Using GIS to Conduct a Landscape Level Assessment of New Hampshire's Wetlands

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NEW HAMPSHIRE
DEPARTMENT OF
Environmental
Services

Current Situation

- New Hampshire is in the process of rewriting our Comprehensive Monitoring Strategy
- Wetlands have previously not been addressed
- Little to no monitoring information
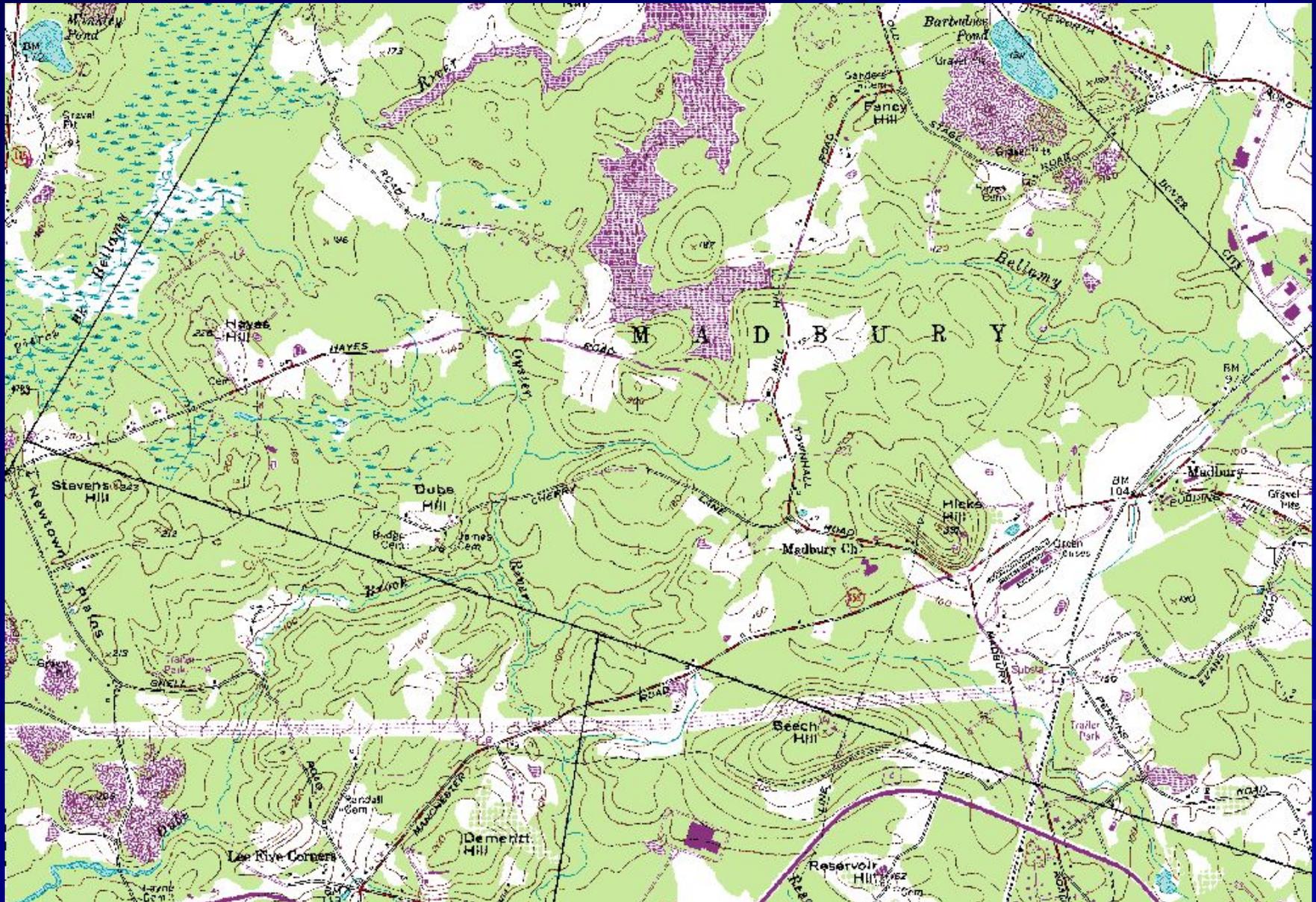- Had no workable assessment units
- 2006 - No reporting in 305(b)

