

Presentation Title: Surface Water Withdrawal - Existing Condition

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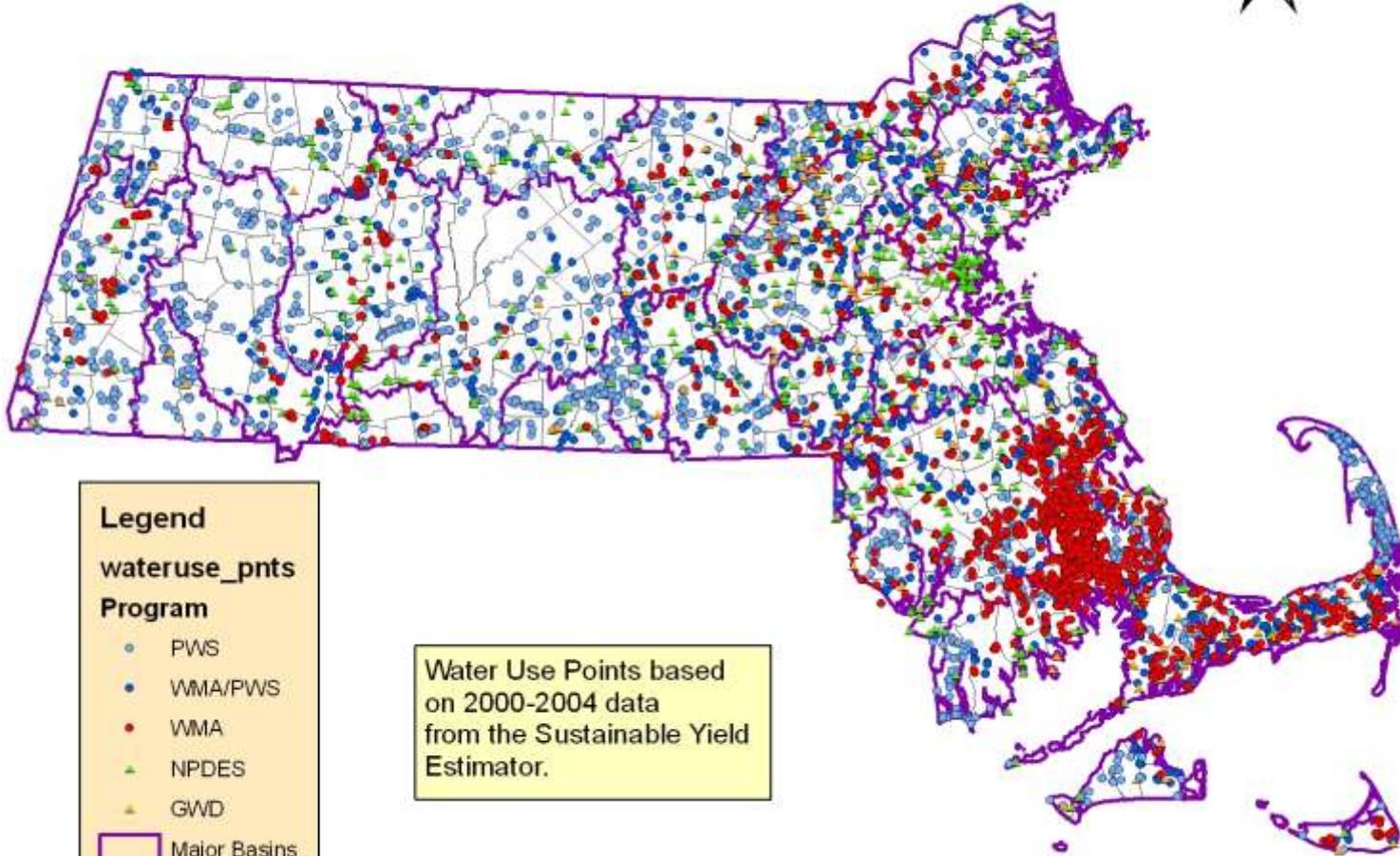
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Surface Water Withdrawal Existing Condition for Sustainable Water Management Initiative (SWMI)

