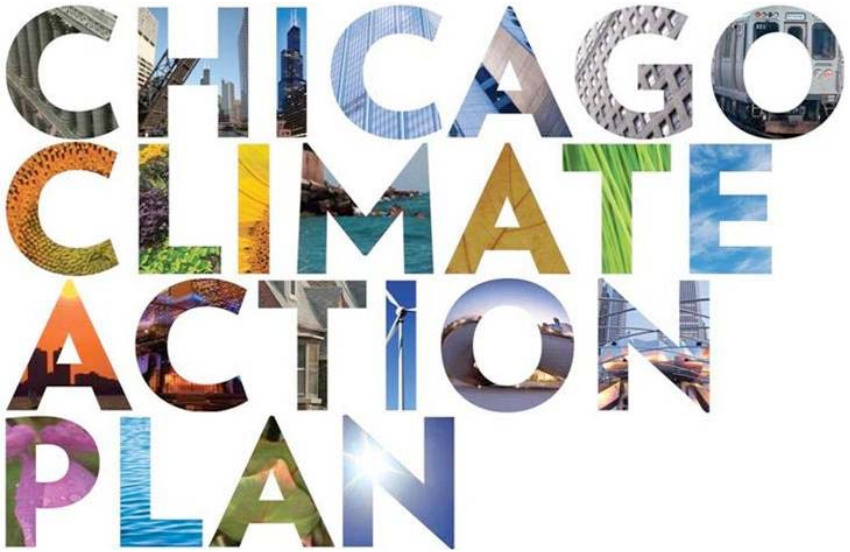
Models for Adapting to Climate Change Impacts in Cities

New Partners for Smart Growth
Annual Conference
Thursday, February 4, 2010



Chicago Department of Environment

Global Philanthropy Partnership

Global Climate Change in Chicago

Unprecedented challenge …

Unprecedented opportunity …

We are having an impact.

Chicago Climate Action Plan

Implementation Commenced
Reducing Emissions & Adapting
Grounded in Research

Funding Sources

- Chicago Community Trust
- Clinton Foundation, Clinton Climate Initiative
- Grand Victoria Foundation
- Illinois Department of Commerce and Economic Opportunity
- Joyce Foundation
- Kresge Foundation
- Legacy Fund
- Lloyd A. Fry Foundation
- Nathan Cummings Foundation
- Surdna Foundation

Federal Stimulus Funds

▪ Energy Efficiency and Conservation Block Grant:	**$ 27,649,000**
• LED Traffic Signal Conversions	$ 7,300,000
• Streetlighting Energy Efficiency Upgrades	$ 6,500,000
• City Facility Parking Lot Lighting Conversion to LED	$ 750,000
• Residential Energy Efficiency Programs	$ 5,099,000
• City Facility Energy Upgrades	$ 8,000,000
▪ Chicago Area Alternative Fuels Deployment Project	**$ 14,999,650**
▪ Clean Diesel	**$ 1,337,500**
▪ CREATE	**$300,000,000**
▪ Deconstruction	**$ 8,000,000**
▪ Community Green Jobs	**$ 1,800,000**
▪ Green Job Work Experience & Job Training Program	**$ 5,625,000**
▪ Climate Communities	**$ 600,000**
▪ Urban & Community Forest Program	**$ 1,077,000**
▪ Plug-In Infrastructure	**$ 1,500,000**

Research Teams

University of Illinois

Don Wuebbles & Kathryn Hayhoe

Center for Neighborhood Technology

Jen McGraw, Peter Haas, Anne Evans, & Linda Young

Oliver Wyman

John Rogula & Craig Faris

MWH Global

Rik Lewis & Mark Wagstaff

Regional Economics Applications Laboratory

Greg Hewings

Implementation Strategy Consultants

Adrian Smith and Gordon Gill Architecture

A.T. Kearney

Bain

Boston Consulting Group

Environmental Law and Policy Center

The Field Museum

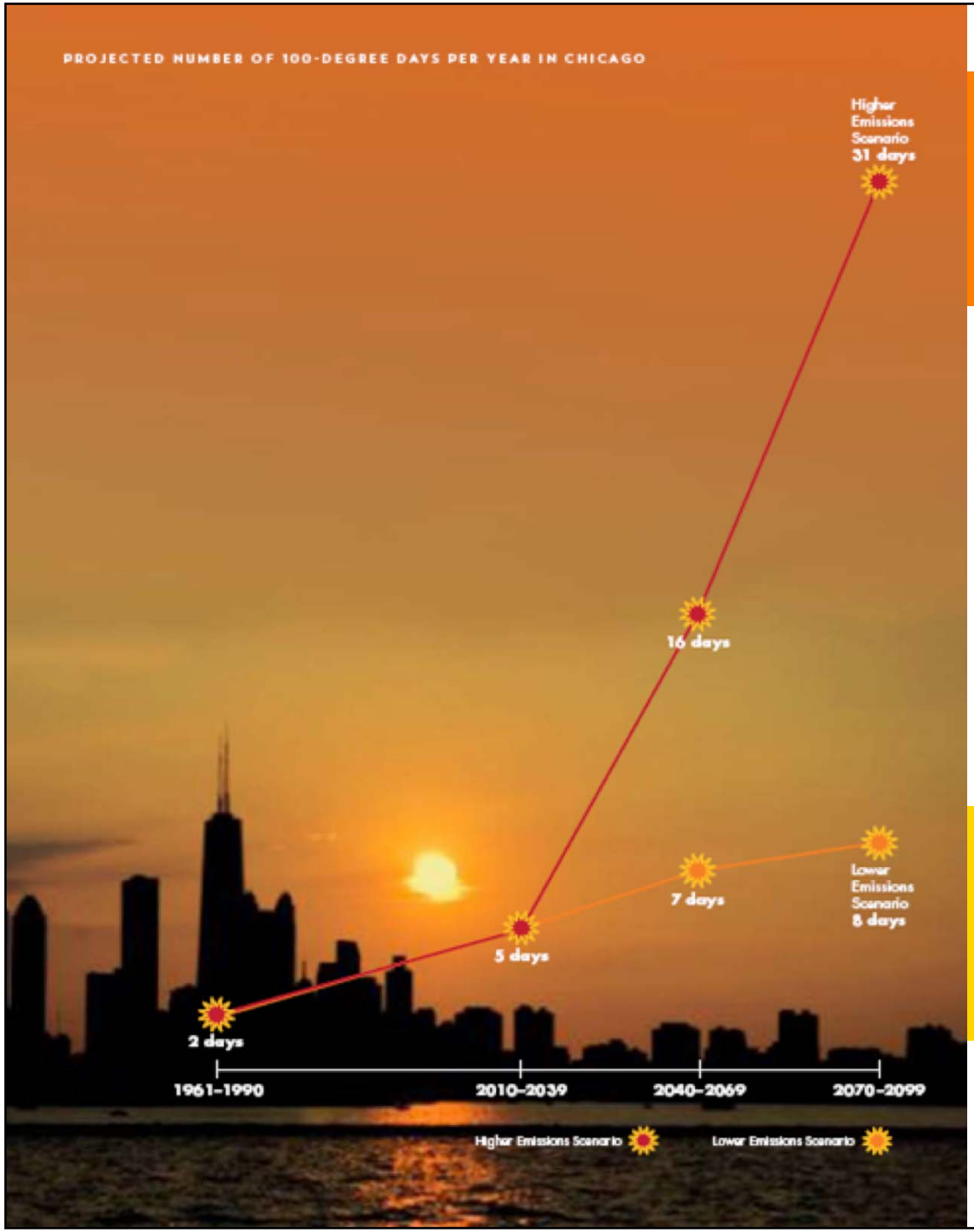
Global Philanthropy Partnership

Katzenbach/Booz

The "Cool 15" Accomplishments January 2008 – August 2009

- Retrofitted 13,500 Dwelling Units and 252 Commercial & Industrial Buildings for Energy Efficiency
- Traded 3,800 Refrigerators and Air Conditioners for Energy Efficient Appliances
- Permitted 200 Buildings to New Chicago Energy Code Since April 2009
- Required 1,200,000 sq. ft. of Green Roof Space Through Planned Developments
- Installed More Than Sixty Green Alleys and Green Streets
- Conserved Twenty Million Gallons of Water per Day
- Increased Chicago Transit Authority Ridership by 5%
- Added 636 New Car Share Vehicles to the Chicago Area
- Added 208 new hybrid buses to the Chicago Transit Authority fleet
- Sold 383,125 Gallons of Alternative Vehicle Fuel
- Decreased Single Family Waste Disposal by 11.5%
- Diverted 204,177 Tons of Waste from Landfills Through Waste to Profit Pairings
- Reduced 115,810 Tons of Greenhouse Gas Emissions Through Reduced Waste and Industrial Pollution
- Developing the Nation's Largest Urban Solar Power Plant
- Commenced Three Ground Source Heat Pump Projects

