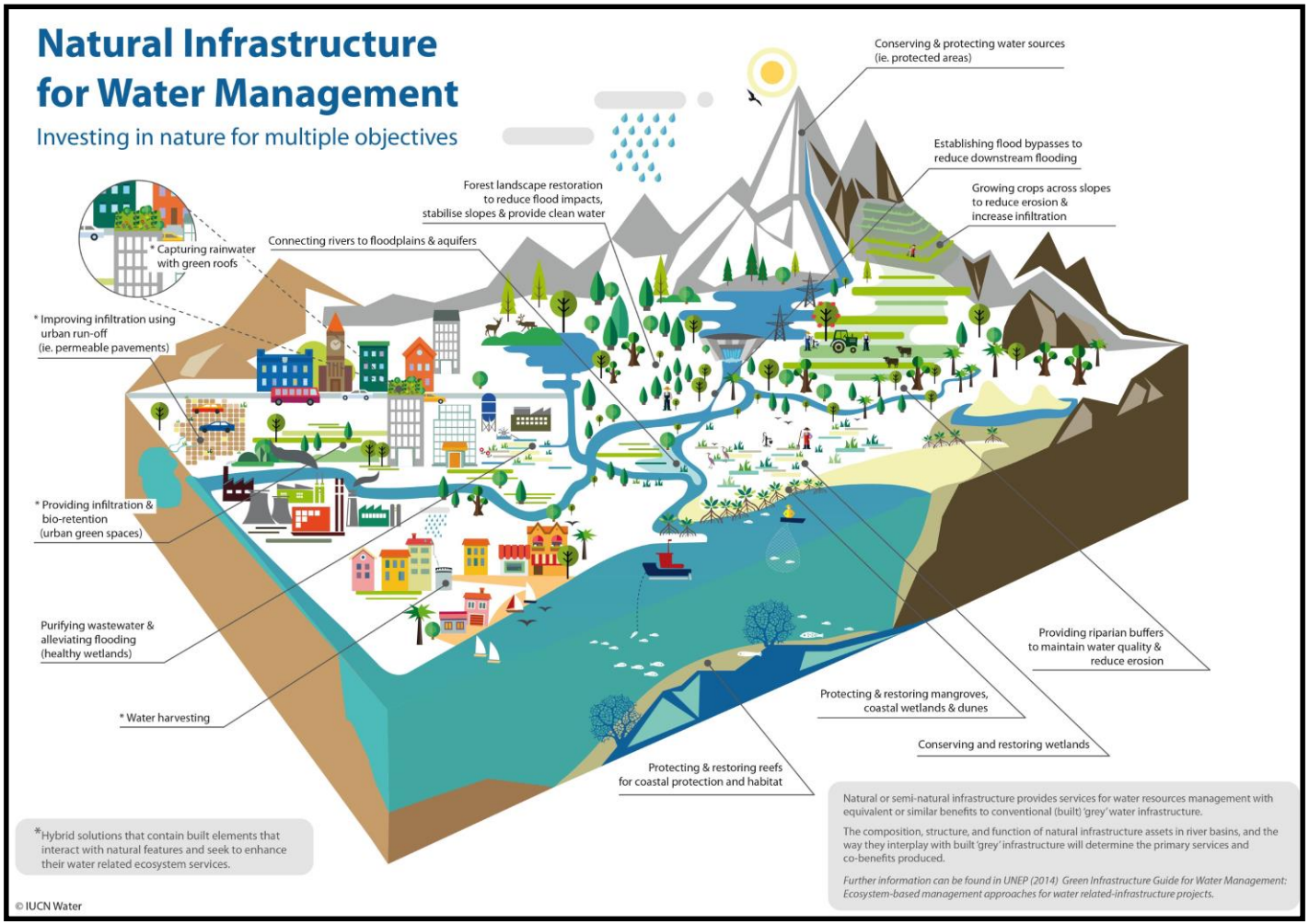
Investing in Natural Infrastructure for Water



Marcy Lyman
Bullard Fellow
Harvard Forest

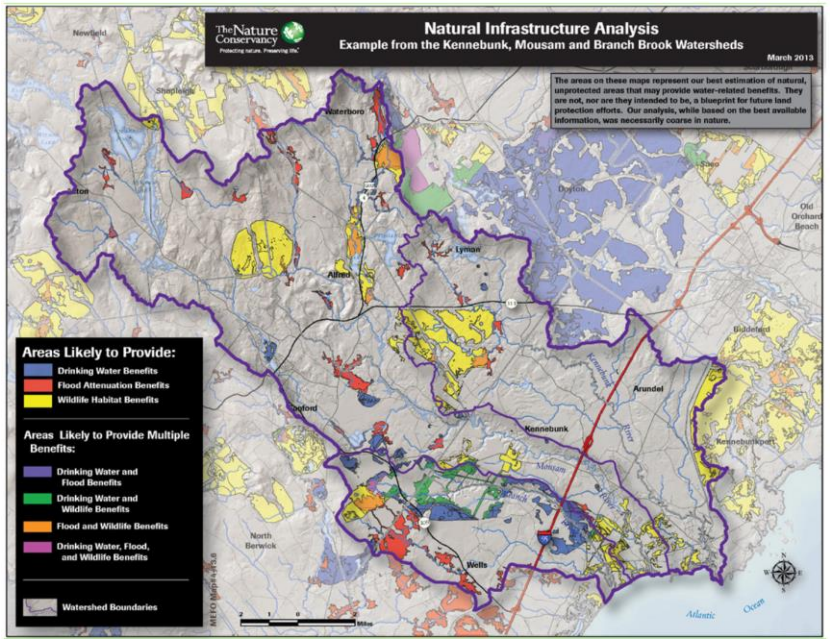
Spencer Meyer
Senior Conservationist
Highstead Foundation

A Natural Infrastructure Investment Program for NH?

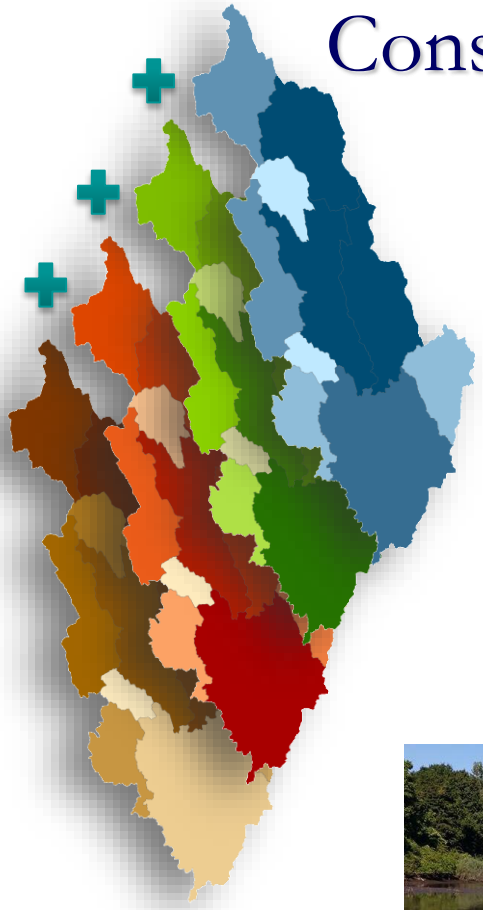
- $3 billion invoice for water infrastructure
- Legislative committee studying funding with no recommendations for natural infrastructure
- History and experience investing in forests for water services

Introduction to Investing in Natural Infrastructure for Water

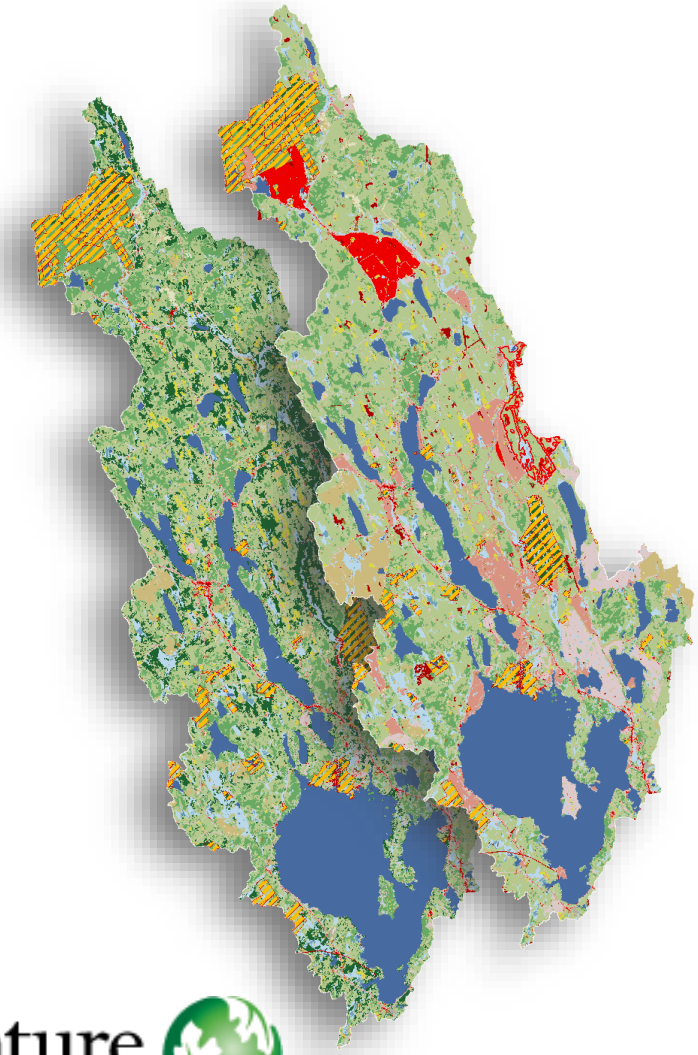
- Make the Case for Conservation & Economics
  - Evaluating multiple conservation and public values
  - Investments vs. "investments"
  - Making a business case for investments
- Opportunities and Challenges
  - Enabling policy
  - Technical knowledge, assistance
  - Stakeholder network
- Case Study: Portland Water District
- Framework for New Hampshire



Conservation's Return on Investment



- Clean water
- Clean air
- Flood control
- Timber
- Carbon
- Recreation
- Wildlife habitat