Step 1

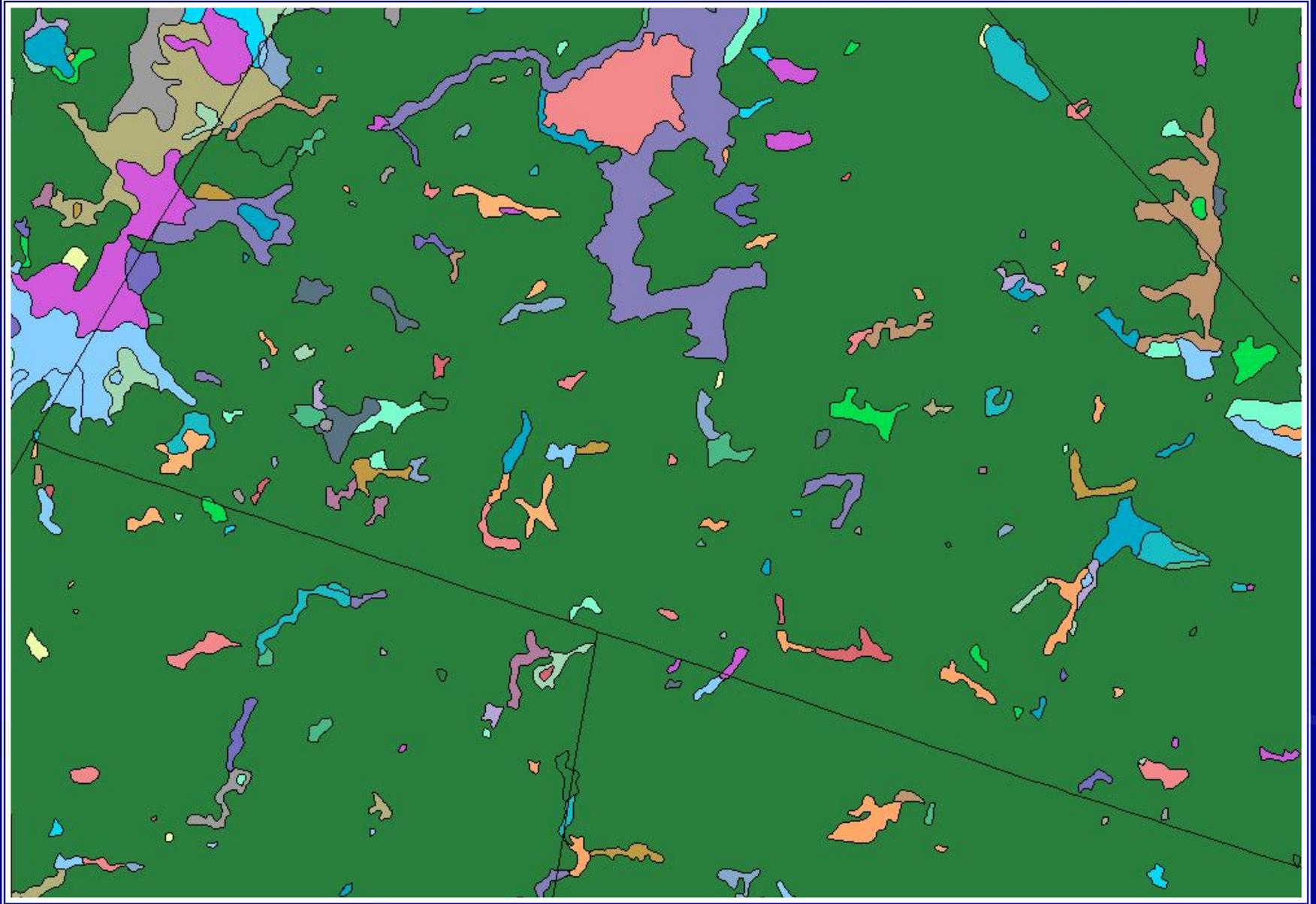# Creating Assessment Units and Buffers

Overview

- National Wetlands Inventory (NWI) Polygons as a base

- Amalgamation of NWI Polygons into Assessment Units (AUs)

- Buffers on AU Amalgamations for Landscape Level Assessments

Create workable and accurate AUID's

# 83,565 NWI polygons statewide covering 484,845 acres

Amalgamation of NWI Polygons into Assessment Units

- Trimmed out all Lacustrine/Limnetic, Palustrine/Open Water, Marine/Subtidal, Estuarine/Subtidal, and Riverine polygons
- Buffer all NWI polygons at 125m and merge all touching buffers so that those NWI polygons within 250m can be coded as within a single buffer complex
- Split any polygon bisected by a road
- Split any polygon bisected by a HUC12 divide.
- Assign unique AUIDs based upon HUC12 to the split buffer complexes
- Assign each AUID to one or more, full or partial NWI polygon as to maintain polygon level Cowardin Code