And Counting……



Higher Emissions:
31 days

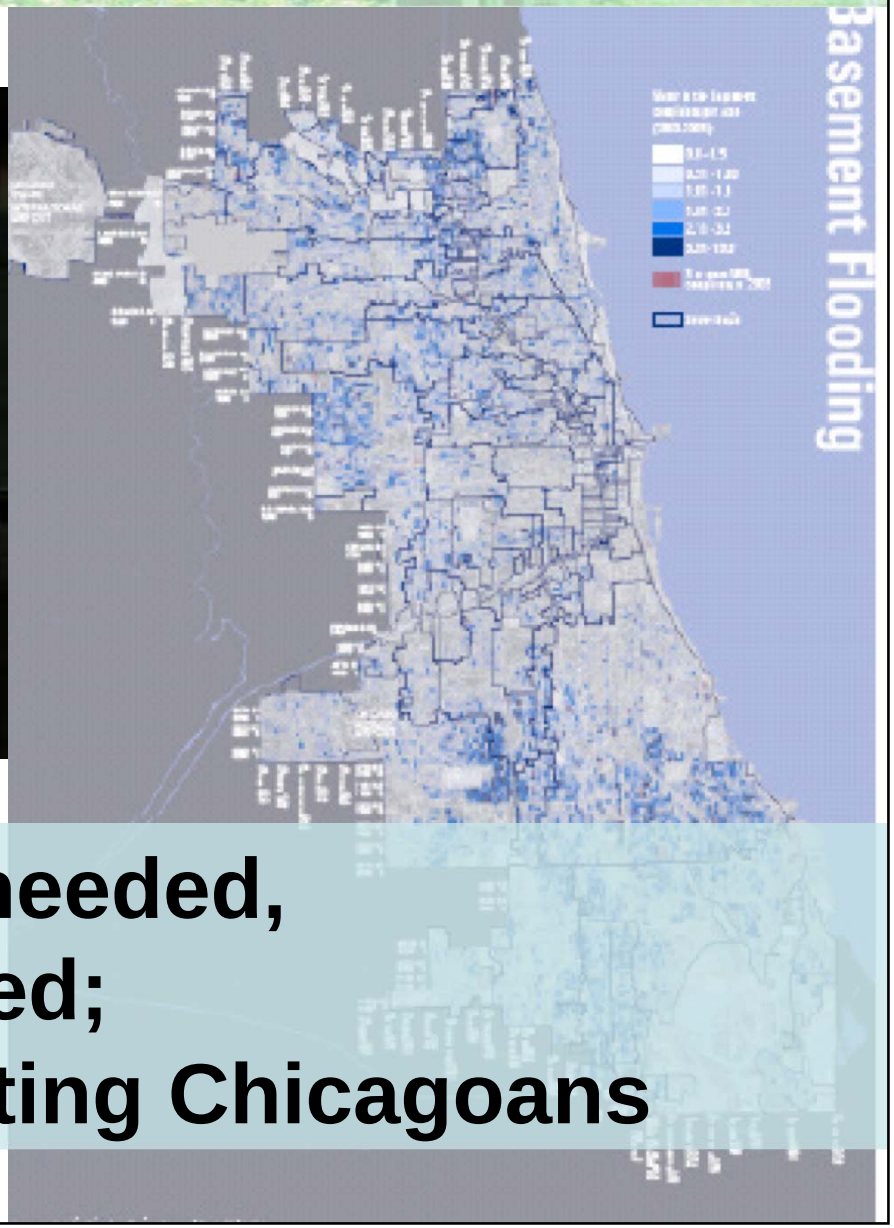
Projected number of 100-degree days per year in Chicago

Lower Emissions:
8 days

Climate Matters: Extreme Heat

Significant economic and health impacts

Climate Matters: Extreme Precipitation



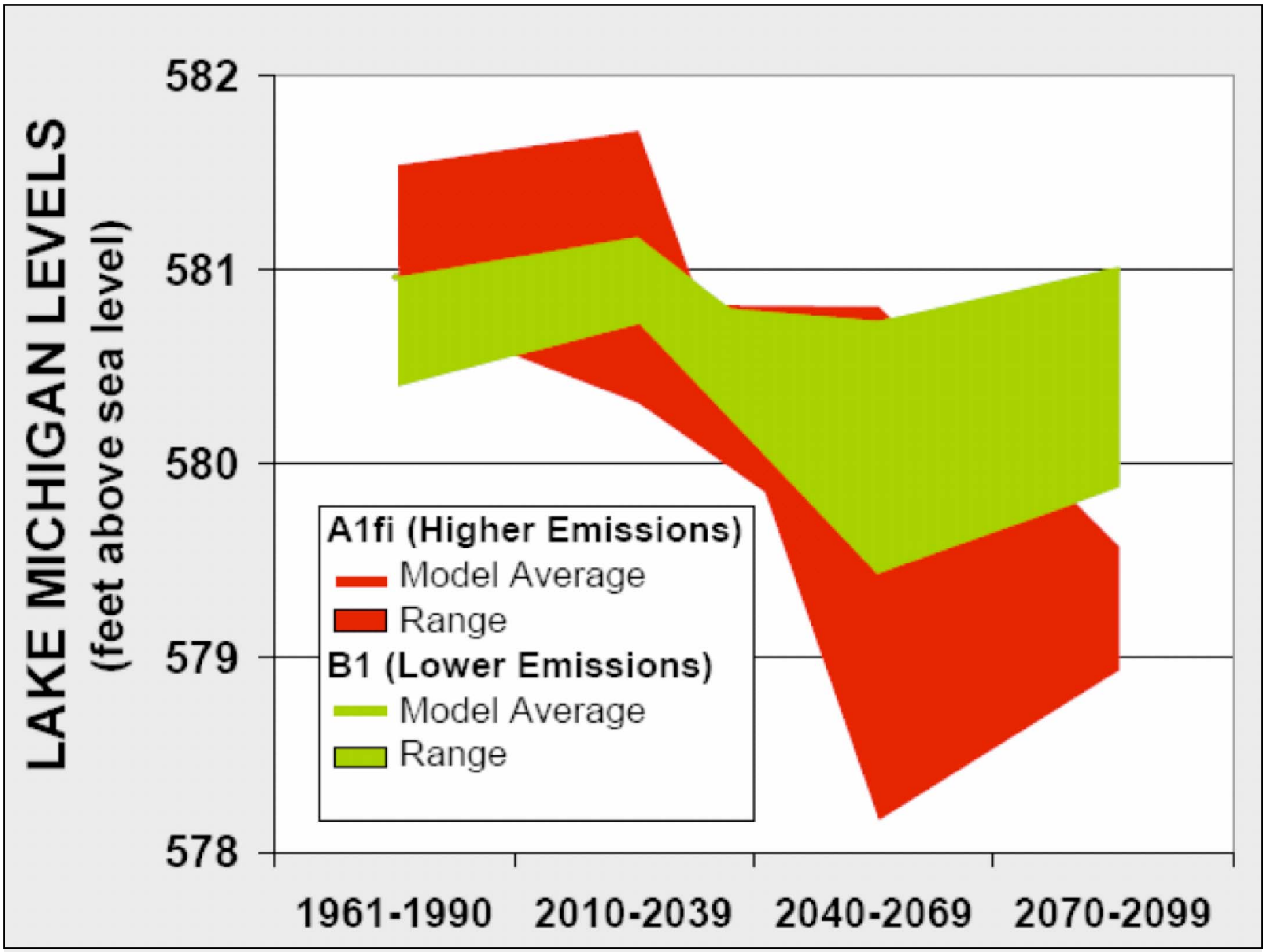
More rain when it is *not* needed,
less when it *is* needed;
adversely affecting Chicagoans

Climate Matters: Emergency Services

More heat emergencies…
More storms…More fires

Increased demand on first responders

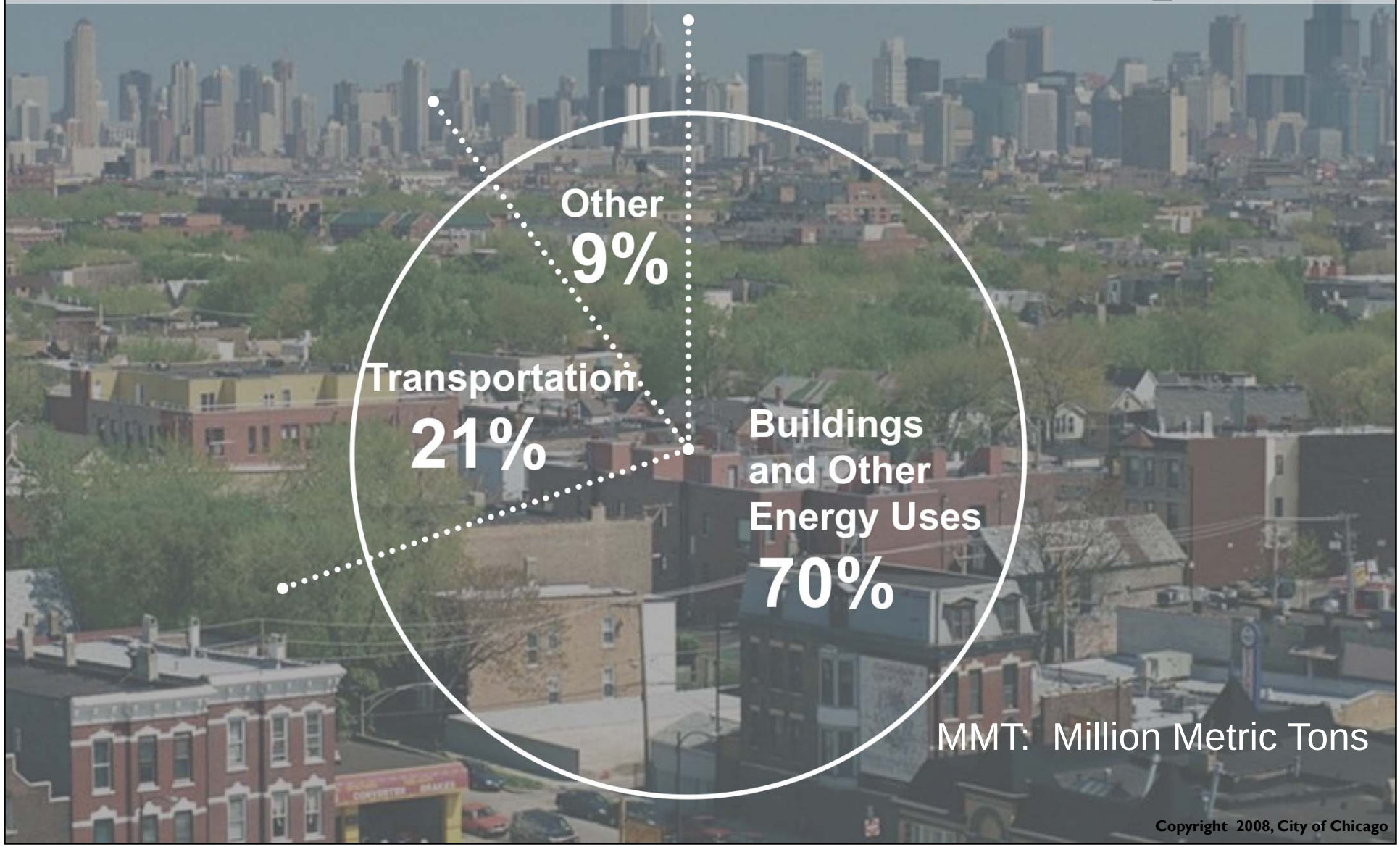
© Jean-Francois Brulotte
Barraclou.com
Chicago Fire Dept. EMS 43
Chicago,IL
May 3rd, 2006


