



What Do We Know About Our Places?

Surface Water Quality



Assessing System Health at Municipal Scale

Building Energy Use



Risks and Opportunities at the Building Scale

Walkability



Looking at the Effect of Development on Communities

Contaminated Sites



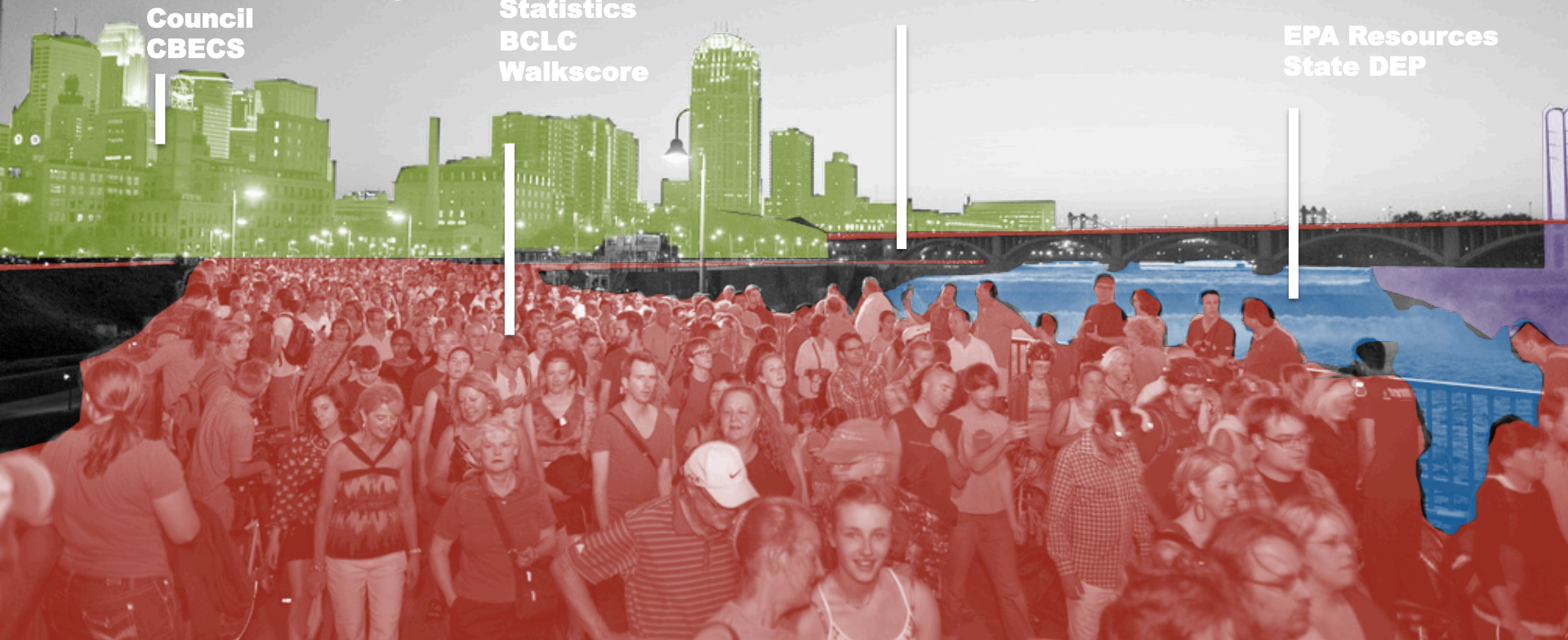
Understanding Community Scale Risks and Opportunities

**Energy Information
Agency
US Department of
Energy
US Green Building
Council
CBECS**

**US Census
Bureau of Labor
Statistics
BCLC
Walkscore**

**State Dept. of
Environment
US Env. Protection
Agency
US Geological Survey**

**EPA Resources
State DEP**



**North America has a wealth of publicly held data
on energy, water, ecosystems, and
demographics.**

The Big Point !

The Hazards are Real
They are Here, Now

Let's Plan,
Rather Than React

Tropical Storm Irene slams New England



BUILDING RESILIENCE IN BOSTON

"Best Practices" for Climate Change Adaptation and
Resilience for Existing Buildings

<http://www.linneansolutions.com/downloads>



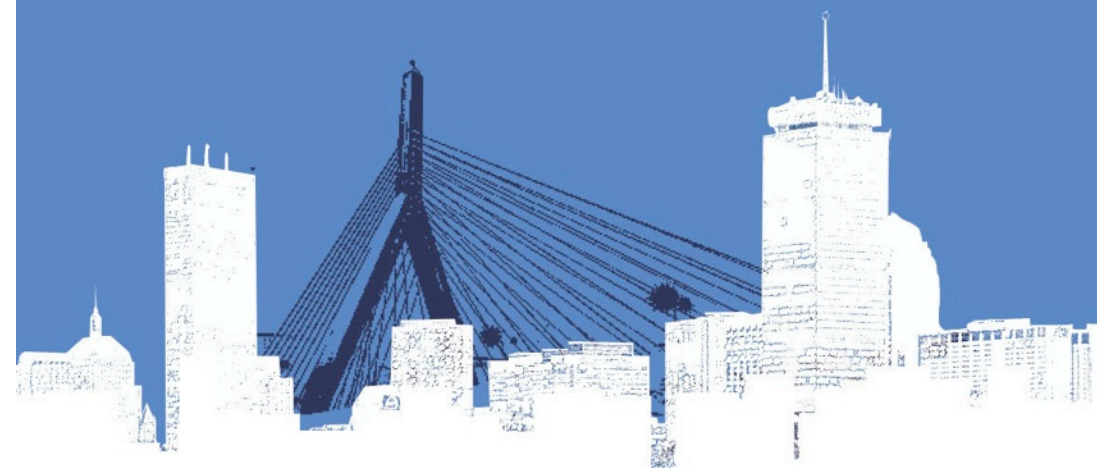
RESILIENT DESIGN
I N S T I T U T E

Community Energy and Resilience

May 20, 2014

Jim Newman

Linnean Solutions



Prepared By:

Linnean Solutions | The Built Environment Coalition | The Resilient Design Institute

Structure of the Report

- *Section 1* is a look at the context of Boston, for buildings, community, and ecosystems, with a focus on the existing building stock of Boston and known hazards.
- **Section 2** describes the key references for the study and resources that were the most helpful.
- **Section 3** lists strategies for improving the resilience of existing buildings. These are presented as 'tear sheets' or key take-aways with references to specific instructions.
- **Section 4** surveys municipal strategies that other cities and municipalities have implemented for enhancing resilience.
- *Section 5* outlines potential next steps. The appendices provide reference material.