NWI Buffered
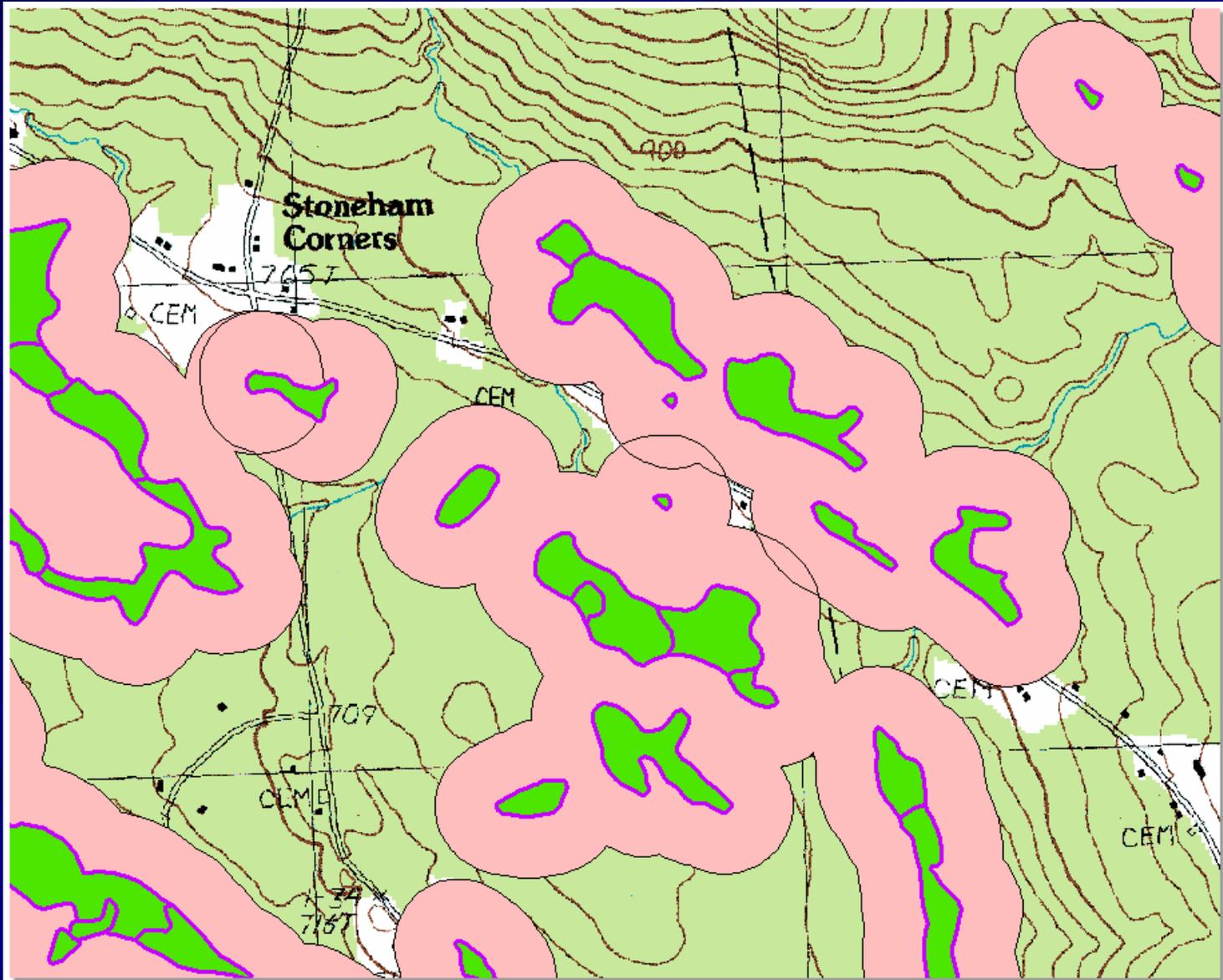
Assessment Units bisected by road split
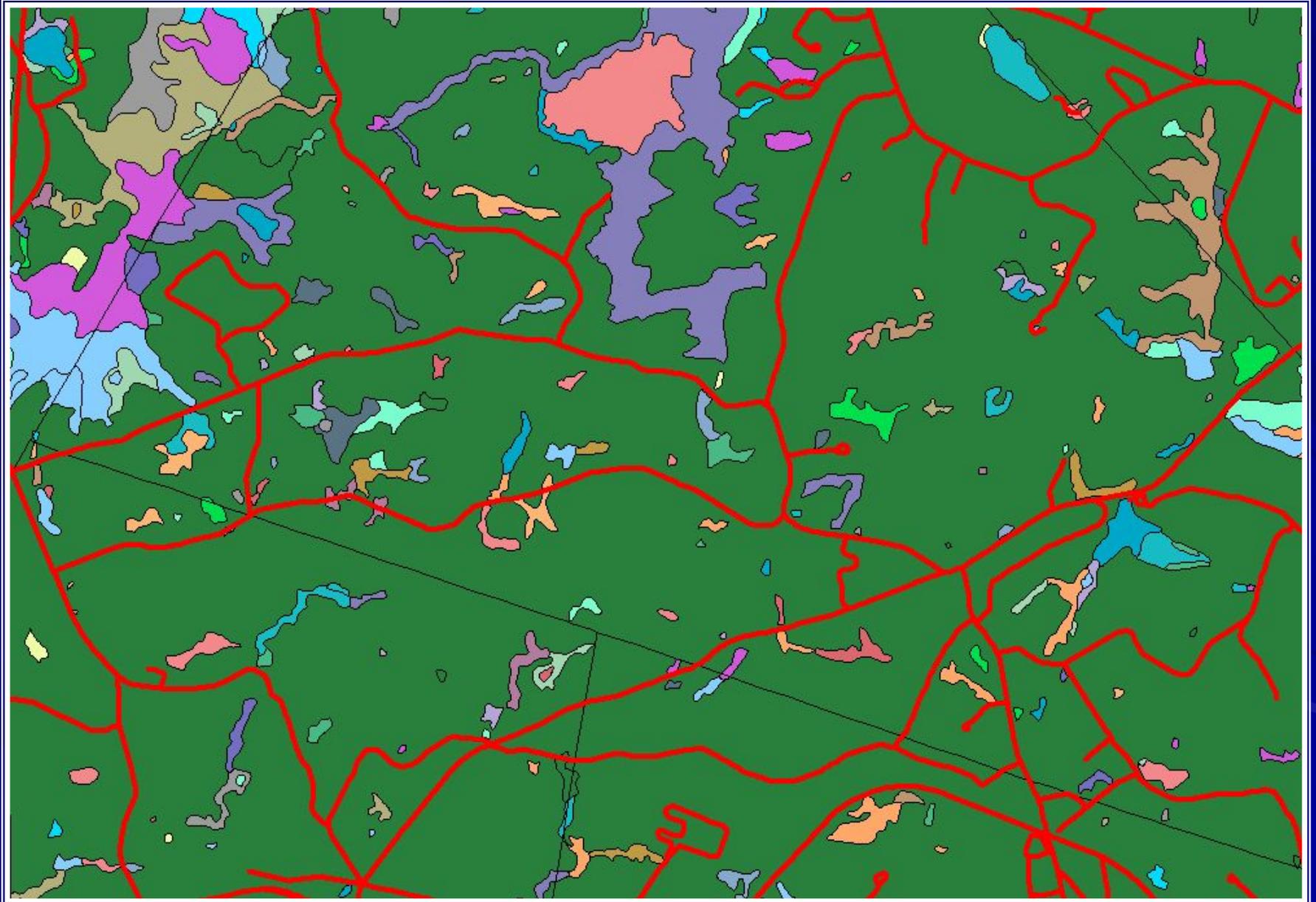
HUC 12 Divides