LAKE MICHIGAN LEVELS
(feet above sea level)
582
581
580
579
578
1961-1990
2010-2039
2040-2069
2070-2099
A1fi (Higher Emissions)
Model Average
Range
B1 (Lower Emissions)
Model Average
Range


AP

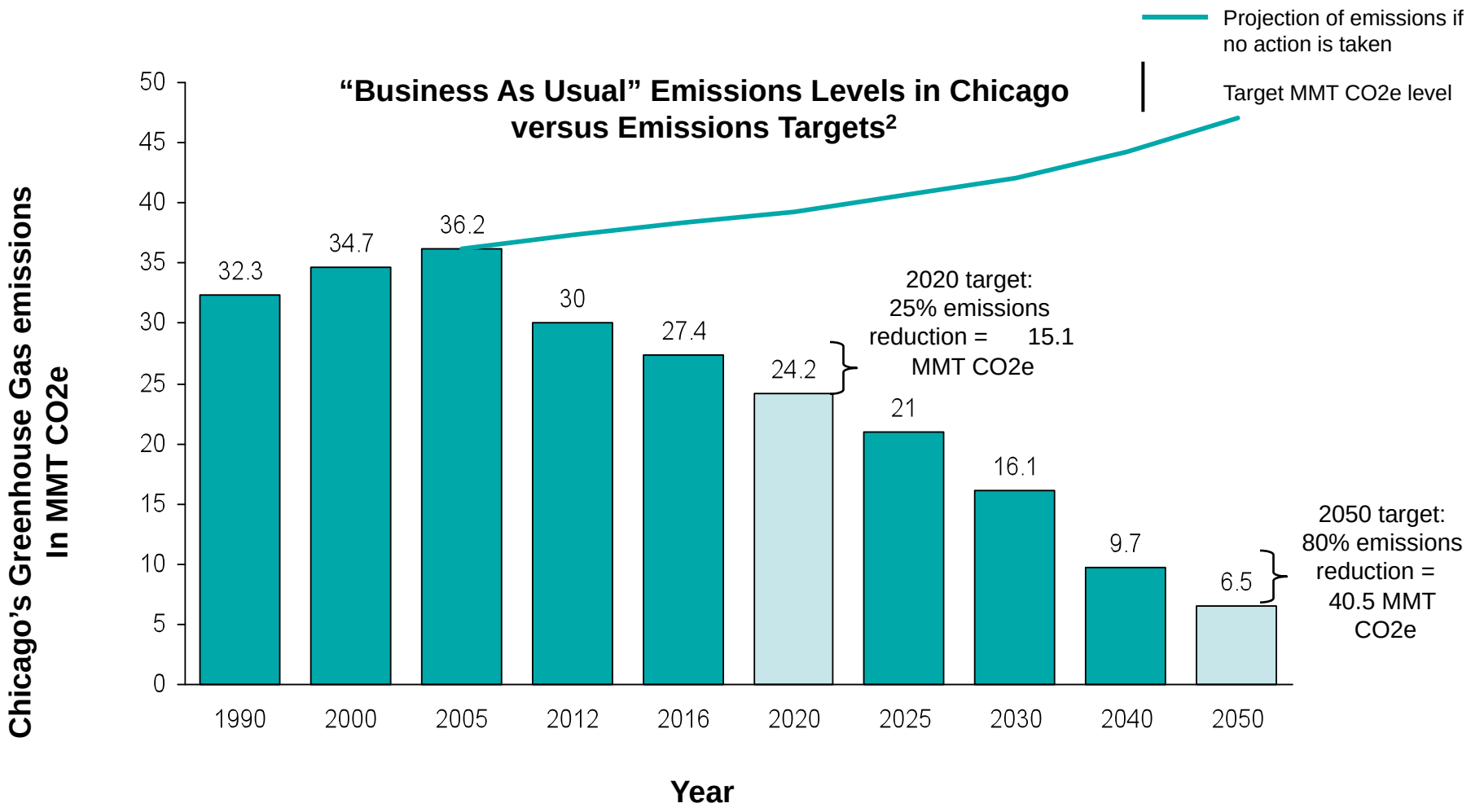
2000 Chicago Greenhouse Gas Emissions

Current Emissions: 34.6 MMTCO_2e

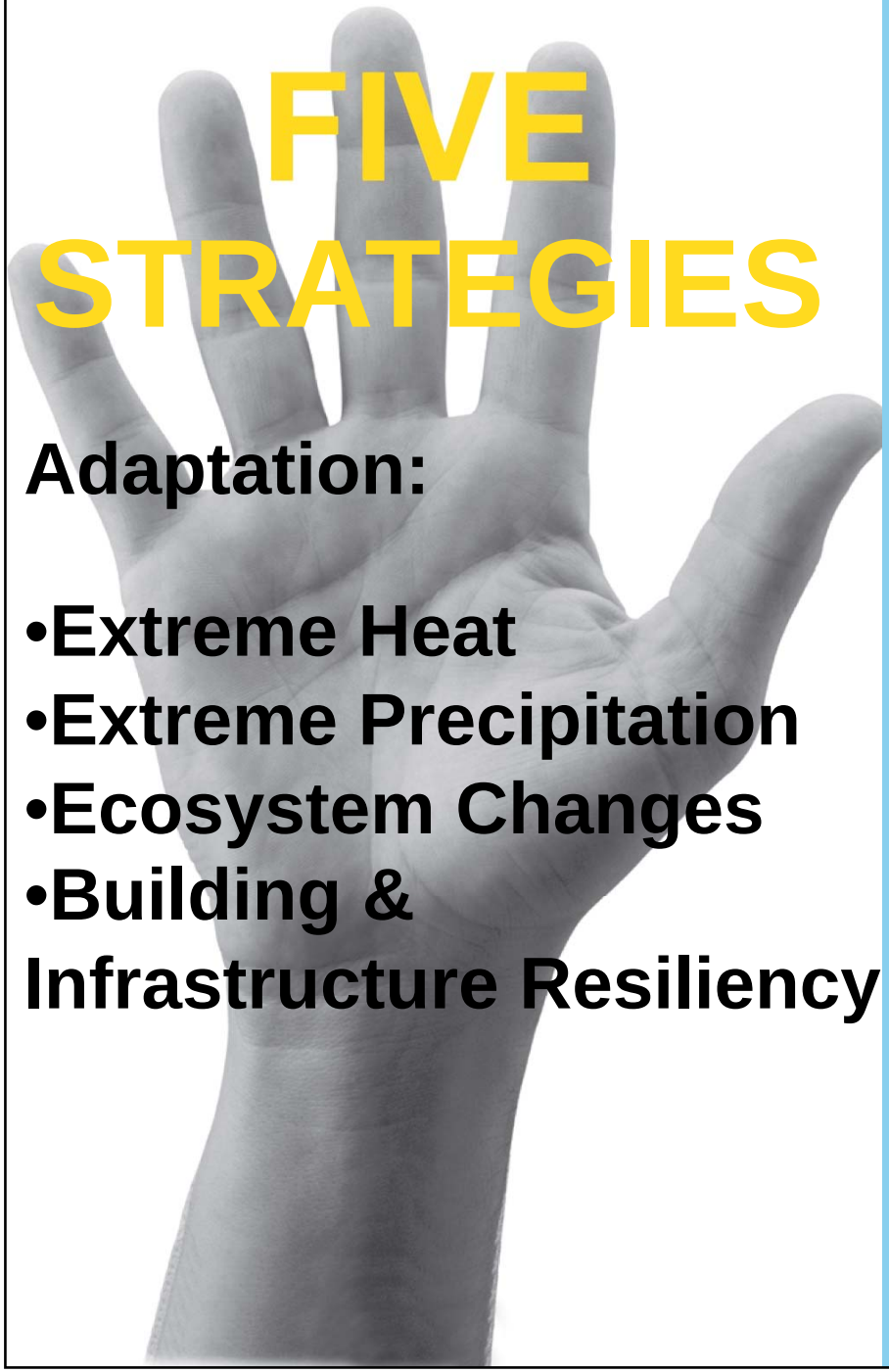


MMT: Million Metric Tons

Chicago's goal is to reduce city-wide emissions by 15.1 MMT CO2e by 2020 and 40.5 MMT CO2e by 2050



