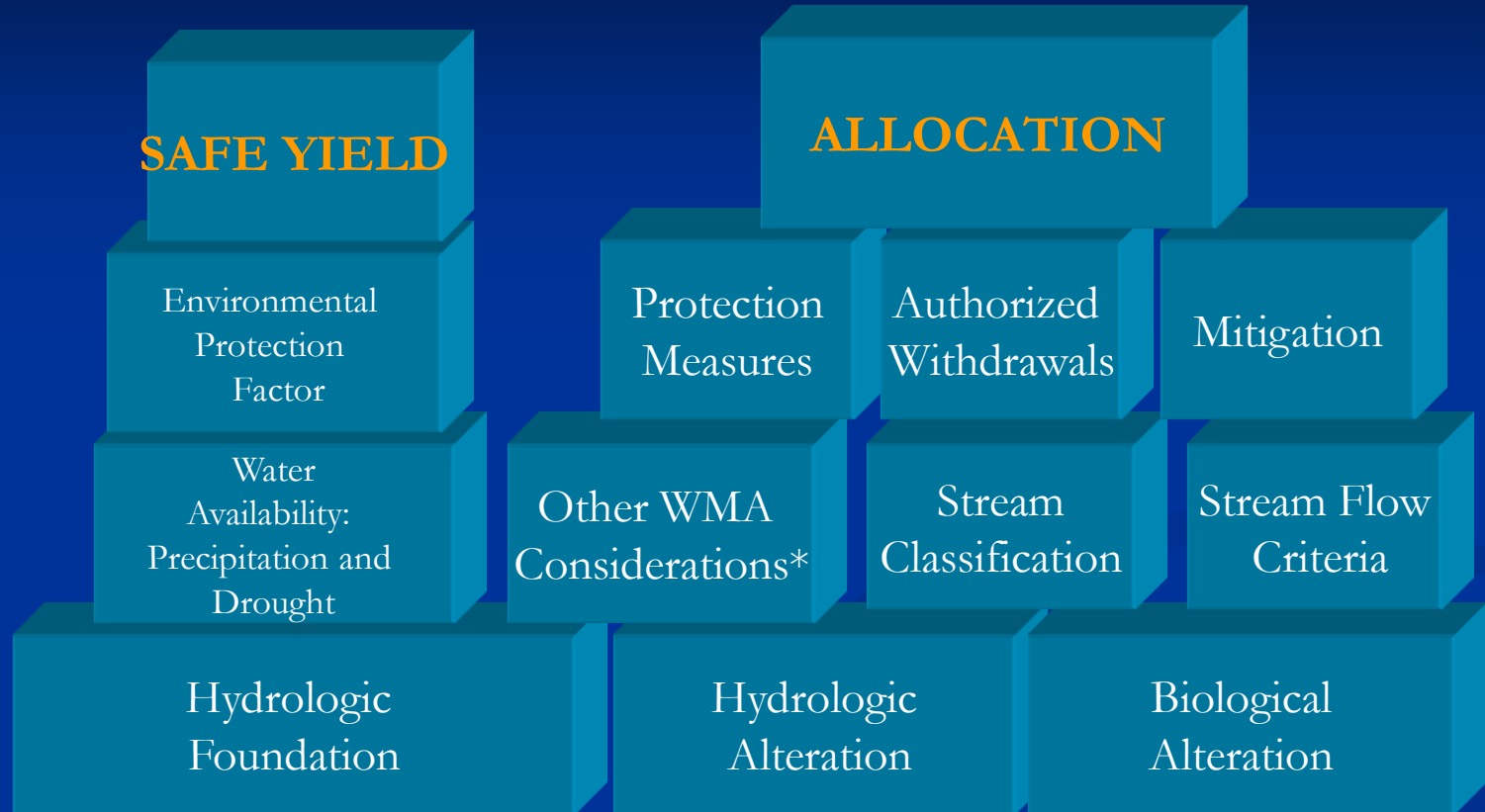


SWMI Update

(Sustainable Water Management Initiative)



Linda Marler Hutchins, Hydrologist
MA Department of Conservation and Recreation
WSCAC
May 26, 2011

Massachusetts Sustainable Water Management Initiative 2009-2010-2011....



- Technical Subcommittee
- Advisory Subcommittee
- Agency Technical Staff Meetings
- Steering Committee
- Implementation Tools Committee
- Facilitated Meetings
- Stakeholders

MA Permit Extension Act

+ 2 Years to all current permits

Includes WMA Permits

Update Summary

- Safe Yield
- Streamflow Criteria
- Policy/Allocations/WMA Permitting
- Current Issues

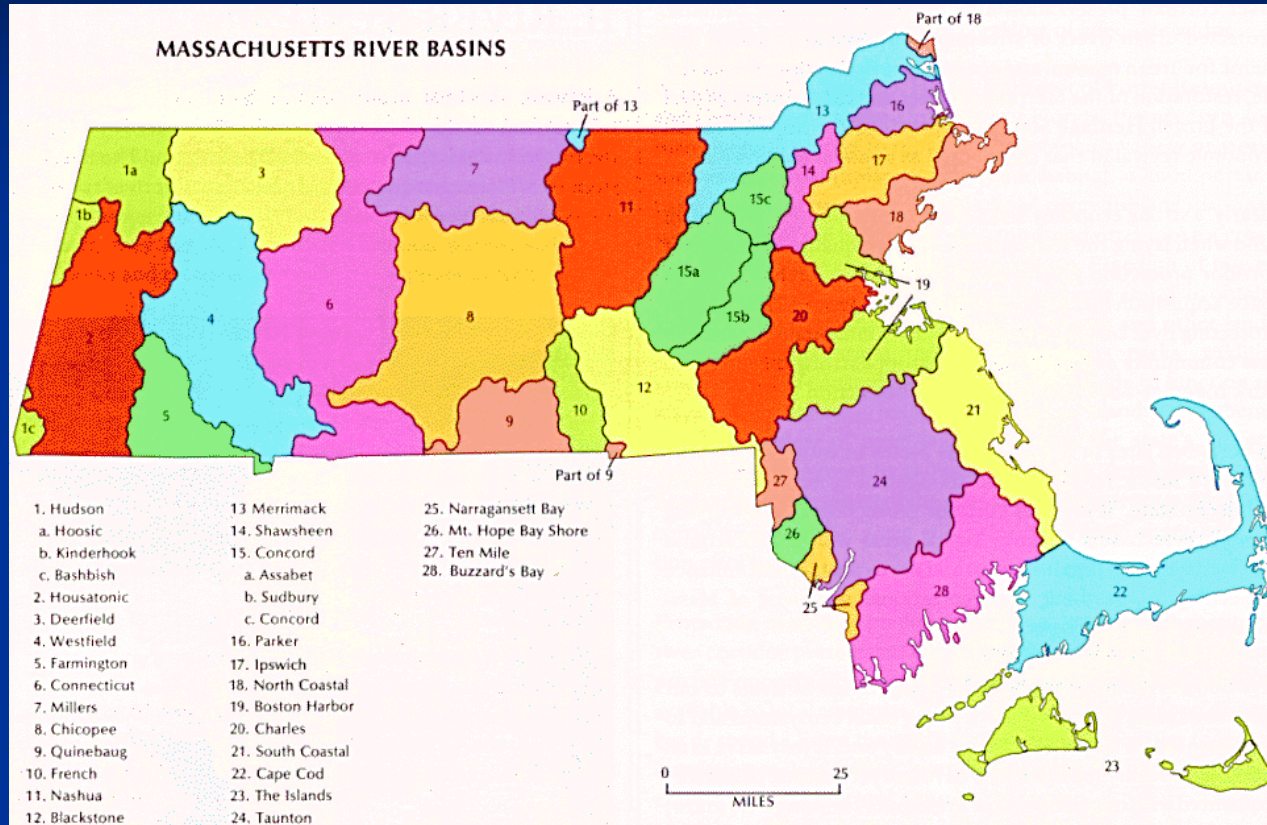
WMA “Safe Yield”

“the maximum dependable withdrawals that can be made continuously from a water source including ground or surface water during a period of years in which the probable driest period or period of greatest water deficiency is likely to occur; provided, however, that such dependability is relative and is a function of storage and drought probability.”

Water Supply Term

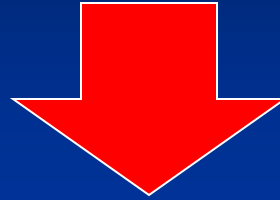
Environment??

Massachusetts Major River Basins



Water Management Act manages water withdrawals in Major Basins
Limits total permitted withdrawal to a “Safe Yield” for each Major Basin

2009 DEP Issues Safe Yield Values for 27 Major Basins



DEP Safe Yield Clarification

November 3, 2009

“MassDEP clarifies and explains that its interpretation of the term **safe yield** under the Water Management Act includes **environmental protection factors, including ecological health of river systems**, as well as hydrologic factors.”

