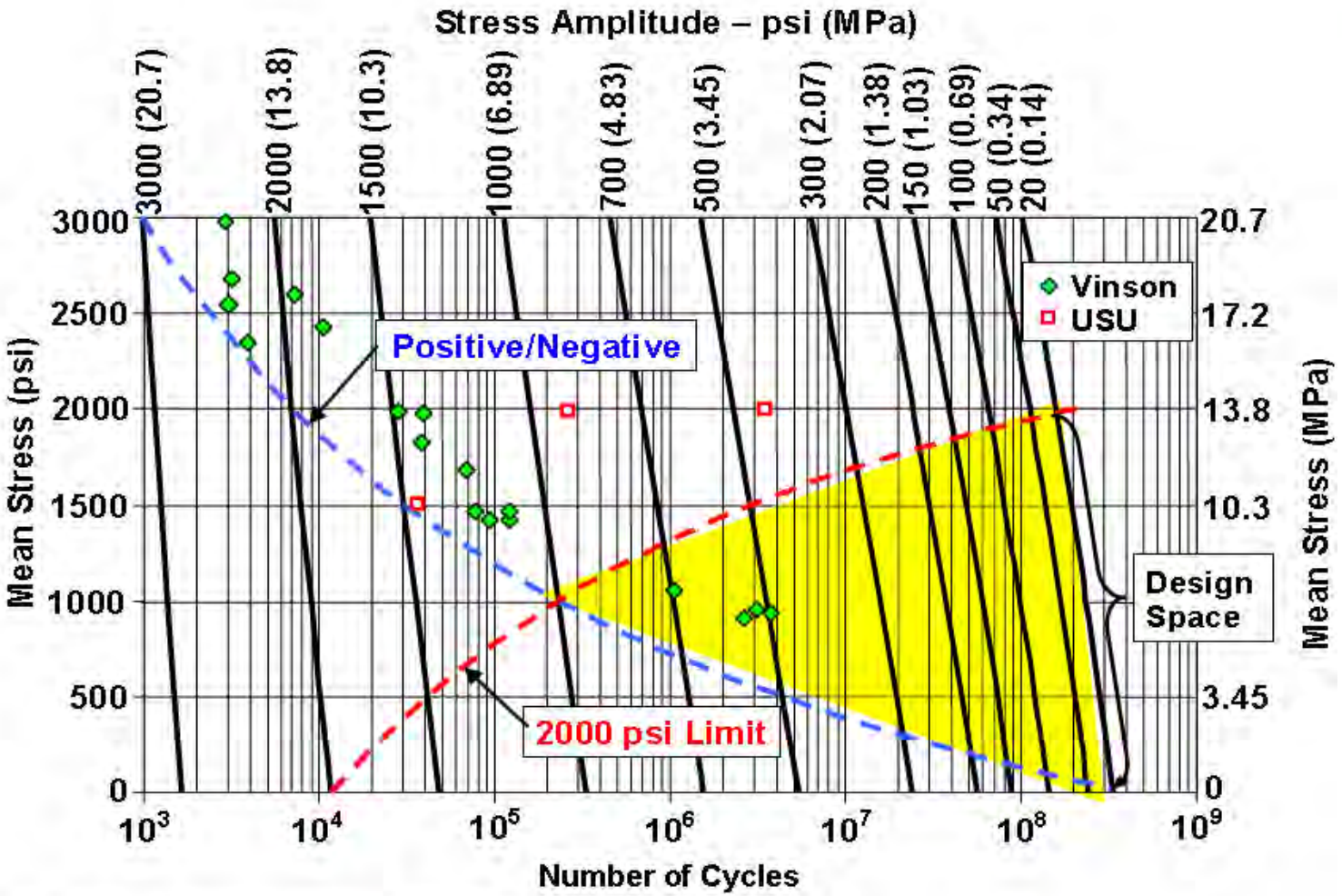
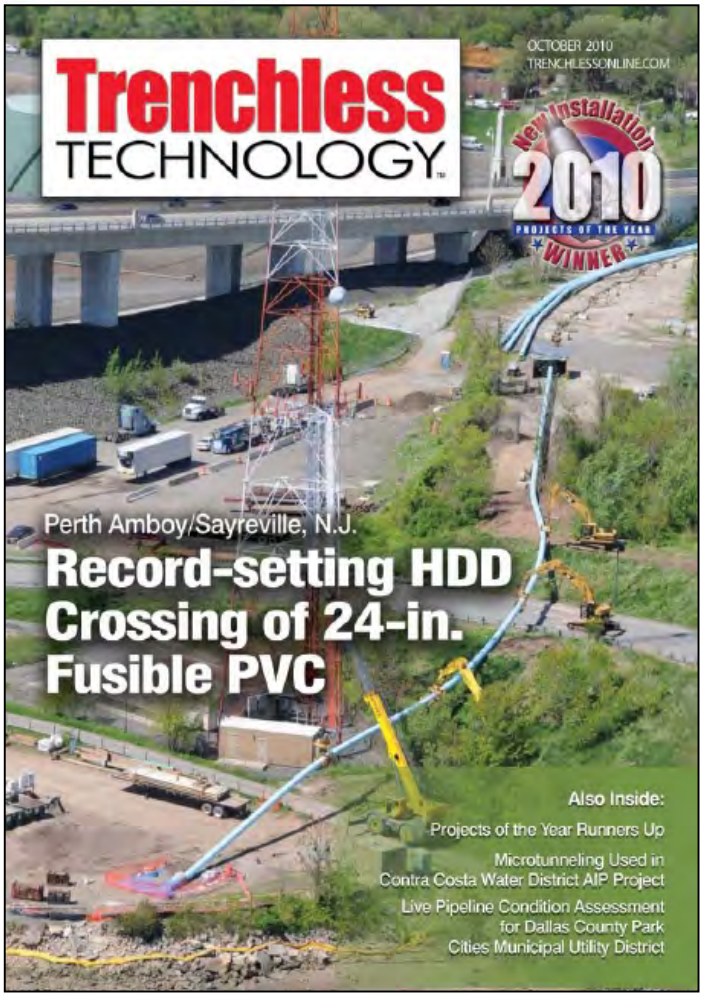


Figure 6. Fatigue criteria from Jeffery (Jeffery, et al, 2003).

Record Setting HDD Raritan River Crossing



- *5,400 LF of 24” DR18 Fusible C905®*
- *Longest unassisted pull of thermoplastic pipe in the water & wastewater industry*
- *“Trenchless Technology Project of the Year 2010”*

Summary of Installed Cost Advantages

- ***Standard Fittings:*** *Fusible PVC® pipe utilizes standard mechanical joint fittings. No special fittings or equipment are required for connections. As a result, Fusible PVC® pipe is easy to connect to and maintain.*
- ***Safe Pulling Allowance:*** *Fusible PVC® pipe has a safe pulling allowance that is significantly greater than that of most other pipe systems, and does not depend on pull-in duration.*
- ***Lower Material Weight:*** *Fusible PVC® pipe will have a lower overall material weight than other pipe systems. This means that drilling equipment costs may be lower to install Fusible PVC® pipe.*
- ***Smaller Bore Hole:*** *Fusible PVC® pipe will require a smaller bore hole diameter than other pipe systems. A smaller bore-hole diameter means that there will be less back reaming, less drilling mud, and less spoil disposal.*

Fusible PVC® - Pipe Innovation

- ***Fastest growing underground infrastructure product-line in North America***
  - *Leak free, restrained joint pipe systems*
  - *Trenchless installation modes that reduce contractor costs*
  - *Rehabilitation capabilities for intractable high pressure water pipe applications*
  - *"Trenchless Rehab Project of the Year 2013"*
- ***Over 7,000 successful projects installed to date with ~ 1,500 miles in service***
  - *In all 50 states, Canada, Mexico, New Zealand*
  - *Over 5,000 HDD's (directional drills)*
  - *Over 8,000 separate pull-in instances (HDD, Slipline, Pipe Burst, Open-Cut)*
- ***Compliant with relevant industry standards***
  - *AWWA C900, C905, NSF-61, NSF-14, PPI-TR2, ASTM D1785, D2241*
  - *Utilizes standard PVC , ductile iron, and steel fittings*
  - *Available in common pipe industry configurations*

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Engineering Structural Soils: Characteristics Impacting Irrigation & Drainage

by Dr. Barrett L. Kays, FASLA
Soil, Hydrologic, & Groundwater Scientist
Landscape Architect
Landis, PLLC, Raleigh, NC

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Why Structural Soils?

- **Sand Based Structural Soils are used for:**
  - High intensity sites that would otherwise become overly compacted
  - Urban construction sites so that the soils can be installed without compaction problems
  - Urban and sports venues that need to drain rapidly after a large rainstorm

- **Gravel Based Structural Soils are used:**
  - Urban tree planting so the tree roots can grow under the sidewalks without cracking the pavement

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Great Lawn in Central Park, NYC

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Nelson Rockefeller Hudson River Park

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EXPLORE | ENGAGE | EXECUTE

Dwight D. Eisenhower Memorial, DC

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Longwood Gardens, Kennett Square, PA

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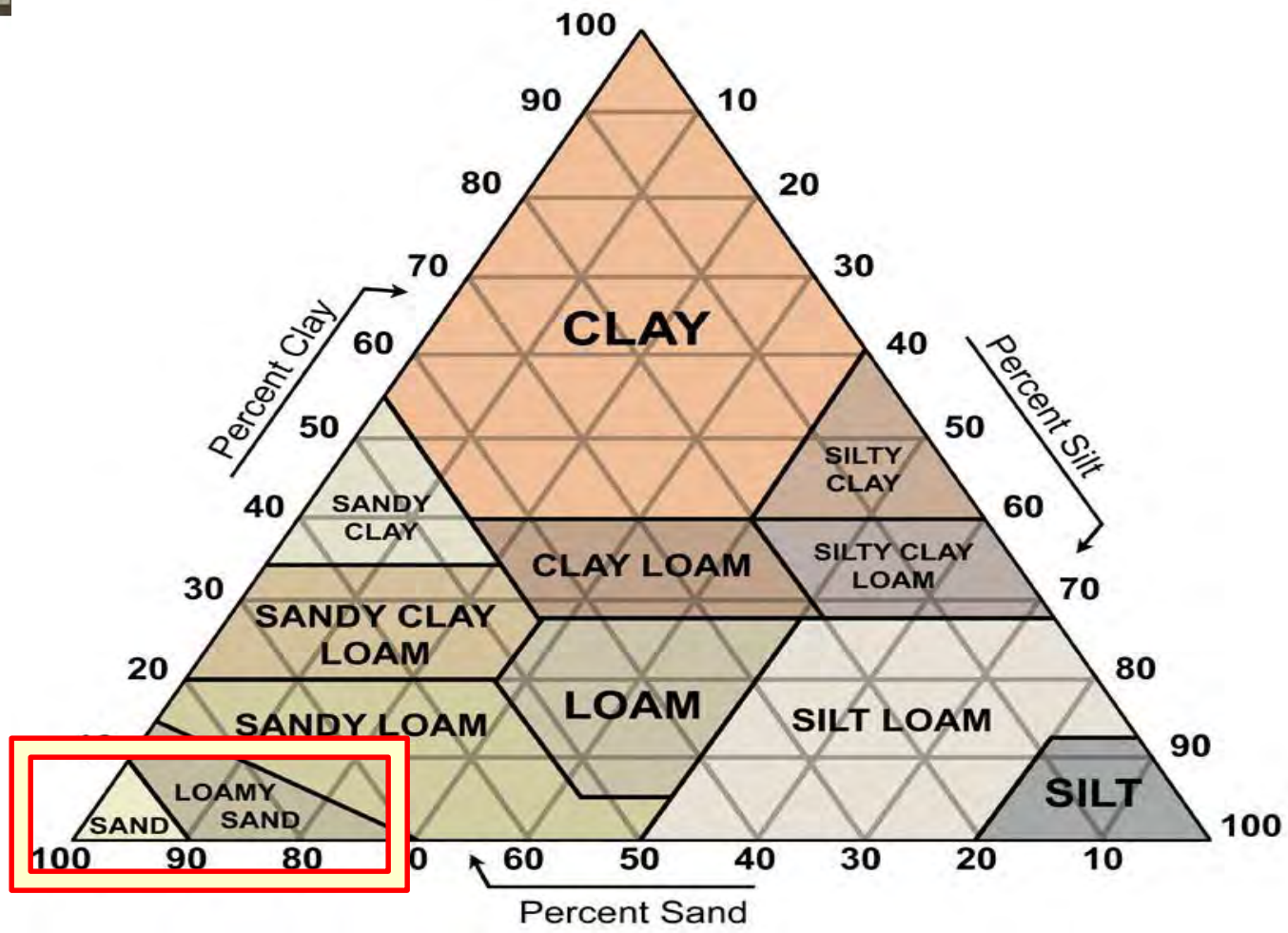
Sand Based Structural Soils



Soil Particle Size

- **Particle size diameters**
  - Very coarse sand – 1.00 to 2.00 mm
  - Coarse sand – 0.50 to 1.00 mm
  - Medium sand – 0.25 to 0.50 mm
  - Fine sand – 0.125 to 0.25 mm
  - Very fine sand – 0.050 to 0.125 mm
  - Silt – 0.002 to 0.50 mm
  - Clay - < 0.002 mm
- **Well graded sands – poor for infiltration**
  - 0.05 to 1.00 mm – very fine sand to coarse sand
  - Particles pack together and create less porosity and smaller effective pore diameters
- **Uniformly graded sands – good for infiltration**
  - 0.25 to 1.00 mm – medium and coarse sand; remove particles < 0.25 mm and particles > 1.00 mm
  - Particles do not tightly pack and create more porosity and larger effective pore diameters

Principals of Water Movement

The Six Principals of Water Movement in Soils

No Graduate Soil Physics Course is Required

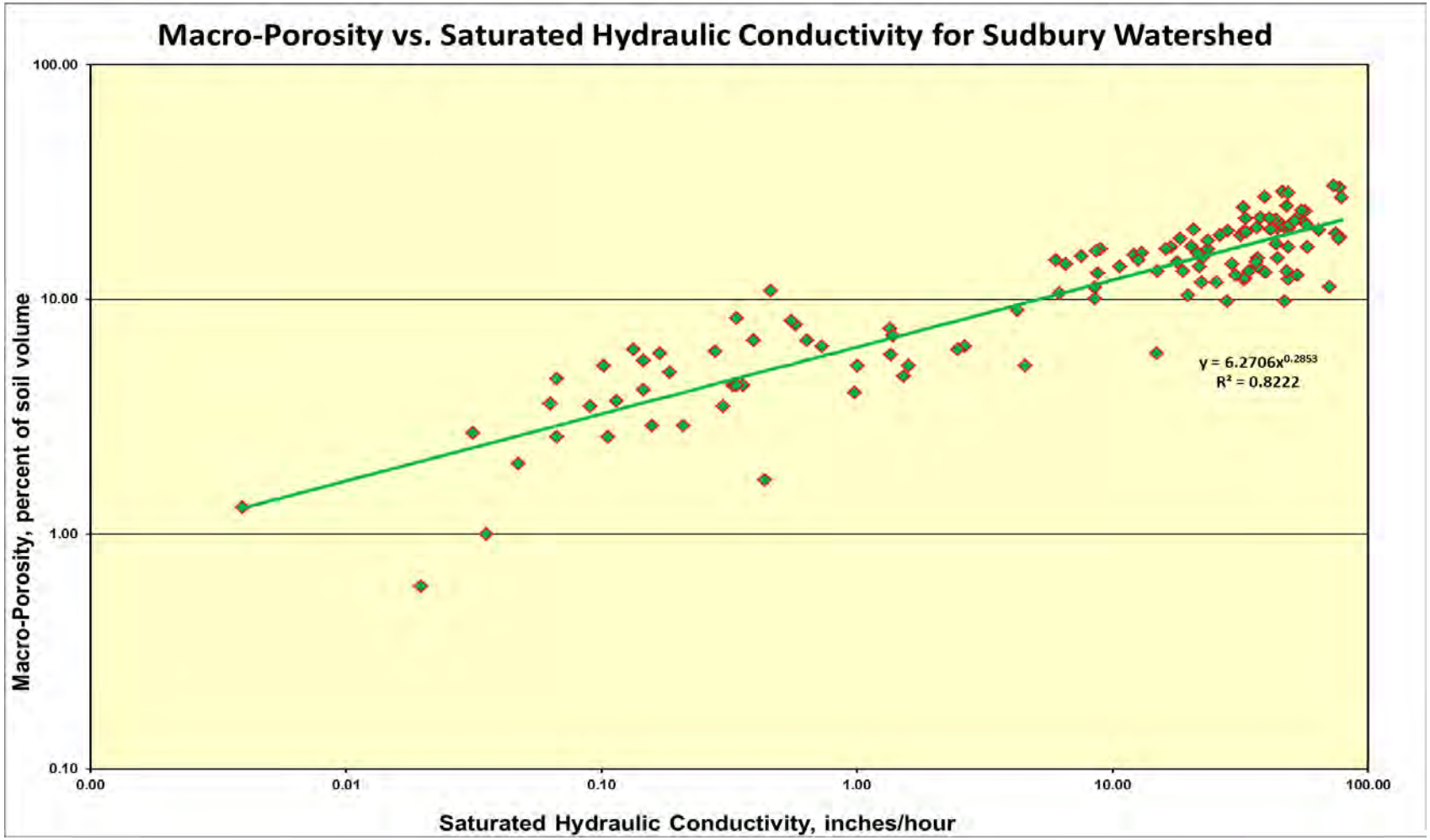
The Six Principals That Make
Most Engineers Scream and Run

Principles of Water Movement

Sandy Soil over Gravel Layer

- **P-1: When saturated to the surface water flows in proportion to size of pores, head, and drips into the gravel layer**
  - When the soil is completely saturated it is at zero negative pressure (soil moisture tension = 0), the rate of flow is through the macro-pores
  - The gravel layer has large pores which are at zero negative pressure (soil moisture tension = 0)
  - Therefore water can flow from the soil layer into the gravel layer

Principles of Water Movement

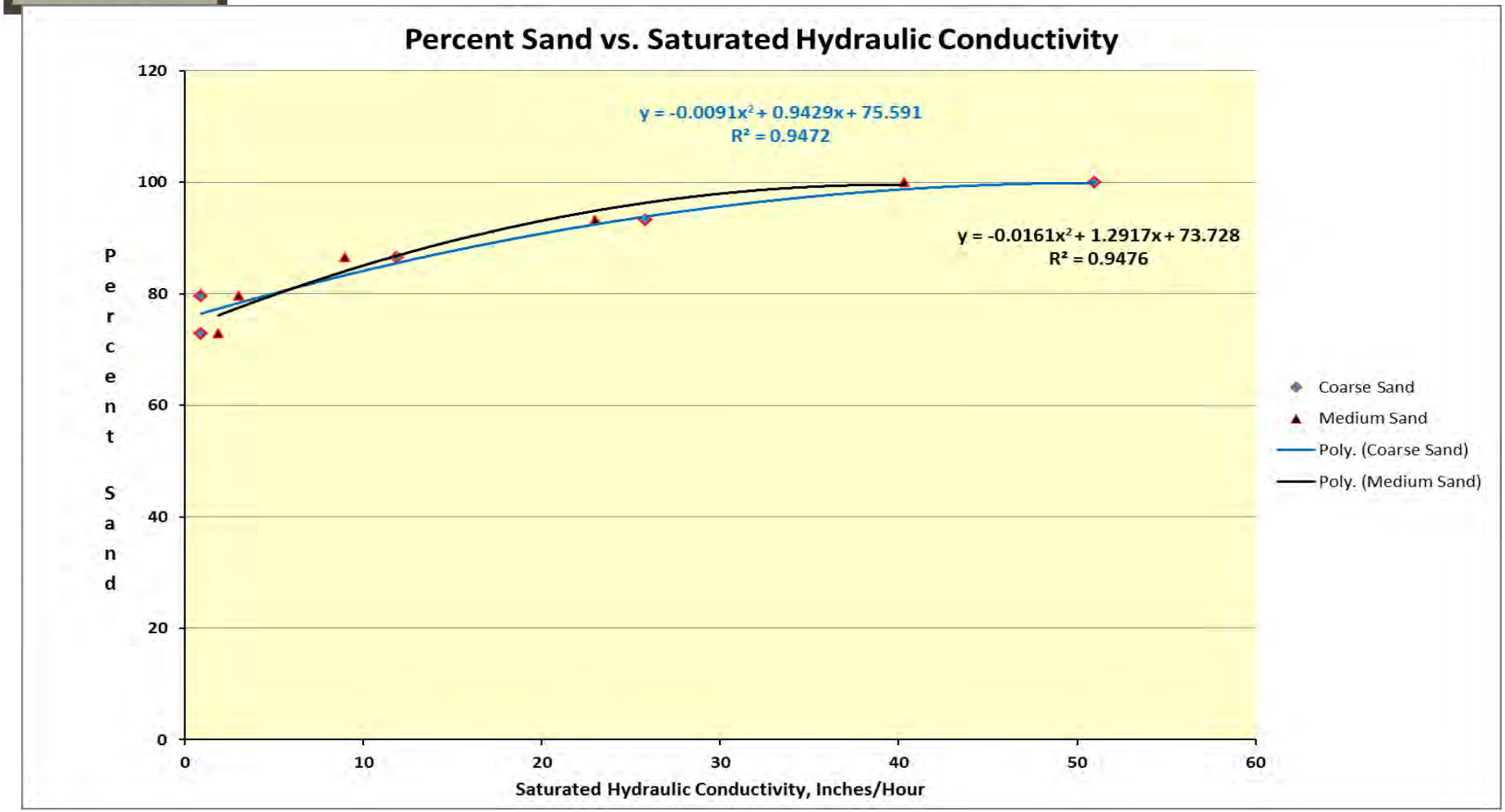


Principles of Water Movement

Sandy Soil over Gravel Layer

- **P-2: Uniformly graded coarse and medium sand conducts water faster when saturated than well graded sands**
  - Uniformly graded (good sands) means that all of the finer and larger sand particles has been screen out and the remaining is only coarse to medium sand (0.25 to 1.0 mm in diameter)
  - Well graded (bad sands) include very fine sand, fine sand, medium sand, coarse sand, and very coarse sand. When compacted the different sizes lock together, thus it makes a good concrete sand, but a bad sand for drainage