[1] MMT CO2e: Million Metric Tons Carbon Dioxide Equivalent. This is a standardized emissions metric that includes multiple greenhouse gases
[2] BAU represents the assumption that emissions growth rates continue based on reasonable predictions for population growth and energy use in the city
Source: CNT "An inventory, forecast, and mitigation analysis"



FIVE STRATEGIES

Adaptation:

- **Extreme Heat**
- **Extreme Precipitation**
- **Ecosystem Changes**
- **Building & Infrastructure Resiliency**

ADDRESSING THE CHALLENGE OF CLIMATE CHANGE

ENERGY EFFICIENT BUILDINGS
8 ACTIONS

CLEAN & RENEWABLE ENERGY SOURCES
5 ACTIONS

IMPROVED TRANSPORTATION OPTIONS
10 ACTIONS

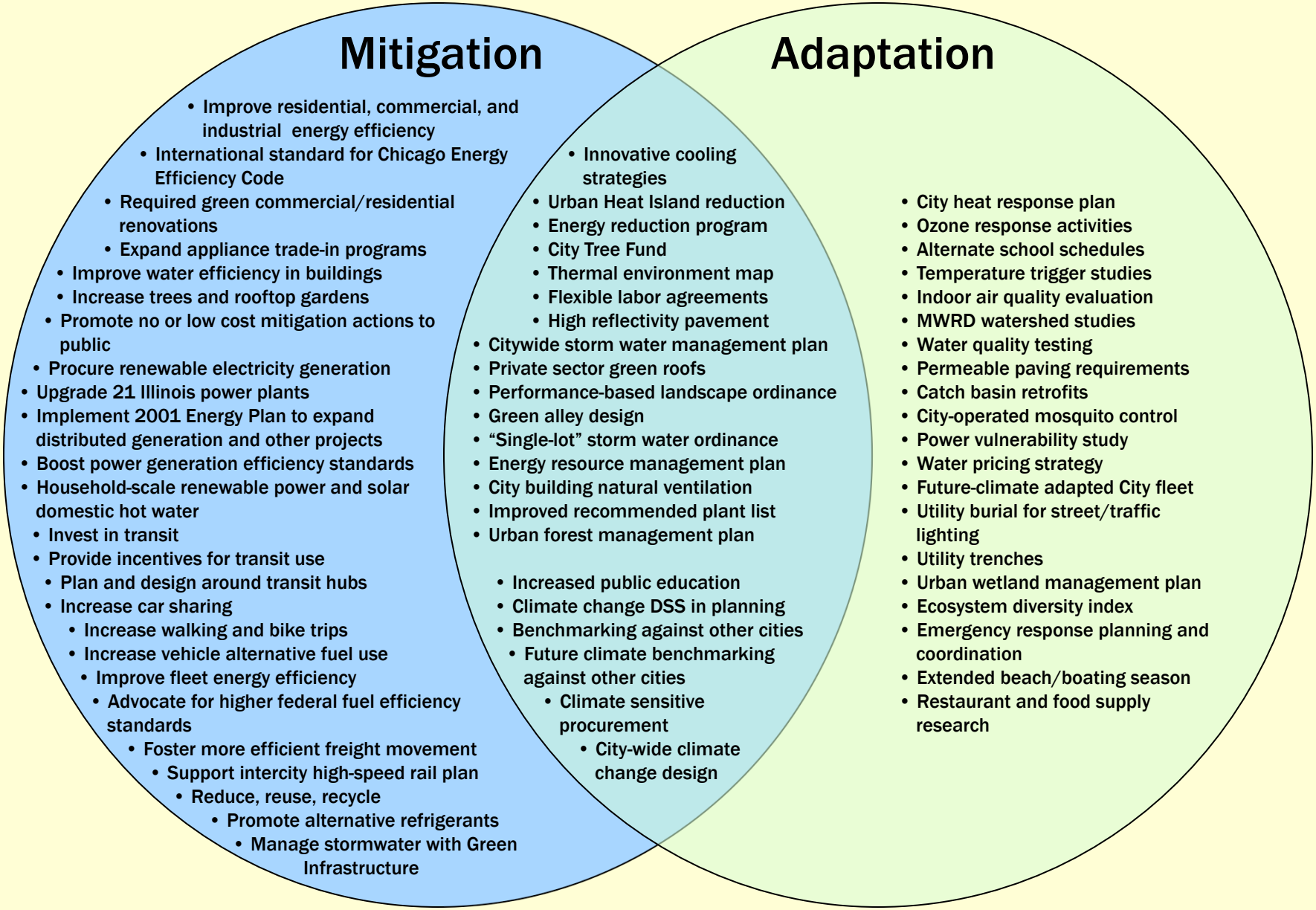
REDUCED WASTE & INDUSTRIAL POLLUTION
3 ACTIONS

PREPARATION

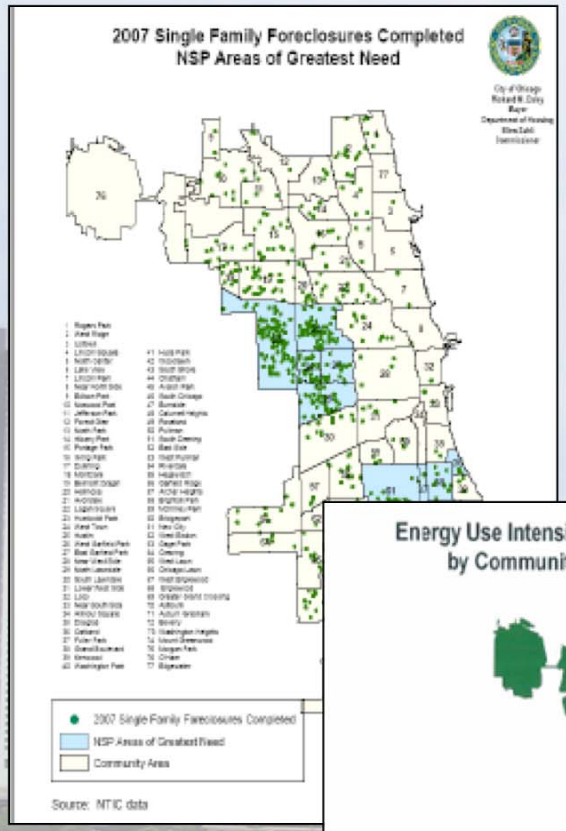
=

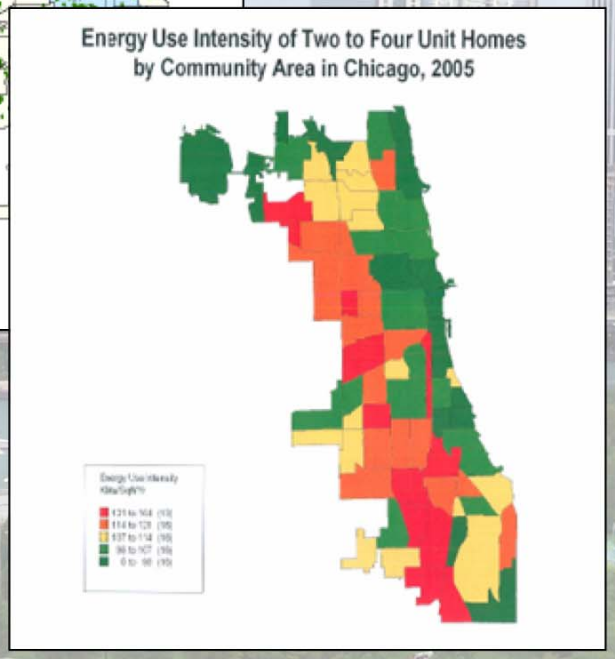
35 WAYS

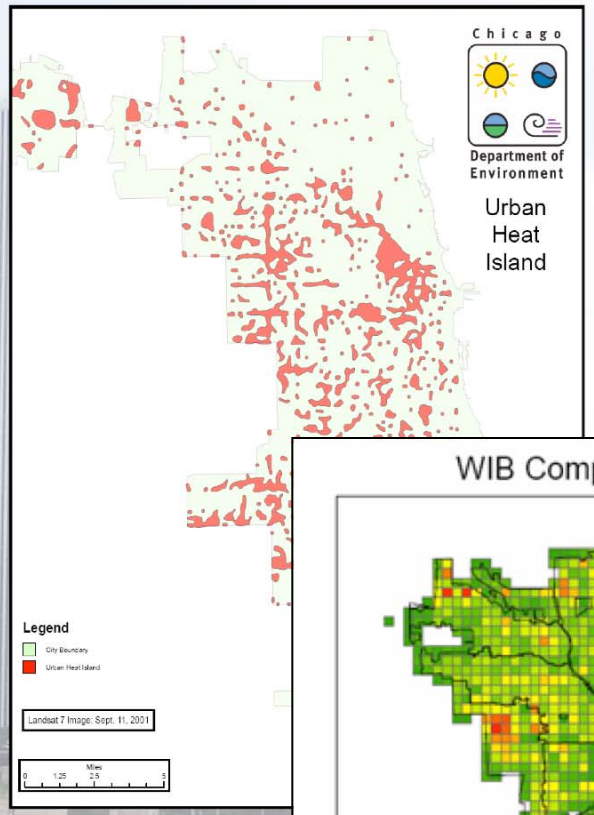
TO ENSURE A RESILIENT CITY

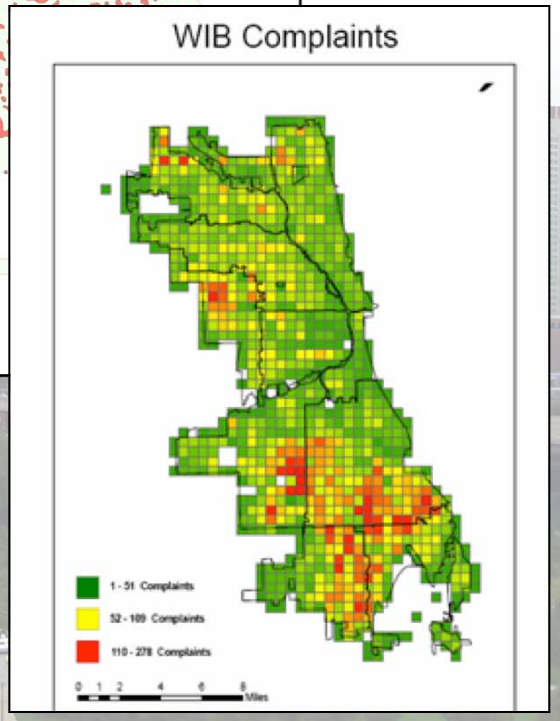

Mitigation
• Improve residential, commercial, and industrial energy efficiency
• International standard for Chicago Energy Efficiency Code
• Required green commercial/residential renovations
• Expand appliance trade-in programs
• Improve water efficiency in buildings
• Increase trees and rooftop gardens
• Promote no or low cost mitigation actions to public
• Procure renewable electricity generation
• Upgrade 21 Illinois power plants
• Implement 2001 Energy Plan to expand distributed generation and other projects
• Boost power generation efficiency standards
• Household-scale renewable power and solar domestic hot water
• Invest in transit
• Provide incentives for transit use
• Plan and design around transit hubs
• Increase car sharing
• Increase walking and bike trips
• Increase vehicle alternative fuel use
• Improve fleet energy efficiency
• Advocate for higher federal fuel efficiency standards
• Foster more efficient freight movement
• Support intercity high-speed rail plan
• Reduce, reuse, recycle
• Promote alternative refrigerants