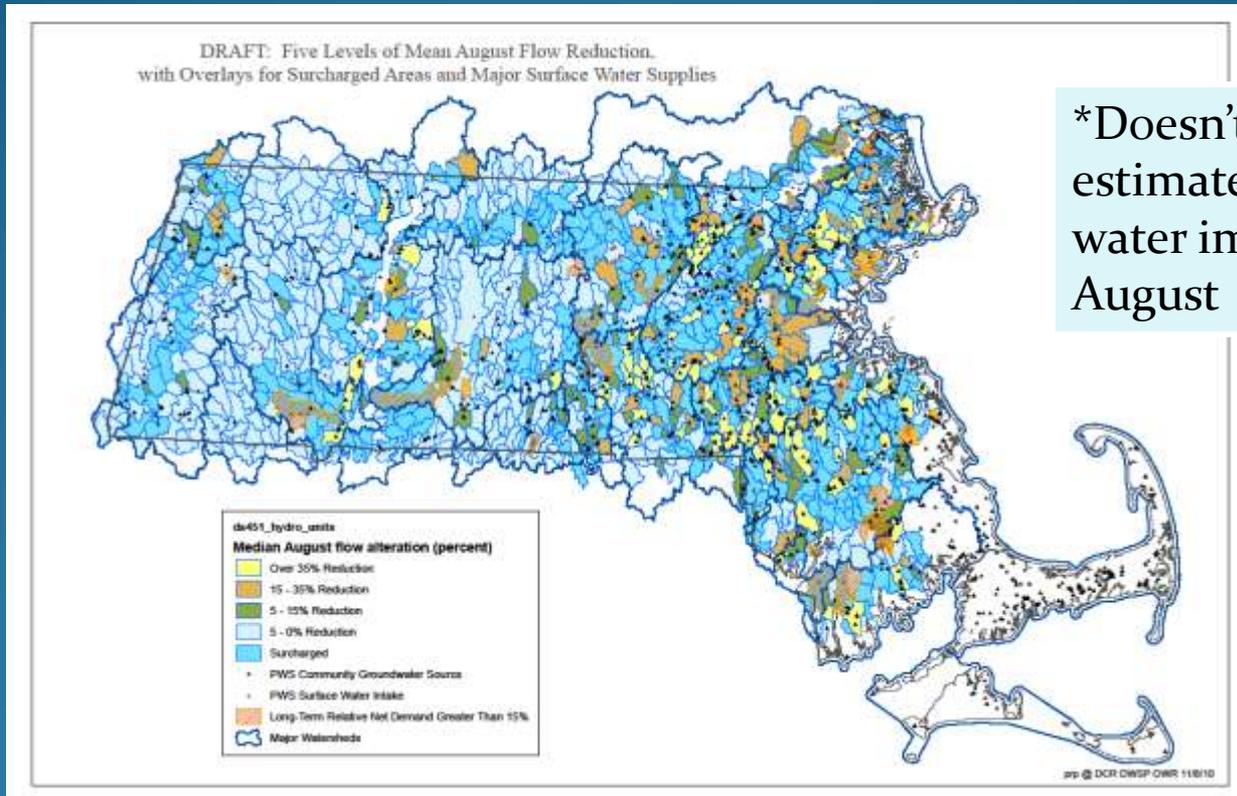
Linda M. Hutchins
DCR Office of Water Resources
SWMI Technical Committee
May 10, 2011

Water Use Points



February 23, 2011

Estimated August Flow Levels



*Doesn't include estimate of surface water impacts in August

- Assume no spilling below reservoirs in August as a rebuttable presumption (USGS, personal communication)

Surface Water Metric:

- Goal: to establish existing conditions for August flow alteration that includes influence of surface water reservoirs and impoundments and is as technically accurate as possible, while recognizing limitations

Limits of understanding:

- Lacking site-specific hydraulic and operational characteristics of supply reservoirs
- Actual dam operations unknown, including releases, spills, seepage, transfers
- Habitat impact of spill/no spill periods over lifespan of dams not documented in Fish and Habitat Report
- Don't know area/stream length(s) impacted

Summary of methods evaluated:

