MANAGING THE COMPETING DEMANDS ON WATER RESOURCES:

BALANCING WATER SUPPLY AND STREAM FLOW

KEN BURKE (WRB) AND ALISA RICHARDSON (RIDEM)

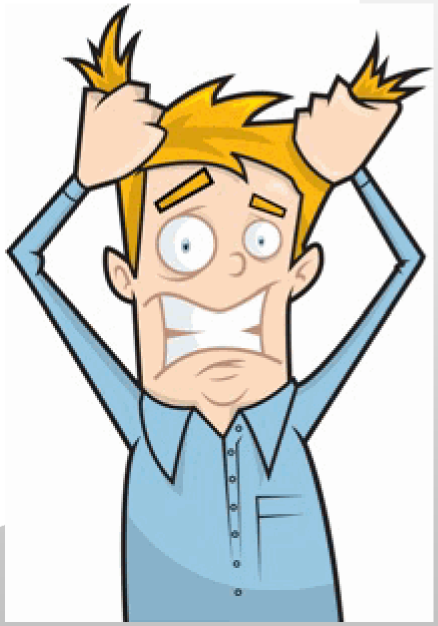
LEGISLATIVE REQUIREMENTS
(ENVIRONMENTAL PARTS)

- **46-15.7-1** MANAGE AMOUNTS, PURPOSES, TIMING, LOCATIONS, RATES – WHILE PROTECTING THE ENVIRONMENT
- ALLOCATE WATER RESOURCES
- **46-15.7-2** PRIORITY TO AGRICULTURE

2009 WATER USE AND EFFICIENCY ACT – COALITION FOR WATER SECURITY

- **46-15.8-2** PROMOTE EFFICIENCY
- PROTECT ECOLOGICAL FUNCTIONING OF THE WATER RESOURCES OF THE STATE
- USE WATER AVAILABILITY ESTIMATES – DEVELOPED BY WRB AND RIDEM INTO LOCAL PLANS
- **46-15.7-3** IDENTIFY SOURCES WHERE EXISTING USES HAVE REACHED OR THREATEN SAFE YIELD

WATER AVAILABILITY ???



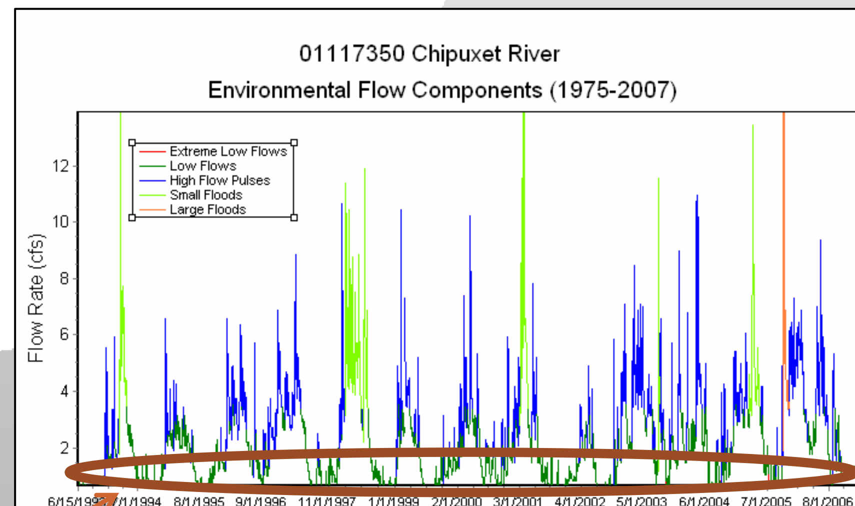
AVAILABILITY ESTIMATES

RESERVOIRS – EASY! – PROVEN ENGINEERING

Photo by Jim McElroy 2011

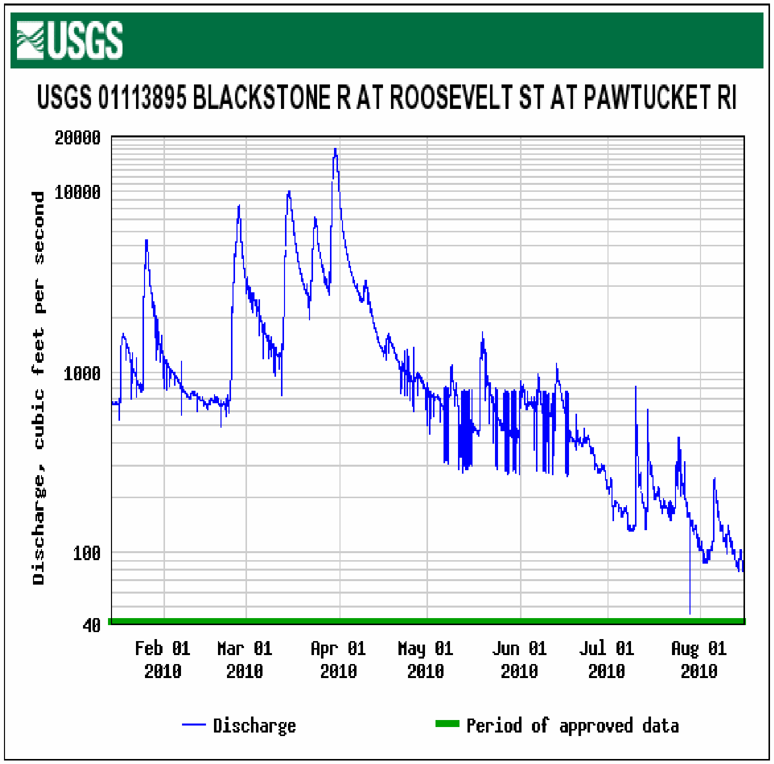
RIVERS – HARD!