Context

Key References

Strategies for Building
Owners

Strategies for the City

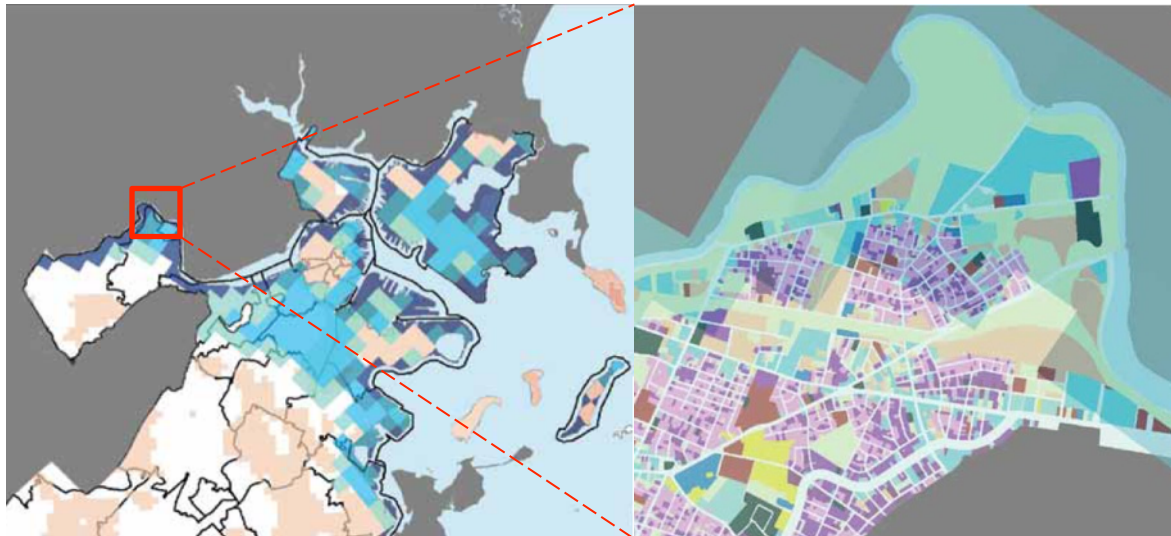
Next Steps



Multi Hazard Approach

- **Flooding Potential** (Elevation data, MassGIS),
- **Hurricane Models** (NOAA),
- **Wind Power classes** (NREL),
- **Impervious Surface** (Mass GIS),
- **Vulnerable Buildings** (Tax Assessors Database and parcel data - City of Boston),
- **Vulnerable Populations** (Census, MassGIS)

Flooding (blue color) combined with Wind Hazards (tan color) in Boston



Allston Buildings Vulnerable to Flooding

*Compared to the State plan, the Boston Hazard Mitigation Plan uses a condensed list of hazards, and identifies **floods and winter storms** as the hazards with expected high frequency, with **hurricanes, severe storms, tornados, and brush fires** with an expected medium frequency.*



Municipal Strategies

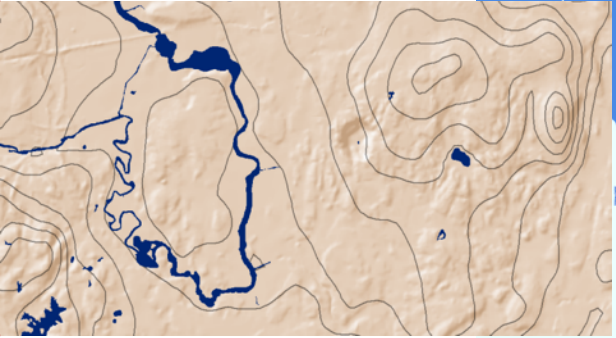
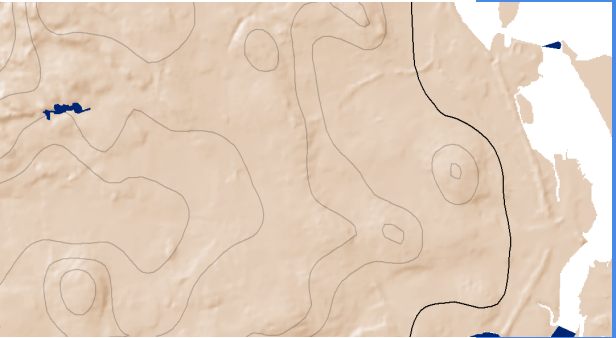
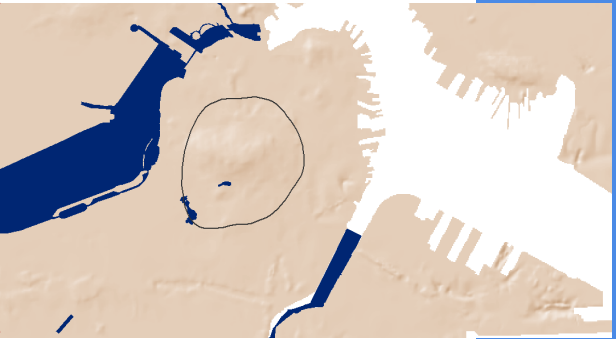
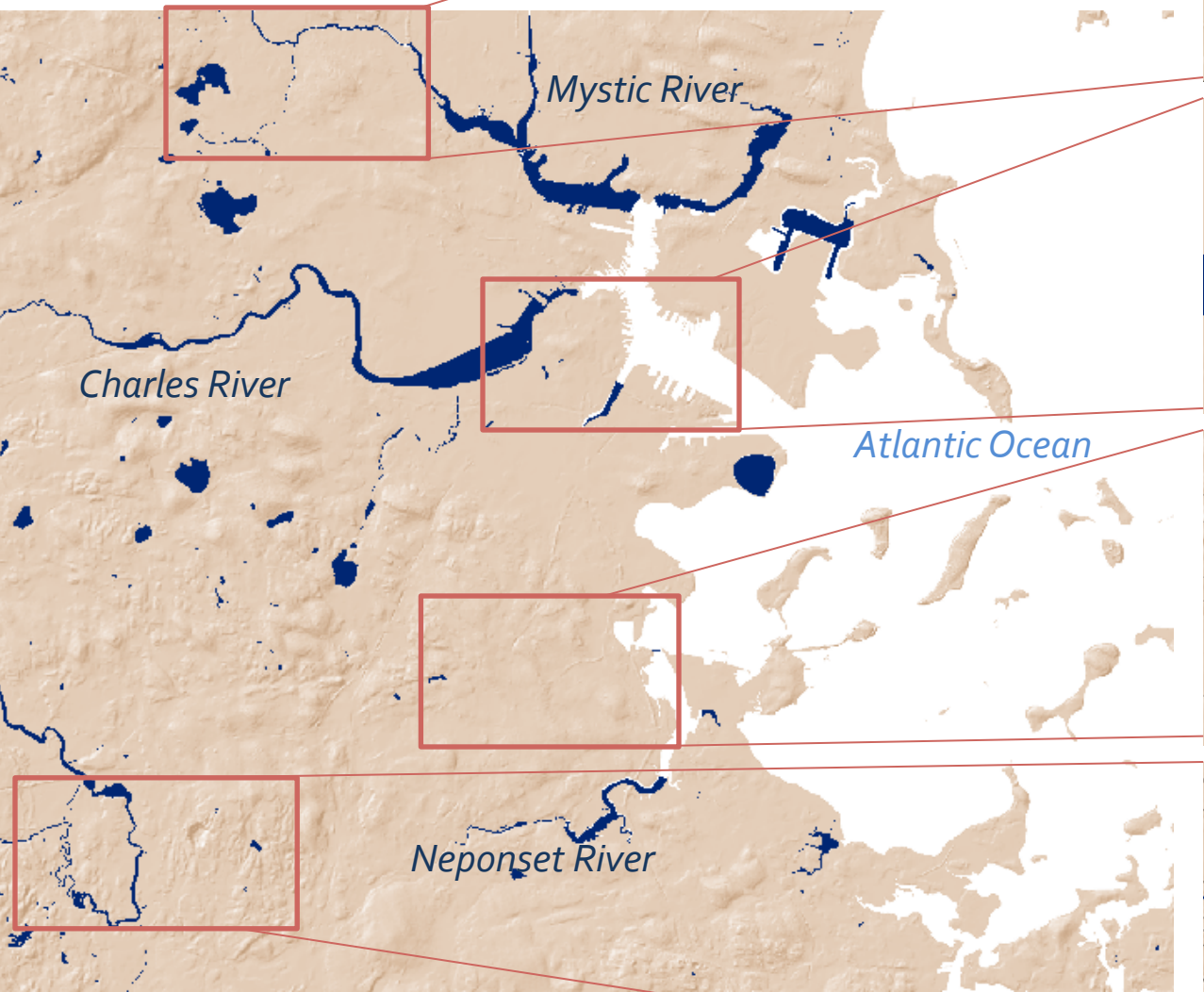
- **Municipal Actions – Taking the Lead**
- **Mandatory Building Retrofits**
- **Mandatory Actions (Building Codes) for New Construction or Major Renovations**
- **Incentives for Voluntary Action**
- **Financing Mechanisms and Grants to Facilitate Voluntary Actions**
- **Education and Outreach Efforts**

