The Connecticut Hydrologic Stressor Index for Streamflow Goal Classification

Mary Becker and Chris Bellucci

Connecticut Department of Environmental Protection

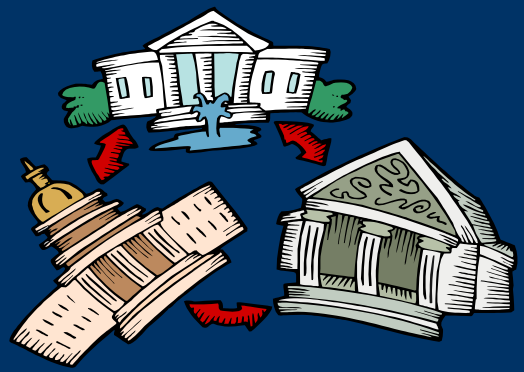
Public Act 05-142

An Act Concerning the Minimum Water Flow Regulations

effective October 1, 2005

- **Makes Changes to §26-141a –141c of general statues**
- **Expands Regulatory Authority to <u>All</u> Streams Not Just "Stocked" Streams**
- **DEP Commissioner to form advisory group**

Overview CT Streamflow Regulations



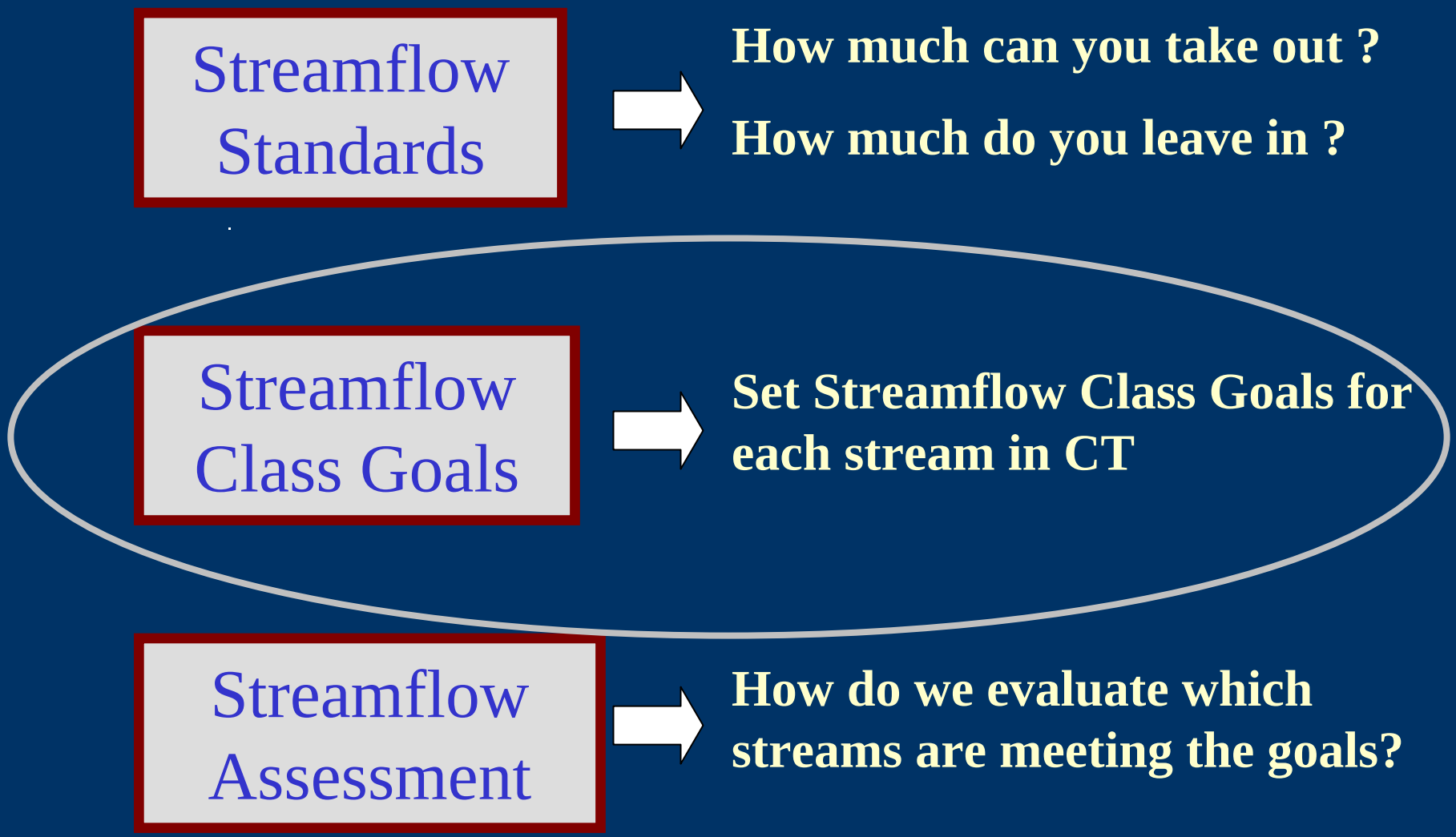
Commissioner's Advisory Group

Began Meeting in December 2005

Scientific – Technical Workgroup

Policy – Implementation Workgroup

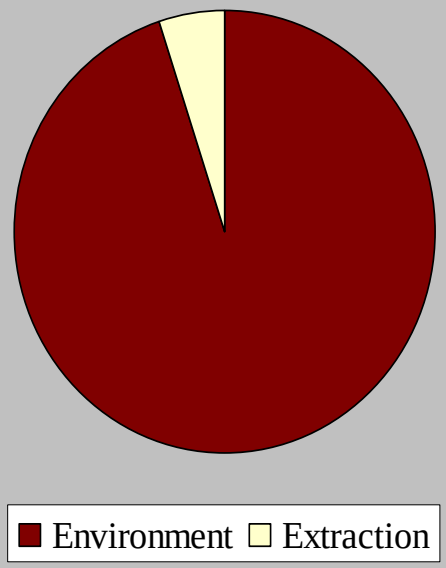
Overview CT Streamflow Regs

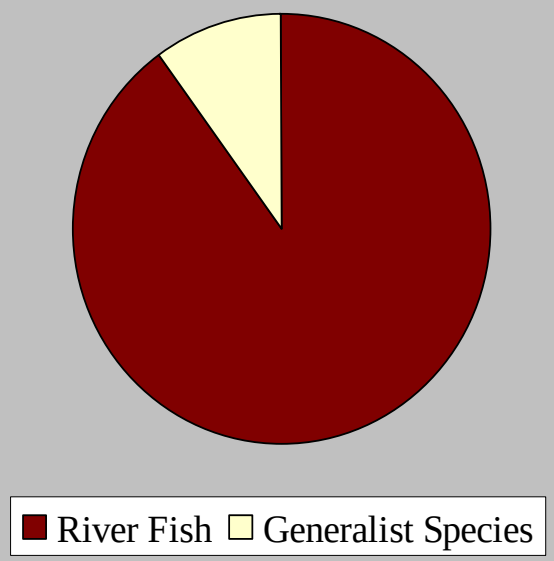


Streamflow Class Goals

Class 1 –

- **Minimal / no impact**
- **Rivers for River Fish**
- **Allow for limited extraction**
- **“Natural”**

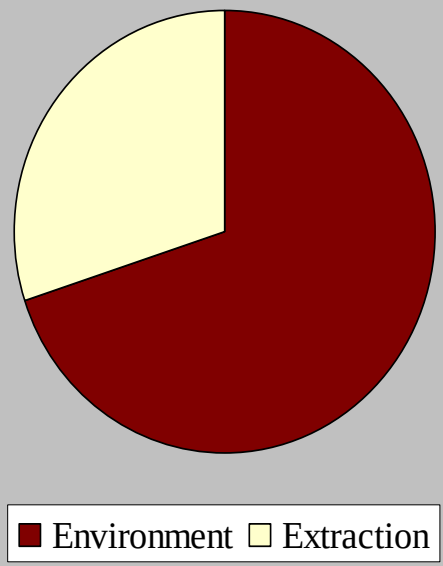


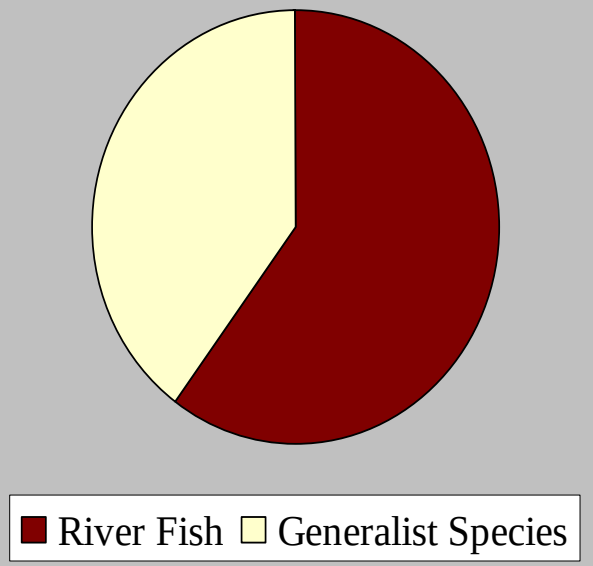


Streamflow Class Goals

Class 2 –

- Some impact / risk of impairment
- Rivers for some River Fish
- Allow greater extraction
- “Near Natural”