AT THE TIME OF LEGISLATION THERE WERE NO PROVEN SCIENTIFIC METHODS FOR NON-DAM CONTROLLED RIVERS

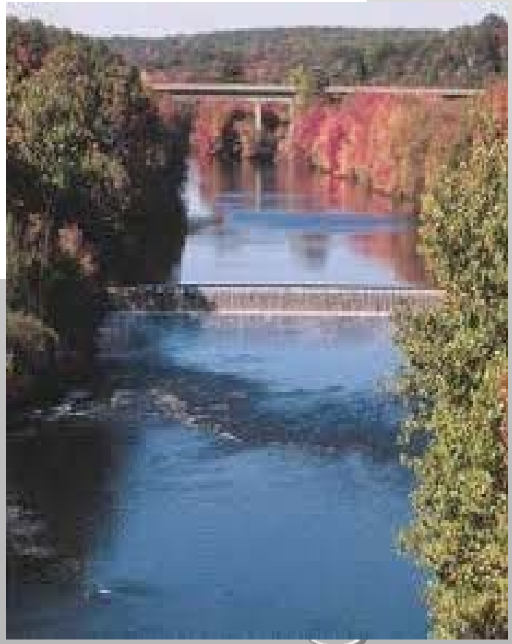


How much is too much?

Focused here


USGS
USGS 01113895 BLACKSTONE R AT ROOSEVELT ST AT PAWTUCKET RI
Discharge, cubic feet per second
20000
10000
1000
100
40
Feb 01 2010
Mar 01 2010
Apr 01 2010
May 01 2010
Jun 01 2010
Jul 01 2010
Aug 01 2010
Discharge
Period of approved data


RIDOT, FLICKR SITE
MARCH 2010



RESEARCH IN OTHER STATES

COLORADO RIVER
IN MEXICO

EARTH A NEW WILD | WATER
PBS

100% OF FLOW

FENTON RIVER
NEAR UCONN

BY ROBERT M. THORSON
HARTFORD COURANT

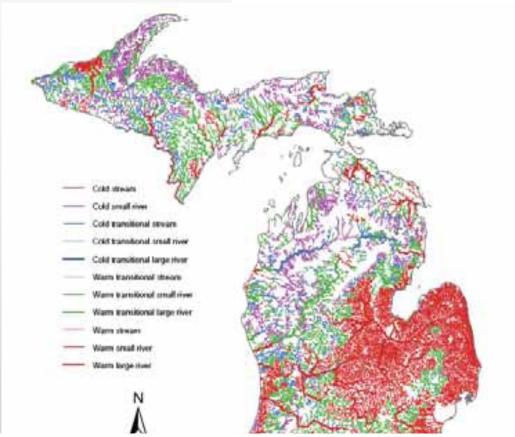
230% OF 7Q10 ALLOCATED

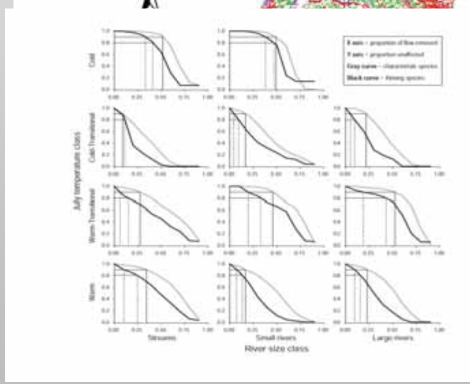
IPSWICH RIVER,
128 CORRIDOR MA

IPSWICH RIVER WATERSHED ASSOCIATION

174% OF 7Q10 ALLOCATED

WE LOOKED AT OTHER STATE PROGRAMS AND STUDIES





Michigan DEC, 2009

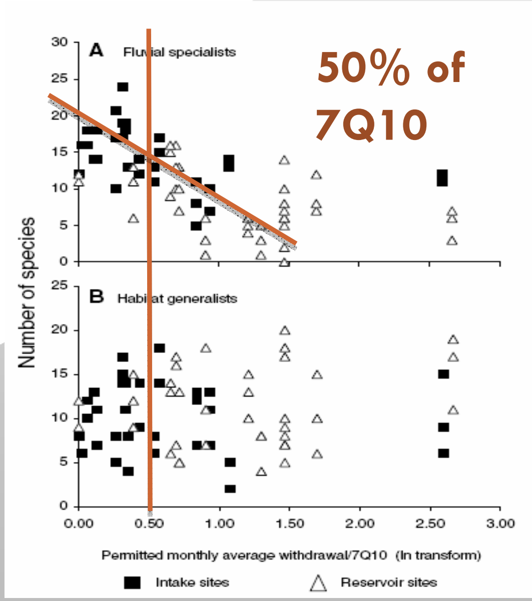
Table 1 - Protected instream flow criteria for fish in the Lamprey Designated River

Bioperiod Approximate dates	Rearing & Growth July 5 - Oct. 6	Salmon Spawning Oct. 7 - Dec. 8	Overwintering Dec 9 - Feb. 28	Spring Flood March 1 - May 4
Indicator	Common shiner	Atlantic Salmon	Flow	Flow
Watershed area (mi²)	183	183	183	183
Common flow (cfs)	110	90	237.9	622
Common flow (cfsm)	0.60	0.49	1.30	3.40
Allowable duration under (days)	46	17	20	14
Catastrophic duration (days)	81	55	57	42
Critical flow (cfs)	22	40	109.8	238
Critical flow (cfsm)	0.12	0.22	0.60	1.30
Allowable duration under (days)	15	11	10	10
Catastrophic duration (days)	32	33	37	19
Rare flow (cfs)	16	20	73.2	146
Rare flow (cfsm)	0.09	0.11	0.40	0.80
Allowable duration under (days)	6	6	7	3
Catastrophic duration (days)	28	11	30	9
Bioperiod Approximate dates	**Clupeid Spawning** May 5 - June 19		**GRAF Spawning** May 5 - July 14	
Indicator	Min	Max	Min	Max
Watershed area (mi²)	183	183	183	183
Common flow (cfs)	143		101	
Common flow (cfsm)	0.78		0.55	
Allowable duration under (days)	13		11	
Catastrophic duration (days)	28		15	
Critical flow (cfs)	62	156	22	156
Critical flow (cfsm)	0.34	0.85	0.12	0.85
Allowable duration under (days)	5		5	
Catastrophic duration (days)	13		10	
Rare flow (cfs)	57	242	16	242
Rare flow (cfsm)	0.31	1.32	0.09	1.32
Allowable duration under (days)	4		2	
Catastrophic duration (days)	10		3	