List of municipal strategies that have been implemented in cities and municipalities around the US and the world.



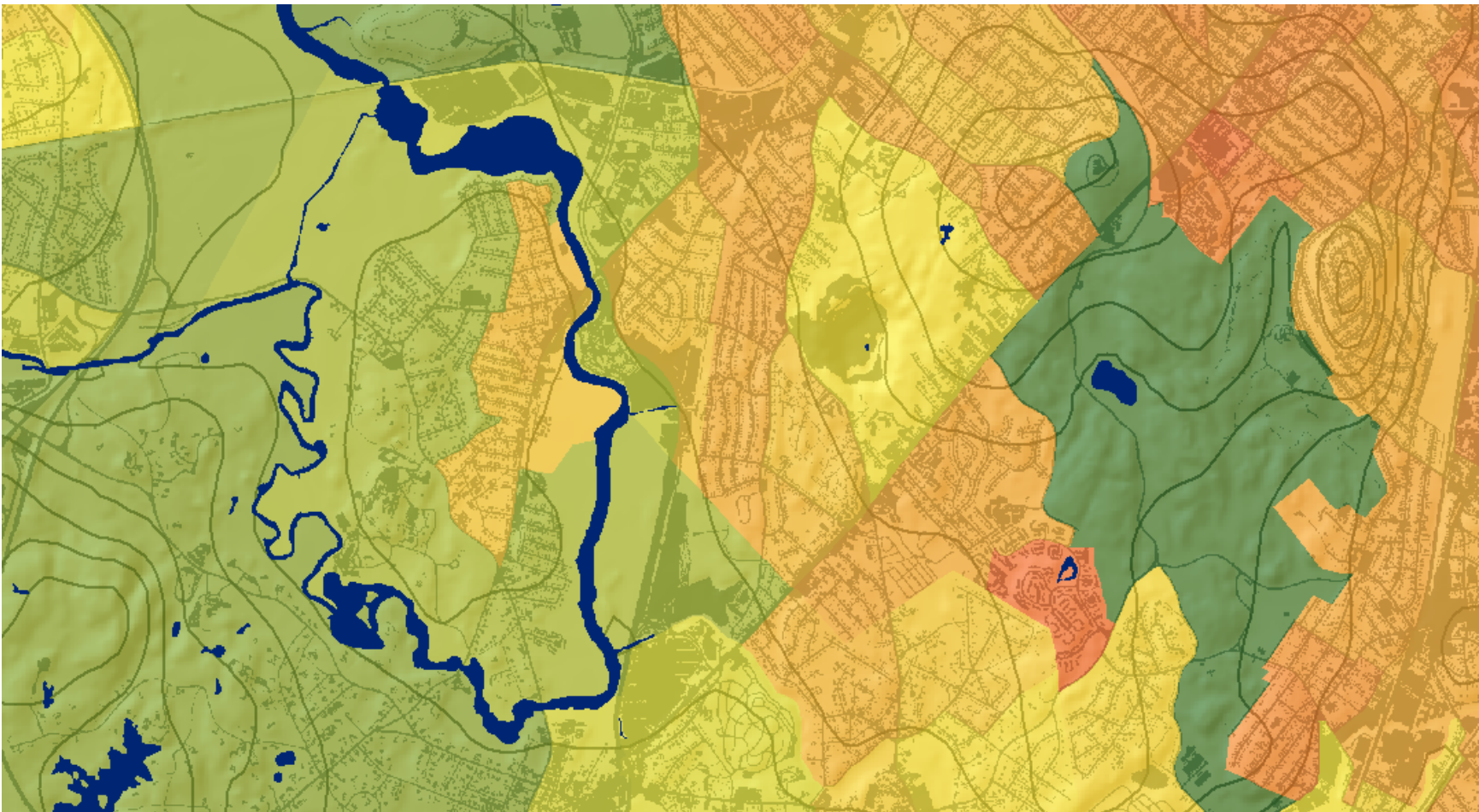
Each Area has Unique Characteristics

