


Community Planning for Resiliency: Reducing Vulnerabilities through Green Infrastructure

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Mass Audubon
Protecting the Nature of Massachusetts

SHAPING the Future of YOUR COMMUNITY

Building Resilient Communities – Smart Planning and Siting, Low Impact Development and Green Infrastructure

- Climate Change – Impacts
- Landscape-level Planning for Resiliency
- Infrastructure – Gray and Green
- Building More Sustainably – Conservation Design, Low Impact Development

2014 National Climate Assessment

- Climate change is already affecting the American people in far-reaching ways… extreme weather events … have become more frequent and/or intense, including prolonged periods of heat, heavy downpours, and, in some regions, floods and droughts…These and other aspects of climate change are disrupting people's lives and damaging some sectors of our economy.

Climate Impacts on Communities

Temperature

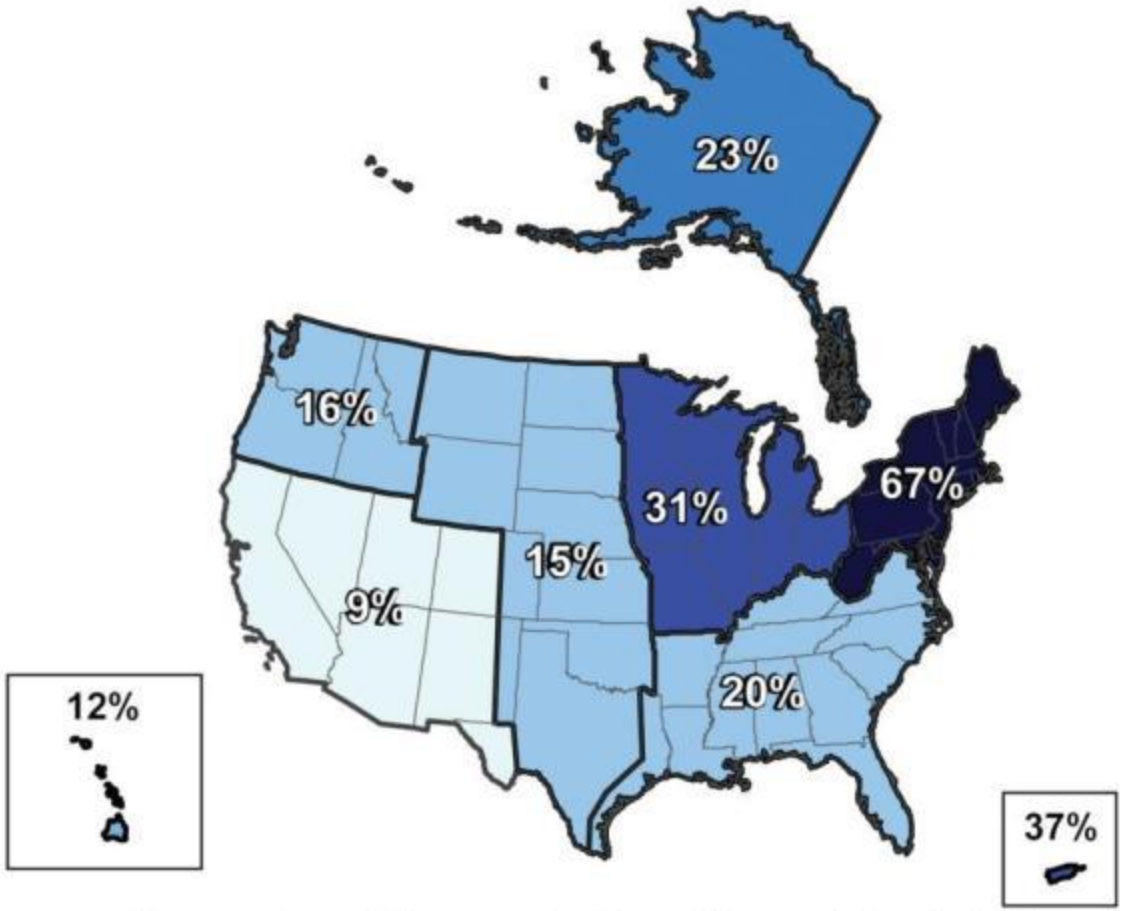
- Warm weather energy demand stresses energy systems
- Vulnerable populations

Precipitation

- Flooding, storm surge
- Combined sewer overflows >> water pollution
- Loss of life due to drowning

Extreme weather events

- Energy supply
- Emergency response capacity
- Public safety hazards



Updated from Groisman *et al.*[113]

The map shows the percentage increases in very heavy precipitation (defined as the heaviest 1 percent of all events) from 1958 to 2007 for each region. There are clear trends toward more very heavy precipitation for the nation as a whole, and particularly in the Northeast and Midwest.

Image credit: U.S. Global Change Research Program (www.globalchange.gov).