Basin Yield

Annual Drought Volume

Calculated from SYE Statistics

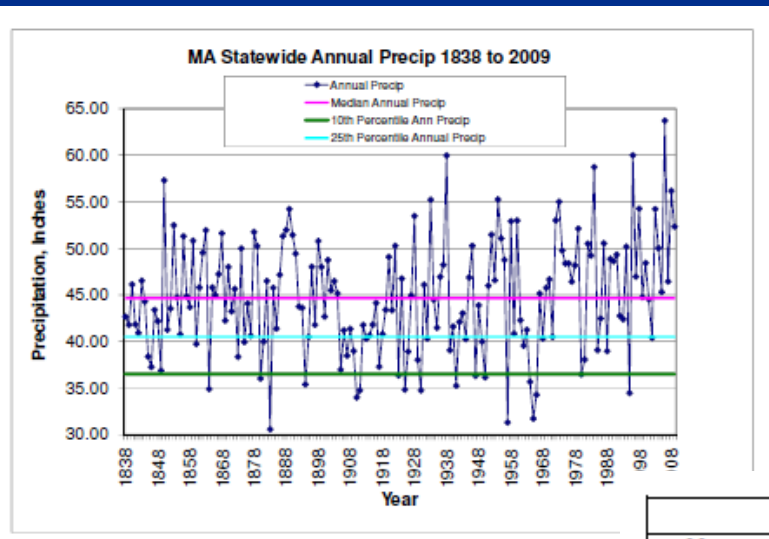
using Monthly 90th percentile low flows

Millers	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Q98	0.24	0.34	0.56	0.92	0.44	0.21	0.14	0.09	0.08	0.16	0.22	0.27	0.31
Q95	0.34	0.43	0.74	1.05	0.54	0.25	0.16	0.14	0.12	0.20	0.26	0.40	0.38
Q90	0.44	0.57	0.91	1.28	0.70	0.30	0.20	0.15	0.15	0.23	0.34	0.48	0.48
Q80	0.62	0.72	1.16	1.72	0.98	0.40	0.25	0.20	0.21	0.31	0.51	0.63	0.64
Q75	0.70	0.80	1.32	1.93	1.11	0.46	0.26	0.22	0.22	0.34	0.58	0.73	0.72
Q50 (Medians of Daily Means)	1.11	1.23	2.24	2.95	1.63	0.84	0.39	0.33	0.33	0.53	1.11	1.29	1.16
Median of Monthly Means, cfs/m	1.54	1.49	2.94	4.11	2.06	1.02	0.56	0.40	0.46	0.66	1.31	1.54	1.50

Monthly values are time-weighted and “rolled up” into an average annual value *

* = ((Jan x 31 days) + (Feb x 28 days) + (Mar x 31 days) + (Apr x 30 days) + (May x 31 days) + (Jun x 30 days) + (Jul x 31 days) + (Aug x 31 days) + (Sep x 30 days) + (Oct x 31 days) + (Nov x 30 days) + (Dec x 31 days)) / 365 days

Precip Records: 1965 was generally the dryest year in MA that we also have Streamflow Record



Year	State Ann. Precip In.	%normal	Rank	Exceedance Probability %	Recurrence Interval (yrs)
1883	30.54	68	1	99.4	173.0
1957	31.28	70	2	98.8	86.5
1965	31.70	71	3	98.3	57.7
1910	33.97	76	4	97.7	43.3
1966	34.26	77	5	97.1	34.6
1995	34.46	77	6	96.5	28.8
1911	34.73	78	7	95.9	24.7
1930	34.74	78	8	95.3	21.6
1925	34.82	78	9	94.8	19.2
1864	34.86	78	10	94.2	17.3

Monthly Q90 Rollup:

A synthesized low-flow year.

How does it compare to real years?

What is the recurrence interval?

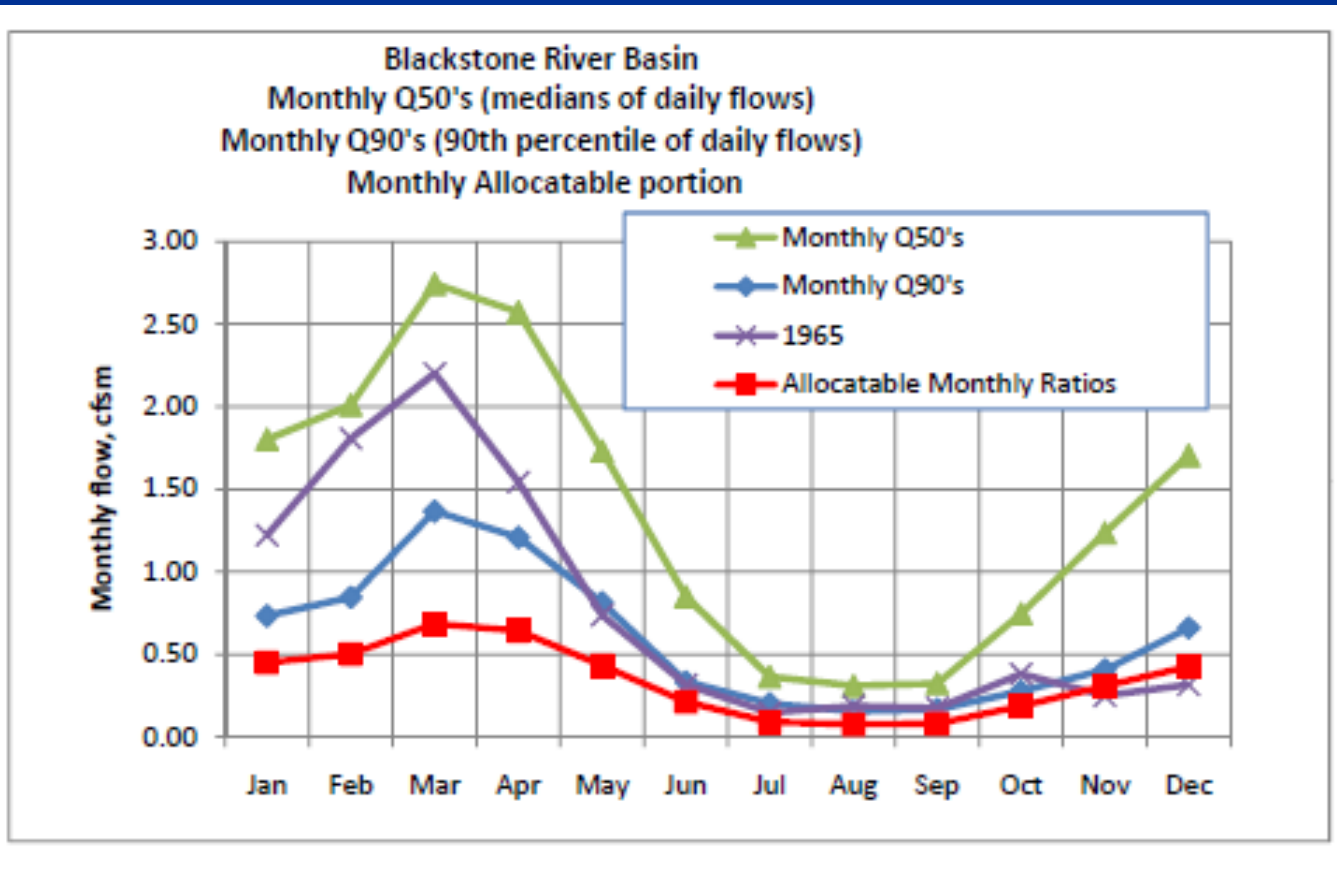
We compared all the SYE Simulated Years

	Monthly Median of Daily Mean Flows, cfsm												Ann
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1961	0.88	0.88	3.52	6.13	2.52	1.04	0.53	0.31	0.41	0.45	0.89	0.95	1.54
1962	1.76	0.95	2.02	4.58	1.88	0.65	0.24	0.28	0.17	0.99	2.73	2.11	1.53
1963	1.70	1.16	2.59	2.24	1.60	0.79	0.20	0.10	0.06	0.08	1.33	1.52	1.11
1964	1.29	1.72	2.98	2.66	1.60	0.52	0.48	0.08	0.04	0.12	0.15	0.39	1.00
1965	0.44	1.12	1.52	1.72	0.93	0.45	0.12	0.14	0.15	0.21	0.28	0.27	0.61
1966	0.33	1.17	2.72	1.23	1.00	0.46	0.12	0.10	0.17	0.28	0.73	0.61	0.74
1967	0.61	0.68	1.83	3.90	2.97	1.38	0.61	0.30	0.21	0.25	0.66	1.15	1.23
1968	1.34	1.25	2.97	1.66	1.07	1.80	0.67	0.20	0.12	0.35	1.44	1.63	1.21
1969	1.31	1.56	2.22	3.89	1.52	0.57	0.22	0.24	0.21	0.28	2.33	2.71	1.42
1970	1.58	2.39	1.60	2.70	1.70	0.93	0.57	0.14	0.15	0.30	1.29	1.02	1.19
1971	0.78	1.82	3.54	3.29	2.57	0.99	0.33	0.10	0.14	0.24	0.41	1.66	1.32
1972	1.25	1.53	4.20	3.70	2.57	3.31	1.96	0.33	0.55	0.62	2.38	2.58	2.08
1973	2.44	2.15	3.28	4.78	3.17	1.09	0.84	0.28	0.13	0.14	0.85	1.96	1.74
1974	1.16	1.54	1.78	2.76	1.85	0.78	0.65	0.25	0.22	0.24	1.18	0.94	1.18

Monthly Q90 Rollup:

A synthesized low-flow year.