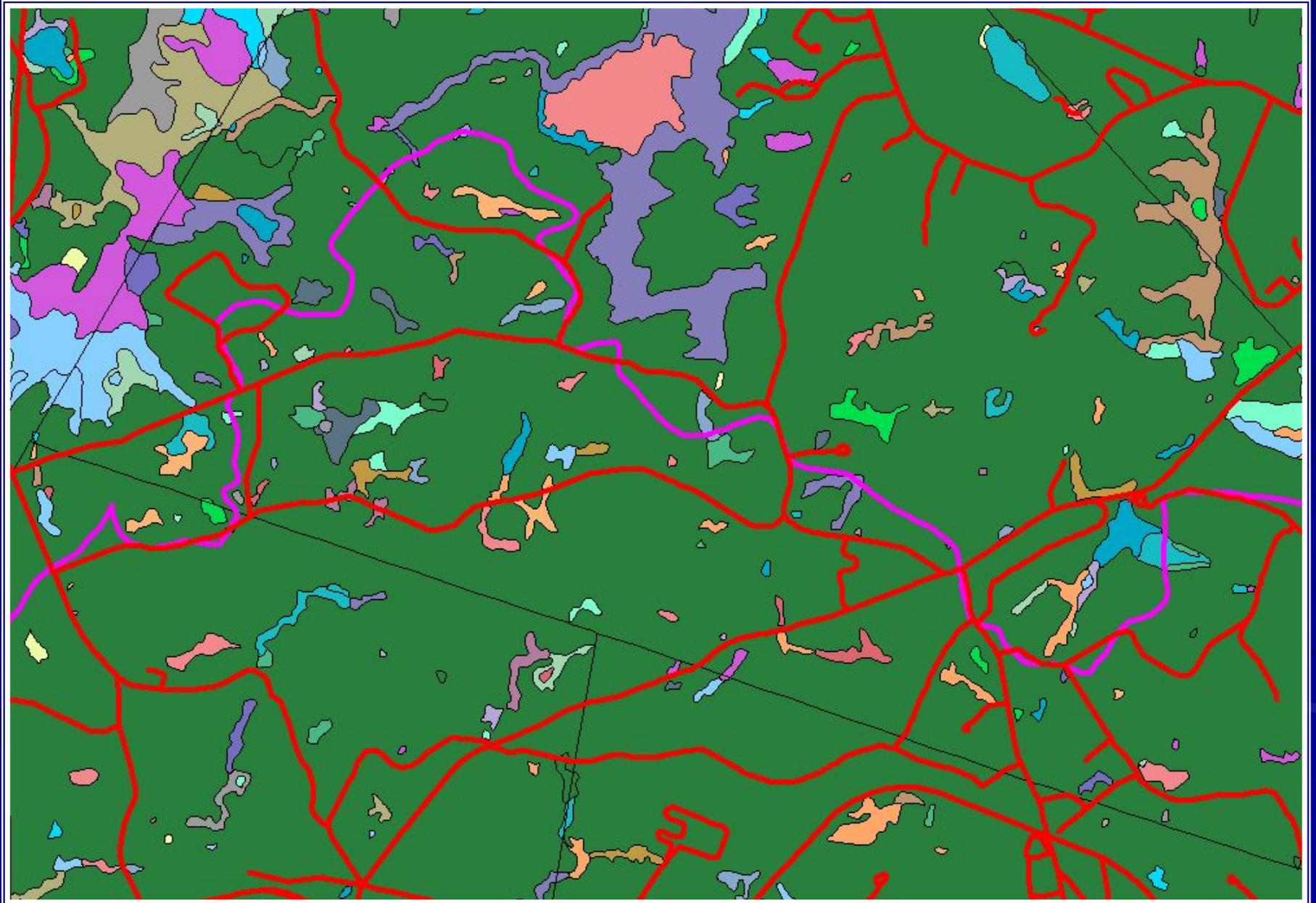
Resulting AUID Buffer Complex Areas
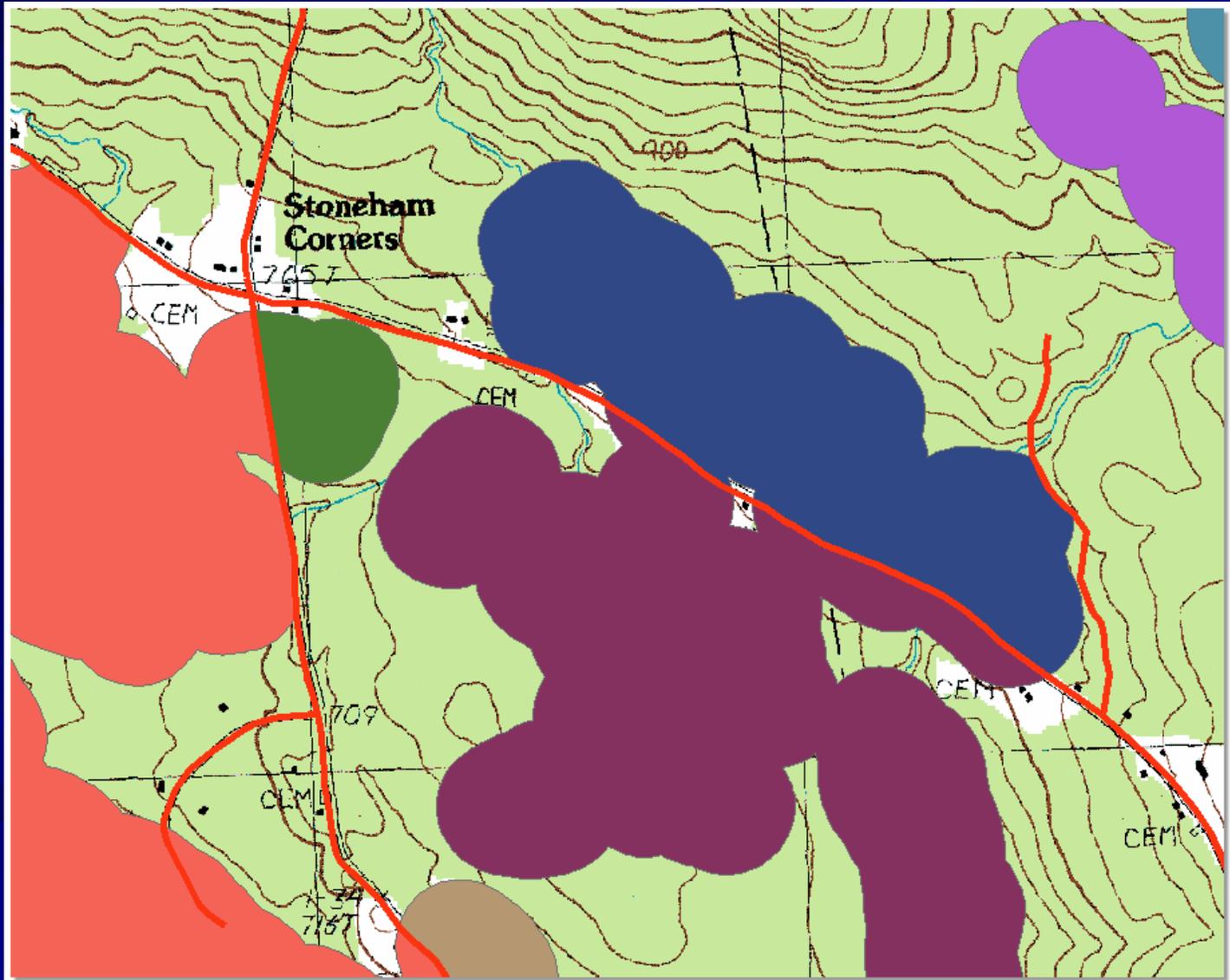
Resulting AUIDs (n=23,626) applied to NWI Polygons
