

Saving Land, Water, and Money

with smart land use solutions



conserve



restore



protect



save money

Broadmoor Wildlife Sanctuary

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Project Coordinator

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Funding provided by



What is Low Impact Development?

“ LID is an approach to land development (or re-development) that **works with nature to manage stormwater** as close to its source as possible.

LID employs principles such as **preserving & recreating natural landscape features** and minimizing imperviousness to create site drainage that **treats stormwater as a resource** rather than a waste product. ”

- EPA



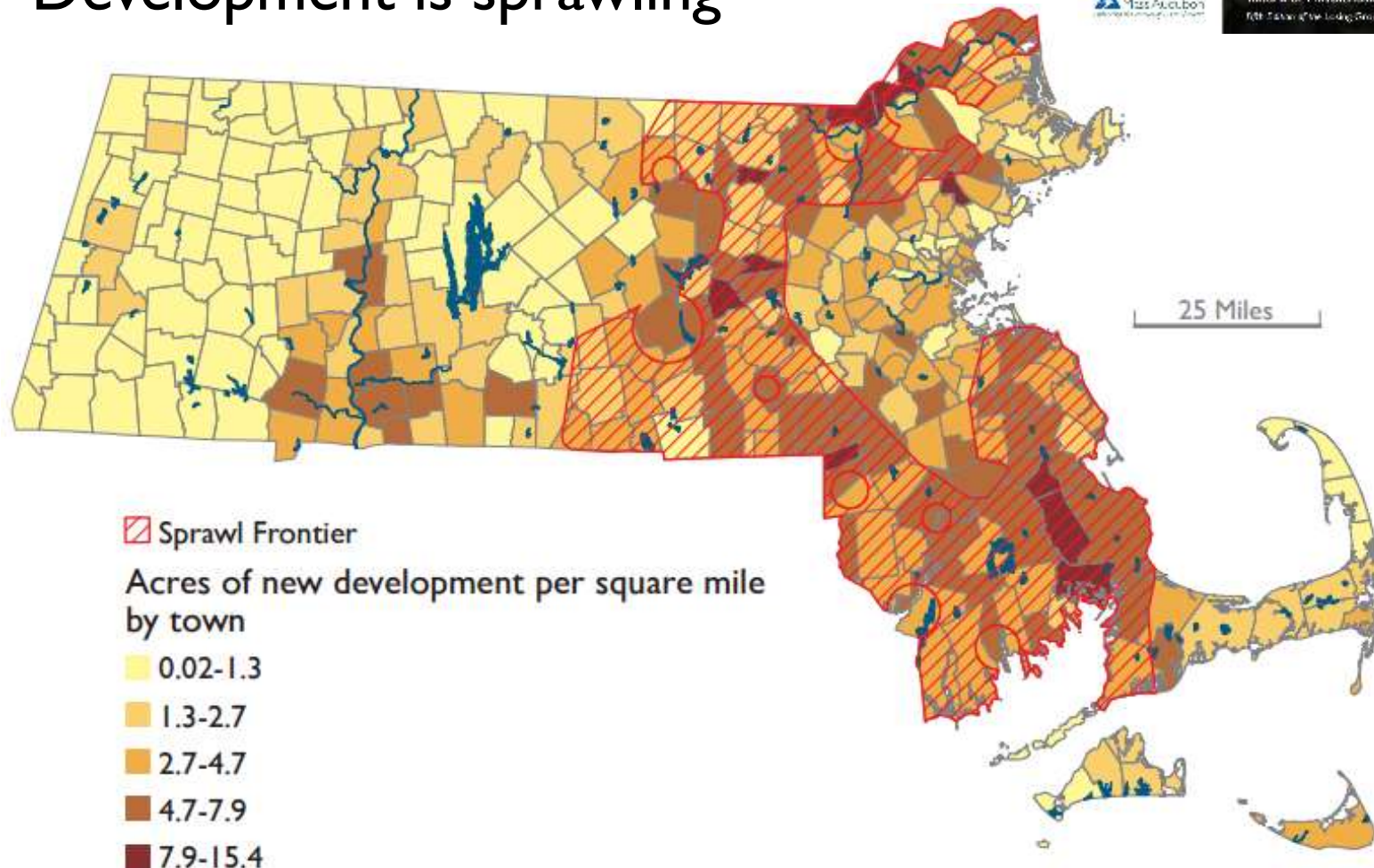
Source: Whole Buildings Design Guide, wbdg.com

What's the Problem?

Development is sprawling



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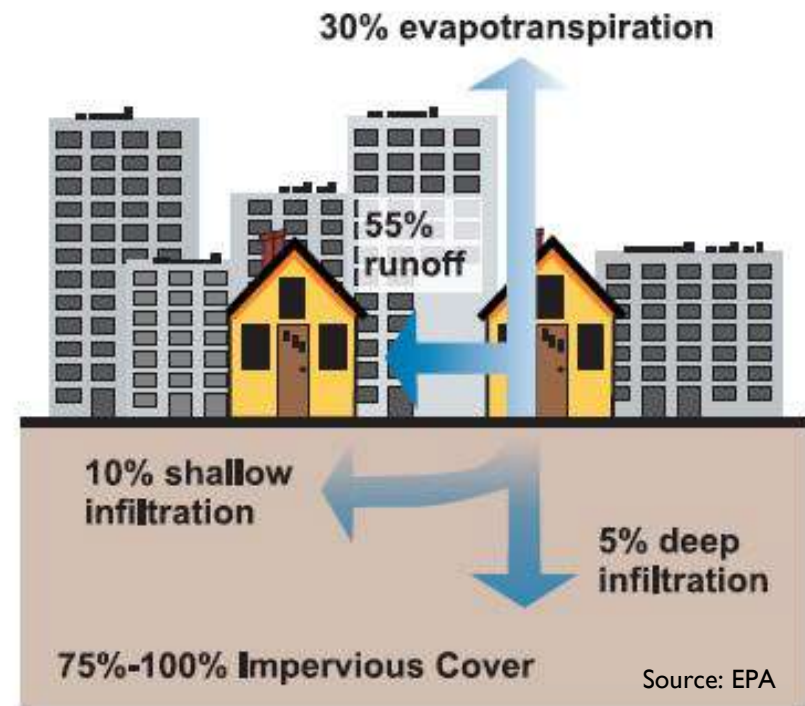
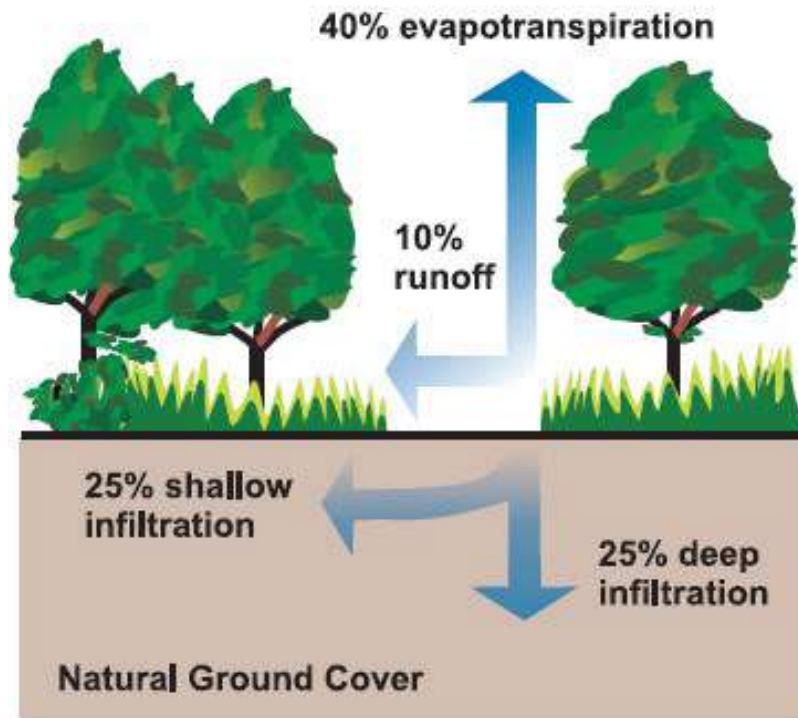


What's The Problem?