Principles of Water Movement

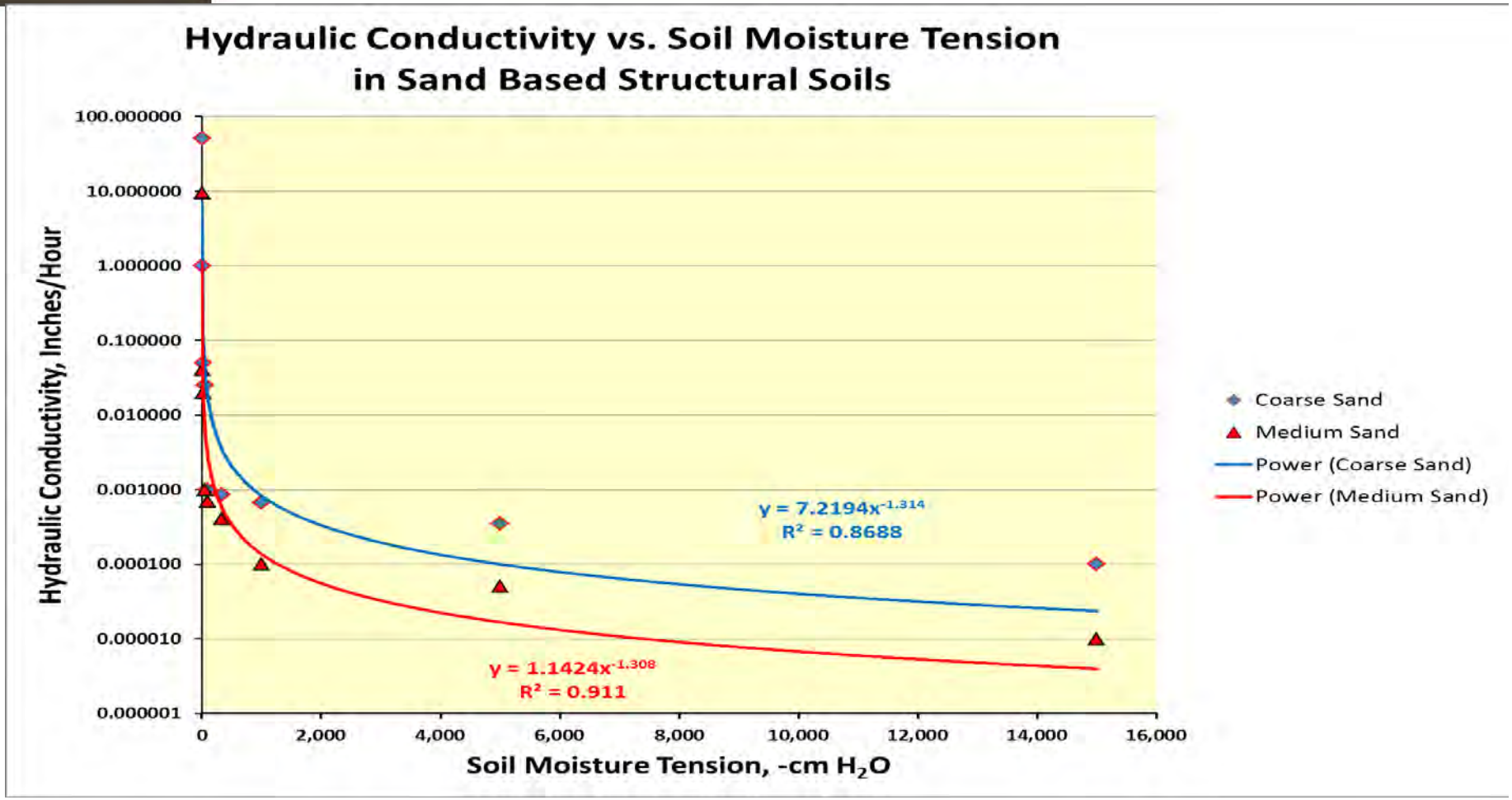


Principles of Water Movement

Sandy Soil over Gravel Layer

- **P-3: When <u>unsaturated</u> the flow of water in the soil slows to very low hydraulic rates:**
  - Just like when you irrigate a site if the application rate is less the saturated hydraulic conductivity, the soil remains unsaturated
  - The hydraulic rate slows because the unsaturated flow occurs in micro-pores or on the surface of macro-pores
  - After the irrigation or rain the water in an unsaturated state slowly begins to redistribute through the soil

Principles of Water Movement

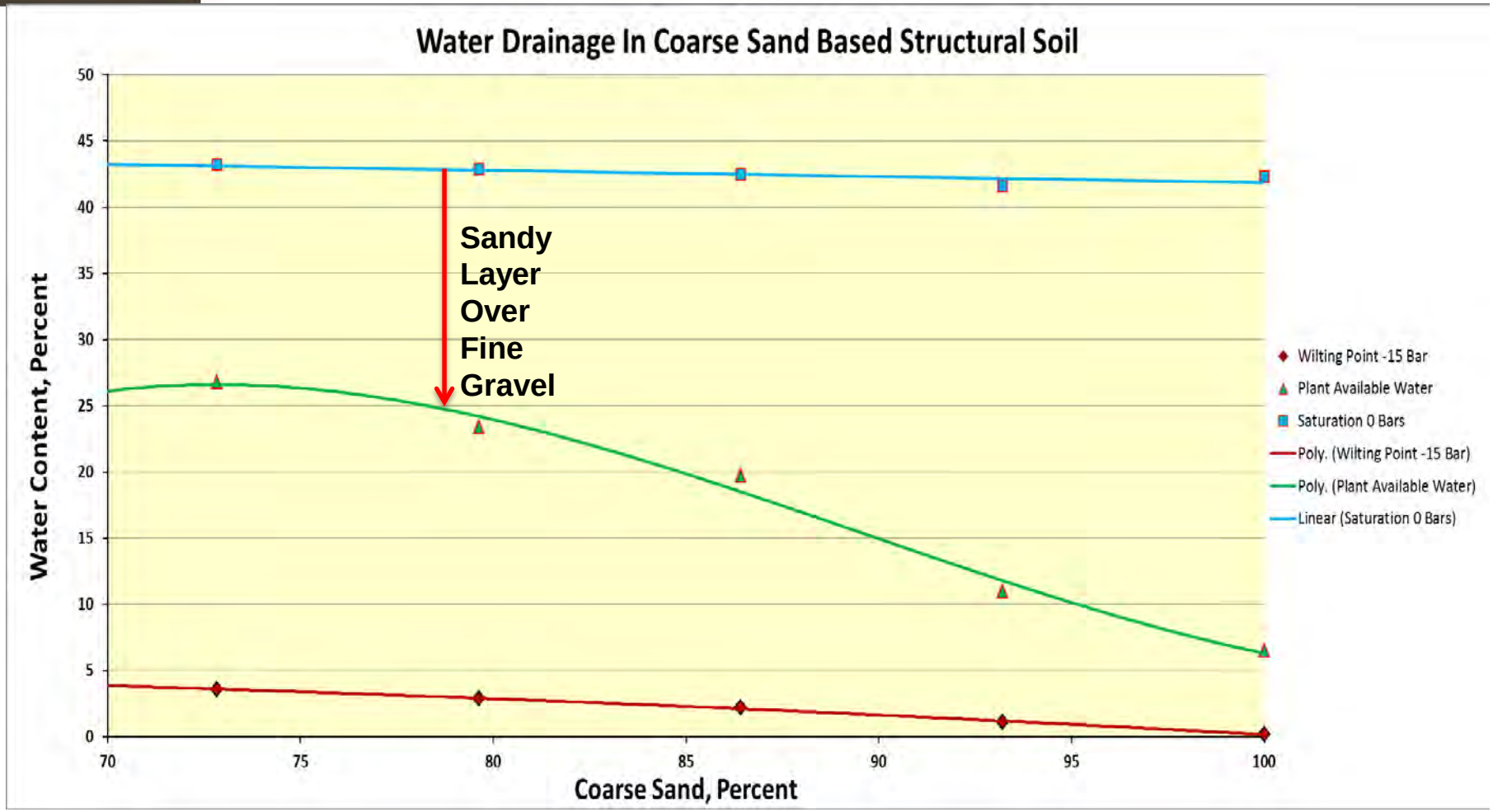


Principles of Water Movement

Sandy Soil over Gravel Layer

- **P-4: When unsaturated, water stops flowing into gravel layer, due to the greater soil moisture tension in the sandy soil**
  - After a small amount of water drains out of the sandy soil, it is no longer saturated and the negative pressure (soil moisture tension) has increased
  - When unsaturated water always flows in the direction of the greatest negative pressures (greatest soil moisture tension) and since the tension in the gravel is still zero, the water cannot move downward into the gravel
  - Engineers know that water in pipes flow from high pressure to low pressure; but in soils water always flows from low negative pressures to high negative pressures. Hold on tight the world just flipped upside down!
  - The gravel layer acts to impede unsaturated water movement from moving downward, thus leaving considerably more water in the sandy soil

Principles of Water Movement



Principles of Water Movement

Sandy Soil over Gravel Layer

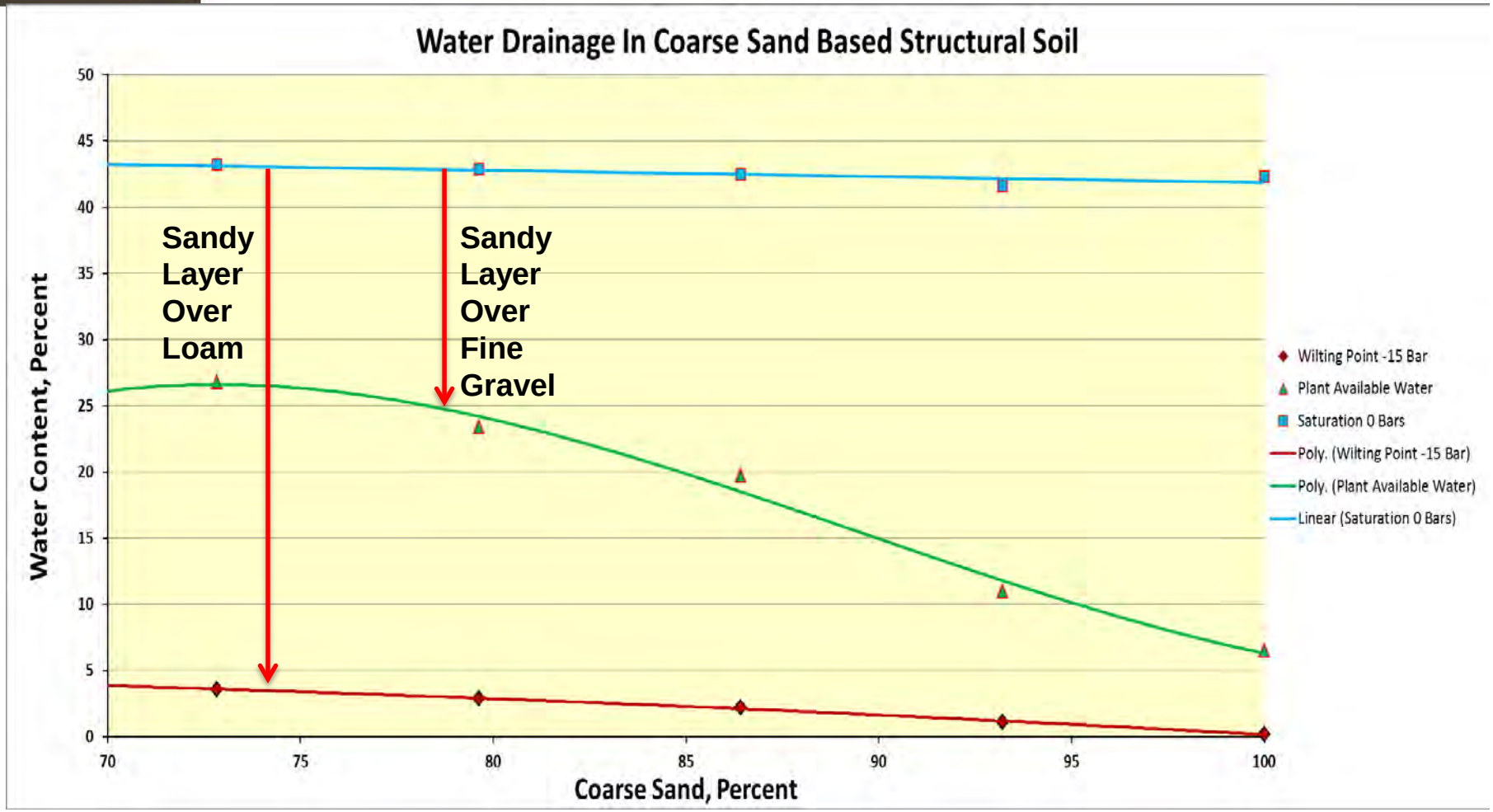
- **P-5: When unsaturated more water is held in uniformly graded medium and coarse sand, than in well graded sands**
  - More water is held in the uniformly graded sands because it has a greater porosity
  - Well graded sands have a variety of sand sizes that pack together and have a lower porosity

Principles of Water Movement

Sandy Soil over Loamy Layer

- **P-6: When unsaturated water continues to drain from the sandy soil because the underlying loamy soil has a greater soil moisture tension**
  - When unsaturated water always flows in the direction of the greatest negative pressures (greatest soil moisture tension) and since the tension in the loamy soil is greater, the water continues to move downward until the sandy soil is dry

Principles of Water Movement



Review - Principles of Water Movement

- **P-1:** When saturated to the surface water flows in proportion to size of pores, head, and drains readily into an underlying gravel layer
- **P-2:** Uniformly graded coarse and medium sand conducts water faster when saturated than well graded sands
- **P-3:** When unsaturated the flow of water in the soil slows to very low hydraulic rates
- **P-4:** When unsaturated water stops flowing into gravel layer, due to the greater soil moisture tension in the sandy soil
- **P-5:** When unsaturated more water is held in uniformly graded medium and coarse sand, than in well graded sands
- **P-6:** When unsaturated water continues to drain from the sandy soil because the underlying loamy soil has a greater soil moisture tension

Which profile will drain the fastest when fully saturated?

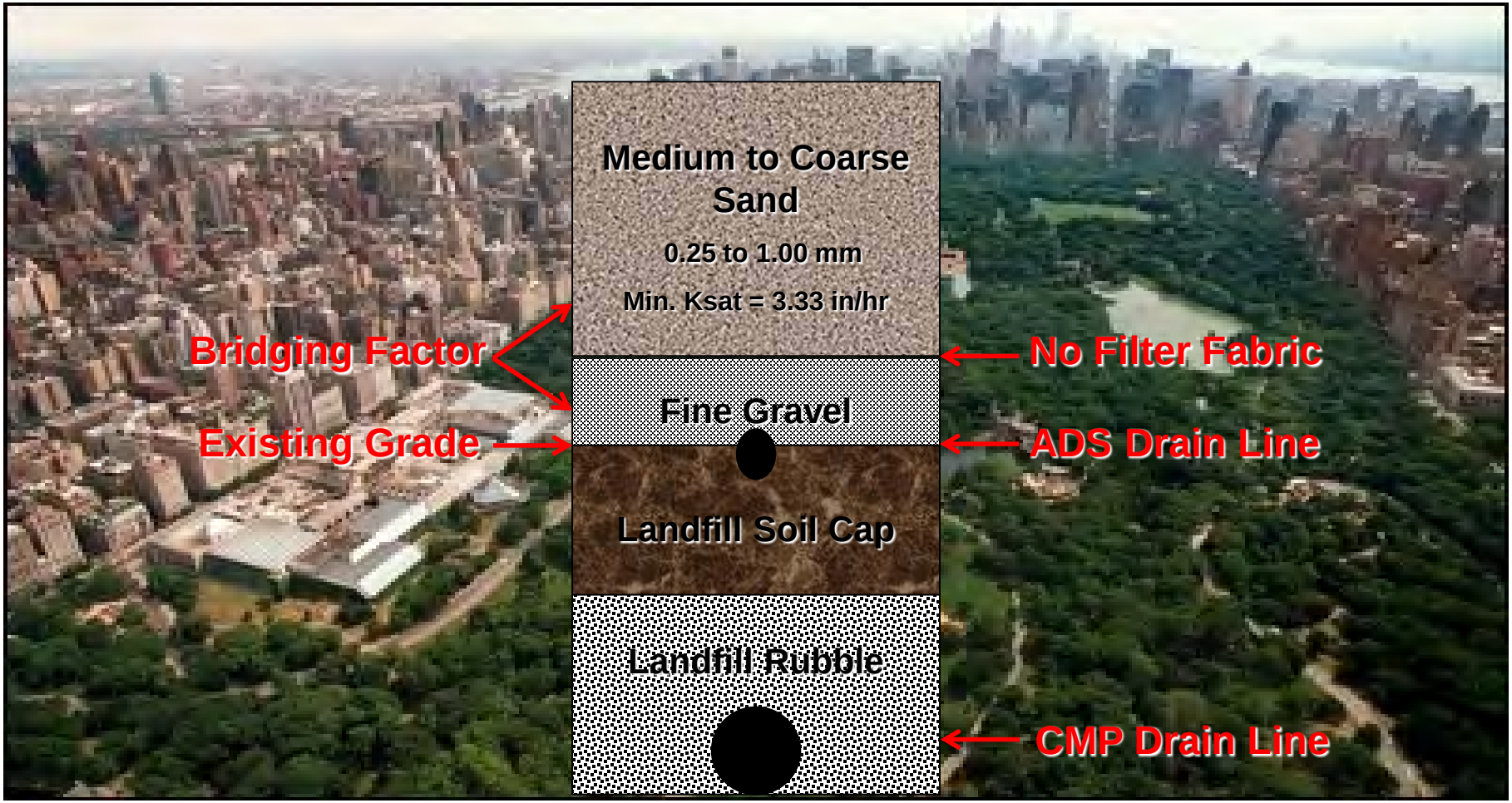
Which profile will hold the most moisture after draining?

All profiles have free drainage at the base.

Layered Soil Systems

- **Layered systems can be used to hold moisture in the rooting zone, prevent downward or upward water movement**
- **Layered systems are used for structural soils, high infiltration rates, high quality lawn systems, high traffic areas, and golf greens**
- **Standards for layer soil systems**
  - Bridging Factor – allows bridging of a layer of finer particles over a layer of coarser particles; comparison of two layers
  - Uniformity Factor – determines whether layer is narrowly enough graded
  - Permeability Factor – determines the saturated hydraulic rate of a layer

Soil Profile Design



High Impact Venue

Pocahontas Premiere

4th of July Concert

New York Philharmonic Concert

Bon Jovi Concert

100-Year Storm Drainage – Zero Runoff

More About The Soil Principles!

- Most of the soil principles are contained in a new publication recently published by ASLA entitled:

  - "Planting Soils for Landscape Architectural Projects" by Barrett L. Kays, 2013, ASLA LATIS Publication, 76 pp.

http://www.asla.org/ContentDetail.aspx?id=1064&PageTitle=Professional%20Practice&RMenuId=58

How to Determine the Amount of Irrigation that is Needed

- Average water needed for optimum growth of open grown trees after the late Dr. Thomas O. Perry:
  - Low moisture species = 0.70 inches/week (approximates the ET)
  - Moderate moisture species = 1.75 inches/week
  - High moisture species = 7.00 inches/week
- Most consultants simply use about 1.00 inches/week.
- What is the optimum amount for hot dry periods??? We really need to understand the climatic extremes more than the averages.

Evapotranspiration Data for NYC

- PET Central Park Station, New York, NY - inches/day

January	0.025	July	0.265
February	0.035	August	0.245
March	0.068	September	0.180
April	0.125	October	0.115
May	0.160	November	0.050
June	0.225	December	0.025

- July PET Central Park Station, New York, NY – inches/week
  - Average July Day: 7 x 0.265 = **1.86** inches/week

Rainfall Probabilities for NYC

- Monthly Precipitation Probabilities and Quintiles, 1971 – 2000 by NOAA
- July Quintiles for Central Park Station, New York, NY
  - $Q_{0.0}$ = 0.44 inches
  - $Q_{0.1}$ = 1.43
  - $Q_{0.2}$ = 2.11
  - $Q_{0.4}$ = 3.33
  - $Q_{0.5}$ = 3.99
  - $Q_{0.6}$ = 4.73 inches
  - $Q_{0.8}$ = 6.77
  - $Q_{0.9}$ = 8.63
  - Q_{max} = 11.77

A New Approach

Determining the Drainage and Irrigation for the Real Extremes using DRAINMOD Computer Simulated Model

DRAINMOD Computer Simulation Model

- State of art computer model using hourly or daily climatic data and actual soil characteristics for your site
- Accurately determines subsurface drainage – spacing, depth, and size of pipes
- Accurately determines irrigation needed for optimum soil moisture
- Accurately determines percent of plant stress due to excess water or lack of water

DRAINMOD Computer Simulation Model

- **DRAINMOD** determines water balance on daily or hourly basis in soil profile using climatic records to simulate performance of:
  - Infiltration
  - Evapotranspiration
  - Runoff
  - Depth to water table
  - Amount of drainage through soil
  - Amount of irrigation

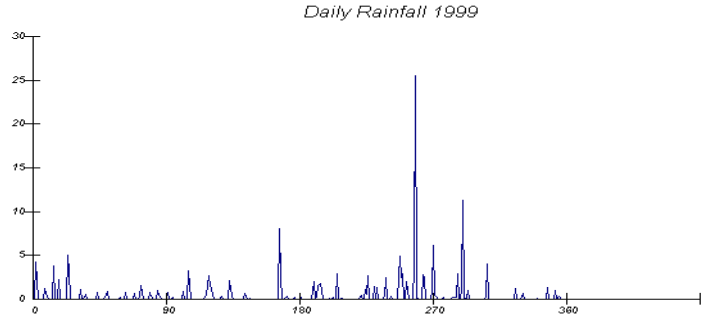
DRAINMOD Computer Simulation Model

- **DRAINMOD** input files include:
  - Soil – depth, Ksat, and soil moisture release curves for each layer – using both field and lab data
  - Weather – daily or hourly rainfall and temperature data from nearest official meteorological station
  - Plantings – depth of rooting, plant data and growing season,
  - Drainage system files – type of drainage structures, size, depth and spacing

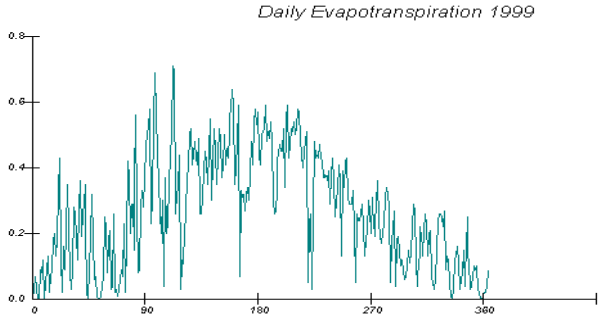
DRAINMOD Computer Simulation Model

- **DRAINMOD** allows us to accurately focus on:
  - Most extreme climatic conditions of record
  - Actual soil characteristics, infiltration rates, and runoff volumes (not peak flows)
  - Determining the affect of proposed changes in soil profile to achieve enhanced infiltration

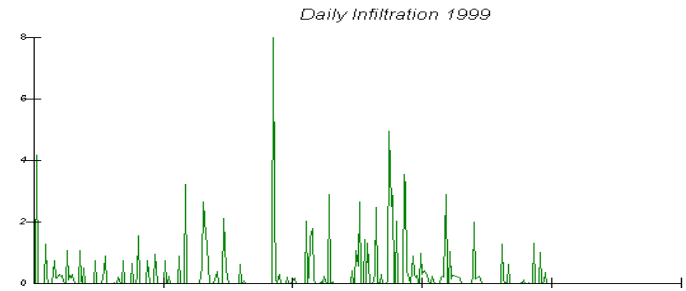
DRAINMOD Computer Simulation Model



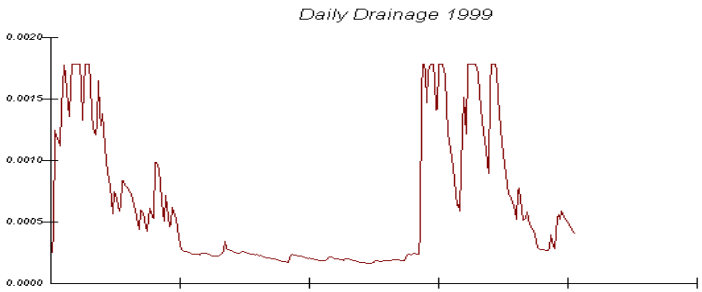
63.7-in.