How does it compare to real years?

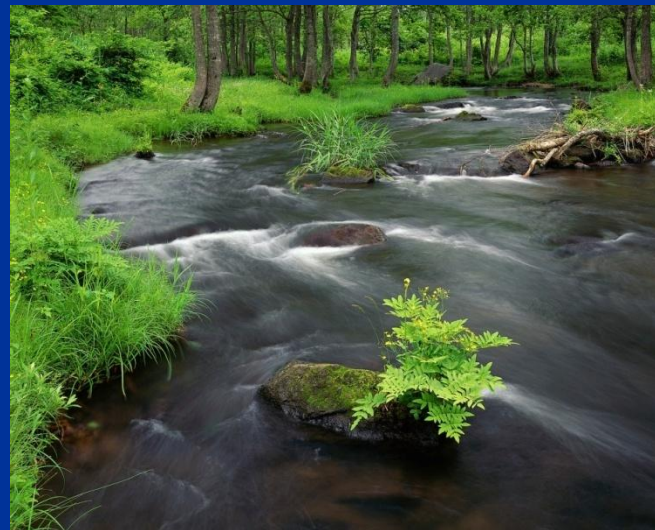
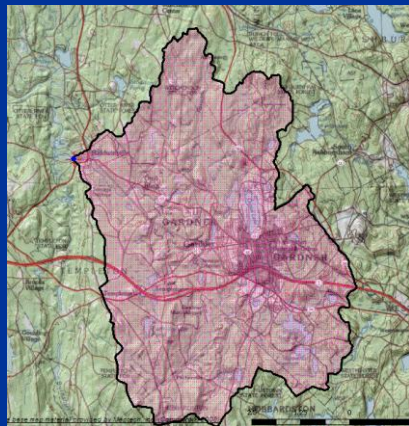


Other Safe Yield Issues

- Include Reservoir Storage volumes for reservoirs that hold > 1 yr of annual inflow and use:
 - Wachusett ~ 127 MGD
 - Quabbin ~ 242 MGD
- Recharge methods for Cape Cod, Islands, Plymouth Carver Aquifer in South Coastal
- Compliance issues where WMA Authorizations $> SY$
- What % of Basin Yield to Authorize for WMA?

Streamflow ~~Standards~~ Criteria

Envisioned to protect streamflow at smaller geographic and time scale than Safe Yield



NO GRANDFATHERING!

Will apply to all Water Management Act Permits

2009-2011: Statewide "Fish and Flow Study"

Fish Community Response to Flow Alterations, Land Use, Impoundments, and Water Quality in Massachusetts

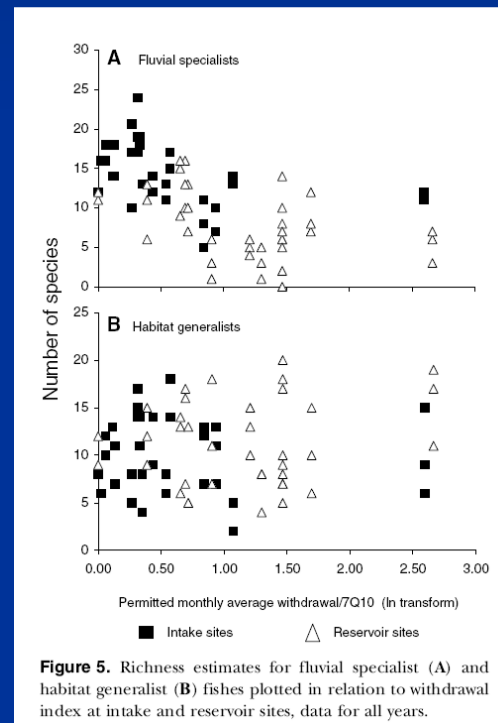
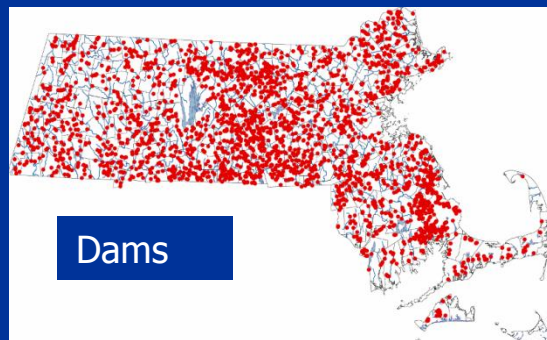
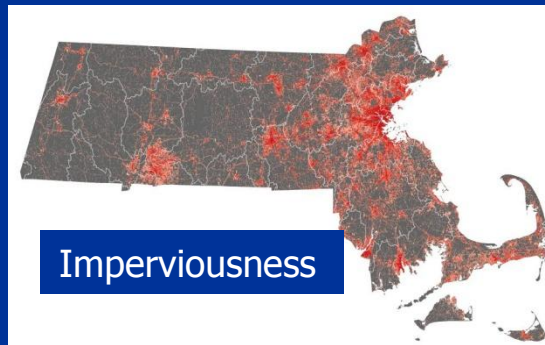
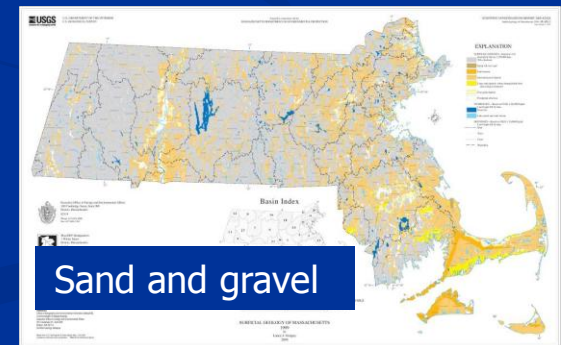
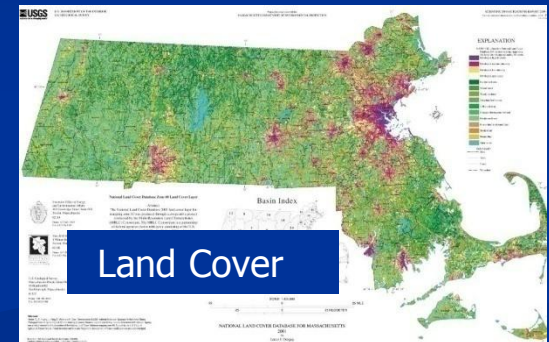


Figure 5. Richness estimates for fluvial specialist (A) and habitat generalist (B) fishes plotted in relation to withdrawal index at intake and reservoir sites, data for all years.



2010 Accelerated Fish and Habitat Study

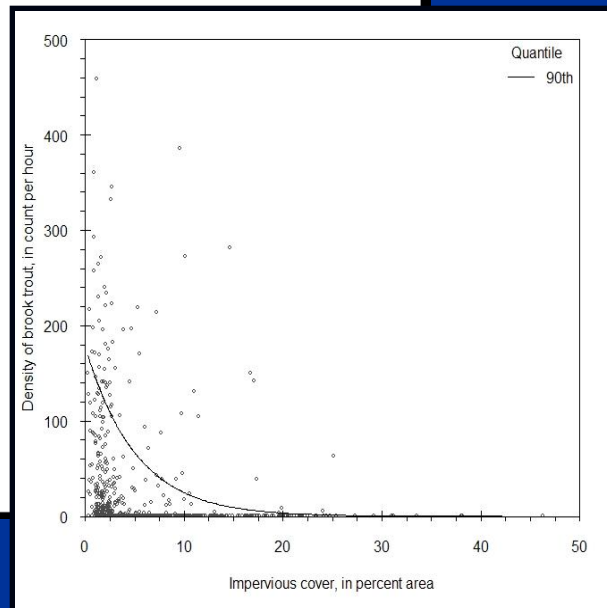


Prepared in cooperation with the
Massachusetts Department of Conservation and Recreation, the
Massachusetts Department of Environmental Protection, and the
Massachusetts Department of Fish and Game