Impervious
surface



Runoff



Impacts of Stormwater Runoff



We Need to Change Course

Traditional development



Impervious surfaces



Stormwater runoff



Water quality impairment

Infrastructure impacts



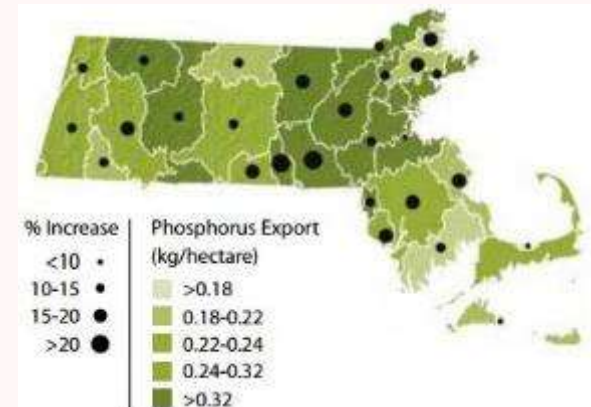
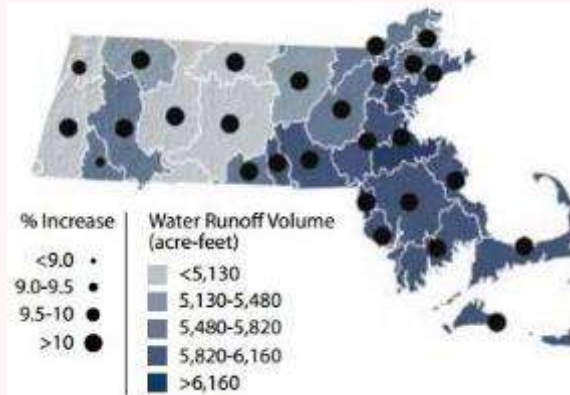
Financial and regulatory burden



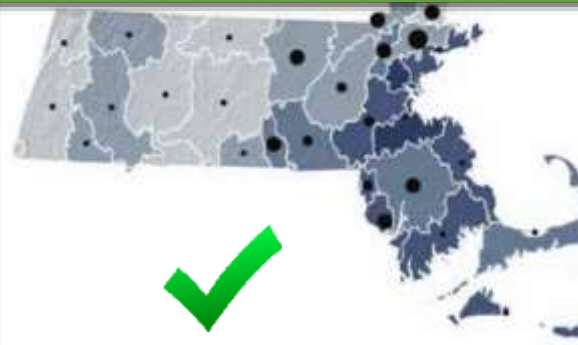
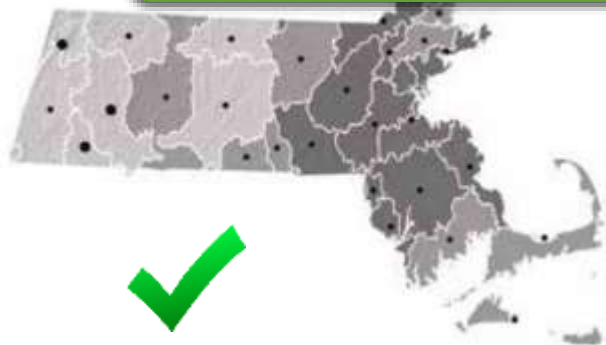
The Value of Green: Impervious, Runoff, Nutrients

Source: Harvard Forest Changes to the Land 2014

If we continue to follow opportunistic growth, in 2060:



These allow for nearly the **same amount of development**,
but 2/3 of it is **clustered** development



A Different Direction: Greening Your Community

Sustainable
development



Increased
infiltration



Reduced
runoff & more
groundwater



Improved
water quality



















Intact
infrastructure



Regulations met
Money saved



Benefits of LID Practices

Benefit	Reduces Stormwater Runoff				Increases Available Water Supply	Increases Groundwater Recharge	Reduces Salt Use	Reduces Energy Use	Improves Air Quality	Reduces Atmospheric CO ₂	Reduces Urban Heat Island	Improves Community Livability					Improves Habitat	Cultivates Public Education Opportunities
	Reduces Water Treatment Needs	Improves Water Quality	Reduces Grey Infrastructure Needs	Reduces Flooding								Improves Aesthetics	Increases Recreational Opportunity	Reduces Noise Pollution	Improves Community Cohesion	Urban Agriculture		
Practice																		
Green Roofs	●	●	●	●	○	○	○	●	●	●	●	●	◐	●	◐	◐	●	●
Tree Planting	●	●	●	●	○	◐	○	●	●	●	●	●	●	●	●	◐	●	●
Bioretention & Infiltration	●	●	●	●	◐	◐	○	○	●	●	●	●	●	◐	◐	○	●	●
Permeable Pavement	●	●	●	●	○	◐	●	◐	●	●	●	○	○	●	○	○	○	●
Water Harvesting	●	●	●	●	●	◐	○	◐	◐	◐	○	○	○	○	○	○	○	●



Yes



Maybe



No

Source: Center for Neighborhood Technology's The Value of Green Infrastructure

Start Here.★

Conserve the natural green infrastructure already providing free ecosystem services
Incorporate LID and green infrastructure design into development
Restore the resiliency of urban landscapes through LID in redevelopment



conserve



restore



protect



save money

Conserve

Conserve the natural green infrastructure already providing free ecosystem services

Integrate LID and green infrastructure designs into current development projects

Restore the resiliency of urban landscapes through LID in redevelopment



Integrate

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Restore

Conserve the natural green infrastructure already providing free ecosystem services
Integrate LID and green infrastructure designs into current development projects
Restore the resiliency of urban landscapes through LID in redevelopment



Free Ecosystem Services:

Free services provided by the natural landscape

Every \$1 invested in land conservation offers a **\$4 Return on Investment** in terms of these ecosystem service values

- **Flooding:** Floodplains provide flood protection and reduce infrastructure damage
- **Public Health:** Managing stormwater and reducing retention ponds reduces creation of mosquito habitat
- **Air Quality & Public Health:** Trees reduce the urban heat island effect, reducing smog creation and resulting asthma occurrences as well as reducing nitrogen dioxide and particulate matter
- **Water Quality:** Streamside vegetation filters pollutants and reduces erosion
- **Water Quantity:** Forests and wetlands store water, improve water quality, and recharge groundwater
- **Recreation:** Clean, flowing waters support recreation, including boating, fishing, and swimming while open space provides areas for hiking and biking
- **Quality of Life:** Open space and street trees create a more enjoyable walking environment, benefiting community connection, health, and economic benefit in downtowns and commercial areas
- **Property Value:** Healthy, mature trees add an average of 10-30% to a property's value

The Value of Green: Reduced Paving Costs

Traditional paving costs \$5-7/ft². Reducing just a short, two-mile road from 28' to 20' equates to a savings of **\$422,400 - \$591,360**.



That's *half a million dollars* saved by reducing a short stretch of pavement by just four feet per lane!



When the entire road is shortened for a condensed subdivision instead of sprawling development, that savings grows to the *millions*.

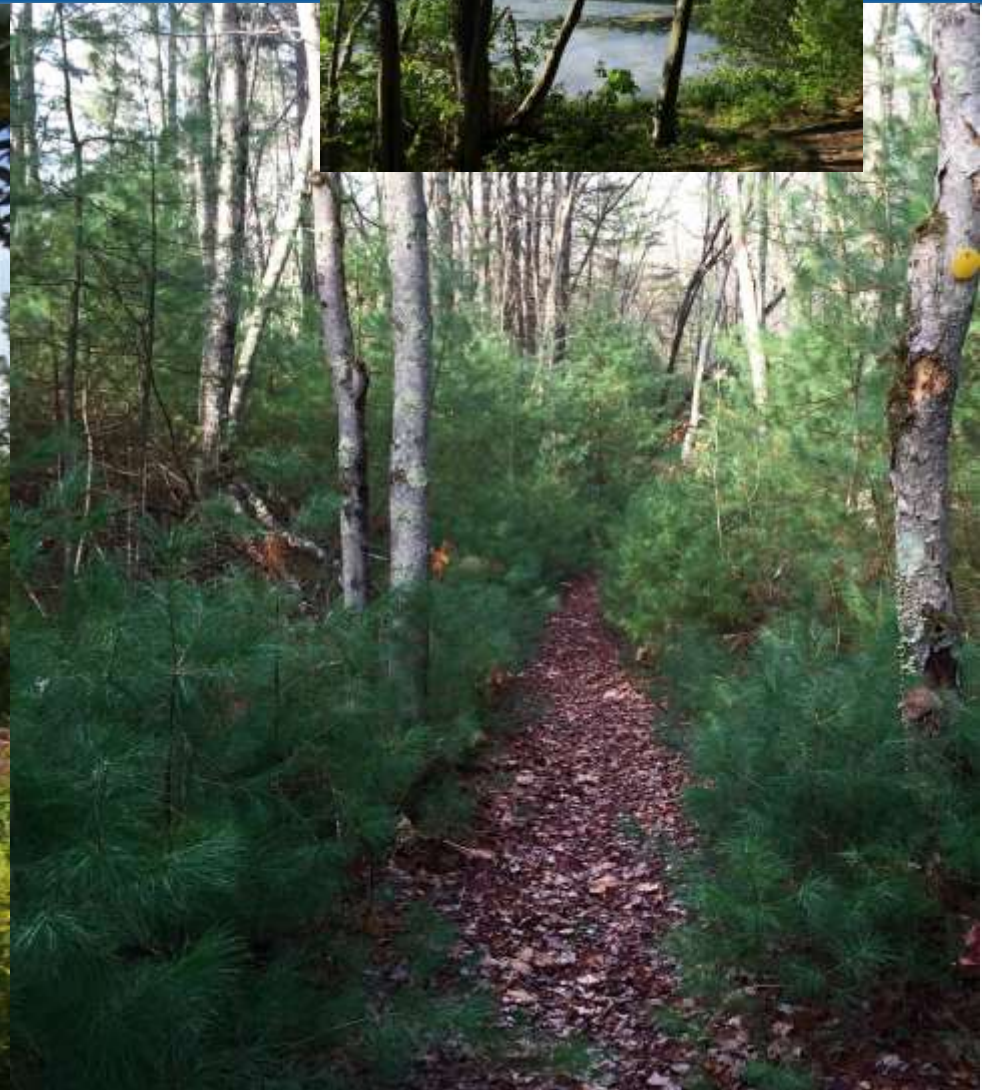
The Value of Green: Reduced Clearing & Grading Costs

- A 20-unit development with two-acre lots requires 40 acres to be cleared and graded.
- Conservation subdivisions that preserve 50% of land save \$200,000-300,000, while maintaining the same amount of development.



The more
land you save,
the more
money you
save.

But which land?



Where to conserve?

As of 2013, **over half** of the land in Massachusetts had not yet been protected or developed.