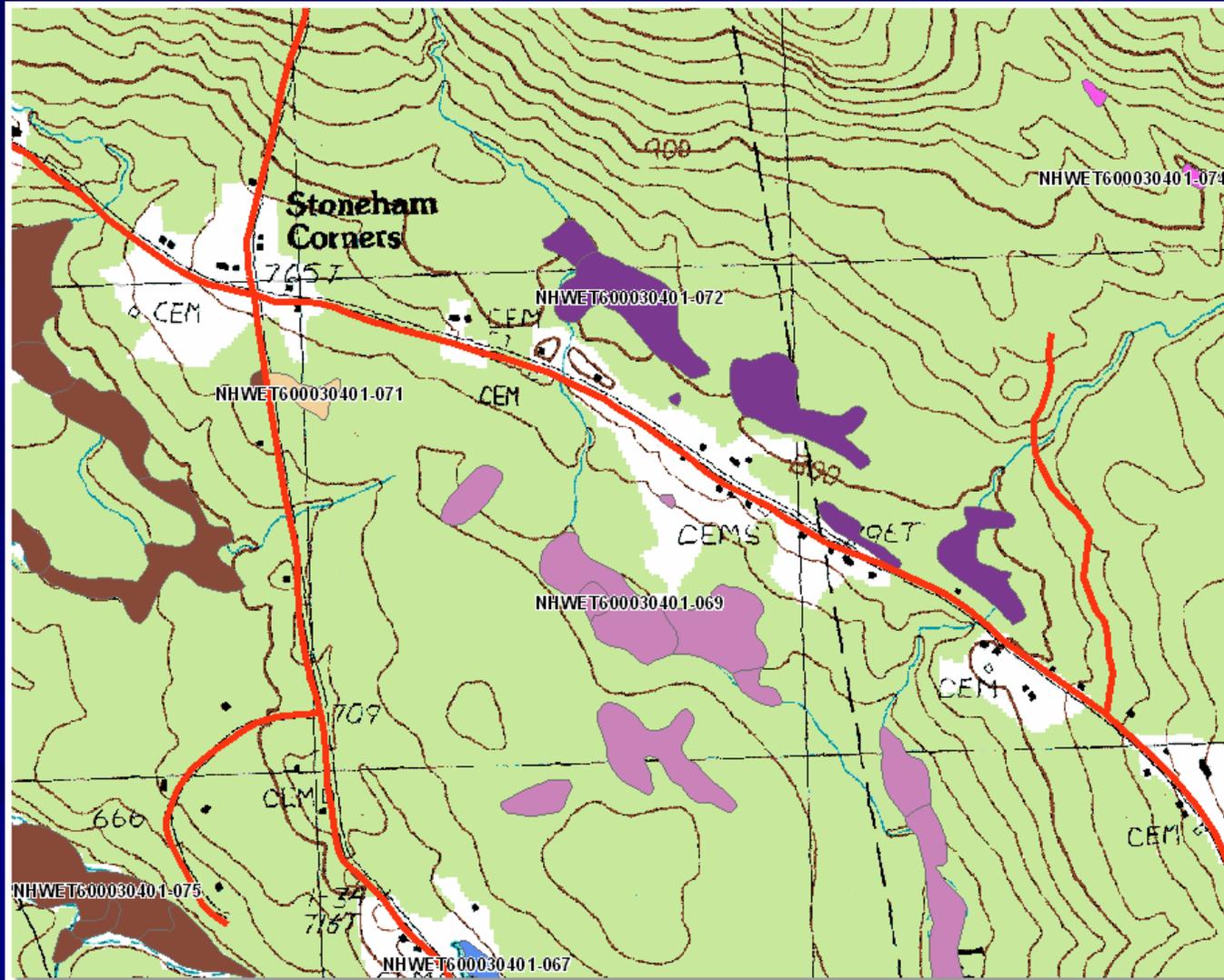
Cowardin Coding Maintained
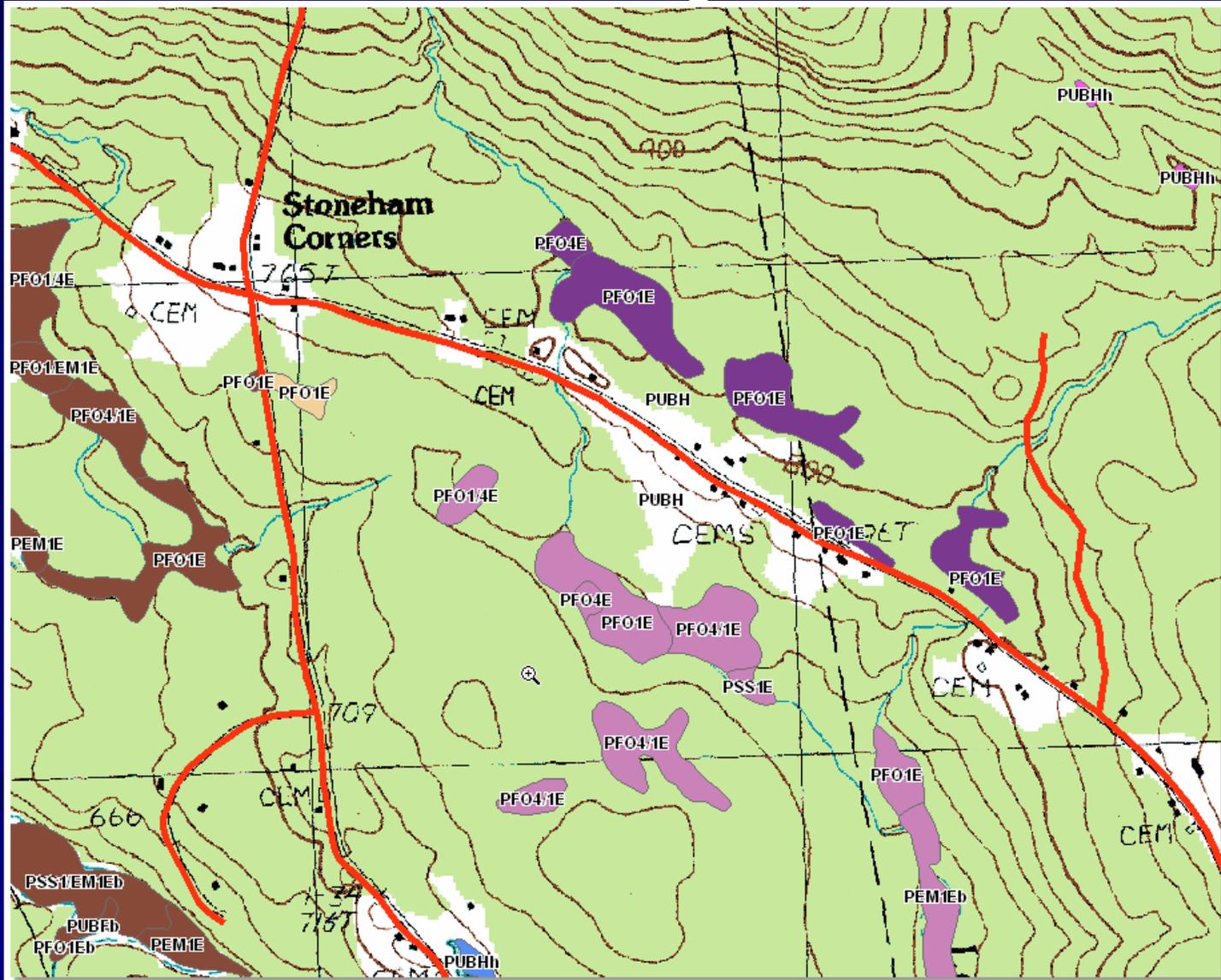
Create Second Buffer Set for Landscape Level Assessments