25-YEAR, 24-HOUR PRECIPITATION (IN.)				
	TP-40	1971-2000 (Baseline)	2046-2075 (A1b)	2046-2075 (A1fi)
+95% c.i.	5.1	7.46	9.53	12.22
"most likely"		5.37	6.86	8.35
-95% c.i.		3.85	4.92	5.66

TABLE 5-2
Rainfall Design Depths from Climate Change for Oyster River Infrastructure Vulnerability Assessment

Source: University of New Hampshire

Methods for designing roads, culverts, stormwater systems are inadequate

Climate Change Paradox

NOAA

Mass Rivers Alliance 2009

More Floods

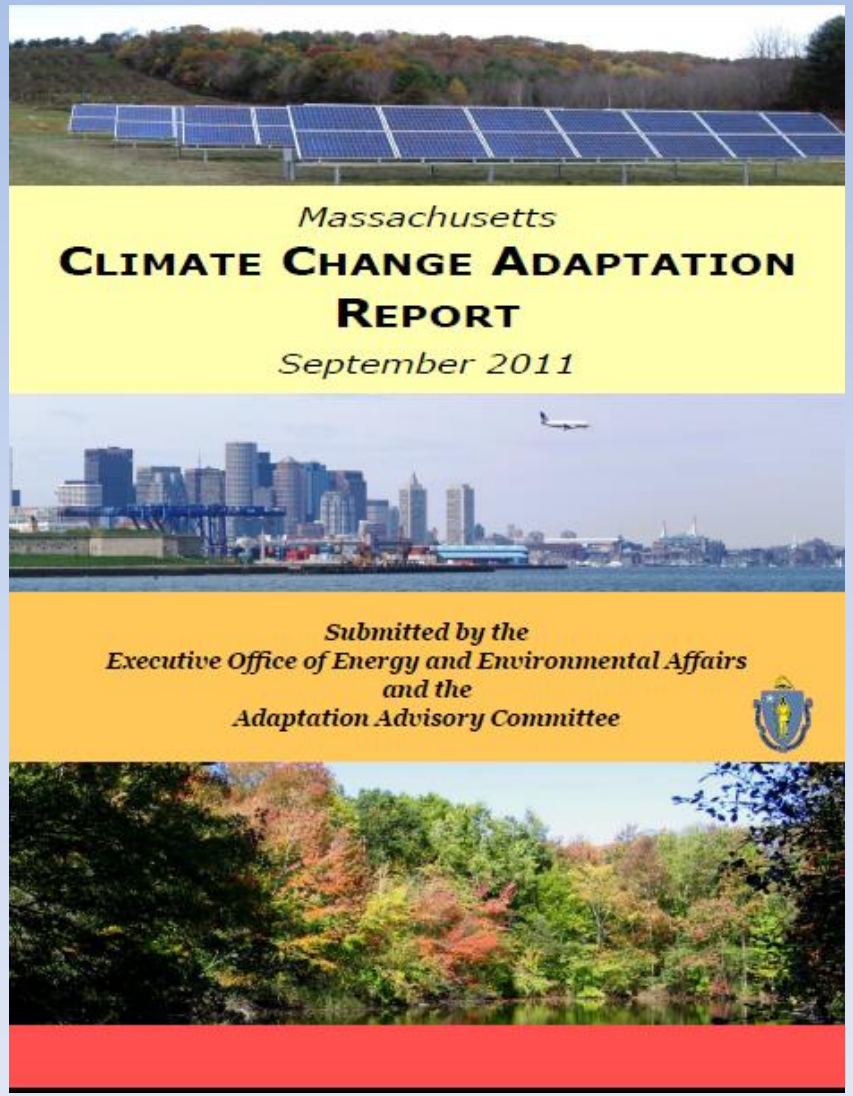
More Droughts

Stresses of sprawl, impervious surfaces, nonpoint source pollution exacerbated

Adaptation

- ADAPTATION means **increasing resiliency** and **reducing vulnerability** of our natural and built systems, and better preparing our response capabilities

State Legislation



Global Warming Solutions Act
- Mandatory GHG reductions
- GWSA Sub-Committee on Adaptation

Sub-Committee report issued findings
- Few specifics
- Need priorities, course of action

Legislation required for climate adaptation

Preparing our Communities

- Energy infrastructure
- Transportation infrastructure
- Drinking water supply, wastewater
- Safety and flood control
- Solid and hazardous waste
- Buildings and structures
- Emergency preparedness

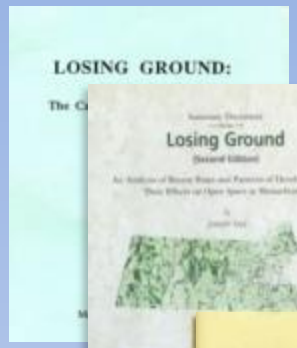
Bill S.2028 *An Act providing for the establishment of a* ***comprehensive adaptation management plan [CAMP]*** *in response to climate change*