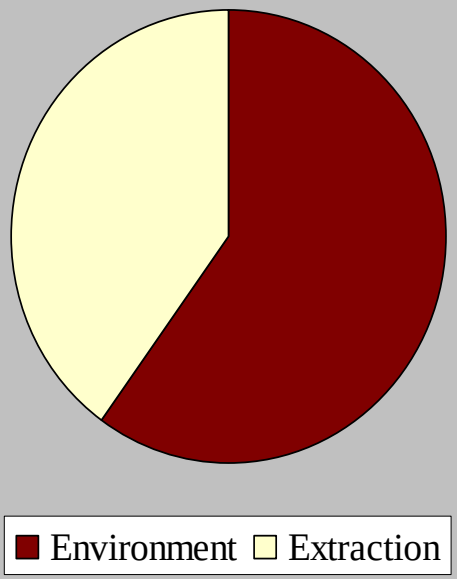


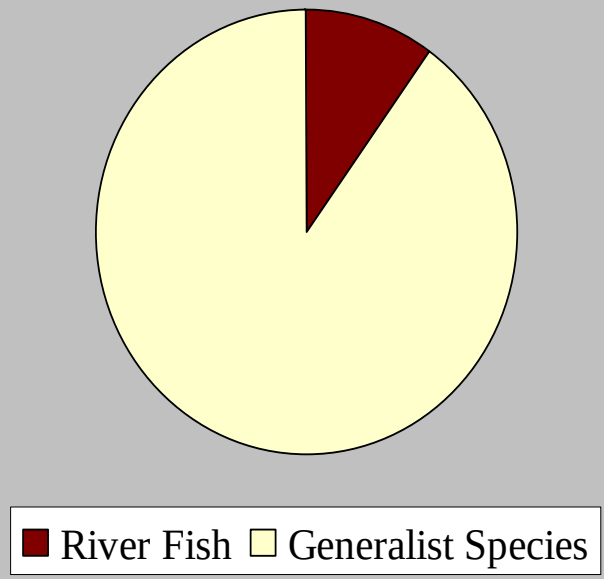


Streamflow Class Goals

Class 3 –

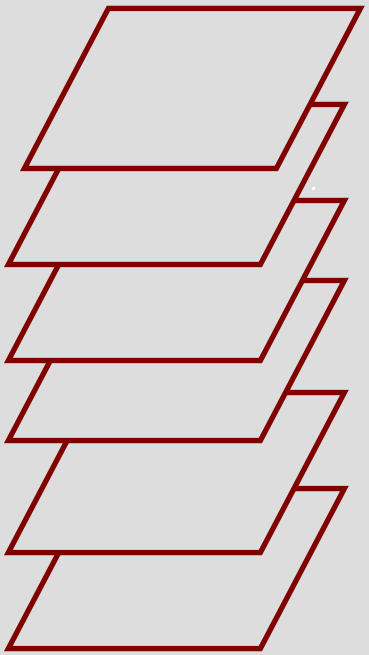
- **Some impact / higher risk impairment**
- **Rivers for some Fish**
- **Allow even greater extraction**
- **“Sustainable”**





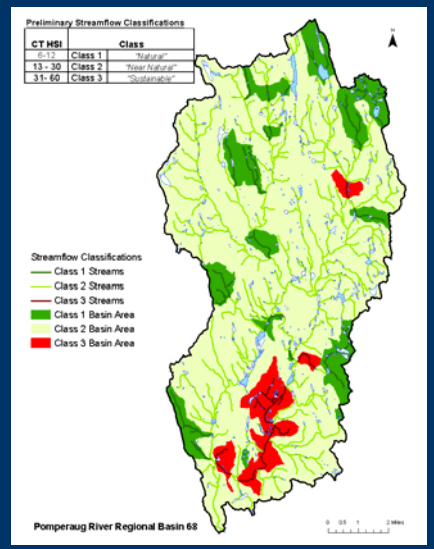
How Do We Assign Streamflow Class Goals to All Streams in CT ?

GIS Data Layers



- Diversions
- Dams
- Impervious Cover
- Return Flow
- Conservation
- Development

Preliminary Streamflow Class Goals

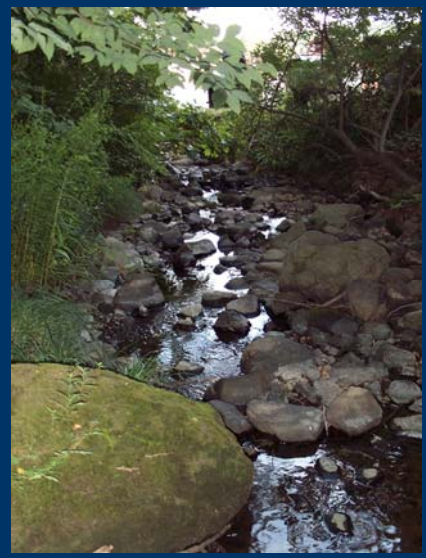


Public Participation

DEP Adopts Streamflow Class Goals

CT Hydrologic Stressor Index

Composite Index Score based on 6 Metrics



- Diversions
- Reservoirs
- Impervious Cover
- Return Flow
- State Plan of C&D (1 metric for C, 1 for D)

CT HSI

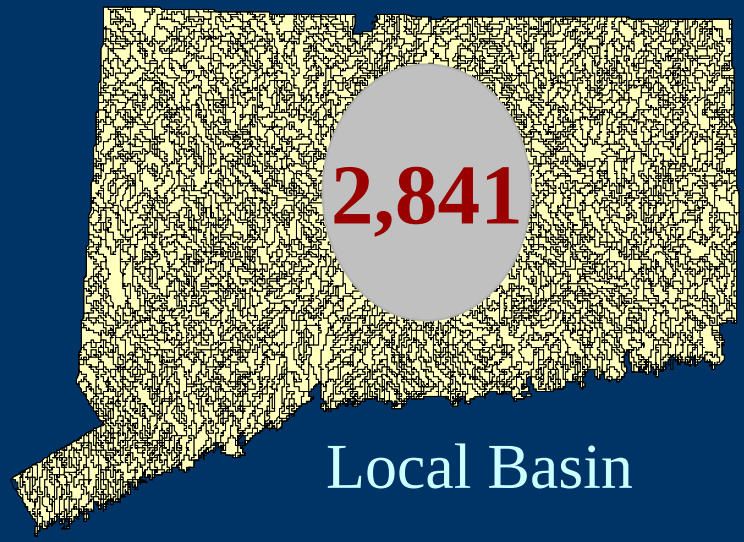
- Each basin is assigned a CT HSI Score based on adding the six individual metrics
- CT HSI Scores range from from 6-60

(Low Index Scores are least altered, High Index Scores are most altered)

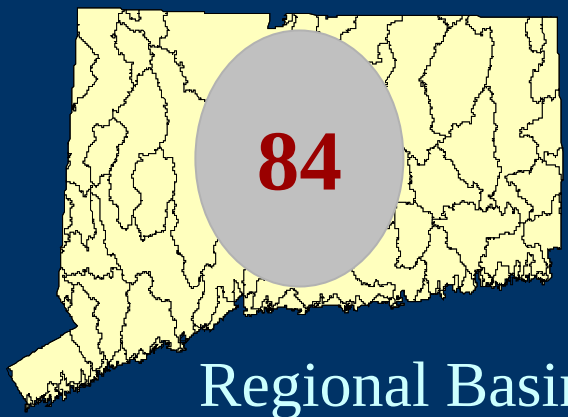
- CT HSI Score can be used to assign preliminary Stream Class Goals to all Perennial Streams in CT