• Manage stormwater with Green Infrastructure
• Innovative cooling strategies
• Urban Heat Island reduction
• Energy reduction program
• City Tree Fund
• Thermal environment map
• Flexible labor agreements
• High reflectivity pavement
• Citywide storm water management plan
• Private sector green roofs
• Performance-based landscape ordinance
• Green alley design
• "Single-lot" storm water ordinance
• Energy resource management plan
• City building natural ventilation
• Improved recommended plant list
• Urban forest management plan
• Increased public education
• Climate change DSS in planning
• Benchmarking against other cities
• Future climate benchmarking against other cities
• Climate sensitive procurement
• City-wide climate change design
Adaptation
• City heat response plan
• Ozone response activities
• Alternate school schedules
• Temperature trigger studies
• Indoor air quality evaluation
• MWRD watershed studies
• Water quality testing
• Permeable paving requirements
• Catch basin retrofits
• City-operated mosquito control
• Power vulnerability study
• Water pricing strategy
• Future-climate adapted City fleet
• Utility burial for street/traffic lighting
• Utility trenches
• Urban wetland management plan
• Ecosystem diversity index
• Emergency response planning and coordination
• Extended beach/boating season
• Restaurant and food supply research

Extreme Heat & Extreme Precipitation Strategic Adaptation Implementation

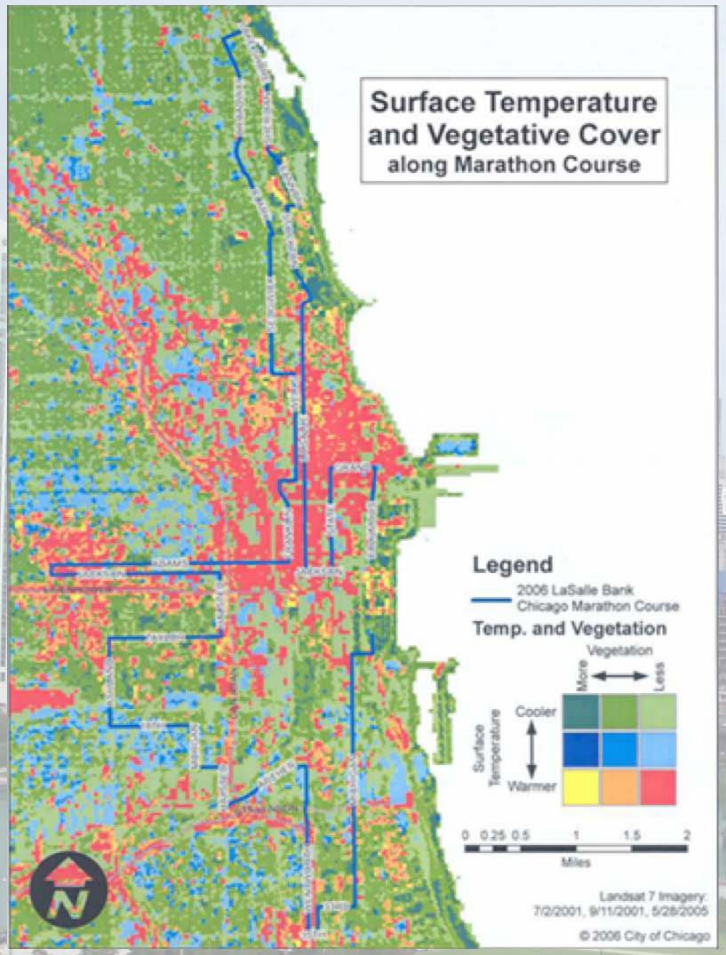


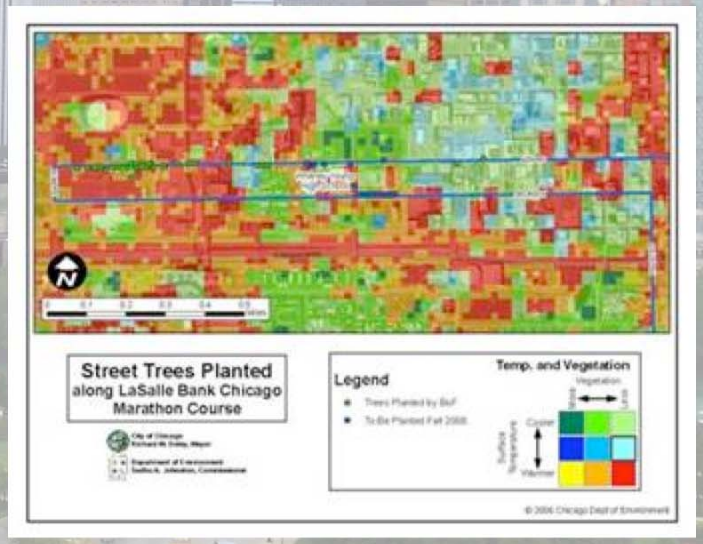






Urban Heat Island



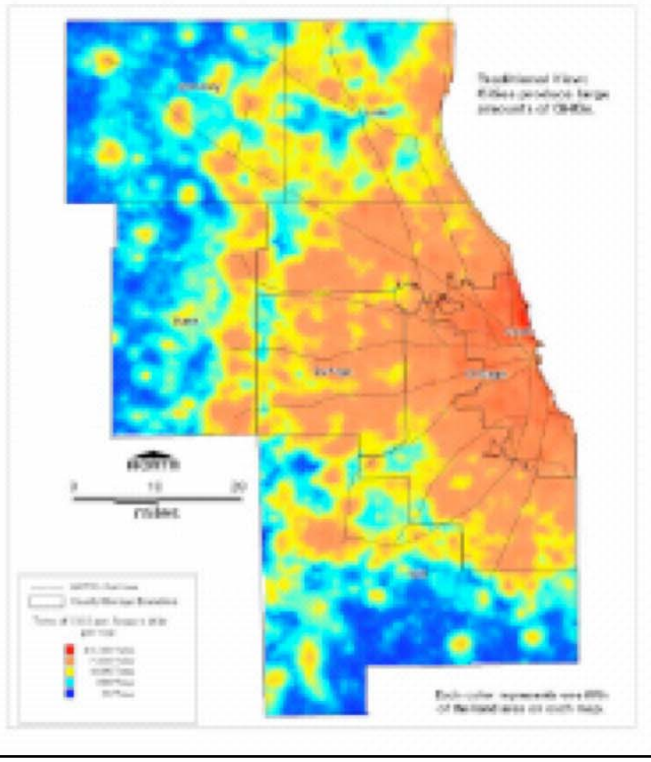


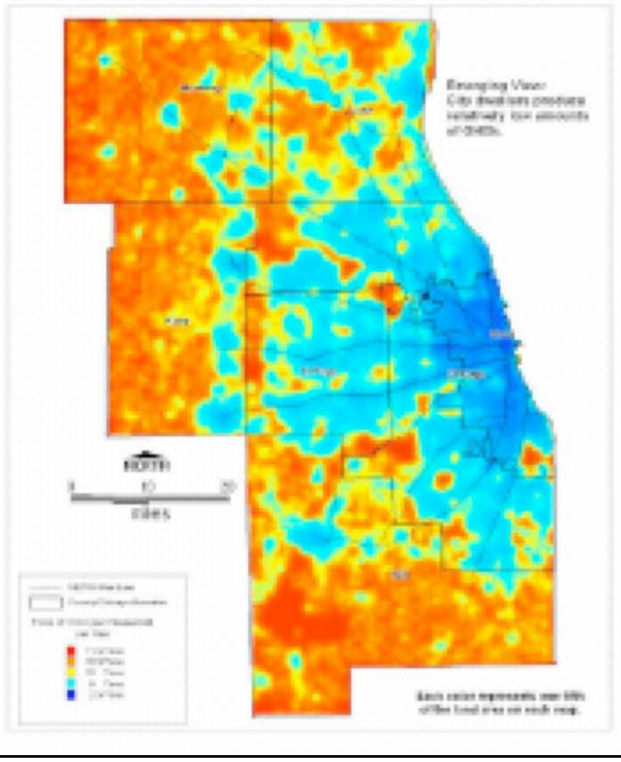
Comprehensive Sewer Model

Existing on Rogers | **Rogers Ave CIP**

Existing Trunk | **Trunk Sewer Improved**

THE ROLE OF CITIES





Climate Change Adaptation Process

2007: External Expert Engagement

- Climate Science: High & Low Emissions Climate Projections and Potential Impacts
- Economic Risk Analysis: Municipal Cost of Doing Nothing
- Adaptation Action Planning: Prioritizing Adaptation Actions by Risk & Time