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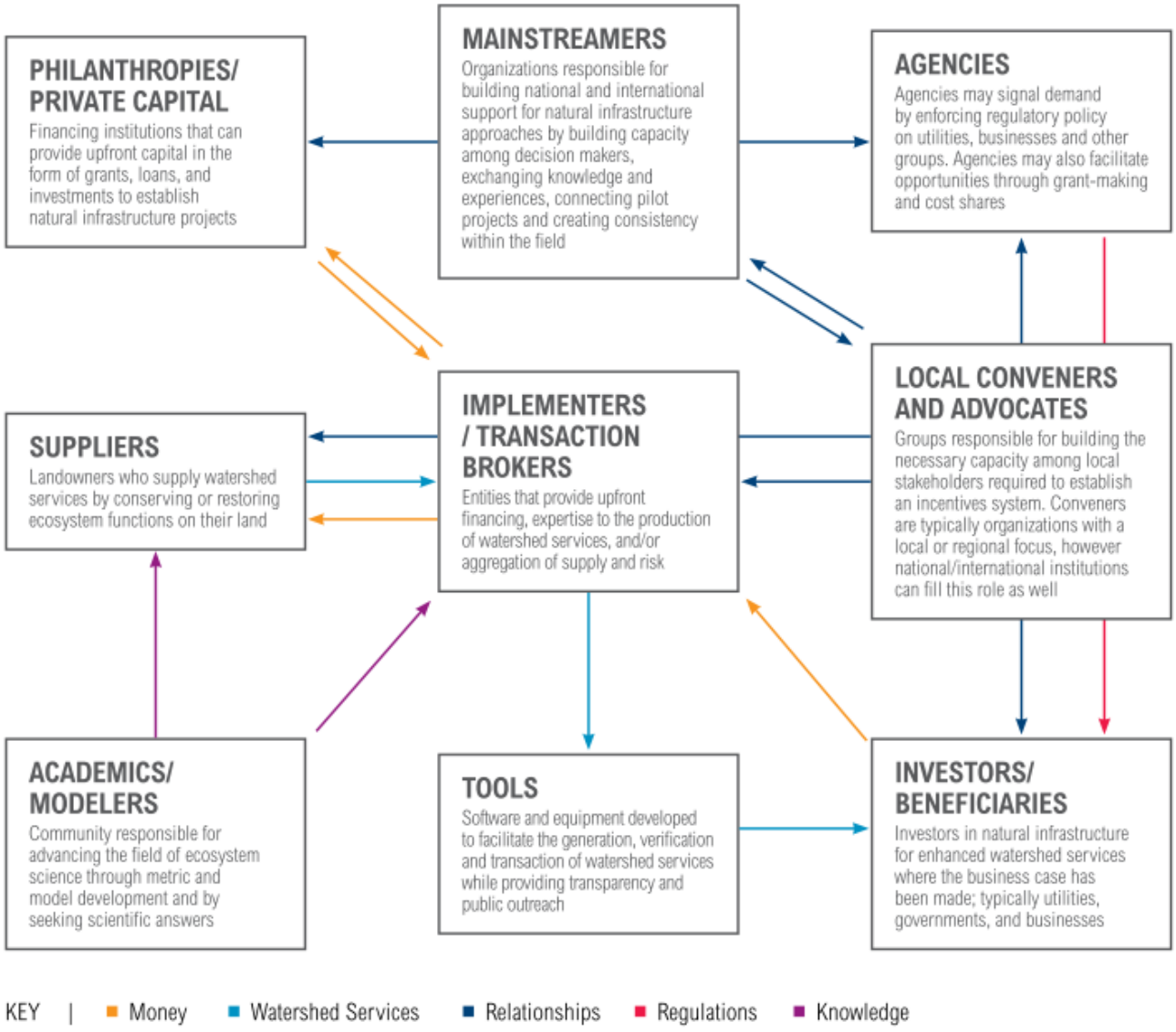
The Challenges of Investing in Watersheds:

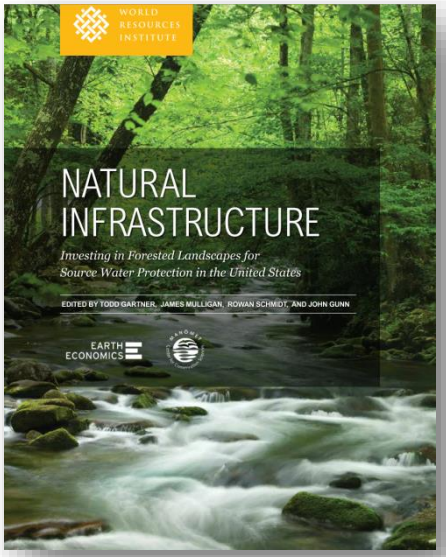
Pay for Ecosystem Conservation/Restoration
Now to Reduce Future Costs

- Who pays costs in the long run?
- Who stands to gain?
- Who will put up capital now?
- How will performance be evaluated?
- Will the ecosystem be restored?
- Will you still need to invest in grey infrastructure later?

Water as Fragmented Sector

Figure 10 | **The "Actor Network" in Successful Natural Infrastructure Efforts**





Selling the Business Case
…for each type of investment

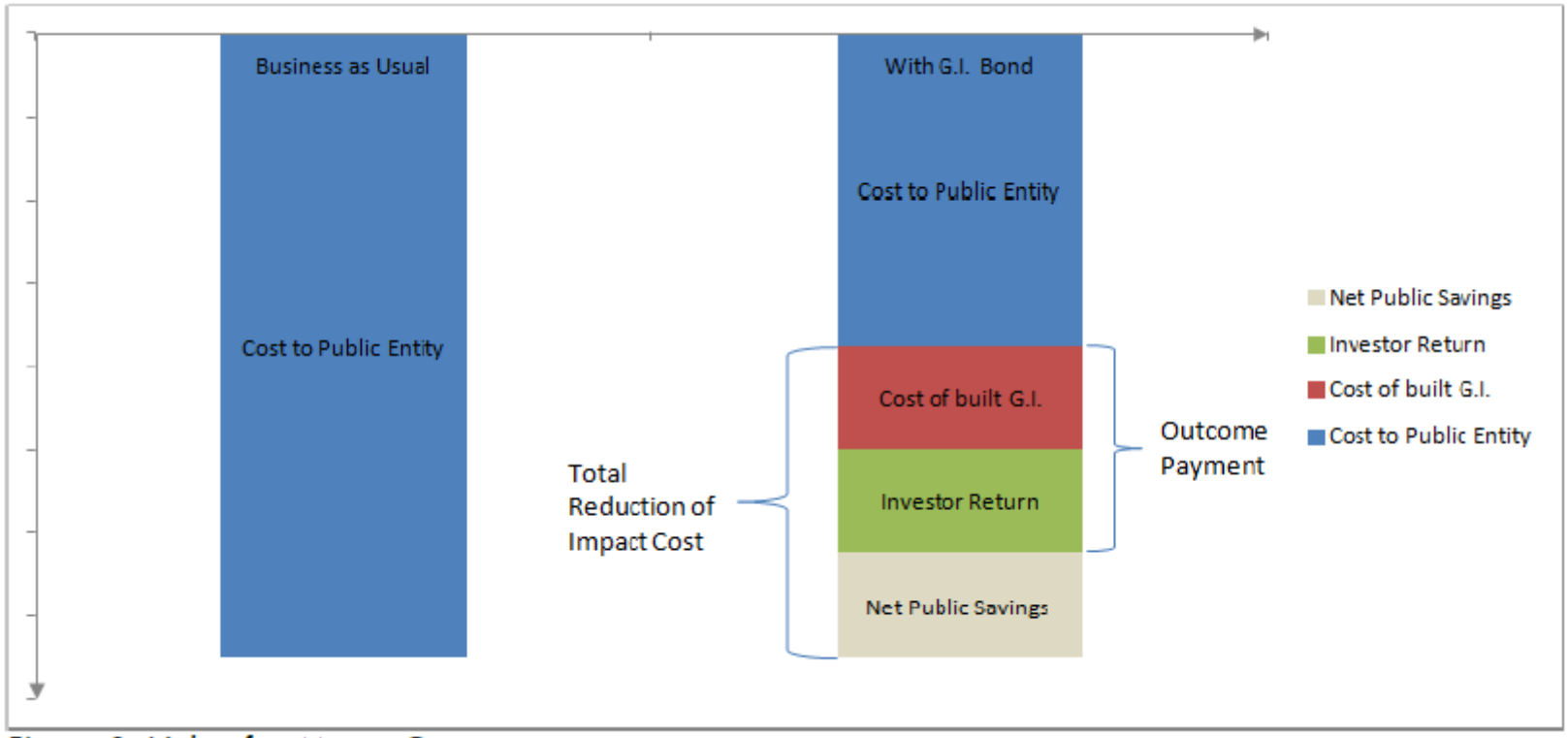
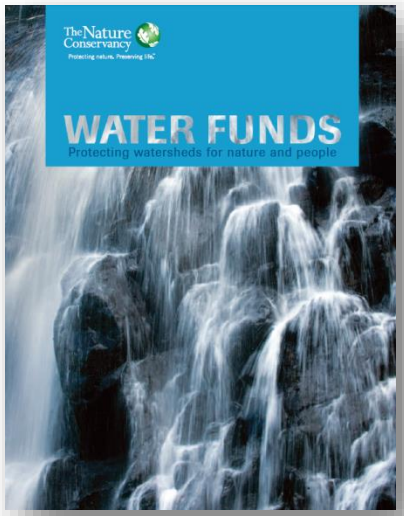


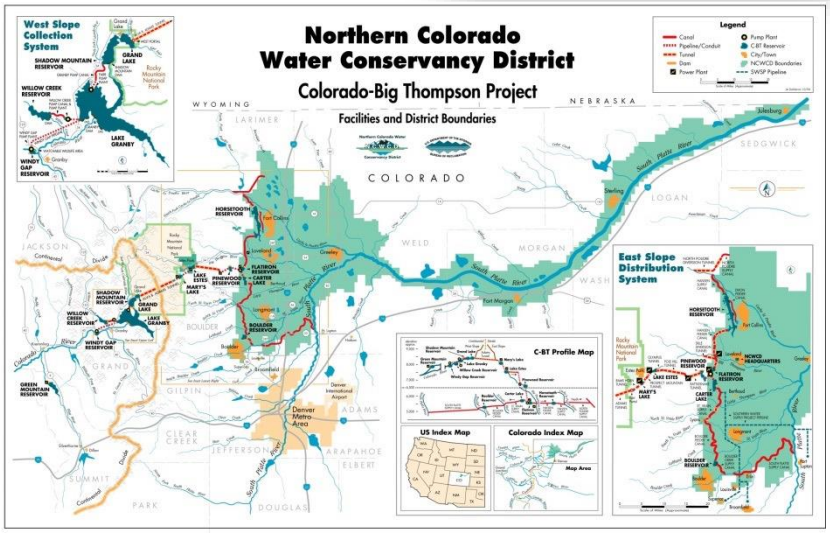
Figure 2: Value-for-Money Case

Holland and Daniello 2014

Water Funds

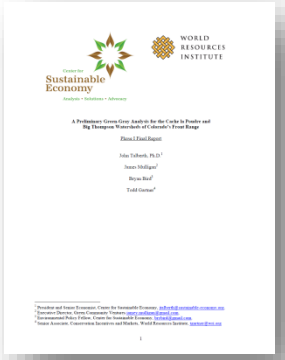
- Stakeholders invest in their water
- Key Components
  - Ecosystem services mechanisms
  - Financial mechanisms
  - Institutional mechanisms
  - Water funds linked to conservation
  - Accountability