Land Use and Resiliency

- Natural landscapes provide free protective services – “nature’s defenses”
- Forests and wetlands: absorb water, decrease flooding and recharge our drinking water.
- Coastal and inland upland buffers reduce storm impacts
- Compact development and land conservation keeps forested and natural (carbon absorbing) lands intact
- Massachusetts’ forests are sequestering 12% of our annual carbon emissions. An acre of forest holds 85 tons of carbon
- Trees provide shade, reduce urban heat islands. LID/bioretention in built areas – multiple benefits

Green Infrastructure

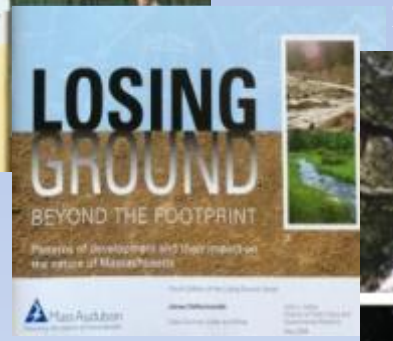
- Provide ecosystem services such as water filtration and recharge; temperature moderation; preventing erosion; capturing carbon, nutrients, and pollutants; and supporting fish, wildlife, and/or food production
- Features may be natural such as forests, floodplains, wetlands and buffer areas, or
- Built or engineered to mimic or restore natural processes, such as rain gardens, green roofs, bioretention areas, constructed wetlands, or living shorelines.