Number of Polygons

Major Basin

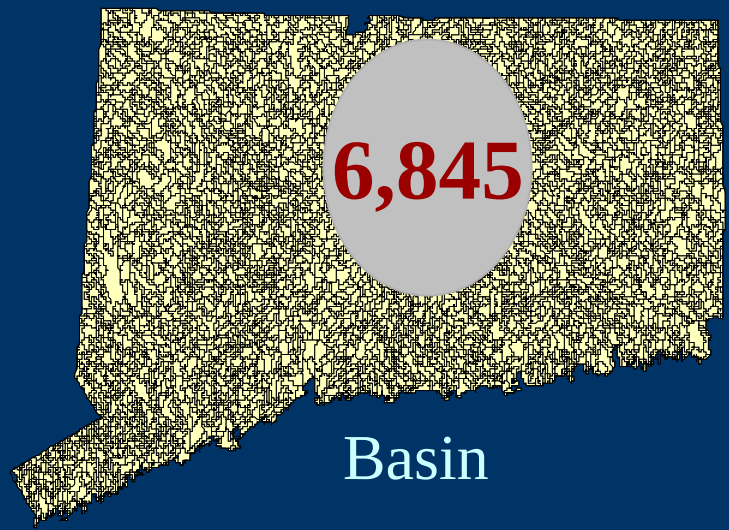


Local Basin



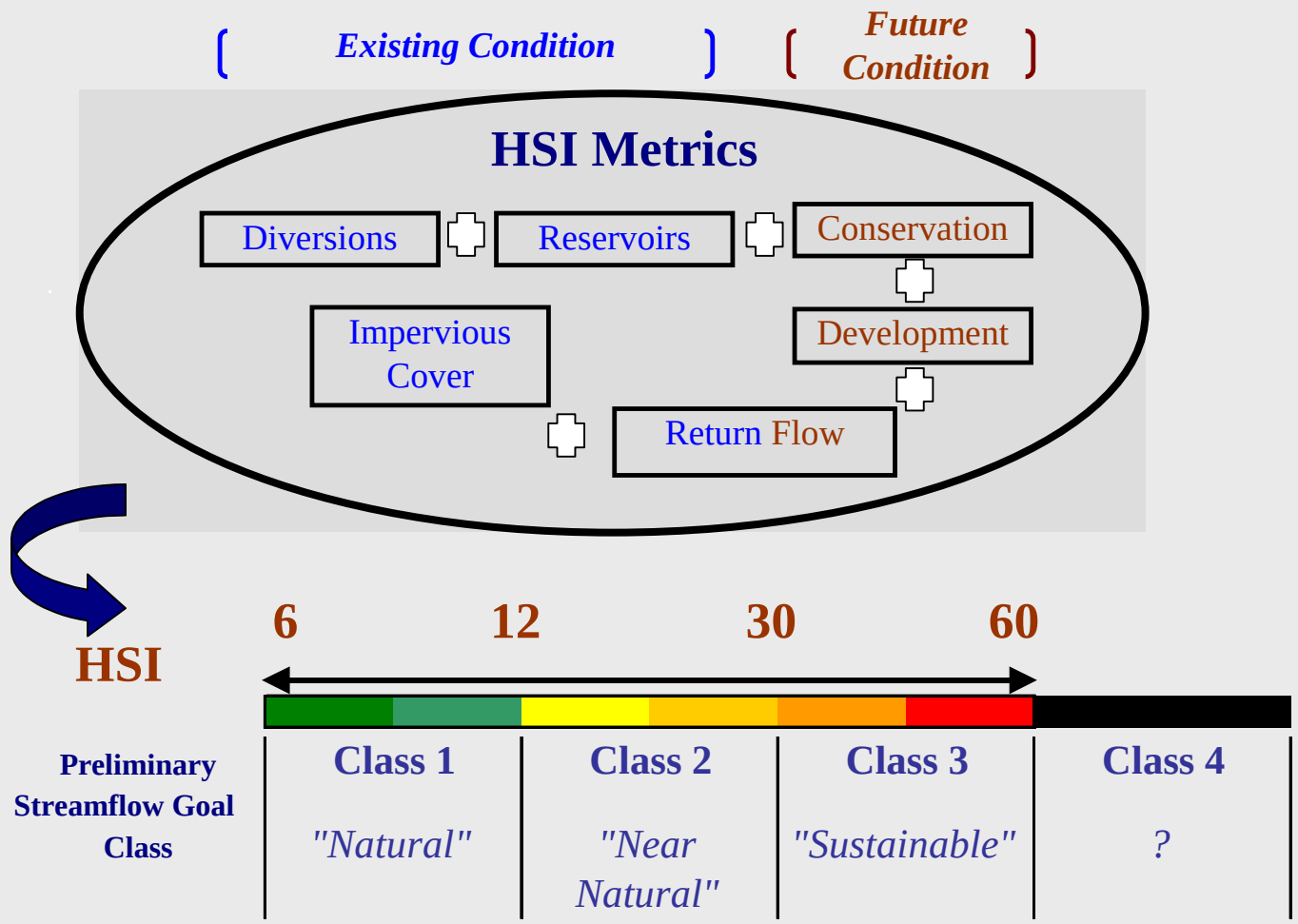
Regional Basin

Subregional Basin



Basin

Metrics → CT HSI →Preliminary Streamflow Class Goals



CT HSI Metrics

Diversion Metric

Relevance to CT HSI-

Surface and groundwater diversions alter the natural hydrology of streams directly by lowering water tables and reducing the magnitude and frequency of high and low flows. Research confirms changes in biology in response to streamflow extraction.

Diversions/ Square mile	Metric Value
0	1
0.01-1.00	3
1.01-2.00	5
> 2.00	10

Measure –

Number of Diversions per square mile

CT HSI Metrics

Reservoir Metric

Relevance to CT HSI-

Reservoirs alter the natural hydrologic regime by reducing the timing and frequency of high and low flows and alter downstream channel geomorphology.

Measure –

Distance downstream from closest Reservoir

Distance from Closest Reservoir (km)	Metric Value
0 – 5.0	10
5.1-10.0	7
10.1-15.0	4
15.1-20.0	3
>20.1	2
None	1

CT HSI Metrics

Impervious Cover Metric

Relevance to CT HSI-
Impervious cover alters the natural hydrologic regime by reducing infiltration and groundwater recharge and causes unnatural spikes to natural hydrograph.

Measure –

Percent Impervious Land Cover

Percent IC	Metric Value
0 – 5.0%	1
5.1-12.0%	5
12.1-20.0%	7
20.1-30.0%	9
30.1-100%	10

CT HSI Metrics

Return Flow Metric

<u>Relevance to CT HSI</u>-

Point source discharges alter the natural hydrologic regime by reducing flow variability which disrupts seasonal fish cues.

<u>Measure</u> –

Connecticut Surface Water Quality Classification Goal (*NPDES Permit Required consistent with CT WQS*)

Surface Water Classification Goal	Metric Value
Class A	1
All other water classes	10

CT HSI Metrics

Conservation Metric

Relevance to CT HSI-

Conservation areas promote attributes that support a more natural flow regime (low IC, low extraction etc.)

Measure –

Percentage of Land that is Classified as Conservation Areas from State Plan of C&D

Percent of Area	Metric Value
0%	10
0.01-25%	5
25.01-50%	4
50.01-75%	2
75.01-100%	1

CT HSI Metrics

Development Metric

Relevance to CT HSI-

Development areas promote attributes that support an altered flow regime (high IC, high extraction etc.)

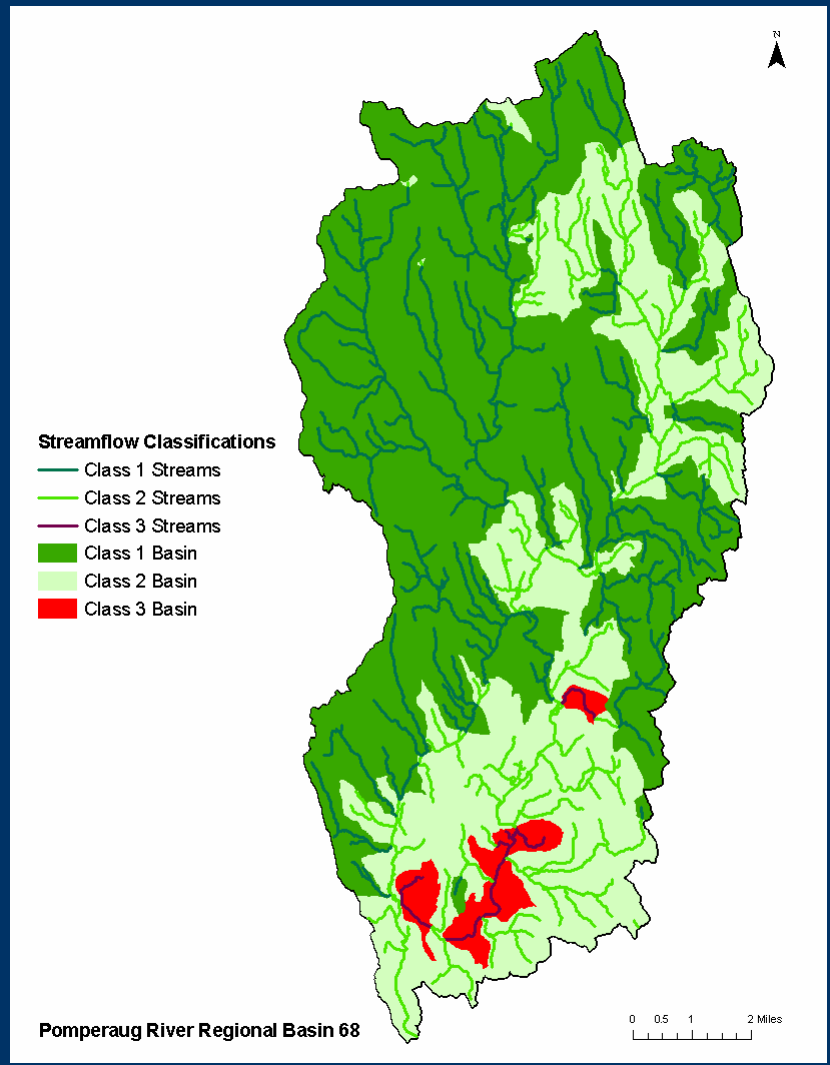
Measure –

Percentage of Land that is Targeted as Development Areas from State Plan of C&D

Percent of Area	Metric Value
0.0%	1
0.1-25.0%	5
25.1-50.0%	7
50.1-75.0%	9
75.1-100.0%	10

Part II

HSI in Action



Metrics → CT HSI →Preliminary Streamflow Class Goals

CT HSI Metric
Diversions – Existing
Reservoirs - Existing
Impervious Cover - Existing
Return Flow- Existing/Future
Conservation – Future
Development – Future