Colorado Conservation Exchange: The Lower Watershed Opportunity

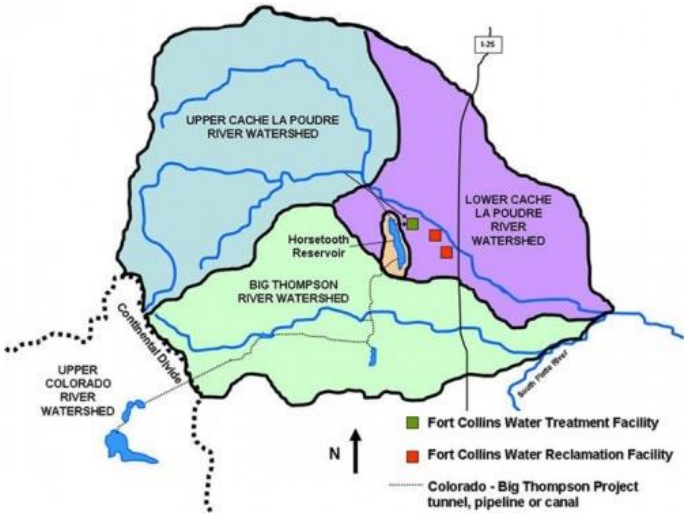
213,000 grazing acres and 172,000 farm acres could add BMPs



BAU cost: $23-26 million

NI cost: $7-13 million

Savings: $10-15 million



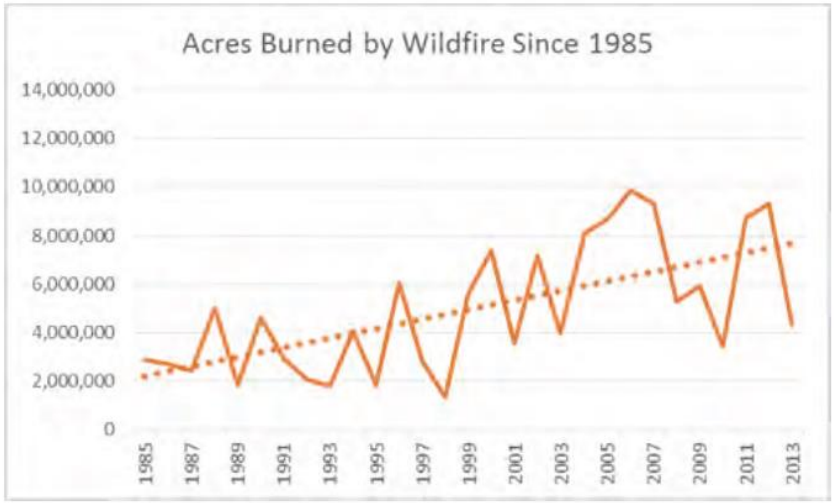
Colorado Conservation Exchange: The Upper Watershed Opportunity

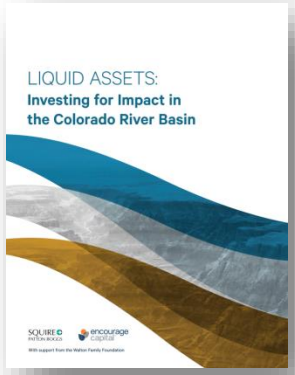
270,000 to 470,000 high-risk acres to be treated

BAU cost: $565 million

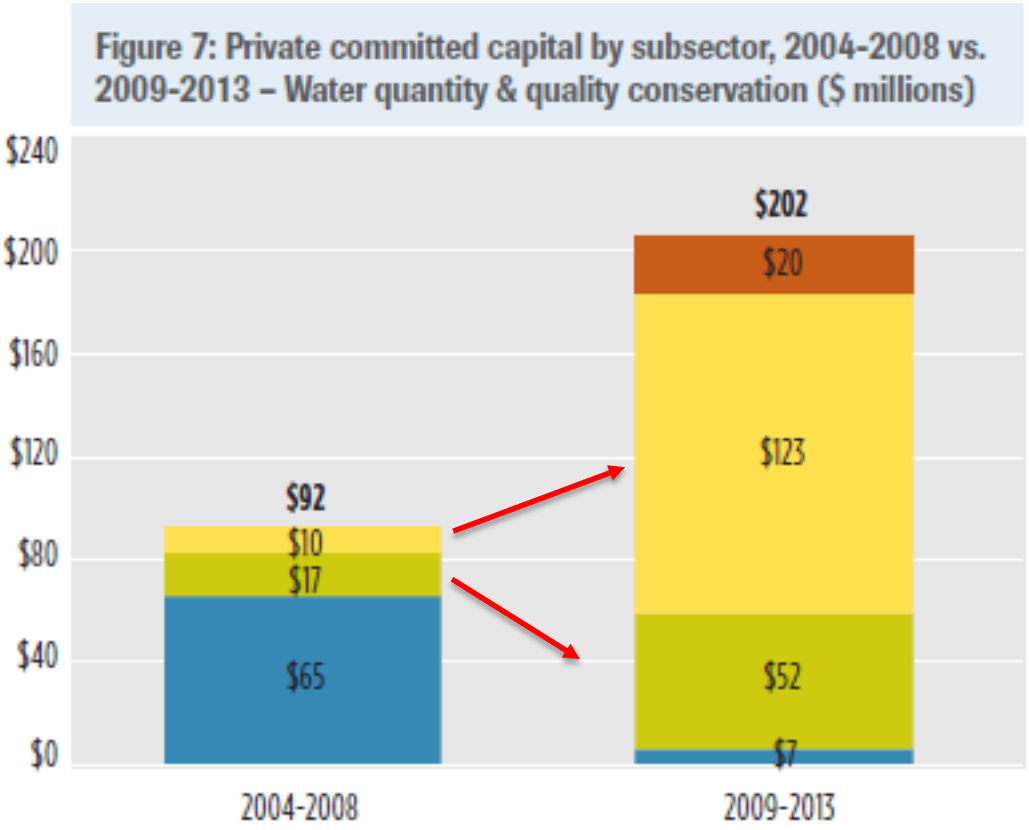
NI cost: $247-366 million

Savings: $200-320 million

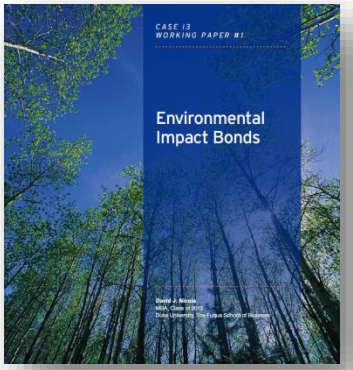




Scaling Up
Water Quality/Quantity Investments



Environmental Impact Bonds



- Use when need capital to fund future savings (e.g., green infrastructure)
- "Pay-for-Performance" ties returns to conservation outcomes
- Requires <u>future cash flows</u>, <u>standard metrics</u>, and usually <u>regulation</u>

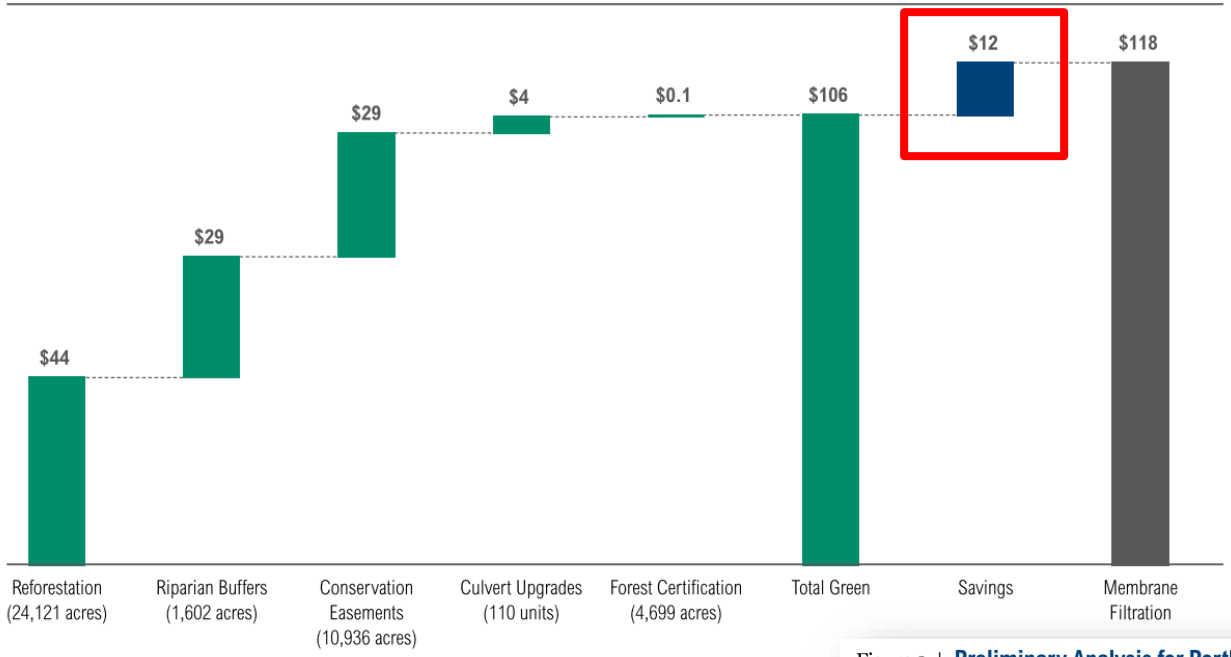
		Annual Bonus Return-at-Risk
Investment ("Bond Principal")		$10 mm
Annual Coupons		Yes (e.g., 5% of principal)
Annual Bonus		Yes
Performance Targets Are Met	Payment at Maturity	$10 mm
	Investor Return on Investment (ROI)	Positive
Performance Targets Are Unmet	Payment at Maturity	<$10 mm ($10 mm less the nominal value of prior coupon and bonus payments)
	Investor Return on Investment (ROI)	0.0%

Case Study: Portland, ME

- Portland Water District: 22 M gal/day for 200,000 consumers
- Water from 30,000 ac Sebago Lake
- Filtration avoidance permit = $97-155M savings
- 10% of watershed is protected from development