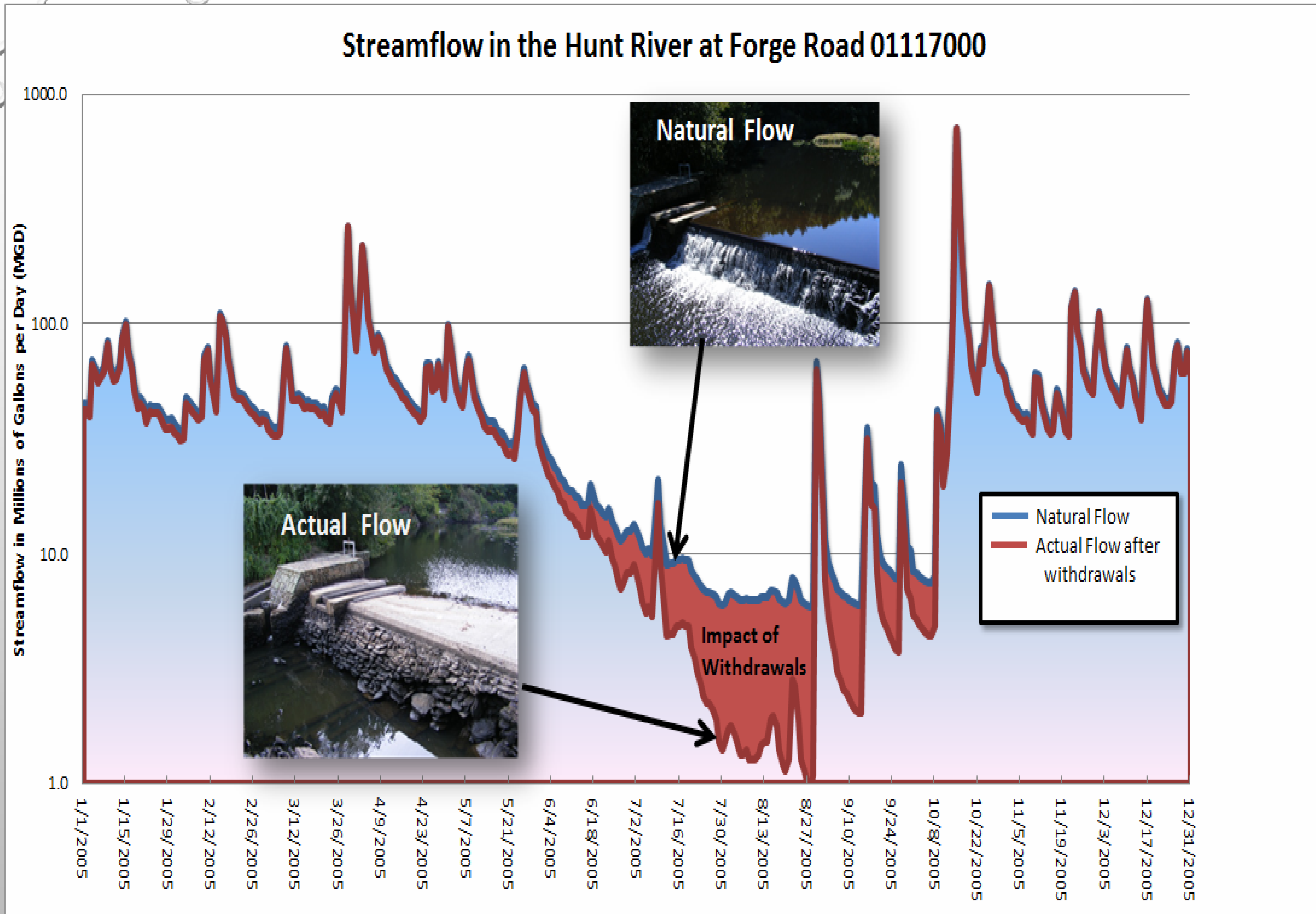
GRAF Spawning | Common shiner R&G

Lamprey River Proposed Protected Instream Flow Report 2009

PIEDMONT STREAMS IN GEORGIA



Freeman, M. C. and P. A. Marcinek. 2006 USGS

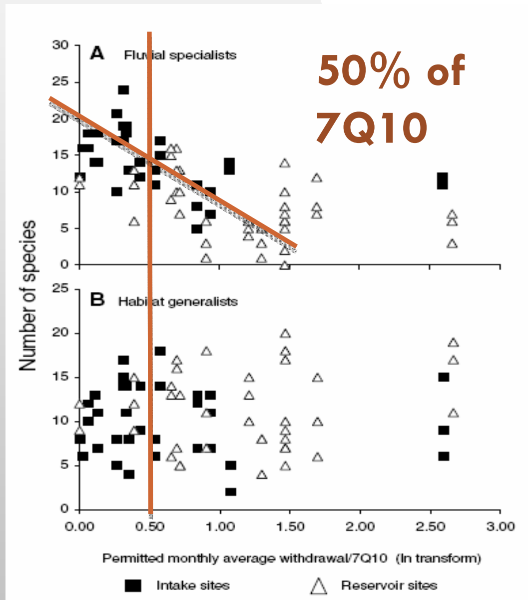


Streamflow in the Hunt River at Forge Road 01117000
Streamflow in Millions of Gallons per Day (MGD)
1000.0
100.0
10.0
1.0
1/1/2005
1/15/2005
1/29/2005
2/12/2005
2/26/2005
3/12/2005
3/26/2005
4/9/2005
4/23/2005
5/7/2005
5/21/2005
6/4/2005
6/18/2005
7/2/2005
7/16/2005
7/30/2005
8/13/2005
8/27/2005
9/10/2005
9/24/2005
10/8/2005
10/22/2005
11/5/2005
11/19/2005
12/3/2005
12/17/2005
12/31/2005
Natural Flow
Actual Flow
Impact of Withdrawals
Natural Flow
Actual Flow after withdrawals

