When is a River no Longer a River?

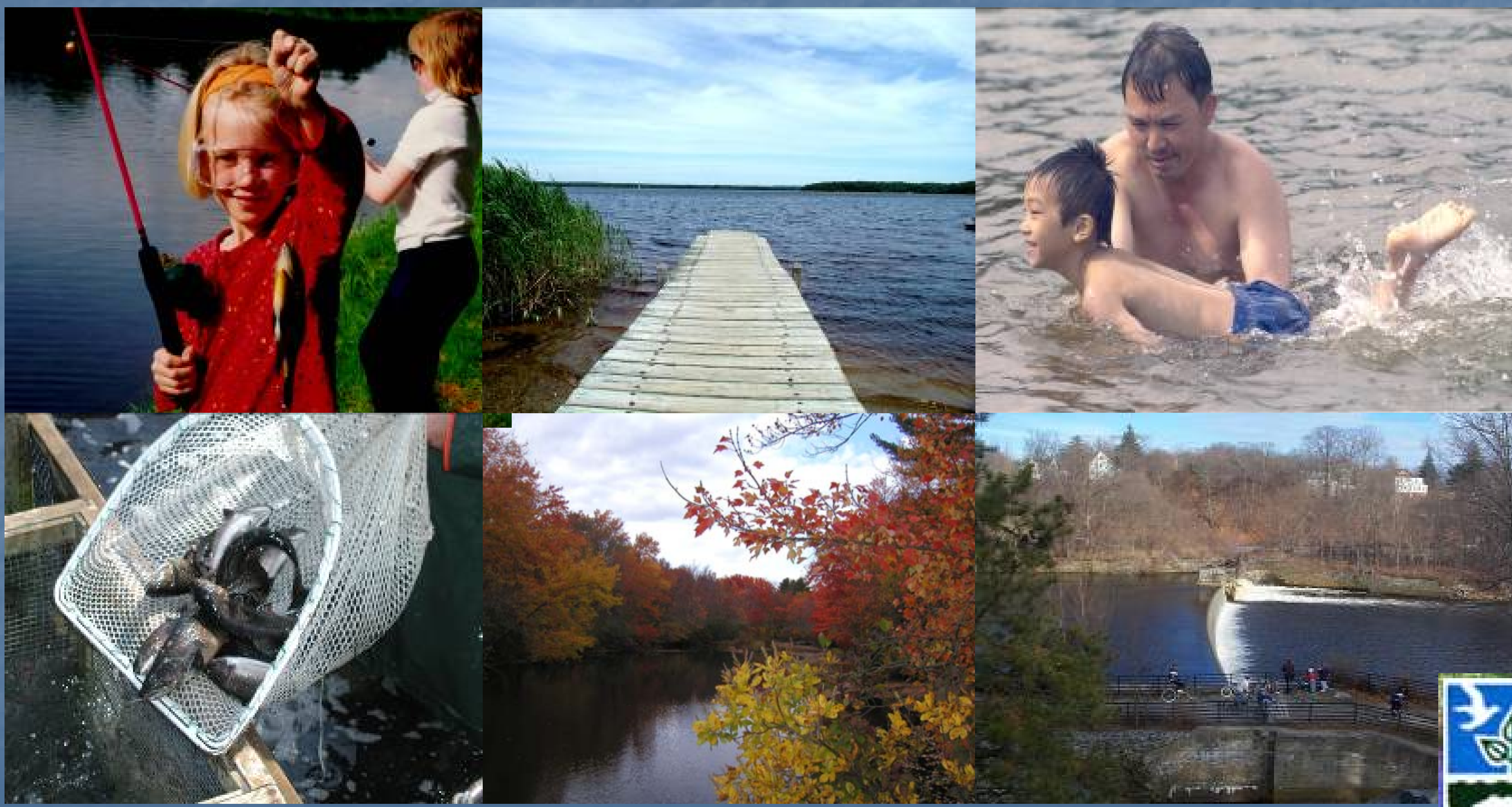
By Alisa Richardson

RIDEM

Land and Water Summit 2009

DEM mission and mandates:

- Environmental Protection
- Sustainable Natural Resource Management



Scituate Reservoir – SY 92MGD

Available Surface Water

142 MGD

- PWSB = 92 MGD
- CUMBERLAND = 9.4 MGD
- PAWTUCKET = 22 MGD
- WOONSOCKET = 9.0 MGD
- NEWPORT = 10 MGD
- JAMESTOWN = .06

RI Water Needed Annually

- GOLF ~ 23 MGD
- FARMING ~ 50 MGD
- SELF SUPPLY
- INDUSTRY

2005 TOTAL = 193 MGD

2025 TOTAL = 208 MGD

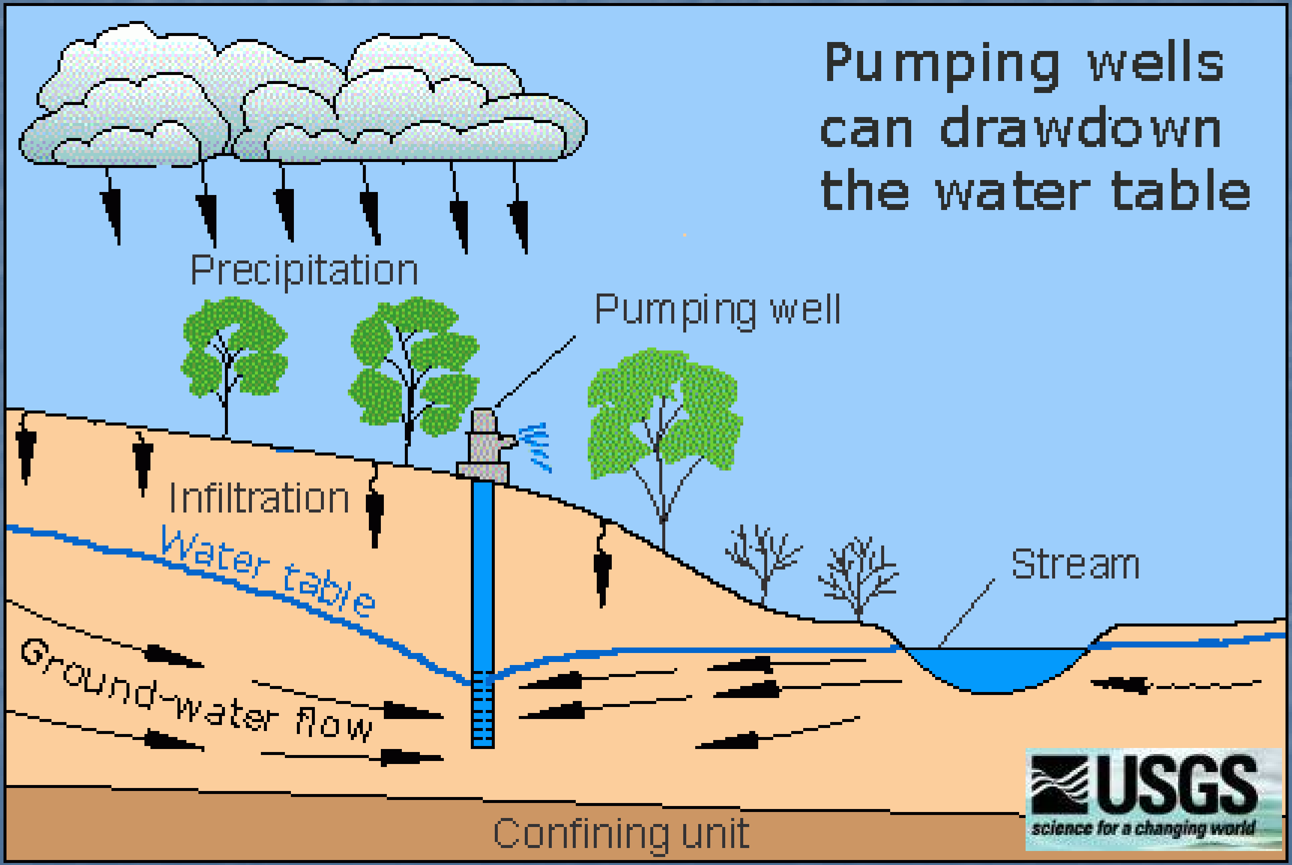
BUILD OUT = 227 MGD

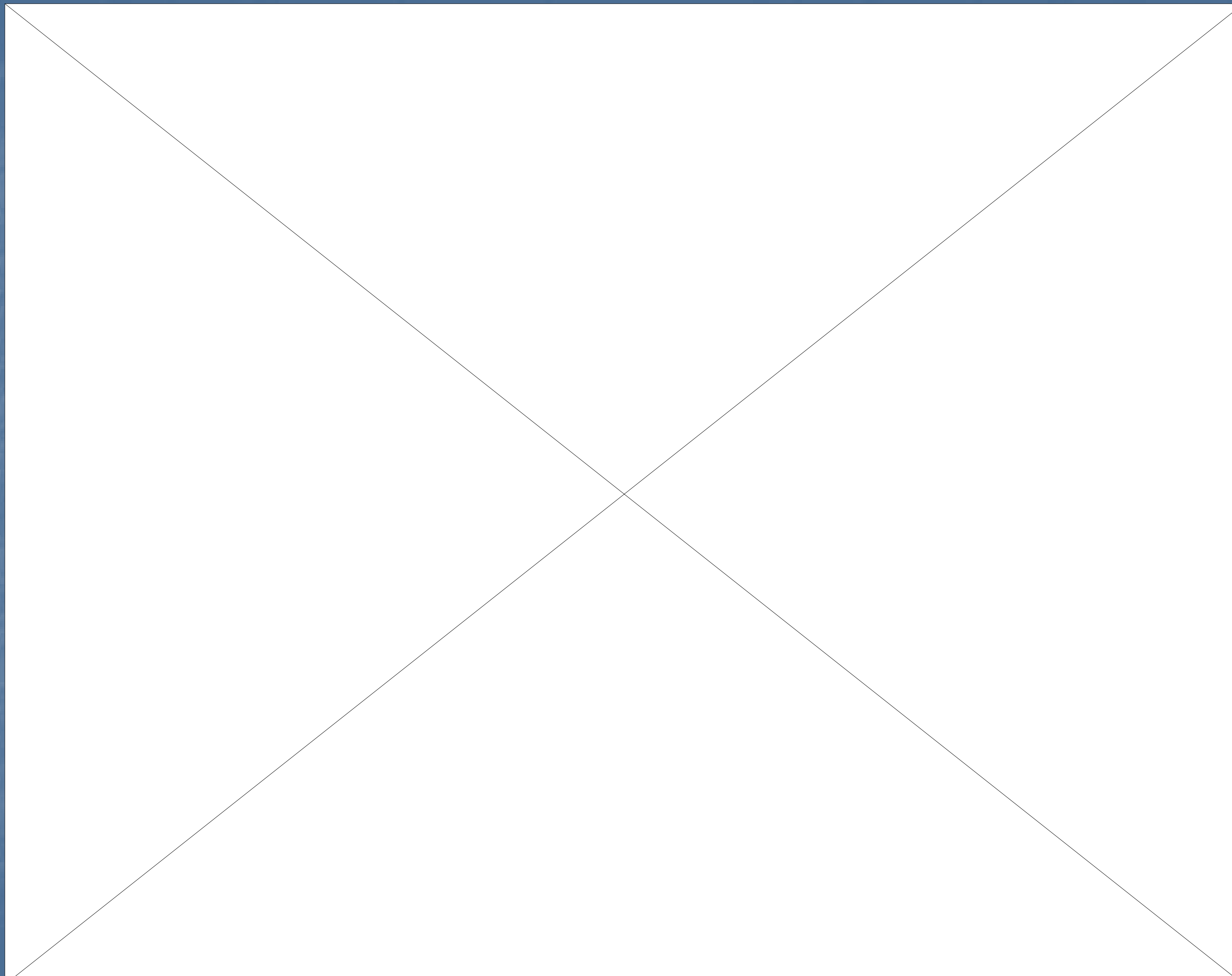
With no new SW Sources

NEED= 85 MGD GW/Conservation

Sources are McGuire Report, 2008, WRB Annual Report, RIDEM Estimates

Wells and direct withdrawals effect stream flow



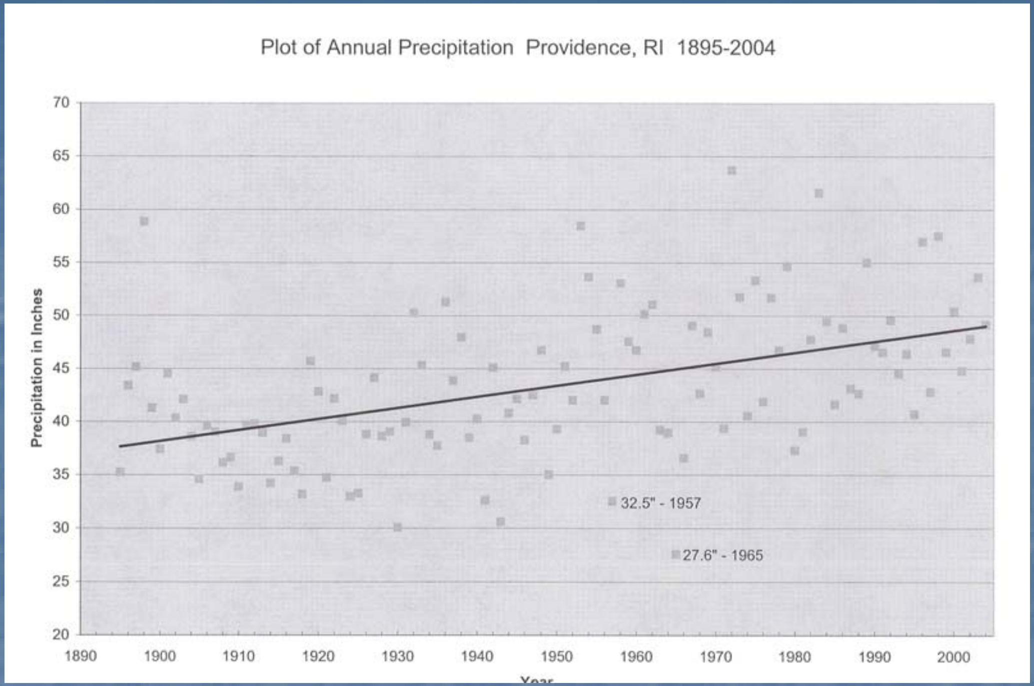


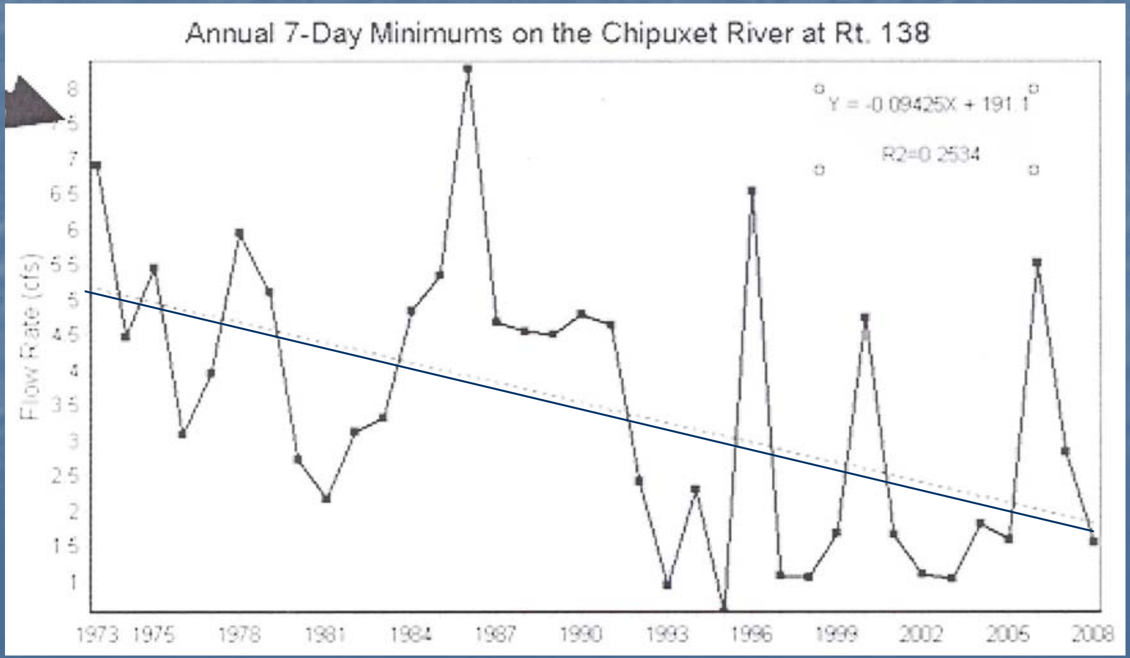
Massachusetts

- The Ipswich River in Massachusetts is suffering from excessive groundwater withdrawals and has begun to dry up every other year since 1995.
- American Rivers nominated the Ipswich River as the 3rd most endangered river in 2003

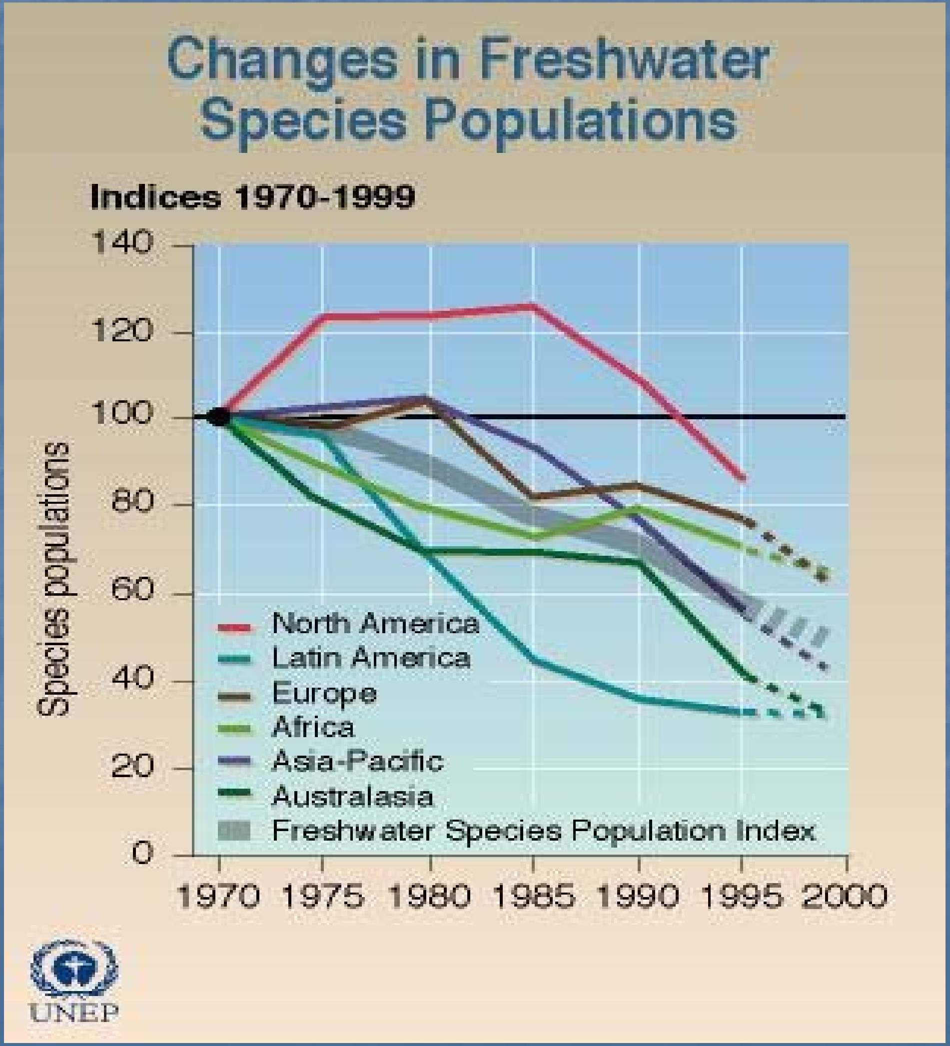
Rhode Island

Chipuxet River





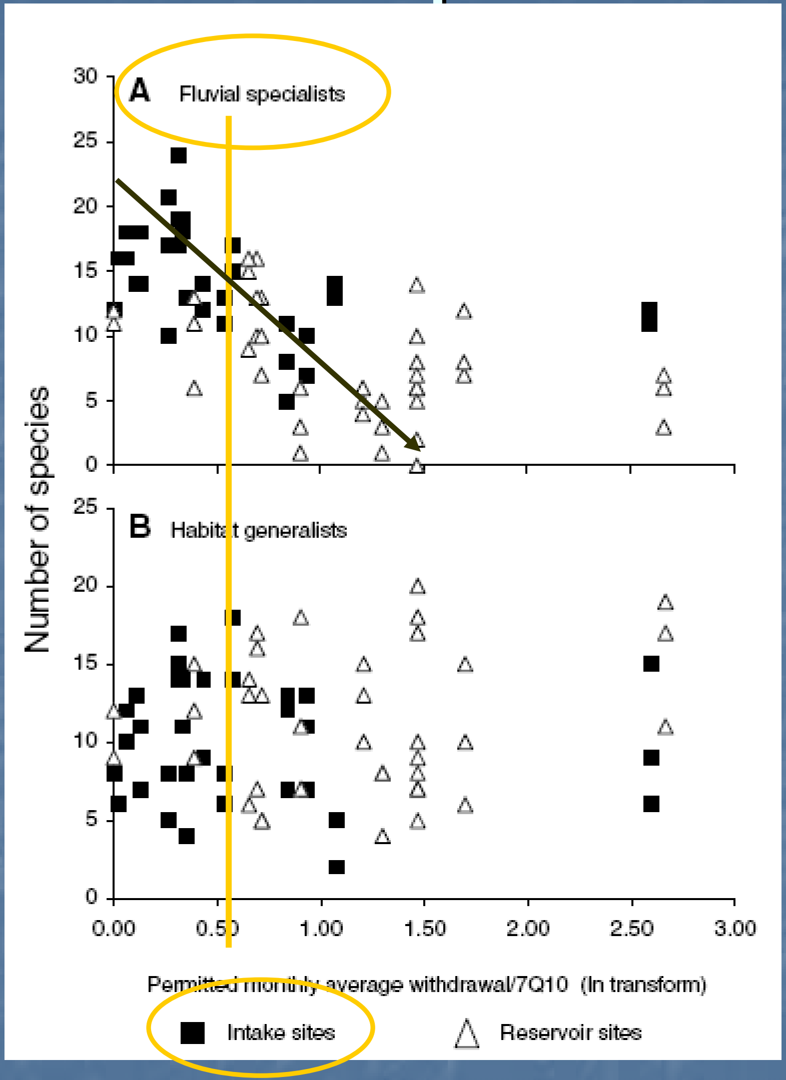
Unsustainability resulting in a Collapse of Fisheries



Water Withdrawals = Loss of Species

USGS Scientists state

- **Significant losses of river fish due to withdrawal rates greater than 50% of the 7Q10**



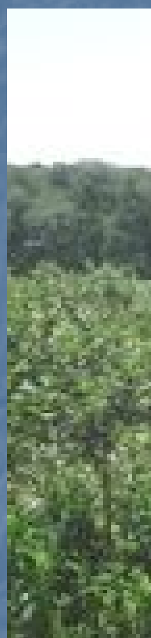
Freeman, M. C. and P. A. Marcinek. 2006. Fish assemblage responses to water withdrawals and water supply reservoirs in Piedmont streams.
Environmental Management 38: 435-450.