Natural Infrastructure Savings

Figure 2 | **Preliminary Analysis for Portland, Maine—Baseline Scenario ($ millions)**



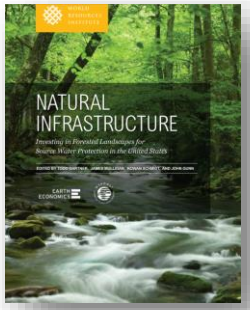
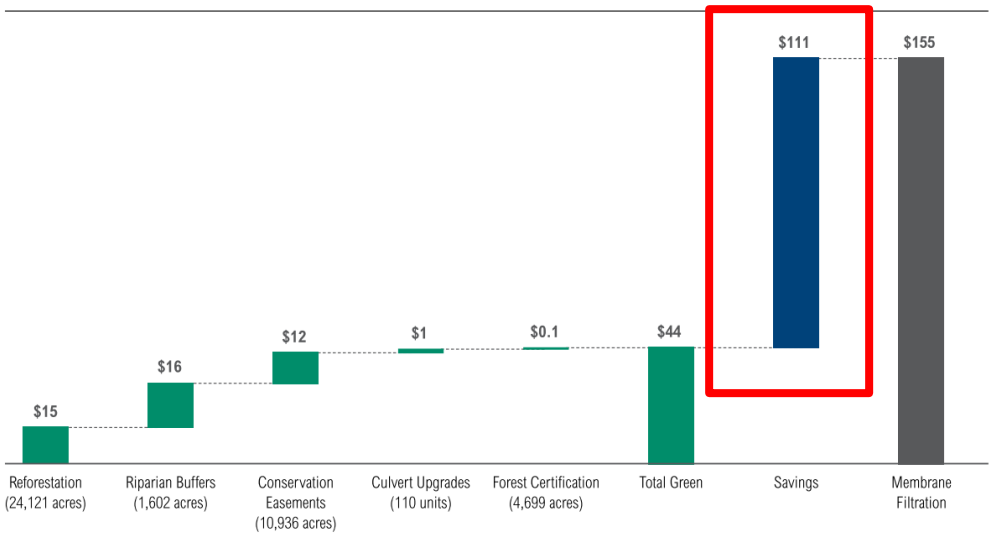
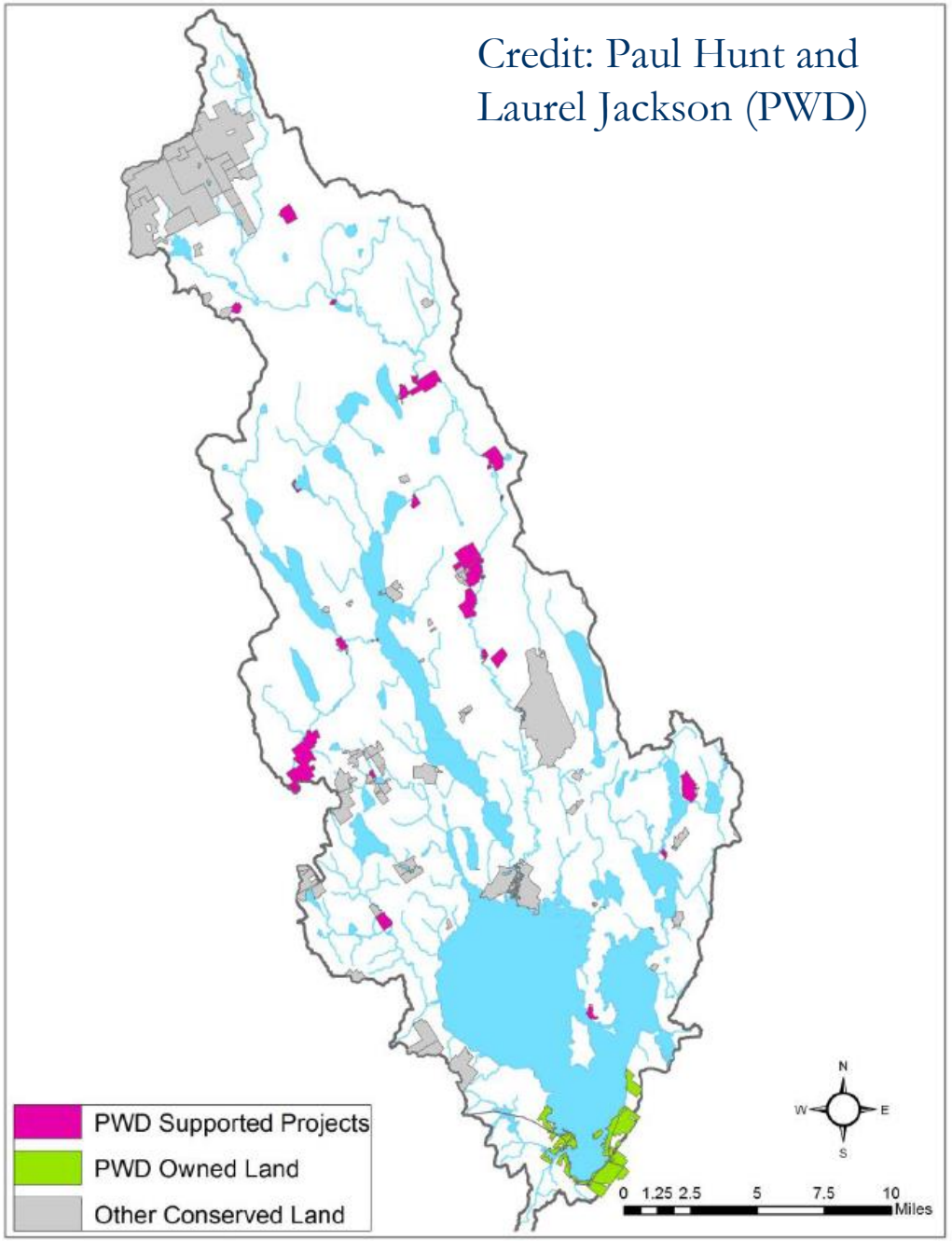


Figure 3 | **Preliminary Analysis for Portland, Maine—Optimistic Scenario ($ millions)**

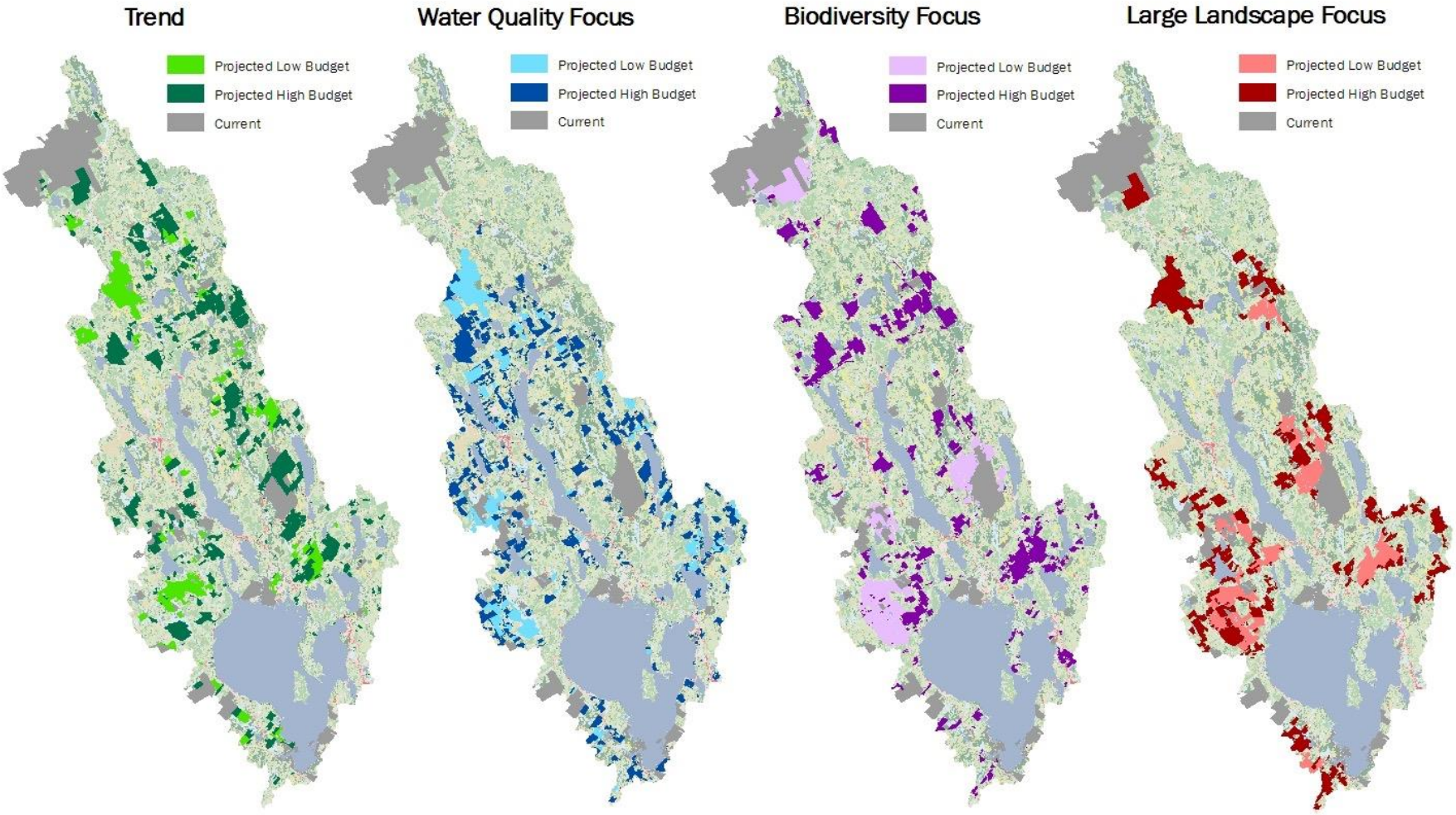


PWD Land Conservation

- Began in 2007
- PWD land conservation program will up to 25% of individual conservation transactions
- Equates to ~ $6M over next 25 years
- Works with local land trust partners



Sebago Watershed Alternative Conservation Futures



Background indicates land cover classes from 2011 NLCD.
Projected conservation is based on simulations of current trends and alternative future conservation priorities. For all scenarios, 7.6% of the Sebago Lake watershed is currently conserved, an additional 4.1% is conserved with a projected low budget, and an additional 12.4% is conserved with a projected high budget.