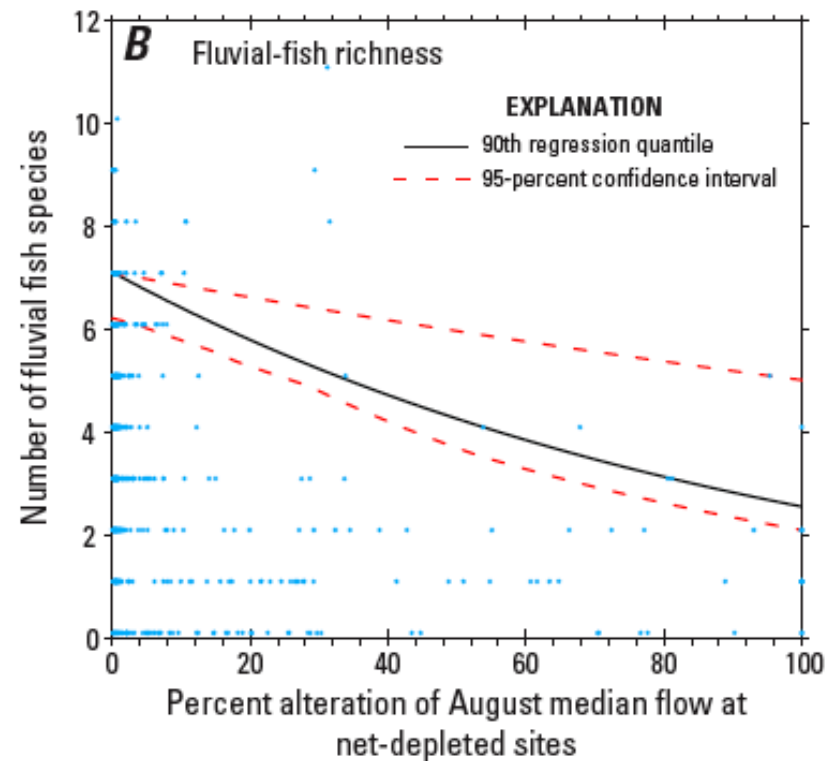
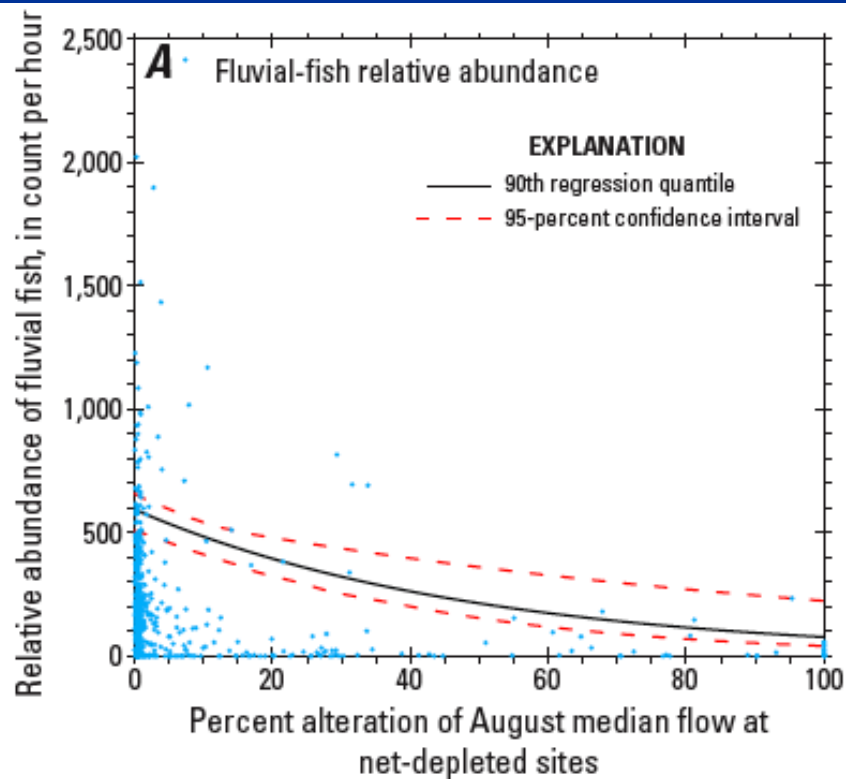
Preliminary Assessment of Factors Influencing Riverine Fish Communities in Massachusetts

Open-File Report 2010-1139

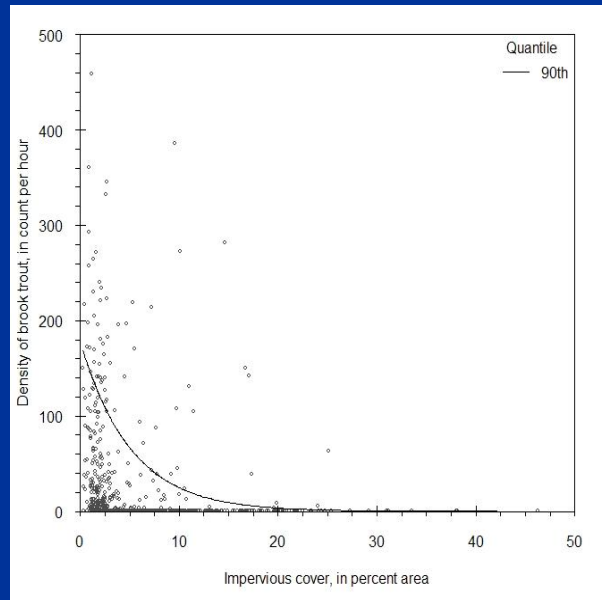
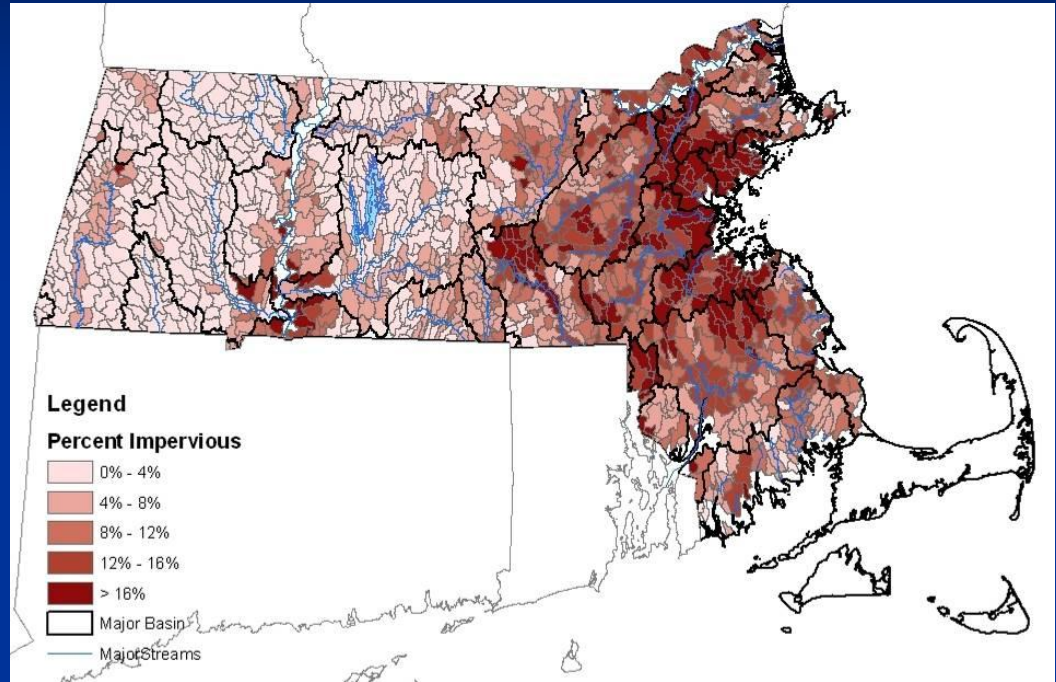
U.S. Department of the Interior
U.S. Geological Survey



The Preliminary Fish and Flow Study showed that depletion of August Median Flow is associated with decreases in the abundance and diversity of river fish.