Greater Boston Area



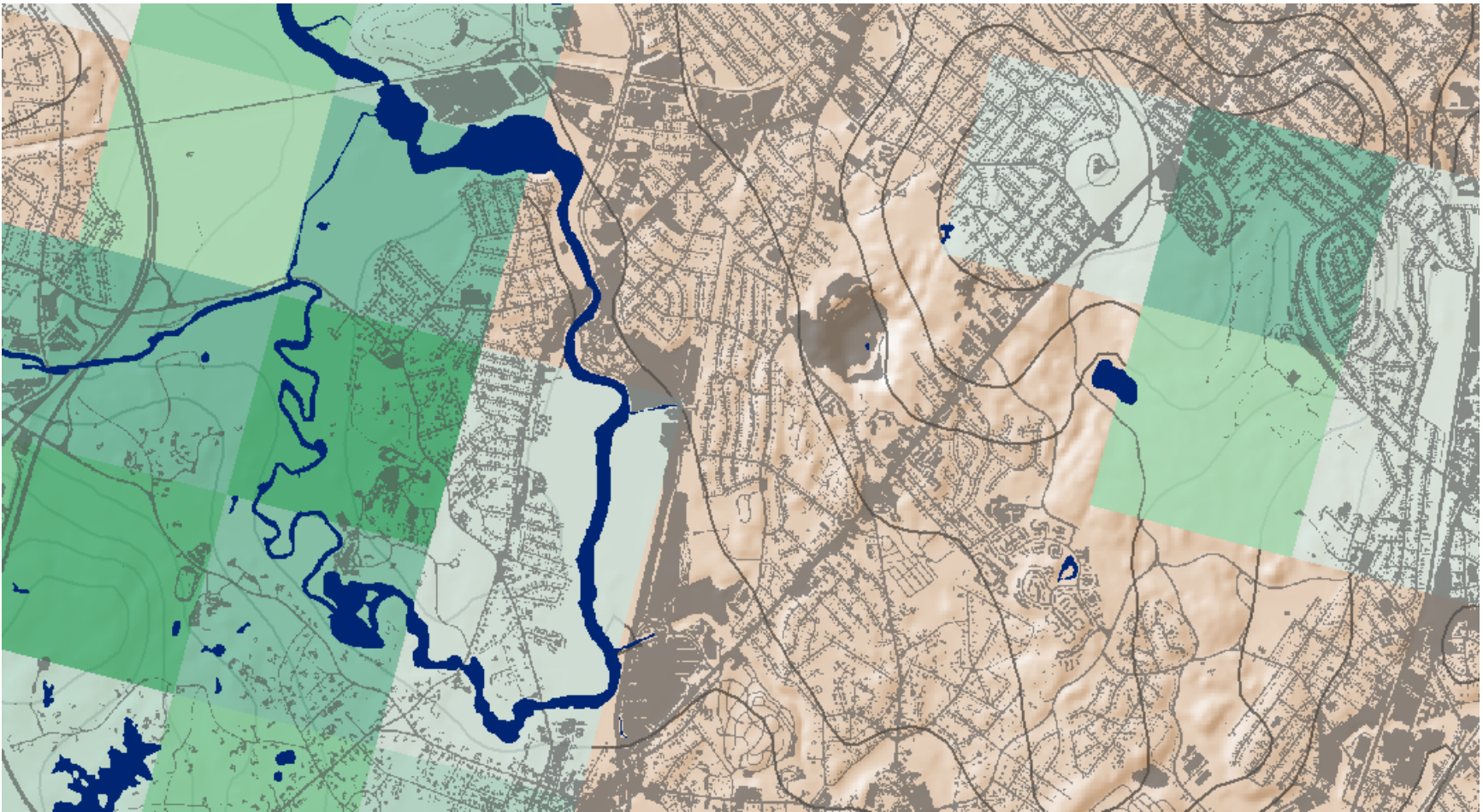
Population Density

Census Data

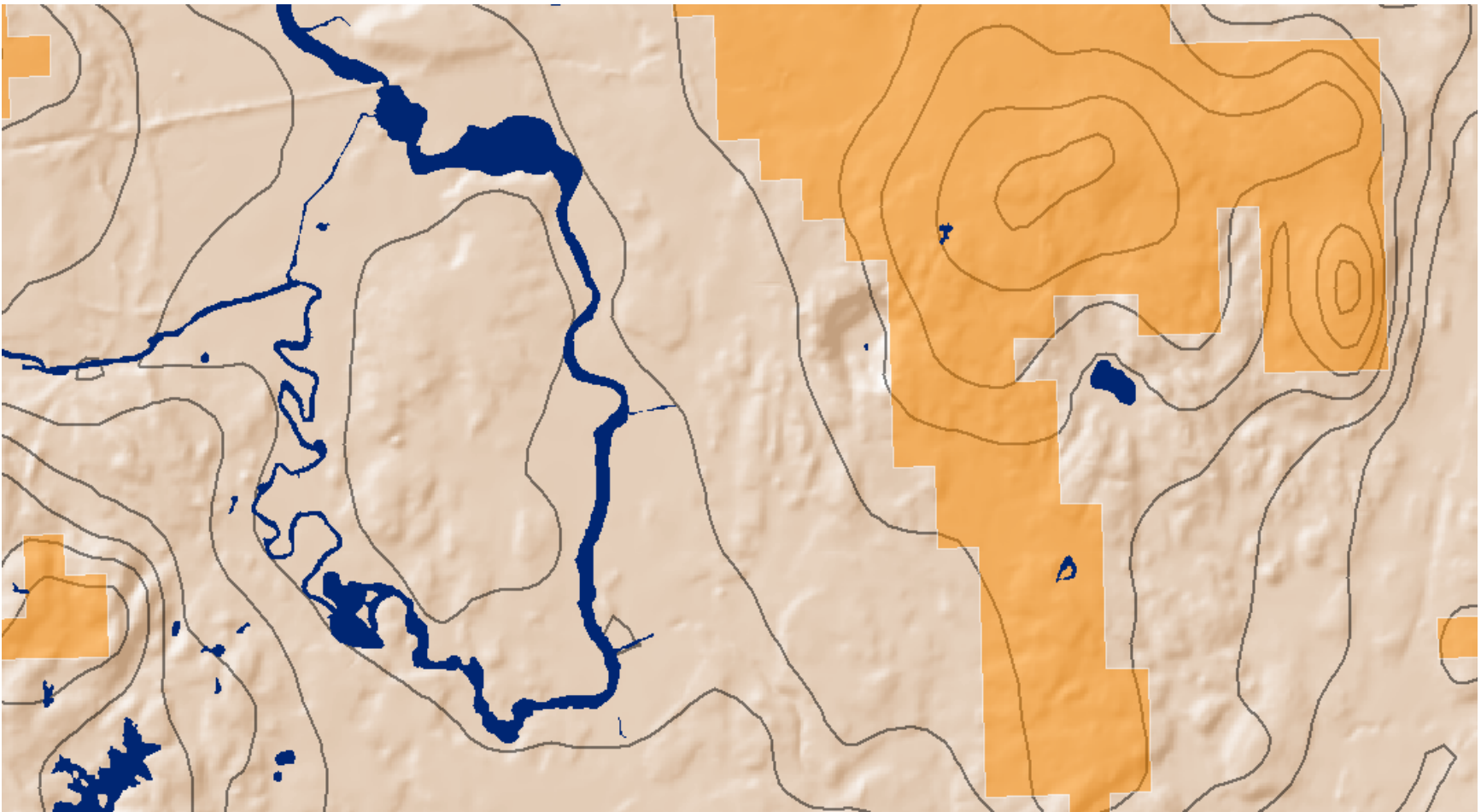


Heat Island Effect

Deadliest Hazard for US Urban Areas!