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0 2.755.5 11 16.5 22 Kilometers

N

Spencer Meyer
Malia Carpio
[Contact: smeyer@highstead.net]
DRAFT: March 7, 2016

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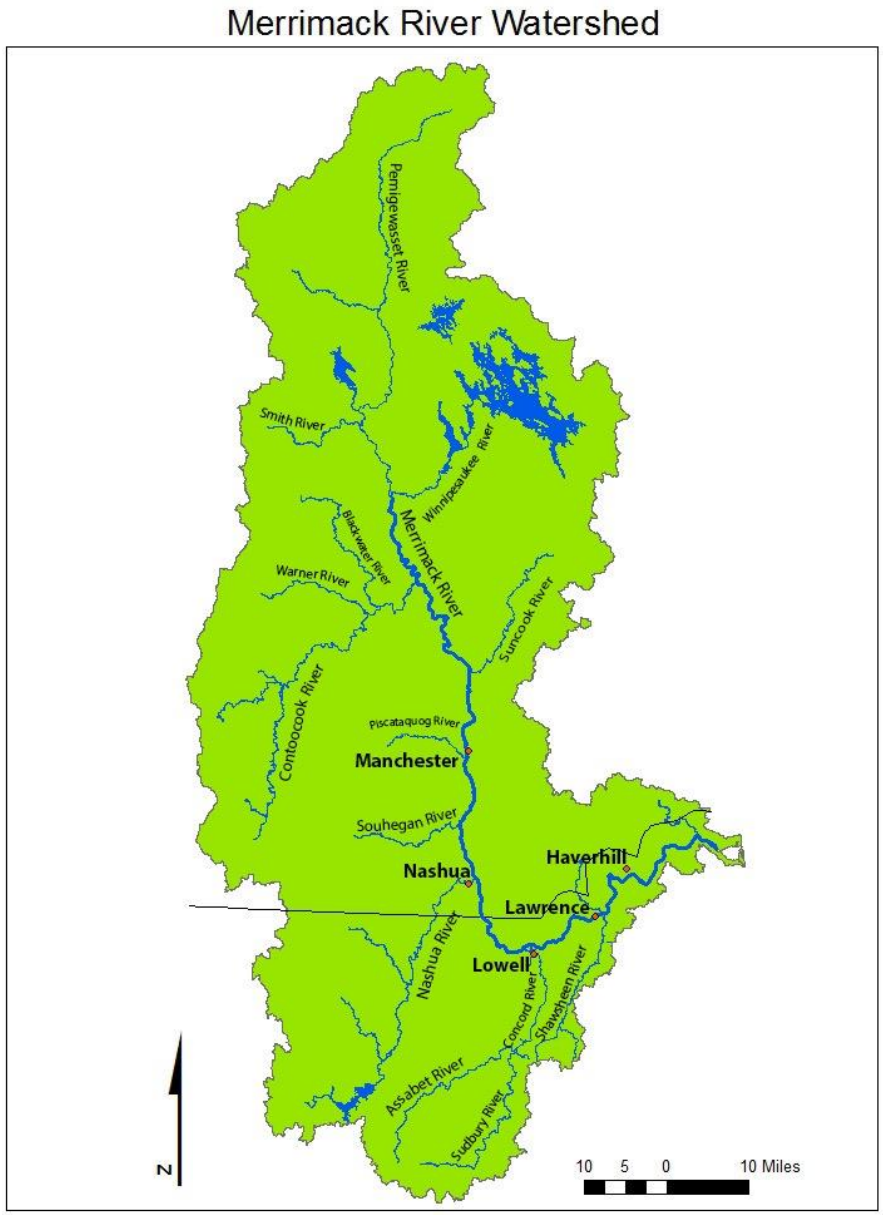
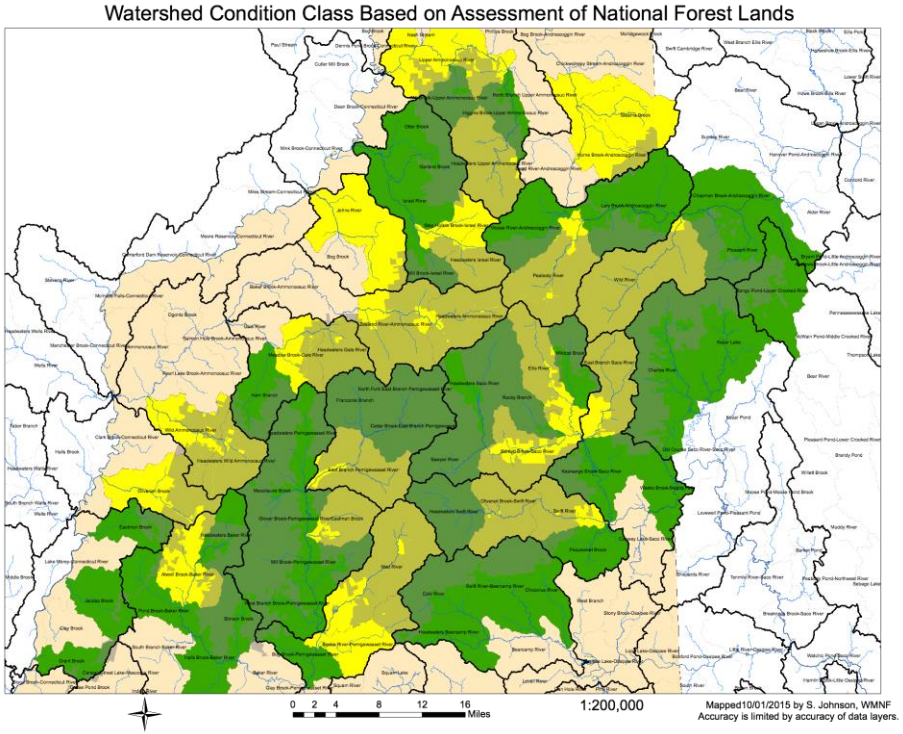
Framework for NH

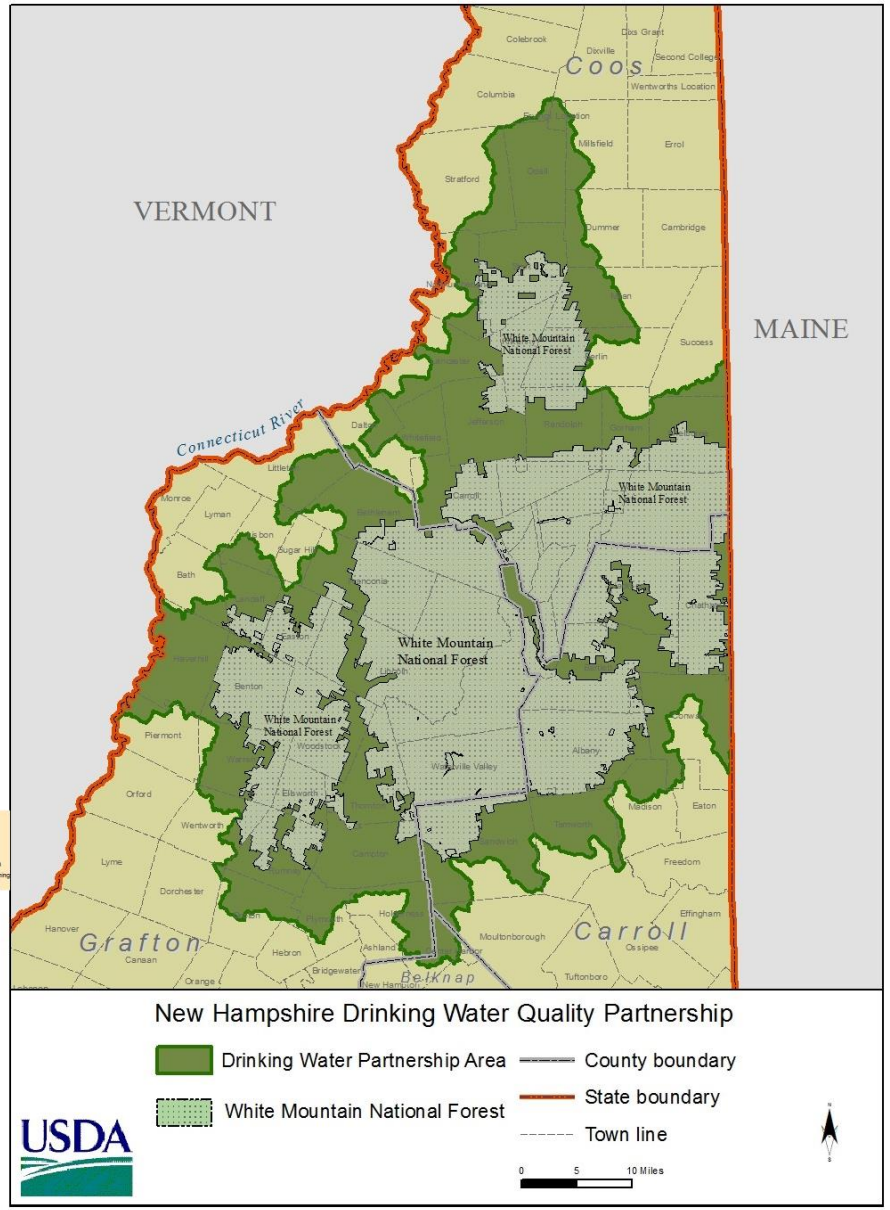
- Making the case and quantifying public value
- Enabling policy
- Technical knowledge, assistance
- Stakeholders

- 5,010 sq miles
- Water supplies for over 600,000 people
- Loss of forested land from housing development
- 4th most threatened for impacts to water quality (USFS)