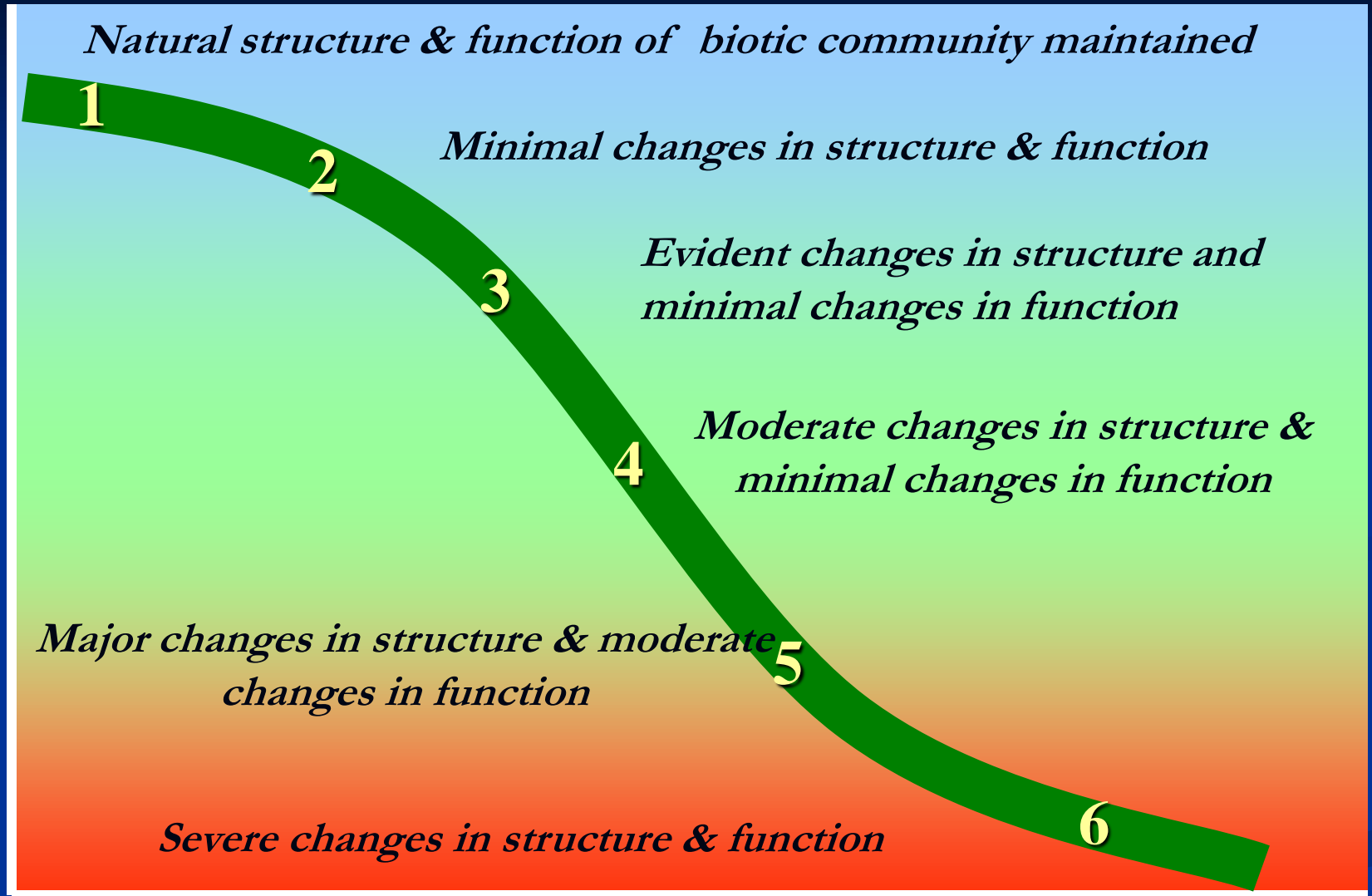


Impervious Cover: The other smoking gun!



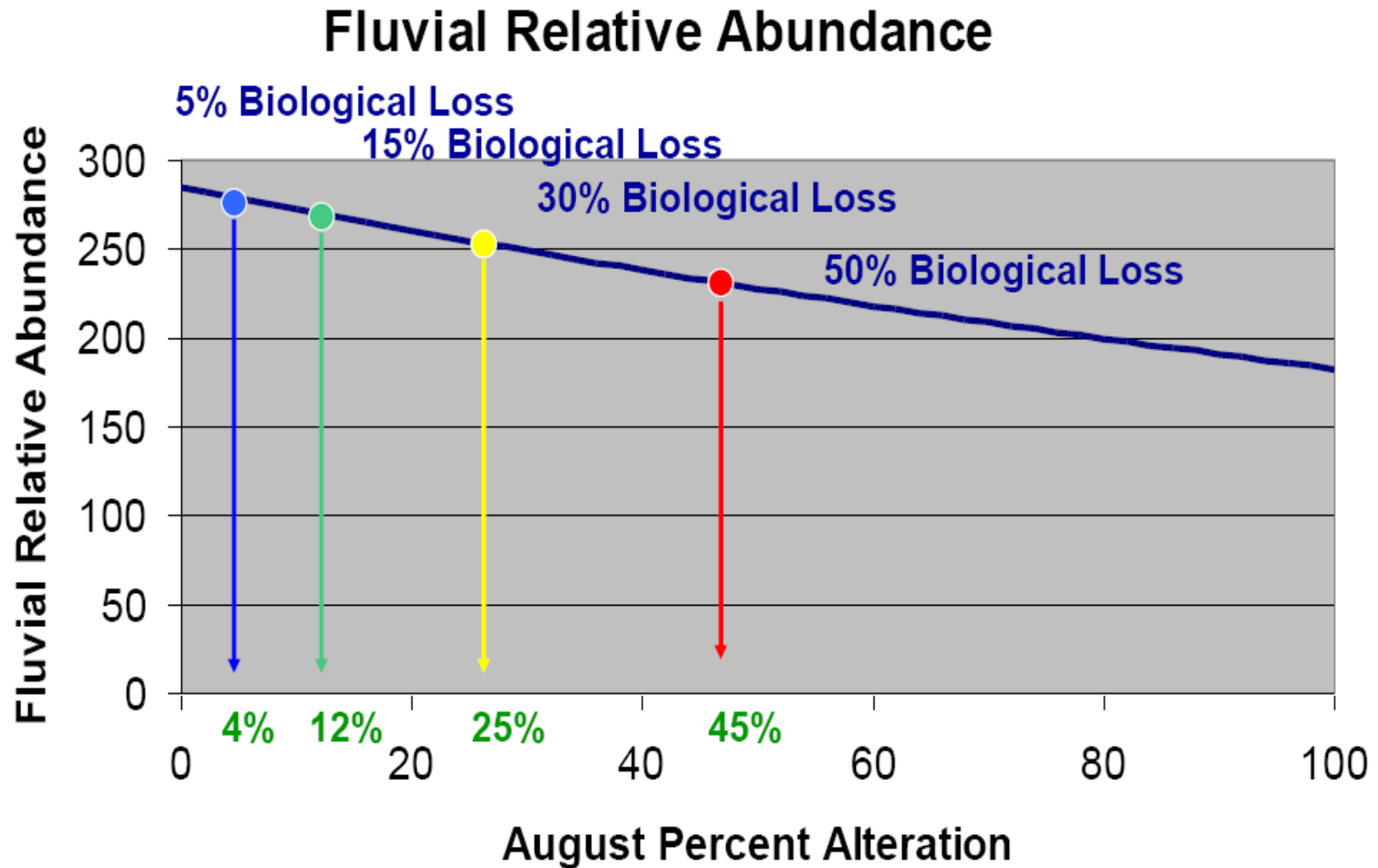
The Biological Condition Gradient – Concept