1987

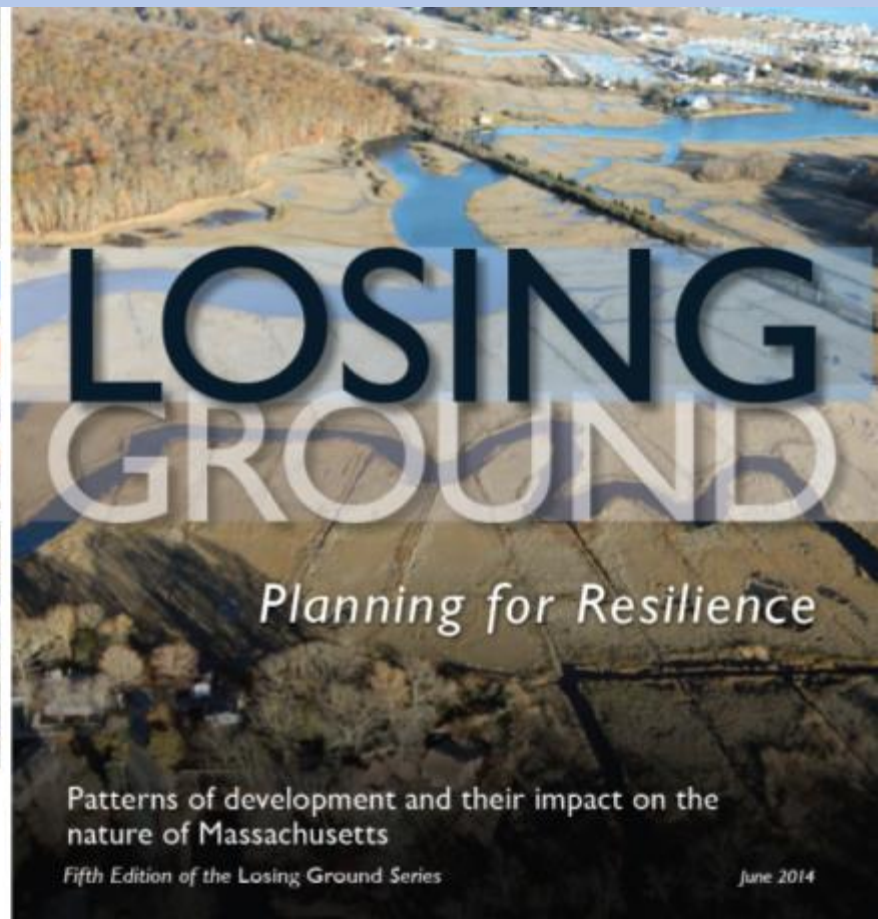
1999

2003



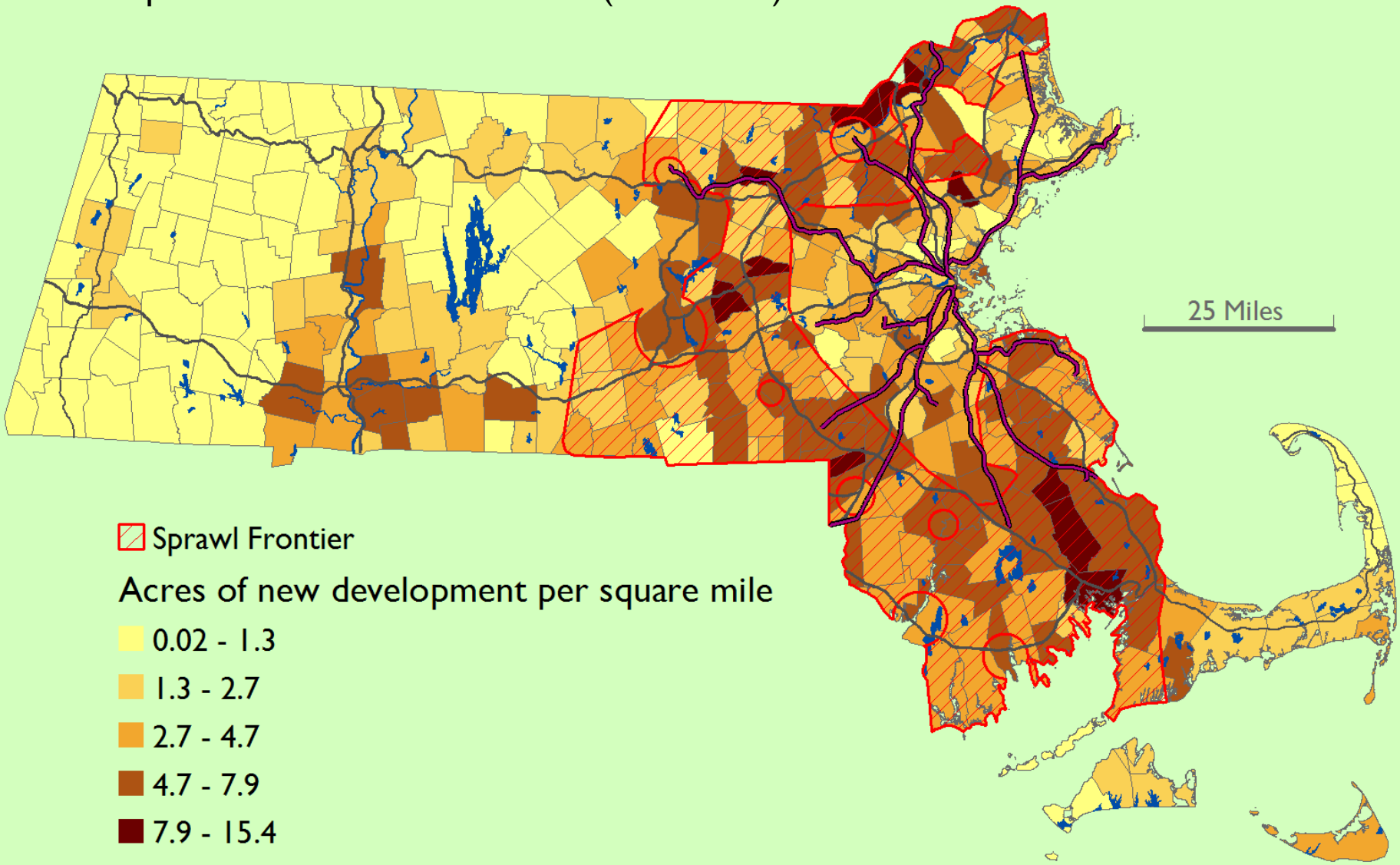
2009

Fifth edition, 2014

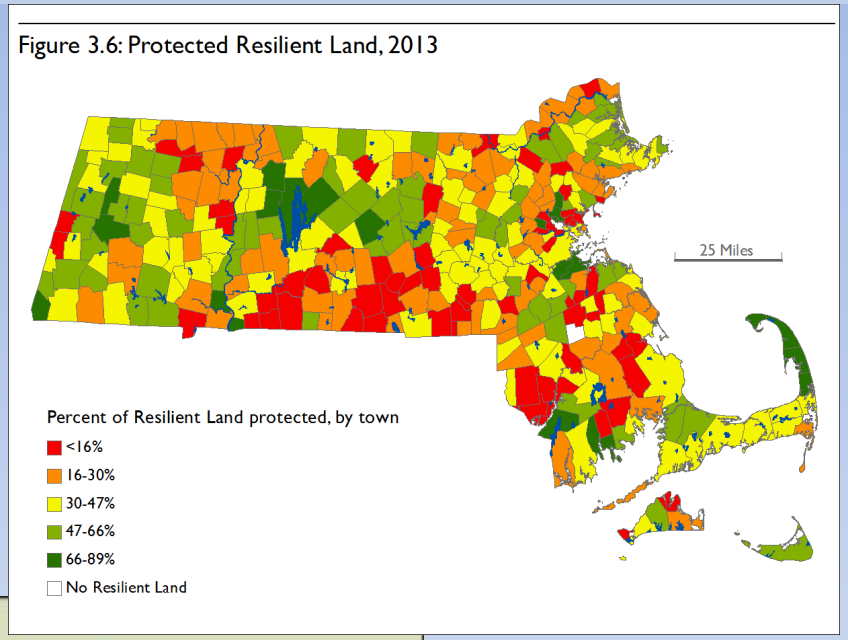


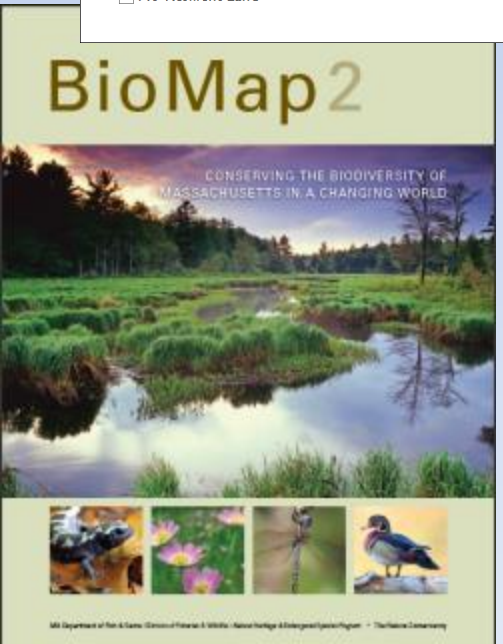
New Development Trends