3 methods were evaluated: 2 Annual, 1 August

- **Annual Metrics**

- 1) Long Term Annual Demand (presented at Feb Tech Mtg.)
- 2) Long Term Annual Relative Net Demand (from MWI)

- **August Metric**

- 3) August reservoir inflow reduction

Summary of Annual metrics:

- **Method 1:** Long Term Annual Demand (shown at Feb Tech Mtg.)
 - *SW WD/UA Flow*
 - SW WD = Annual reported surface water withdrawals (2000-2004)
 - UA Flow = estimated mean annual unaffected flow (1961 to 2004)

- **Method 2:** Long Term Annual Relative Net Demand (from MWI)
 - *A Flow/UA Flow*
 - A Flow = Mean annual affected flow (minus 2000-2004 GW & SW withdrawals, plus returns)
 - UA Flow = estimated mean annual unaffected flow (1961 to 2004)

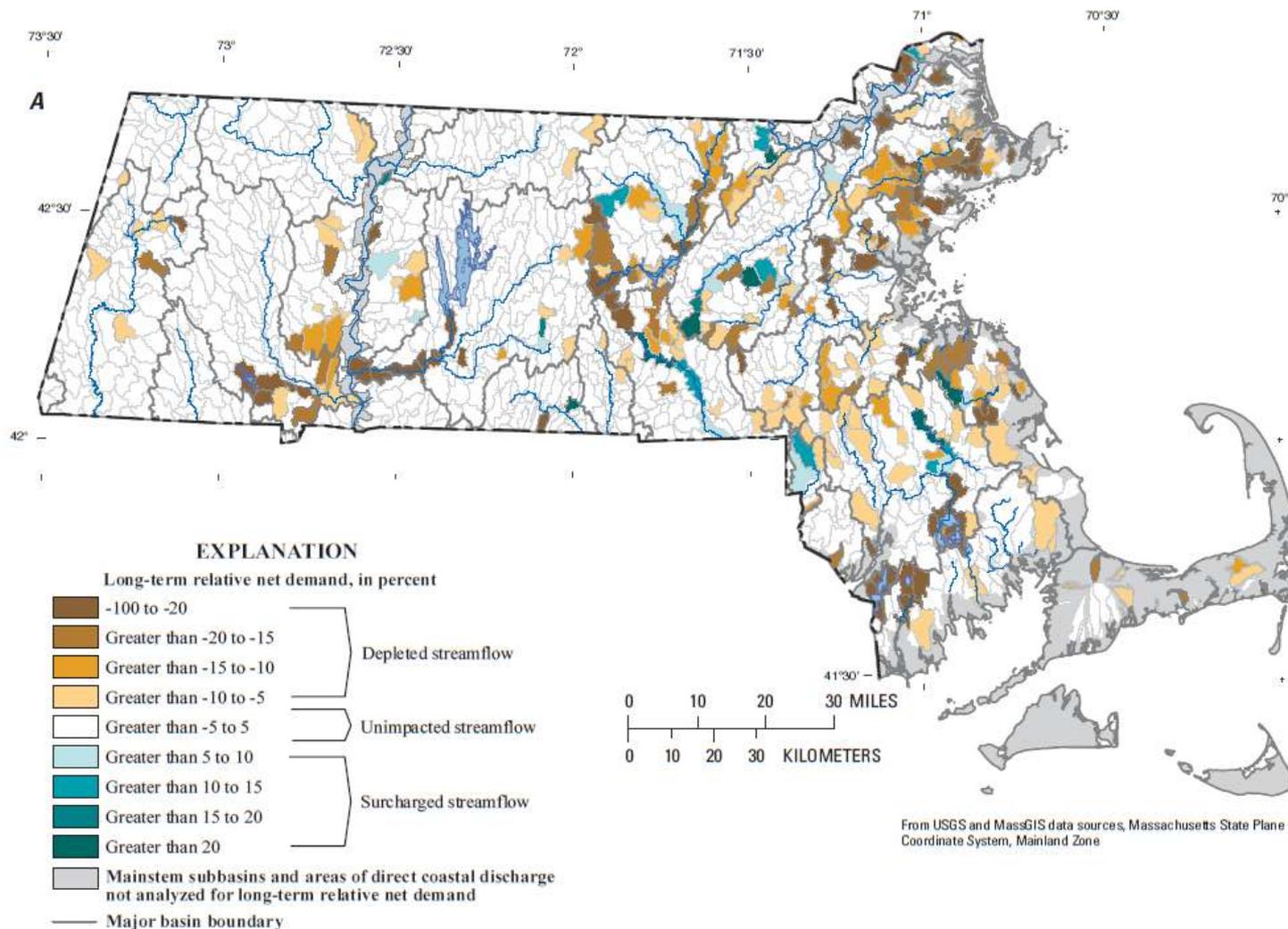


Figure 14. (A) Long-term relative net demand, water-use scenario 2 (with surface-water reservoir withdrawals). (B) Long-term relative net demand, water-use scenario 2, at the 12-digit Hydrologic Unit (HUC-12) scale (with surface-water reservoir withdrawals).

Pros and Cons of Annual metrics:

Pros:

- Already calculated and published in MWI
- MWI includes narrative link between annual and August flow alteration
 - *“A given value of long-term RND... can be expected to be associated with a substantially higher percentage of alteration for ... August flow.”*

Cons:

- August flow levels 1-5 established based on biology, no clear corresponding levels for annual metrics

Summary of August metric:

Method 3: August reservoir inflow reduction

- For any public water supply surface water reservoir, calculate what flows in during August and subtract from current estimated August flow alteration for that subbasin. Subtract that August inflow from downstream subbasins.

Method 3 example: SYE run at PWS reservoir dams to estimate Aug. inflow

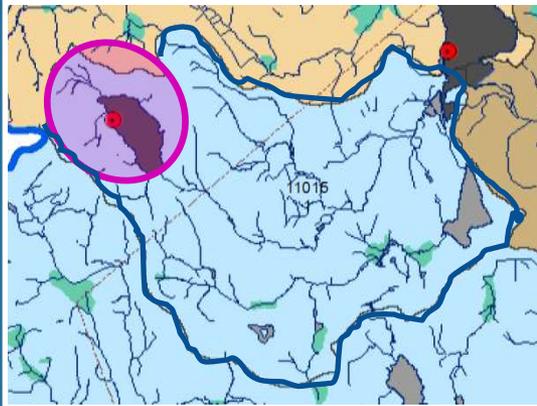


Muschopauge Pond

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*

Method 3 Subbasin Examples:

BEFORE
(GW withdrawal only)

AFTER
(Method 3 applied)

Groundwater only August flow level	Estimated August % alteration		Adjusted August % alteration including surface water	Adjusted August flow level
-1	-2%	→	-7%	-2
-1	-2%	→	-81%	-5
-1	-3%	→	-45%	-4
-2	-6%	→	-56%	-4
-2	-8%	→	-34%	-3

Pros and Cons of August metrics:

Pros:

- Provides an estimate for August flow alteration that includes surface water impacts
- Shows a more complete picture of existing conditions in August
- August has the strongest link to understanding impacts on biology

Cons:

- Not included in MWI, would require additional calculations of August reservoir inflows for method 3
- Upstream of reservoir impact may appear overstated b/c entire subbasin is categorized based on pour point (same is true for groundwater-only flow levels).

Preferred Method:

Method 3 is most promising and given limitations of understanding, provides the best estimate of August flow alteration, at a statewide screening level

Discussion...