CT HSI = Diversions + Reservoirs + IC + Return Flow + Conservation + Development

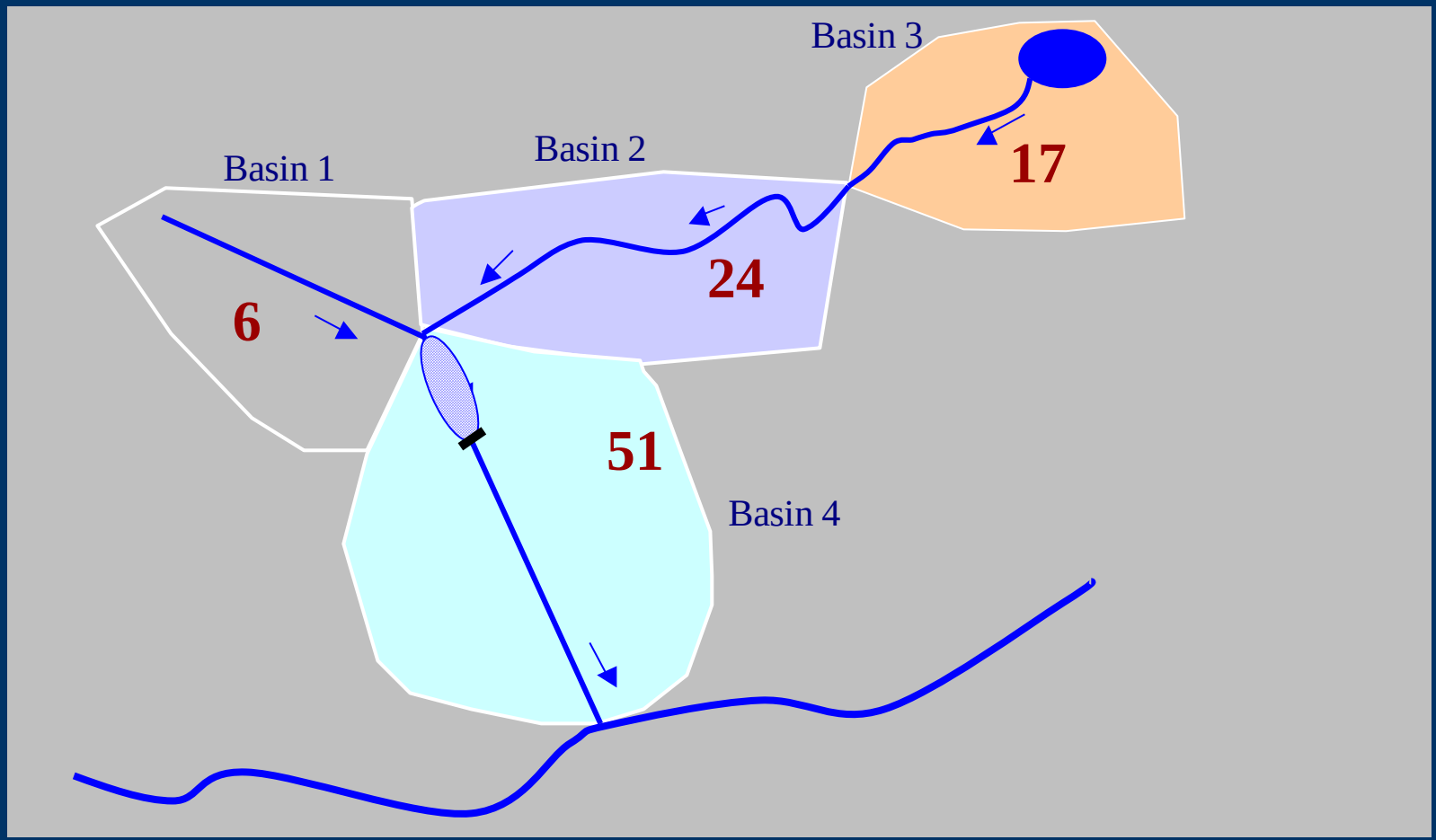
CT HSI	**Preliminary Streamflow Class Goal**
6-12	Class 1 *"Natural"*
13 - 30	Class 2 *"Near Natural"*
31- 60	Class 3 *"Sustainable"*

CT HSI -Example

Basin	HSI Metrics						HSI	Streamflow Goal Class
	Diversions	Reservoirs	IC	Return Flow	Conservation	Development		
1	1	1	1	1	1	1	**6**	**Class 1**
2	5	1	7	1	5	5	**24**	**Class 2**
3	3	1	1	1	10	1	**17**	**Class 2**
4	10	10	10	10	10	1	**51**	**Class 3**

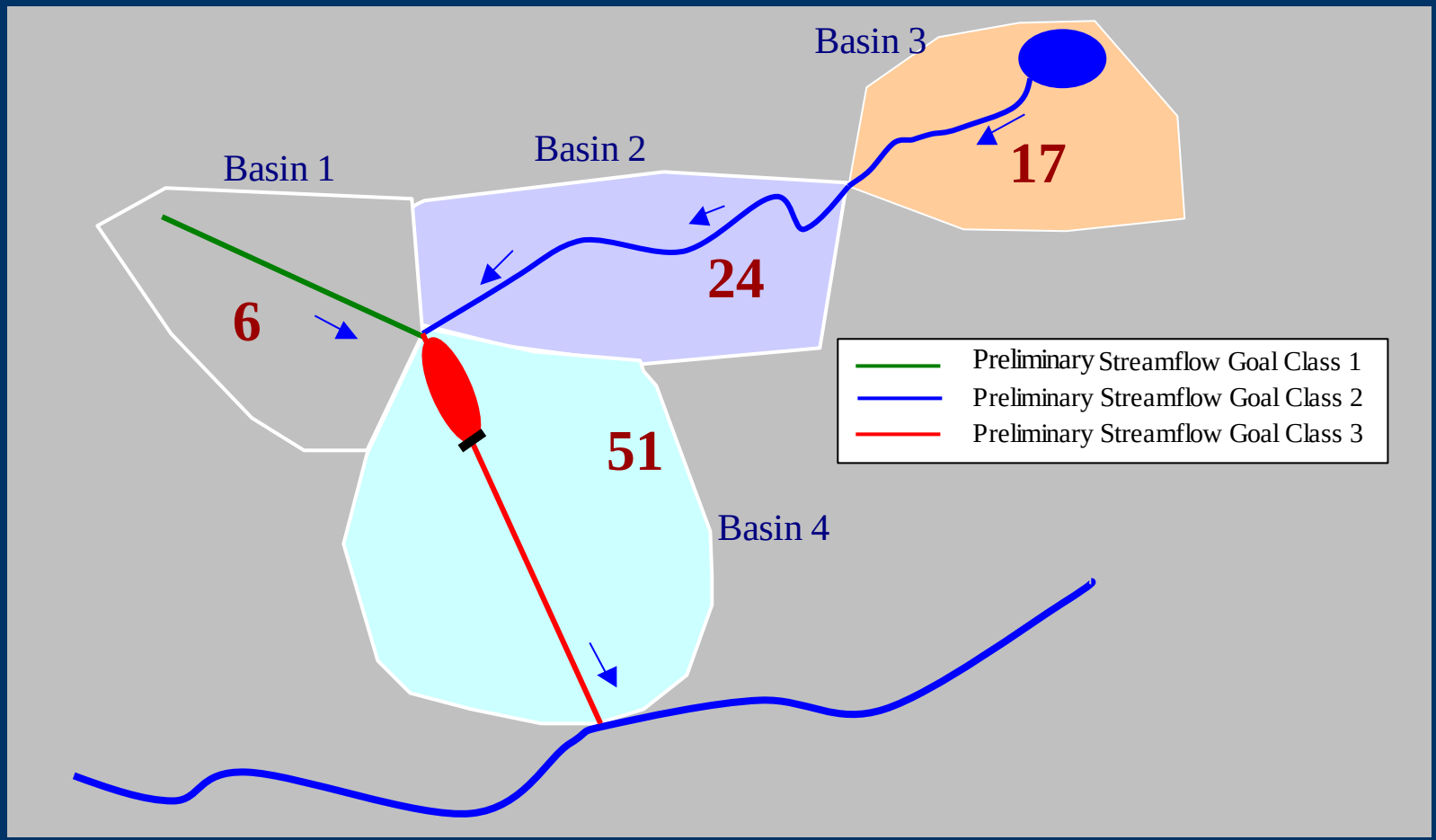
CT HSI Index -Example

CT HSI Index = Diversions + Reservoirs + IC + Return Flow + Conservation + Development

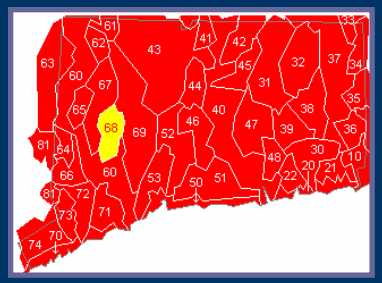


CT HSI Index -Example

CT HSI Index = Diversions + Reservoirs + IC + Return Flow + Conservation + Development



Pomperaug River Regional Basin (68)