2008: City Leaders' Ownership

5 Work Groups: 15 City Departments & 6 sister Agencies Create 39 Adaptation Tactics

September '08: Mayor launches Chicago Climate Action Plan (CCAP)

2009: Adaptation Business as Usual

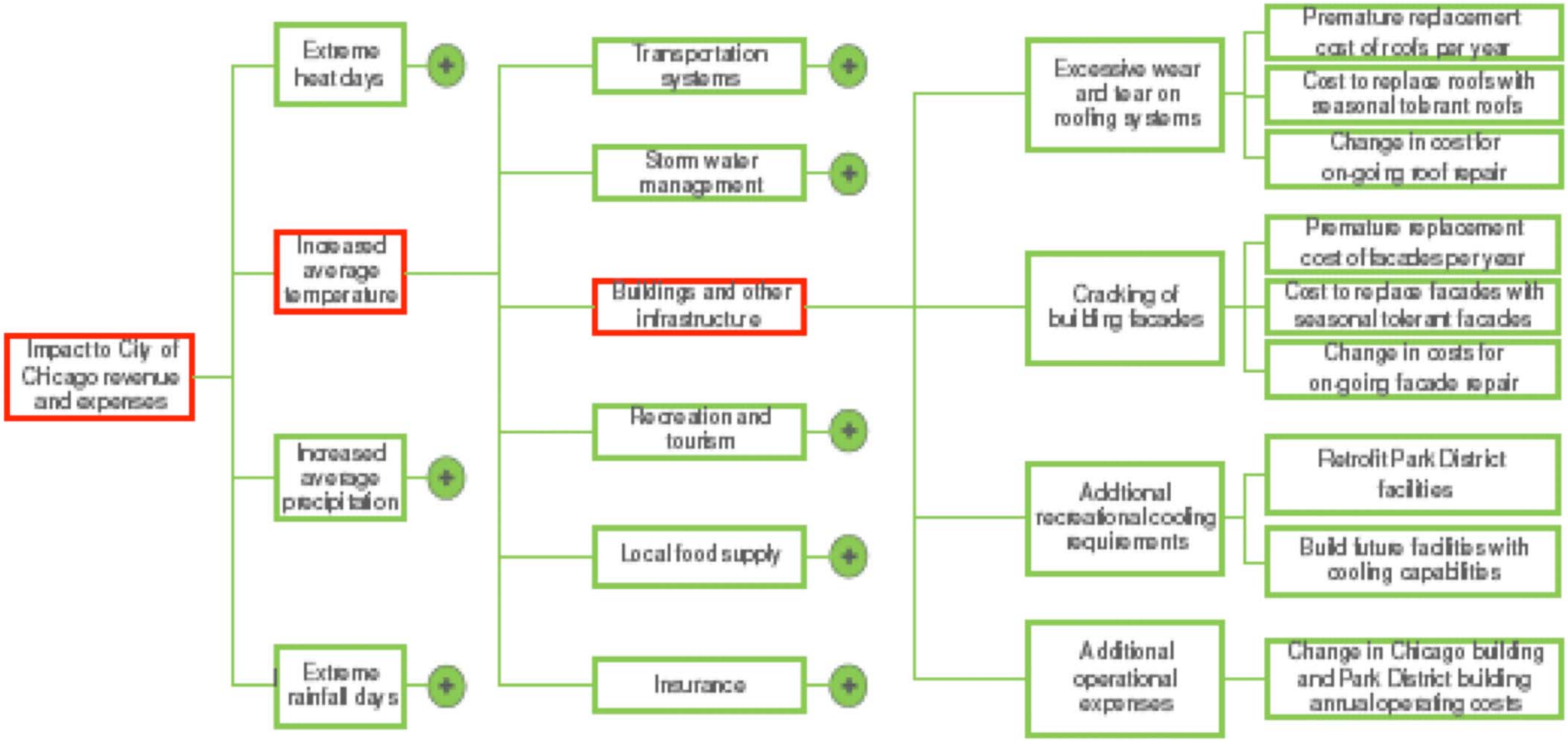
Department Work Plans Including Who Will Do What by When

Decision Pathway for Adaptation Actions for one Department

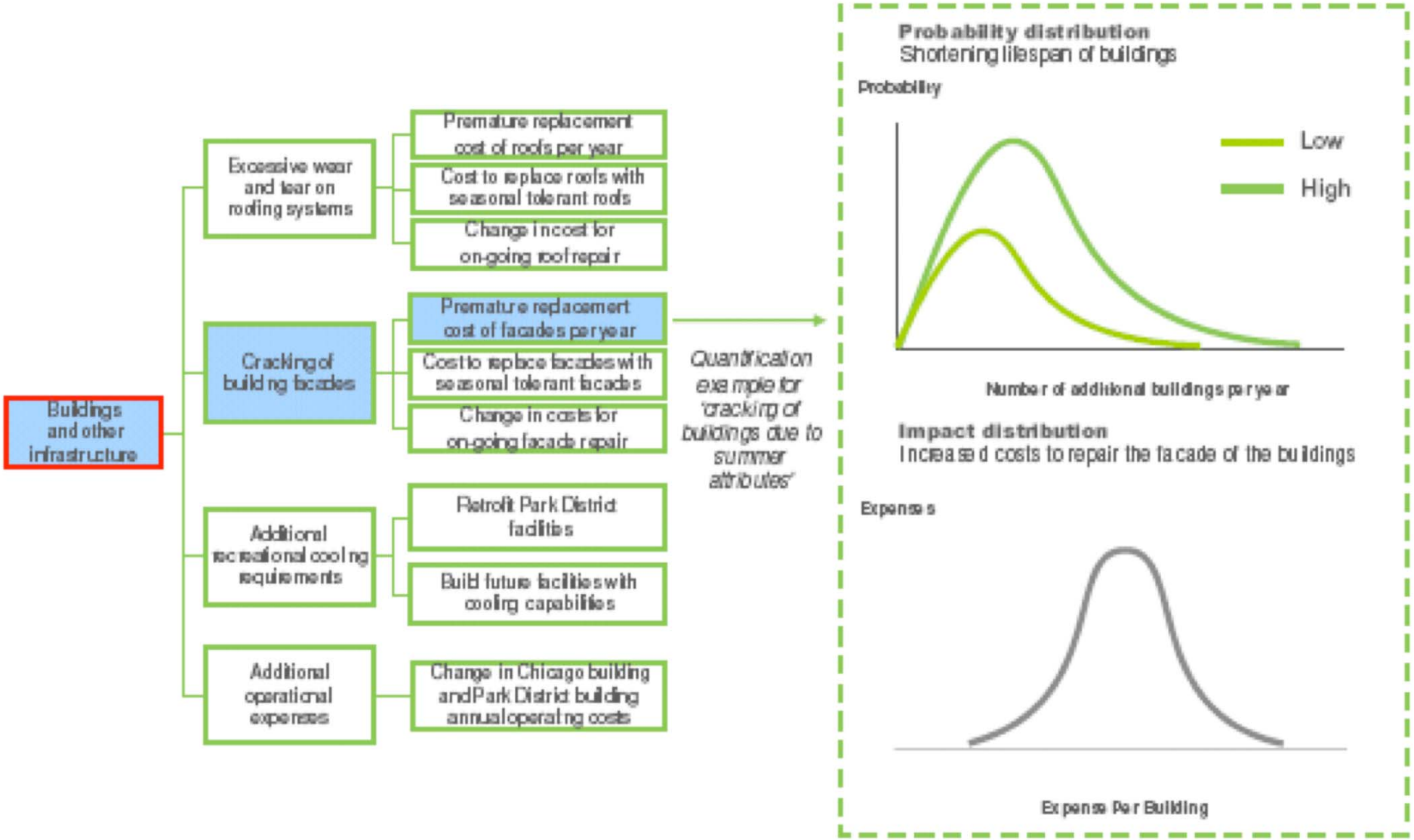
Each impact in the pyramid has a series of drivers organized in cause and effect chains and serves as the basis for risk quantification

Impact pyramid example:
Impact to City of Chicago revenue and expenses

Increased average temperature example:
Buildings and other infrastructure



Economic Risk Analysis



Climate Change Adaptation Risk Scoring System

MWH Climate Risk Scoring System		
Score	**Likelihood**	
5	Occurring now	E.g. UIUC/TTU report cites evidence of detectable trend.
4	Very Likely	E.g. Prediction is primarily driven by increased average temperatures, which in general are more reliable output from general circulation models (GCM)
3	Likely	E.g. Prediction is driven by generally less reliable GCM output such as increased storminess
2	Somewhat likely	E.g. Prediction is hypothesized based on a combination of simultaneous climate outcomes.
1	Unlikely	E.g. Prediction is outside of range of likely scenarios presented by UIUC/TTU
0	Not used	N/A