Biological Condition



Increasing Effect of Human Activity →

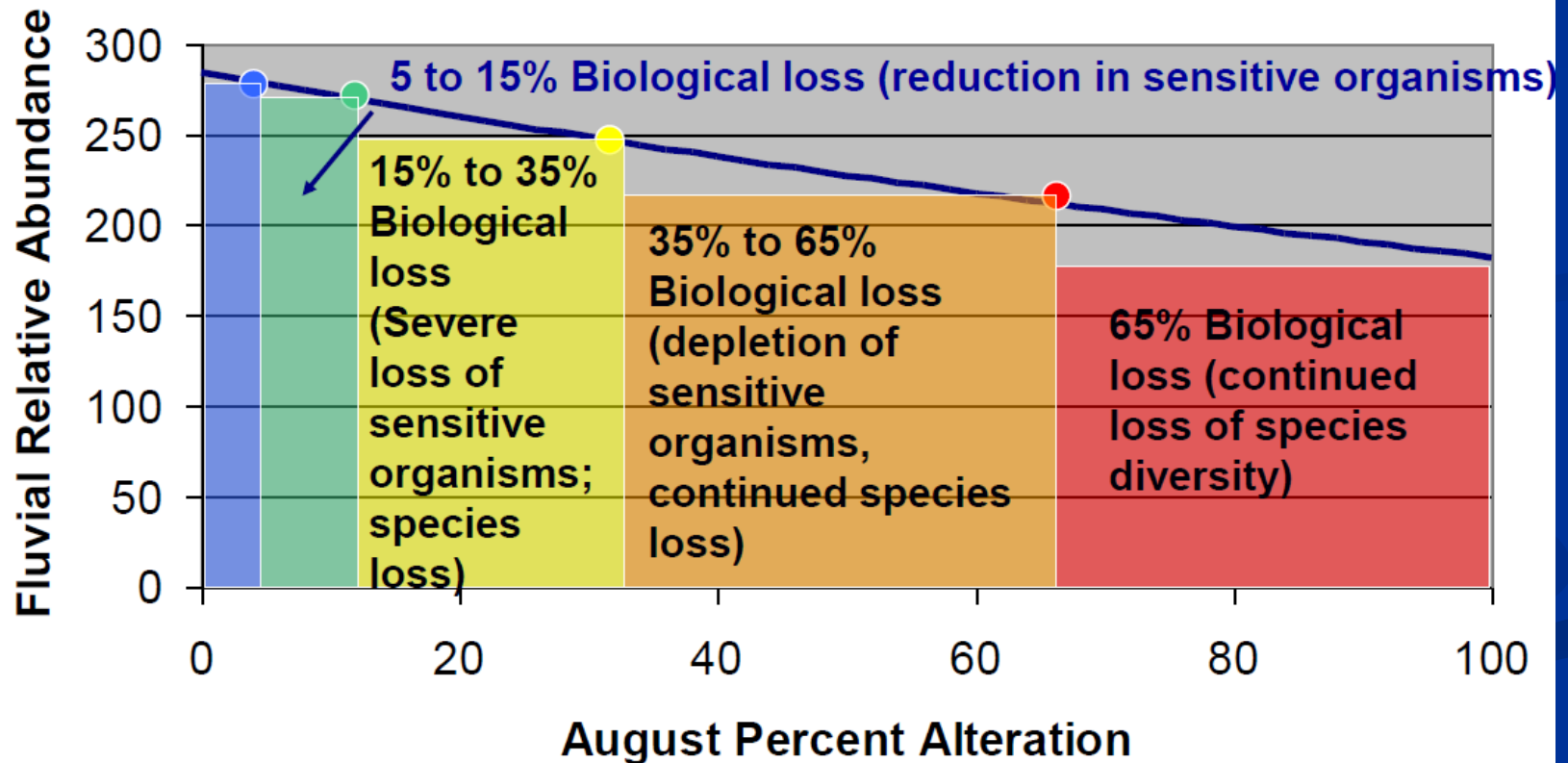
“Fish & Habitat” Response Curves → River Categorization