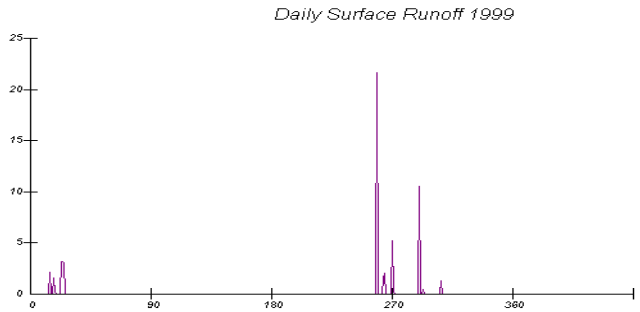
38.7-in.



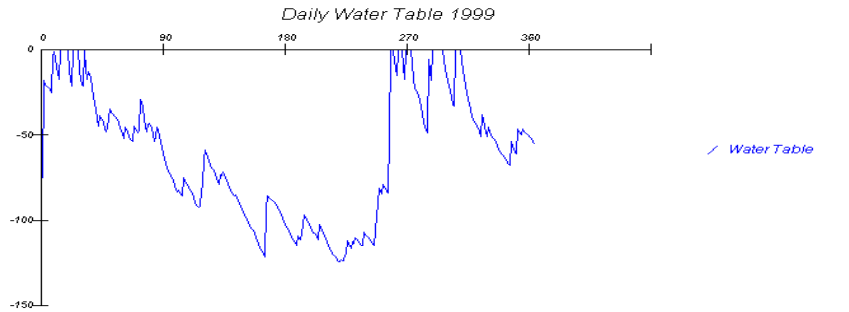
41.0-in.



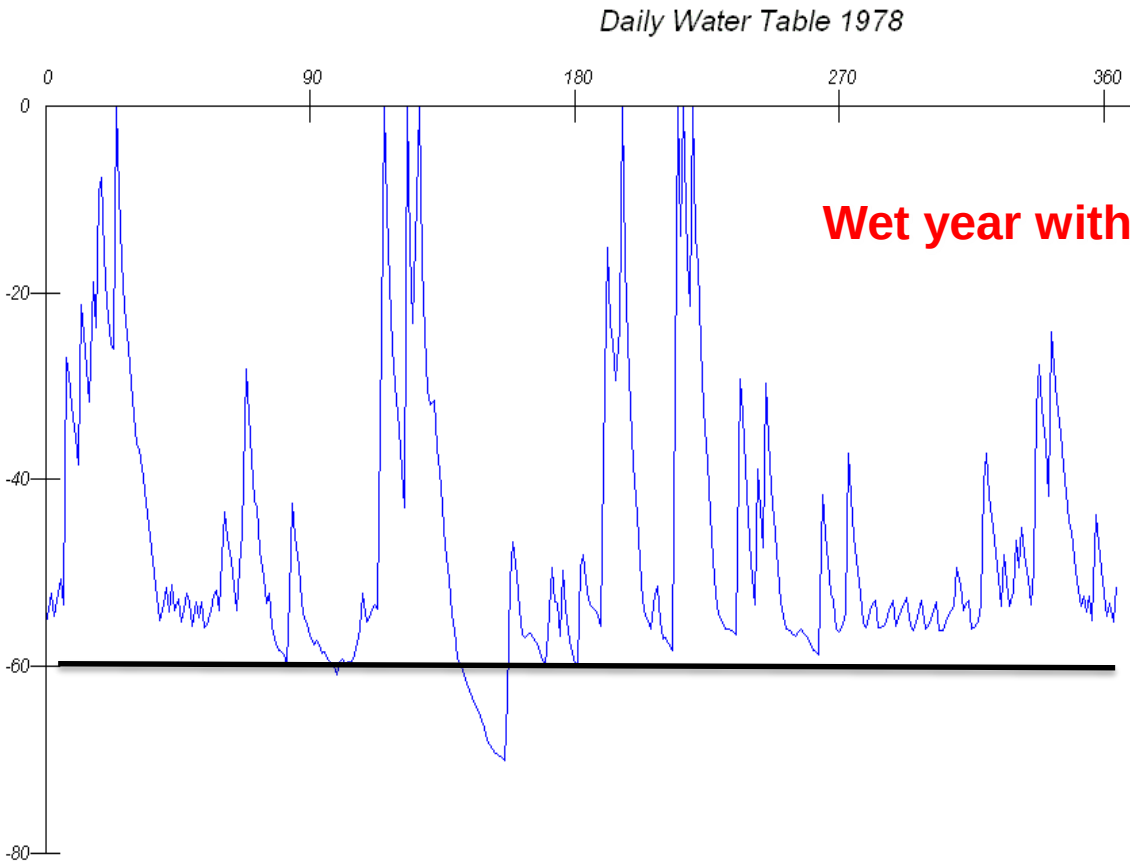
2.3-in.



22.7-in.

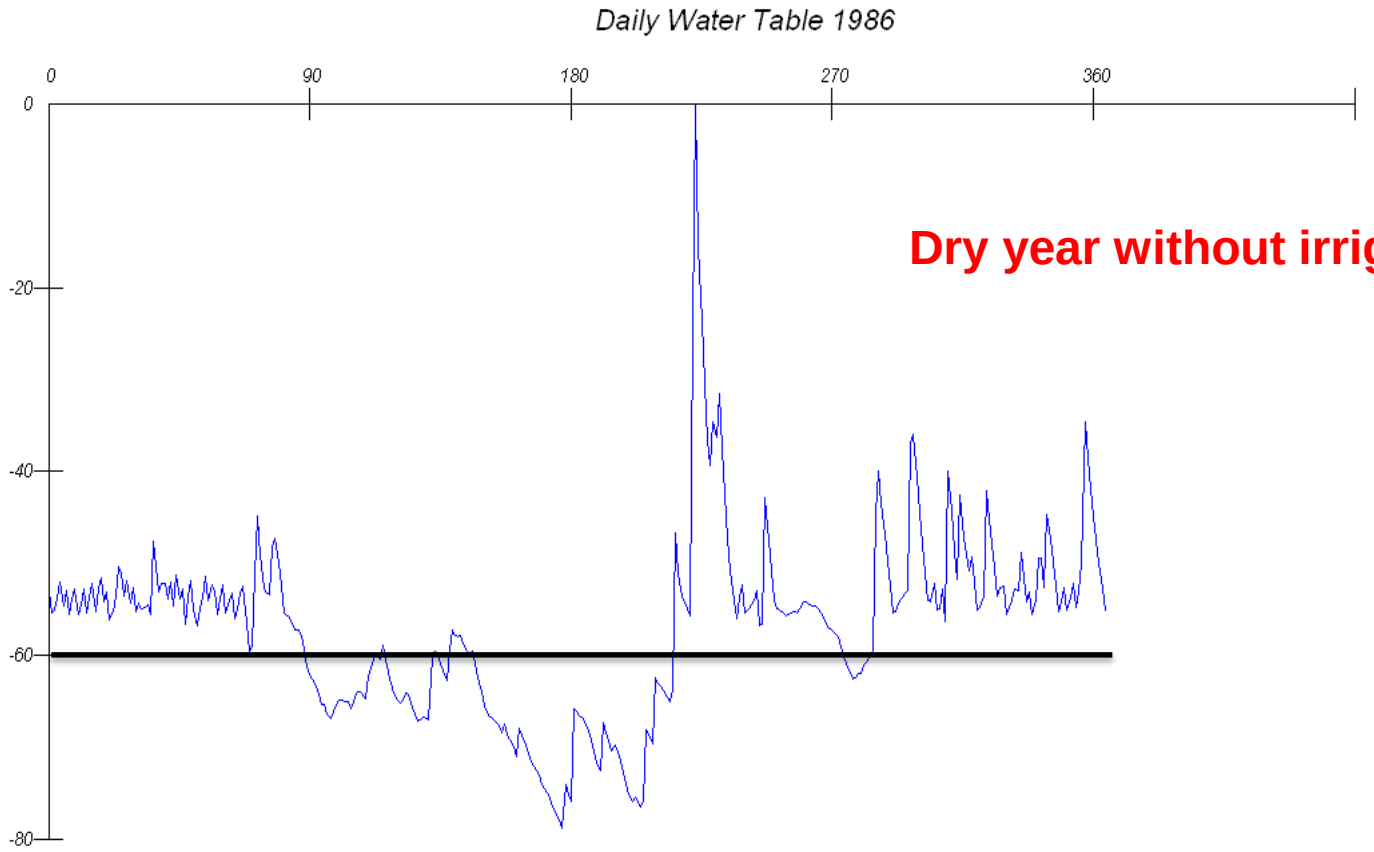


Testing the Great Lawn Soil Design



Wet year with subsurface drainage

Testing the Great Lawn Soil Design



Dry year without irrigation

Pressure vs. Tension

TD Head, Feet	TD Head, Centimeters
492.13	15,000
328.08	10,000
32.808	1,000
3.281	100
0.328	10
0	0
-0.328	-10
-3.281	-100
-32.808	-1,000
-328.08	-10,000
-492.13	-15,000

Soil Moisture Tension

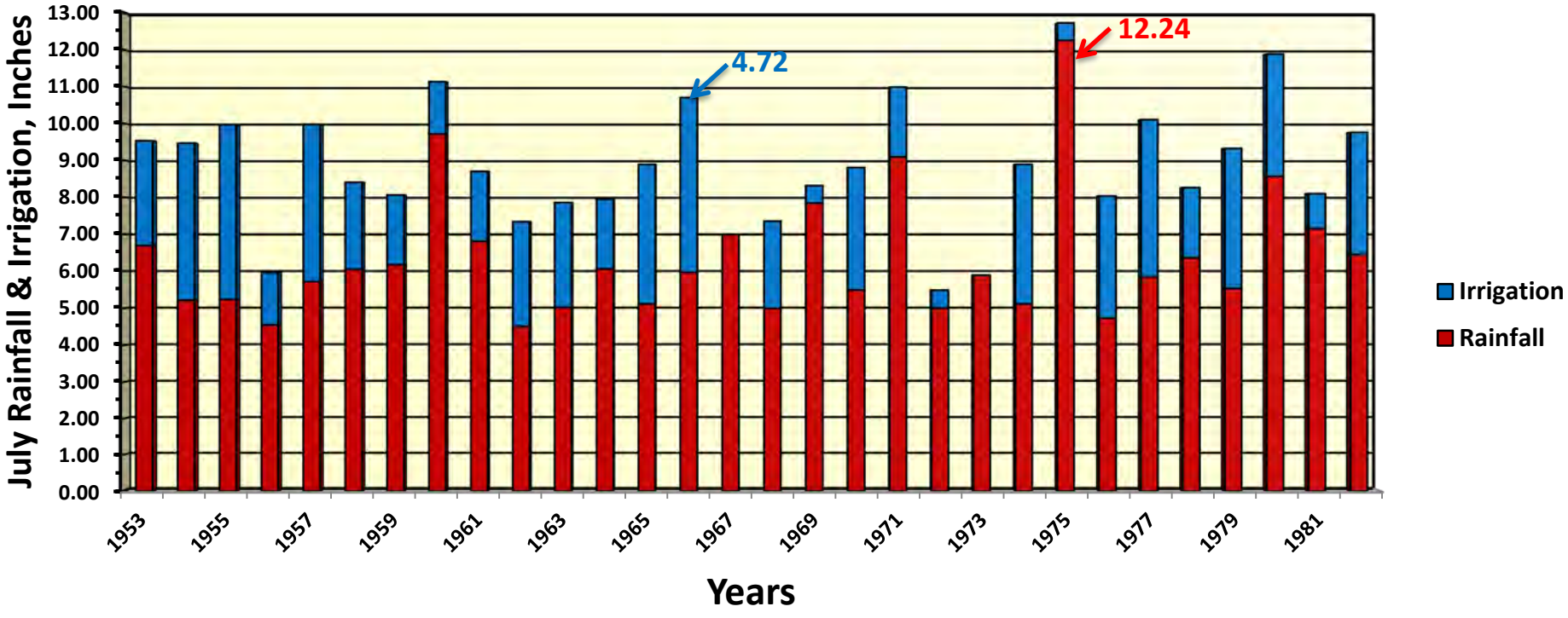
-Bars	-CentiBars	-cm H_20	Vol. H_20	Change
0.0	0.0	0.0	0.50	
0.025	2.50	25.0	0.35	0.15
0.05	5.00	50.0	0.33	
0.75	7.50	75.0	0.31	
0.10	10.0	100.0	0.30	
0.15	15.0	150.0		
0.20	20.0	200.0		
0.25	25.0	250.0		
0.30	30.0	300.0		
0.33	33.0	333.0	0.25	0.25
1.00	100.0	1,000.0		
10.0	1,000.0	10,000.0		
15.0	1,500.0	15,000.0	0.10	

DRAINMOD Irrigation Simulation

- Irrigation rate = 0.25 inches/hour
- Maximum duration = 2 hours
- Amount of rain to postpone irrigation = 0.40 inches
- Minimum SMT required to irrigate = -25 cm
- July 1966 rainfall = 5.97 inches
- July 1966 irrigation = 4.72 inches
- July 1966 drainage = 0.00 inches
- Total water used = 10.69 inches or 2.67 inches/week

DRAINMOD Irrigation Simulated

Central Park Metrological Station, New York, NY



Mean July Rainfall = 6.34-inches Mean July Irrigation = 2.34-inches

Max. July Rainfall = 12.24-inches Max. July Irrigation = 4.72-inches

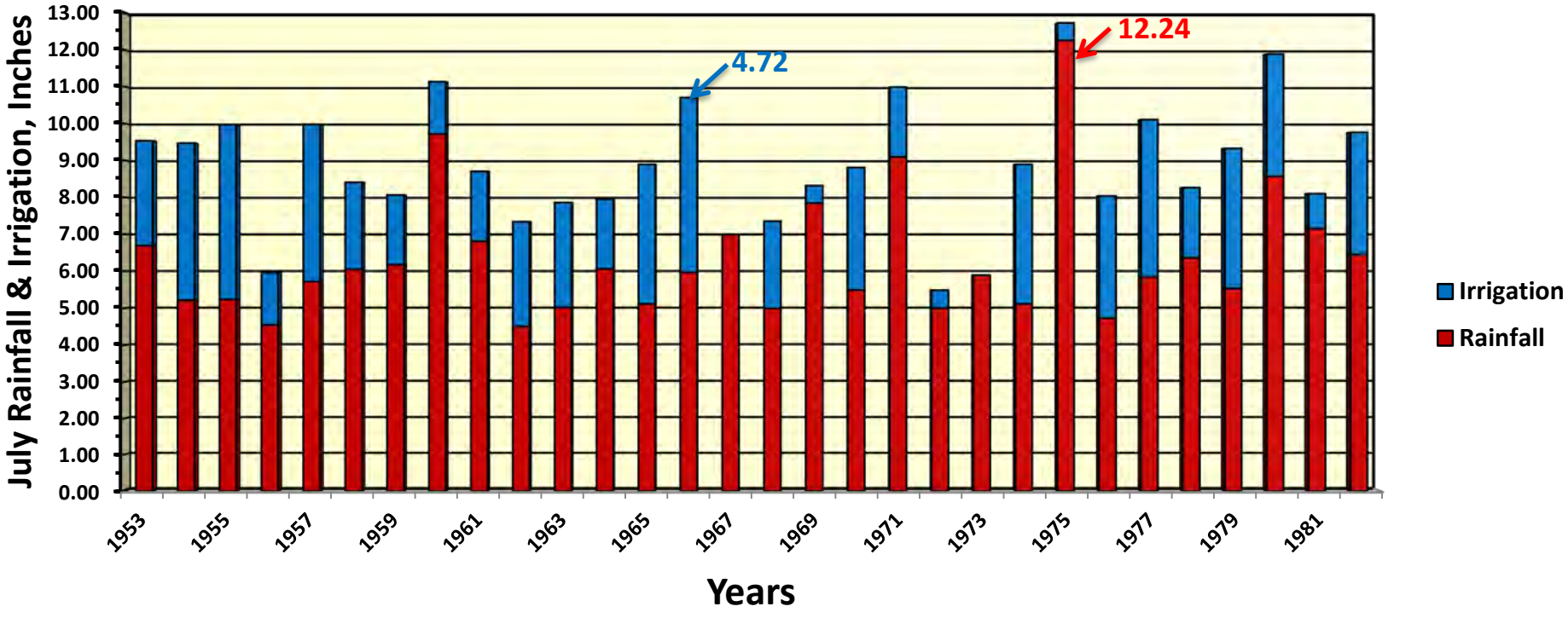
DRAINMOD Irrigation Simulation

Comparing 5 Approaches for Central Park, New York, NY

- **Method #1 – DRAINMOD: 30 Year Irrigation Simulation**
  - DRAINMOD – July 1966 rainfall = 1.50 inches/week
  - DRAINMOD – July 1966 irrigation = 1.17 inches/week
  - Total 2.67 inches/week 100%
- **Method #2 – Probability**
  - $Q_{0.5}$ Rainfall = 1.43 inches/week
  - $Q_{0.5}$ Irrigation = 0.53 inches/week
  - Total 1.96 inches/week 73%
- **Method #3 – Evapotranspiration**
  - Average July evapotranspiration = 1.86 inches/week 70%
- **Method #4 – Average Moisture for Trees**
  - Mod. moisture uptake by trees = 1.75 inches/week 66%
- **Method #5 – PAW Lab Data Analysis**
  - July PAW = 1.61 inches/week 60%

DRAINMOD Irrigation Simulated

Central Park Metrological Station, New York, NY



Mean July Rainfall = 6.34-inches Mean July Irrigation = 2.34-inches

Max. July Rainfall = 12.24-inches Max. July Irrigation = 4.72-inches

Questions!