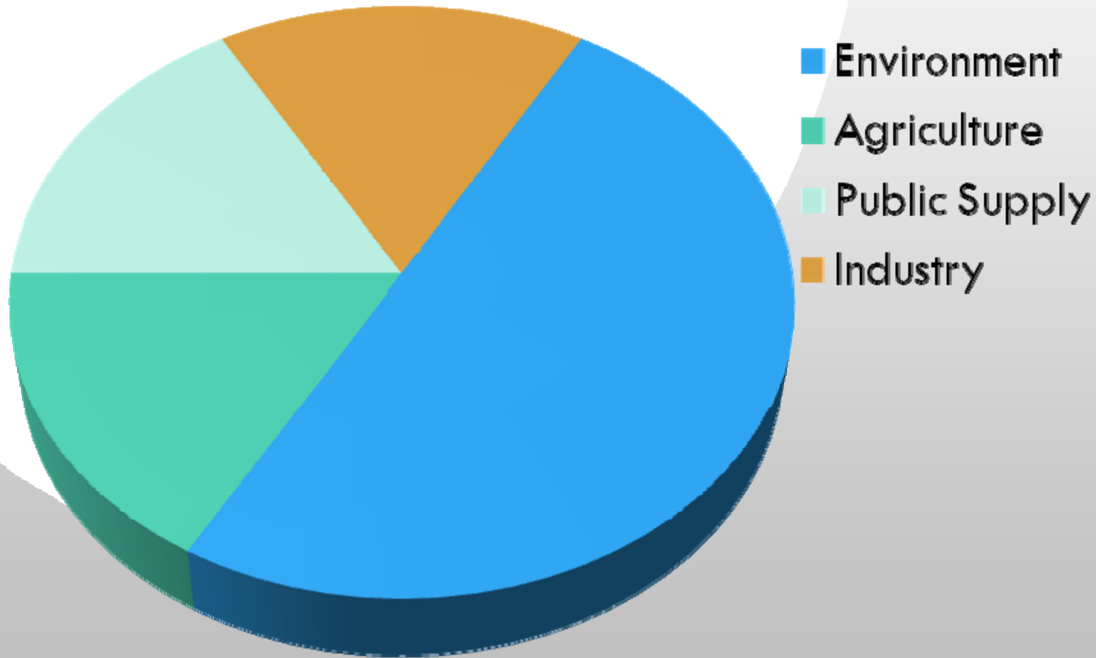
WHY DEPLETION AS A MANAGEMENT TOOL FOR GROUNDWATER?

- STREAMFLOW RESPONSE TO GROUNDWATER PUMPING IS LONGER-TERM (ONE OR MORE MONTHS)
- DEPLETION ENCOURAGES RECHARGE
- DEPLETION ENCOURAGES RETURN FLOW (NET DEPLETION)
- DEPLETION MANAGEMENT ALLOWS FOR SUSTAINABLE YIELD CALCULATIONS ON BASEFLOW
- DEPLETION MANAGEMENT ALLOWS THE MANAGER TO ADD UP ALL THE PARTS

50% DEPLETION OF THE 7Q10 DURING LOW FLOW



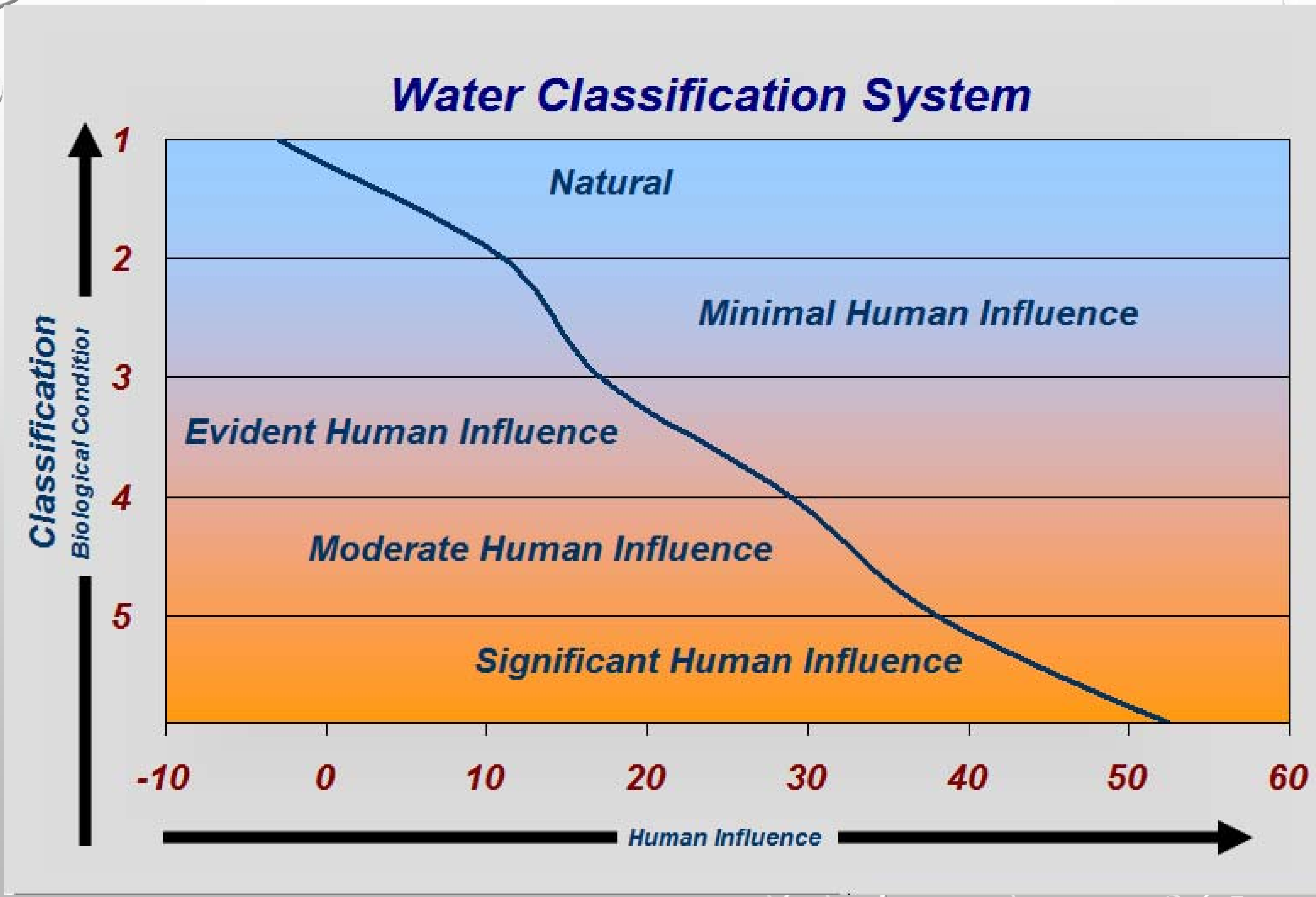
Freeman, M. C. and P. A. Marcinek. 2006 USGS