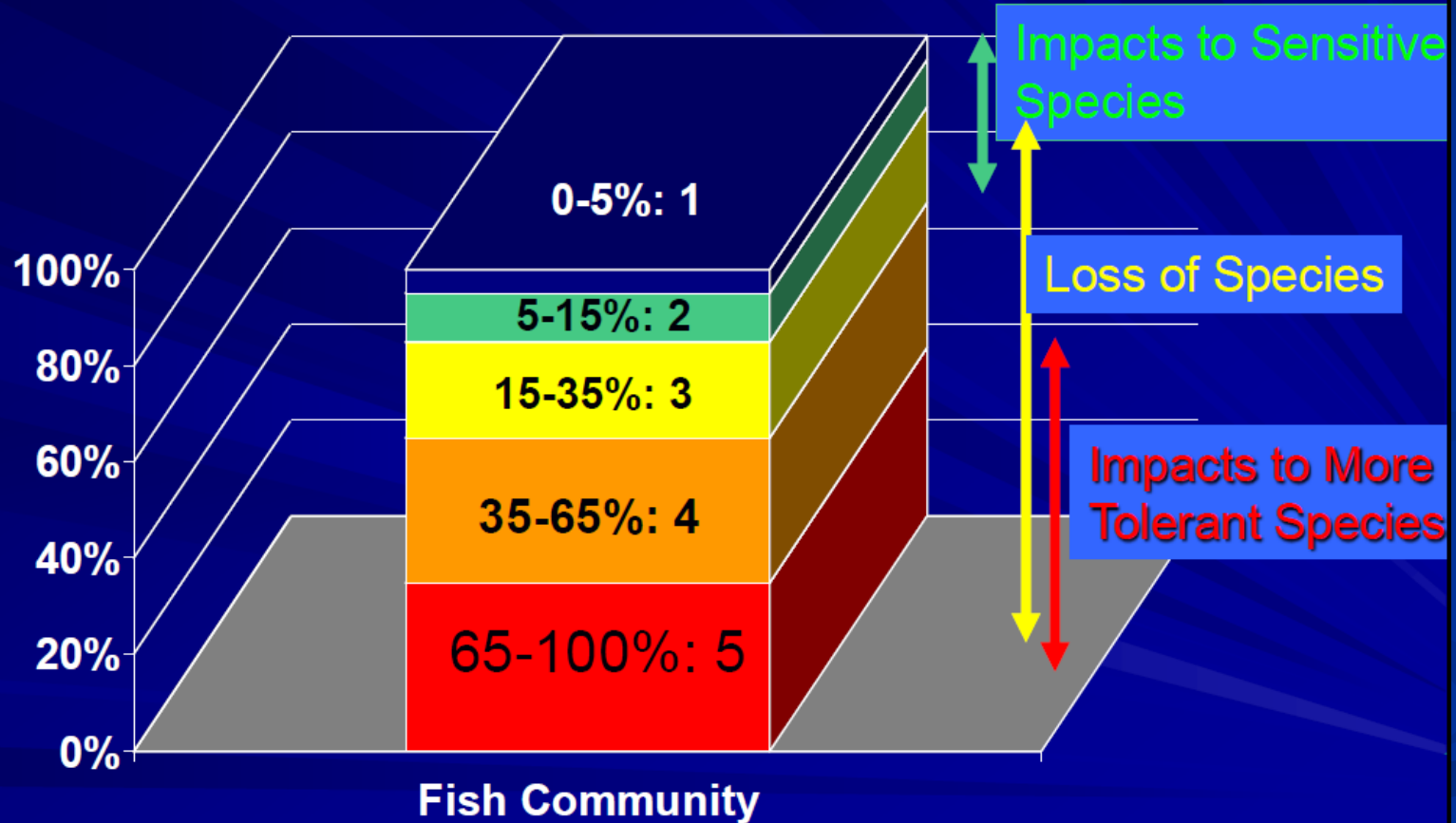
Biological Categories

Curve based on basin characteristics
for a specific % Percent Impervious cover

Fluvial Relative Abundance

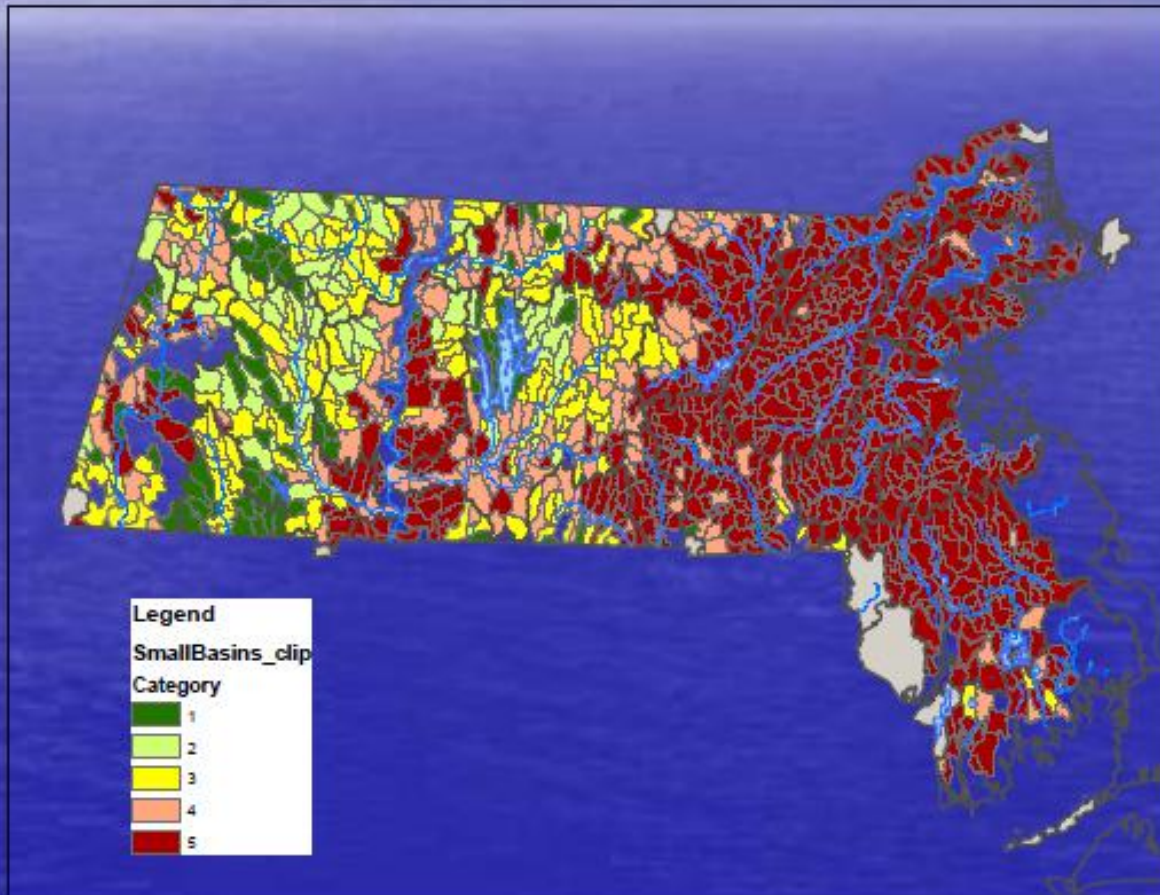


Fish Community Response



Draft MA Biological Categories Map

Considers both Impervious Cover and August Flow Alteration



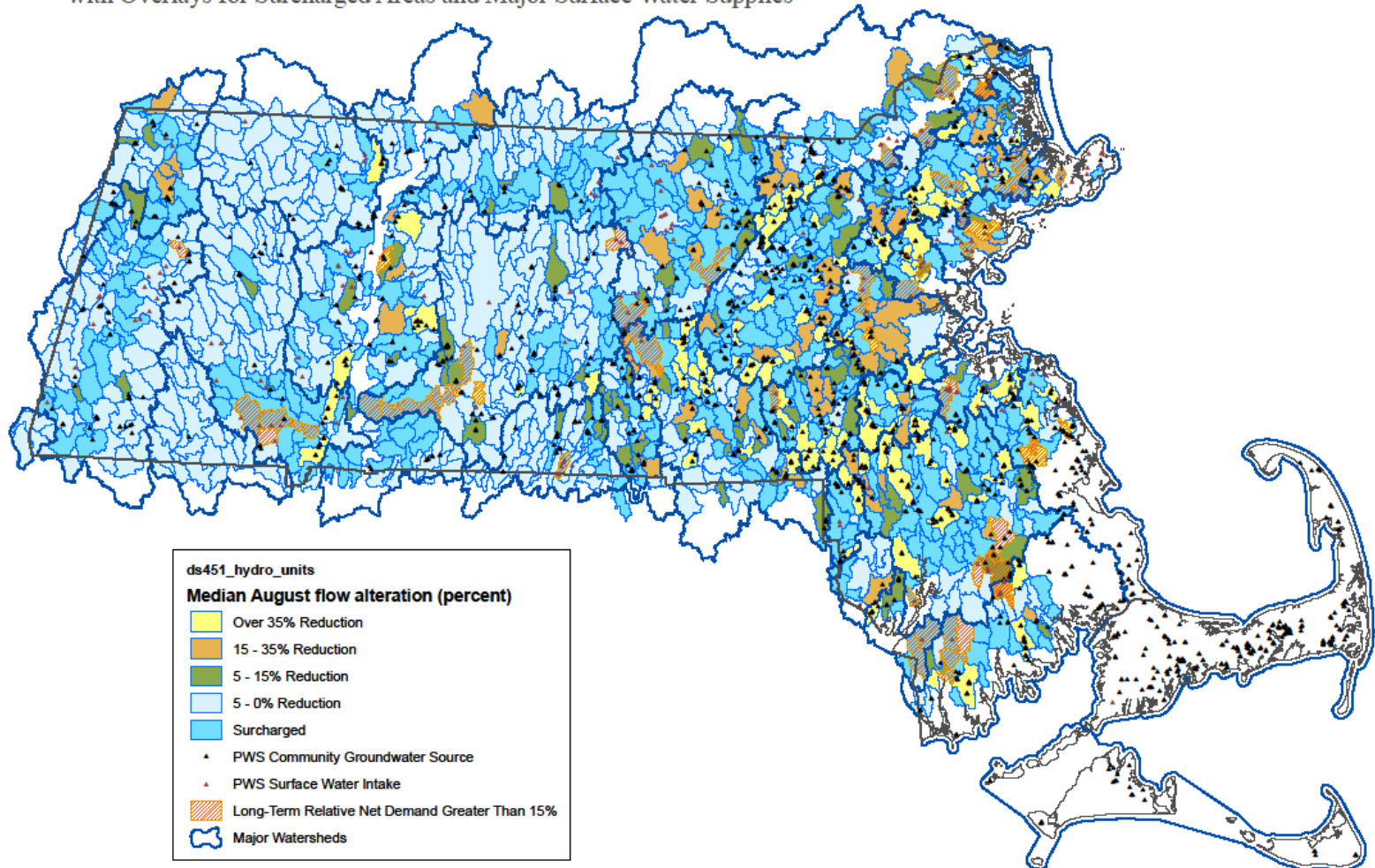
Category 5:
>65% Reduction in
Fluvial Fish
Relative Abundance

Draft MA Streamflow Criteria

Flow Level	% Aug Flow Alteration	% Oct Flow Alteration	% Jan Flow Alteration	% Apr Flow Alteration
1	5	5	5	5
2	15	5	5	5
3	35	15	15	15
4	65	Feasible Mitigation and Improvement		
5	>65			

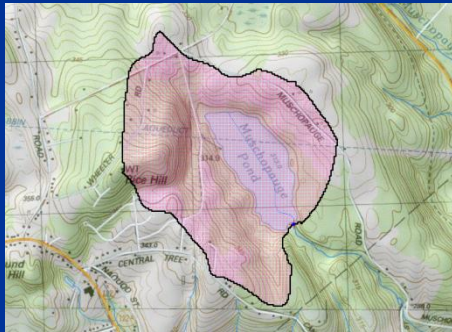
Streamflow Levels

DRAFT: Five Levels of Mean August Flow Reduction,
with Overlays for Surcharged Areas and Major Surface Water Supplies



SURFACE WATER WITHDRAWAL INCORPORATION INTO STREAMFLOW LEVELS

*SUBTRACT AUG INFLOW TO PWS RESERVOIRS FROM SUBBASINS
WHERE PWS RESERVOIRS EXIST, AND DOWNSTREAM*

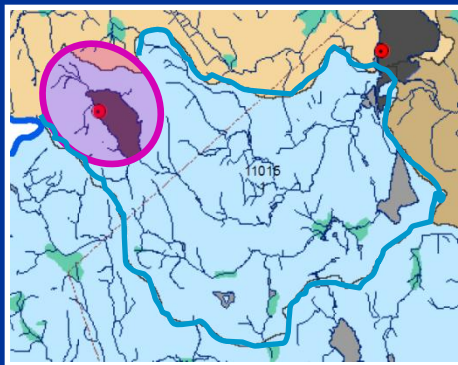


Muschopauge Pond

Drainage Area = 0.6 sqmi

Aug. inflow = 0.055 cfs

part of



Subbasin 11015

Drainage Area = 3.80 sqmi

Aug. Flow = 1.16 cfs

*Assumption: During August, no flow is passing the water supply dam;
So the inflow will be deducted from that subbasin and downstream subbasins*

Streamflow Criteria--Water Management Act Permits

WMA PERMIT REVIEW TIERS	WMA REVIEW THRESHOLDS	FLOW LEVEL TO WHICH REVIEW TIER MAY APPLY	BIOLOGICAL CATEGORY 1 OR COLD WATER FISHERIES RESOURCE (CFR)	MITIGATION
Tier 1	No additional withdrawal request above baseline	August flow levels 1 through 5	If present, then do a Desktop Pumping Evaluation (DPE)	Conditions 1-8*
Tier 2	Withdrawal request is for: 1) withdrawal volume equal to or less than 5%** estimated unaffected Aug median flow and; 2) will not result in flow level change; and 3) will not result in biological category change	August flow levels 1, 2 and 3	If present, then consult with agencies (DEP, DFG, DCR) to establish mitigation options, including DPE	Conditions 1-8* ----- Immediately evaluate additional mitigation options ----- Implement mitigation after first exceedence of baseline
Tier 3***	Withdrawal request is for: 1) greater than 5% of estimated unaffected August flow or; 2) would result in a change in flow level (up to flow level 3); or 3) would result in a change in biological category	August flow levels 1, 2 and 3	If present, then consult with agencies (DEP, DFG, DCR) to establish mitigation options, including DPE	Conditions 1-8* ----- Conduct alternatives analysis must demonstrate no feasible alternative**** ----- Consult with agencies to evaluate mitigation options
	any additional withdrawal request	August flow levels 4 and 5		----- Implement mitigation options

**For the purposes of this document, 5% was selected to distinguish large withdrawal requests from smaller withdrawal requests, the additional criteria illustrate that even small requests can cause impacts and result in a tier 3 review.