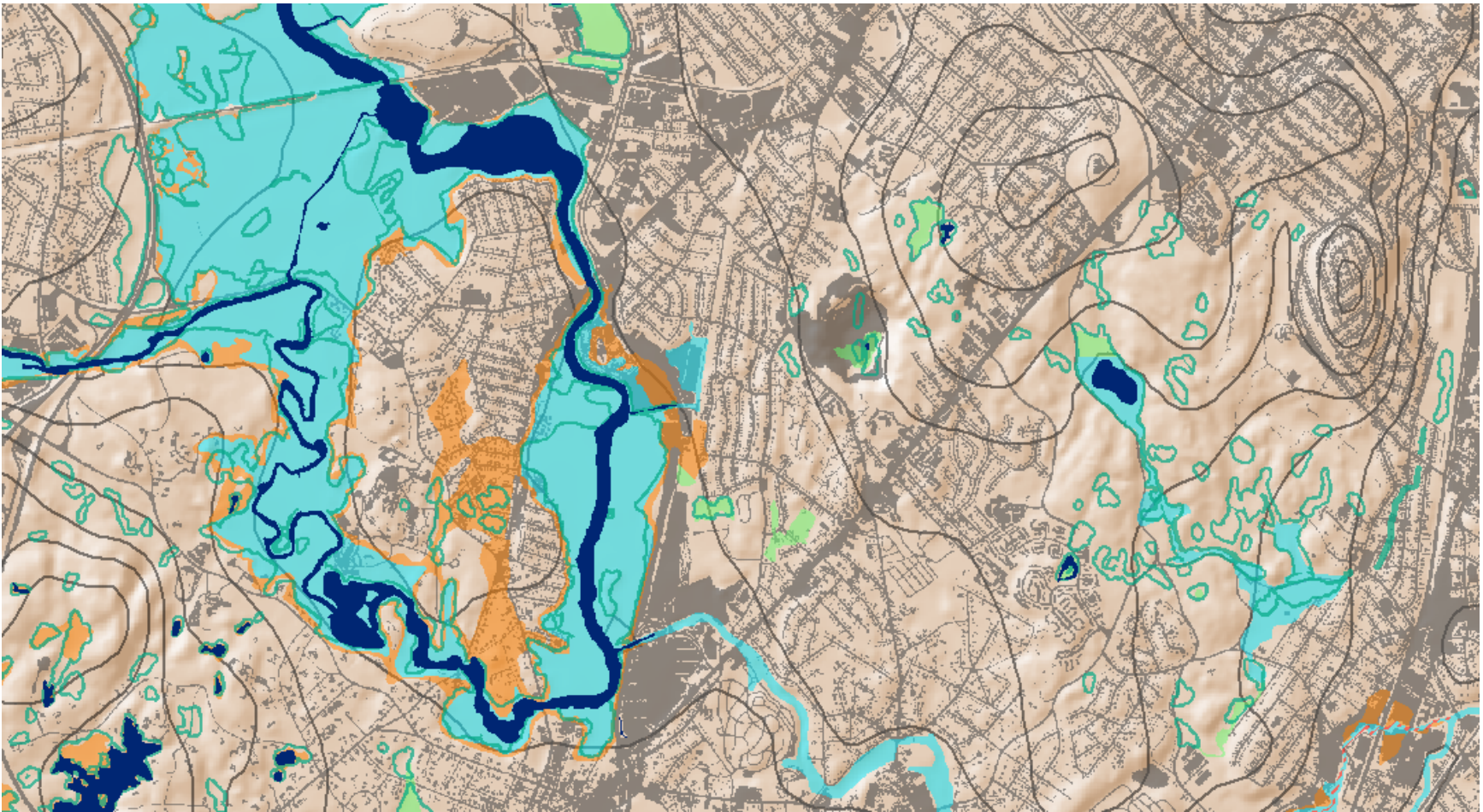


High Wind Hazard Areas

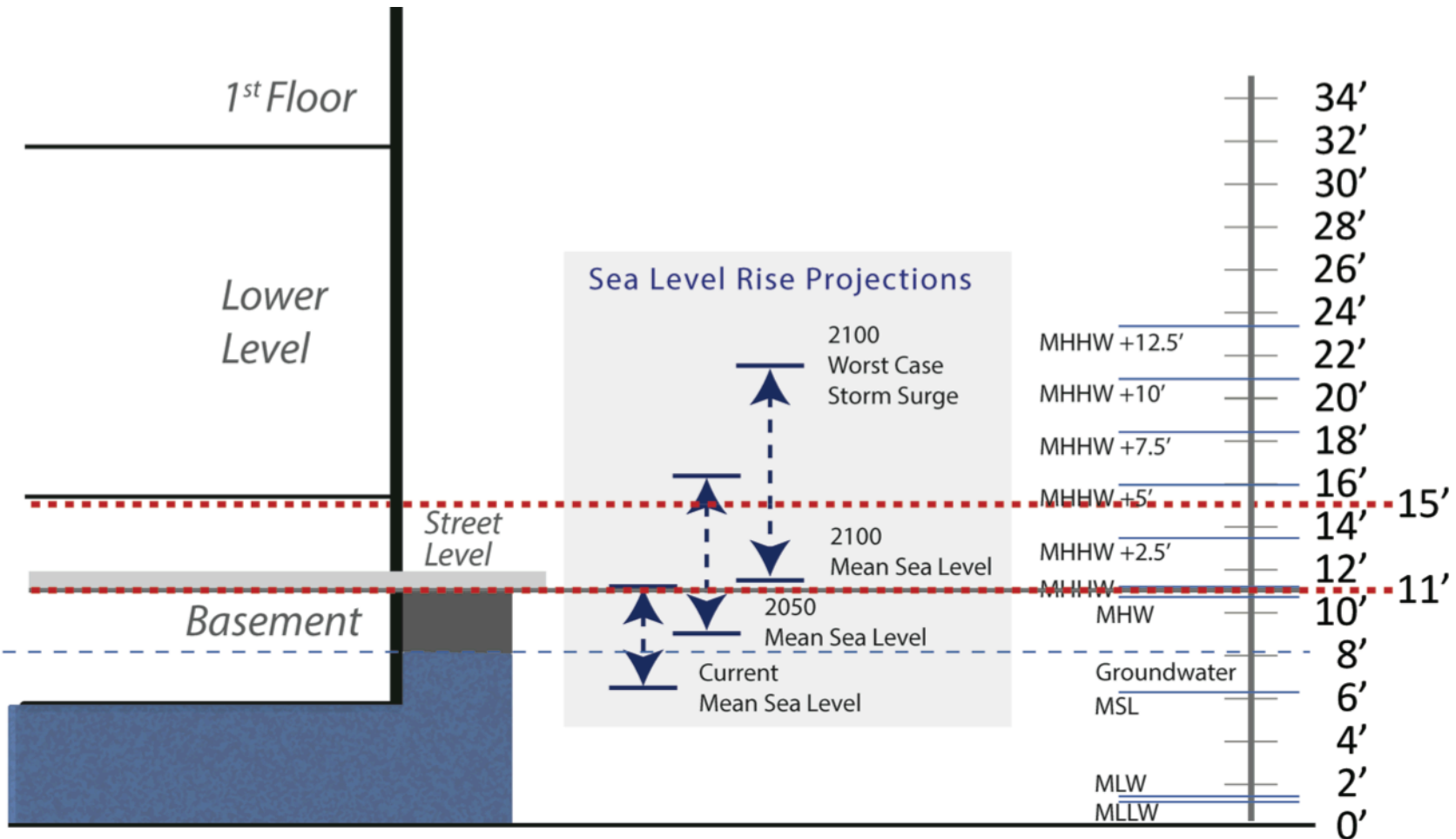


FEMA Flood Maps

Riverine & Local Intense Precipitation Flooding



Flooding Scenarios & Building Vulnerability



Flooding Scenarios & Building Vulnerability



Transformer and switch gear on the street

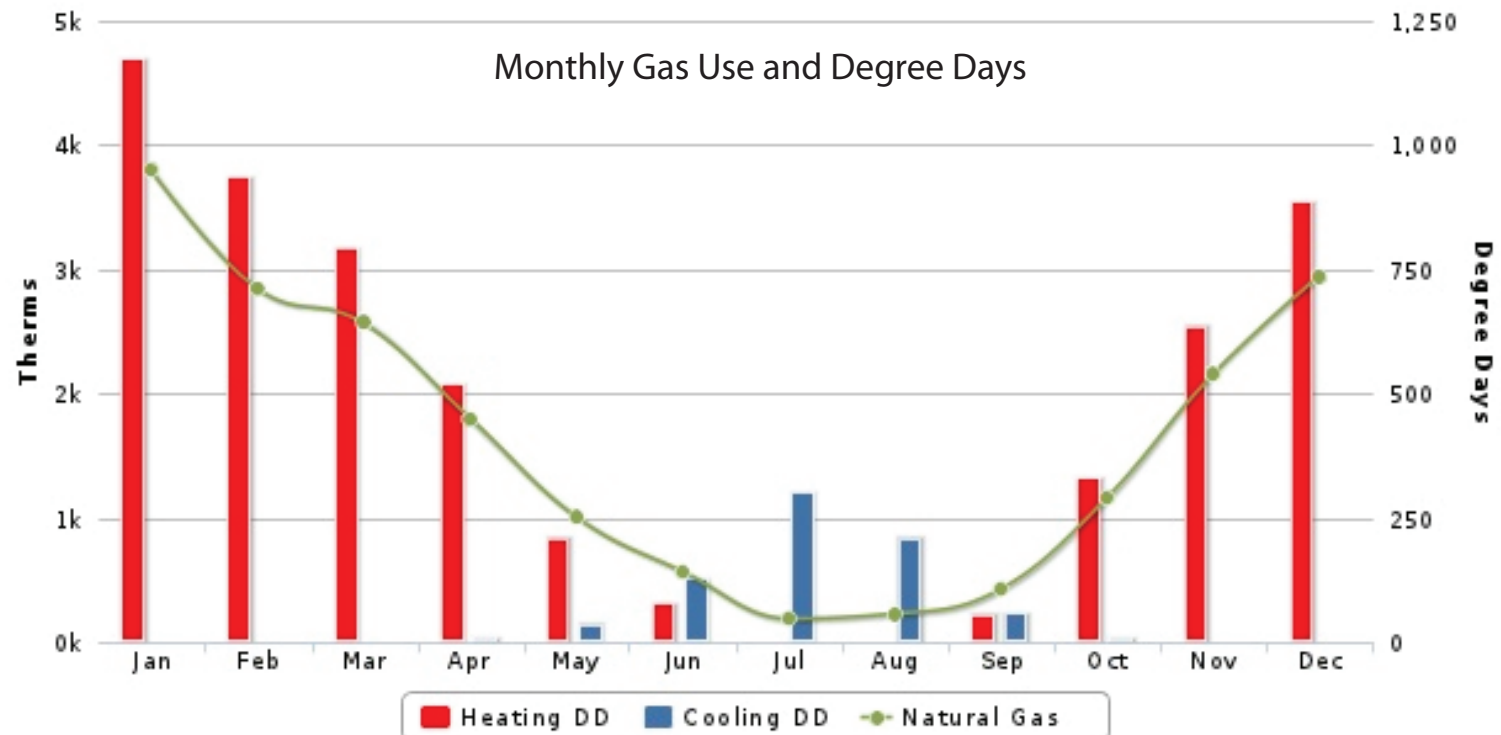