Development Rates in Massachusetts (2005-2013)



Landscape Planning



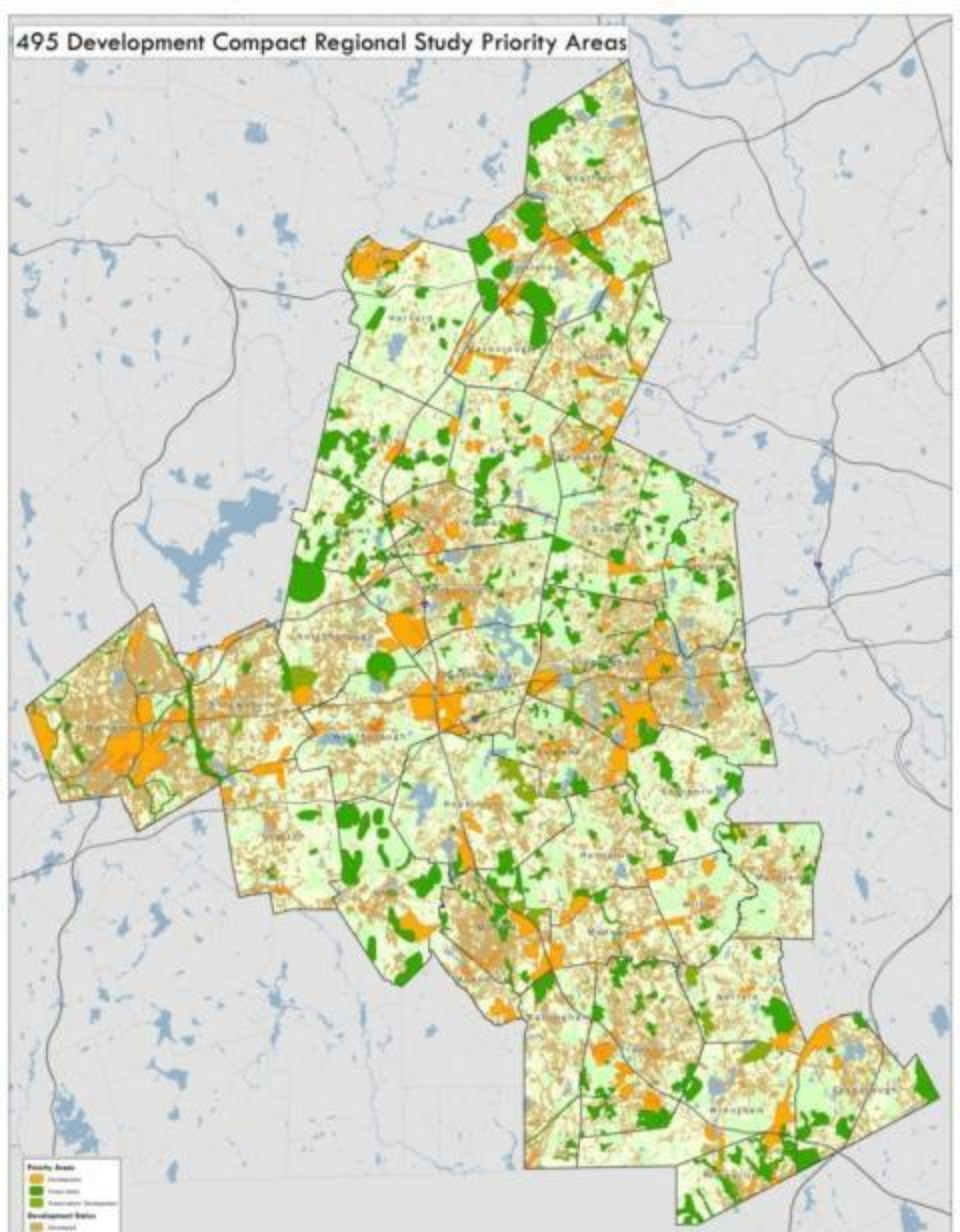


- Protect highly resilient lands
- Concentrate development away from vulnerable areas
- Align local plans and zoning
- Look beyond parcel and municipal boundaries