Managing the Water Resources for a Sustainable Yield

1. Consider the timing of water withdrawals
2. Consider the quantity of water withdrawals
3. Consider the duration and frequency of the water withdrawal
4. Consider the Ecological Resources

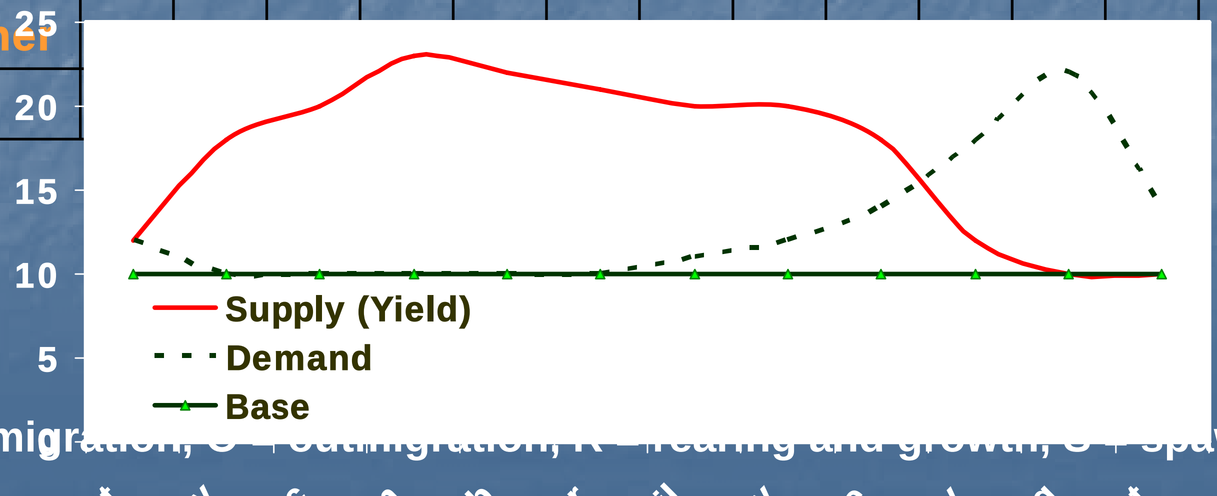
1. Timing – Hunt River

2. Consider the Quantity of Water



3. Timing

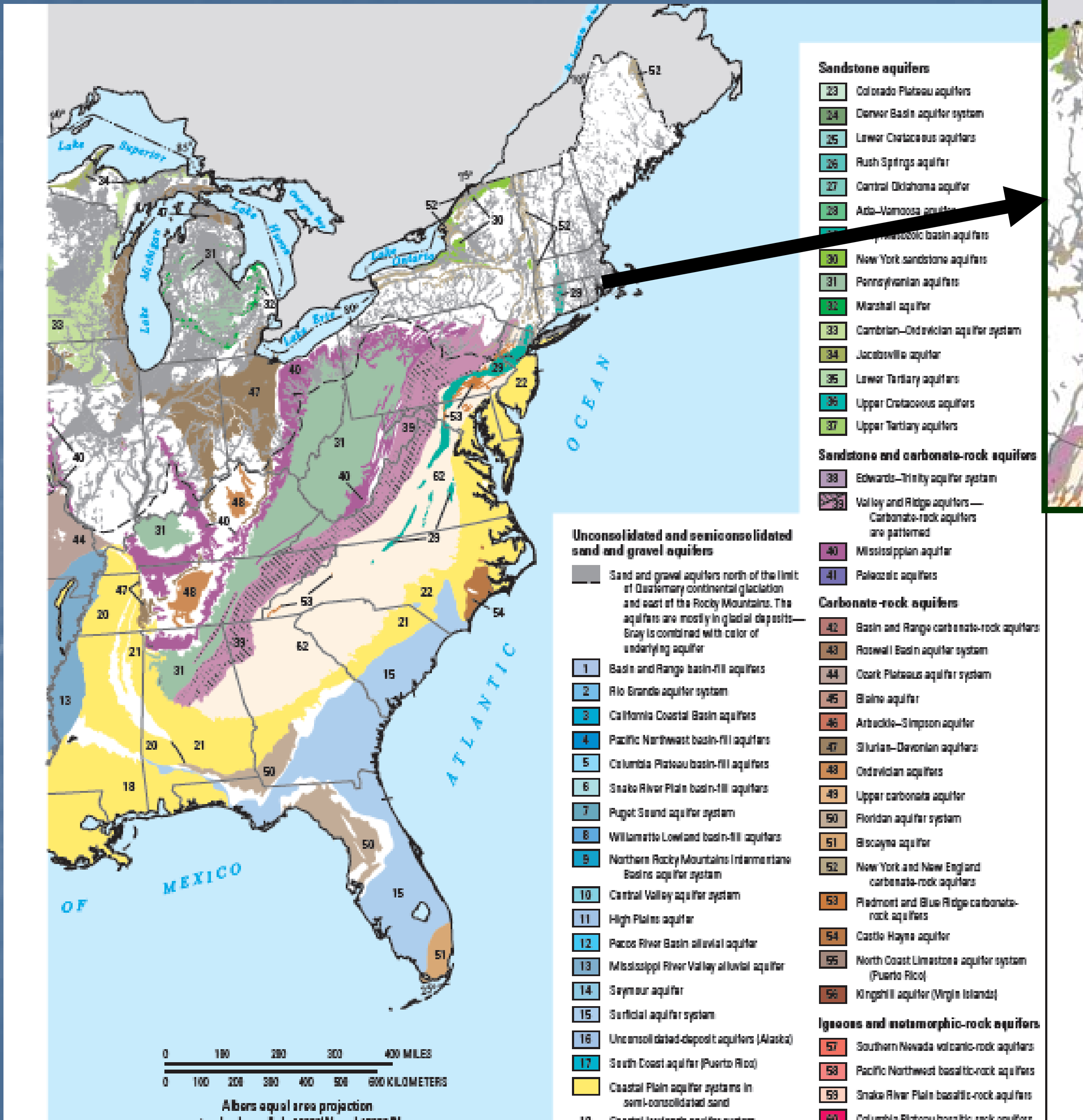
Species	O	N	D	J	F	M	A	M	J	J	A	S
Blacknose Dace								S	S	S	R	
Longnose Dace								S	S	S	R	
Fallfish							S	S	R			
Creek Chubsucker						S	S	S	R			
Atlantic Salmon						O	O	M	M	M		
Brook Trout	S	S										S
Tesselated Darter							S	S	R			
River Herring	O	O				SM	SM	SM	MO	RO	O	O
American Shad	O	O					SM	SM	SM	R O	O	O
Common Shiner												
White Sucker												

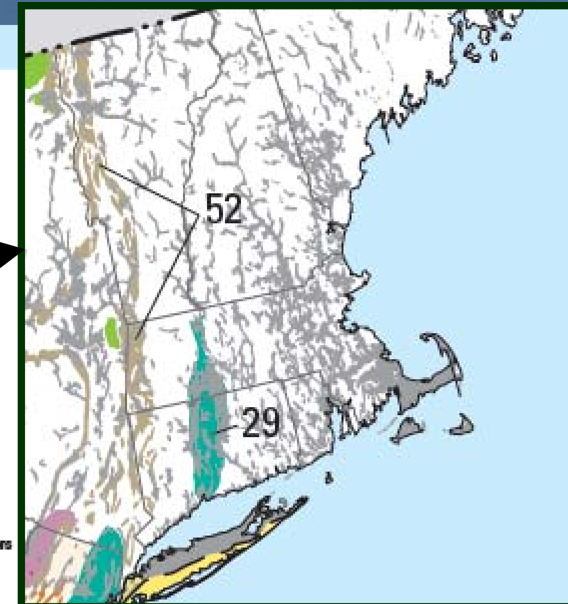


M = upstream migration, O = outmigration, R = rearing and growth, S = spawning

Why is this a problem in the Northeast?

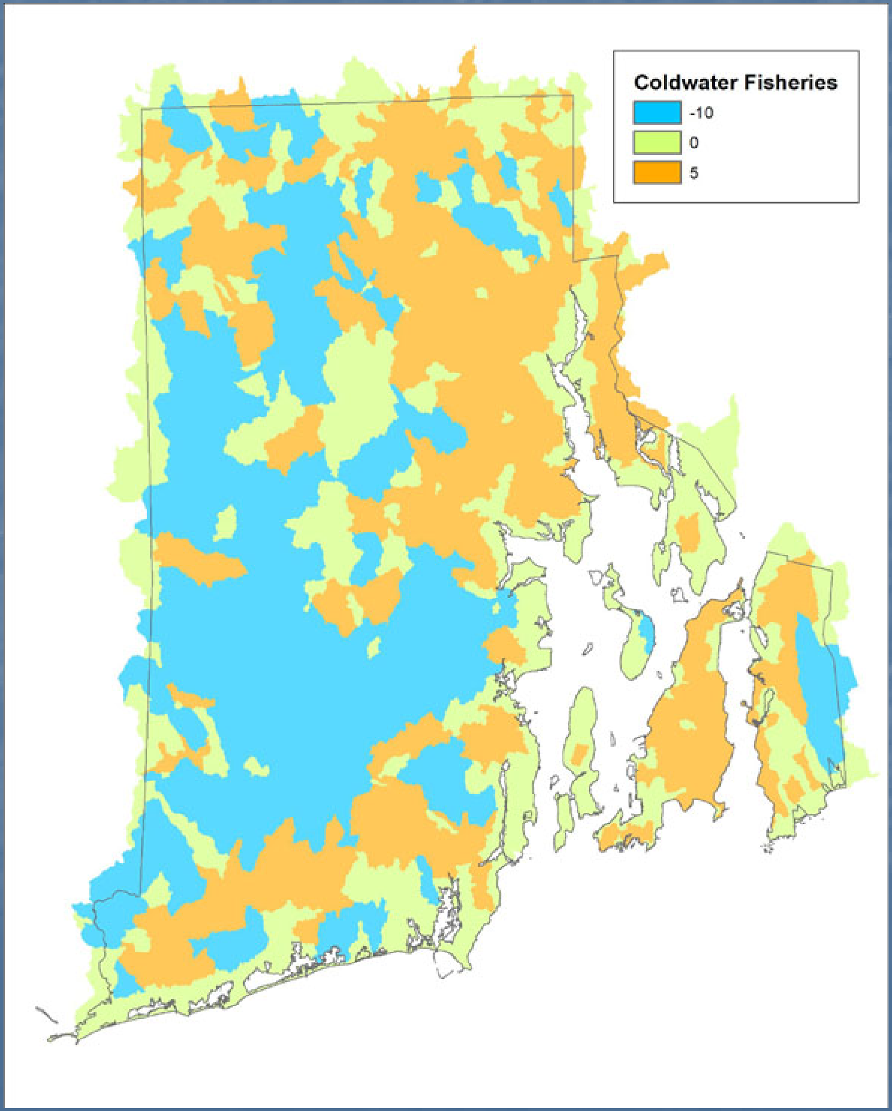
- Shallow aquifers
- Loss of perviousness