Electrical panels in the building basement



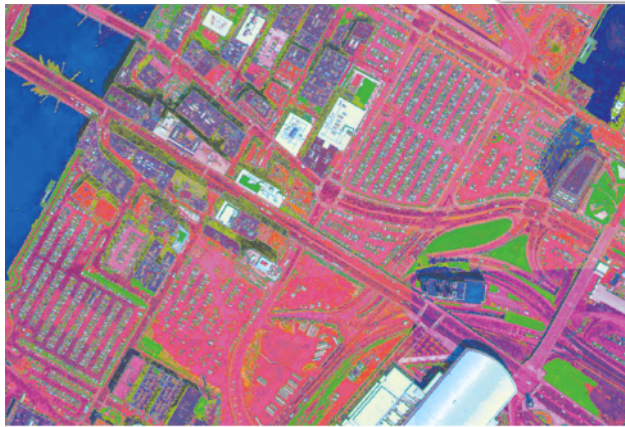
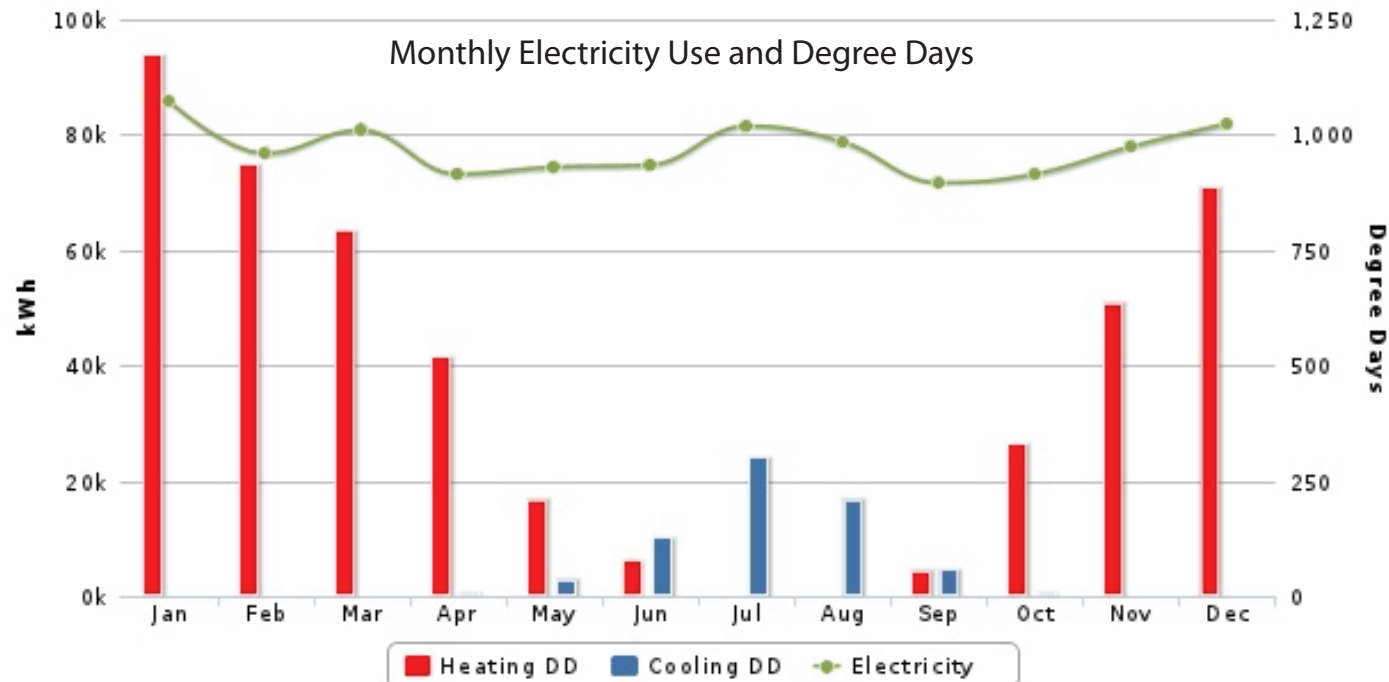
Energy Demand - Cold Weather

Heating Demand



Energy Demand - Hot Weather

Electricity Demand



Decentralized Local Power Production

Load Reduction and Added Back-up Power

A New Combined Heat and Power Plant