ALLOWABLE DEPLETIONS FOR EACH CLASS DURING LOW HYDROPERIOD

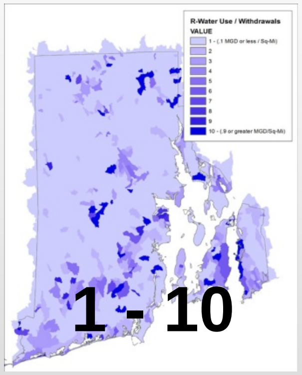
Class	% of 7Q10 Withdrawn	
1	10	Natural Streams
2	20	Minimal Human Influence
3	30	Evident Human Influence
4	40	Moderate Human Influence
5	50	Significant Human Influences

Assign a Classification Based on Total Metric Score



HUMAN INFLUENCE POINTS

Diversions



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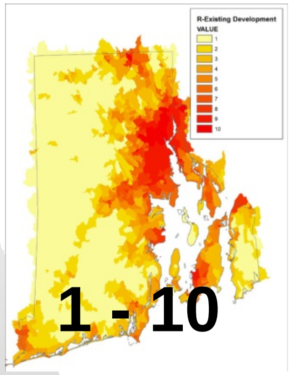
Existing Impervious



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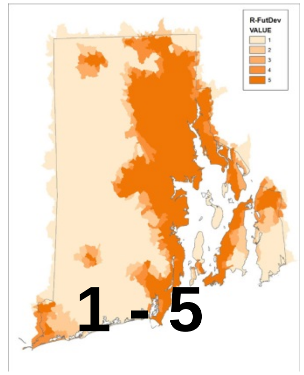
Future Development



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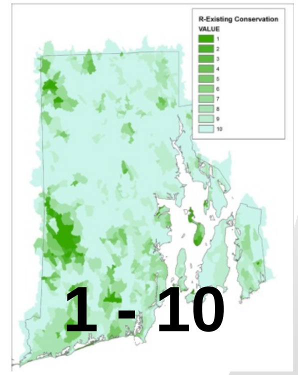
Existing Conservation



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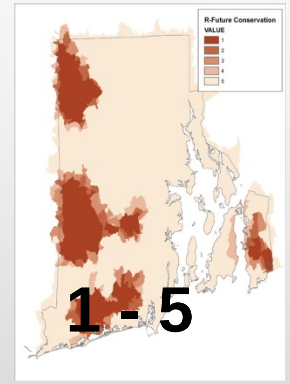
Future Conservation



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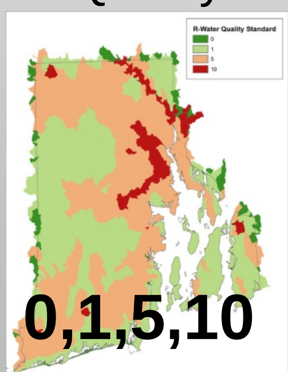
Water Quality



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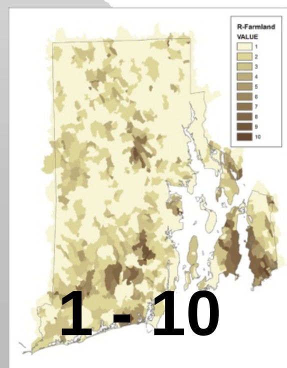
Farmland



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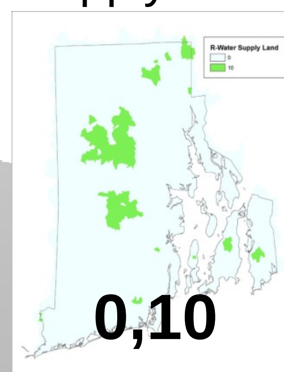
Water Supply Land



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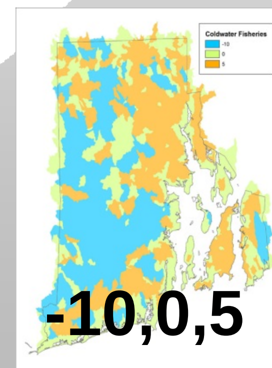
Coldwater Fisheries