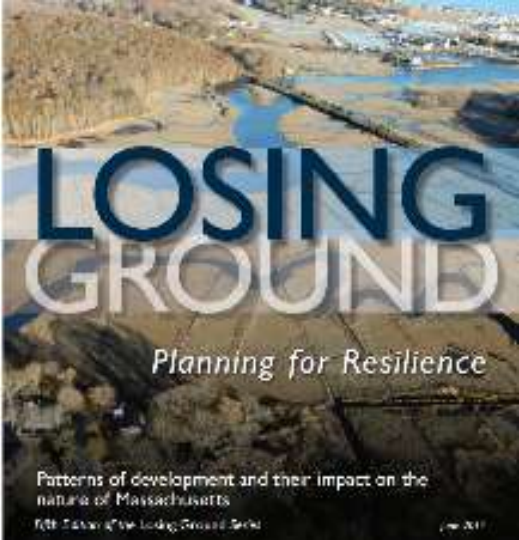
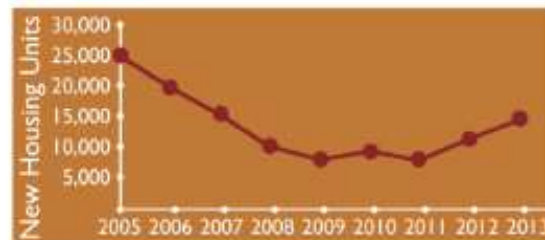
Recent Trends

During the period of 2005-2013,

13 acres of land per day were **developed** (on average).

41 acres of land per day were **protected** (on average).

The rate of development plummeted during the recent **Great Recession**. Lately, however, **new housing permits** are on the rise.



Planning for the Future



of the remaining unprotected land is of **high conservation value**. (BioMap 2)

As development pressures increase, we can plan our land use for both a **strong economy** and a **safe, healthy environment**.



GET OUTDOORS

GET INVOLVED

LEARN

OUR CONSERVATION WORK

NEWS & EVENTS

ABOUT US

Home > Our Conservation Work > Education & Community Outreach > Sustainable Planning & Development > MAPPR Project



OUR CONSERVATION WORK

Wildlife Research & Conservation

Land Conservation

Ecological Management

Education & Community Outreach

Sustainable Planning & Development

Losing Ground Report

Shaping the Future of Your Community Program

Preservation & Development Toolkit

Guidebook to Involvement in Your Community

Cost Effective Low Impact Development (LID)

MAPPR Project

Schools

Partners

Visitor Experience

Mapping & Prioritizing Parcels for Resilience Project



Mass Audubon, in partnership with The Nature Conservancy and LandVest, developed **Mapping and Prioritizing Parcels for Resilience (MAPPR)** to allow Massachusetts conservationists to rapidly identify specific parcels that, if protected, could contribute the most to achieving land protection goals.

While land trusts, towns, and agencies have long relied on a wide range of maps and data sets to identify priority areas for land protection to meet their goals, MAPPR takes advantage of newly available digital parcel data to identify specific land protection opportunities. MAPPR also helps land trusts, towns, and agencies to easily define and refine their priorities, discover new opportunities, and extract the data necessary to take the next steps in land protection.

Support for MAPPR

Development of MAPPR has been supported by the Open Space

Resources

MAPPR Tool

Resources

Questions

For more information:

MAPPR@massaudubon.org

Project Partners



Three main inputs

- **TNC Resilient Landscapes**

- Identifies resilient areas that offer adaptation based on complexity (elevation, soils) and connectivity

- **BioMap2**

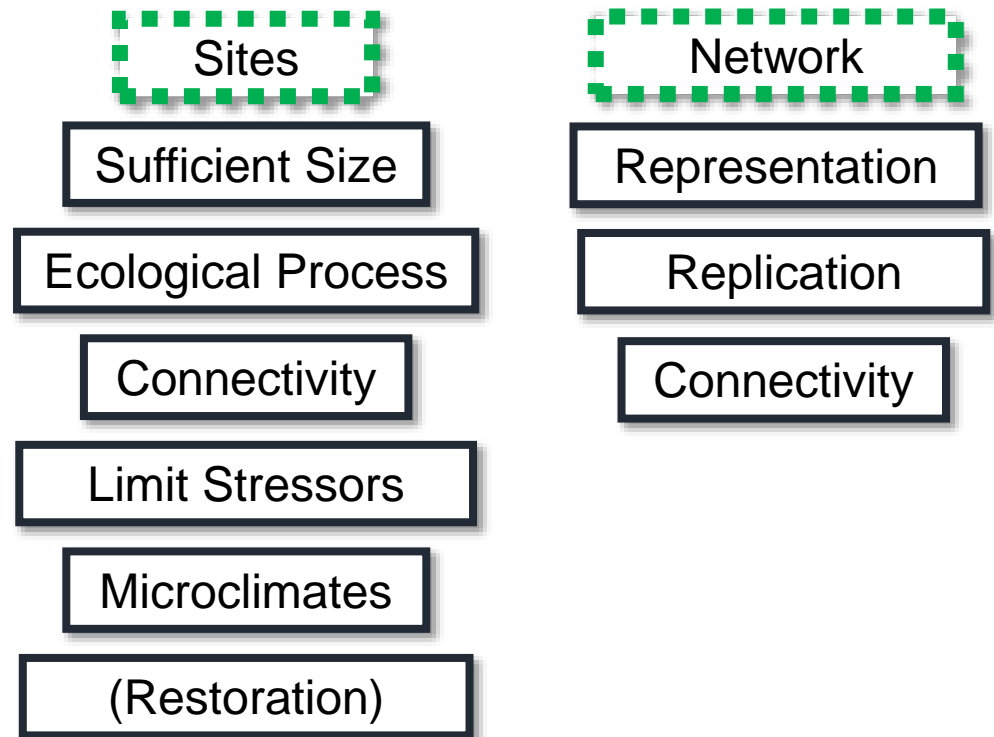
- Identifies areas most critical for ensuring the long-term persistence of rare and other native species and their habitats, exemplary natural communities, and a diversity of ecosystems

- **UMass Amherst's Critical Linkages**

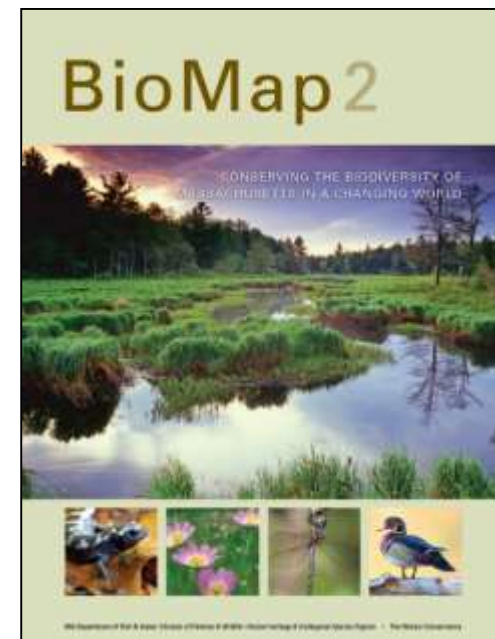
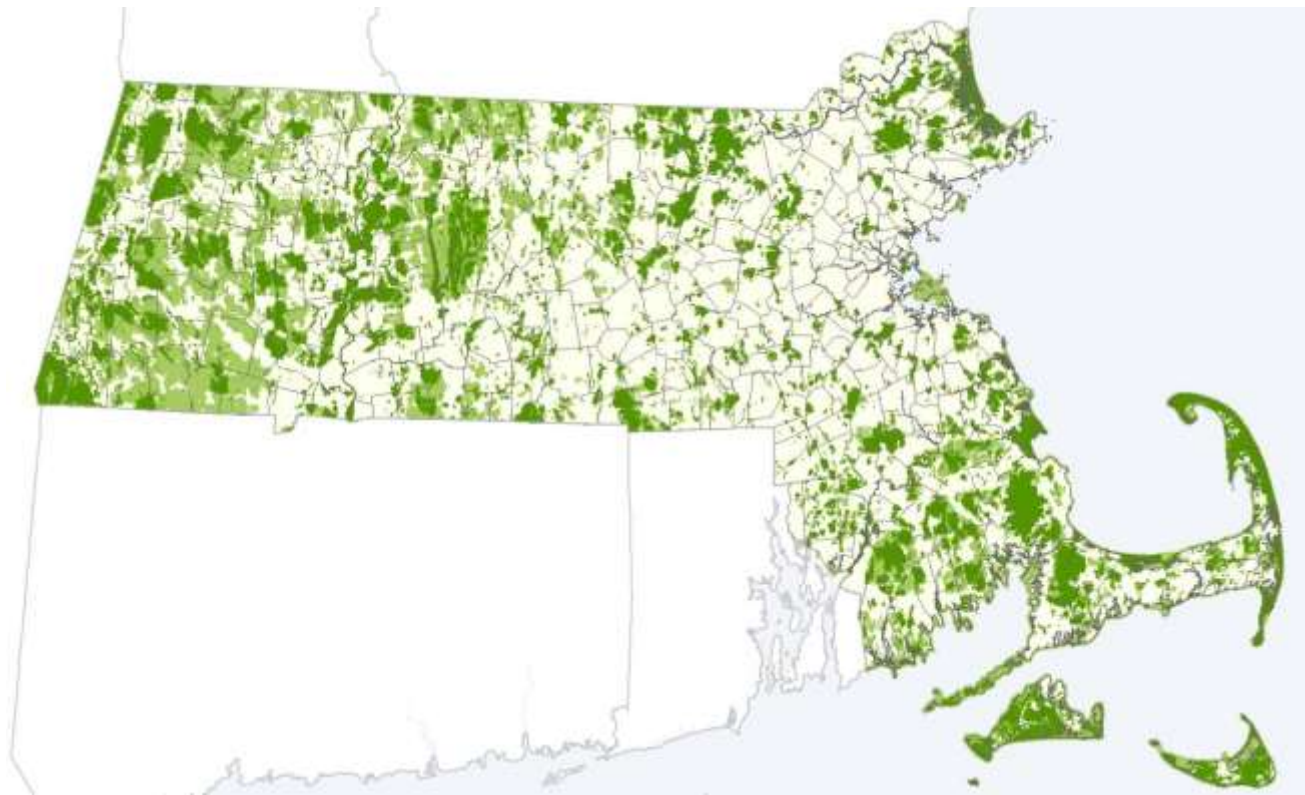
- Identifies connections to protect/restore to support MA's wildlife and biodiversity