Dr. Barrett L. Kays, FASLA
Landscape Architect
Soil, Hydrologic, & Groundwater Scientist
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www.barrettkays.com
www.linkedin.com/in/barrettkays

American Society of
Irrigation Consultants

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Portland, Oregon

2·0·1·4

ASIC

GCBAA

Certified Golf Course Irrigation Contractor Program

Justin Apel – Executive Director

ASIC

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sclaimer

perience

- University of Nebraska –

ASIC

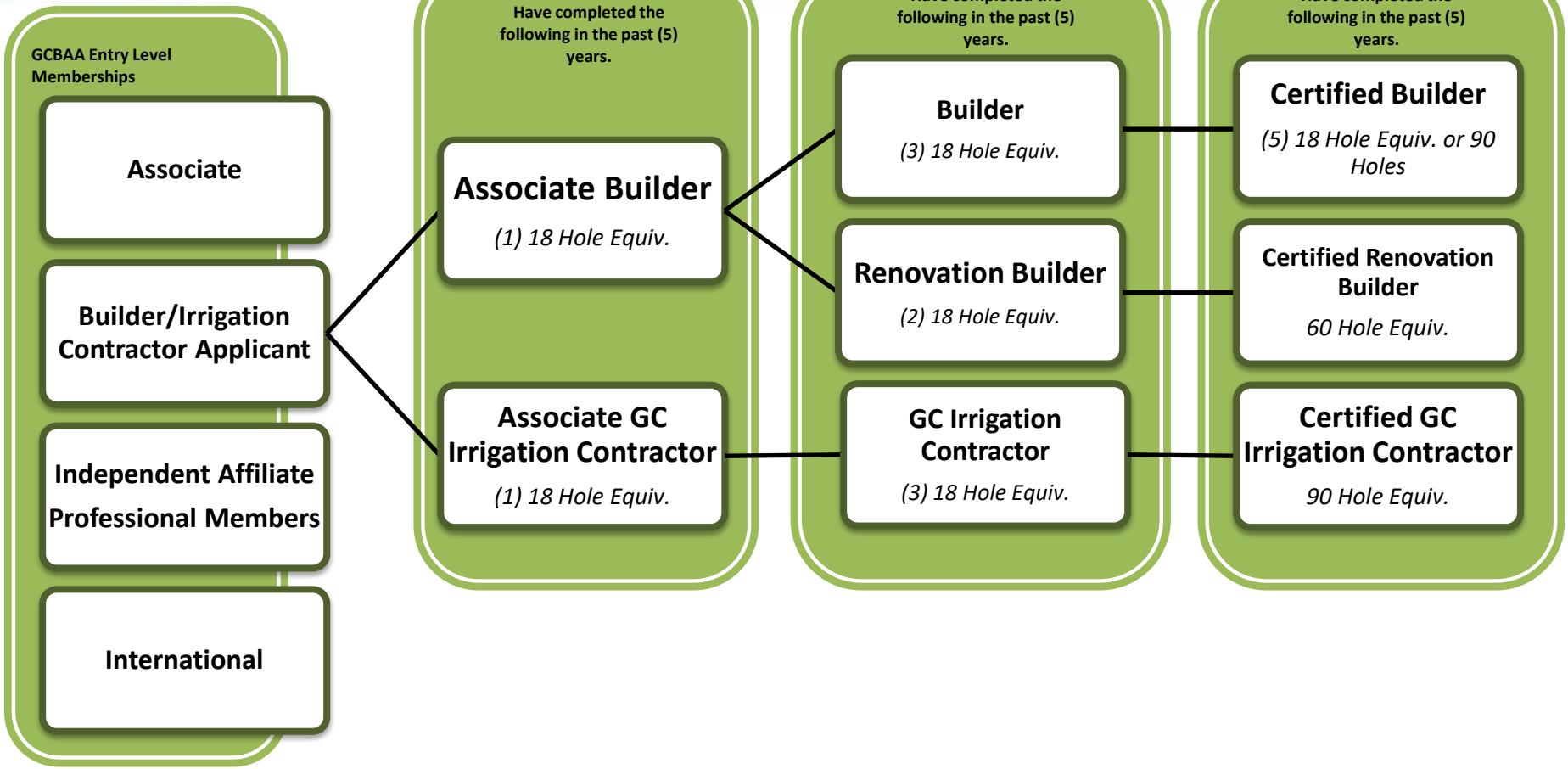
GCBAA Certification Program

- Celebrating 43 Years – 1971 – 2014
- Nonprofit Trade Association Representing
  - Golf Course Builders and Contractors
  - Suppliers
  - Consultants & Designers
- Over 300 Domestic & International Members in nearly 50 States and 17 Countries
- Membership Categories
  - Builder Companies
    - Certified Builders
    - Certified Renovation Builders
    - *Certified Golf Course Irrigation Contractors
    - Builders
    - Renovation Builders
    - Golf Course Irrigation Contractors
    - Associate Golf Course Irrigation Contractors
    - Associate Builders
    - Builder/Irrigation Contractor Applicants

GCBAA Certification Program

- Other
  - Associates
    - Sub Contractors
    - Suppliers
    - Design Firms
  - Independent Affiliate
  - Professional Members
  - International

GCBAA Certification Program



TAKING CHARGE OF CHANGE

EXPLORE | ENGAGE | E

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GCBAAJobQualificationWorksheet (1) [Compatibility Mode] - Microsoft Excel

Home | Insert | Page Layout | Formulas | Data | Review | View | Developer | Add-Ins | AbleBits.com | Nuance OCR | Nuance PDF | Acrobat

Normal | Page Layout | Page Break Preview | Custom Views | Full Screen | Workbook Views

Ruler | Gridlines | Message Bar | Formula Bar | Headings | Show/Hide

Zoom | 100% | Zoom to Selection | Zoom

New Window | Arrange All | Freeze Panes | Split | Hide | Unhide | View Side by Side | Synchronous Scrolling | Reset Window Position | Save Workspace | Switch Windows | Window

Macros | Macros

A3

Style Manager for Excel | Find & Replace for Excel

PROJECT TYPE	PER HOLE	
New Construction	1.00	Includes complete construction of new golf hole per descriptions below or Driving Range
Renovation, Green, Tees, Bunkers	0.75	Includes - see "Tee Renovation Only", "Bunker Renovation Only" and "Green Construction"
Green Construction	0.35	Includes demo of existing green (if needed), grading, shaping, irrigation, drainage, gravel install, mix install, and grassing of new green
Tee Renovation Only	0.14	Includes demo of existing tee (if needed), grading, shaping, irrigation, drainage, install mix, laser level and grassing of new tee
Tee Leveling Only	0.03	Includes laser leveling of tee surface and grassing
Bunker and Tee Renovation	0.30	Includes - see "Tee Renovation Only" and "Bunker Renovation Only"
Bunker Renovation Only	0.16	Includes demo existing bunker (if needed), grading, shaping, irrigation, drainage, sand installation and grassing of new bunker
Bunker Clean-Out Only	0.10	Includes removal of existing sand and drainage and installation of new sand and drainage
Cart Path Renovation Only	0.09	Includes cut out, paving, backfill, finish grading and grassing
Hole Regrassing Only	0.06	Includes existing turf removal, finish grading, and grassing
Fairway Regrading Only	0.12	Includes grading and shaping of fairway area only with drainage, irrigation and grassing
Irrigation Only	0.07	Includes layout and installation of all irrigation components

Meets Qualification	
Associate Builder	No
Renovation Builder	No
Builder	No

	PROJECT	LOCATION	START DATE	FINISH DATE	CONTACT NAME	OWNER PHONE	ARCHITECT NAME	ARCHITECT PHONE	# OF HOLES	PROJECT TYPE (Select One)	HOLE WEIGHT	OVERALL WEIGHT
1											0.00	0.00
2											0.00	0.00
3											0.00	0.00
4											0.00	0.00
5											0.00	0.00
6											0.00	0.00
7											0.00	0.00
8											0.00	0.00
9											0.00	0.00
10											0.00	0.00
										Weighted Total:		0

Include dollar amount in each column for work done

		REQUIRED PROJECT COMPONENTS												
		Bonding	Clear & Grub	Earthwork	Feature Shaping	Site Drainage	Green Const	Bunker Const	Tee Construction	Irrigation System	Pump Station	Lake Const	Landscaping	
1	0													
2	0													
3	0													
4	0													
5	0													
6	0													
7	0													
8	0													
9	0													
10	0													
		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$
			INCOMPLETE	INCOMPLETE	INCOMPLETE	INCOMPLETE	INCOMPLETE	INCOMPLETE	INCOMPLETE	INCOMPLETE		INCOMPLETE		INCO

Note* Each yellow column must contain a value to be considered for approval

Sheet1 | Sheet2 | Sheet3

Ready | Page: 1 of 1 | Average: 1.271573034 | Count: 181 | Sum: 113.17 | 75%

CERTIFIED GCBAA GOLF COURSE IRRIGATION CONTRACTOR

ASIC

GCBAA Certification Program

- **Certified Golf Course Builder**

- GCBAA Board of Governors – Entity of individuals representing suppliers, consultants, contractors, manufacturers
  - Member in Good Standing Minimum 5 years under same company name
  - Completed construction on 18 holes of golf per year for 5 years (90 Holes)
  - References from:
    - Owner/Developer
    - Golf Course Architect
    - Engineer
    - Irrigation Designer
    - Golf Course Superintendent
    - Municipality
    - GCBAA Certified Builder
    - Financial Institution
    - Credit Agency
    - Insurance Company
    - Bonding or Bank Letter of Reference
  - Pass written Certification Exam
  - Interview with GCBAA Board of Governors
  - Attend Annual Industry Event
  - Consistently Engage in Ethical Business Practices
  - Maintain annually re-certification – ***18*** hole equivalent
  - Company Representatives maintaining Continuing Education

GCBAA Certification Program

- **Certified Golf Course Renovation Builder**

- GCBAA Board of Governors – Entity of individuals representing suppliers, consultants, contractors, manufacturers
  - Member in Good Standing Minimum 5 years under same company name
  - Completed construction on 18 holes of golf per year for 5 years (60 Holes)
  - References from:
    - Owner/Developer
    - Golf Course Architect
    - Engineer
    - Irrigation Designer
    - Golf Course Superintendent
    - Municipality
    - GCBAA Certified Builder
    - Financial Institution
    - Credit Agency
    - Insurance Company
    - Bonding or Bank Letter of Reference
  - Pass written Certification Exam
  - Interview with GCBAA Board of Governors
  - Attend Annual Industry Event
  - Consistently Engage in Ethical Business Practices
  - Maintain annually re-certification – ***12*** hole equivalent
  - Company Representatives maintaining Continuing Education

TAKING CHARGE OF CHANGE

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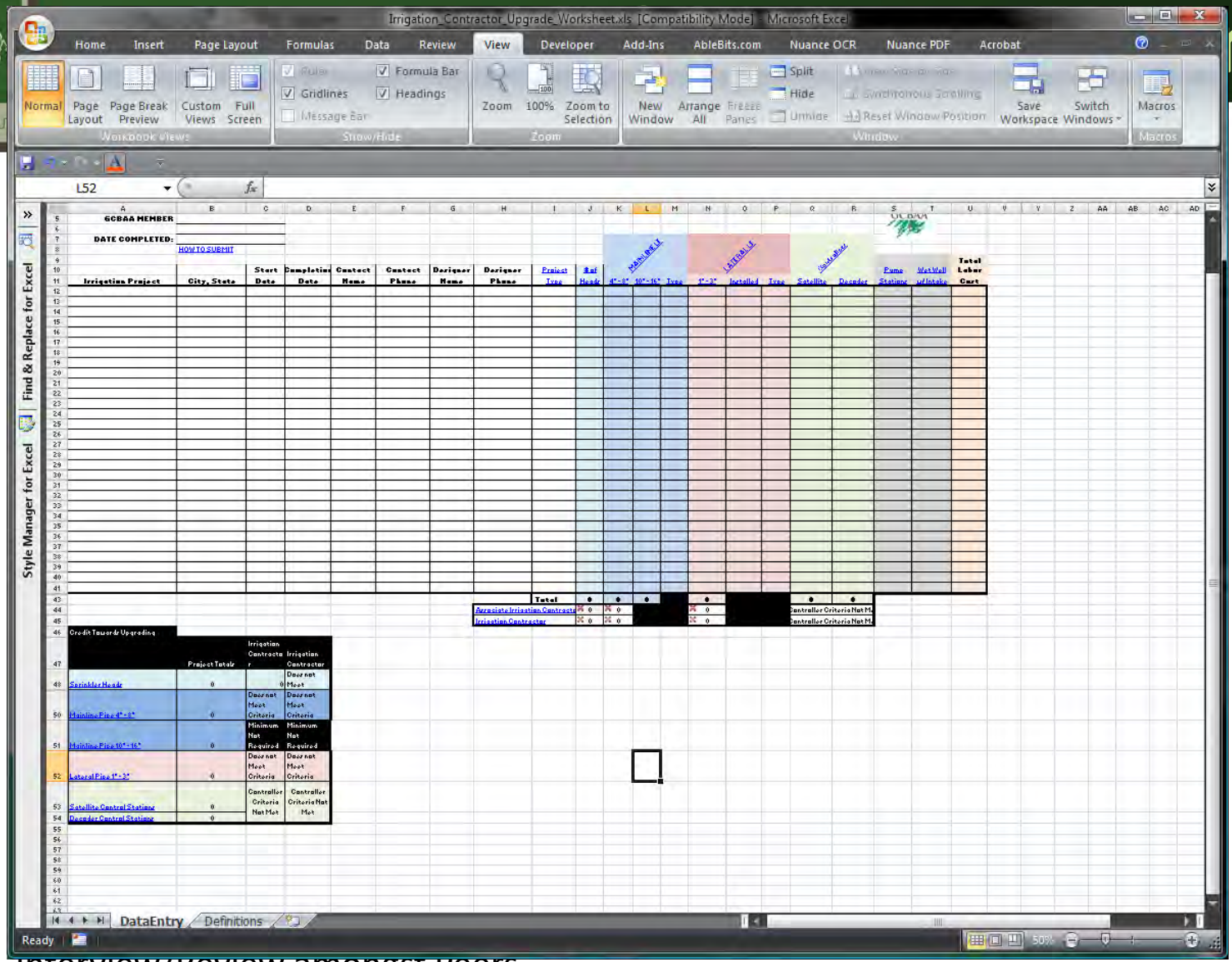

- Interview/Review amongst Peers

GCBAA Certification Program

- **Certified Golf Course Irrigation Contractor**

- GCBAA Board of Governors – Entity of individuals representing suppliers, consultants, contractors, manufacturers
  - Member in Good Standing Minimum 5 years under same company name
  - Completed installation of 90 holes of golf irrigation in the past 5 years
  - Have installed one complete 18 hole golf course irrigation system in the past year
  - References from:
    - Owner/Developer
    - ***Distributor/Manufacturer***
    - Golf Course Architect
    - ***Local Government***
    - ***Golf Course Construction Manager***
    - ***Golf Course Management Company or GC General Manager***
    - Irrigation Designer
    - Golf Course Superintendent
    - GCBAA Certified Member
    - Financial Institution
    - Credit Agency
    - Insurance Company
    - Bonding or Bank Letter of Reference
  - Pass written Certification Exam
  - Interview with GCBAA Board of Governors
  - Attend Annual Industry Event
  - Consistently Engage in Ethical Business Practices
  - Maintain annually re-certification – ***18*** hole equivalent
  - Company Representatives maintaining Continuing Education

GCBAA Certification Program

- **Certified Golf Course Builder**
- **Certified Golf Course Renovation Builder**
- **Certified Golf Course Irrigation Contractor**
  - ACC Golf Construction
  - Aspen Corporation
  - Course Crafters, LLC
  - Duininck Golf
  - Frontier Golf
  - Glase Golf, Inc.
  - Golf Creations
  - Golf Development Construction
  - Heritage Links
  - Landirr, Inc.
  - Landscapes Unlimited, LLC
  - Lepanto Golf Construction, Inc.
  - MacCurrach Golf
  - McDonald & Sons, Inc.
  - Medalist Golf, Inc.
  - Mid-America Golf & Landscape, Inc.
  - NMP Golf Construction Corp.
  - QGS Development
  - Ryan Inc. Central
  - Ryan Golf Corporation
  - Shapemasters, Inc.
  - Southeastern Golf, Inc.
  - TDI International, Inc.
  - Total Golf Construction Inc.
  - Total Turf Services, Inc.
  - United Golf LLC
  - Wadsworth Golf Construction

Certified Golf Course Renovation Builder
Certified Golf Course Irrigation Contractor
George E. Ley Co.
Hartman Companies

Certified Golf Course Irrigation Contractor
Formost Construction Co.
Mike Roach, Inc.

GCBAA Certification Program

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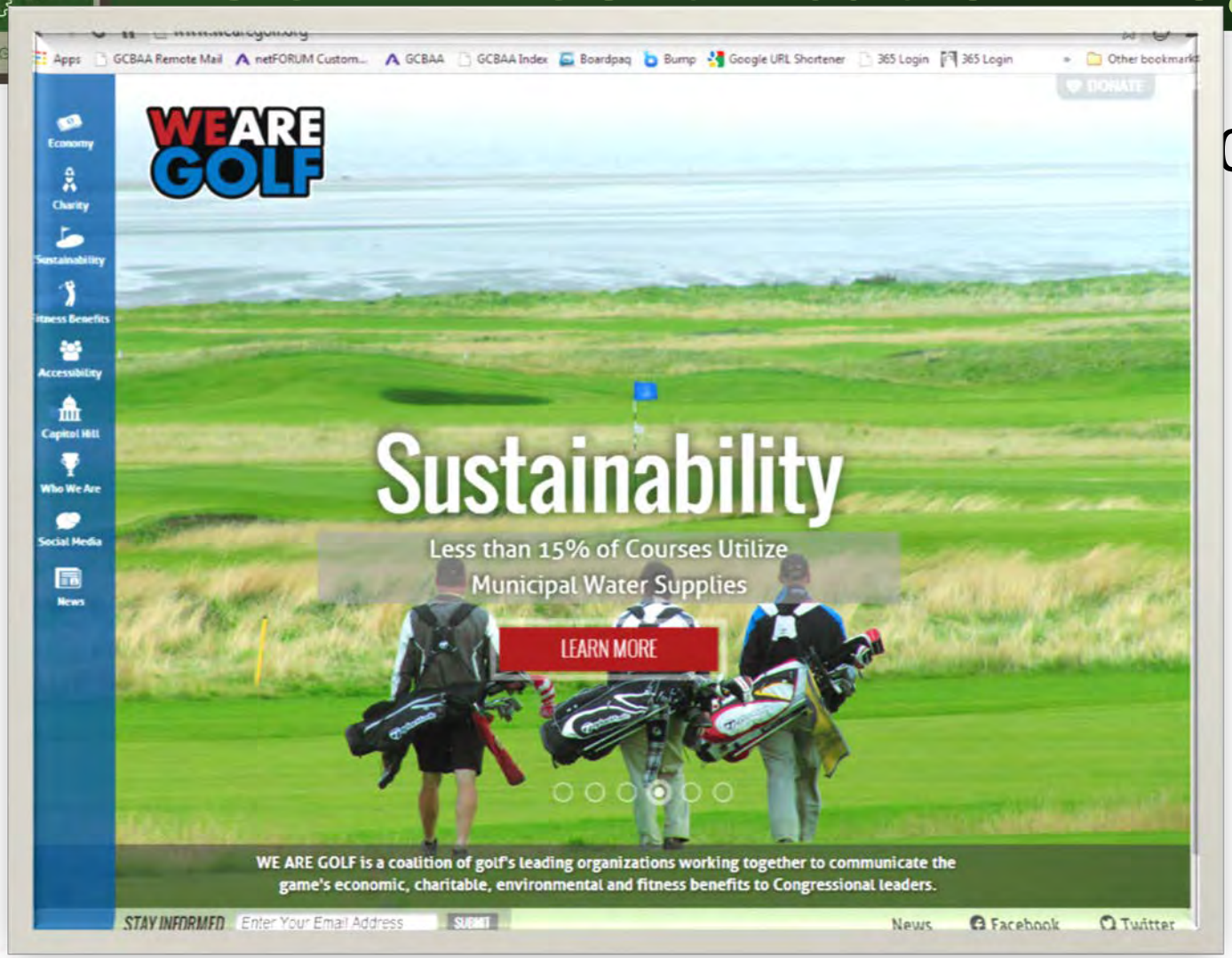


GCBAA Certification Program

- Education

GCBAA Certification Program

- Experience

GCBAA Certification Program

- Quality

GCBAA Certification Program

- Best Practices

GCBAA Certification Program

- Build Better


N
Image County of San Bernardino
© 2009 Google
Imagery Date: Mar 31, 2007
34°00'30.41" N
117°21'39.28" W
elev 249 m
Eye alt 634 m

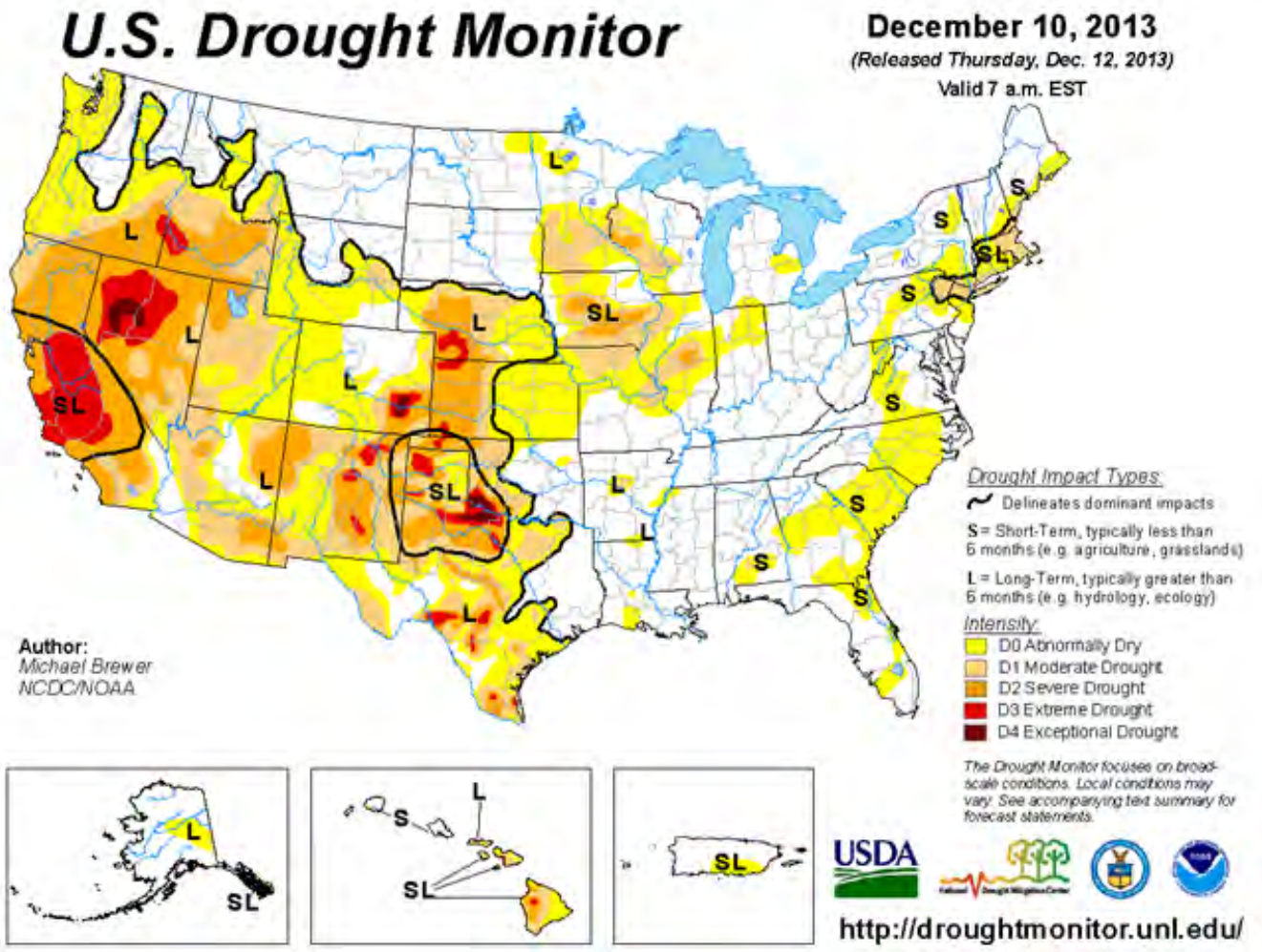
Questions?