125 Potential Adaptation Actions Organized by Risk, Timing and Department

Impact	Risk	Timing **	Construction, Buildings & Property	Tourism	Environment	Fire	Fleet Management	Housing	Human Services	Emergency Management	Police	Public Health	Streets and Sanitation	Transportation	Water Management	Parks and Open Space	Storm Water Management
Need to get greater penetration of A/C to residential units (particularly high risk areas)	Moderate	Near	x					x				x					
Damage to property and increasing cost of insurance due to stormwater	Moderate	Mid	x			x			x			x	x		x		x
Higher costs associated with managing invasive species	Moderate	Mid			x										x	x	
Increased potential for shoreline erosion/ storm damage	Moderate	Mid			x						x					x	
Possibility of higher frequency/severity of storms	Moderate	Mid				x				x	x		x			x	

Adaptation Work Groups

Chicago Climate Change Task Force

Chicago Mayor's Office

Work Groups and their Leading Departments

Extreme Heat: Office of Emergency Management and Communications

Department of Buildings

Extreme Precipitation: Department of Water Management

Department of Transportation

Buildings, Infrastructure & Equipment: Department of Buildings and Department of Transportation

Ecosystems: Department of Zoning and Land Use Planning

Leadership, Planning and Communication: Department of Environment

City Department CCAP Work Plans
"Lead By Example"

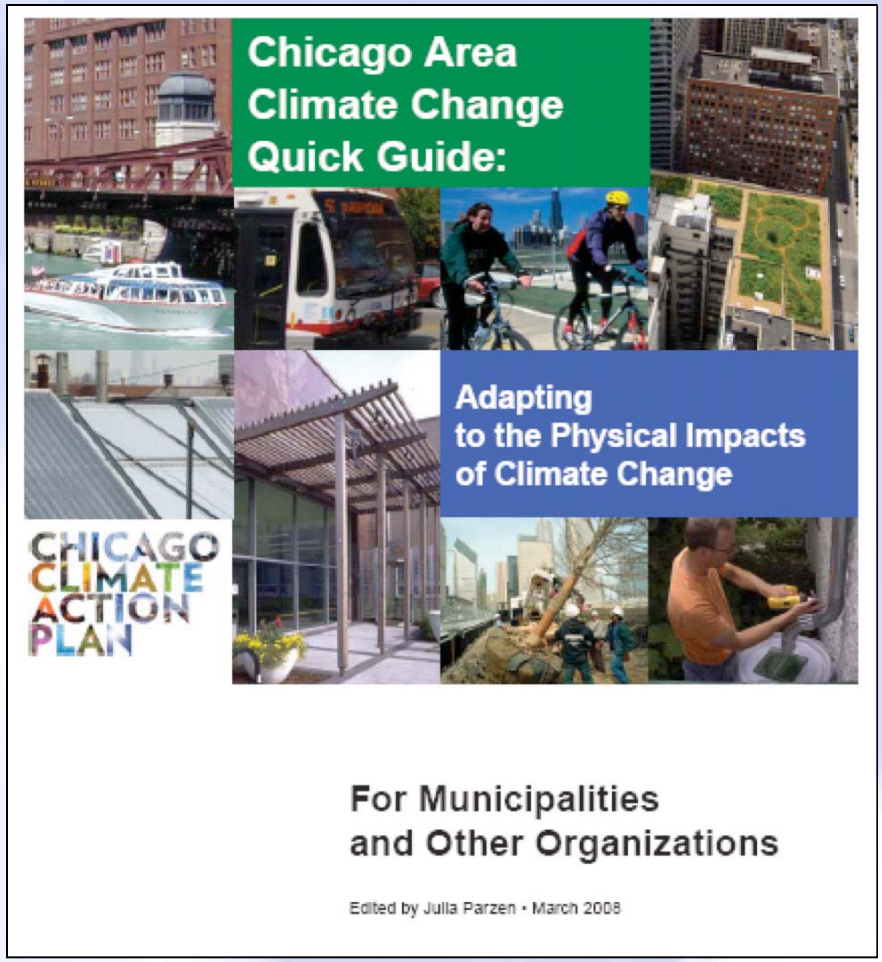
Department/ Agency	Initiatives
Aviation	30
Buildings	14
Chicago Department of Transportation	37
Chicago Park District	47
Chicago Public Schools	31
Chicago Transit Authority	39
Community Development	10
Environment	72
Fleet Management	11
General Services	24
Office of Emergency Management & Communications	12
Public Building Commission	48
Streets & Sanitation	24
Water Management	39
Zoning and Planning	18
Grand Total	**456**

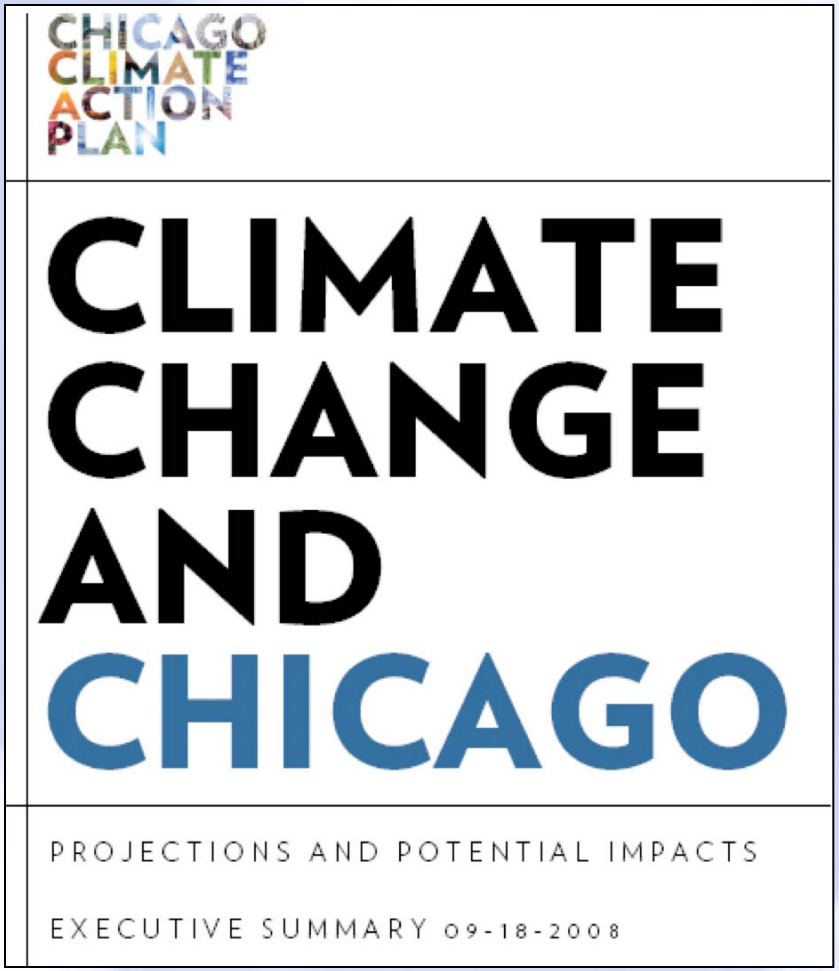
Highlights

- CCAP work plans for 15 Departments & Sister Agencies
- Total of 458 CCAP initiatives
- CCAP milestones to be reviewed by Mayor's office

