Stormwater & Flooding
The view from Chez Arnold...
We are an urbanizing state/region/country

CT’s Changing Landscape
The “development footprint”...

Developed = 946 mi$^2$

Turf = 384 mi$^2$
Impervious Surfaces
Hydrologic Impacts of Development

More Runoff Arriving Faster
The Effects of Urbanization

Falls River, Essex
The Effects of Urbanization

Goodwives River, Darien
The Effects of Urbanization

Trout Brook(?!), West Hartford
The Effects of Urbanization: Park River, CT
Yeah, but is it really that big of a deal?
Our beloved venue
57,000 ft$^2$ of impervious area

1 inch of rain = 35,530 gallons

Annual (48”) = 1,705,544 gallons

= 2.6 Olympic pools!
Yeah, but is it really that big of a deal?
Stormwater is the #1 source of water pollution in the U.S. (US EPA)
Sewage Spill In Stamford Closes Beaches, Cancels Regatta

By KELLY GLISTA, Kglista@courant.com
5:55 pm, May 1, 2014

STAMFORD — Heavy rains overnight caused about 25 million gallons of partially-treated sewage to spill into the Stamford Harbor from the wastewater treatment plant, officials said Thursday.

The city has closed the beaches and shellfish beds, and canceled a regatta that was scheduled for this weekend as a precaution, city Director of Administration Mike Handler said. Increased beach patrols are planned as well.

The spill began at about 10:30 p.m. Wednesday, Handler said, when the water flow exceeded what the wastewater treatment plant was designed to handle. Early Thursday morning the plant experienced the highest level of water flow ever recorded there, he said.

The water flow level decreased throughout the day Thursday and is expected to return to normal levels Thursday night, Handler said.

A state Department of Energy and Environmental Protection spokesperson said that they've been in touch with Stamford officials since early Thursday morning. The city Health Department will be taking samples of the water to measure bacteria levels, which are expected to be very high.
Flooding = erosion

CT River after Irene
Infrastructure Meltdown

April 30, 2014

Google this!
http://www.youtube.com/watch?v=zglXPDQHIHY
Homeowner with a FROG phobia is awarded $1.6M after runoff flood water inundates his property with the slimy creatures

By HELEN PW

PUBLISHED: 17:16 EST, 8 April 2013 | UPDATED: 17:26 EST, 8 April 2013

A frog-fearing New York state man has won a $1.6 million payout after a developer drained so much storm water onto his property it turned into a wetland inundated with the slimy amphibians.

Paul Marinaccio Sr. described himself as 'a prisoner in my own home' after the Town of Clarence, a suburb in Buffalo, gave Kieffer Enterprises the go-ahead to divert water onto his 40-acre property, making it the ideal habitat for frogs.

While the state’s highest court ruled a couple of weeks ago that he wasn’t entitled to an additional $250,000 in punitive damages, he’s still come out a winner, and the town has also agreed to dig a drainage channel to dry up his land and, hopefully, the frogs.
And NOW...

All studies indicate more rainfall, and more intense rainstorms, in the Northeastern US
Our Soggy Prospects

In this study, a range of definitions for extreme precipitation was examined to provide a robust indicator of climate change in the Northeastern United States. All of the definitions...indicate that the occurrences of extreme precipitation events, and the intensity of rainfall, are increasing.
Annual precipitation (inches)

## Probability and Return Period

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<th>Recurrence interval (years)</th>
<th>Probability of occurrence in any given year</th>
<th>Percent chance of occurrence in any given year</th>
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Probability model for New London, CT, updated with recent rainfall data

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<th>RI</th>
<th>TP-40 (in)</th>
<th>Updated values (in)</th>
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“100-yr storm” is the new 50
Strategies

They’re mostly about infrastructure
Resizing conventional Infrastructure

- identify priority flood-prone areas
- Revise drain and culvert standards based on the new precipitation regime
- Build this into the capital expenditures plan
Green Infrastructure
Urban trees as stormwater devices

“UTC” Goals

25 gal/week

125 gal/week
Low Impact Development
Low Impact Development

A site design strategy intended to maintain or replicate a site’s natural hydrology systems through the use of small-scale controls integrated throughout the site to manage runoff as close to its source as possible.
2011
Laurel Hall
2013

Rain Gardens & pervious asphalt parking stalls near Whetten Center.
But does it work?

Glen Brook Green (Jordan Cove) Research/Demo Project
Jack Clausen’s $1M graph...

Flow Rate

Time

Conventional

LID
First: Awareness

WNYC

 Causes of Sandy Flooding Rooted in Over Development

Tuesday, February 12, 2013

By Bob Hennelly
THANKS!

The Climate Adaptation Academy
Teaching: Communities
Today’s Offering

• urbanization & your waterways
• Climate change implications for flooding
• Things to think about
Rain Garden

A depression that collects rainwater from a roof, driveway, or yard and allows it to infiltrate into the ground.
Rain Garden Smartphone App

Basics
Basic information about rain gardens.

Design
How to pick a site and size your garden.

Choose Plants
How to select plants for your garden.

Install
How to install, plant and maintain your garden.

My Rain Gardens
How to save information about the rain gardens you have installed.
Cumulative volume of stormwater reduction by campus LID practices........

Total area of IC disconnected by campus LID practices............................
“LID Cluster” subdivision

- 12 lots clustered on 6.9 acres
- Designed to minimize site runoff
CT land cover change: 1985 - 2010
Storm Frequency Analysis

- Calculated from past data for a measurement location

- Sort and rank precipitation data, highest to lowest

- Return period (T) =

Where n=the total number
m=rank of that value
http://bcove.me/2lspa5ig
Buffers help, but can’t do the whole job alone...
Uses of storm frequency values
Effects of Using Outdated TP-40 Values

http://precip.eas.cornell.edu/
Quiz Time!

Last year we had a 100-year storm (8 inches of rain in a 24 hour period). What are the chances that we will have another 100-year storm this year?

A. 0.1%
B. 1%
C. 10%
D. 50%
Figure 10: Graph showing the average annual precipitation from 1900-2007 for the eleven long-term stations in the Northeast. The trend line shows an increase in the average annual precipitation since 1900.