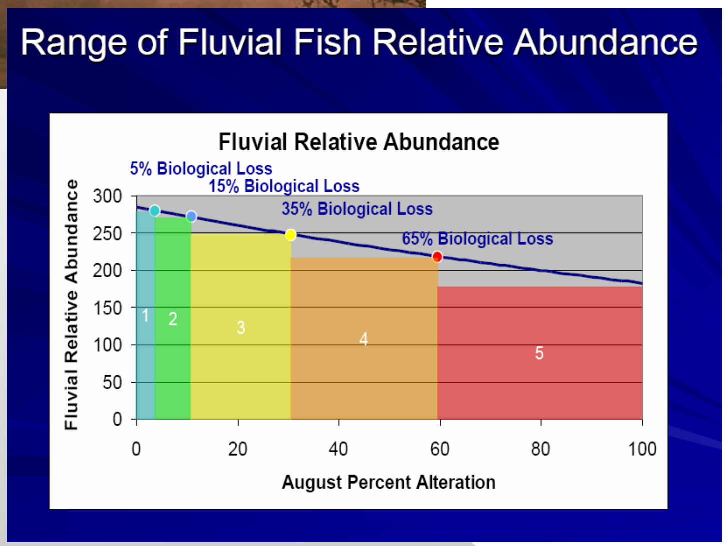


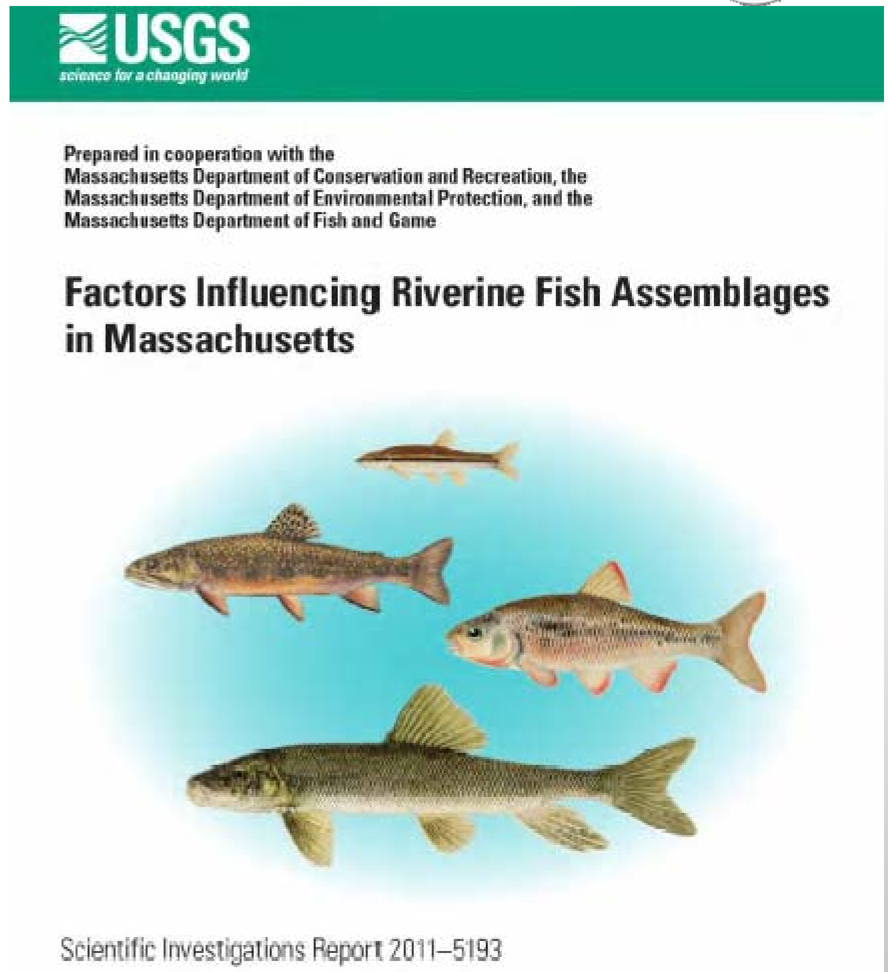
= Total Metric Score

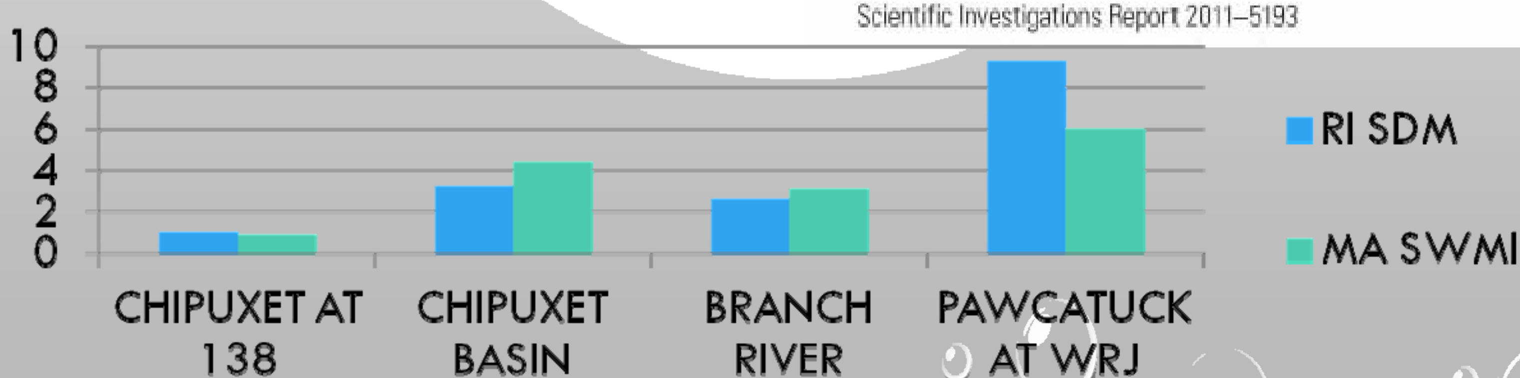
FOR MORE INFO...