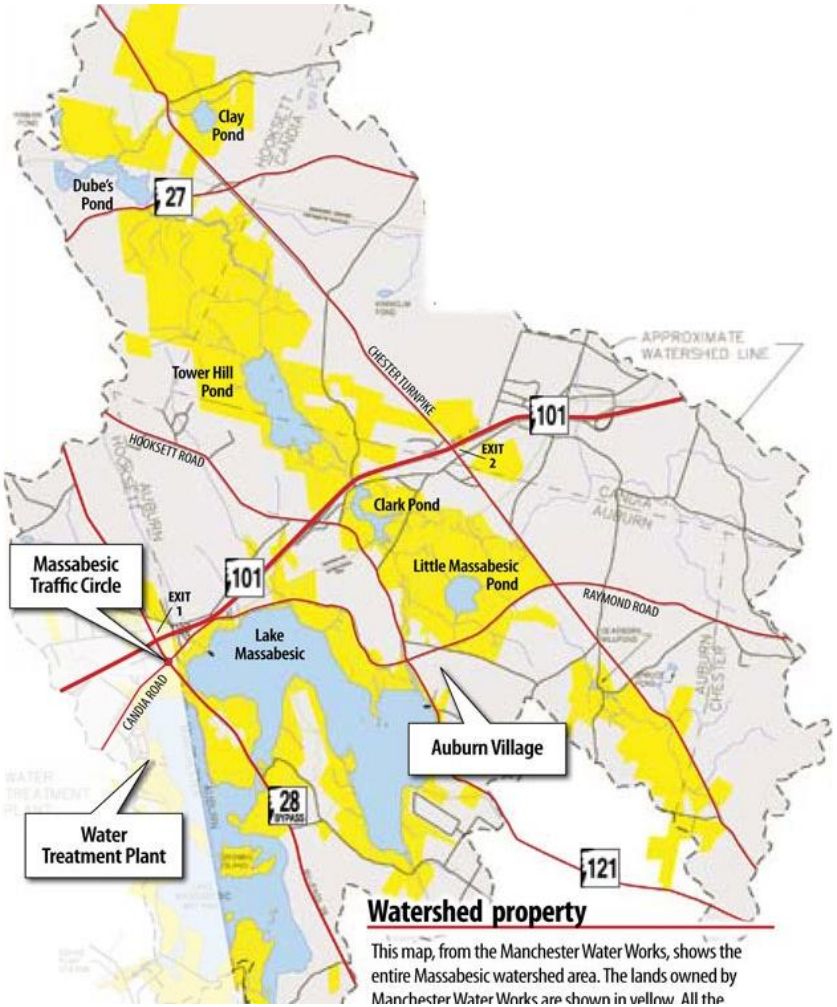
White Mountain National Forest





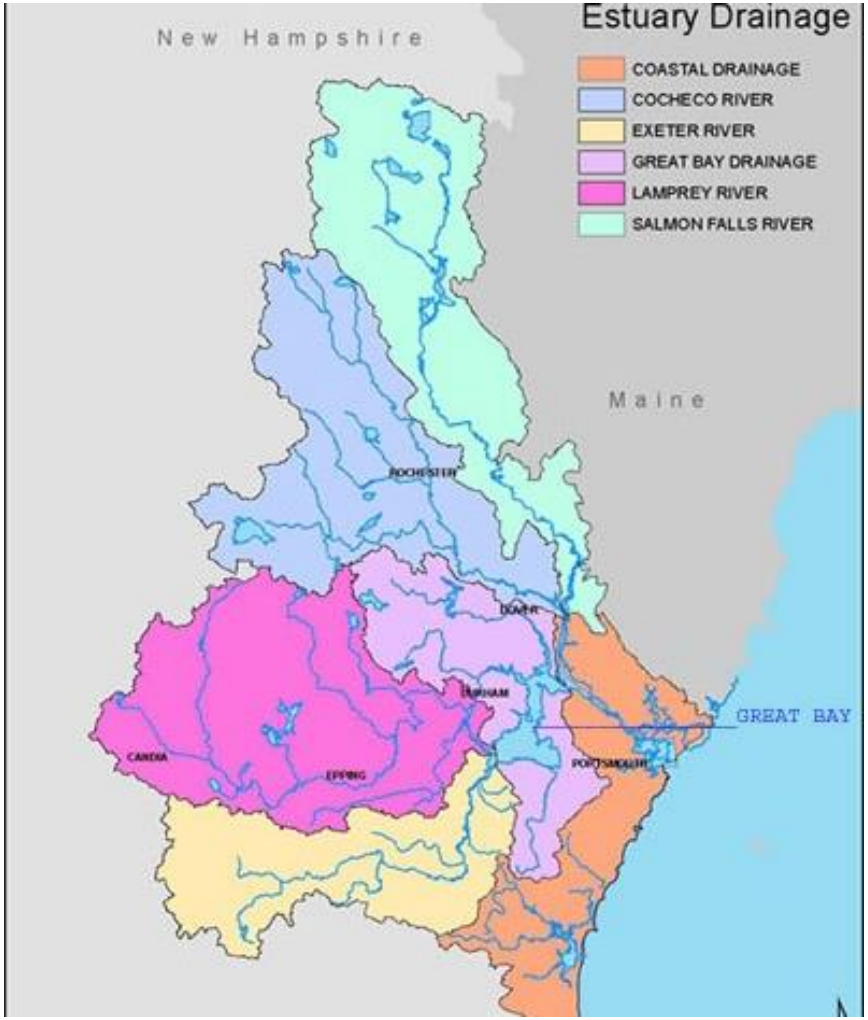
Manchester Water Works

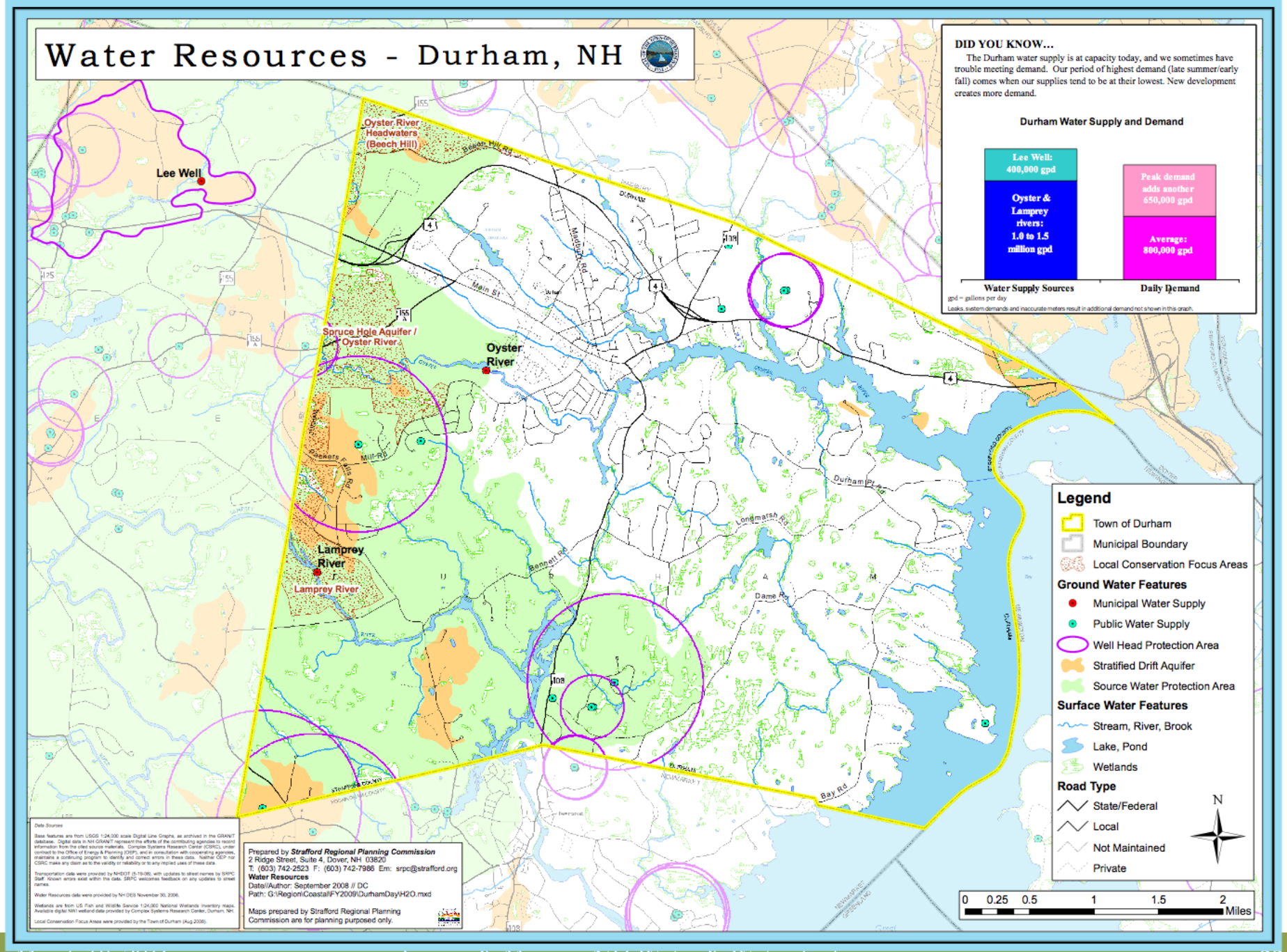
forest land ownership and management
water quality and supplies
conservation investment