Resilience: The ability to recover from disturbance

- Resilient sites are defined by complexity & connectivity
- Physical settings or characteristics of each site are
 - enduring features
 - drivers of biodiversity
 - the foundation for a resilient network of sites



BioMap2



Resilience = Complexity + Connectivity

Landscape Complexity

- How many landforms are available from each point (“microclimates”)

Landscape Connectivity (Permeability)

- How connected are the lands at each point



James C. Engberg

Choose a study area: town, county, watershed

MAPPR Tool

Mapping and Prioritizing Parcels for Resilience (MAPPR) allows land conservationists to identify the parcels within an area of interest that are the highest priorities for protection based on habitat quality, climate change resilience, and other metrics such as parcel size and adjacency to existing protected parcels. Analyses are based on open space data and assessor parcel data available through MassGIS as of April 2015. As a result, ownership information and protection status may be inaccurate for some parcels. Check with your town assessor for the most up-to-date information. Please email any comments to mappr@massaudubon.org.

Instructions [show](#)

Example

Study Area [?](#)

None selected - select one now.

Pre-configured Models

- ☐ Balanced Model
- ☐ Resilience Model
- ☐ Aquatic Model
- ☐ Biological Model

Assign Model Values [?](#)

- ☐ Resilient Sites for Conservation
- ☐ Critical Linkages Priorities
- ☐ BioMap2 Core Habitat
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- ☐ Adjacent to Protection
- ☐ Under-represented Settings

Ref Layer [?](#)

Filter by Parcel Size [?](#)

select min parcel size

Filter by Block Size (Unprotected Acres) [?](#)

select min block size

Constrain Model Only Adjacent to Protection [?](#)

☐

Misc. Controls [?](#)

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- ☐ Show parcel export IDs
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- ☒ Parcel priority rank colors
- ☐ Mass GIS Open Space Layer
- ☐ Blocks of Contiguous Parcels

Map Type Selector [?](#)

- ☒ Street Map
- ☐ Satellite

Run Model [➤](#)

Study Area [?](#)

Choose a category

Town

County

Watershed

Study Area [?](#)

select a town

Barnstable
Barre
Becket
Bedford
Belchertown
Bellingham
Belmont
Berkley
Berlin
Bernardston
Beverly
Billerica
Blackstone
Blandford
Bolton
Boston
Bourne
Boxborough
Boxford
Boylston

Choose a pre-calculated model

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Instructions [show](#)

Examples [show](#)

Study Area [?](#)

Note: [Click here to zoom now.](#)

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[Run Model >](#)

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Or choose your own adventure

MAPPR Tool

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Ref Layer [?](#)

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Check out the differences between models

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[Examples](#) [show](#)

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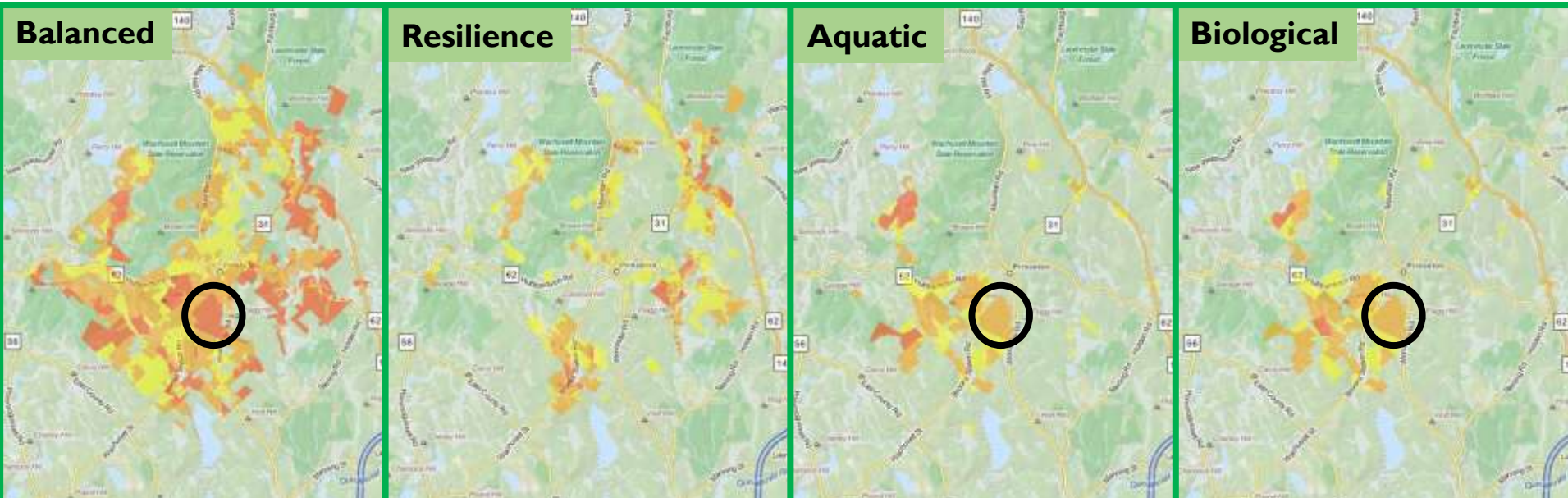
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The different models: Princeton



Priority

- High Priority Parcels
- Medium Priority Parcels
- Lower Priority Parcels

Additional considerations

MAPPR Tool

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Let's try it out!

www.massaudubon.org/mappr

Let's take a minute to review

1. Development is **sprawling**
2. We need to develop **sustainably**
3. First line of defense is to **conserve land**

Now we know where

4. Next, incorporate **LID** practices into development

Let's find out how and who else has done it!