Example: Upper Nashua Basin

August Flow Levels
Without SW Withdrawals

August Flow Levels
WITH SW Withdrawals

From SYE run at reservoir dam

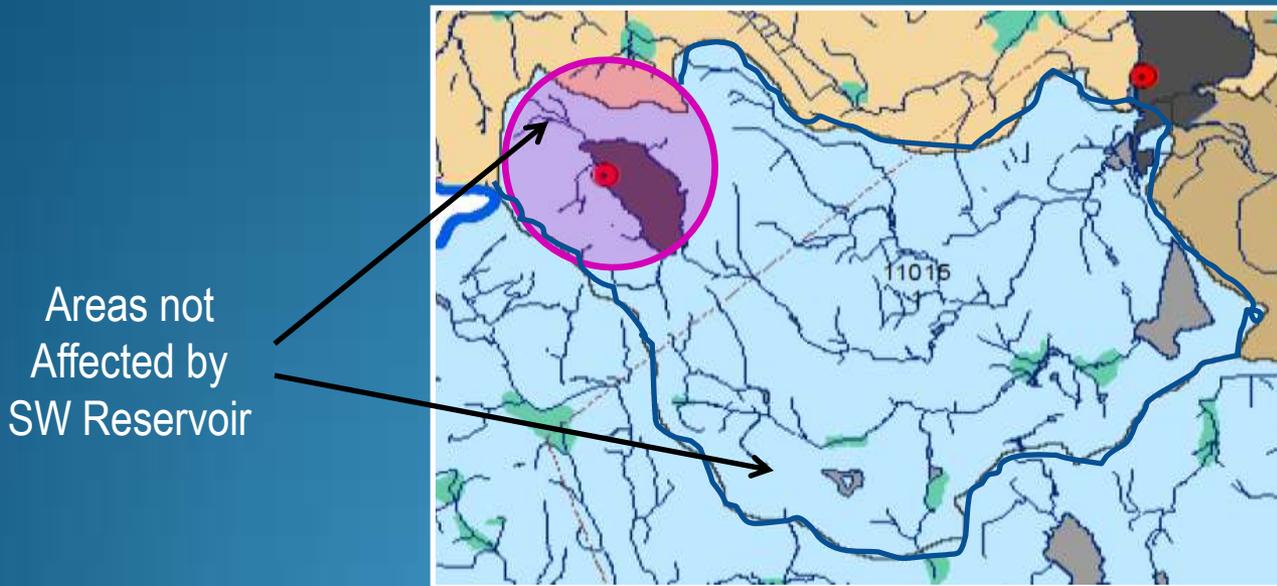
Nashua	Reservoirs Affecting	MWI	MWI	MWI	GW ONLY Flow Level	Total	Adjusted	Adjusted	Adjusted
		Aug	Aug	Aug		Reservoir	Aug	Aug	
		Unaffected	Affected	Alteration		Inflow	Affected	Aug	Aug
		flow (cfs)	flow (cfs)	%		(cfs)	Flow (cfs)	Alteration	Flow
		(U)	U-GW WD (A)	GW ONLY		(Res In)	AA = A	%	Level
Subbasin		MWI	MWI	MWI		SYE	- Res In	= (AA-U)/U	
11015	Muschopauge	1.15	1.13	-2%	-1	0.06	1.07	-7%	-2
11016	Quinapoxet	4.33	4.24	-2%	-1	3.42	0.82	-81%	-5
11056	Kendall & Pine Hill	4.13	3.99	-3%	-1	1.70	2.29	-45%	-4
11055	Muschopauge Quinapoxet	6.93	6.53	-6%	-2	3.48	3.05	-56%	-4
11012	Muschopauge, Quinapoxet, Kendall, Pine Hill	11.87	10.91	-8%	-2	5.18	5.73	-52%	-4
11013		15.63	14.63	-6%	-2	5.18	9.45	-40%	-4
11003		19.57	18.42	-6%	-2	5.18	13.24	-32%	-3
11009		20.23	18.58	-8%	-2	5.18	13.40	-34%	-3
11064	Rocky Pond	3.88	3.16	-19%	-3	0.02	3.14	-19%	-3
11005		8.55	7.72	-10%	-2	0.02	7.70	-10%	-2
11008		11.14	10.20	-8%	-2	0.02	10.18	-9%	-2

Subbasins with PWS reservoirs in yellow

Subbasins downstream of PWS reservoirs.

$$\text{GW-WD affected flow+ SW returns} - \text{Aug inflow to reservoir(s)} = \text{Adjusted Aug Affected Flow}$$

All of subbasin 11015 would be classified with -6% August flow alteration
= August Flow Level 2



Without August inflow reduction (GW Withdrawals Only) was -1.5% Aug flow alt
= August Flow Level 1

This is a scale issue and also occurs with ground water withdrawals in subbasins!