Lake Superior
Lake Michigan
Lake Huron
Lake Ontario
Lake Erie
Georgian Bay
ATLANTIC OCEAN
OF MEXICO
Sandstone aquifers
23 Colorado Plateau aquifers
24 Denver Basin aquifer system
25 Lower Cretaceous aquifers
26 Rush Springs aquifer
27 Central Oklahoma aquifer
28 Ada–Vamoosa aquifer
30 New York sandstone aquifers
31 Pennsylvanian aquifers
32 Marshall aquifer
33 Cambrian–Ordovician aquifer system
34 Jacobsville aquifer
35 Lower Tertiary aquifers
36 Upper Cretaceous aquifers
37 Upper Tertiary aquifers
Sandstone and carbonate-rock aquifers
38 Edwards–Trinity aquifer system
39 Valley and Ridge aquifers— Carbonate-rock aquifers are patterned
40 Mississippian aquifer
41 Paleozoic aquifers
Carbonate-rock aquifers
42 Basin and Range carbonate-rock aquifers
43 Roswell Basin aquifer system
44 Ozark Plateaus aquifer system
45 Blaine aquifer
46 Arbuckle–Simpson aquifer
47 Silurian–Devonian aquifers
48 Ordovician aquifers
49 Upper carbonate aquifer
50 Floridan aquifer system
51 Biscayne aquifer
52 New York and New England carbonate-rock aquifers
53 Piedmont and Blue Ridge carbonate-rock aquifers
54 Castle Hayne aquifer
55 North Coast Limestone aquifer system (Puerto Rico)
56 Kingshill aquifer (Virgin Islands)
Igneous and metamorphic-rock aquifers
57 Southern Nevada volcanic-rock aquifers
58 Pacific Northwest basaltic-rock aquifers
59 Snake River Plain basaltic-rock aquifers
60 Columbia Plateau basaltic-rock aquifers
Unconsolidated and semiconsolidated sand and gravel aquifers
Sand and gravel aquifers north of the limit of Quaternary continental glaciation and east of the Rocky Mountains. The aquifers are mostly in glacial deposits—Gray is combined with color of underlying aquifer
1 Basin and Range basin-fill aquifers
2 Rio Grande aquifer system
3 California Coastal Basin aquifers
4 Pacific Northwest basin-fill aquifers
5 Columbia Plateau basin-fill aquifers
6 Snake River Plain basin-fill aquifers
7 Puget Sound aquifer system
8 Willamette Lowland basin-fill aquifers
9 Northern Rocky Mountains Intermontane Basins aquifer system
10 Central Valley aquifer system
11 High Plains aquifer
12 Pecos River Basin alluvial aquifer
13 Mississippi River Valley alluvial aquifer
14 Seymour aquifer
15 Surficial aquifer system
16 Unconsolidated-deposit aquifers (Alaska)
17 South Coast aquifer (Puerto Rico)
Coastal Plain aquifer systems in semi-consolidated sand
18 Coastal lowlands aquifer system
0 100 200 300 400 MILES
0 100 200 300 400 500 600 KILOMETERS
Albers equal area projection
standard parallels 29°30'N and 45°30'N


52
29

USGS

4. Ecological Resources - Coldwater Fisheries



Ecological Resources
Wetlands

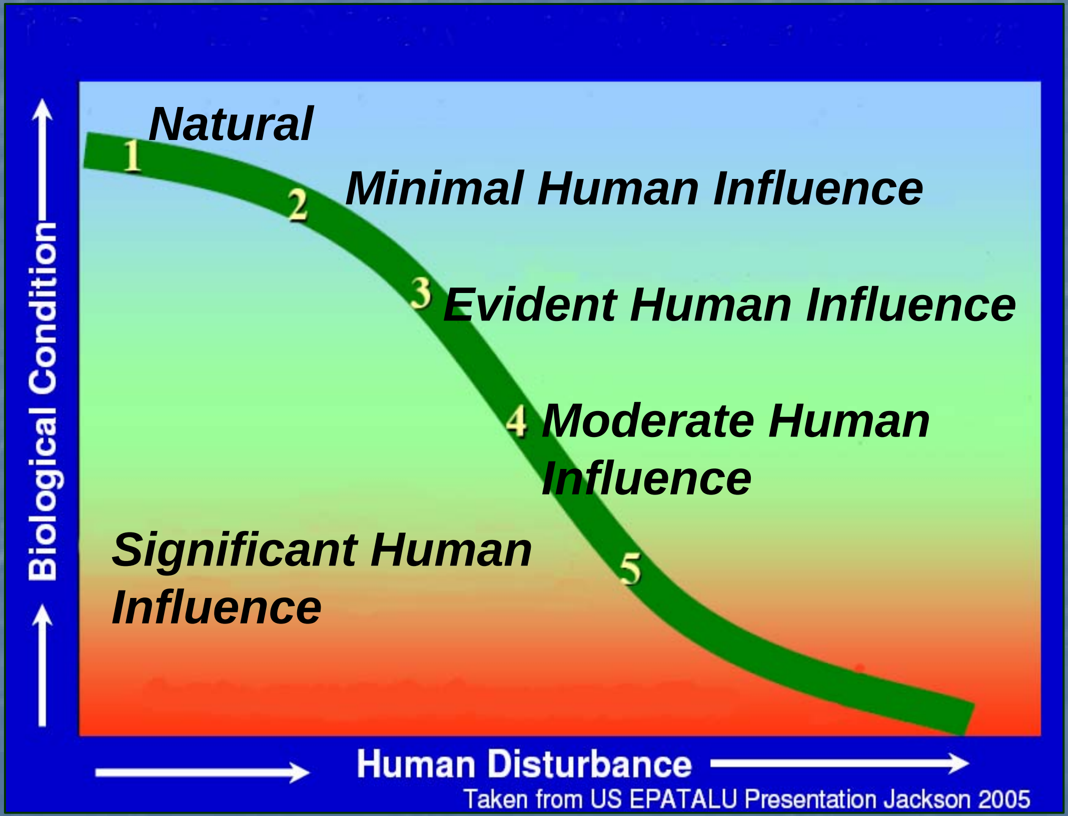
Designing Water Standards

Classification System

recognizing that more water is required to maintain the ecological integrity of a natural/pristine system than a moderately influenced system so more water can be allocated to the influenced system

More water to ecology
To maintain sustainability

Less water needed to ecology to maintain sustainability



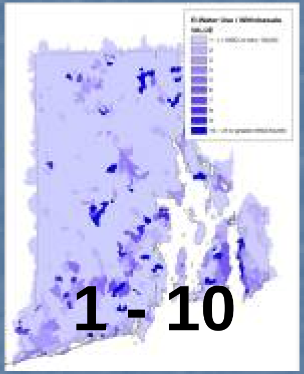
Classification Metrics

Each Watershed Unit is given a value for each metric listed below

Metrics Used to Assign Class
Diversions – Existing water withdrawals
Existing Impervious Cover - Existing Development
Future Impervious Cover - Urban Service Boundary
Existing Conservation Lands - (excluding water supply lands)
Future Conservation Plans – RIDEM, TNC, Land Conservancy, Audubon
Water Quality – Water Quality Standards
Water Supply Land
Farmland
Coldwater Fisheries

For each watershed unit add the Values for each of the nine metrics

Diversions



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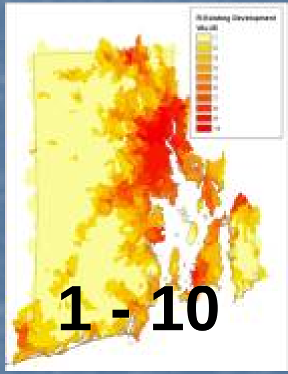
Existing Impervious



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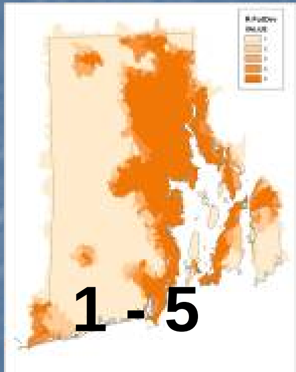
Future Development



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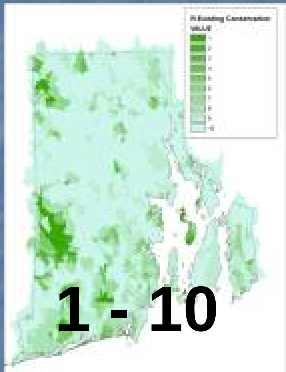
Existing Conservation



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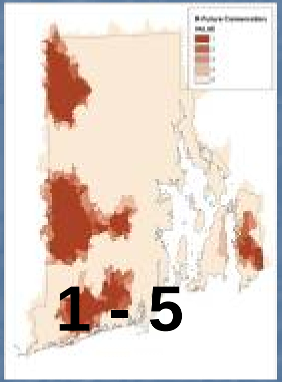
Future Conservation



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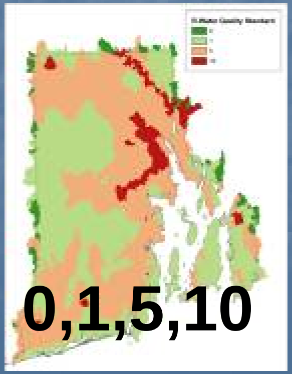
Water Quality



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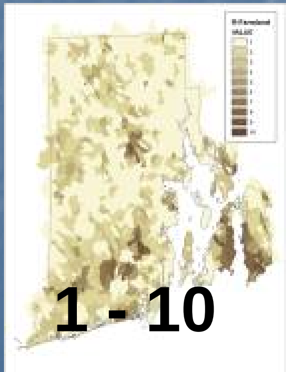
Farmland



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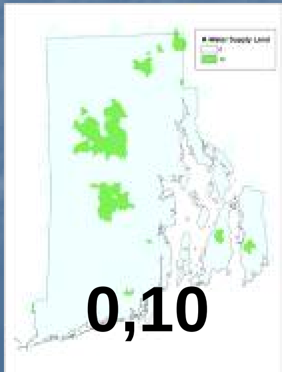
Water Supply Land



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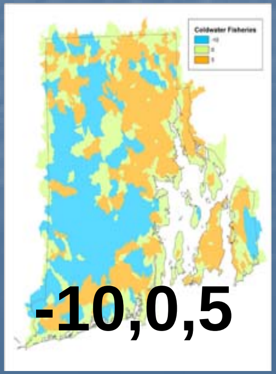
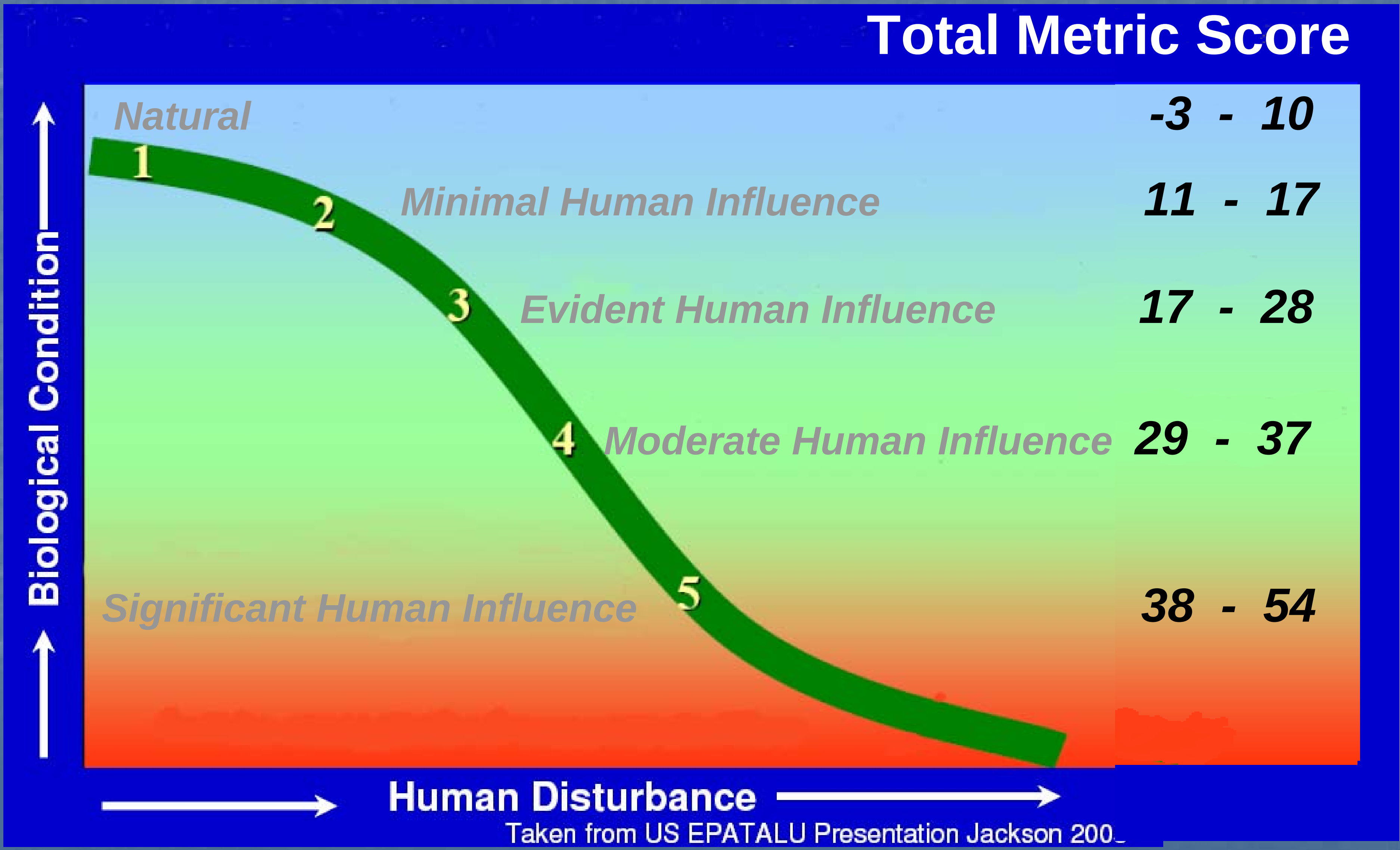
Coldwater Fisheries