<u>Basin Area</u> – 89 square miles

Major Basin - Housatonic

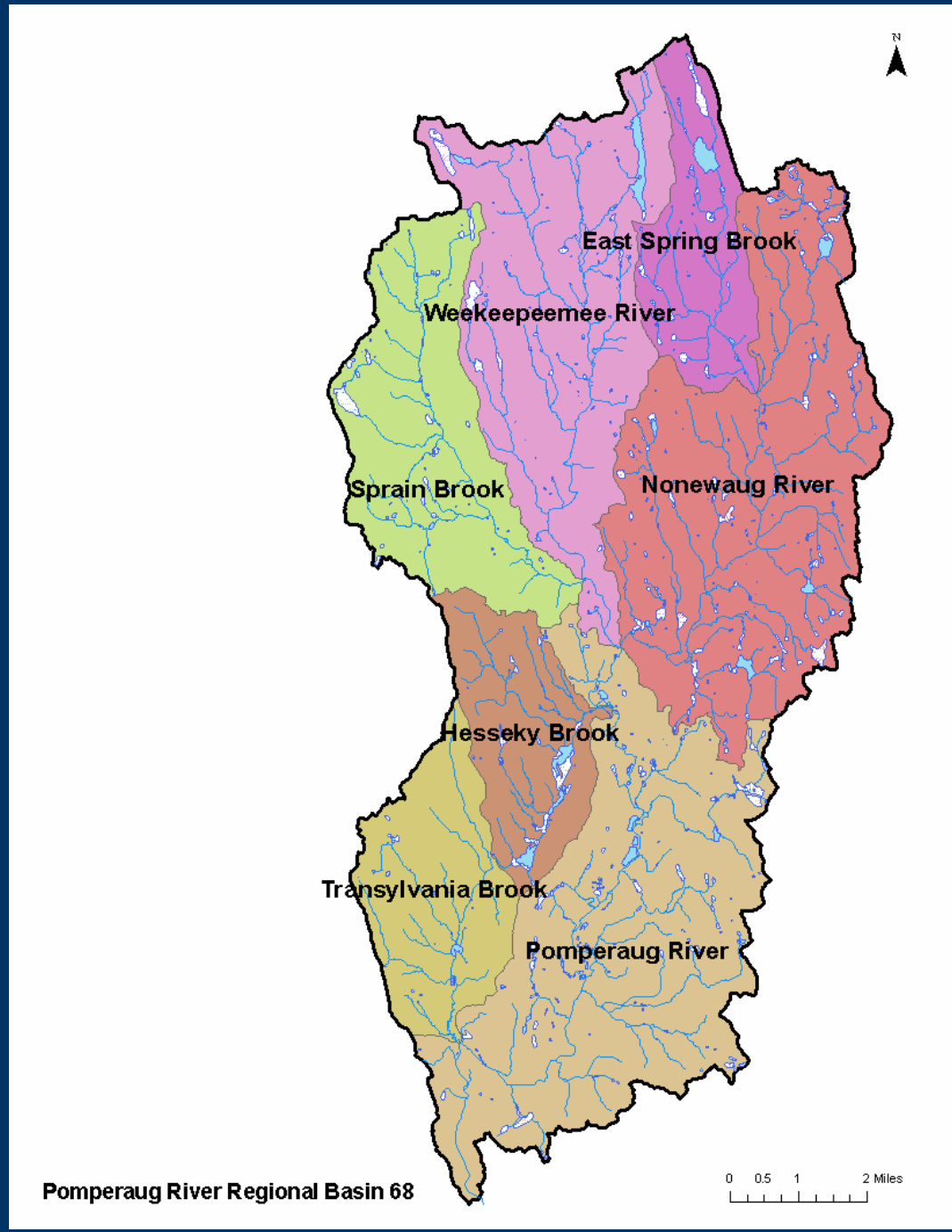
Includes Subregional Basins -

East Spring Brook, Hesseky Brook, Nonewaug River, Pomperaug River, Sprain Brook, Transylvania Brook, Weekeepeemee River

Census 2000

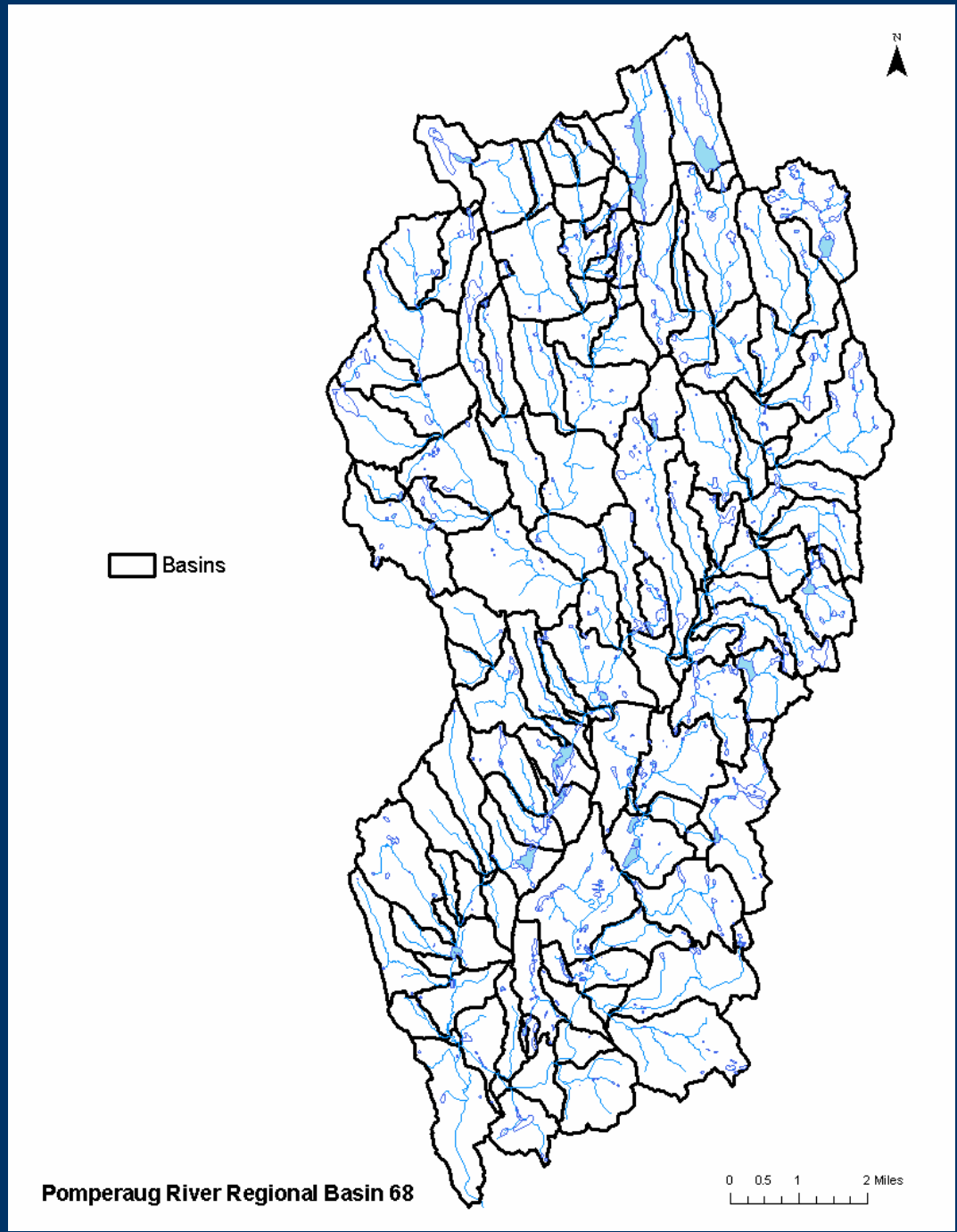
Population 25,203

Population per sq mile 283



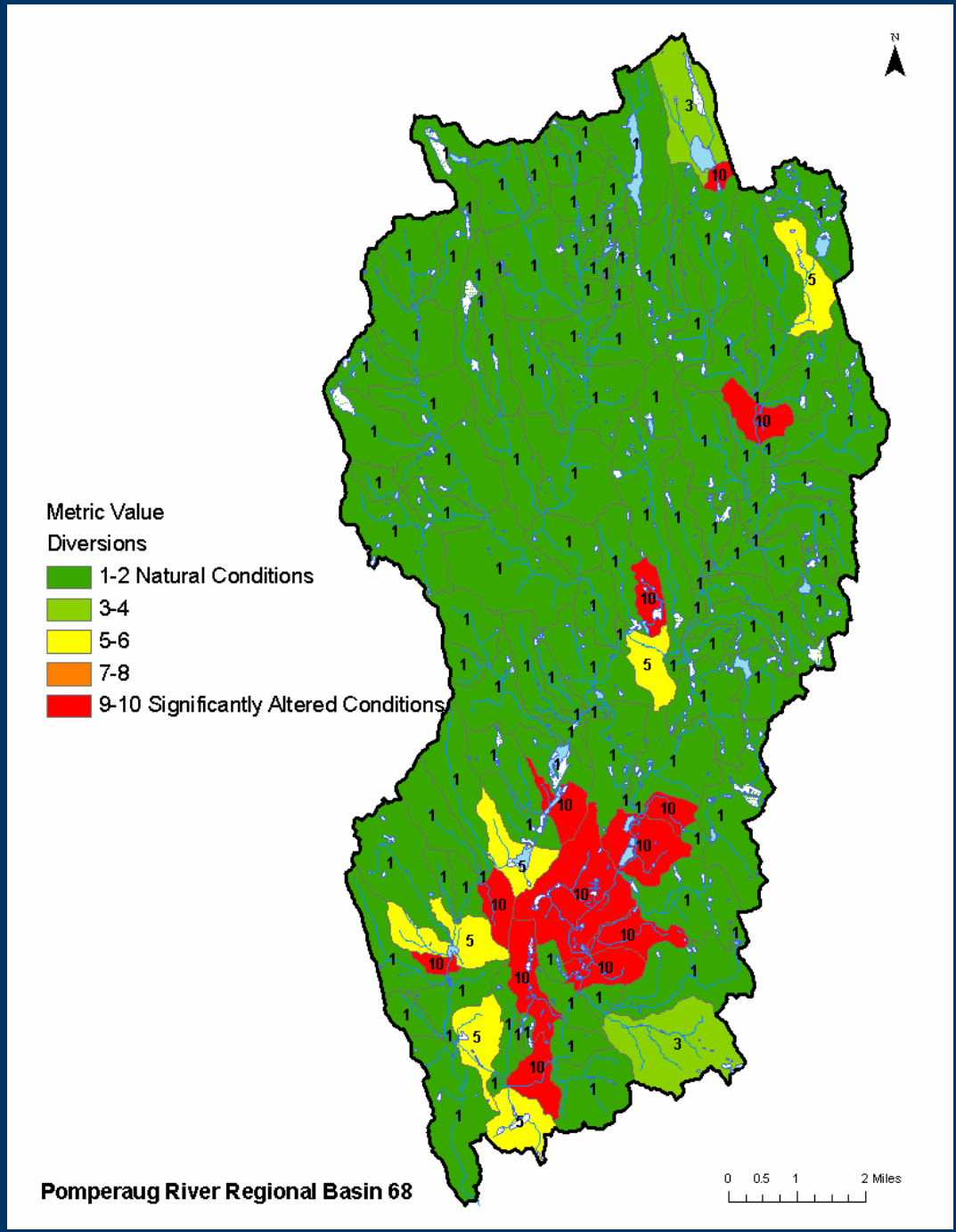
Pomperaug River Regional Basin (68)