Justin Apel – Executive Director
727 O' St.
Lincoln, NE 68508
(402) 476-4444
www.gcbaa.org m.gcbaa.org
justin_apel@gcbaa.org

The USGA Water Initiative

Pat Gross
Southwest Director
USGA
Green Section

What is the USGA doing about the water issue?



NOTE: To view regional drought conditions, click on map above. State maps can be accessed from regional maps

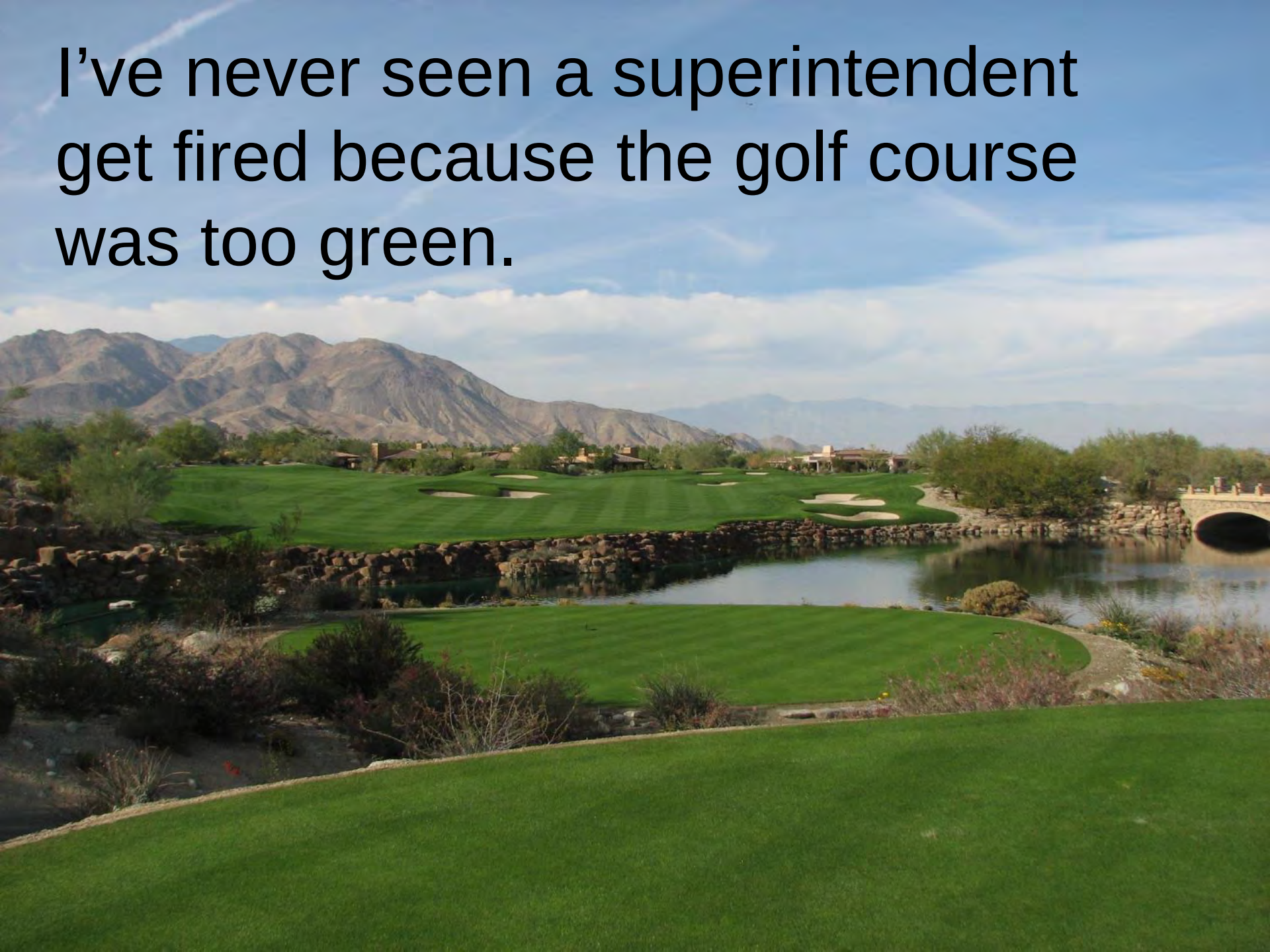
Issue 1: Drought, water restrictions, limited water supply

San Luis Reservoir - 2013

Issue 2: Water quality protection

- Clean Water Act
- TMDL (total maximum daily load)

I’ve never seen a superintendent get fired because the golf course was too green.



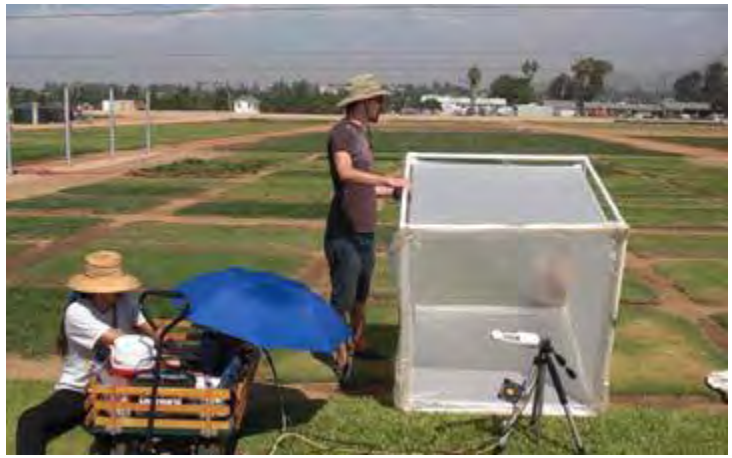
USGA Water Initiative

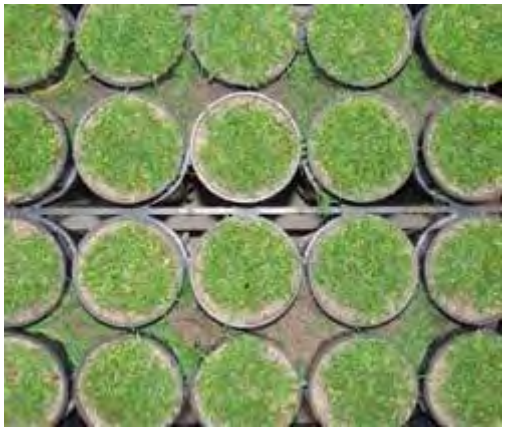
- Water related research
- USGA Water Resource Center website
- Course Consultation Service
- USGA Resource Conservation efforts.

Green Section
Turfgrass and Environmental Research

- **Key Initiatives (1985):**

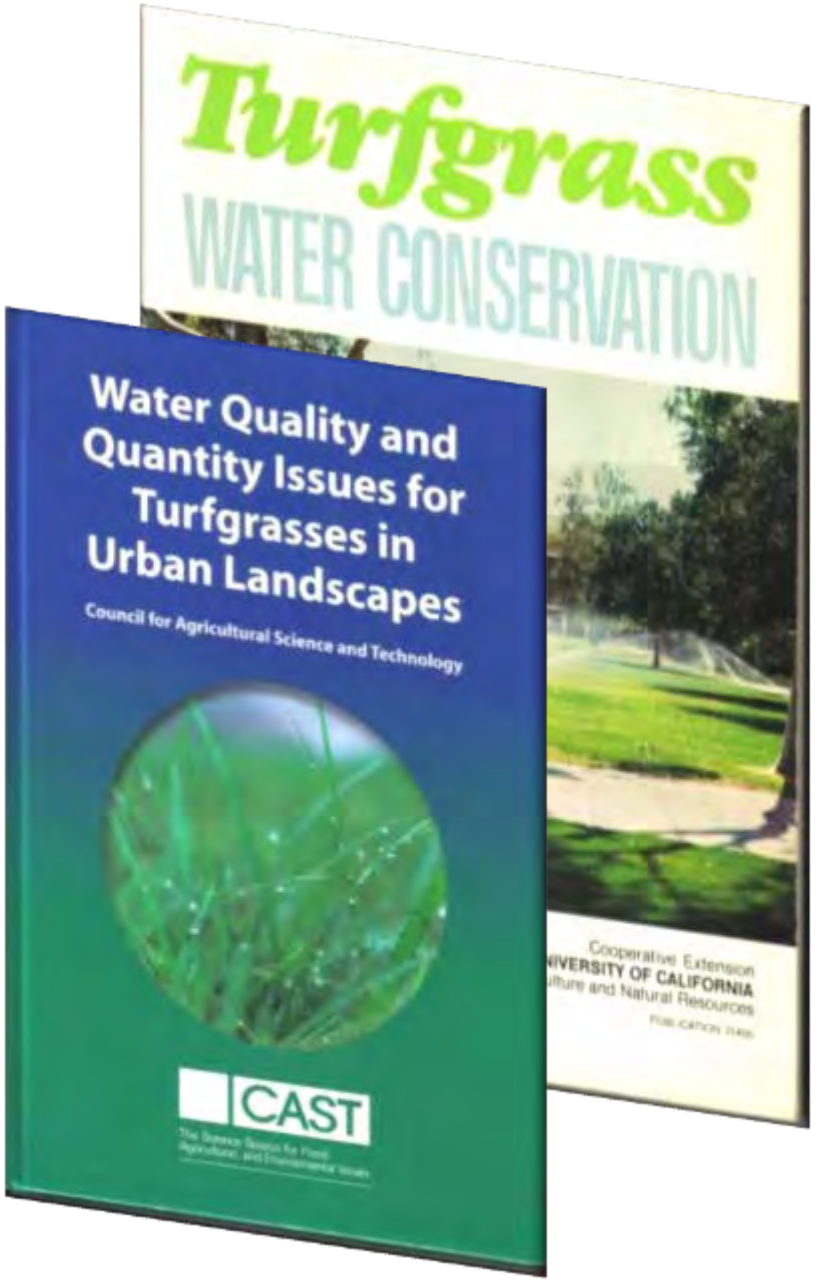
1. Develop grasses that use less water, fertilizer, and that have better pest resistance.
2. Research golf's impact on the environment.
3. Communicate research results for the benefit of golf course and environmental sustainability





Water Conservation

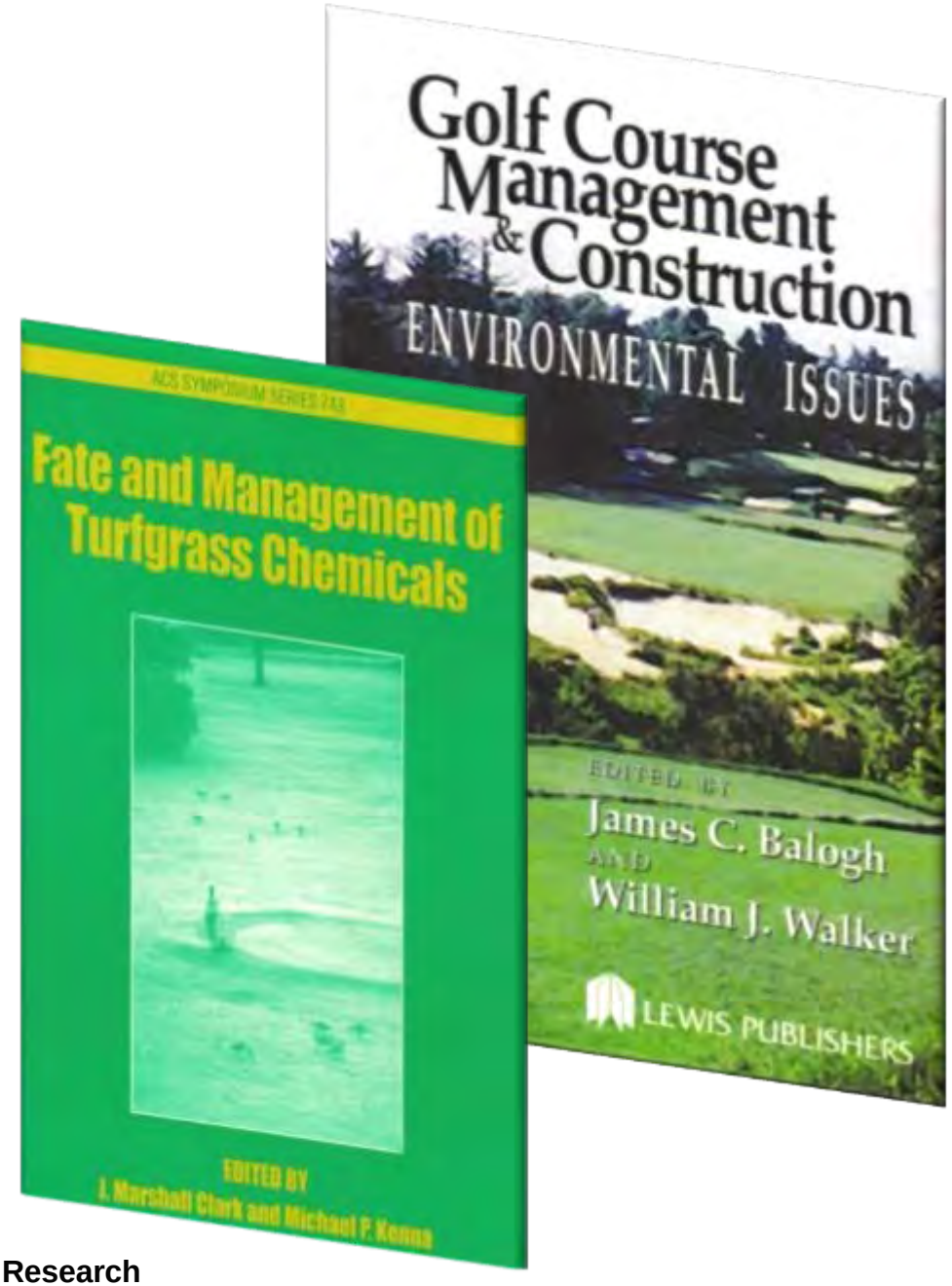
- ET for various turfgrass species.
- Impact of deficit irrigation
- Information and guidelines on recycled water
- Turfgrass cultural practices during drought.



Fate and Transport

- Groundwater
- Surface water
- Volatilization

We have the information!!!



www.usga.org/water

1.Resources for the Community

- Non-technical audience.
- Regulators, press, politicians, neighbors.
- “Why golf courses need water and how they manage this valuable resource.”

2.Resources for Golfers

- Non-technical audience.
- “How water affects your course and your game.”
- Educate golfers to support/ prefer less than lush green conditions.

3. Resources for Golf Facilities

- Technical audience; superintendents, general managers, golf professionals, committees.
- Organize and assemble existing resources.
- Know how to reduce water use; just need permission to do so.

Case Studies

- Interactive map.
- State BMP’s
- Case Studies
- Contributions from allied associations.

USGA Water Initiative

- Course Consulting Service: Irrigation and Water Use Efficiency Visit.
  - Document irrigation practices.
  - Water management plan.
  - Best management practices.
  - Preventive maintenance program.
  - Hire designers, consultants, specialists to correct deficiencies.

USGA Resource Conservation Program

Conserve

Money

Water

Preserve

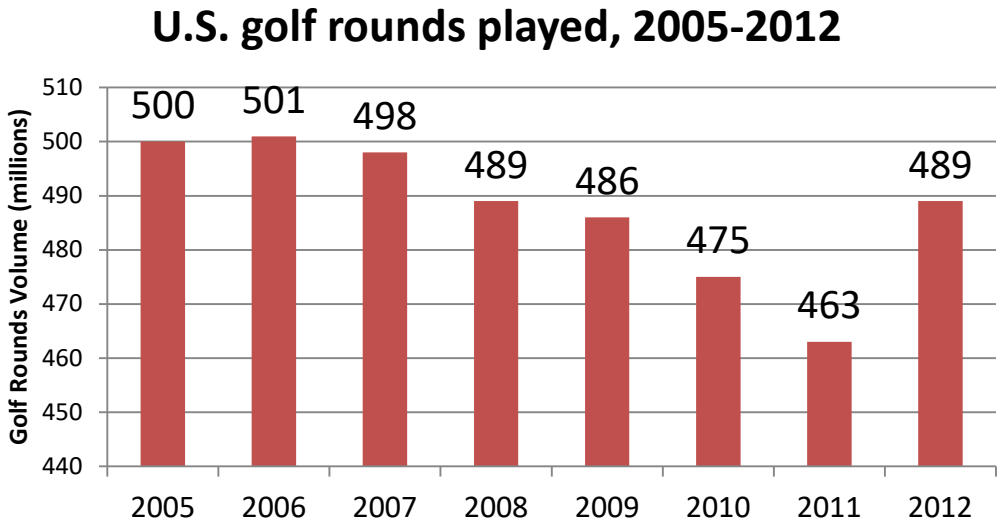
Pace of Play

Playing Quality

Two of the most commonly cited reasons for not playing more golf:

"It takes too long"

"It's too expensive"



The most serious environmental issue facing the game:

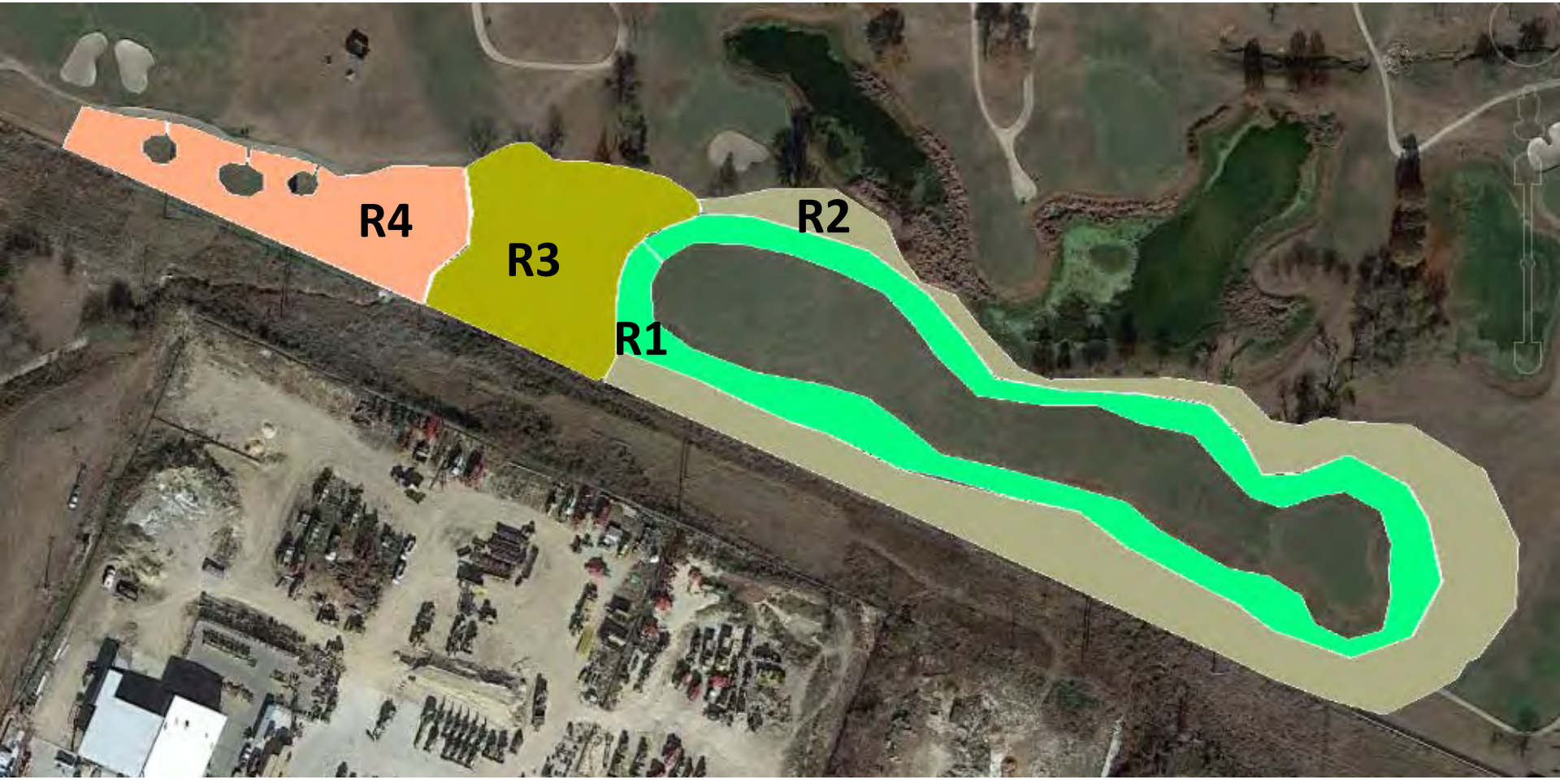
golf's consumption of water

Solution to the Dilemma

- Identify course areas that result in slow play
  - Identify where players are going and NOT going
- Reduce maintenance and water use on areas of the course that seldom come into play
- Reallocate resources to areas that come into play most often
- Increase efficiency of maintenance tasks

By converting this

To this



Course-wide totals	Scenario 1	Scenario 2	Difference
Fuel Cost	5,979.75	3,160.73	2,819.03
Fuel Gallons	1,407.00	743.70	663.30
Labor Cost	7,875.00	4,162.50	3,712.50
Labor Hours	525.00	277.50	247.50
Water Cost	9,000.00	6,000.00	3,000.00
Water Ac/ft	60.00	40.00	20.00
Energy Cost	15,000.00	10,000.00	5,000.00
Fertilizer Cost	22,000.00	11,000.00	11,000.00
Pesticides Cost	14,000.00	12,000.00	2,000.00
			-
Total Cost	**73,854.75**	**46,323.23**	**27,531.53**
Water use (ac/ft)	**60.00**	**40.00**	**20.00**