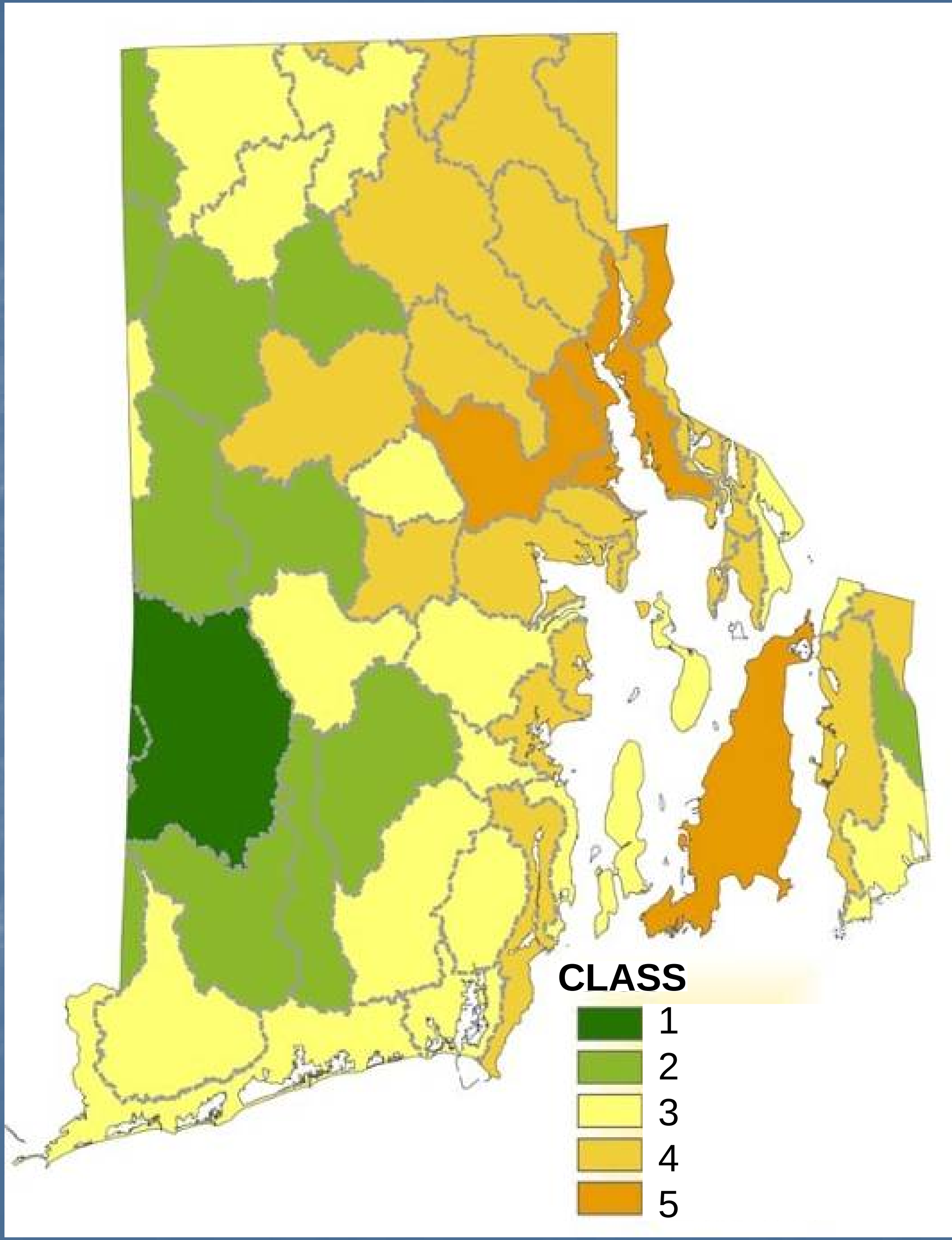


= Total Metric Score

Assign a Classification Based on Total Metric Score



Water Withdrawal Classification

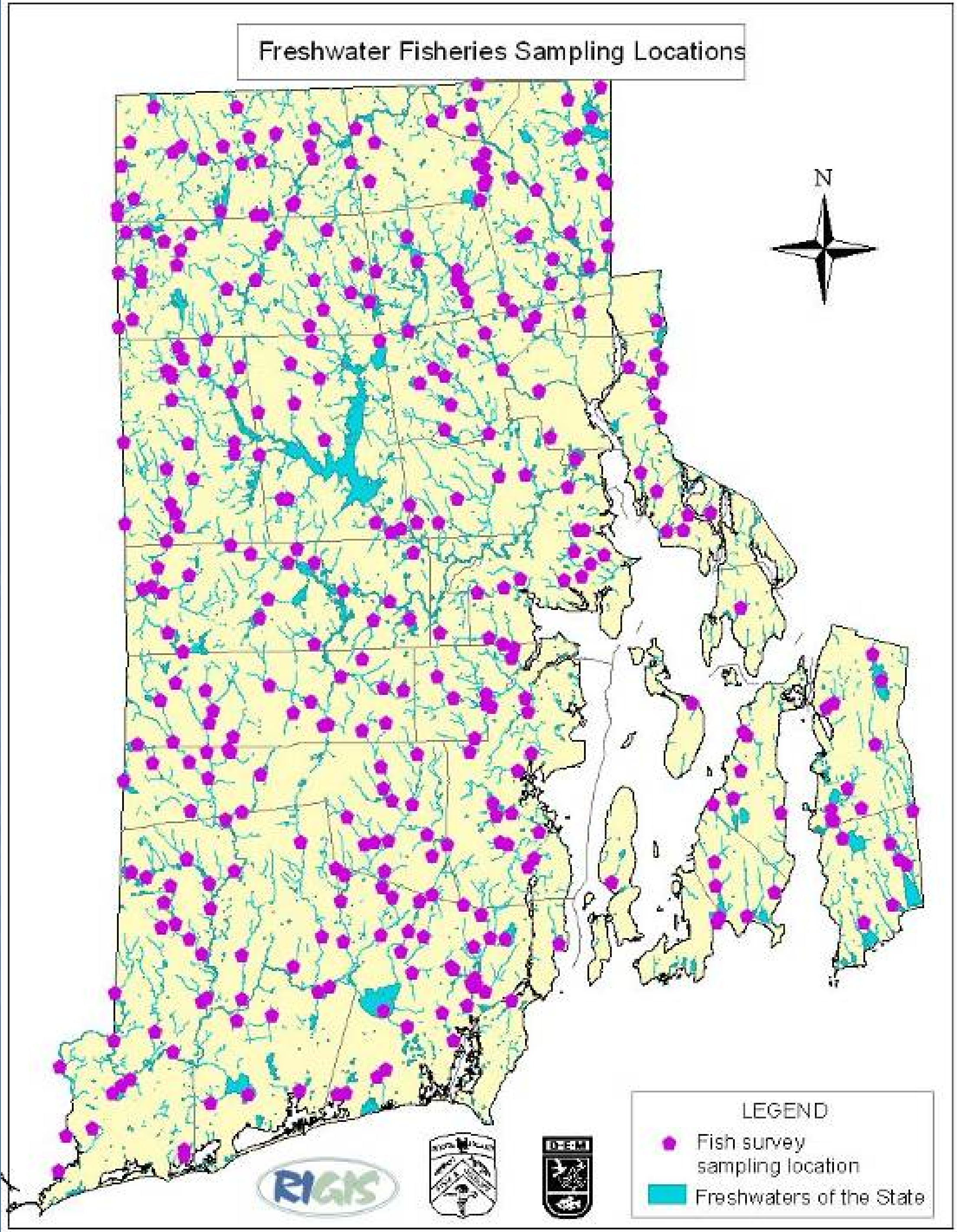


Sustainable Water Resources

Fish are the “Canary in the Coal Mine”

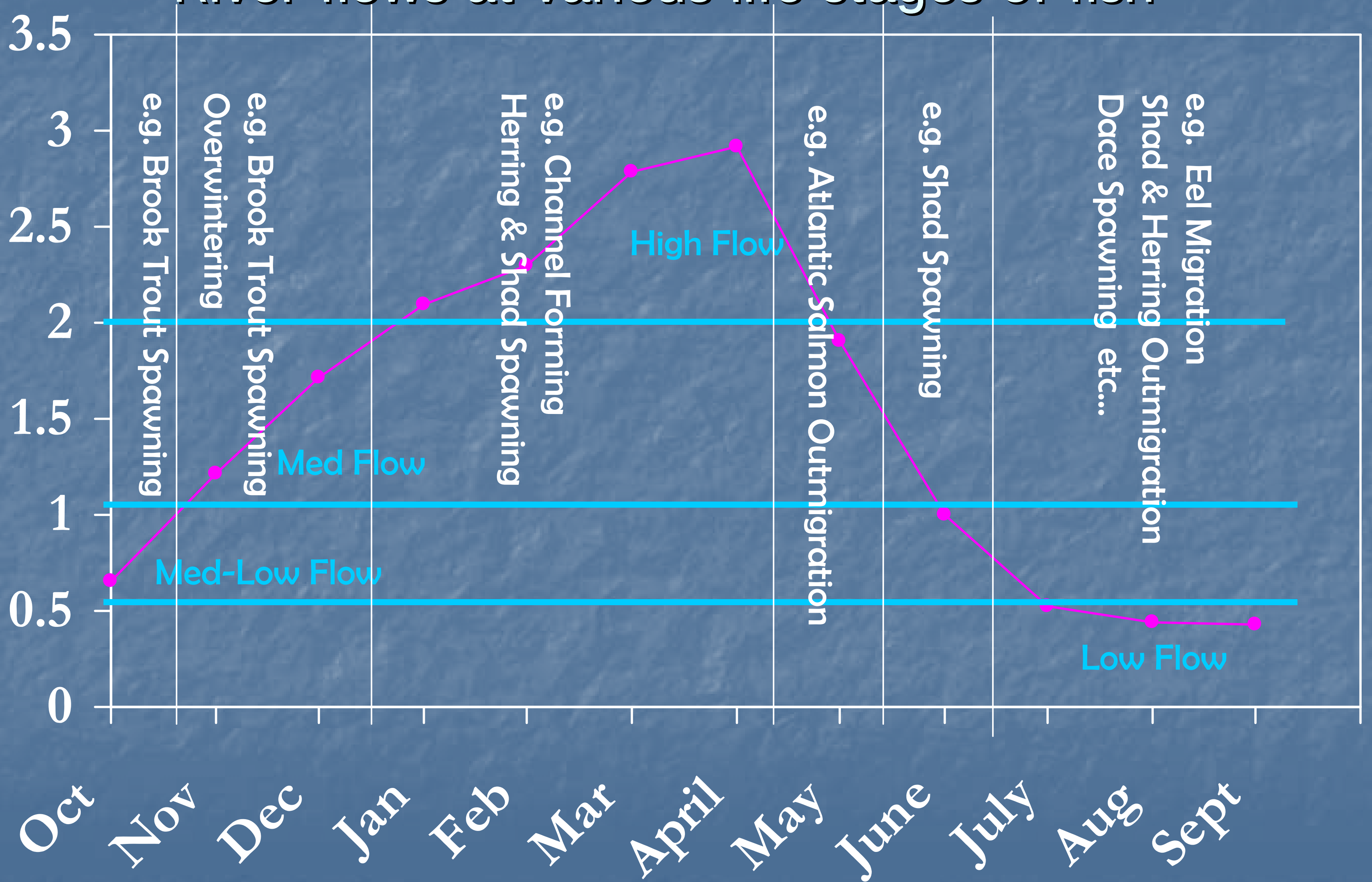
Sustainability = Healthy Rivers

- Healthy Oceans
- Healthy Land Ecosystems
- Waste assimilation
- Recreation
- Manufacturing and businesses
- Sustainability for Future Generations