Planning Ahead for Growth and Development

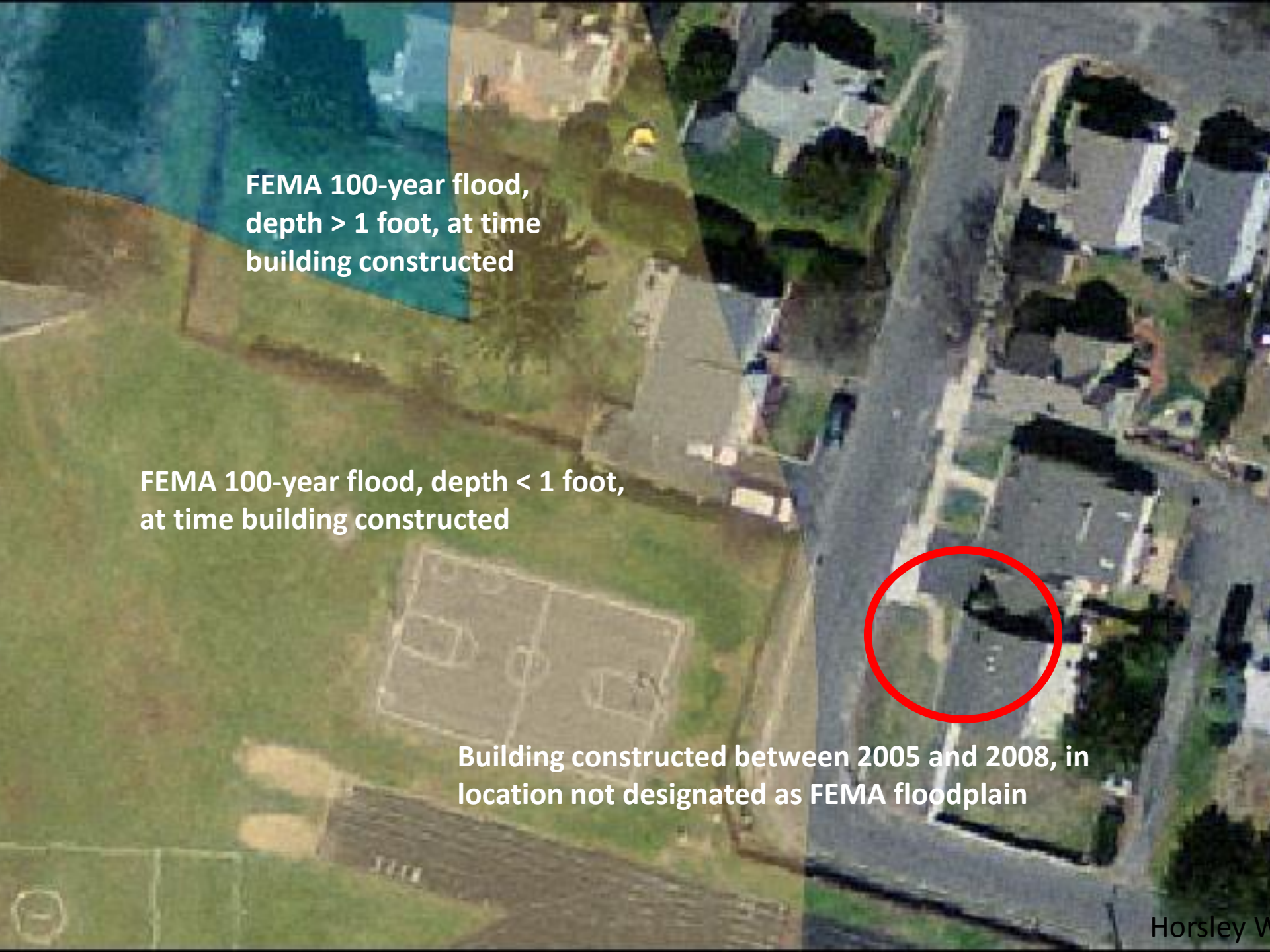
Prioritize Protection:
Important habitat and
Green Infrastructure