141 Basins



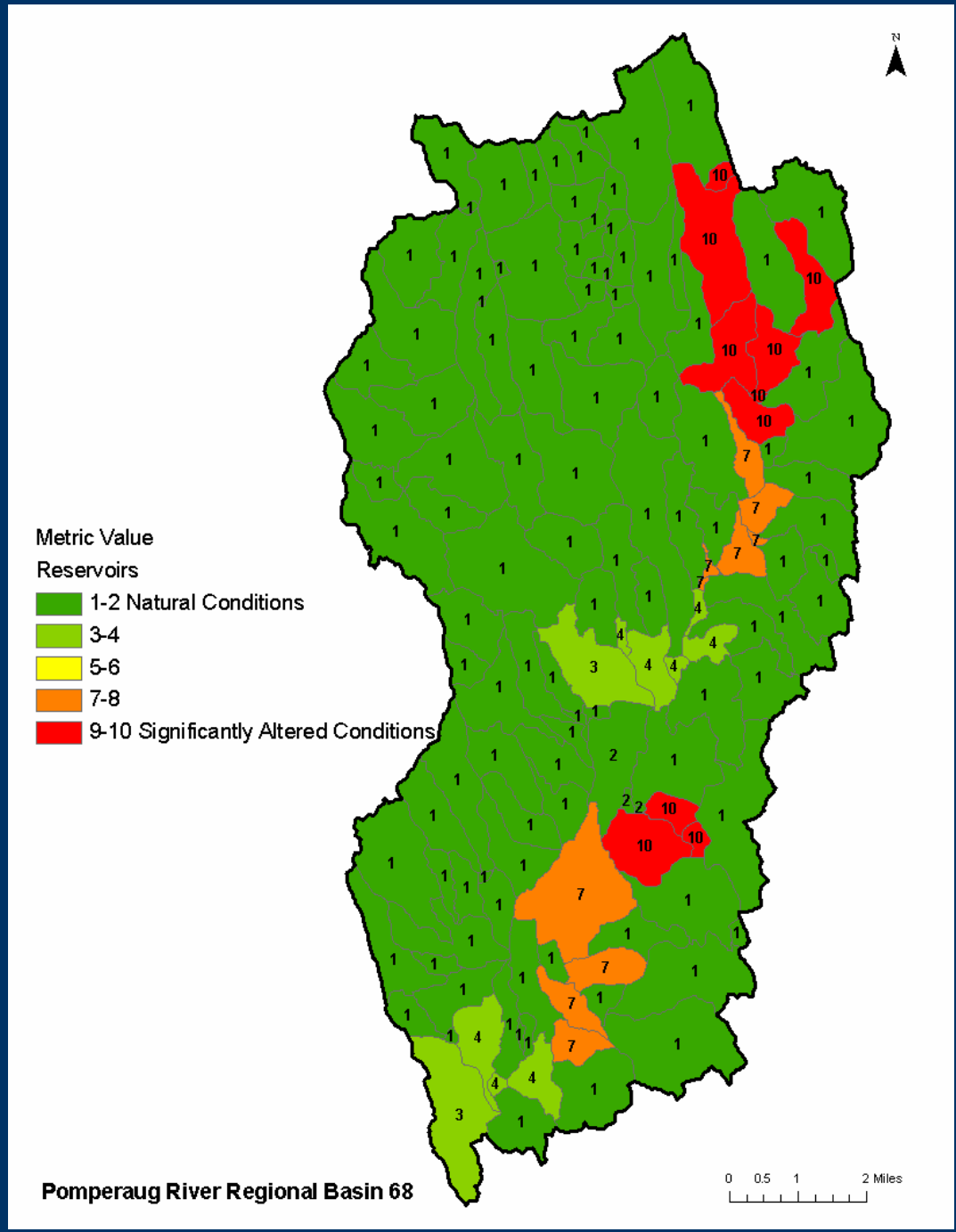
HSI Metrics for Pomperaug Basin- *Diversions*

Diversions	
#Div/SqMi	Metric Value
0	1
0.01 - 1	3
1.01 - 2	5
> 2	10



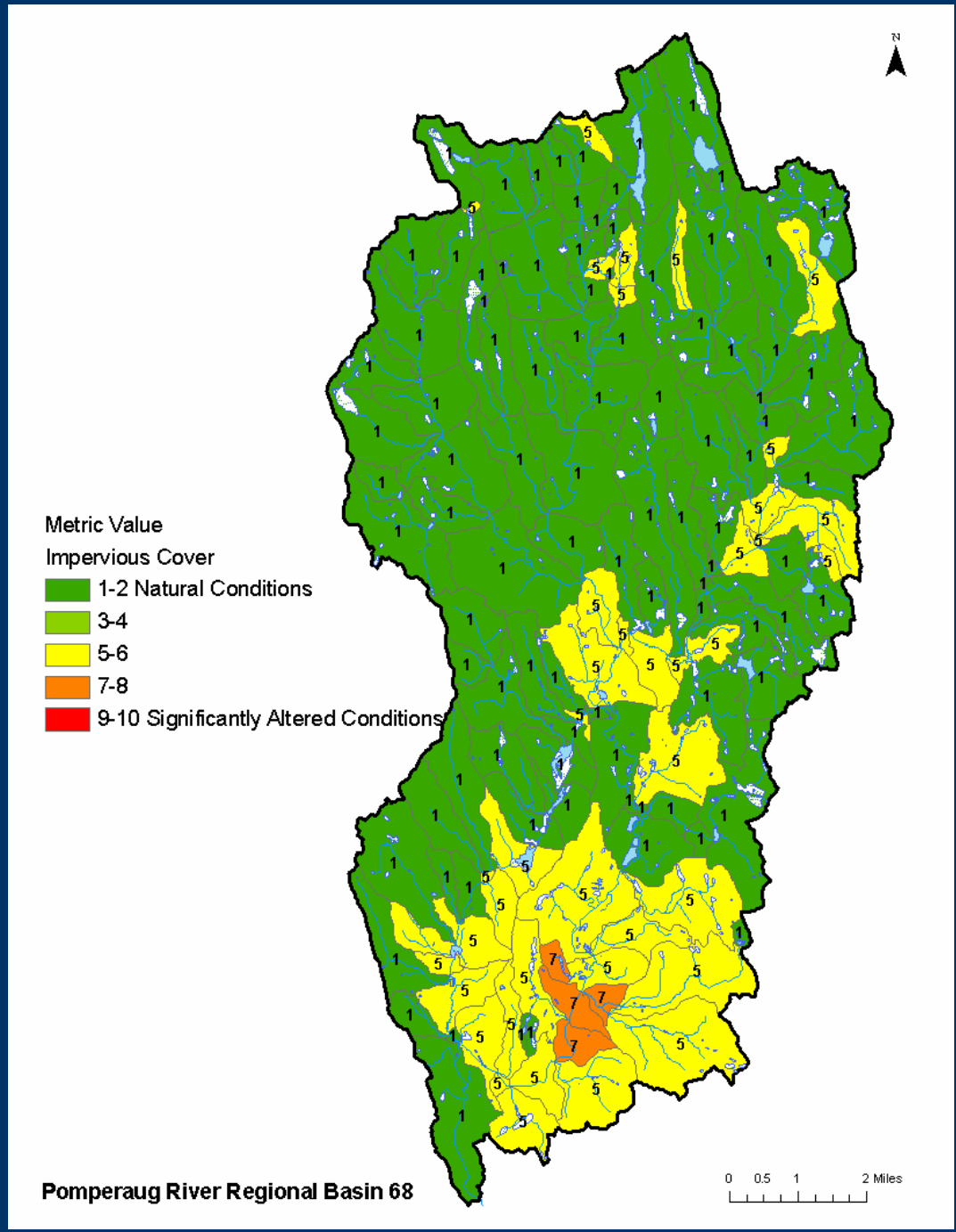
HSI Metrics for Pomperaug Basin- *Reservoirs*

Reservoirs	
Dist from Closest Reservoir (km)	**Metric Value**
0-5	**10**
5.01-10	**7**
10.01-15	**4**
15.01-20	**3**
>20.01	**2**
No US Reservoir	**1**