75 Kwh electricity output
5.2 Kbtu/hour heat output
Weight: 3,100 lbs

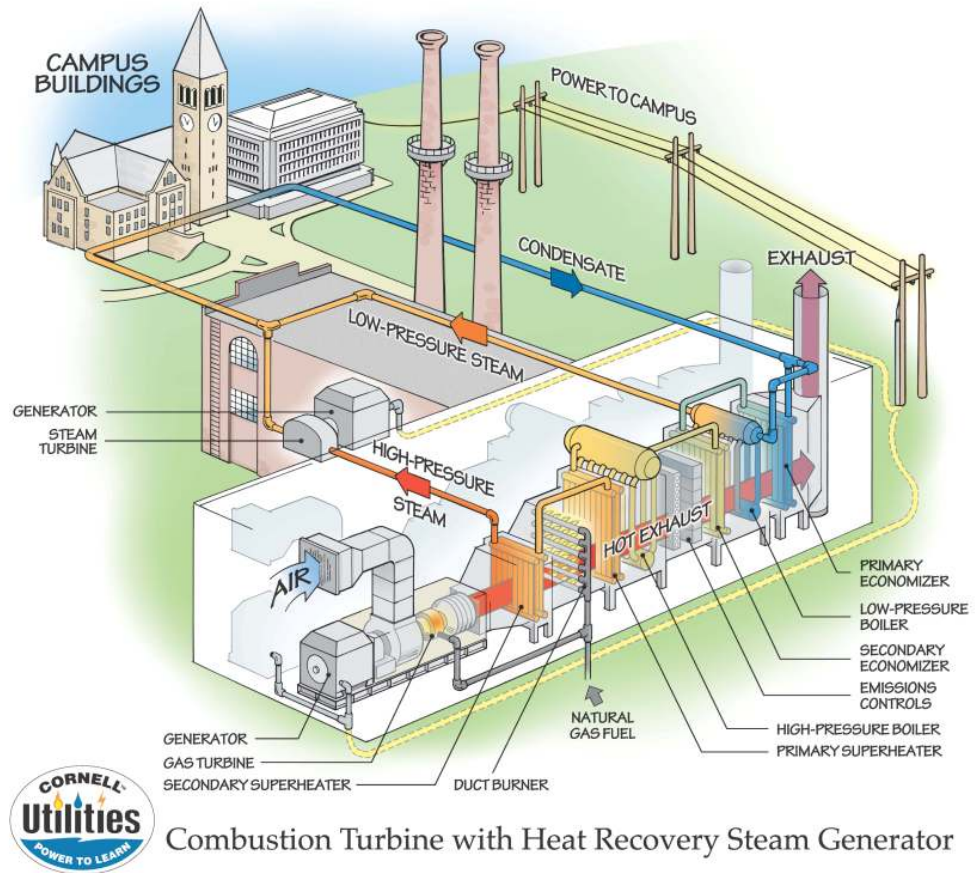
A CHP plant on the roof would provide extra emergency power, electrical power to the building when in use that would both reduce overall demand charges and reduce charges, and provide heat to the upper floors of the building at a very low cost.