Cottages on Greene: East Greenwich, RI





Cottages on Greene



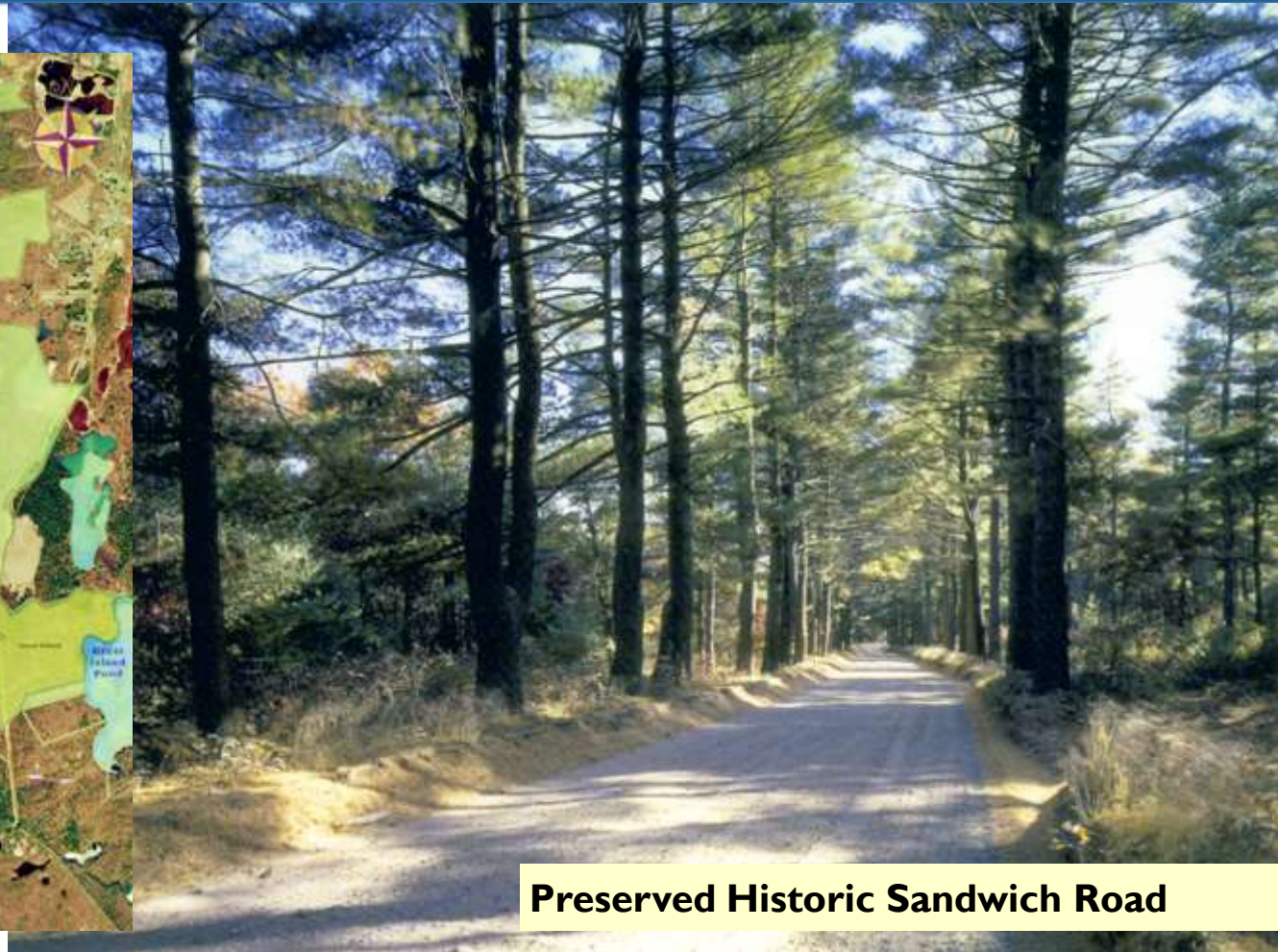
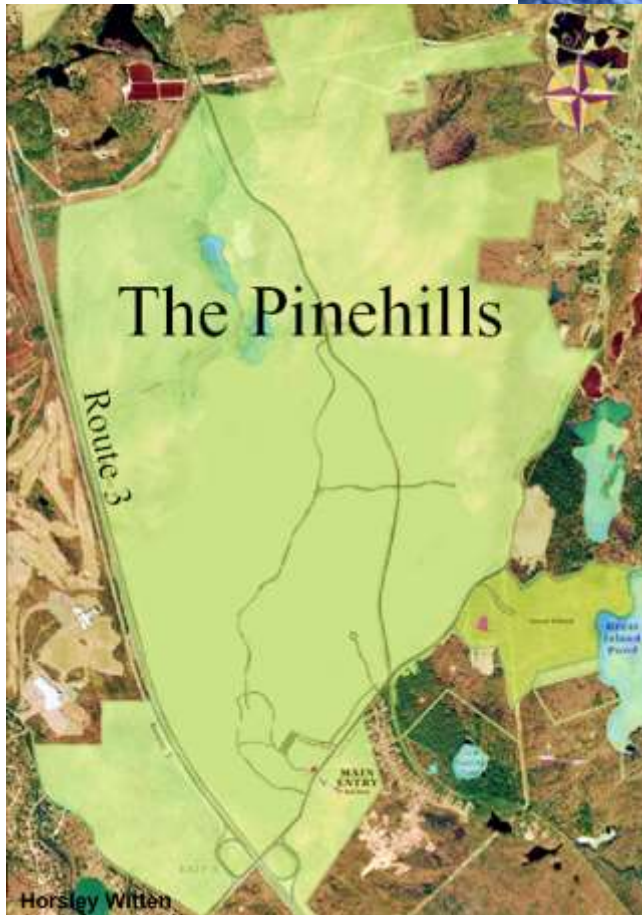
Cottages on Greene

[illegible]

* Preliminary estimate – site design was revised.

****“Apples to apples” starting with a compact site.**

Pinehills: Plymouth, MA



Preserved Historic Sandwich Road

Pinehills



Leominster, MA



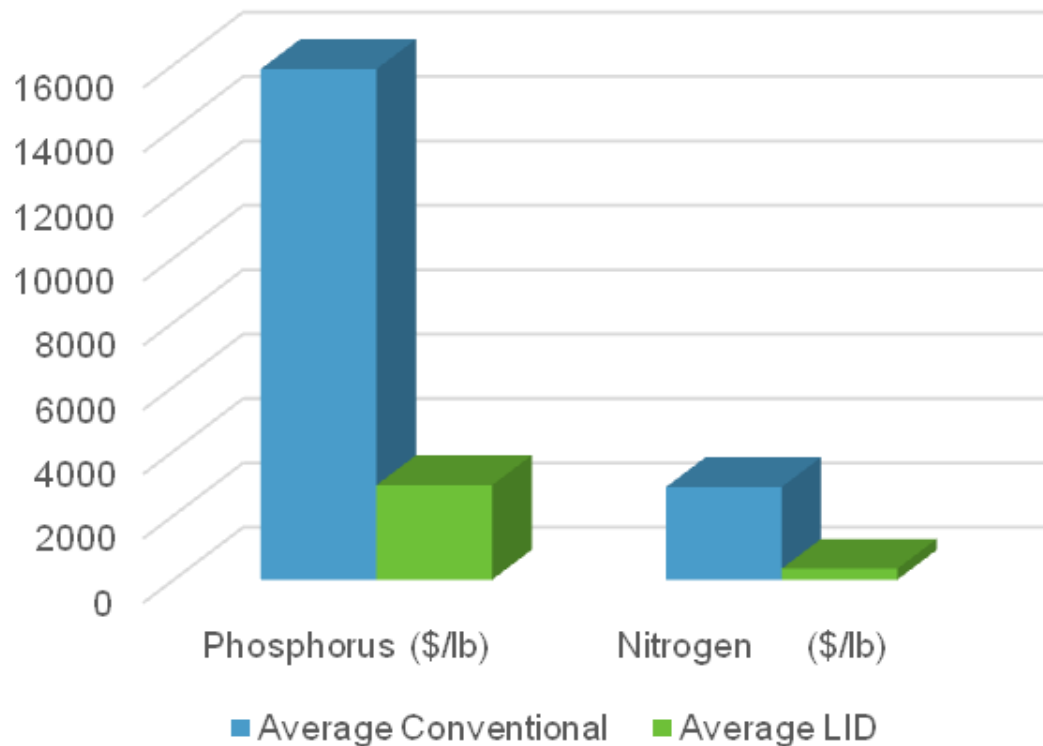
Leominster

Comparison of Nitrogen (N), Phosphorus (P), and Total Suspended Solids (TSS) Reduction:

		Percent reduction:										
		0	10	20	30	40	50	60	70	80	90	100
Bioretention	N				30-50%							
	P				30-90%							
	TSS									90%		
Deep Sump Catch Basin	TSS			25%								
Gravel Wetlands	N								75%			
	P						58%					
Hydrodynamic Separator	TSS				35%							
Infiltration Trench	N					40-70%						
	P					40-70%						
	TSS									80%		

Leominster

Comparison of Present Value Costs in
Nitrogen and Phosphorus Reduction:
LID vs Conventional Detention Systems



Permeable Pavement

- Higher initial cost (\$12/sf vs \$5-7/sf)
- Reduces the amount of land needed for stormwater management
- Can infiltrate as much as 70-80% of annual rainfall
- Reduced flood risk may increase property value by 2-5%
- Can reduce salt use by as much as 75%



Rain Barrels and Cisterns

Runoff Reduction & Water Conservation

- Downspouts directed to tanks or barrels
- 1" rainstorm generates 623 gallons stormwater per 1,000 sf of roof
- Storage: 50 – 10,000 gallons
- Excess diverted to drywell or rain garden
- Landscaping, car washing, other non-potable uses



Bioretention

- \$300-500/year in labor for maintenance (varies by size of swale)
- 70% TSS removal credit with adequate pretreatment



Source: Larry Gavin



Rain Garden

- \$2-12/ft² installed
- \$200/year in labor for maintenance
- Reduces runoff by 90%
- Reduces N, P, metals, and TSS by 65-90%



Green Roofs

- Reduced flooding of and damage to urban streets
- Interior heating and cooling benefits of 10 degrees or more
- Carbon sequestration & air purification
- Recreational amenity
- Improved aesthetics



Green Roofs

- Reduces runoff by 30-86%
- Extended roof life, estimated at 40 years
- Payback of 6.2 years

Over a 50-year period

- Installation, replacement and maintenance cost: \$18/sf
- Stormwater and energy benefit: \$19/sf
- Benefits to the community savings: \$38/sf



U.S. General Services Administration Study:
Green Roof Cost Benefit Analysis

Nature does it best

“LID employs principles such as
**preserving & recreating
natural landscape features**”



Land Protection = Water Protection

- Quabbin & Wachusett Reservoirs serve 2.5 million
- Over 20 years, Massachusetts Water Resources Authority spent \$130M to protect 22,000 acres of watershed lands
- Avoided ratepayer cost of \$250M on a filtration plant and \$4M/yr in operations



The Power of a Bylaw: Westford

- Adopted a Conservation Subdivision bylaw in 1978
- Requires developers to submit both conservation and conventional & Planning Board chooses preferred
- 48 developments protected over 1,700 of land



The Power of a Bylaw: Westford

- Preserved local habitat
- Protected water resources
- Created 13 miles of hiking trails & public recreation
- Town didn't have to purchase the land themselves, saving millions of dollars



Rail Trail in Westford

Save Land, Water, & Money with Smart Land Use Solutions:

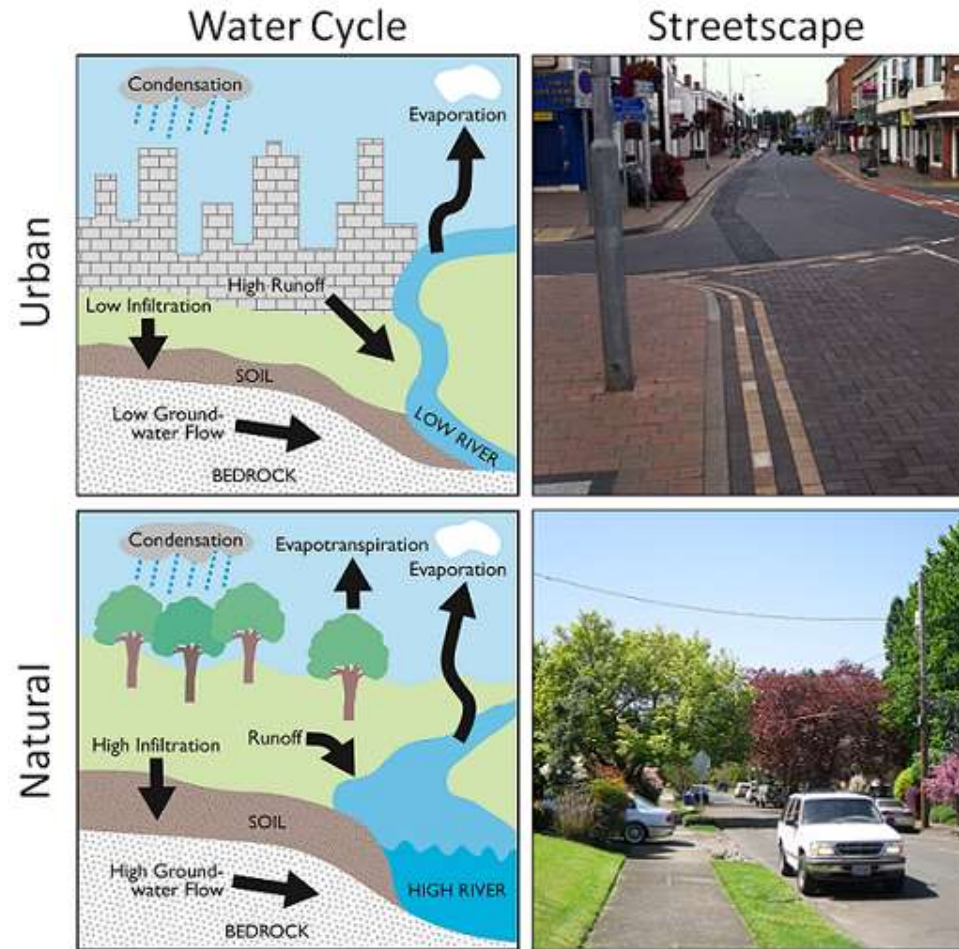
Low Impact Development, and Green Infrastructure
& the **Municipal Sanitary Storm Sewer System
(MS4) Permit**

April 27, 2016

Metropolitan Area Planning Council

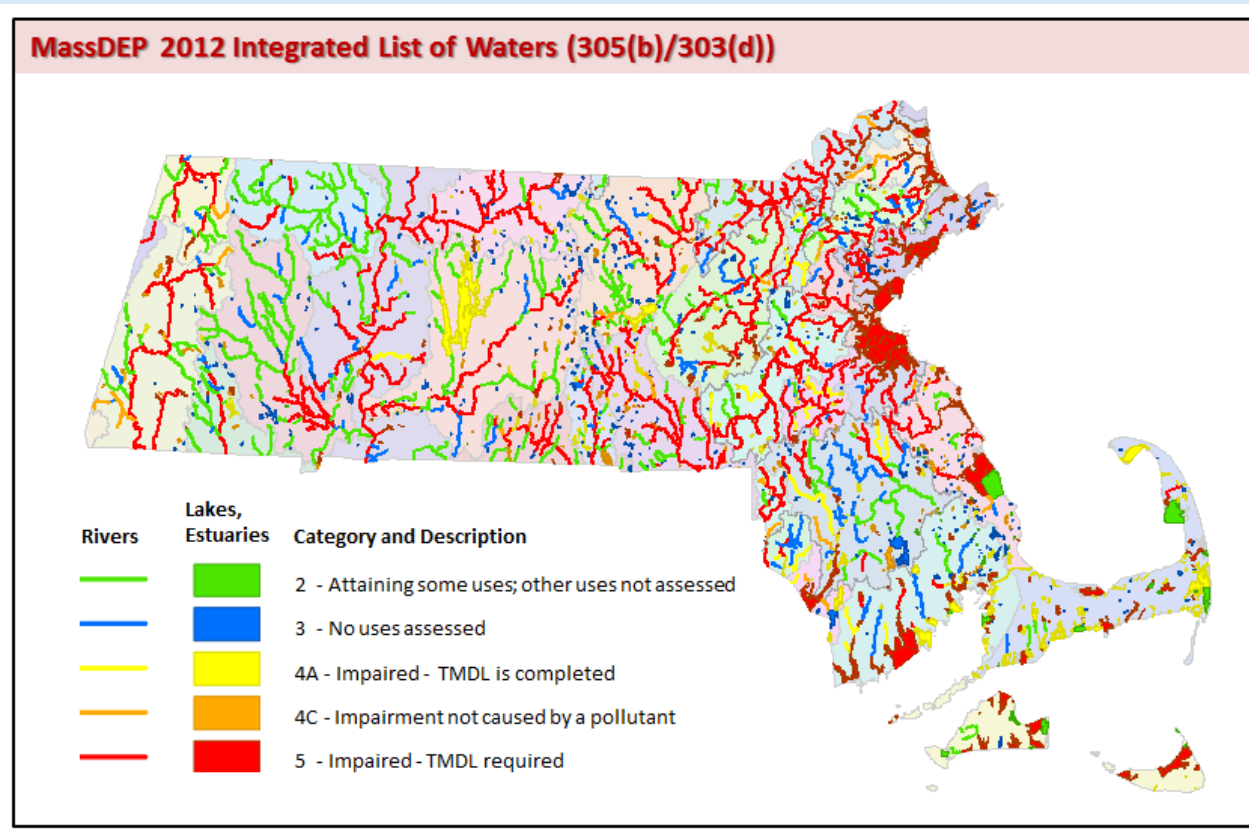


Problem



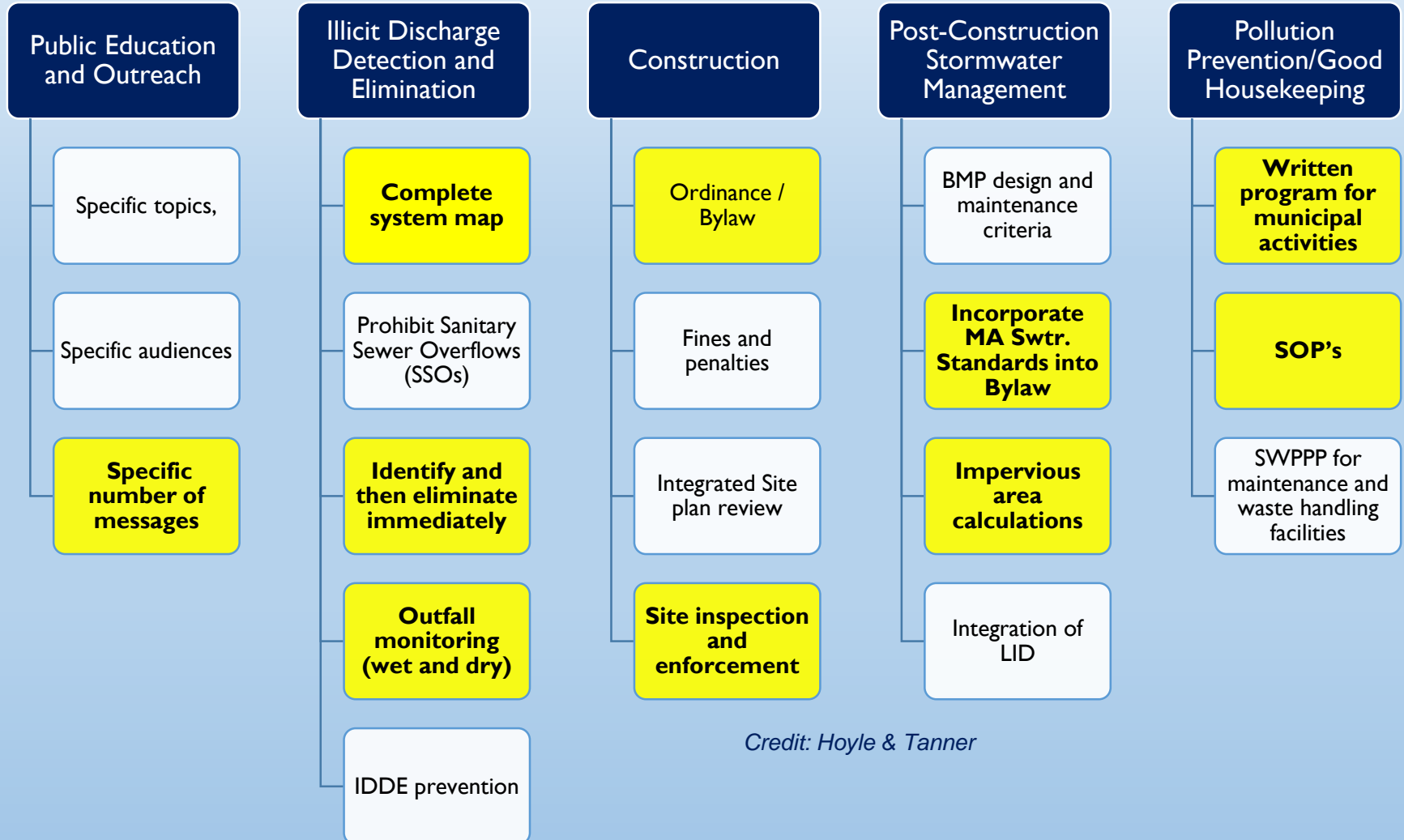
↑ **Impervious Surfaces**
= Env./Human Impacts ↑

Problem



Impervious Surfaces ↑
= Env./Human Impacts

MS4 Requirements



Six “Minimum Control Measures”

- ☑ Public Education and Outreach
- ☑ Public Involvement and Participation
- ☑ Illicit Discharge Detection and Elimination (IDDE) Program
- ☑ Construction Site Stormwater Runoff Control
- ☑ Stormwater Management in New Development and Redevelopment AKA “Post-Construction SW Management”
- ☑ Good House Keeping and Pollution Prevention

Work Together!