*** Could result in backsliding

****Water Metrics maps may be considered here (need to determine how)

Tiered Permit Review Levels
Based on Flow Levels, Biological Category, and Cold Water Fisheries

Mitigation Based on Permitting Tier and Agency Consultation

Water Supply Related Mitigation	Physical Instream Habitat	Water Quality/Municipality
Total ban on non-essential Seasonal Water use	Down stream releases for surface water withdrawals (systems releasing water downstream may operate based on a DEP approved reservoir management plan. Such a plan would allow the PWS to implement water use restrictions based on their plan, not DEP's.)*	Implement Stormwater Utility
Always below 55 RGPCD		Waterwater Reuse/Return
PWS above 65rgpcd: 1 day/week calendar & 0 day/week streamflow trigger	Connectivity Improvement a. install fish ladder Replace/Resize Identified Culverts c. Dam Removal All pending DFG approval	MS4 requirements for municipality not subject to requirements
Water Bank		MS4 requirements town-wide where not required town-wide
Bylaw prohibiting automatic irrigation systems		Water Quality and recharge rules that exceed MS4 rules
Private Well Bylaw controlling irrigation	Restore stream buffers	Require LID in stormwater Bylaw
adoption and enforcement of a bylaw to require the installation of moisture sensors or similar climate related control technology on all irrigation systems (RGPCD)	*All Tier 2 & Tier 3 PWS with SW sources will be required to evaluate downstream releases as part of the consultation sessions.	Land acquisition/CR a. stream corridor; b. ecosystem
Provide water savings devices (faucet aerators & low shower heads) at cost (RGPCD)		
provide rebates or other incentives for the purchase of low water use appliances (RGPCD)		I/I Reduction Plan
PWS always below 65 RGPCD: 2 days/week calendar & 1 day/week streamflow trigger		Mitigation Fund
the use of increasing block or seasonal rate structure to increase conservation (RGPCD)		
Monthly or quarterly billing (RGPCD & UAW)		
Enterprise account	RED	
Stretch Code for Water efficiency (low flow devices, Industrial/Commercial Audits etc)	BLUE	

WATER SUPPLY METRICS

Existing water supply areas– Aquifer maps and Zone II's

Future potential water supply areas– untapped aquifers

How to implement streamflow criteria on existing water supplies?

- in high quality Biological Category areas?
- in degraded Flow Level areas 4 and 5?
- in low quality Biological Category areas with high impervious cover?

SURFACE WATER SUPPLIES

Many are Registered only/not WMA Permitted

Many have been in place >100 years

Many are serving water needs near their Firm Yield

Some could serve as regional water supplies where current demand is less than Registrations

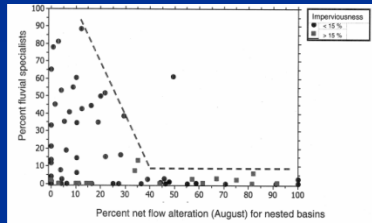
Downstream releases are desired– but limited feasibility

Incorporate Streamflow Criteria into an Allocation scheme using Predictable Permitting Decisions

ALLOCATION



Statewide Fish & Flow Study Results



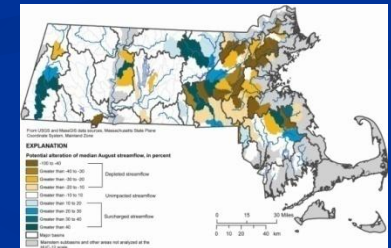
Seasonal Streamflow Criteria *Set thresholds and limits*



Compare to



MA Water Indicator Results



Apply to



Allocation/Classification Scheme
Guidelines for Protection/ Mitigation

Implement through

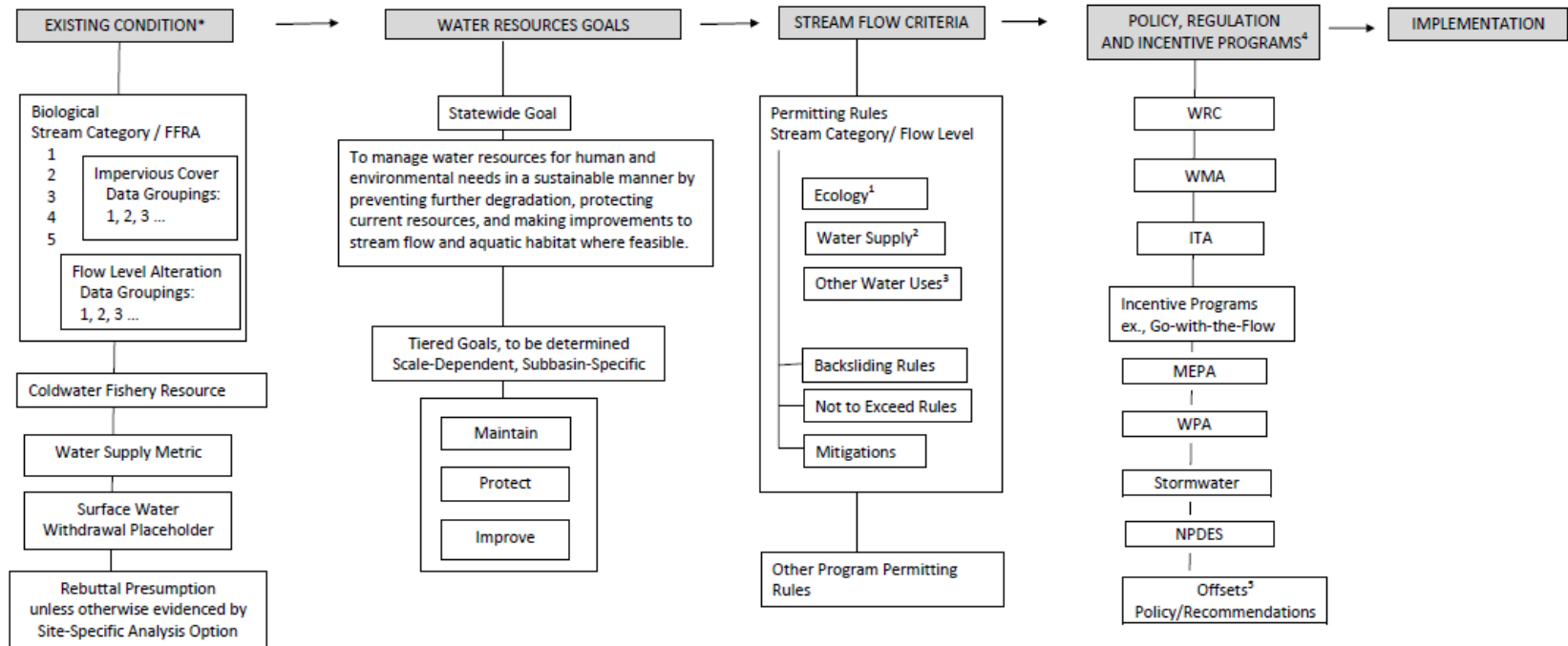


WMA Permits + Other Programs?



Current Issues

- Habitat Protection and Water Supply
- Mitigation in Flow Level 4/5 areas
- Mitigation Measurement
- Implementation of Streamflow Criteria
 - DEP Regulation Change
 - Water Resources Commission?
 - Seasonal criteria other than August?



Notes:

*EXISTING CONDITION refers to a present characterization of the fish community based on Fluvial Fish Relative Abundance (FFRA) as impacted by groundwater withdrawals and discharges (exclusive of surface water withdrawals). The conceptual framework offered here employs an adaptive management approach to integrate new data as it becomes available along with monitoring and re-evaluation as we move forward. Stream Flow Criteria allows for balancing multiple uses at the same location based on applicable use determination and priorities.

- 1 Ecology (ecological health – as defined by FFRA is an underlying statewide default position for reasonable protection of fish and wildlife as informed by Biological Alteration Stream Category.
 - Stream Categories 1 & 2 may be considered a geographic-specific small basin Ecology priority use.
 - Coldwater Fisheries may be considered a geographic-specific stream segment Ecology priority use.
- 2 Water Supply Use, particularly, public water supply drinking water use, is determined by basin characteristics (ex. aquifers) and human uses, i.e. existing & future water supply (Water Supply Metric).
- 3 Other Water Uses (economic development, wastewater assimilation capacity, navigation, hydropower, water-based recreation, other interests, etc.) are determined by statutory requirements and community needs.
- 4 Policy, Regulations and Incentive Programs refer to related statutes, regulations and overall constructs whose programs may be affected by the new stream flow data and criteria.
- 5 Offsets include the whole range of Best Management Practices and Low Impact Development measures.

This summary is offered for discussion purposes only and does not necessarily represent current statute, regulation, or policy positions of the Commonwealth of Massachusetts unless specifically acknowledged. This summary is not to be cited as a reference. Its purpose is to foster open and broad discussion of the issues of sustainable water management as well as help assure public awareness of the discussions as of the date of the presentation.