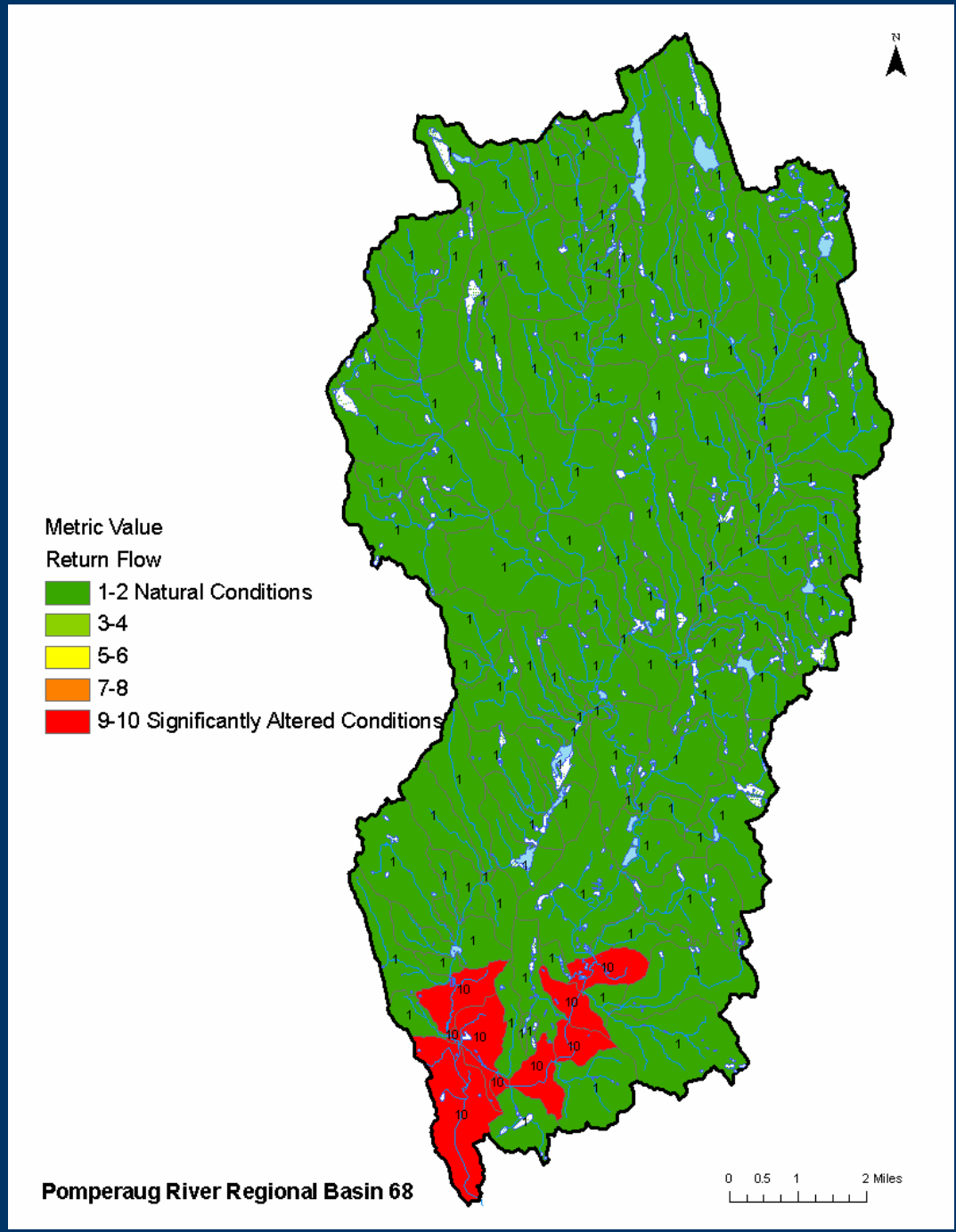
HSI Metrics for Pomperaug Basin- *Impervious Cover*

Impervious Cover	
% IC	Metric Value
0-5%	1
5.01-12%	5
12.01-20%	7
20.01-30%	9
30.01-100%	10



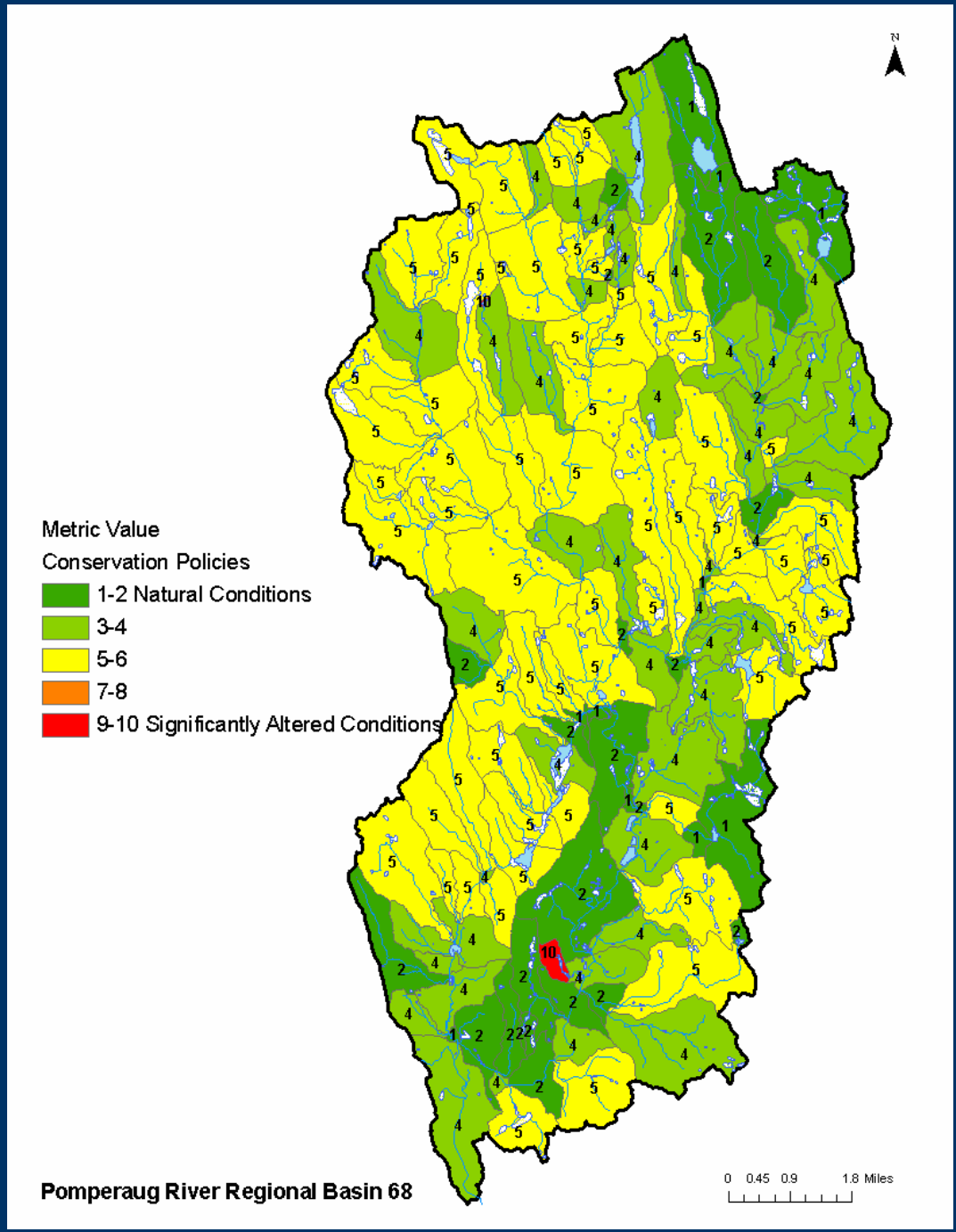
HSI Metrics for Pomperaug Basin- *Return Flow*

Return Flow	
Goal Class	**Metric Value**
Goal Class A	**1**
Goal Class B or below	**10**



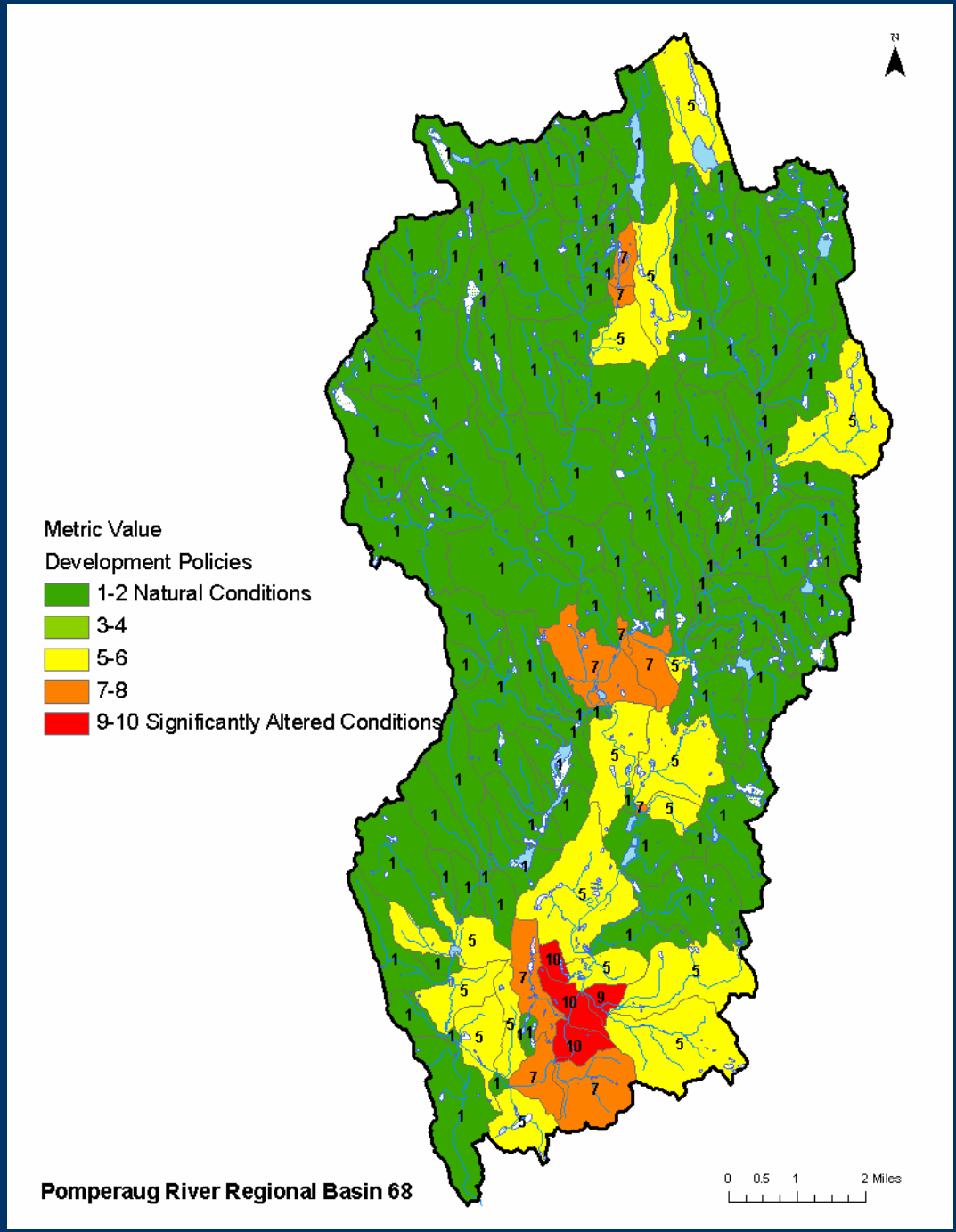
HSI Metrics for Pomperaug Basin- *Conservation*