Decentralized Local Power Production

Campus-Scale Combined Heat and Power

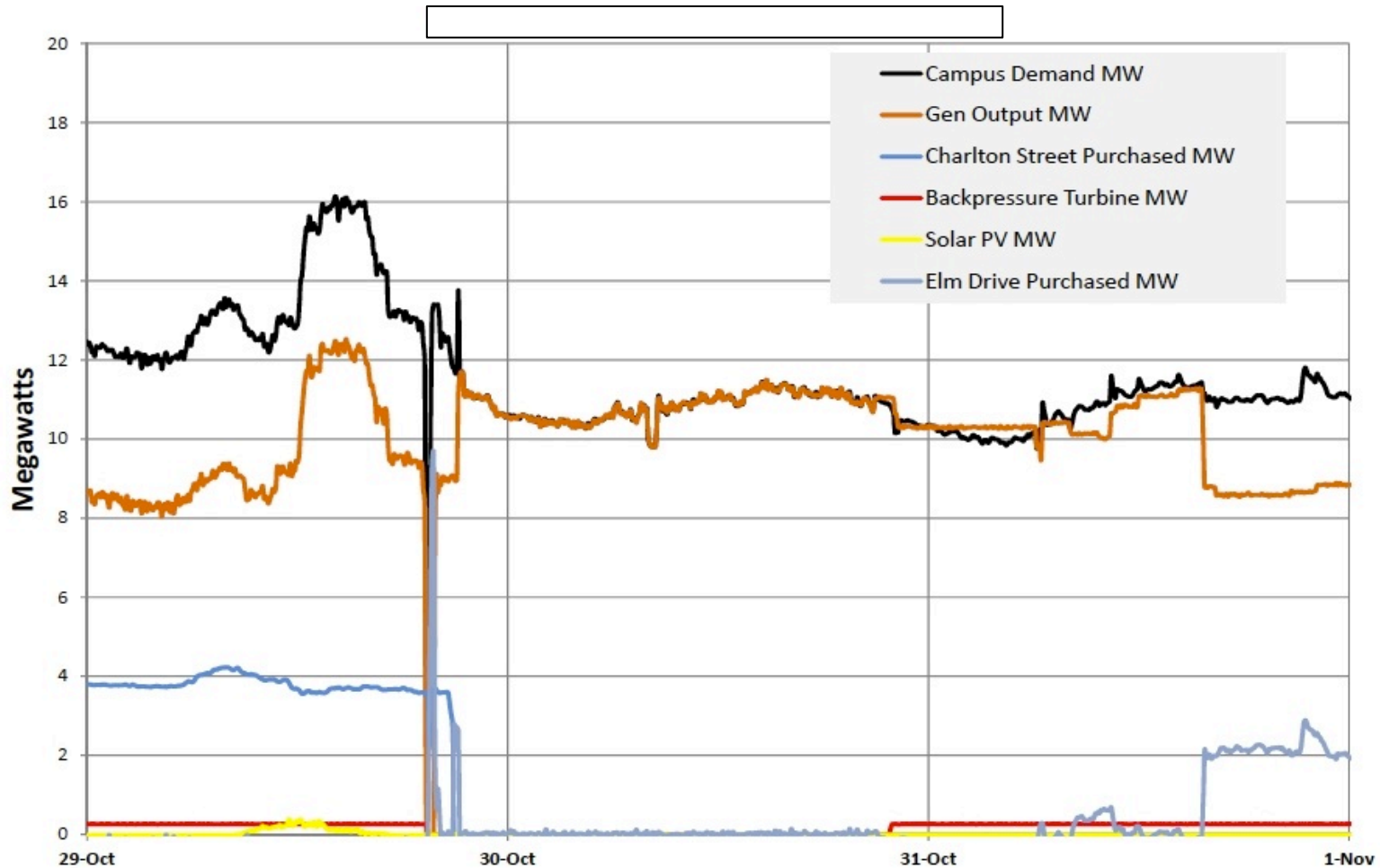
- Two 15 MW combustion turbines coupled with heat-recovery steam generators
- Natural-gas-fired
- Provides majority of campus power
- 25 miles of piping
- Heat to 150 bldgs.
- 80% combined efficiency
- Full islanding capability if regional grid goes down



Cornell Combined Heat & Power Plant
graphic: Cornell University

Decentralized Local Power Production

Campus-Scale Combined Heat and Power



40 MW CHP plant that typically supplies all of the heat and hot water and half its electricity

- Thomas Nyquist, P.E., Princeton University



Municipal Strategies

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Listed municipal strategies have been implemented in cities and municipalities around the US and the world.



Municipal Strategies

Portfolio Example

Mandatory Building Retrofit

- Energy/Water Conservation. Chico, CA

Mandatory actions for new construction or major renovations

- Water Conservation. Dekalb County, GA

Incentives for Voluntary Actions

- Tiered pricing for water. Austin, TX

Financing mechanisms and grants to facilitate voluntary actions

- Direct payment for lawn conservation. Las Vegas, NV

Education and Outreach efforts

- Extreme heat alert program. Toronto, Ontario.

Cross cutting strategies

Dekalb County's Inefficient Plumbing Fixture Replacement Plan went into effect in 2008 and requires that pre-1993 toilets, showerheads, and other plumbing fixtures be replaced when a property is sold.



Next Steps

Help Building Owners Act Now

- Create Building-Type Specific Collections of Strategies
- Create Neighborhood-by-Neighborhood Mapping of Hazards and Building Types



Next Steps

Supporting the Municipality

- Define Portfolios of Municipal Strategies to Meet Local Hazards and Needs
- Help Provide Support for Key City Actions
- Help to Convene Stakeholders to Consider Infrastructure Needs