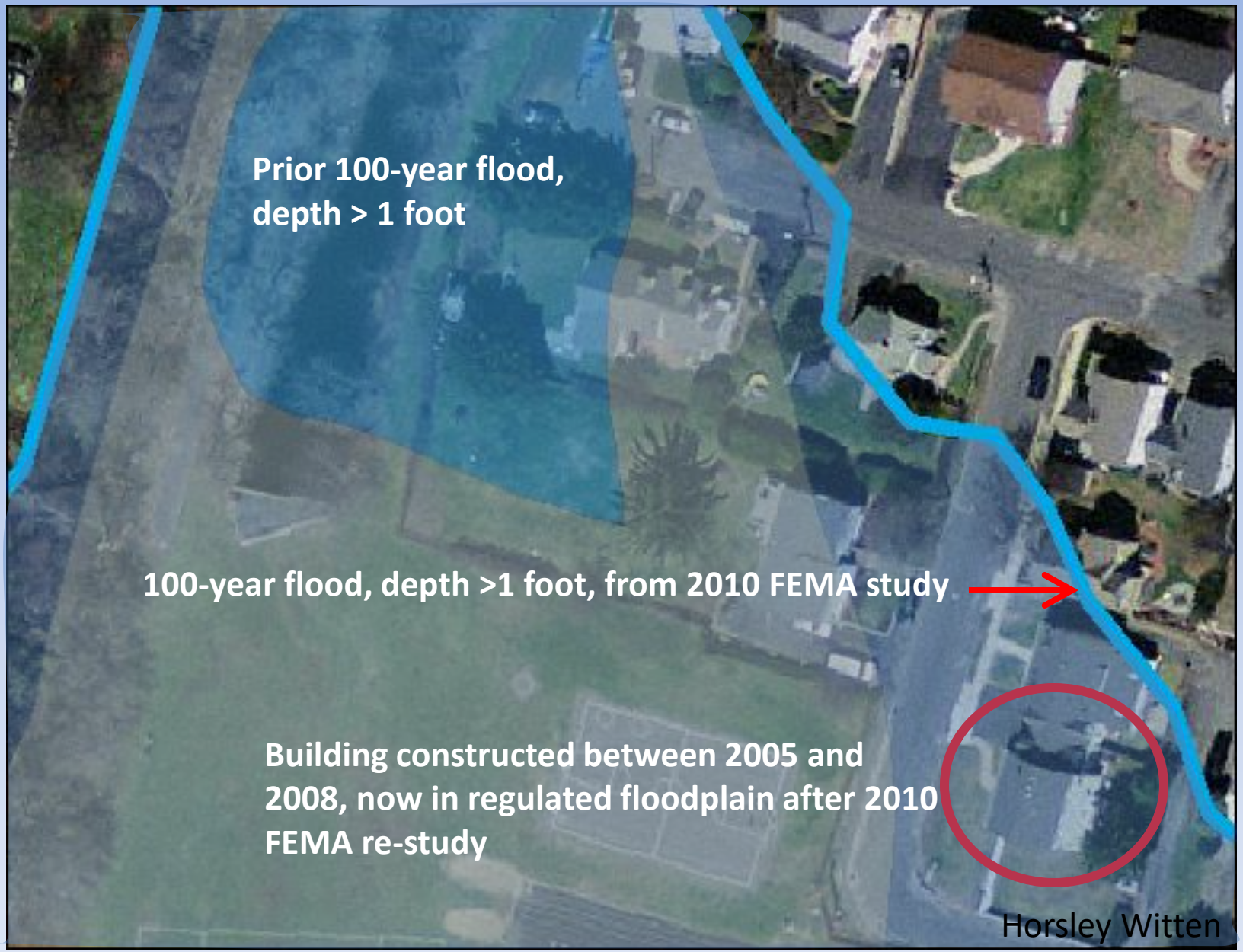
Prioritize Development:
Concentrate near infrastructure and away from important natural resources



Regional Plans – Implementation Toolkit
www.massaudubon.org/495Toolkit

Horsley Witten

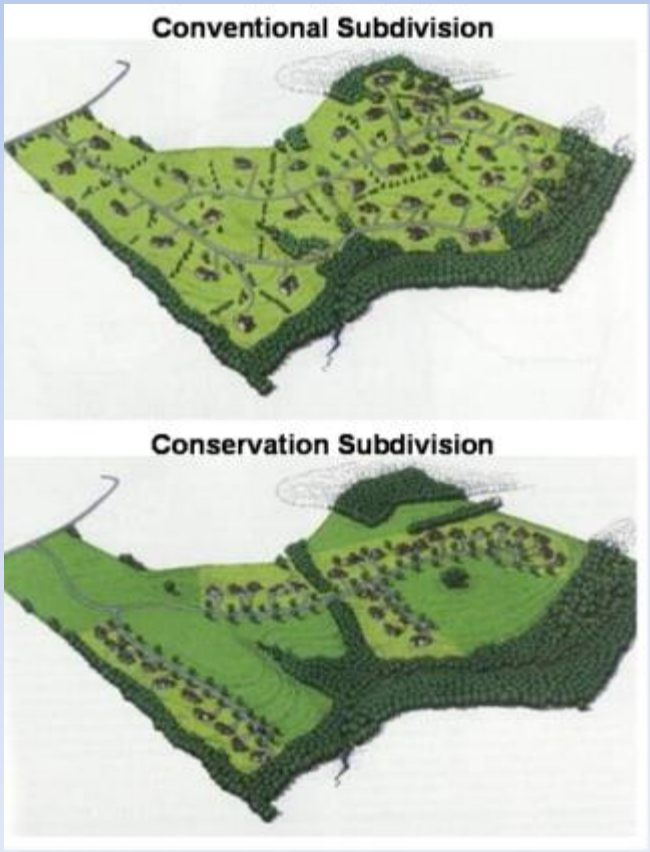

FEMA 100-year flood, depth > 1 foot, at time building constructed
FEMA 100-year flood, depth < 1 foot, at time building constructed
Building constructed between 2005 and 2008, in location not designated as FEMA floodplain
Horsley W