C&D Plan Conservation Policies	
% of Area	Metric Value
0%	10
0.01-25%	5
25.01-50%	4
50.01-75%	2
75.01-100%	1

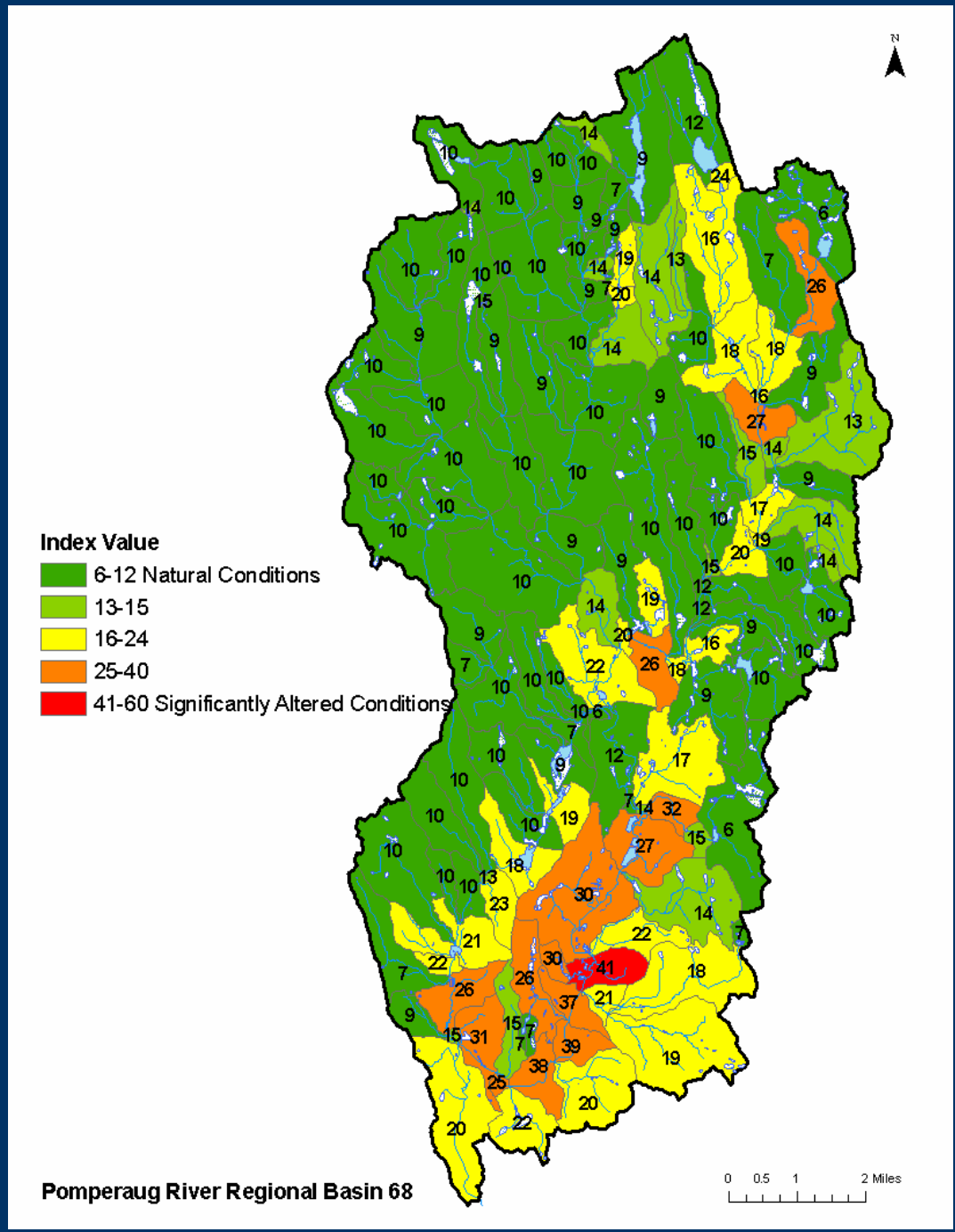


HSI Metrics for Pomperaug Basin- *Development*

C&D Plan Development Policies	
% of Area	Metric Value
0%	1
0.01-25%	5
25.01-50%	7
50.01-75%	9
75.01-100%	10

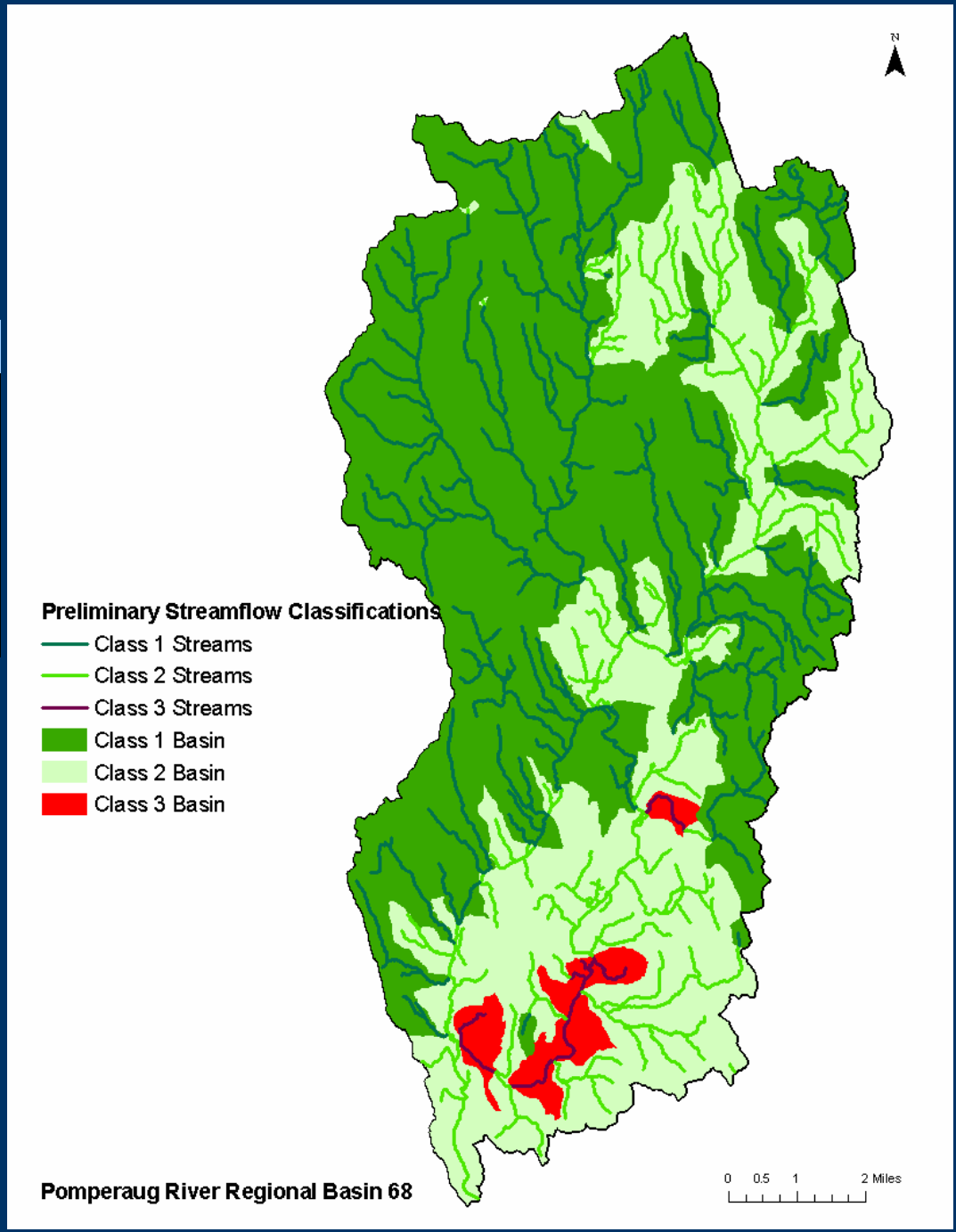


Hydrologic Stressor Index for the Pomperaug Basin



Preliminary Streamflow Classifications for the Pomperaug Basin

Preliminary Streamflow Classifications		
CT HSI	Class	
6-12	Class 1	*"Natural"*
13 - 30	Class 2	*"Near Natural"*
31- 60	Class 3	*"Sustainable"*



CT HSI Summary

- CT HSI is an index score composed of the sum of six metrics that influence streamflow
- CT HSI can be used to determine preliminary streamflow goal classes for all perennial streams in Connecticut
- Work continues to refine individual metrics

Questions ???

Mary Becker 860-424-3262

mary.becker@po.state.ct.us

Chris Bellucci 860-424-3735

christopher.bellucci@po.state.ct.us

Department of Environmental Protection

Bureau of Water Protection and Land Re-use

79 Elm Street, Hartford, CT 06106

www.ct.gov/dep