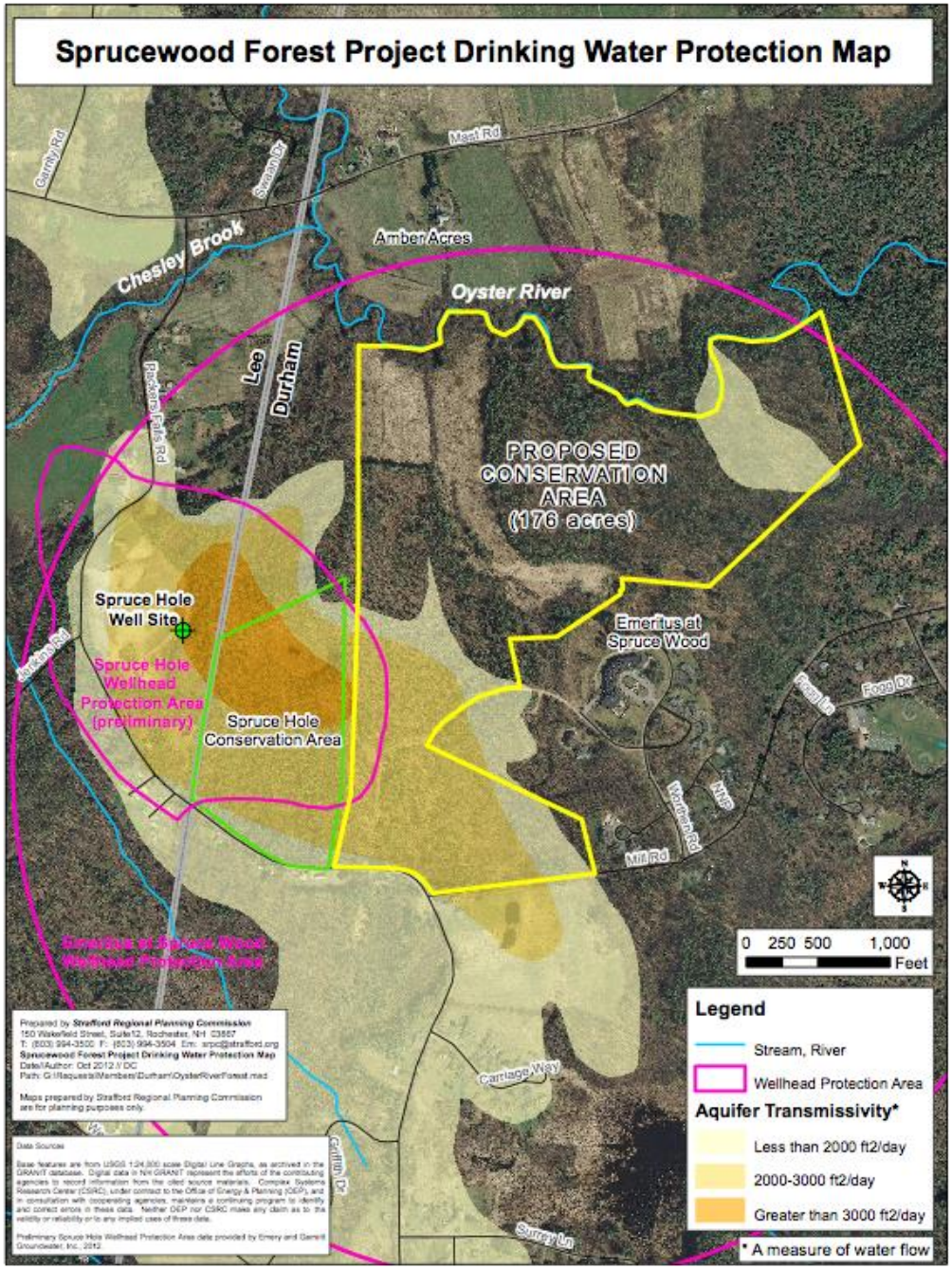


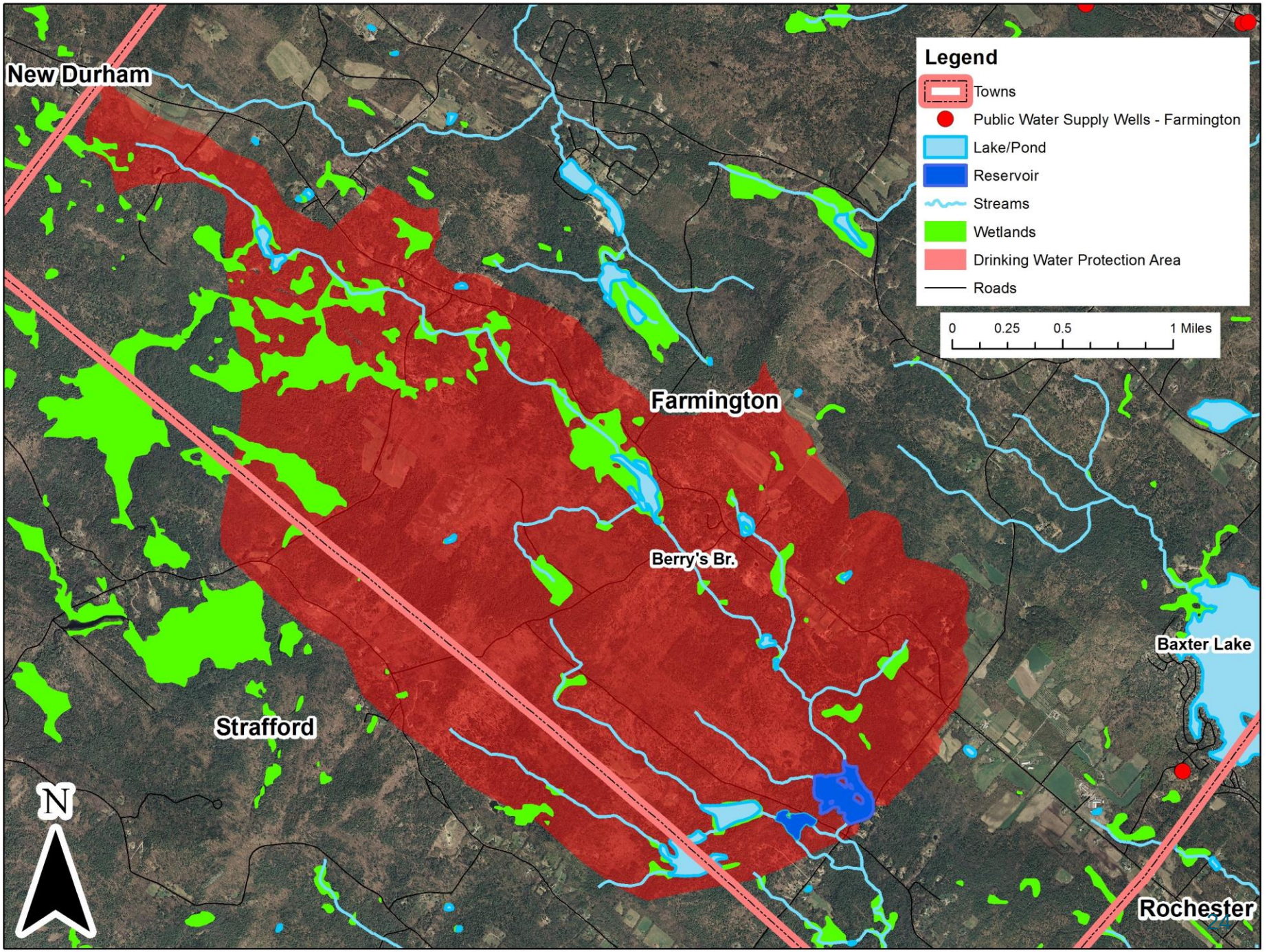
Great bay

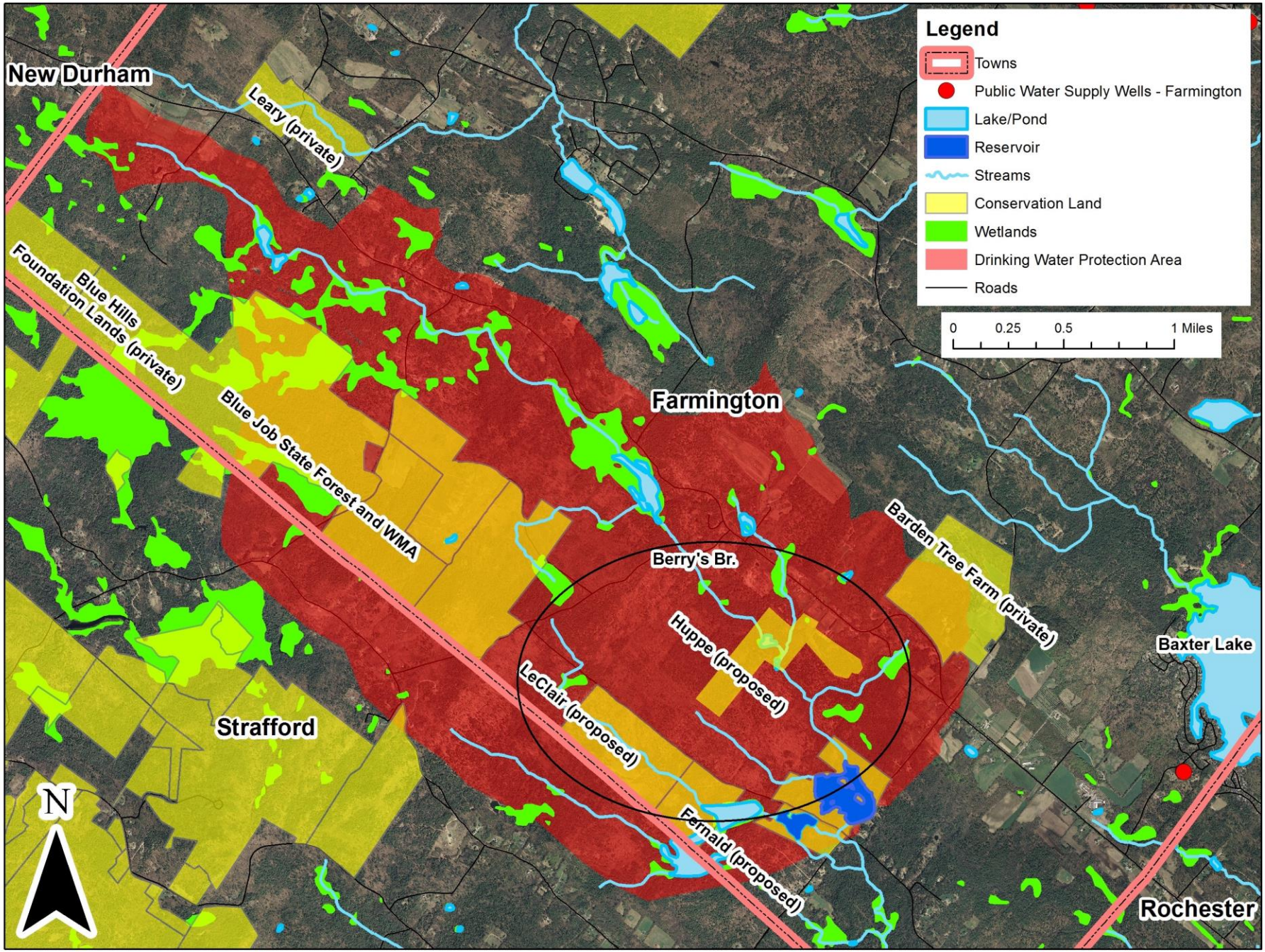
EPA Compliance order
Lamprey River/EPSCOR
Great Bay Estuarine Partnership
- Ecosystem Services project
Land conservation projects for Durham/UNH water supplies
Collaborative land management at headwaters




Water Resources - Durham, NH
DID YOU KNOW...
The Durham water supply is at capacity today, and we sometimes have trouble meeting demand. Our period of highest demand (late summer/early fall) comes when our supplies tend to be at their lowest. New development creates more demand.
Durham Water Supply and Demand
Lee Well: 400,000 gpd
Oyster & Lamprey rivers: 1.0 to 1.5 million gpd
Peak demand adds another 650,000 gpd
Average: 800,000 gpd
Water Supply Sources
Daily Demand
gpd = gallons per day
Leaks, system demands and inaccurate meters result in additional demand not shown in this graph.
Oyster River Headwaters (Beech Hill)
Lee Well
Spruce Hole Aquifer / Oyster River
Oyster River
Lamprey River
Lamprey River
Legend
Town of Durham
Municipal Boundary
Local Conservation Focus Areas
Ground Water Features
Municipal Water Supply
Public Water Supply
Well Head Protection Area
Stratified Drift Aquifer
Source Water Protection Area
Surface Water Features
Stream, River, Brook
Lake, Pond
Wetlands
Road Type
State/Federal
Local
Not Maintained
Private
N
0 0.25 0.5 1 1.5 2 Miles
Prepared by Strafford Regional Planning Commission
2 Ridge Street, Suite 4, Dover, NH 03820
T: (603) 742-2523 F: (603) 742-7986 Em: srpc@strafford.org
Water Resources
Date//Author: September 2008 // DC
Path: G:\Region\Coastal\FY2009\DurhamDay\H2O.mxd
Maps prepared by Strafford Regional Planning Commission are for planning purposed only.