Planners, Engineers, DPW Working on...

1. Stormwater Management Plan (SWMP)

2. Stormwater Bylaws and Regulations

- 2003 Requirements
- New Permit: Regulatory Review and Updates

3. Non-Stormwater Bylaw LID and Green

Infrastructure Assessment



Stormwater Management Program

Develop Stormwater Management Program...

- Within one year of Final GP Issuance

SWMP must:

- Address Six Minimum Controls
- Establish Measurable Goals
- Establish Schedule for Achieving Goals
- Designate Responsible Person for Each BMP
- Include Identification/Mapping of:
 - Receiving waterbody segments, classification, and impairment
 - Interconnected MS4s and other separate storm sewer systems receiving a discharge from the permitted MS4



Public Participation is *required*.

Post-Construction SW Management



- ◆ SW Management program for new and re-development disturbing ≥ 1 acre ***AND discharging to MS4***
- ◆ Bylaw/Ordinance to Include:
 - ◆ Retain and/or treat first 1" of runoff
 - ◆ Infiltration near "environmentally sensitive areas"
 - ◆ BMPs that at least meet MA SW Standards
 - ◆ Avoid disturbance of natural areas
- ◆ Track changes to directly connected impervious by sub-basin or catchment annually (year 2)

MCM 4 & 5: Construction Site Runoff Control and Post-Construction Stormwater Management

The permittee must develop, implement, and enforce a program to:

...reduce pollutants in any stormwater runoff to the MS4 from construction activities that result in a land disturbance of... (MCM 4)

....address stormwater runoff from new development and redevelopment projects that disturb.... (MCM 5)

...greater than or equal to one acre. The permittee must include disturbances less than one acre if part of a larger common plan of development which disturbs greater than one acre.

Post-Construction SW Management

- 💧 Report on street and parking rules/design guidance (by year 3)
- 💧 Report on zoning and other changes to allow: green roofs, LID infiltration, and water harvesting (by year 4)
- 💧 Inventory and priority ranking of municipal property & infrastructure that could be retrofitted with BMPs (year 4)



Post-Construction SW Management

Green Infrastructure

Conventional (Gray) Infrastructure	Green Infrastructure
Singe function – carry waste and water; built for cars only; electricity from fossil fuels	Multi-functional - store and treat stormwater; aesthetically pleasing; provide wildlife habitat; electricity from wind, solar; multi-modality, etc.
Manufactured materials	Manufactured and natural materials
Transports stormwater away from site	Manages stormwater on site
Concentrates stormwater and pollutants	Naturally treats and disperses stormwater and pollutants
Roads built for cars only	Roads that accommodate bicycles and pedestrians, and often, have natural elements too.
Electricity from fossil fuels	Electricity from multiple renewable energy sources
Cookie-cutter approach, no room for creativity or complementariness	Work well in tandem with and are complimentary to other types of infrastructure

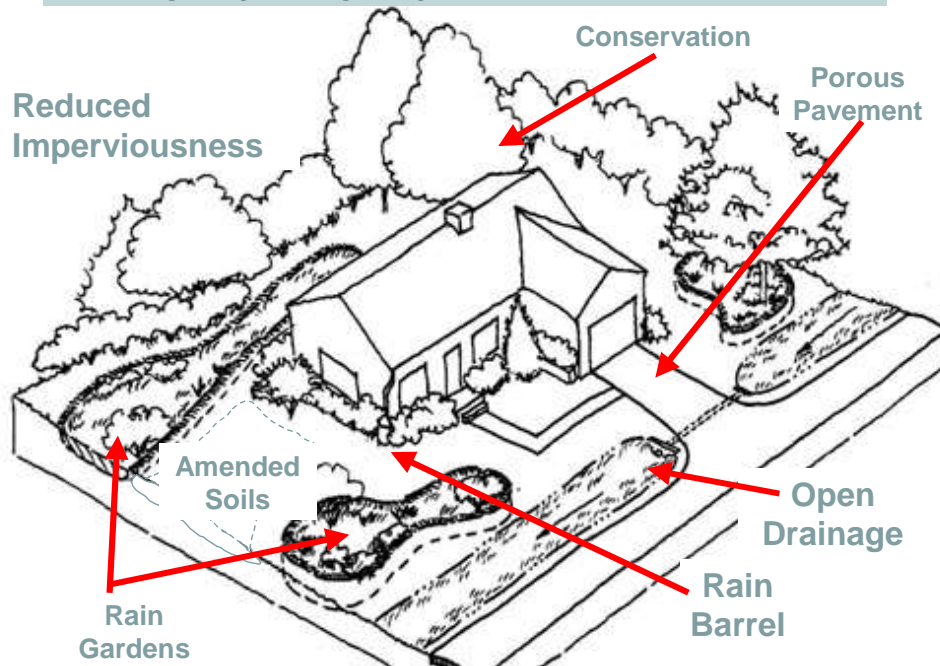
Post-Construction SW Management

Low Impact Development

An ecosystem
based approach
to development



Creating a Hydrologically Functional Lot



Post-Construction SW Management

GI / LID Techniques

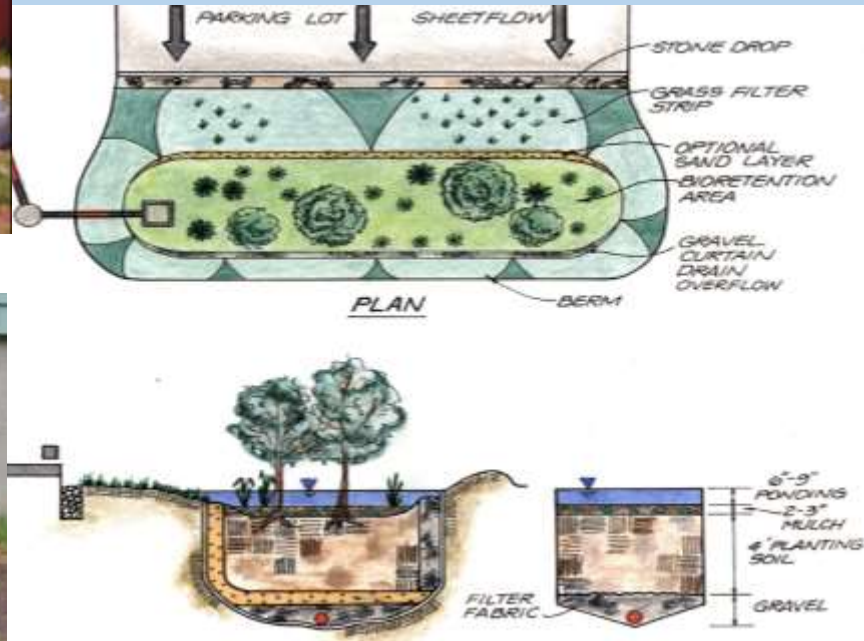
Green Roof



Rainwater Harvesting



Bioretention



Marlborough: Zoning Recommendations

- 1.Reduce parking requirements if there is demand for shared parking applications.
- 2.Allow parking reserves that are unpaved, landscaped in addition to open space requirements).
- 3.Reduce number of parking spaces required where shared parking is allowed off-site
- 4.Eliminate parking requirements for commercial properties
- 5.Limit parking requirements for residential and allowed for payment in lieu of parking



Source: <http://www.upstreammatters.com/green-infrastructure-low-impact-development-providing-watershed-resiliency-for-more-sustainable-communities/>

Stoughton: Zoning Recommendations

Article XXX “Requesting the Town of XX will vote to amend the zoning by-law to establish a XX [location] Mixed Use Overlay District, and Overlay Zoning District by-law map, described as follows:

[1.0] Purpose and Intent

- a) “...benefits of the XX Zoning By-law shall accrue only to those parcels located within the boundary of the District, as follows...”
- b) “The District is established for the accomplishment of the following purposes:
 - facilitating economic development while remaining consistent with the ***established Design Guidelines and sensitive to environmental impacts...***”

[3.0] Special Permit Granting Authority

- a) For all purposes pursuant to Section XX, the ***Planning Board*** is hereby designated as the Special Permit Granting Authority - eliminating the need for multiple board review