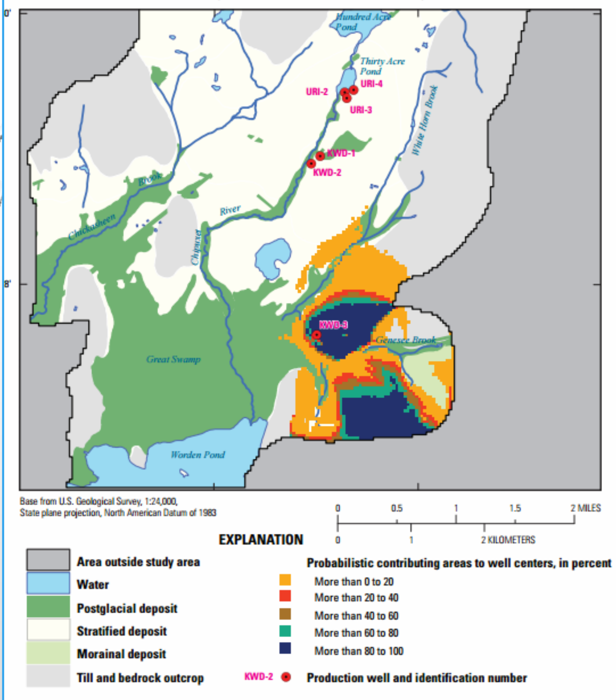
GOOGLE THE RI STREAM DEPLETION METHOD


Massachusetts
SUSTAINABLE WATER
MANAGEMENT
INITIATIVE
Framework Summary
November 28, 2012


Range of Fluvial Fish Relative Abundance
Fluvial Relative Abundance
5% Biological Loss
15% Biological Loss
35% Biological Loss
65% Biological Loss
Fluvial Relative Abundance
300
250
200
150
100
50
0
1
2
3
4
5
0
20
40
60
80
100
August Percent Alteration


USGS
science for a changing world
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
Factors Influencing Riverine Fish Assemblages in Massachusetts
Scientific Investigations Report 2011–5193


10
8
6
4
2
0
CHIPUXET AT 138
CHIPUXET BASIN
BRANCH RIVER
PAWCATUCK AT WRJ
RI SDM
MA SWMI



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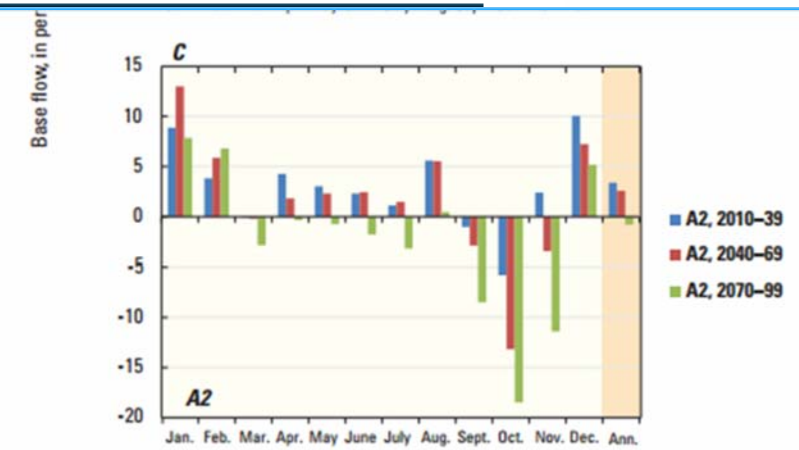


Figure 22. *A*, Simulated base flow to the Chipuxet River for the late 20th century (1970–99) and the late 21st century (2070–99) for two greenhouse gas emission scenarios (B1, lower emissions and A2, higher emissions) and changes in base flow for three periods in the 21st century (2010–39; 2040–69, and 2070–99) relative to the late 20th century (1970–99) for emission scenarios *B*, B1 and *C*, A2 in the Chipuxet River and Chickasheen Brook Basins, Rhode Island. Projected values represent the averages of five general circulation models.