Scenario 1					
Annual costs	R1	R2	R3	R4	R5
Acres	30	50	0	0	0
Mowings	30	24	6	2	0
Ac/ft of water/ac	2	0	0	0	0
Total ac/ft of water	60	0	0	0	0
Fertilizatons	2	1	0	0	1
Pest. Apps	3	1	1	1	1
Fuel	2,562.75	3,417.00	-	-	-
Labor	3,375.00	4,500.00	-	-	-
Water	9,000.00	-	-	-	-
Energy	15,000.00	-	-	-	-
Fertilizer	12,000.00	10,000.00	-	-	-

R1	Fine textured turfgrass, mowed weekly at 1.5 inches or less, green throughout growing season, find the ball quickly, no exposed soil, no more than 1/2 shot penalty
R2	Fine to coarse textured turfgrass, mowed four times monthly at 3.0 inches or less, dormant (brown) during drought stress, find the ball quickly, no exposed soil, no more than 1 shot penalty
R3	Mixture of coarse textured grass plants, mowed monthly at 12 inches or less, wide variance in color during the year, finding the ball more difficult, exposed soil, minimum of 1 shot penalty
R4	Mixture of native grasses, wildflowers, and woody plants, mowed twice annually at 18 inches or less, wide variance in color during the year, finding the ball very difficult, Minimum 1 shot penalty

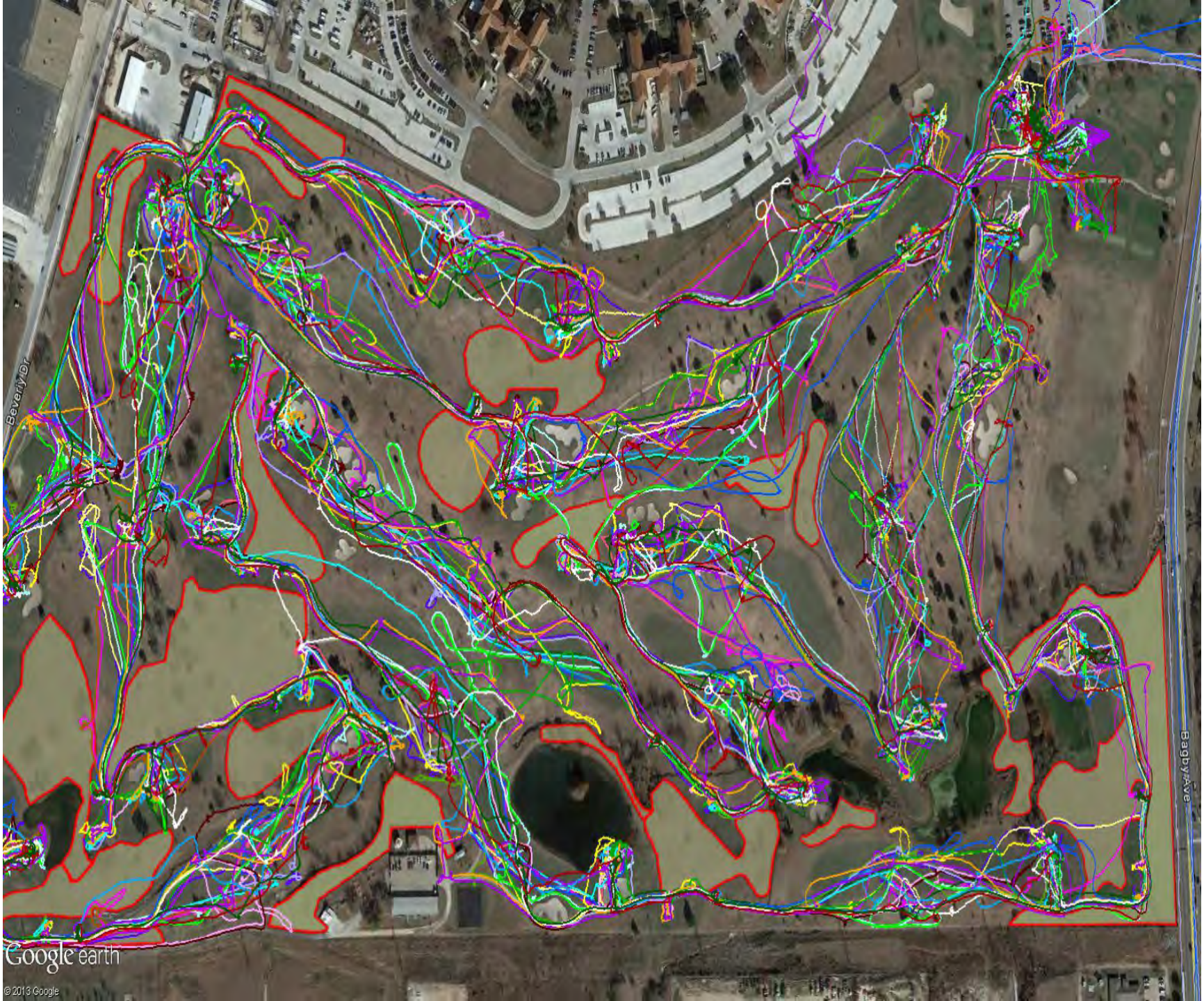
GPS/GIS Analysis

GPS Data Loggers

Track Players

Track Maintenance


Beverly Dr
Bagby Ave
Google earth
© 2013 Google


Beverly Dr
Bagby Ave
Google earth
© 2013 Google

www.usga.org/water

Thank You

Have a successful 2014

Turfgrass Information Center

Navigating the Michigan State University Turfgrass Library

Pete Cookingham

Michigan State University Libraries

ASIC National Conference -- Portland – April 2014

Turfgrass Information Center

Why?

- **Communication….**
- **Information……**
- **Documentation**

Turfgrass Information Center

Hopefully of interest…….

- We're a documentation center; we don't do advocacy (except for access) . We support science and decision-making (including management). We don't have axes to grind.
- Cooperative/consortium project: sector & geographic independence.
- A very grey literature, and poorly collected.
- Technology-based delivery to end-users since day one

Turfgrass Information Center

Mission of the Center (TIC)

- **Collect, digitize, & preserve turfgrass materials, both print & online . Maximize access to materials within copyright law and copyright-holder comfort zone.**
- **Provide precise access to turf information resources, including the above (primarily via metadata work).**
- **Assist users of the materials & help with access issues.**
- **Provide physical and online infrastructure supporting turfgrass scholarship, and raise the level of scientific discourse.**
- **Build a stable, sustainable long-term structure to continue this work – the TIC Endowment**


JAMES B BEARD
TURFGRASS LIBRARY COLLECTION


Turfgrass
Information Center

Turfgrass Information Center

How do we fit in your work?

- TIC at the MSU Libraries hopes and intends to exhaustively collect and index this literature; enabling you to find materials even if you don't know they exist.
- You can directly link to every record within TGIF regardless of your affiliation with us. The literature is thus identifiable, verifiable, & accessible

Turfgrass Information Center

From: tic.msu.edu

Then “Search TGIF Now”

user ID: ASICdemo

PW: TT2014T

ASIC National Conference -- Portland – April 2014

Turfgrass Information Center

TIC Online Presence

- **Public website & public resources**
  - Archive of digitized serial runs
  - Archive of digitized monographs
  - Archive of digitized graphic & visual content
- **Turfgrass Information File (TGIF) database**
  - All formats, all languages, all turf, "all content", *Turfgrass Thesaurus* indexing: moving towards a being a disciplinary discovery device.
- **Limited access resources (within TGIF)**
  - Some digitized serial runs
  - Beard's *Turfgrass Encyclopedia* – full text

The Turfgrass Information Center

What's New
TIC Blog
Current *Sward* Issue
TIC Annual Report 2012

Increase Full-Text!
Monographs
Theses/Dissertations
ITS Authors

Current TGIF Features:
Breeding for Drought
Drought

In Memoriam - The TGIF Legacy:
John H. Dunn
1937-2012

C. Reed Funk
1928-2012

Stanley J. Zontek
1949-2012

Make a Stanley J. Zontek Memorial Gift Now

The Turfgrass Information Center (TIC), a specialized unit at the Michigan State University Libraries (MSU), contains the most comprehensive publicly available collection of turfgrass educational materials in the world. TIC has over 200,000 records in its primary database, the Turfgrass Information File (TGIF), with over 50% linked to the full-text of the item.
Please read our disclaimer.

Turfgrass Information File

Worldwide Access to Turfgrass Science Information

Search TGIF Now

(Getting Started with TGIF)

Browse Full-Text Resources

TGIF is a cooperative project of:

USGA

MSU LIBRARIES

MSU is an affirmative action/equal opportunity employer.

Publication Title	Publisher	Coverage
 **ASGCA Architect's Gallery**		
 **CUTT**	Cornell Cooperative Extension	1990-Present
 **The Golf Course**	Peterson, Sinclaire & Miller Inc. in conjuction with Carter's Tested Seeds, Inc.	1916-1923 Incomplete
 **Golfdom**	North Coast Media, LLC Includes *Turfgrass Trends* 2002-2012	1927- Present Less 6 Months
 **Golf Course Industry**	GIE Media Horticulture Group	1989-2009 Under Construction
 **Greenkeeper International**	The British and International Golf Greenkeepers Association Includes *British Golf Greenkeeper; Golf Greenkeeping and Course Maintenance; Greenkeeper; Greenkeeper & The International Greenkeeper; Golf Greenkeeping; The Golf Course;* and *Greenkeeping Management*	19xx-Present(?) Under Construction
 **Hole Notes**	Minnesota Golf Course Superintendents Association	1975-Present
 **Landscape Management**	North Coast Media, LLC	1962-Present

Publication Title	Publisher	Coverage
 **Bulletin for Sports Surface Management**	Sports Turf Research Institute Includes *Sports Turf Bulletin; International Turfgrass Bulletin*	1951-Present Less 1 Year
 **Golf Course Management**	Golf Course Superintendents Association of America Includes *Greenkeepers' Bulletin; Greenkeepers' Reporter; Golf Course Reporter; Golf Superintendent*	1933-Present Less 1 Month
 **The Grass Roots**	Wisconsin Golf Course Superintendents Association	1975-Present Less 1 Month
 **GreenKeepers**	Asociación Española de Greenkeepers Includes *Césped Deportivo*	1999-Present
 **GreenMaster**	Canadian Golf Superintendents Association	1965-Present Less 3 Months
 **International Turfgrass Society Research Journal and Proceedings**	International Turfgrass Society	1969-Present Less 2 Years, with Author Permission for materials pre-2009 Continuous Construction
 **Journal of Turfgrass and Sports Surface Science**	Sports Turf Research Institute Includes *Journal of the Board of Greenkeeping Research; The Journal of the Sports Turf Research Institute; Journal of Turfgrass Science*	1929-2007

Welcome to the

Turfgrass Information File

A Unique Resource for Turfgrass Researchers, Practitioners, and Students

USGA

A cooperative project of the United States Golf Association and the Michigan State University Libraries' Turfgrass Information Center

Turfgrass Information Center

NOTICE: Due to a system upgrade on 26/March/2013, some users may need to clear their browser cache to successfully log in to the TGIF database

Select from the following options to access the Turfgrass Information File (TGIF) database:

Academic Institutional Users

- On Campus or Authenticated
- Off Campus (see list below)

Academic Institutional Subscription Information

Note: A listed institution may permit access only from certain buildings or specific computers. Contact your instructor or library to find out what local restrictions may apply.

Contributing Cooperators

Organizations:

- American Society of Golf Course Architects (ASGCA)
- Asociación Española de Greenkeepers (AEdG)
- Australian Golf Course Superintendents Association (AGCSA)
- British and International Golf Greenkeepers Association (BIGGA)
- Canadian Golf Superintendents Association (CGSA)
- Golf Course Superintendents Association of America (GCSAA) - Class A, SM, C, ISM, AA, or A-RT members
- Midwest Association of Golf Course Superintendents (MAGCS)
- Sports Turf Association (STA)
- Sports Turf Managers Association (STMA)
- Turfgrass Producers International (TPI)
- Wisconsin Golf Course Superintendents Association (WGCSA)

Michigan Residents: Access via Michigan eLibrary (MeL)

Corporations with Access Agreements

Contributing Cooperator Information

Annual/Individual Users

User ID:

Password:

Enter

Annual Subscription Information

Off Campus Links to Authenticate or Log in to TGIF

Academic Institution	State/Province	Country
Abraham Baldwin Agricultural College	Georgia	USA
Auburn University	Alabama	USA
California Polytechnic State University, San Luis Obispo	California	USA

Academic Institution	State/Province	Country
Southern Illinois University	Illinois	USA
State University of New York, Cobleskill	New York	USA
State University of New York, Delhi	New York	USA

Turfgrass Information File

Worldwide Access to Turfgrass Science Information

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L'ASSOCIATION CANADIENNE DES SURINTENDANTS DE GOLF for their support of TIC

Basic Search

Log Out | Help | Feedback

Other Search Options

Guided Search

Power Search

Browse Options

Browse Turf Topics

Browse Full-Text Journals **(Logs out)**

What's NEW in Turfgrass Research

Type what you are looking for below, then press **Search**:

paspalum salinity tolerance

Search | Clear

Limit by Industry Sector (if Available): all sectors

(Caution! Roughly 56% of all records have no assigned industry sector.)

Dig Deeper (Search Full Text) ☐

(Caution! Roughly 75% of all records currently have no full text to search.)

Maximum number of records to retrieve: All (Default)

Basic Search Hints and Examples

Getting Started with TGIF Guide (PDF)

Experiencing Search Difficulties? Contact the Turfgrass Information Center

Search results from the

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Retrieved 57 Record(s). Displaying 1 through 25.

Mark	Item is a	Title - Items linked where available (Items may require software - see More Detail)	Author and Source	More Detail	TGIF #
☐	Report Article: Abstract or Summary only	Development and characterization of seashore paspalum SSR markers and identification of markers associated with salt tolerance	Harris-Shultz, Karen R.; Raymer, Paul; Duke, Mary; Ballard, Linda; Scheffler, Brian; Arias, Renee S. 2012. *ASA, CSSA and SSSA Annual Meetings* [2012]. p. 75038.	MORE Ab Kw	213385
☐	Refereed Article	*DOI link* Effects of salinity on seashore paspalum cultivars at different mowing heights* - **Access Restrictions (See More Detail)**	Shahba, Mohamed A.; Alshammary, Saad F.; Abbas, Mohamed S. 2012. *Crop Science*. May. 52(3): p. 1358-1370.	MORE Ab Kw	203705
☐	Refereed Article	*DOI link* Sodium chloride efficacy for smooth crabgrass (*Digitaria ischaemum*) control and safety to common bermudagrass and seashore paspalum* - **Access Restrictions (See More Detail)**	McCullough, Patrick E.; Raymer, Paul L. 2011. *Weed Technology*. October-December. 25(4): p. 688-693.	MORE Ab Kw	193839
☐	Refereed Article	Differential photosynthetic responses to salinity stress between two perennial grass species contrasting in salinity tolerance* - **Access Restrictions (See More Detail)**	Liu, Liming; Du, Hongmei; Wang, Kai; Huang, Bingru; Wang, Zhaolong. 2011. *HortScience*. February. 46(2): p. 311-316.	MORE Ab Kw	175821
☐	Report Article: Abstract or Summary only	Salinity impacts vigor of seadwarf seashore paspalum	Berndt, William. 2010. *2010 International Annual Meetings: [Abstracts] [ASA-CSSA-SSSA]*. p. 58711.	MORE Ab Kw	170415
☐	Report Article: Abstract or Summary only	Use of salt to control annual bluegrass in seashore paspalum	White, J. Lewayne Jr.; McCullough, Patrick; Raymer, Paul. 2009. *2009 International Annual Meetings: [Abstracts] [ASA-CSSA-SSSA]*. p. 55395.	MORE Ab Kw	159091
☐	Report Article:	Salinity tolerance of festulolium and major turfgrass species of	Barnes, Brent D.; Baird, James H.; Grieve, Catherine M.; Poss, James A.; Suarez,	MORE	

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Basic Search

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Other Search Options

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Type what you are looking for below, then press **Search**:

boron [Search] [Clear]

Limit by Industry Sector (if Available): all sectors

(Caution! Roughly 56% of all records have no assigned industry sector.)

Dig Deeper (Search Full Text) ☐

(Caution! Roughly 75% of all records currently have no full text to search.)

Maximum number of records to retrieve: All (Default)

Basic Search Hints and Examples Getting Started with TGIF Guide (PDF)

Experiencing Search Difficulties? Contact the Turfgrass Information Center

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Back to Search | Display Format - Sort: Brief Table - Default (New to Old) | Records/Screen 25 | Display | Display Marked Records | Clear Marked Records | Next | Log Out | Help | Feedback

Page: [1] 2 3 4 5 6 7 8 9 10 11

Download Records:

Retrieved 454 Record(s). Displaying 1 through 25.

Mark	Item is a	Title - Items linked where available (Items may require software - see More Detail)	Author and Source	More Detail	TGIF #
☐	Beard Encyclopedia Entry	boron	Beard, James B; Harriet J. Beard. 2005. *Beard's Turfgrass Encyclopedia for Golf Courses, Grounds, Lawns, Sports Fields*. Michigan State University Press. p. 58-59.		
☐	Beard Encyclopedia Entry	boron source	Beard, James B; Harriet J. Beard. 2005. *Beard's Turfgrass Encyclopedia for Golf Courses, Grounds, Lawns, Sports Fields*. Michigan State University Press. p. 59.		
☐	Beard Encyclopedia Entry	toxicity, boron	Beard, James B; Harriet J. Beard. 2005. *Beard's Turfgrass Encyclopedia for Golf Courses, Grounds, Lawns, Sports Fields*. Michigan State University Press. p. 466.		
☐	Chapter	*DOI link* Secondary nutrients and micronutrient fertilization	St. John, Rodney A.; Christians, Nick E.; Liu, Haibo; Menchyk, Nicholas A. 2013. p. 521-543. In: Stier, John C.; Horgan, Brian P.; Bonos, Stacy A., eds. *Turfgrass: Biology, Use, and Management*. Madison, Wisconsin: American Society of Agronomy.	MORE Ab	220136
☐	Refereed Article	Soil chemical property changes on golf course fairways under eight years of effluent water irrigation	Skiles, David J.; Qian, Yaling. 2013. *International Turfgrass Society Research Journal*. 12: p. 561-566.	MORE Ab Kw	223309
☐	Professional Article	Nothing minor about micronutrients	Samples, Tom; Sorochan, John; Thoms, Adam; Jakubowski, Brad. 2013. *SportsTurf*. February. 29(2): p. 8, 10-13.	MORE Ab Kw	216965
☐	Book	*Best Management Practices for Saline and Sodic Turfgrass Soils: Assessment and Reclamation*	Carrow, Robert N.; Duncan, Ronny R. 2012. Boca Raton, Florida: CRC Press. xxiv, [16], 456 pp.	MORE Ab	183810
☐	Report Article: Abstract or Summary only	Boron tolerance in four turfgrass species	Zhang, Qi; Wang, Sheng; Rue, Kevin; Li, Deying; Hatterman-Valenti, Harlene. 2012. *ASA, CSSA and SSSA Annual Meetings* [2012]. p. 75438.	MORE Ab Kw	213439

Retrieved 1 Record(s).

Full TGIF Record for: 223309	
Author(s):	Skiles, David J.; Qian, Yaling
Author Affiliation:	Department of Horticulture and Landscape Architecture, Colorado State University, Fort Collins, CO
Title:	Soil chemical property changes on golf course fairways under eight years of effluent water irrigation
Section:	Soil biology, chemistry and plant nutrition Records with this section
Meeting Info.:	Beijing, China: July 14-19, 2013
Source:	*International Turfgrass Society Research Journal*. Vol. 12, 2013, p. 561-566.
# of Pages:	5
Publishing Information:	Madison, Wisconsin: International Turfgrass Society
Keywords:	Chemical properties of soil; Effluent water use; Nutrients; Soil testing
Abstract:	"Effluent water used for landscape irrigation has the potential to change soil chemical properties over time. Changes in soil chemistry can be observed across a range of time scales and in a variety of soil conditions. The objective of this study was to determine long-term changes in soil chemistry in soils under effluent water irrigation on golf course fairways. Soil testing was conducted for the years of 1999, 2000, 2002, 2003, and 2009 for Heritage Golf Course in Westminster, Colorado. Parameters of each soil sample tested included pH, extractable salt content (calcium, magnesium, potassium, sodium, iron, manganese, copper, zinc, phosphorus, and boron), base saturation percent of calcium, magnesium, potassium and sodium, soil organic matter (SOM), and cation exchange capacity (CEC). Regression analysis was used to evaluate the changes in individual soil parameters over time after the use of effluent water for irrigation. Soil pH, CEC, extractable aluminum, copper, manganese and iron along with both base saturation percentages and exchangeable percentages of calcium and magnesium did not change over time. The strongest indications of change are seen for extractable boron ($R^2 = 0.56$), Bray II extracted phosphate ($R^2 = 0.56$), and sodium base saturation percentage ($R^2 = 0.44$). The regression analysis indicated that B, P, and sodium increased linearly during the 8 year's irrigation with effluent water. Further studies are needed to determine if these parameters would continue to increase or would stabilize. Continued accumulation of sodium could eventually result in loss of soil structure."
Language:	English
References:	26

Turfgrass Information Center

We need you!

email if questions or with leads on resources which we should know about. We need you as a supplier, cooperator – and user!