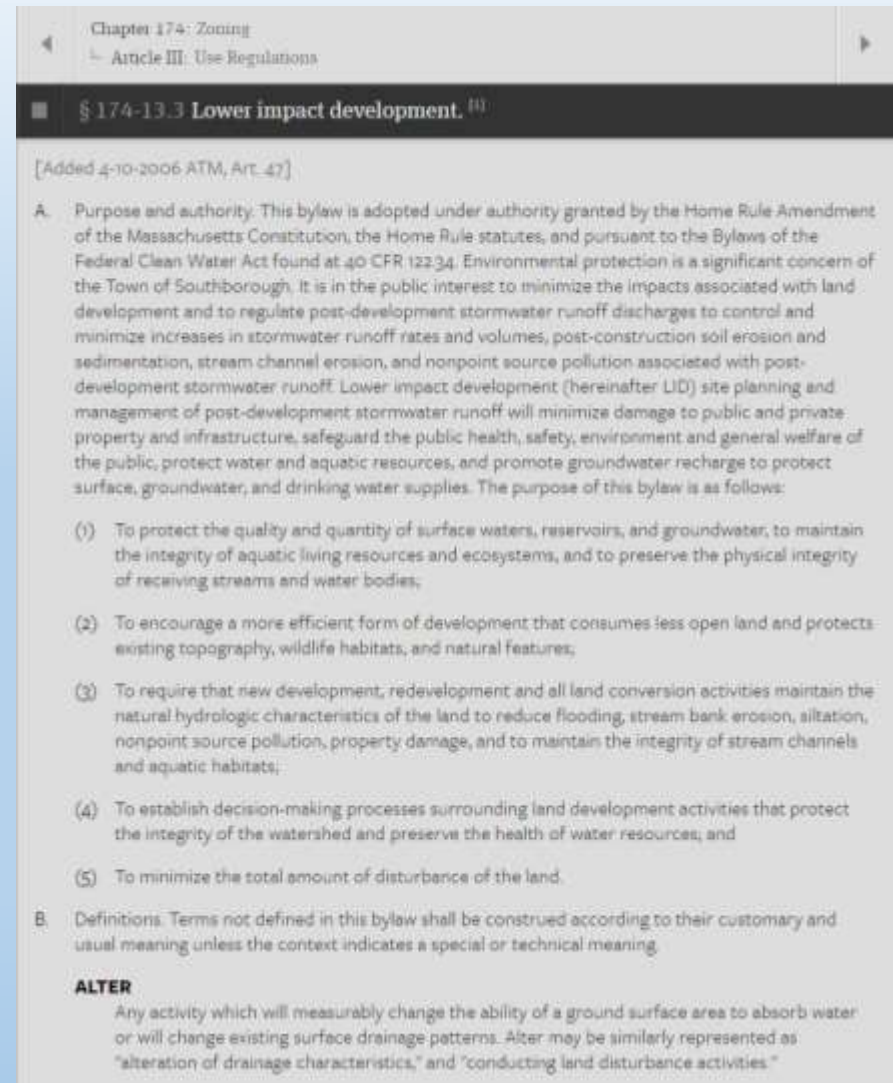
Southborough: LID Bylaw (Site Plan Review)

Zoning Article III: Use Regulations

Section 174: Lower Impact Development

Purpose:

- Protect quality and quantity of surface waters, reservoirs, and groundwater, to maintain the integrity of aquatic living resources and ecosystems;
- Encourage a form of development that consumes less open land and protects existing topography, wildlife habitats, and natural features;
- Redevelopment and all land conversion activities maintain the natural hydrologic characteristics of the land to reduce flooding, stream bank erosion, siltation, nonpoint source pollution, property damage, and to maintain the integrity of stream channels and aquatic habitats;
- Minimize the total amount of disturbance of the land.



Winchester: Code Review

- ✓ Assessment of the Town's existing local measures pertaining to Low Impact Development, in order to identify opportunities to strengthen the town's approach to LID.
- ✓ Used MAPC LID Checklist, based on Center for Watershed Protection Codes and Ordinances Worksheet (COW) - which evaluates a community's existing LID measures based on the following 22 factors:

- | | |
|----------------------------|----------------------------------|
| 1. Street Width | 12. Setbacks and Frontages |
| 2. Street Length | 13. Sidewalks |
| 3. Right of Way | 14. Driveways |
| 4. Cul-de-Sacs | 15. Open Space Management |
| 5. Vegetated Open Channels | 16. Rooftop Runoff |
| 6. Parking Ratios | 17. Buffer Systems |
| 7. Parking Codes- | 18. Buffer Maintenance |
| 8. Parking Lots | 19. Clearing and Grading |
| 9. Structured Parking | 20. Tree Conservation |
| 10. Parking Lot Runoff | 21. Land Conservation Incentives |
| 11. Open Space Design | 22. Stormwater Outfalls |



Source: <https://www.epa.gov/soakuptherain/rain-barrels>

Winchester: Code Review

Key Findings:

Parking ratios

- Consider establishing maximum parking requirements versus minimum standard
- Reduce parking ratios if shared parking arrangements can be implemented or if mass transit or municipal parking facilities are within a short distance (up to 400 feet).

Parking Codes- Investigate the feasibility of establishing shared parking arrangements, including offering shared parking model language agreements

Parking Lots- Consider allowing the creation of reserve parking areas with pervious surface materials.

Open Space Design- Consider allowing cluster / other open space residential design developments as by-right instead of by special permit

Tree Conservation:

- Prevent the clearing of specific stands of trees over a certain caliper size or the clearing of special environmental areas unless specific mitigation measures were offered in exchange.
- Consider updating “Damage to Trees” ordinance in Town Bylaw with a stand-alone tree ordinance.

Neponset Stormwater Partnership: Non- Storm Water (SW) Bylaw Review

[illegible]

Neponset Stormwater Partnership: Non- Storm Water (SW) Bylaw Review

Priority Non-stormwater Bylaw Recommendations	Canton	Dedham	Milton	Sharon	Stoughton	Westwood	Medfield	Norwood	Randolph	Walpole
Don't require greater than 22-foot paved widths on low traffic residential streets.	R		R		R		R	R	R	R
Permit road-side swales and don't require conventional curbing on both sides of the street.	R				R	R	R	R	R	R
Allow permeable parking for shoulders and parking lanes in residential areas.	R	R	R		R	R	R	R	R	R
Require re-establishment of soil permeability compacted by construction work.	R		R	R	R		R	R	R	R
Minimize cul-de-sac radii. (35 feet optimal)	R	R			R		R	R	R	R
Require landscaped cul-de-sacs with bio-retention cells.					R		R	R	R	R
Permit one-way loop streets to eliminate turnarounds.	R						R	R	R	R
Zoning and subdivision regulatory language should not prohibit Low Impact Development	R	R				R	R	R	R	R

Low Impact Development Toolkit



State standards and EPA's Phase II rules have made stormwater a critical development issue, and many cities and towns are now considering local stormwater bylaws to expand and centralize local authority.

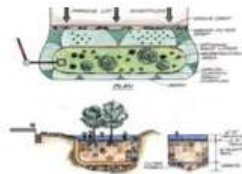
However, communities and developers are looking for alternatives to conventional "pipe and pond" stormwater controls, which are often considered unsightly, expensive, and ineffective. Meanwhile, combined sewer overflows are forcing municipalities to address runoff from densely developed areas.

Low Impact Development

Low Impact Development (LID) is a more sustainable land development approach that begins with a site planning process that first identifies critical natural resource areas for preservation. LID ensures that maintenance of natural drainage flow paths, minimization of land clearance, building clustering, and impervious surface reduction are incorporated into the project design. LID includes a specific set of strategies that treat stormwater management at the site level, ensuring that water is managed locally rather than engineering the discharge of water away from its source.



Low impact techniques are used nationwide, with an established set of design and performance standards that can be applied to achieve compliance with state and local codes.



Increasing interest in low impact strategies has created a growing demand for LID-proficient designers for both new construction and retrofit efforts.

Low Impact Development (LID) Toolkit

The MAPC Low Impact Development Toolkit builds from the efforts of the State's [Smart Growth/Smart Energy Toolkit](#), providing a practical set of visual fact sheets on Low Impact Development methods including rain gardens, bioretention, pervious pavement, and green roofs. The toolkit also includes model bylaw language and an LID codes checklist.

LID Toolkit Fact Sheets

- [Download Fact Sheets 1-3](#) : Low-impact Site Design, Roadway and Parking Lot Design, & Permeable Paving
- [Download Fact Sheets 4-6](#) : Bioretention areas, Vegetated Swales, & Grass Filter Strips
- [Download Fact Sheets 7-9](#) : Infiltration Trenches and Dry Wells, Cisterns and Rain Barrels, & Green Roofs

For more information about the LID toolkit, please e-mail lid@mapc.org.

How to Get Started!

1. **Research low impact principles and techniques.** Detailed design manuals for LID techniques and applications, published case studies with sizing details, monitoring data, and cost information.
2. **Find opportunities to apply LID techniques.** Begin to recommend simple LID techniques such as swales, bioretention cells, or simply disconnecting downspouts from the stormwater system. Educate your clients!
3. **Educate local boards and regulators.** Provide local officials and board members with information about LID to improve trust and communication during the regulatory review.
4. **Team up with experts.** Some firms in Massachusetts have extensive experience with application of low impact techniques. Find opportunities to partner with them as a learning experience.
5. **Help pass a stormwater bylaw.** As communities draft stormwater bylaws, they now ***must*** permit and encourage LID and green infrastructure. Engineers and planners should be involved to ensure that the bylaw is workable and provides predictability for developers.

Also, work with Mass Audubon's Shaping the Future program...

Technical Assistance

- Meeting with municipal staff and public officials
- Answering questions & sharing resources
- Offering support to review local land use regs in comparison to best practices
- Producing report on findings for each community



Take Home Messages

- Natural GI provides numerous **free services**
- LID/GI offer **numerous benefits** including quality of life, economic, and environmental
- LID/GI are **cost effective** techniques
- **It's been done!** Resources are available.



Take Home Messages

We can't continue on our current, business as usual path.

- Conservation design, narrow streets, & LID drainage need to be the **preferred**, easy-to-permit option
- Do **your** bylaws encourage sustainable development?



Thank you!

For more information, please visit
www.massaudubon.org/LIDcost

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