ATKEARNEY

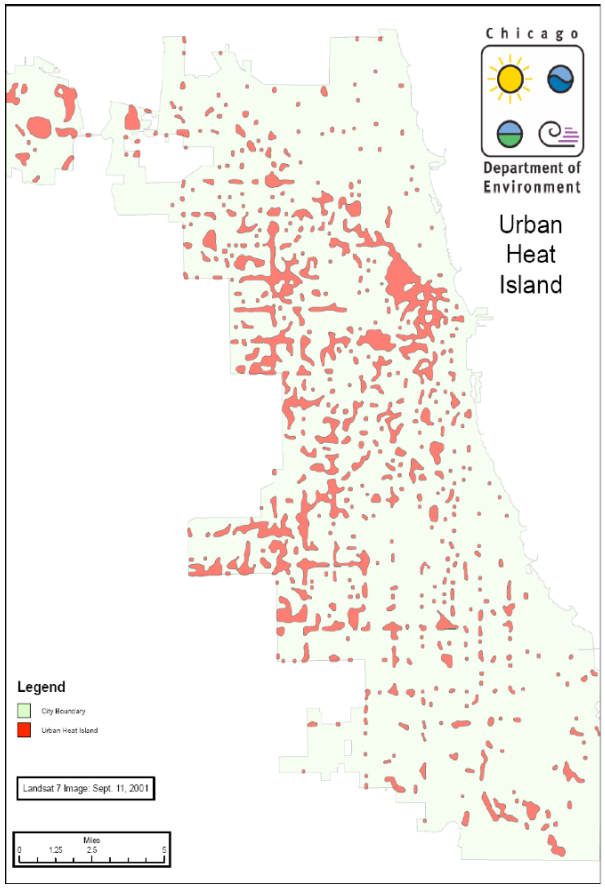
Quick Guide to Adaptation





www.chicagoclimateaction.org

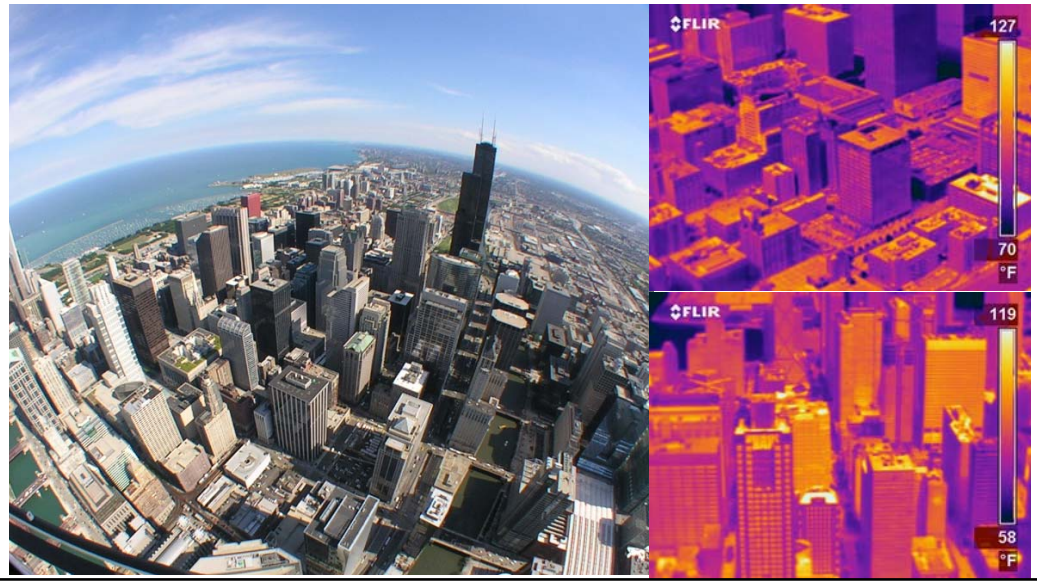
Extreme Heat



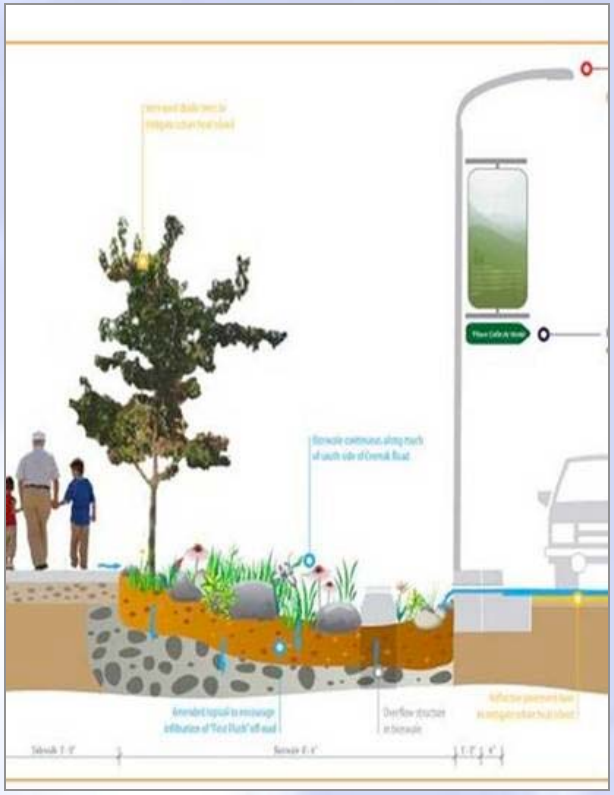
- More than 400 projects and 7 million square feet total green roofs in the last 5 years.
- Extreme Weather Operations Plan now recognizes climate change impacts assessment information.
- Incorporating urban heat island information into urban forestry management plan.

Extreme Heat

- Survey prepared for cooling center users (no extreme heat days to implement).
- Creating an Air Quality Action Agenda.
- Monitoring alternative roadway materials performance.
- Transforming market for infrastructure materials.



Extreme Precipitation

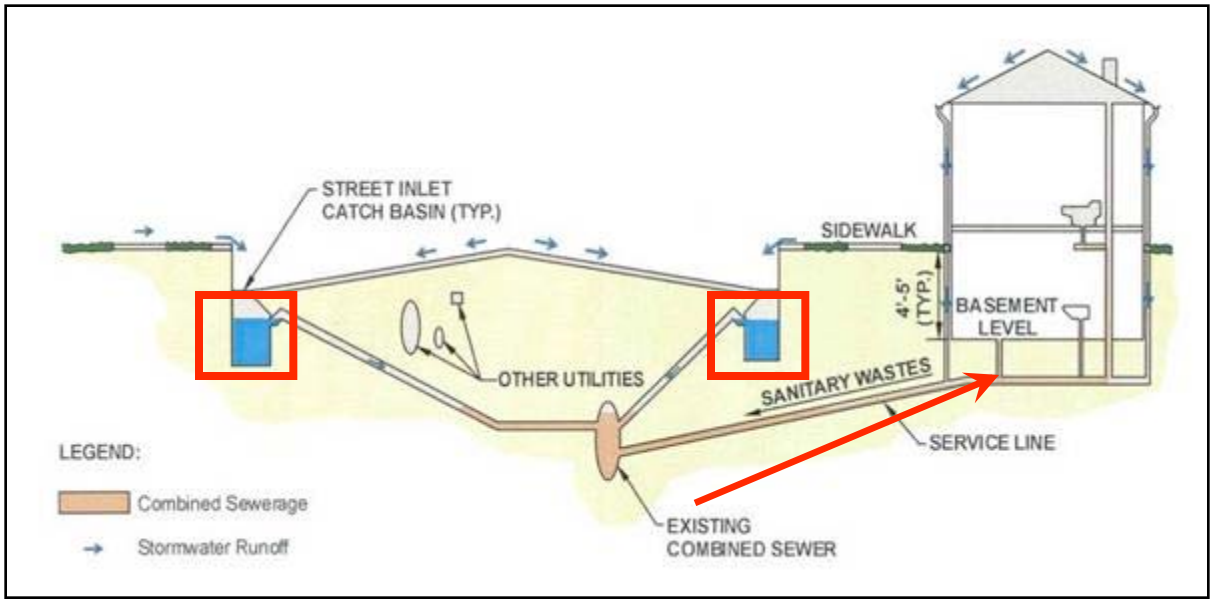


- Commenced enforcement of Stormwater Management Ordinance.
- Created urban forestry inventory.
- More than 60 green alleys and streets installed.
- Extreme Weather Operations Plan added a separate plan for extreme precipitation.

Photo: Chicago Solar Partnership

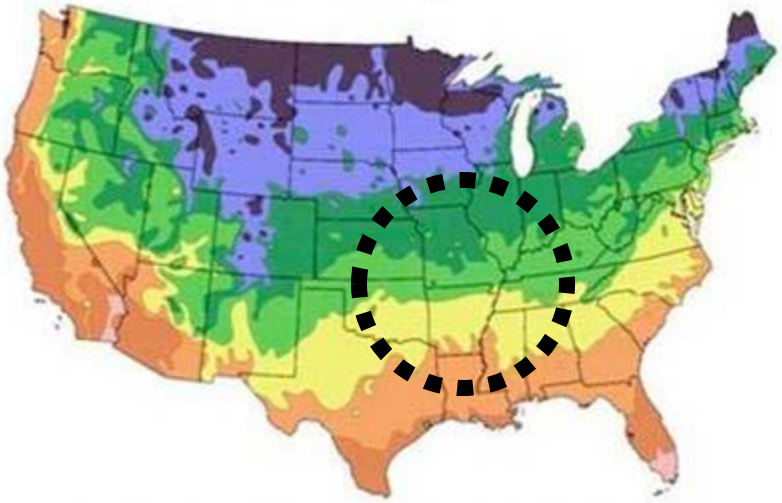
Extreme Precipitation

- Completed model of City's sewer infrastructure, including analysis to identify potential impacts of green infrastructure and infrastructure modernization.
- Green Urban Design passed Plan Commission.
- Alternative dicing pilot is scaling out.
- City Council increased water rates.



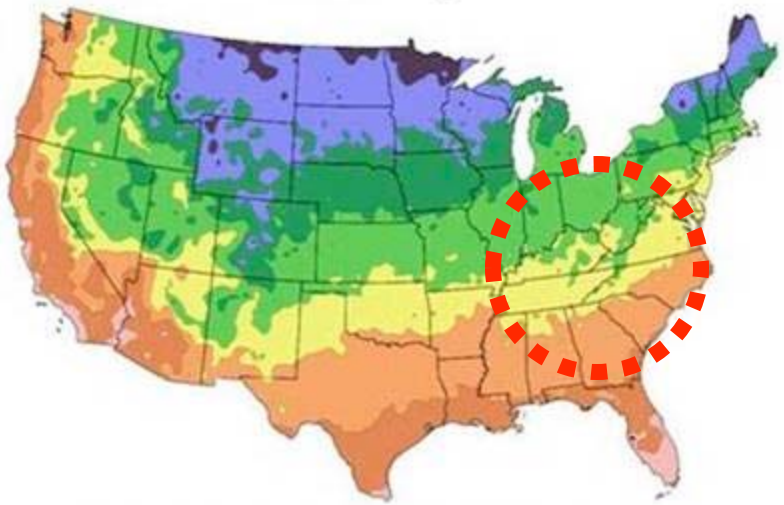
Climate Change Adaptation: Ecosystem Change

1990 Map



After USDA Plant Hardiness Zone Map, USDA Miscellaneous Publication No. 1475, Issued January 1990

2006 Map



National Arbor Day Foundation Plant Hardiness Zone Map published in 2006.

- Partnering with city stakeholders to implement the Chicago Trees Initiative
- Commenced creation of urban forest management plan.
- Performance based Landscape Ordinance research funds granted.
- Partnering with Chicago Wilderness on species diversity index & recommended plant list.


Questions?
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