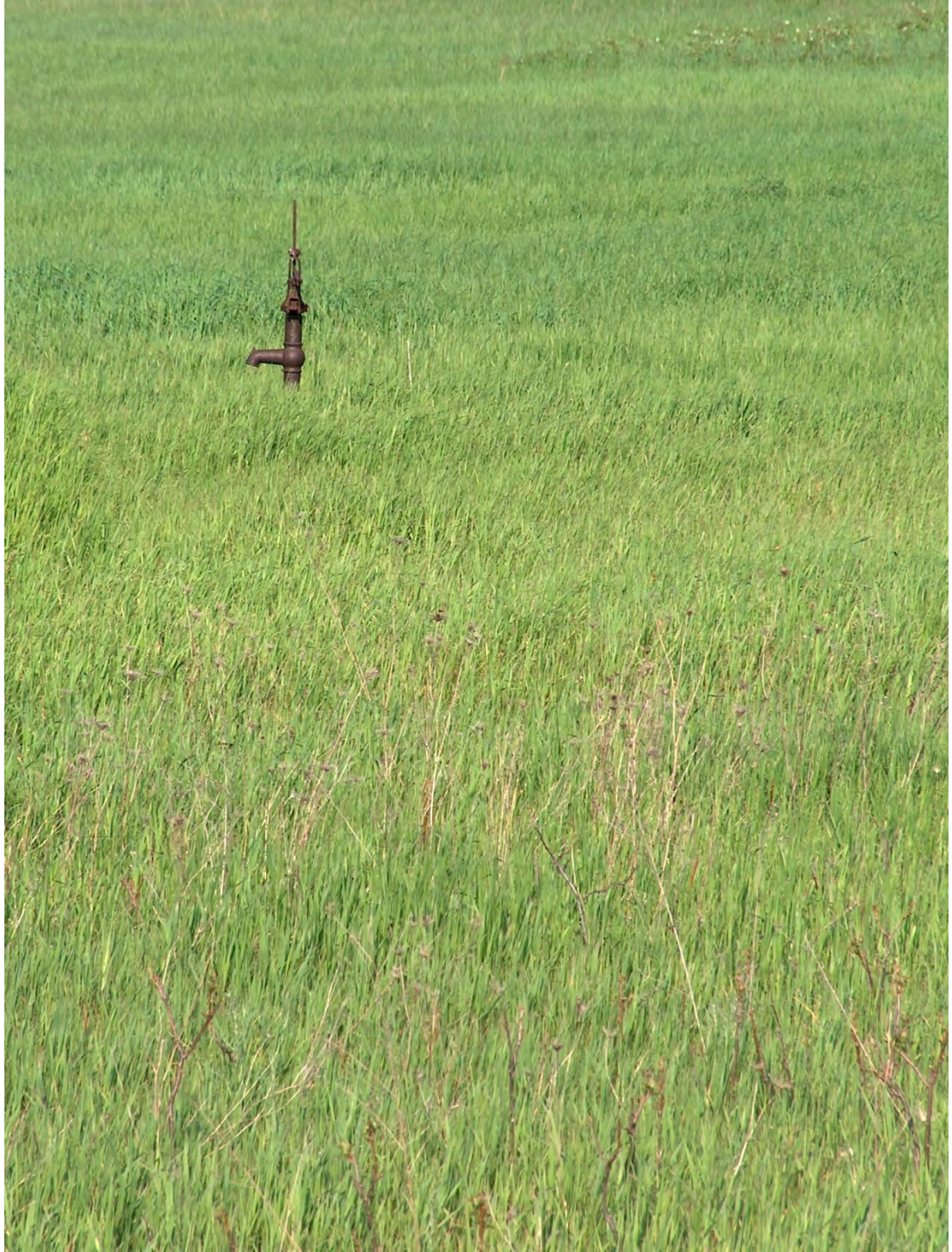
Pete Cookingham

cooking1@msu.edu

tic.msu.edu

thank you!

Turfgrass
Information Center



American Society of
Irrigation Consultants

TAKING CHARGE OF CHANGE

EXPLORE | ENGAGE | EXECUTE

Portland, Oregon

2·0·1·4

ASIC

Executing Professional Specifications

ASIC

About Me:

INTERFACE ENGINEERING

Cherise Schacter, CSI, CDT
Standards Coordinator, Interface Engineering
President-Elect, Portland Chapter CSI
CSI National Education Committee

28 Years Experience in the Design/Construction Industry:
Emerick Construction – 1 year
Selig/Lee/Rueda Architects – 23 years
Interface Engineering - Almost 4 years

Twitter Handle: @CheriseSchacter
They call me "The Kraken"
#CSIKraken

ASIC

Discussion Topics

- Advantages to obtaining CSI Certifications
- Common Specifying Mistakes
- MasterFormat – Old vs. New

Certification Structure

- CDT: Construction Documents Technologist
  - CCS: Certified Construction Specifier
  - CCCA: Certified Construction Contract Administrator
  - CCPR: Certified Construction Product Representative

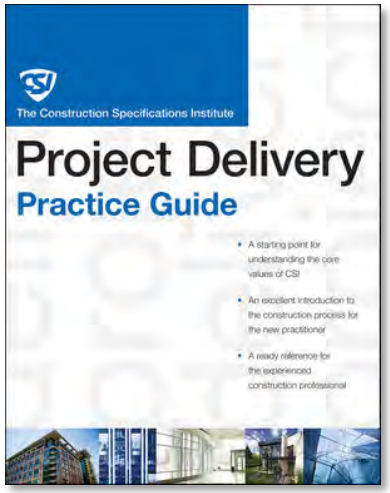
CSI Certification - CDT

- CDT: Construction Documents Technologist Certificate:
  - Basic foundation in industry knowledge:
    - Construction Processes
    - Contractual Relationships
    - Document Procedures and Organization

CSI Certification - CDT

- Candidates may have any level of:
  - Education
  - Years/experience in Construction Industry

- Source Material:
  - Project Delivery Practice Guide
  - MasterFormat
  - Uniformat
  - SectionFormat/PageFormat
  - GreenFormat
  - Sustainability/Green Building: US EPA
  - General Conditions



Exams

Fall 2014 Exams

- Registration Opens *June 2, 2014*
- Early Registration Ends *July 31, 2014*
- Final Registration *August 31, 2014*
- Exam Window *Sept 29-Oct 25, 2014*

Facts

- Consultant/Engineers Facts:
  - No higher education is offered for Consultants/Engineers in project delivery or contract requirements.
  - The first education of this kind, for a consultant, typically happens as a result of a conflict on a specific project.
  - Consultants almost never see the Owner/Arch Agreement, General & Supplementary Conditions, or Division 01 requirements.
  - Consultants typically do not get a full copy of the contract documents until the project hits the streets.
  - Consultants rarely have trained specification writers. Individuals in a firm, regardless of training, typically write and edit their own specs on each project.
  - Sometimes, multiple staff members in one firm are working on different parts of the same spec.

Whaaaaaaaat?

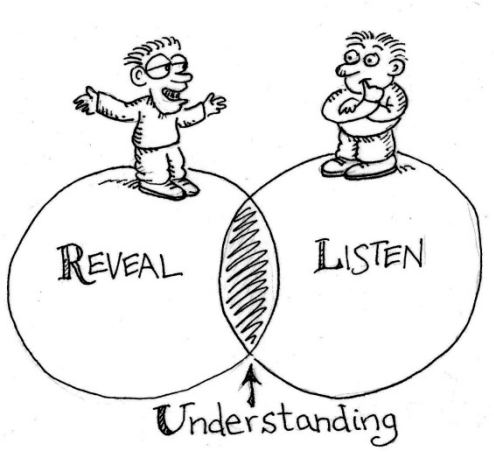
Consulting engineers represent 4% of total CSI Membership

Where are consultants learning about contract requirements to avoid conflicts?

THEY'RE NOT!

Common Problems/conflicts with Consultants

- Duplications
- Omissions
- Contract or Bid Requirements
- Lack of Division 01 Knowledge
- Standard Format/Language Differences
- Open Communication/Exchange
- Owner's Role
- Timing of Decisions
- Terminology



Common Areas needing Coordination/Communication

- Architect/Owner Agreement – Requirements
- General & Supplementary Conditions
- Seismic and Geotech Data
- Existing Conditions/Owner Requirements
- Unit Prices/Alternates/Allowances
- Contract Modification Procedures
- Submittal Procedures
- Location Specific Regulatory Requirements
- Special Project Requirements
- Meetings
- QA/QC Procedures

Common Areas needing Coordination/Communication

- Temporary Facilities/Utilities
- Access Panels
- Warranty Requirements
- LEED Requirements
- Cutting and Patching
- Delivery, Storage and Handling
- Substitution Requirements and Procedures
- Substantial Completion/Final Acceptance
- Startup/Commissioning/Training/Demonstration
- Cleaning/Closeout/Maintenance

- Division Specific Items that may require cross coordination (i.e. Civil and Plumbing)

Possible Consequences from Lack of Coordination

- Loss of valuable time during CA dealing with conflicts
- Excessive Change Orders
- Construction Budget Overrun
- Mediation/Arbitration
- E & O Claims
- Loss of Client

If you can't afford to take the time to coordinate your project then you can't afford the time it will take to deal with the issues.

Common Specifying Mistakes - Specs 101

- Spearin Doctrine

  A U.S. Supreme Court decision in 1918, *United States v. Spearin*, is a key case that has far-reaching implications for the design professions and construction industries.

  Basically, *Spearin* holds that a contractor is entitled to rely on the construction documents provided by the Owner to be sufficient for their intended purpose and is not responsible for the consequences of defects (errors, inconsistencies, or omissions) in the contract documents.

Contract Documents

- Your drawings AND Specifications are the Contract Documents and are **complementary**.
- Contrary to popular belief, one does not take precedence over another.
- In case of a conflict, what is “reasonably inferred” will prevail.
- Treat your documents like you would treat a contract.

General Requirements

- Basic Structure for Administrative Requirements – Know where things belong:
  - General Conditions –Typ. Standard Industry Document
  - Supplementary Conditions – Expand on and Revise General Conditions
  - Division 01 – General Requirements further expand and define the Conditions of the Contract and Administrative Requirements
  - Part 1 of the Specification Section defines administrative requirements specific to that section

Specification Sections – Where does it Belong?

- Spec Sections consist of 3 Parts (See CSI SectionFormat™:
  - Part 1 – GENERAL
    - Administrative Requirements specific to that section. Things like Submittals, Quality ASSURANCE, Reference Standards, Warranty Requirements, etc.

Specification Sections – Where does it Belong?

- Spec Sections consist of 3 Parts:
  - Part 2 – PRODUCTS
    - Articles related to the manufacture and fabrication of products, including:
      - Assembly or Fabrication Tolerances
      - Source Quality Control
      - Tests
      - Inspections
      - Nonconforming Work
      - Manufacturer Services

Specification Sections – Where does it Belong?

- Spec Sections consist of 3 Parts:
  - Part 3 - EXECUTION
    - Covers work performed at the project site as well as:
      - Tolerances
      - Field or Site Quality Control
      - Field or Site Tests
      - Field or Site Inspection
      - Nonconforming Work
      - Manufacturer's Services

Language

- As legally enforceable contract documents, construction specifications should be prepared with concern and respect for their legal status.

- Always use the four principles of effective communication:
  - Clear: Use correct grammar and simple sentence construction.
  - Concise: Eliminate unnecessary words, but not at the expense of clarity.
  - Correct: Present information accurately and precisely.
  - Complete: Do not leave out important information.

Writing Style

- Good writing style is characterized by accuracy, brevity, and clarity:
  - Use simple sentences. Long, complex sentences and stilted language do not contribute to effective communication.
  - Avoid complicated sentences where inadvertent omission or insertion of punctuation could change meaning or create ambiguity.
  - Use words and terms that are simple and clearly understood.

Sentence Structure

- The “Imperative Mood” is the recommended method for instructions covering the installation of products and equipment.
  - Imperative Mood: The verb that clearly defines the action becomes the first word in the sentence.
  - For example: **“Spread adhesive with notched trowel.”** The imperative sentence is concise and readily understandable.

Sentence Structure

- The “Indicative Mood”, passive voice, requires the use of shall in nearly every statement. This sentence structure can cause unnecessary wordiness and monotony. This is not recommended.

Abbreviations, Symbols & Numbers

- Abbreviations, while sometimes effective on Drawings, should generally be avoided in Specifications.
- When numbers are used to define both size and quantity, use the symbol for the number, spell out the quantity
  - For example: Use 2-inches not 2”
  - 50 degrees F.
  - 20 percent
  - Five 2 by 4s

Capitalization, Punctuation

- Capitalization should be consistent throughout the Construction Documents. Capitalize specific nouns and proper names defined in the Conditions of the Contract.

- Sentences should be constructed to that the misplacement or elimination of a punctuation mark will not change the meaning.

Grammar – Subject/Verb Agreement

- Use singular verbs with singular subjects and plural verbs with plural subjects.
  - Incorrect: One of the elongated central fasteners are to be placed around the eye of the panel and bolted.
  - Correct: One of the elongated central fasteners shall be placed around the eye of the panel and bolted.
  - **Preferred:** Bolt one elongated central fastener to panel eye.

Grammar – Subject/Verb Agreement

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Inappropriate Terms

- Inappropriate Terms:
  - As approved; as indicated; as required
  - Herinafter; herinbefore; herewith
  - Any or all
  - Etc.
  - As per
  - In a workmanlike manner
  - To the satisfaction of the architect/engineer
  - Also
  - Minimize or avoid use of pronouns, avoid “which”

Avoid Unnecessary Words

- For example, use of the word “all” is usually unnecessary.
  - Poor:
    - Store all millwork under shelter.
  - Better:
    - Store millwork under shelter.
  - It is a given that the 2nd sentence means all of the millwork.

Prepositional Phrases - Streamlining

- Sentences may be shortened in specification language by using modifiers in place of prepositional phrases.
  - Correct:
    - Top of platform.
  - Preferred:
    - Platform top.
  - Attempt to reduce verbiage. As an old boss told me, K.I.S.S. – Keep it Simple Stupid. Good examples:
    - Adhesive: Spread with notched trowel.
    - Equipment: Install plumb and level.
    - Portland Cement: ASTM C 150, Type 1.

Vocabulary

- Use “amount” when talking about money, “quantity” when writing about number, measurement, area, or volume.
- Do not use the word “any” – It is imprecise
- “Either” implies choice, “Both” is all inclusive
- Flammable and Inflammable mean the same thing
- Use the Right One:
  - Furnish = Supply and deliver to project, ready for installation.
  - Install = Place in position for service or use.
  - Provide = Commonly accepted to mean furnish and install., complete and ready for intended use.

Vocabulary

- Shall = Required
- Will = Optional
- Avoid “must” and “is to”

- Do not give instructions to specific entities.
  - Incorrect: Subcontractor to install 12-feet of pipe.
  - Correct: Install 12-feet of pipe

Design professionals, contractually, **are not responsible** for the Contractors means and methods. It is up to the Contractor to decide who does what and when.

Say it once and say it in the Right Place

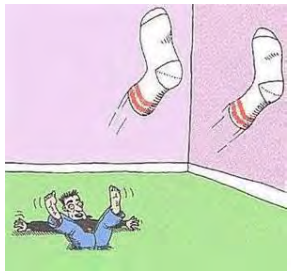
- Important Rule to Remember:
  - Drawings = Quantity & Spatial Relationships
  - Specifications = Quality
  - Example:
    - Drawings should show how many toilets, where they are located and spatial relationships.
    - Specs should define materials, sizes, components, etc.
    - Do not write or repeat specs on your drawings.
    - **Say it once and say it in the right place.**

Tips

- Educate yourself. There is no excuse for not understanding the documents for which you are legally bound.
- We can't begin the dialogue on coordination until you come to the table and get this knowledge. You can't protect yourself without it.
- There are super cost effective ways to get this training for your entire staff. See me after class, I will tell you.
- Don't be afraid to communicate. Ask the right questions.
- Invite a qualified architect or CSI Member to lunch. Bribe them with food and ask if they will look over a few of your sections and get you started in the right direction and in closing the gaps.
- If they are your client, they will be really impressed that you are proactively trying fix these issues. TRUST ME!
- Pay a qualified person to go through your documents and provide advice. The time and money you will save in the long run will far outweigh the cost.

Tips

- Don't let every engineer/consultant in your office write specs. If they don't have the education, they shouldn't touch them. Remember, the drawings and specs are the CONTRACT!
- Educate your support staff. There are many ways your support staff (admin, drafters, etc.) can help you catch mistakes. Get them CDT certified.
- Ask for a copy of the Owner/Architect Agreement, General and Supplementary Conditions, Division 01, and any other important documents you need to do your job.
- Make your own list, in the same order it appears in your documents, of all the items/areas that need to be coordinated or have potential for conflict.
- Call your client, go over your list, ask questions and get on the same page.
  - This will knock their socks off!
  - Why? Because engineers NEVER do it.
  - How do I know? I do it!



Bottom Line

- Consultants:
  - Step outside the box and learn what you don't know
  - I do not have time is an excuse, not a reason
  - Start asking questions, asking for requirements, communicating
  - Be accessible and collaborative
  - Be the consulting engineer that stands out from the crowd. Be the pioneer!

MasterFormat

- Old: Get rid of it.
  - No longer supported by CSI or any current spec writing software.
  - Most new software has a conversion table should you encounter a client using MF95.

MasterFormat

New:

"MasterFormat is a master list of numbers and subject titles classified by work results or construction practices for **organizing information** about their requirements, products and activities into a standard sequence."

MasterFormat – Organizational Structure

- Groups (2)
- Subgroups (5)
- Divisions (50) numbered with titles
- Sections, numbered with titles
- SectionFormat (3 parts) (General, Products, Execution)

MasterFormat – Organizational Structure

Procurement and Contracting Requirements Group

Procurement and Contracting

Requirements: Division 00

Specifications Group

General Requirements Subgroup: Division 01

Facility Construction Subgroup: Divisions 02 - 19

Facility Services Subgroup: Divisions 20 - 29

Site and Infrastructure Subgroup: Divisions 30 - 39

Process Equipment Subgroup: Divisions 40 - 49

MasterFormat – Facility Construction Subgroup

02 Existing Conditions
03 Concrete
04 Masonry
05 Metals
06 Wood, Plastics, and Composites
07 Thermal and Moisture Protection
08 Openings
09 Finishes
10 Specialties
11 Equipment
12 Furnishings
13 Special Construction
14 Conveying Equipment
15-19 Reserved

MasterFormat – Facility Services Subgroup

20 Reserved

21 Fire Suppression

22 Plumbing

23 Heating, Ventilating, and Air Conditioning (HVAC)

24 Reserved

25 Integrated Automation

26 Electrical

27 Communications

28 Electronic Safety and Security

29 Reserved

MasterFormat – Site and Infrastructure Subgroup

30 Reserved

31 Earthwork

32 Exterior Improvements

32 80 00	**Irrigation**
32 82 00	**Irrigation Pumps**
32 84 00	**Planting Irrigation**
32 84 13	Drip Irrigation
32 84 23	Underground Sprinklers
32 86 00	**Agricultural Irrigation**

33 Utilities

34 Transportation

35 Waterway and Marine Construction

36-39 Reserved

MasterFormat – Process Equipment Subgroup

40 Process Integration

41 Material Processing and Handling Equipment

42 Process Heating, Cooling, and Drying Equipment

43 Process Gas and Liquid Handling, Purification, and Storage Equipment

44 Pollution and Waste Control Equipment

45 Industry-Specific Manufacturing Equipment

46 Water and Wastewater Equipment

47 Reserved

48 Electrical Power Generation

49 Reserved

MasterFormat – Sections

- Sections are within Divisions
- Section numbers are generally 6 digits.
- Additional digits are available for very specific or user defined topics.
- Consider as 3 pairs (plus additional pairs when required).

MasterFormat – Guide

- Application Guide
- Key Word Index
- Transition Matrix
  - 1995-2012
  - 2011-2012

- Training:
  - Programs provided by CSI and in collaboration with other organizations.
  - Customized in-house training programs and implementation assistance.
  - Web-based information and training, including continuing FAQ on CSInet.org.

Questions?

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- Erica Smedley Cox, CSI, ecox@csinet.org, 703-706-4732
- Jennifer Antiporda, CSI, jantiporda@csinet.org, 703-706-4749
- Jessica Davison, CSI, jdavison@csinet.org, 703-706-4746

A Very Candid Look at the State of the Green Industry

Pat Jones

Lawn&Landscape

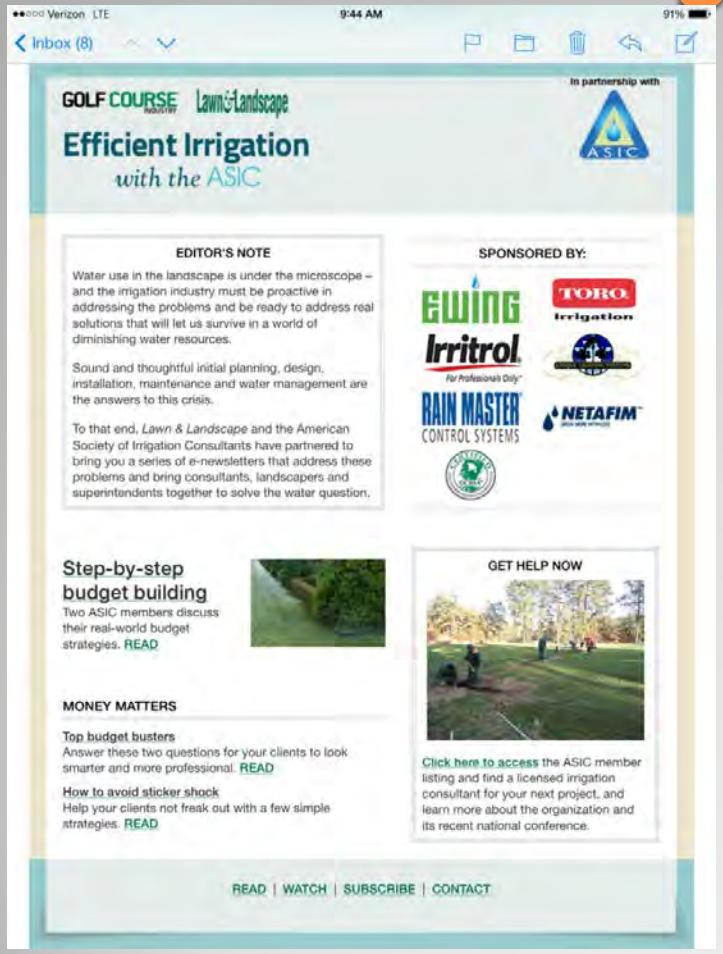
ASIC

GOLF COURSE INDUSTRY

Good afternoon…

- Background
- Landscape Industry
- Golf Industry
- Questions…

We're working together!



IRRIGATION ISSUES

Brian Vinchesi, the 2009 EPA WaterSense Irrigation Partner of the Year, is president of Irrigation Consulting Inc., a golf course irrigation design and consulting firm with offices in Pepperell, Mass., and Huntersville, N.C., that designs golf course irrigation systems throughout the world.

THE LITTLE THINGS

Low- to no-cost additions to make your system easier to operate.

Many times the little things make the difference in separating good from average or great from superior. Irrigation design and installation is no different. The little design and installation nuances that make the irrigation system better have always impressed me. When designing, renovating or installing a system, the following are some of the little things that will make your system easier to manage and troubleshoot.