Freshwater Fisheries Sampling Locations
N
LEGEND
Fish survey sampling location
Freshwaters of the State
RIGIS

Hydroperiods to Bioperiods

River flows at various life stages of fish



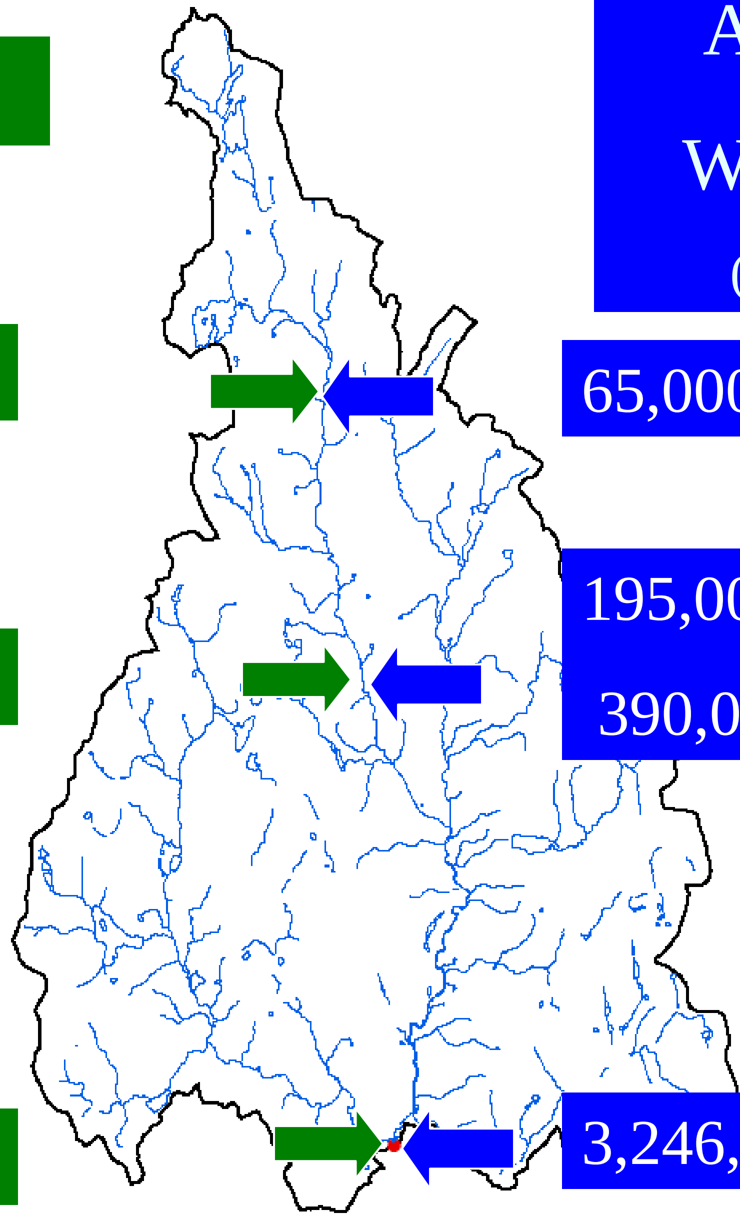
Allowable Withdrawal as a Percent of 7Q10

Month	BioPeriod	HydroPeriod	Class 1	Class 2	Class 3	Class 4	Class 5
Oct	Spawning & Outmig.	Medium-Low	20%	40%	60%	80%	100%
Nov Dec	Overwinter	Mediuum	40%	80%	120%	160%	200%
Jan Feb	Overwinter & Channel Forming	High	60%	120%	180%	240%	300%
Mar April	Anadromous Spawning	High	60%	120%	180%	240%	300%
May	Anad. Spawning	Medium	40%	80%	120%	160%	200%
June	Peak Resident Spawn.	Medium-Low	20%	40%	60%	80%	100%
July Aug Sept	Resident Spawning Rearing and Growth Herring & Shad Out.	Low	10%	20%	30%	40%	50%

Allowable Withdrawals for Each Class during Low Hydroperiod

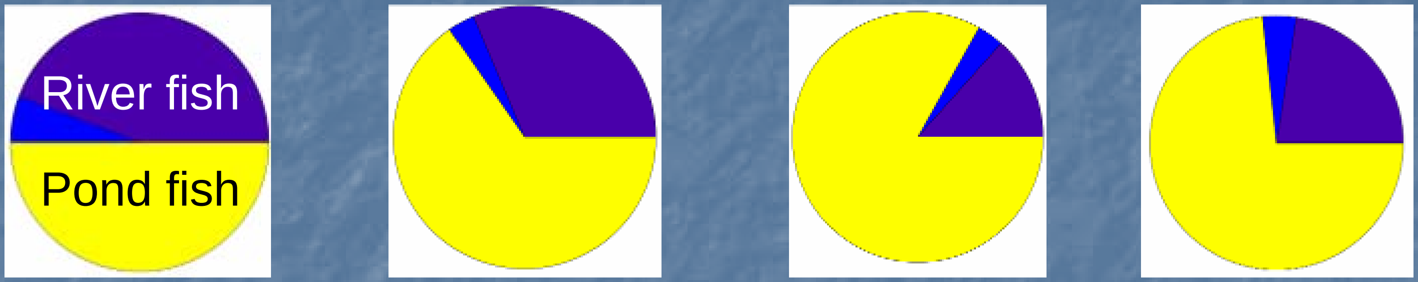
Class	% of 7Q10 Withdrawn	
1	10	Natural Streams
2	20	Minimal Human Influence
3	30	Evident Human Influence
4	40	Moderate Human Influence
5	50	Significant Human Influences

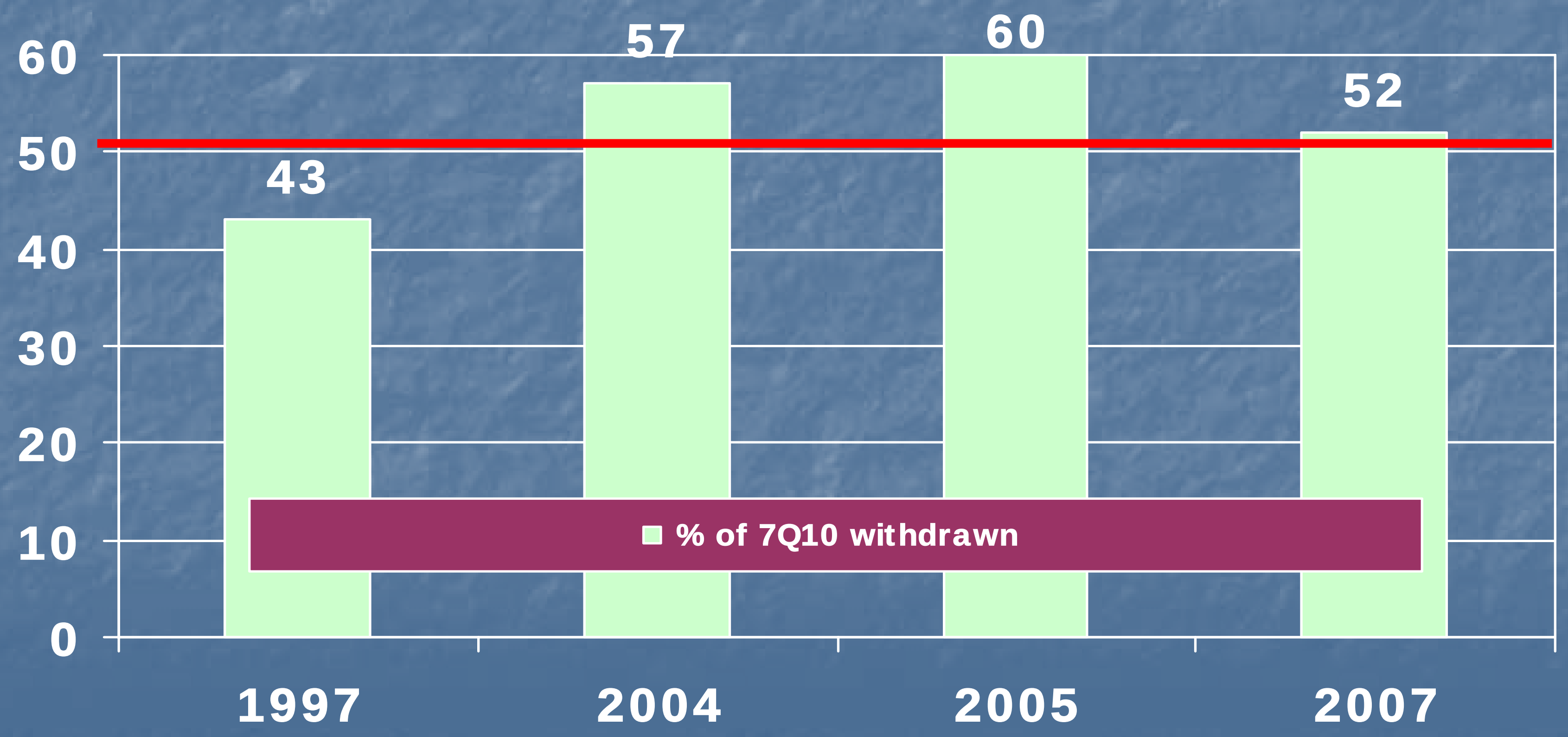
Flow	Allowable Withdrawal (Low Flow)
7Q10 = 1 cfs	65,000 gpd (Class 1)
7Q10 = 3 cfs	195,000 gpd (Class 1) 390,000 gpd (Class 2)
7Q10 = 10 cfs	3,246,000 gpd (Class 5)



RIDEM F&W Study

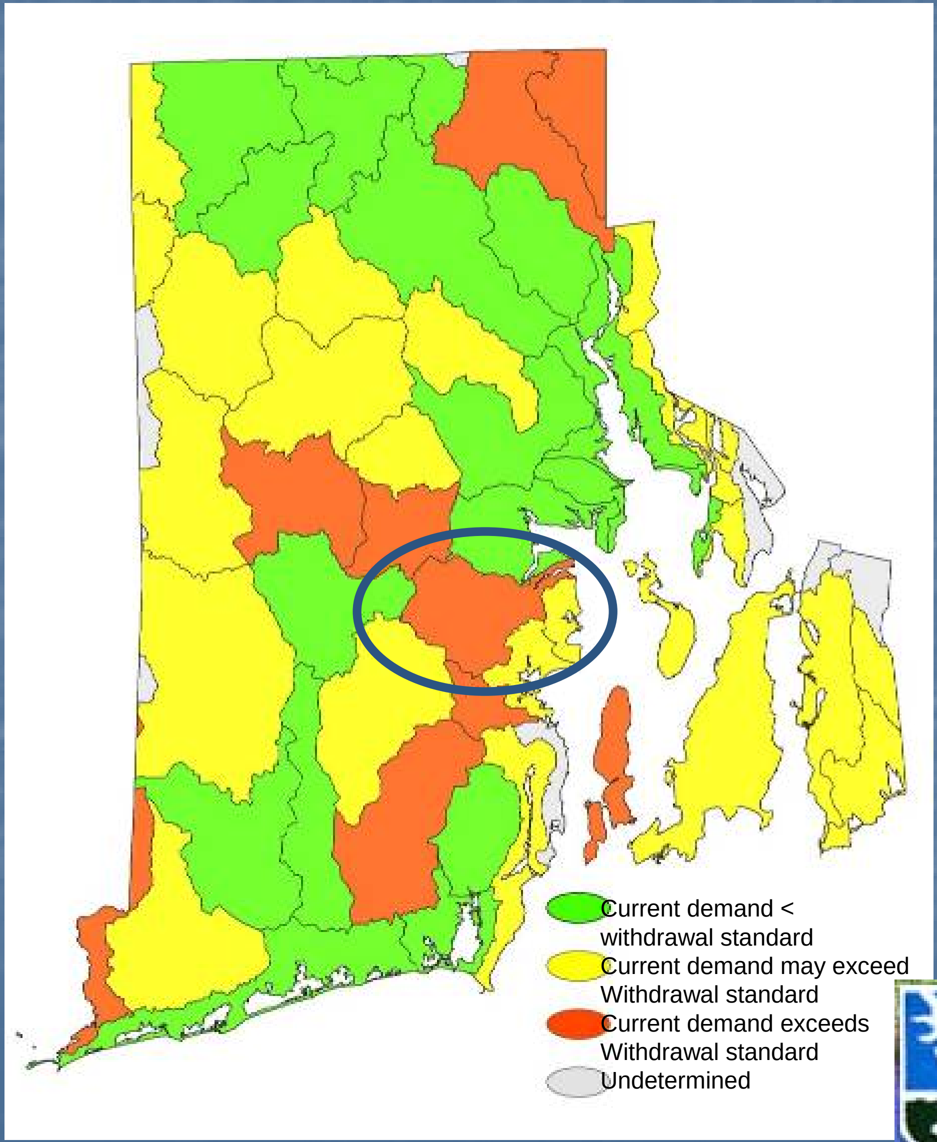
Annual Fish Community Analysis compared to upstream water withdrawals