Prior 100-year flood, depth > 1 foot
100-year flood, depth >1 foot, from 2010 FEMA study
Building constructed between 2005 and 2008, now in regulated floodplain after 2010 FEMA re-study
Horsley Witten


Same building, March 2010 flood
(approximately 40-year flood)
Horsley Witten

Benefits of Reducing Sprawl & Protecting Natural Green Infrastructure

- Lower infrastructure costs – less roads, stormwater management
- Reduced clearing and grading
- Protect water supplies
- Prevent flood damage, protect wetland buffers and floodplains
- Protect forests and farmlands
- Provide open space and trails for people and nature
- Support high quality of life and property values



Resiliency and the Built Environment

Comparison of Estimated Crossing Lifespan and Costs

10 years

Cost of Two Replacements in 6 years:

$130k

Estimate for Stream Crossing Span:

10 years | 10 years | 10 years | 10 years | 10 + years

$300-400k

River process slides courtesy Carrie Banks, MA Division of Ecological Restoration

Bioretention
Soils and Plants Filter and Absorb Water

Green Roofs

- Stormwater Runoff absorption/collection
- Reduced flooding of and damage to urban streets
- Interior heating and cooling benefits of 10 degrees or more
- Air purification
- Recreational amenity
- Improved aesthetics
- Extended roof life, estimated at 40 years

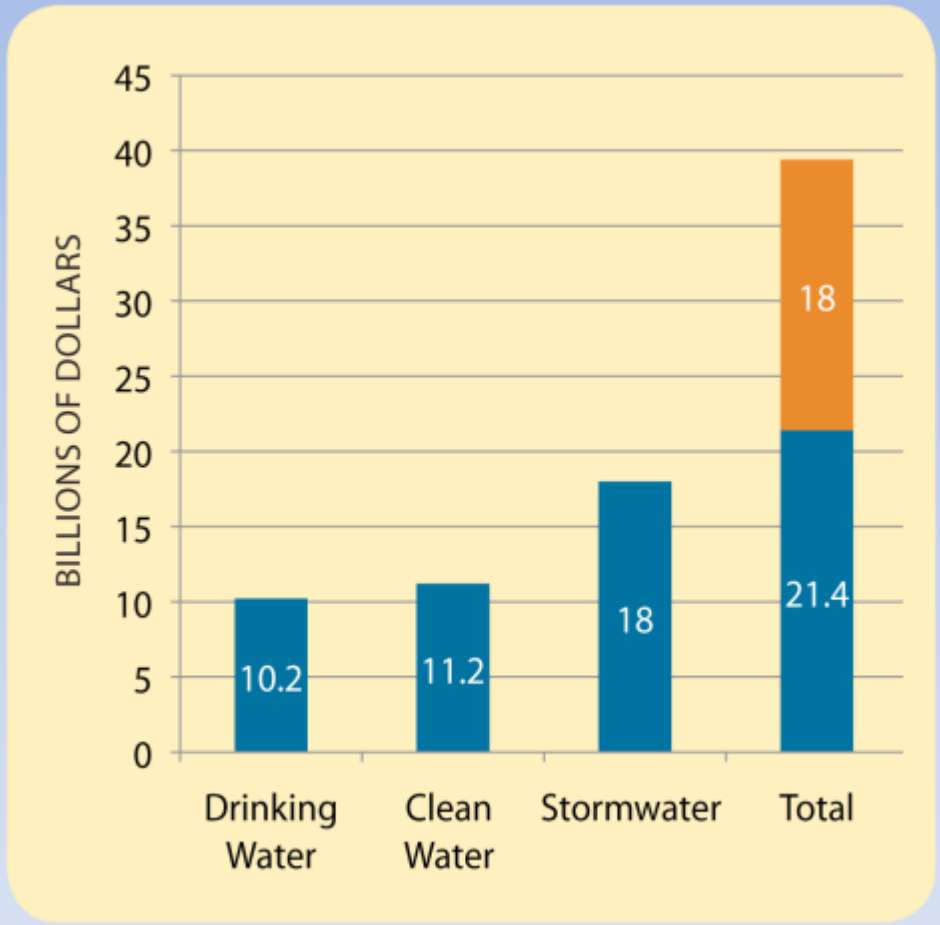
Mosquitoes and Stormwater

Stormwater catch basins and detention ponds are prime mosquito breeding habitat

Low Impact Development does not harbor mosquitoes

Benefits of Green Infrastructure and LID

- Environmental
- Aesthetics and market value
- Avoided costs
- Meeting regulatory requirements
- Adapting to Climate Change



Gap in water infrastructure funding over next 20 years, Water Infrastructure Finance Commission, 2012. Slide by Martin Pillsbury, MAPC

Shaping the Future of Your Community Program

Working in the state's fastest developing regions to provide community leaders and concerned citizens with tools and support to chart a more sustainable future

www.massaudubon.org/shapingthefuture

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