- 125m buffer around all assessment units - donuts

- Ignored HUC 12 divides and road bisects used to create initial assessment units

- Buffer evaluated for factors other than just water quality

Rebuffer Assessment Units
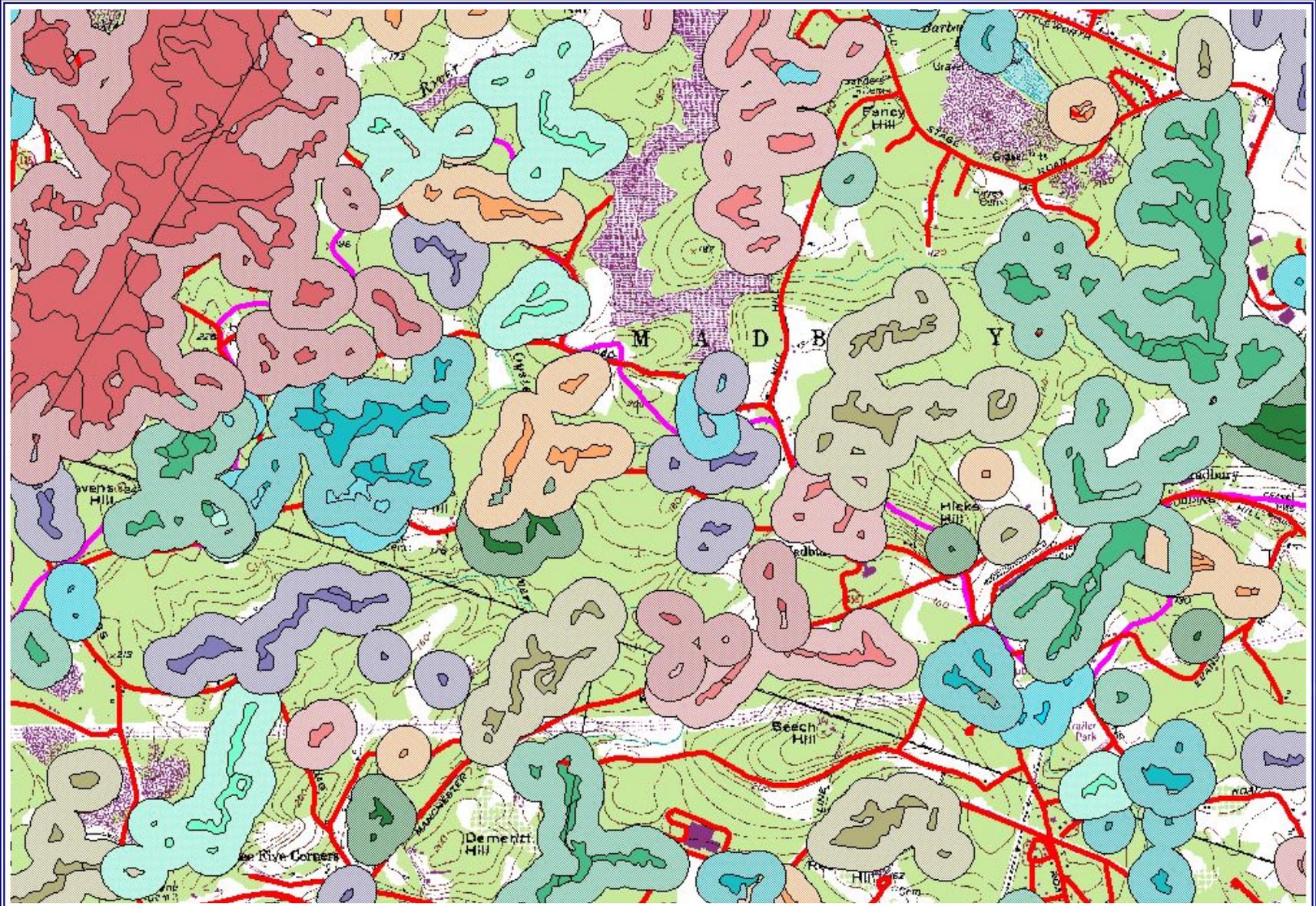
Remove NWI Polygons from Buffers
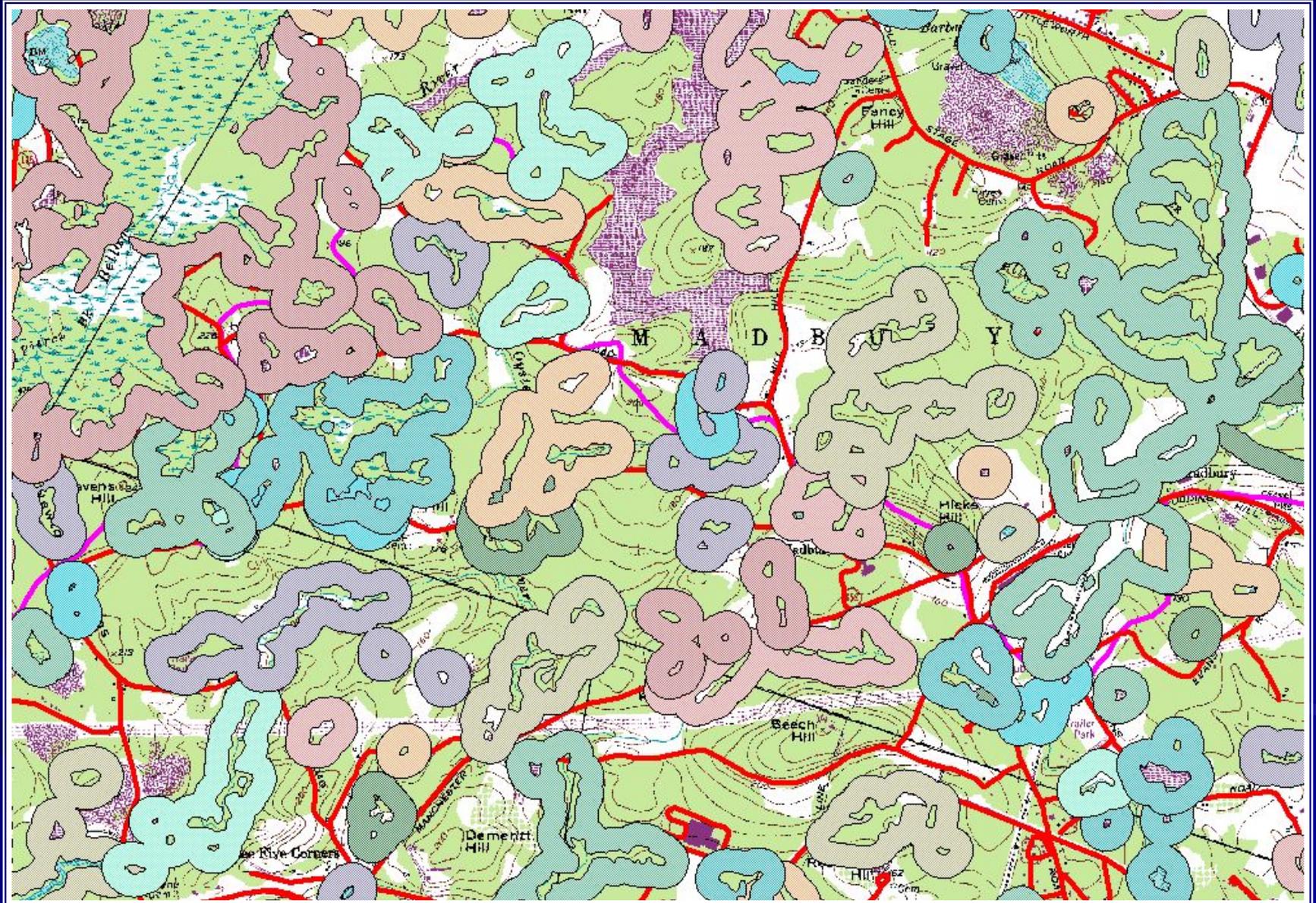
Step 2