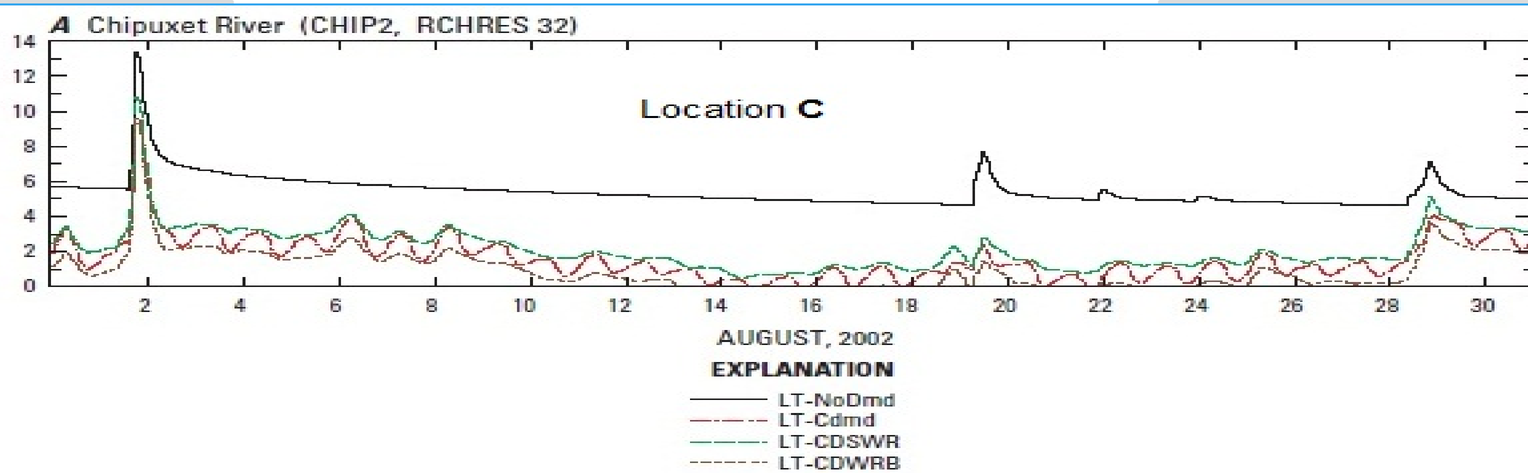


Figure 2–5. August 2002 simulated hourly streamflow under no withdrawals (LT–NoDmd), current (2000–04) withdrawals (LT–CDmd), current withdrawals with selected irrigation withdrawals converted from surface-water to groundwater sources (LT–CDSWR), and current withdrawals with potential new withdrawals (LT–CDWRB) at *(A)* Chipuxet River (CHIP2, RCHRES 32); *(B)* Chipuxet River (CHIP3, RCHRES 33); *(C)* Pawcatuck River (PAWC1, RCHRES 34); and *(D)* Chickasheen Brook (CHIC2, RCHRES 36), Pawcatuck River Basin, southwestern Rhode Island. (Site locations shown in figure 2–1 and described in table A2–4.)

CHIPUXET RIVER – FROM YAGOO TO URI

Alisa Richardson, Chipuxet River
August 2014

IMPROVING EFFICIENCIES AND MOVING TO WELLS
(NRCS AND DIV OF AGRICULTURE)

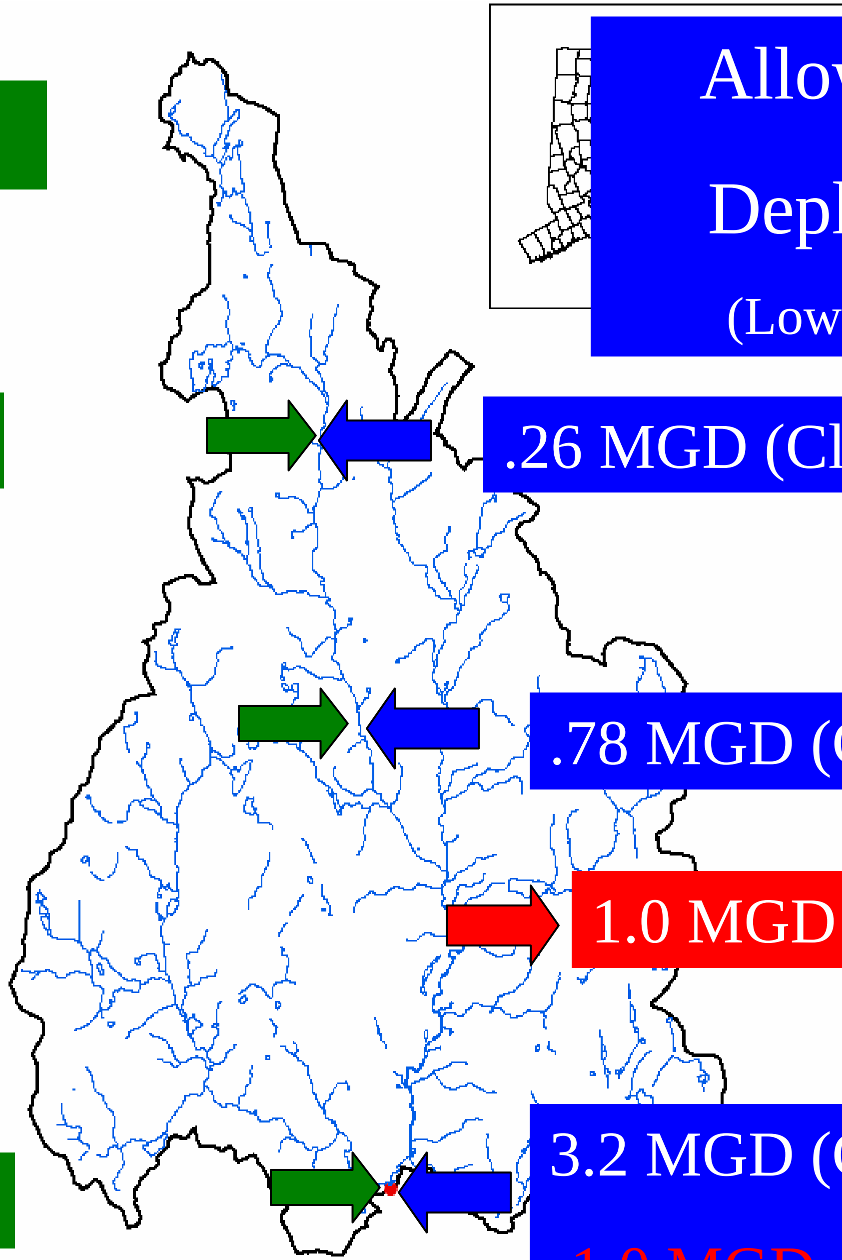
THE STREAM DEPLETION METHOD IS PRESUMPTIVE
(FOR PERMIT SCREENING)

WETLAND PERMITTING – CASE-BY-CASE

- < THAN SDM APPLY FOR PRELIMINARY DETERMINATION
    - EVALUATE IMPACTS TO WETLANDS

- > THAN THE SDM APPLY FOR A SIGNIFICANT ALTERATION
    - EVALUATE ECOLOGICAL IMPACTS TO THE WETLANDS
    - EVALUATE ECOLOGICAL IMPACTS TO THE RIVER

Flow



Allowable

Depletion

(Low Flow)

7Q10 = 4 cfs

.26 MGD (Class 1)

7Q10 = 6 cfs

.78 MGD (Class 2)

1.0 MGD (Class 2)

7Q10 = 10 cfs

3.2 MGD (Class 3)

-1.0 MGD

2.2 MGD ALLOWABLE DEPLETION

THE STREAM DEPLETION METHOD FOR PLANNING

COMPARE ALLOWABLE DEPLETION TO ACTUAL PUMPING

COMPARE SAFE YIELD OF RESERVOIRS TO ACTUAL USE

AREAS WHERE GROUNDWATER PUMPING MEETS OR EXCEEDS SDM

- 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