Sprucewood Forest Project Drinking Water Protection Map
Chesley Brook
Amber Acres
Oyster River
Lee
Durham
PROPOSED CONSERVATION AREA (176 acres)
Spruce Hole Well Site
Spruce Hole Wellhead Protection Area (preliminary)
Spruce Hole Conservation Area
Emeritus at Spruce Wood
Meat Rd
Canney Rd
Shannon Dr
Packers Falls Rd
Durham Rd
Foggs Dr
Mill Rd
Wadleigh Rd
Carriage Way
Griffith Dr
Surrey Ln
0 250 500 1,000 Feet
Legend
Stream, River
Wellhead Protection Area
Aquifer Transmissivity*
Less than 2000 ft2/day
2000-3000 ft2/day
Greater than 3000 ft2/day
* A measure of water flow
Prepared by Strafford Regional Planning Commission
Sprucewood Forest Project Drinking Water Protection Map
Maps prepared by Strafford Regional Planning Commission are for planning purposes only.


New Durham
Farmington
Berry's Br.
Strafford
Baxter Lake
Rochester
N
Legend
Towns
Public Water Supply Wells - Farmington
Lake/Pond
Reservoir
Streams
Wetlands
Drinking Water Protection Area
Roads
0
0.25
0.5
1 Miles


Legend
Towns
Public Water Supply Wells - Farmington
Lake/Pond
Reservoir
Streams
Conservation Land
Wetlands
Drinking Water Protection Area
Roads
0
0.25
0.5
1 Miles
New Durham
Leary (private)
Blue Hills Foundation Lands (private)
Blue Job State Forest and WMA
Farmington
Barden Tree Farm (private)
Berry's Br.
Huppe (proposed)
LeClair (proposed)
Baxter Lake
Strafford
Fernald (proposed)
Rochester
N

QUESTIONS

Cause and effect?

How to connect science and finance?

Opportunities for natural infrastructure investment?

Barriers to investment?

How to compensate?

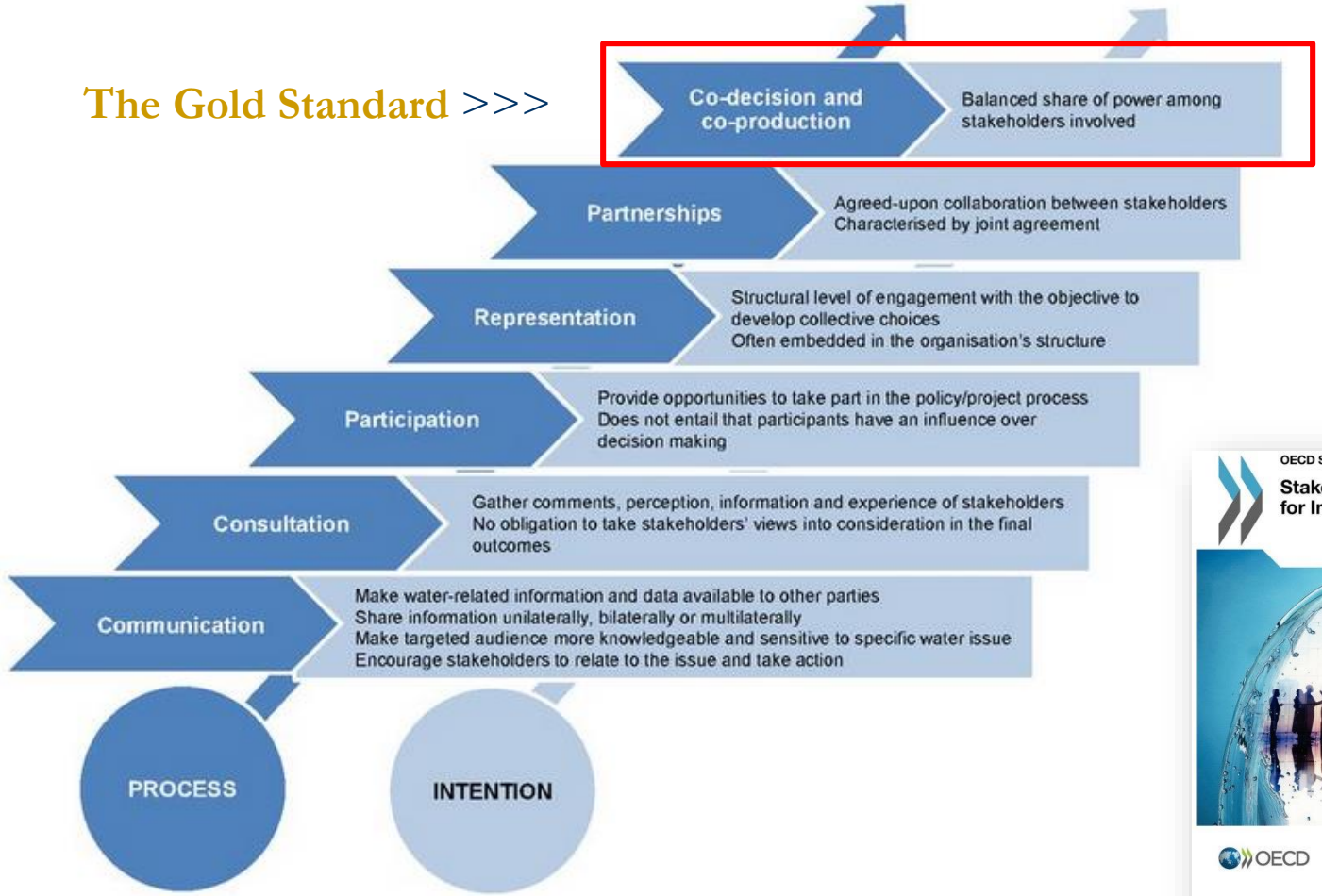
Scale?

Attitudes/knowledge?

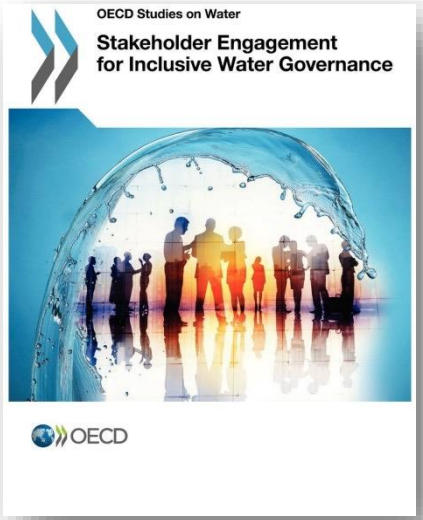
Levels of Stakeholder Engagement

Figure 1.1. **Levels of stakeholder engagement**

The Gold Standard >>>



Source: OECD elaboration.

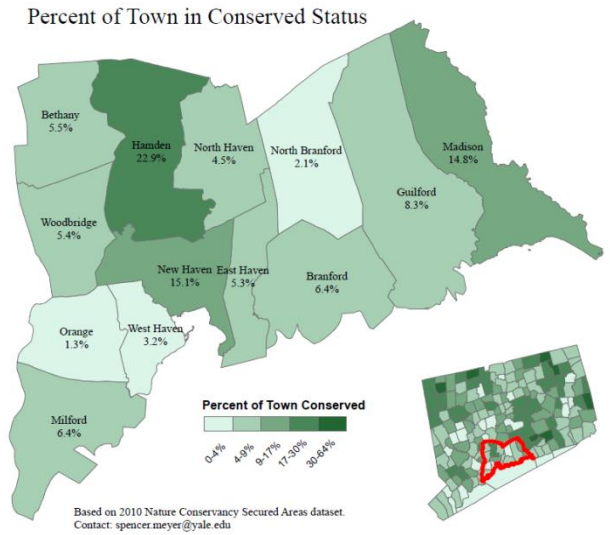


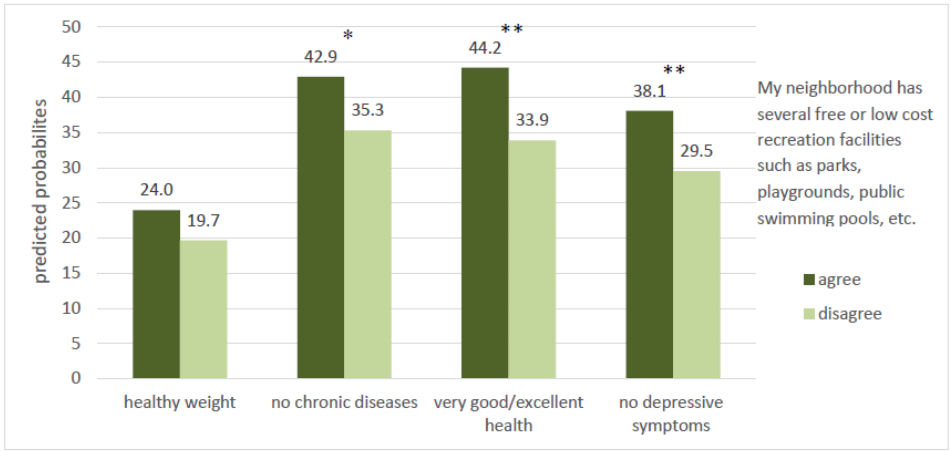
Open Space Mitigates Chronic Disease Costs

	Sample %	Population	Probability of Disease: With Access %	Probability of Disease: Without Access %	% Reduction With Access	Standard Error % Reduction	Avoided Cases With Access	Annual cost/ person[2]	Annual Avoided Cost	Potential with Increased Access: Projected Avoided Cases	Potential with Increased Access: Projected Annual Savings
Population		464,037	71.1%	28.9%							
Asthma[1]	14.7%	68,176	15.4%	12.8%				$ 2,709			
Depression	33.6%	156,142	32.3%	37.3%				$ 4,580			
Diabetes	9.9%	45,817	8.5%	13.5%	5.0%	0.7%	1,402	$ 7,666	$ 10,749,294	905	$ 6,939,418
Hypertension	27.1%	125,822	23.3%	37.2%	13.9%	1.3%	10,679	$ 2,669	$ 28,503,245	6,936	$ 18,511,241
Heart Disease	7.0%	32,519	5.6%	10.5%	4.9%	0.8%	912	$ 8,312	$ 7,579,165	693	$ 5,757,197
Obesity	25.2%	117,124	24.0%	28.6%				$ 6,405			
									$ 46,831,704		$ 5,757,197
									8.29%		1.02%

[1] Difference between those with and without access was not significant

[2] The average annual cost per person for Other Chronic Diseases is weighted based on the expected number of cases and cost for each disease. See Table 2.





*p<0.05, **p<0.01

Ickovics et al., in review