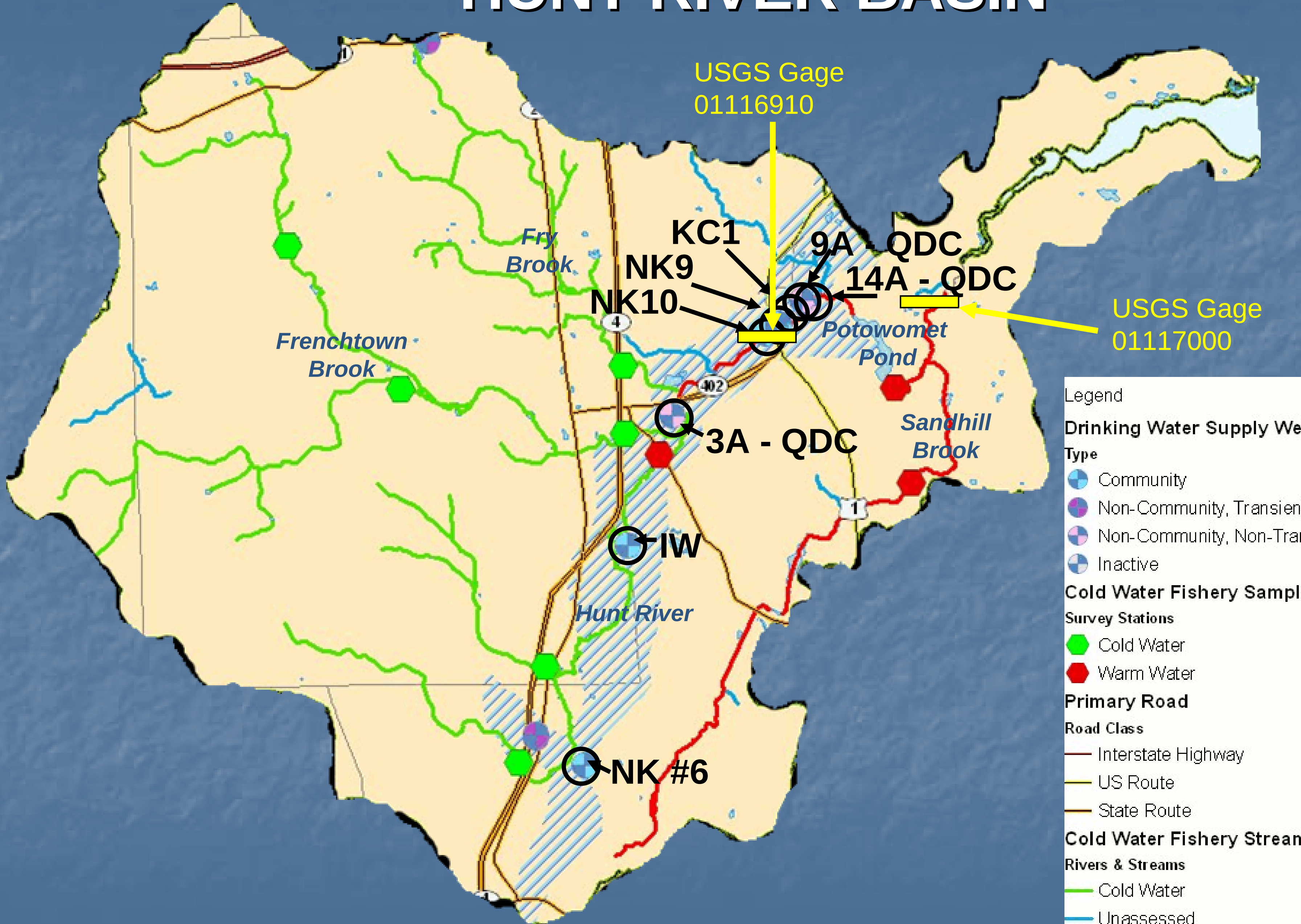


Watersheds of Concern

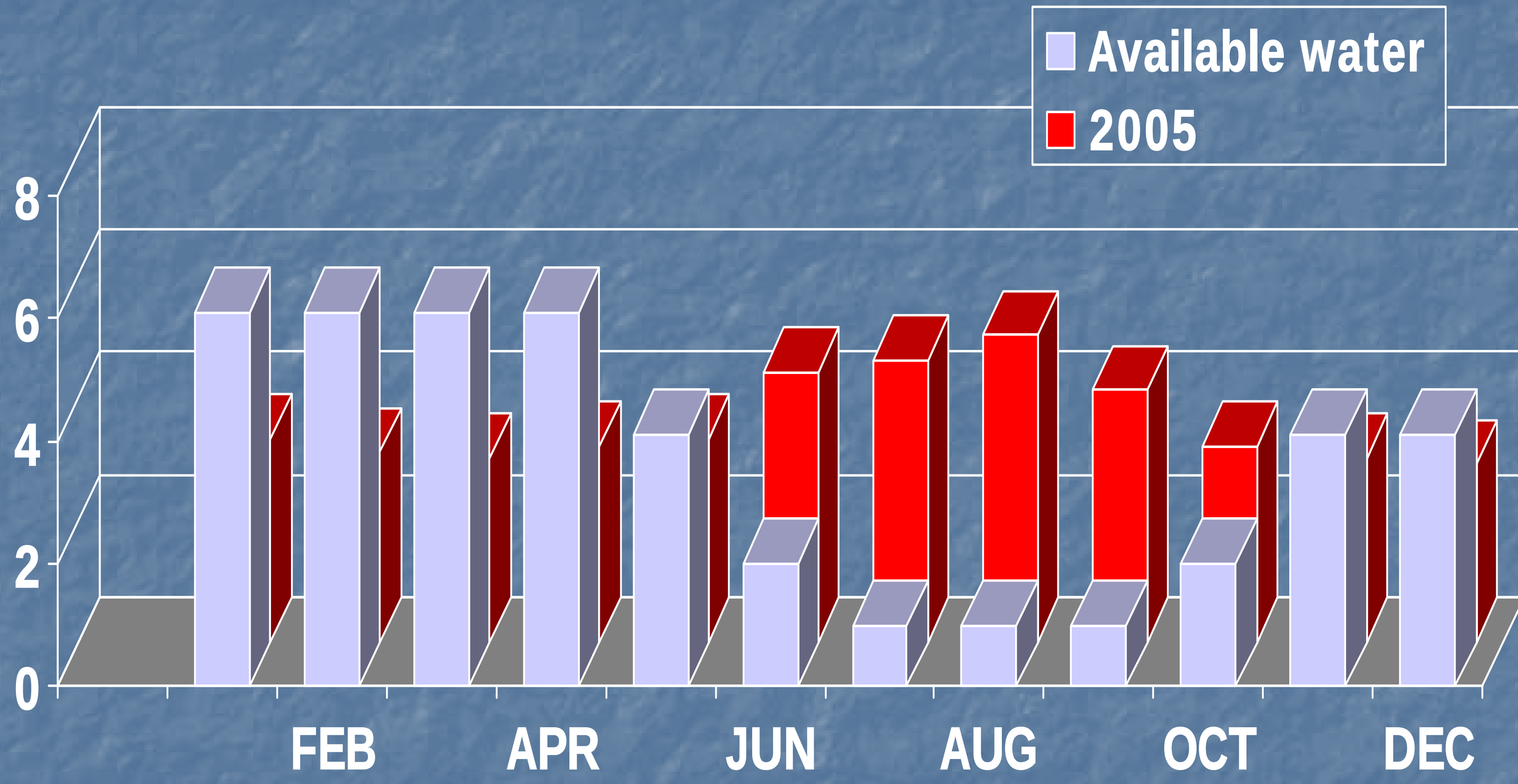
- Preliminary data indicates that the following watersheds may not be supporting the goals
- We need to address the areas in Red through conservation and reduced demand.
  - Hunt River
  - Chipuxet River
  - Westerly
  - Jamestown
  - Cumberland and Woonsocket
- We may be able to look for more water to supplement from the green areas.