Classification of Buffer Landcover Types

Evaluating the Buffers

- Various datasets exist that classify landscape type.

- Propose to use National Landcover Data – Based on Landsat Thematic Mapper Imagery (30m resolution) – collected June 1999 through October 2003.

- Use GIS to tell us what % of each land cover class comprises a given buffer.

NLCD Land Cover Class Definitions

General Group	Code	Detailed Class
Developed	2	High Intensity Developed
Developed	3	Medium Intensity Developed
Developed	4	Low Intensity Developed
Developed	5	Open Spaces Developed
Active agricultural land	6	Cultivated Land
Active agricultural land	7	Pasture/Hay
Active agricultural land	8	Grassland
Forested	9	Deciduous Forest
Forested	10	Evergreen Forest
Forested	11	Mixed Forest
Forested	12	Scrub/Shrub
Wetlands	13	Palustrine Forested Wetland
Wetlands	14	Palustrine Scrub/Shrub Wetland
Wetlands	15	Palustrine Emergent Wetland

NLCD Land Cover Class Definitions

- **Developed, Medium Intensity** - Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-79 percent of the total cover. These areas most commonly include single-family housing units.

- **Developed, High Intensity** - Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to100 percent of the total cover.

- **Cultivated Crops** - Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. This class also includes all land being actively tilled.

Pittsburg – Likely Low Impact

Pittsburg – Likely Low Impact
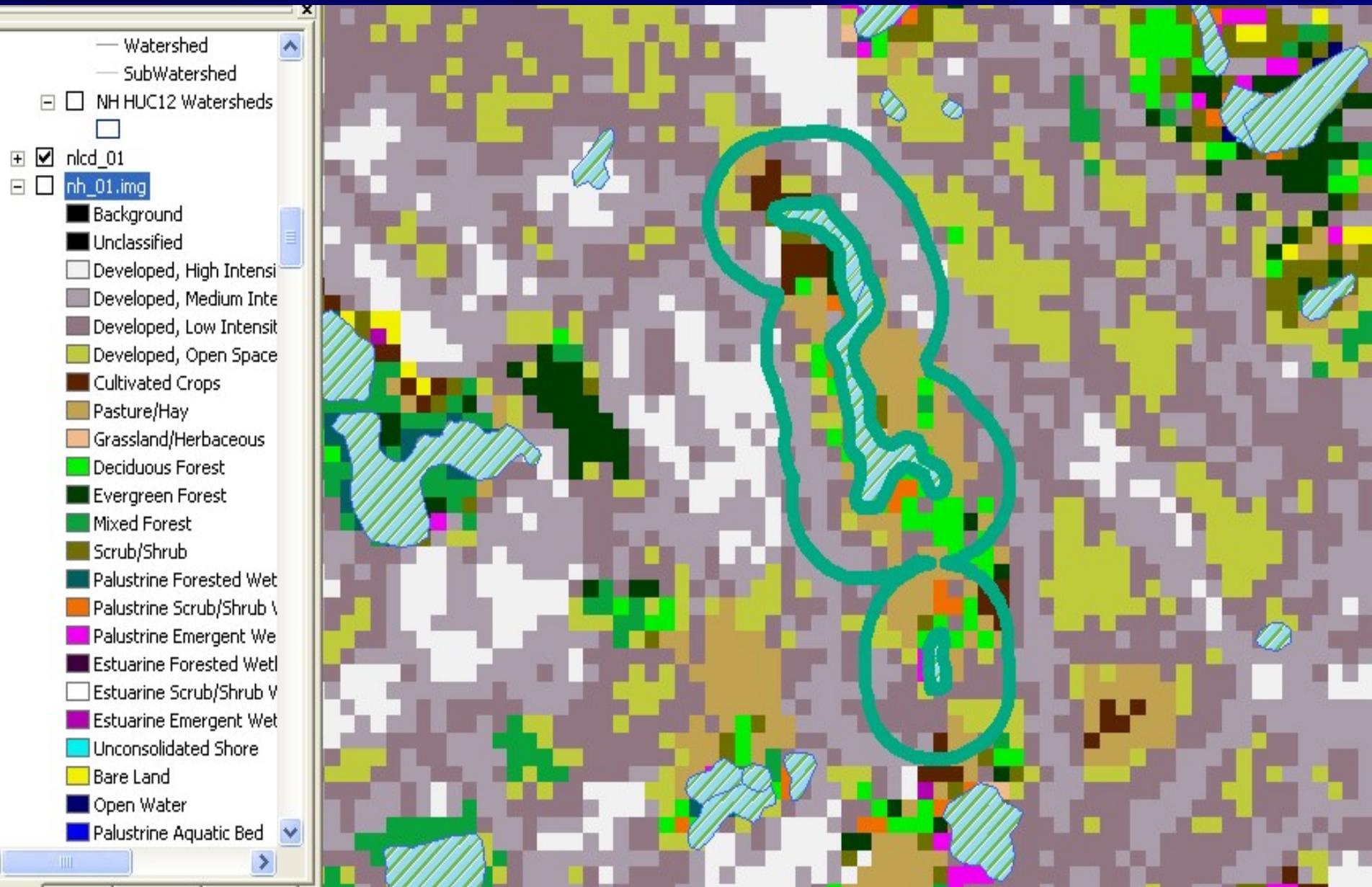
Determine % of Each Landscape Type