VALVE BOX COVERS

Today's irrigation systems have lots of valve boxes installed for isolation valves, drain valves, air release valves, quick couplers, wire splices and electric valves. When you walk up to a group of valve boxes it would be nice to know what is housed in which box without having to pop them all open, especially if you're in a hurry due to a pipe or fitting break. Valve box covers are available in a variety of colors. Pick one each type of valve, keeping in mind what they'll look like in their installed environment and let your crew know what each color represents.

Tired of not being able to find valve boxes? Here's a hint: attach a #10 stainless-steel washer with a stainless-steel screw on the underside of the cover. This makes the valve box easy to locate with a metal detector. Some manufacturers will even supply the covers with the detection already installed. You can also easily add them to your system's existing boxes.

IDENTIFICATION TAGS

Identifying cables and valves helps tremendously with troubleshooting. With the popularity of today's decoder systems, identifying where a communication cable is coming from along with where it is going should be labeled at the time of installation. For example: "from," "to," "volts," "amps" and "output" at each junction should be put on the tag. Lastly, on conventional systems tagging the communication cable path and all electric valves with controller and zone number is also very helpful.

BALL VALVES

Tired of getting wet when quick couplers are engaged or the key removed? Put a ball valve on the outlet between the key and the swivel using two brass nipples. Now you can keep the water flow off when engaging and disengaging the key, keeping you and your crew drier.

WIRE COLOR

Wire comes in many different colors, for #12 and #14 AWG valve and sprinkler wires, decoder cable and some manufacturer's communication cables. Color coding also helps identify what color operates which communication path or what area of the golf course. For example, greens and tees purple control wires, fairway and rough orange control wires; path A communication blue and path B communication yellow.

However, the most beneficial part with different colors is distinguishing between old and new wires. When you install new irrigation the new wires should not be any of the same colors as the old wires, so you immediately know which wires you need to deal with.

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GIE Media…

Lawn & Landscape

Greenhouse Management

Golf Course Industry

Nursery Management

garden center — Smart Ideas for Independent Retailers | Magazine

SNOW Magazine

PCT — Pest Control Technology

A Garden Life

ASIC

Landscape: Next five years

- Design/build and construction and renovation work will continue to grow
- Housing starts and construction are on the rise, but not at an untenable pace like we saw in the middle of the decade
- Money is still flowing, both in project spending and in M&A (KKR, Brickman, ValleyCrest, etc.)
- Continued consolidation in the middle of the market ($5 to $10 million)

Opportunities

- The best opportunity in commercial landscaping is a focus on water management, not irrigation
- Water management is the only way landscapers can truly show ROI to building owners/managers. Smart ones are starting to market that.

Water rates

- Source: 2012 USA Today survey *(bit.ly/waterrates)*

Grow The Market – Part 2

- Nearly half of respondents – 48 percent to be exact – say their budgets will go up in the next two years. Another 45 percent say their budgets will stay about the same.
- A well-maintained landscape at my building helps increase occupancy rates. 78%
- A well-maintained landscape is good for the environment. 74%
- A well-maintained landscape helps save water. 67%
- I spend more time working through problems with my landscaper than with other service contractors. 7%

Golf: Today's market

- 15,650 "facilities"
  - 4,200 private clubs
  - 2,300+ mgt co/multi-course
  - 9-holers are endangered species
- +/- 500M rounds played every year
  - Weather adjusted, trending down 1.5% annually
- $76B = industry impact
- $9B = maintenance spending
- Avg. maintenance budget is $650K

Digging Down

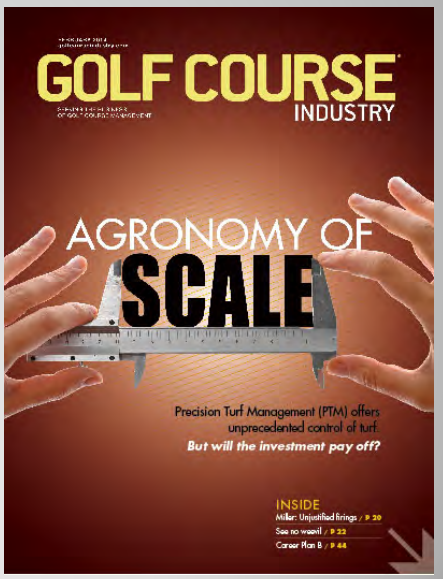
- A third of all courses lose money
- Net loss of 150 courses annually (1%)
- At least 10 years to even supply/demand
- About 8,500 “standard and premium” facilities command 80% of all revenue and spend 77% of total maintenance dollars

Very Candid Conclusions #1

- Flat is the new up for U.S. golf rounds
- Slow market correction means discounting and poor operations will plague us for a decade
- The "core" of the market is relatively sound and those facilities can thrive if they evolve
- Success largely means taking share of wallet from those who already play golf

What the future holds…

- Leaner, smarter market
  - 13,000 courses?
  - Underperforming facilities benefit from underemployed supers?
- Precision Turf Management
  - Metrics for everything
- Variety!
  - No one style works for everyone



Very Candid Conclusions #3

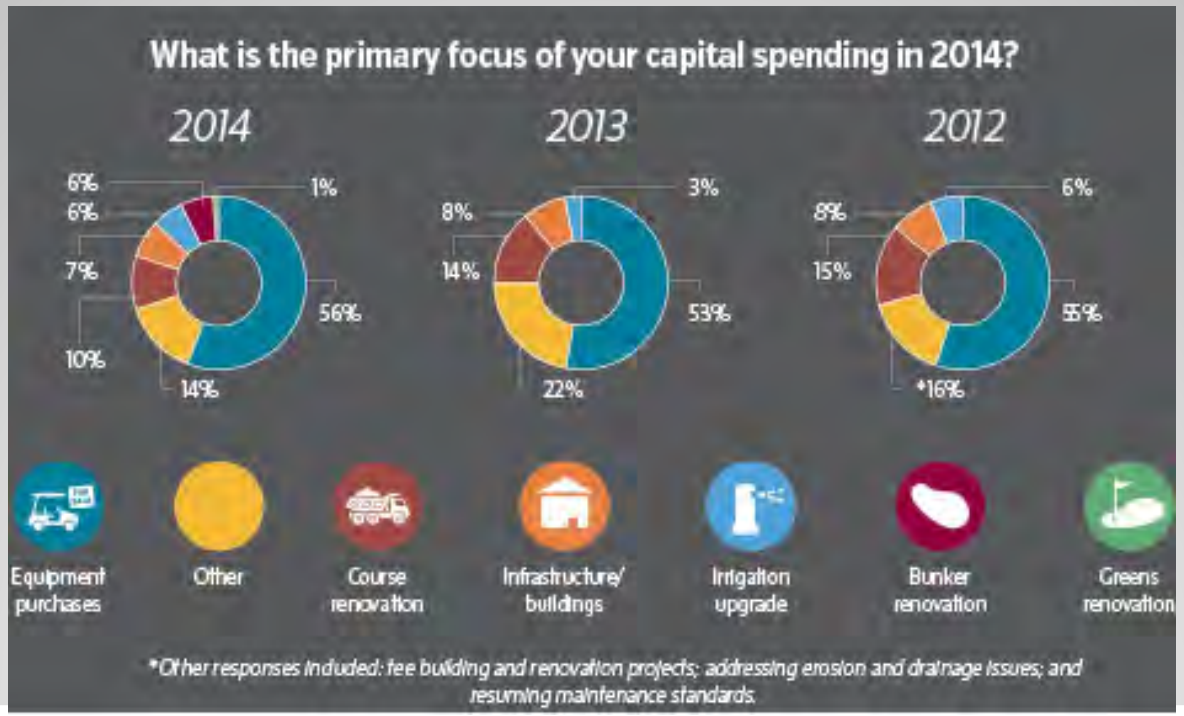
- The key is great cultural management combined with great land management
- Clubs must be meaningful to people who aren't old rich white guys
- Technology will separate winners and losers (PTM)
- Superintendents will play THE critical role in the future
- Nothing matters unless we figure out the water issue

H20 is all that matters

- It is possible that golf may not be played on grass 50 years from now
- It is CERTAIN that the cost of water will become the top economic issue facing golf
- We must be proactive, unified and committed to being the best urban water users (Georgia, etc.)
- Kudos to USGA for focusing on the issue.

H20 is all that matters

- Ironically, that's not where the capital spending is…



Final thoughts…

- Landscape market looks good and spending will remain strong for 3-5 years
- Golf should look better but doesn't overall – the key is to target the opportunities with clubs and smart facilities
- Increasing water prices will drive everything

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American Society of
Irrigation Consultants

TAKING CHARGE OF CHANGE

EXPLORE | ENGAGE | EXECUTE

Portland, Oregon

2·0·1·4

ASIC

Bluebeam Software

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Agenda

PDF background

Workflows using PDF

Live demo

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Bluebeam Software

What is PDF?

A. Protected Document File

B. Published Drawing Format

C. Portable Design File

D. None of the Above

Bluebeam Software

Portable Document Format

- History
  - Pre-press Industry
  - Adobe 1993
  - Free Reader
  - De Facto Standard
  - 2008 ISO 32000

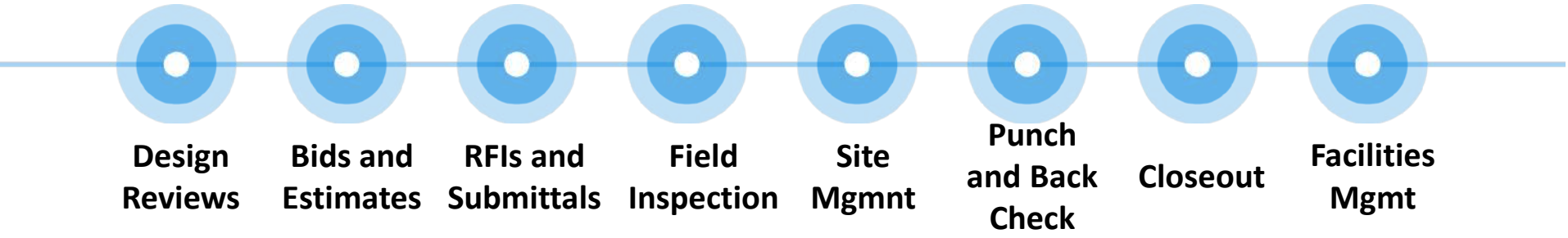
Bluebeam Software

AEC Industry

Past	Static	Non-proprietary	Universally Accepted	Project Deliverable	
Trends	Navigable Sets	Mobile & Cloud	Java Script	3D	PDF/A
Future	Dynamic	Mobile & Cloud	PDF/E		

Bluebeam Software

Better Ways to Work Digitally



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Reduce paper usage by more than **85%**

Real World Results

We enable the world's Largest buildings to open their doors faster

Speed up project communication by **60%**

Track projects **40%** faster

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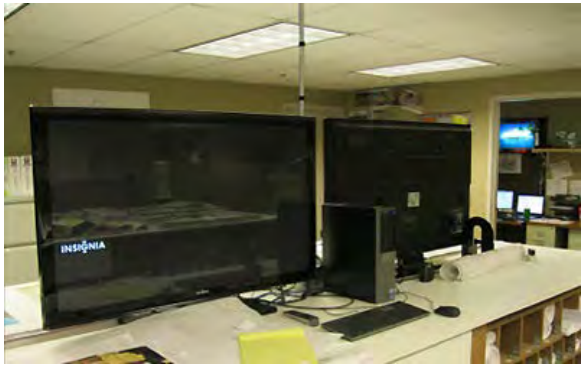
Take Your Projects Paperless…

From this…



…to this.

Bluebeam Software

Bluebeam Revu

- Intuitive Interface
- Industry Standard Markups
- Exclusive Tool Chest™
- Markups list
- Bluebeam Studio™

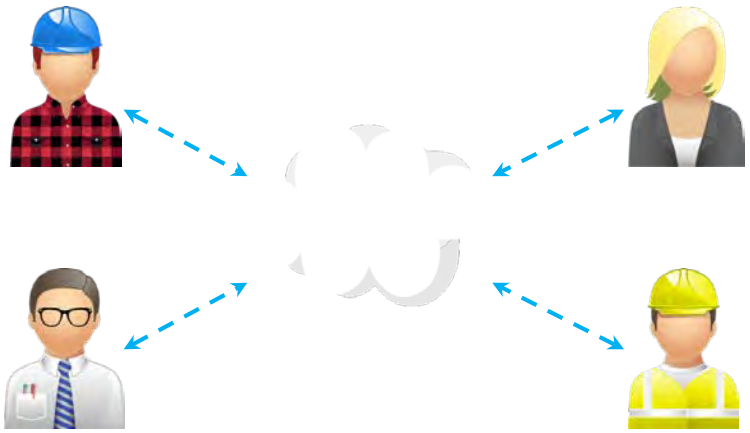
Bluebeam Software

PDF and Cloud

Bluebeam Software

Improve Communication

- Project Team
- Current Project Information
- Tracked and Recorded
- Permissions



Bluebeam Software

Enable real-time

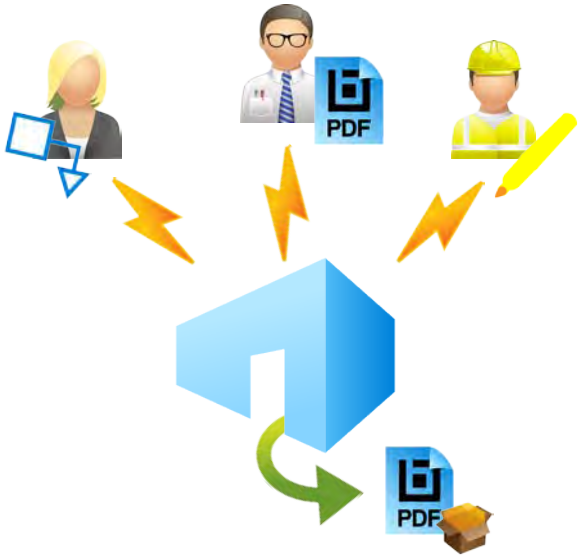
- Design Coordination
- Submittal Review
- Field to Office Issues
- Punch

Bluebeam Software

PDF and Cloud

Sessions

Document-based online collaboration



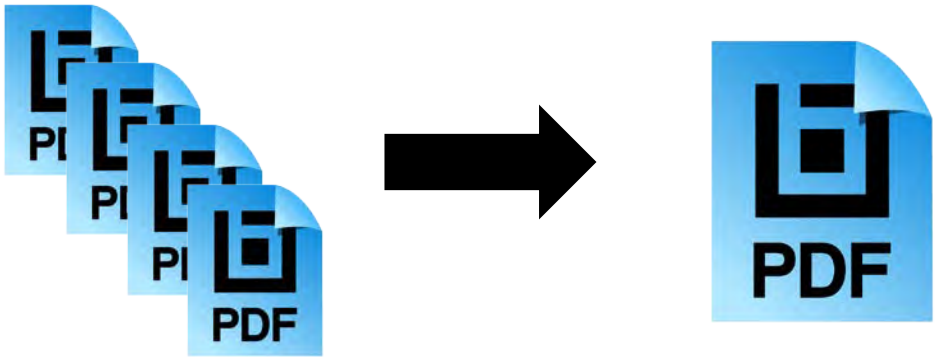
Projects

A simple document management system in the cloud for PDFs and other files

- Share files with others and set permissions
- Unlimited free space for Studio Projects

Bluebeam Software

Submittals



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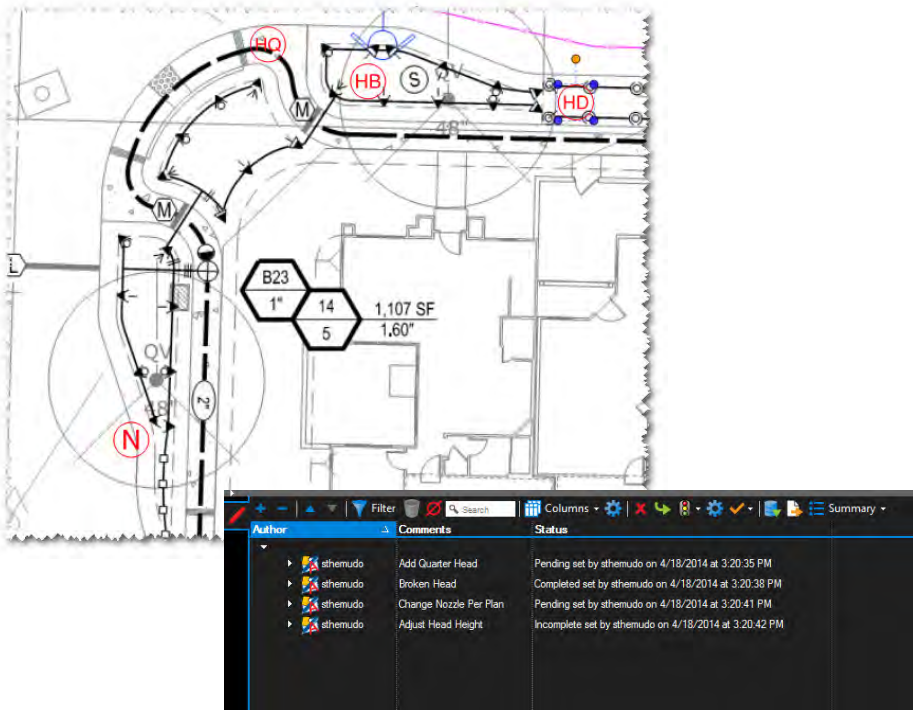
Punch List/ Inspections



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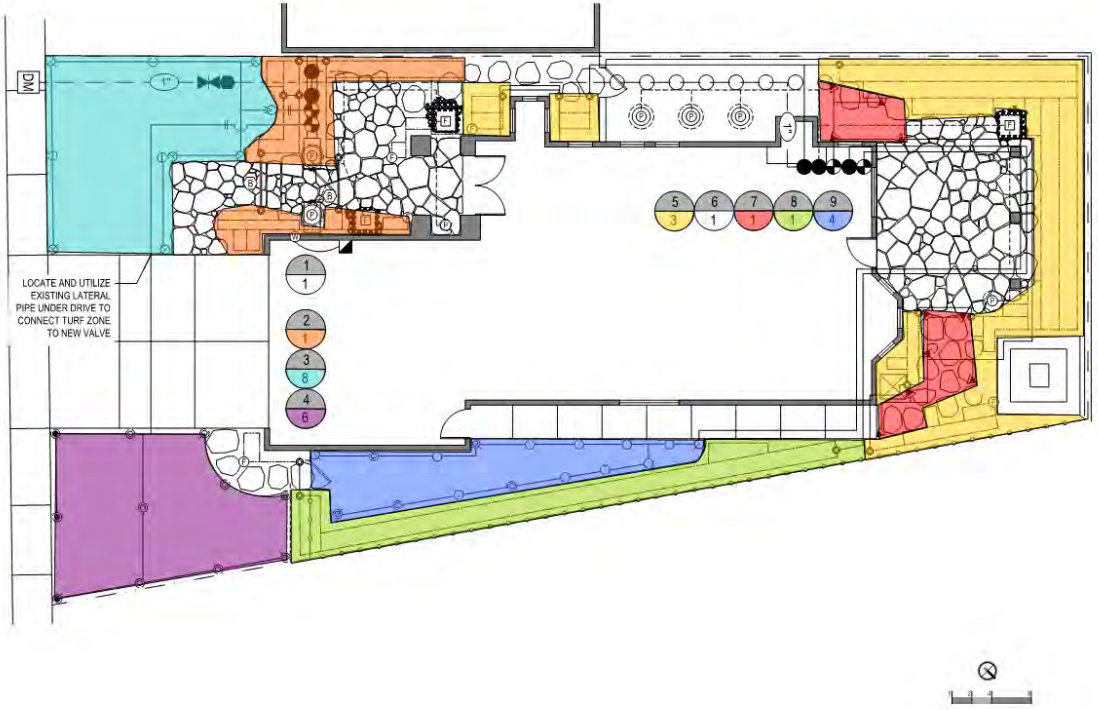
Controller Chart



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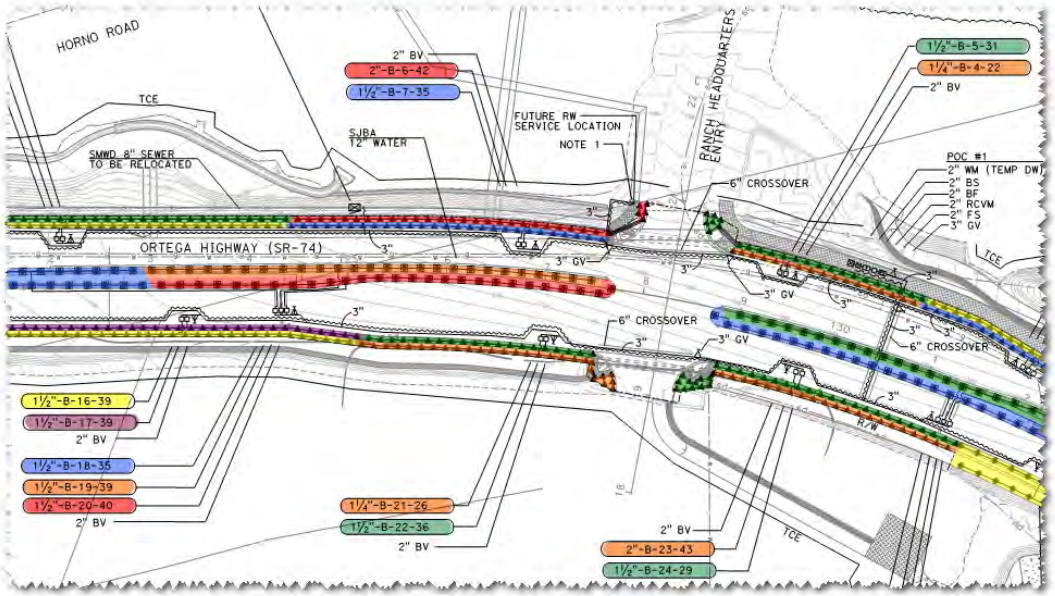
Controller Chart



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Let's See

Bluebeam Revu

In Action…

Bluebeam Software

Bluebeam Software

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