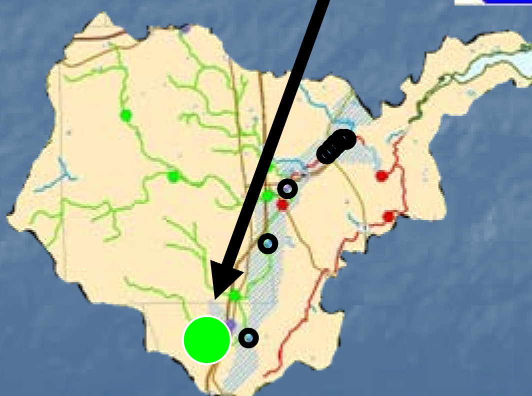


HUNT RIVER BASIN



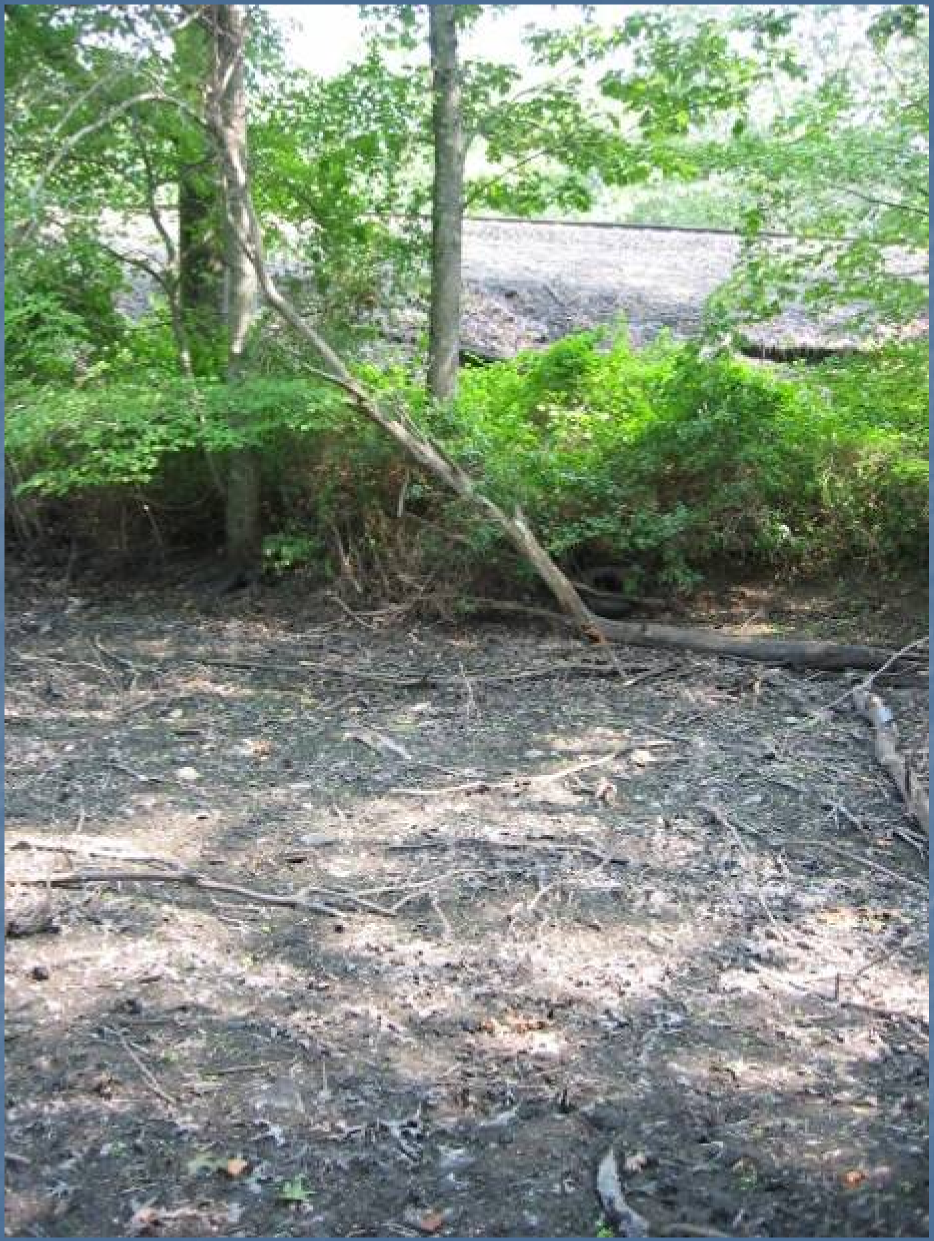
Hunt River Withdrawals





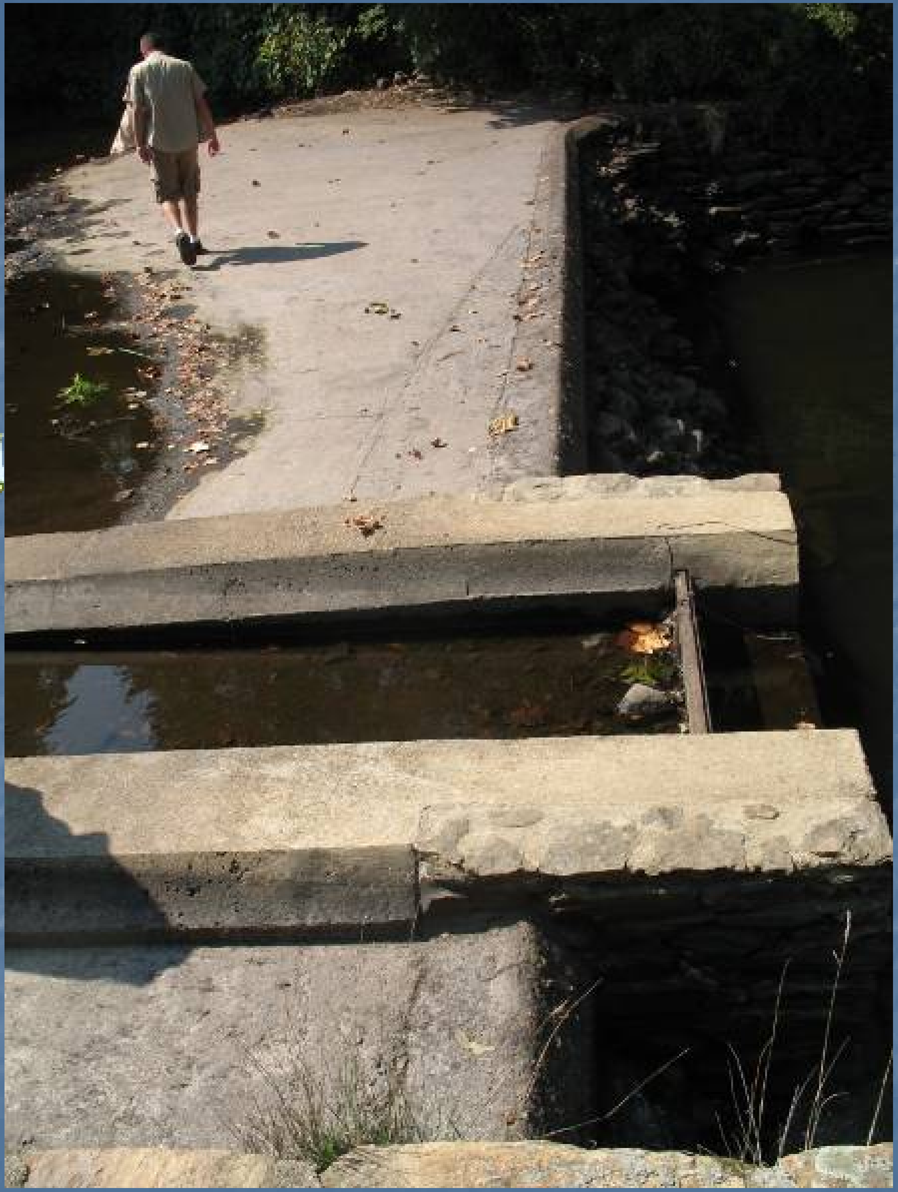
Fry Brook – August 2007

Wetlands Near pumping well
Cluster on Hunt River
August 2005



Potowomet Dam, Summer 2007

Old Forge Dam - 2007



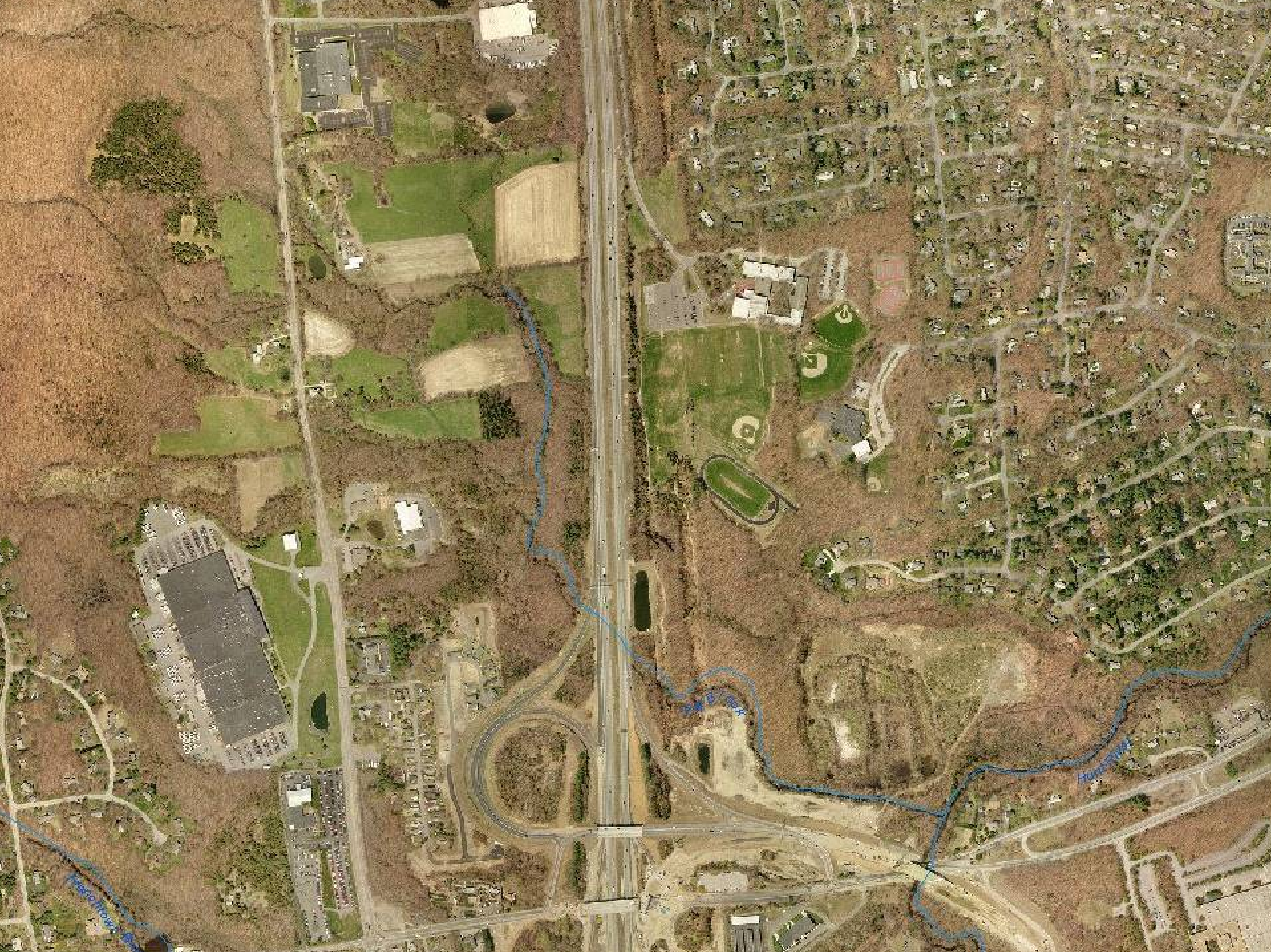
Water Resources Board - HAP Pilot

COOPERATORS

- North Kingstown Water
- QDC
- Kent County Water
- Coalition For Water Security
- Grow Smart

HAP Pilot Goal

The goal is to develop recommendations and a coherent strategy for application in the Hunt-Annaquatucket-Pettaquamscutt basin that will seek to ensure a sustainable balance between human and ecological water needs and will serve as an improved model for statewide water resources conservation, management, and allocation.



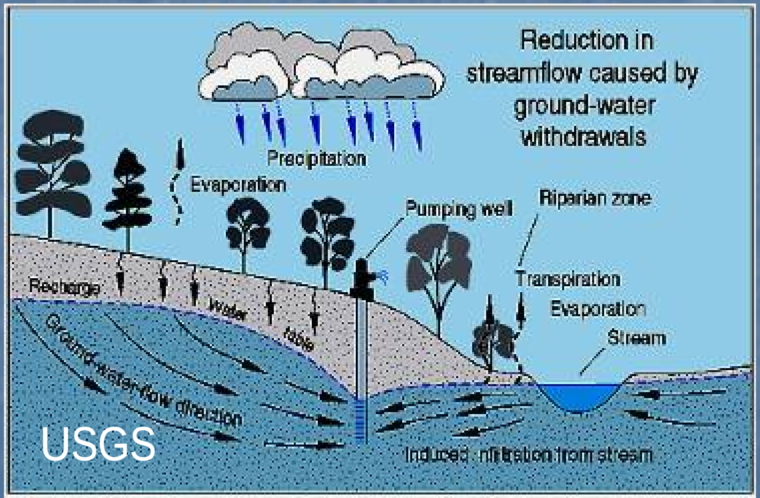
Brook

Wastewater Reuse

Jamestown and Carnagie

Improving the Stormwater Manual

- LID Design – where it makes sense



Rapid infiltration basins. (Photograph courtesy of Water Conserv II facility, Orlando, Florida.)

Improving Efficiencies and Moving to Wells
(NRCS and Div of Agriculture)


Removing Non-Potable Uses from the Public Supply System

More Practical Considerations for Smaller Projects

Construction of a large underground cistern at a commercial site; this vault consists of a weight-bearing skeleton wrapped in a waterproof membrane. Photo: Rainwater Recovery Systems, LLC

- Rain cisterns, rain harvesting, stormwater infiltration, wastewater reuse, use of constructed ponds for irrigation, etc..
- Reduces stormwater pollution while reducing water demands in the summer.

We need help from everyone

- ~40 MGD is used on outdoor watering in this State

Summer Demand Managment

- Conservation plumbing fixtures
- Leak detection and repair
- Minimize lawns
- Keep trees on-site
- Install rain gages on irrigation systems
- Specify drought tolerant grasses and shrubs

Resources:

URI Master Gardner

http://www.uri.edu/ce/healthylandscapes/tips/4.html

Water used to be so simple!