Portsmouth

- 40% Developed – Med. Density
- 20% Developed – Low Density
- 15% Pasture/Hay
- 10% Developed – High Intensity
- 5% Developed – Open Space
- 3% Palustrine – Scrub/Shrub
- 2% Estuarine – Emergent

Pittsburg

- 60% Deciduous Forest
- 35% Mixed Forest
- 5% Pasture/Hay

Step 3

Evaluation of Buffer Landcover Types

Conduct a GIS Based Landscape Level Assessment of all Wetland Buffers

- Assess for "aquatic life" designated use
- Assessments to be based on an evaluation of the 125m buffers not the wetlands themselves (Donuts)
- No definitive support categories will be made due to the inherent roughness of this exercise.
- Use support categories
  - -potentially supporting
  - -potentially not supporting
  - -insufficient information

Weighting Impacts of Land Cover Classes

1. Assign event mean concentrations for pollutants to NLCD land use coverages.

2. Assign % impervious cover to each land use – a range of % impervious cover is given for each NLCD land cover class.

3. For calculating pollutant loading use the highest value for each range.

Event Mean Concentration Values (mg/L)

Pollutant	Agriculture/ Pasture	Forest Rural Open	Highway	Industrial	Commer.
BOD (mg/L)	5.5	3.0	17	15.3	14
COD (mg/L)	53	36.5	103	85	60.6
TSS (mg/L)	142.5	77.5	141.5	110.3	67.3
TDS (mg/L)	415	415	294	202	174
TP (mg/L)	0.705	0.12	0.39	0.24	0.23
DP (mg/L)	0.09	0.035	0.22	0.43	0.11
TKN (mg/L)	1.64	0.825	1.8	2.08	1.31
NO2/3 (mg/L)	4.06	0.67	0.83	1.5	0.81
Pb (mg/L)		0.27	0.17	0.28	0.068
Cu (mg/L)			0.04	0.076	0.049
Zn (mg/L)		0.142	0.21	0.502	0.18
Cd (mg/L)			0.003	0.005	0.003
Fec. Coli	3250	300	600	1022	4736

Weighting Impacts of Land Cover Classes

1. Assign event mean concentrations for each pollutant to NLCD land use coverages.

2. Assign % impervious cover to each land use – a range of % impervious cover is given for each NLCD land cover class.

3. For calculating pollutant loading use the highest value for each range.

Impervious Fraction

NLCD Landcover Type	% Impervious
High Intensity Developed	100
Medium Intensity Developed	80
Low Intensity Developed	50
Developed Open Space	20
Agriculture/Pasture	15
Forest/Rural/Open	0
Wetland/Water	0

Weighting Impacts of Land Cover Classes

	Forest Rural Open	Water Wetland	Agricult. Pasture	High Intensity Developed	Medium Intensity Developed	Low Intensity Developed	Developed Open Space
Imper/Fraction	**0.00**	**0.00**	**0.15**	**1.00**	**0.79**	**0.49**	**0.20**
Load Ratio = (Annual Pollutant Load/Annual Pollutant Load for High Intensity) X 100							
BOD	1	1	6	100	80	52	9
CODTP	2	1	12	100	80	52	12
TSS	4	1	27	100	80	52	20
TDS	11	0	40	100	80	52	49
TP	2	1	43	100	80	52	15
DP	1	1	7	100	80	52	7
TKN	2	2	16	100	80	52	16
NO2/3	3	3	72	100	80	52	17
Pb	4	0	0	100	80	52	4
Cu	0	1	0	100	80	52	13
Zn	3	1	0	100	80	52	8
Cd	0	1	0	100	80	52	6
Fecal Col	0	0	14	100	80	52	17
E. coli	0			100	80	52	
Score	**3**	**1**	**18**	**100**	**80**	**52**	**15**

Weighting Impacts of Land Cover Classes

	Forest Rural Open	Water Wetland	Agricult Pasture	High Intensity Developed	Medium Intensity Developed	Low Intensity Developed	Developed Open Space
Impervious Fraction	0.00	0.00	0.15	1.00	0.79	0.49	0.20

Proposed Level 1 Wetland Assessment Score

Final Score	0	0	15.8	100	79.6	50.5	11.9

Developed High Intensity Impact → 100% Impervious Surface

At 10% Impervious Surface Water Quality Violations Likely

(Center for Watershed Protection/NHDES Coastal Impervious Surface Mapping)

Any wetland buffer with >10% Impervious Surface → Potentially Not Supporting

Calculating Level 1 Assessment Score

Total *Score* = *Σ %LC$_i$ * LCS$_i$*

where:

Total Score = Total Assessment Score for Wetland Buffer
%LC = percent of the total area in a given land cover class
LCS = Assessment score for given land cover class

Any score greater than 10 → Potentially Not Supporting

Sample Assessment - Pittsburg

NLCD Landcover Class	Fraction	Land Cover Class Assessment Score	Total Score
Deciduous Forest	0.6	0	0
Mixed Forest	0.35	0	0
Pasture/Hay	0.05	15.8	0.79
Potentially Supporting			0.79

Sample Assessment - Portsmouth

NLCD Landcover Class	Fraction	Land Cover Class Assessment Score	Total Score
Developed - Medium	0.4	76.6	30.64
Developed - Low	0.2	50.5	10.1
Pasture/Hay	0.15	15.8	2.37
Developed - High	0.10	100	10.0
Developed – Open Space	0.05	11.9	0.60
Palustrine – Scrub/Shrub	0.06	0	0
Estuarine - Emergent	0.04	0	0
Potentially Not Supporting			**53.61**

Contact Information:

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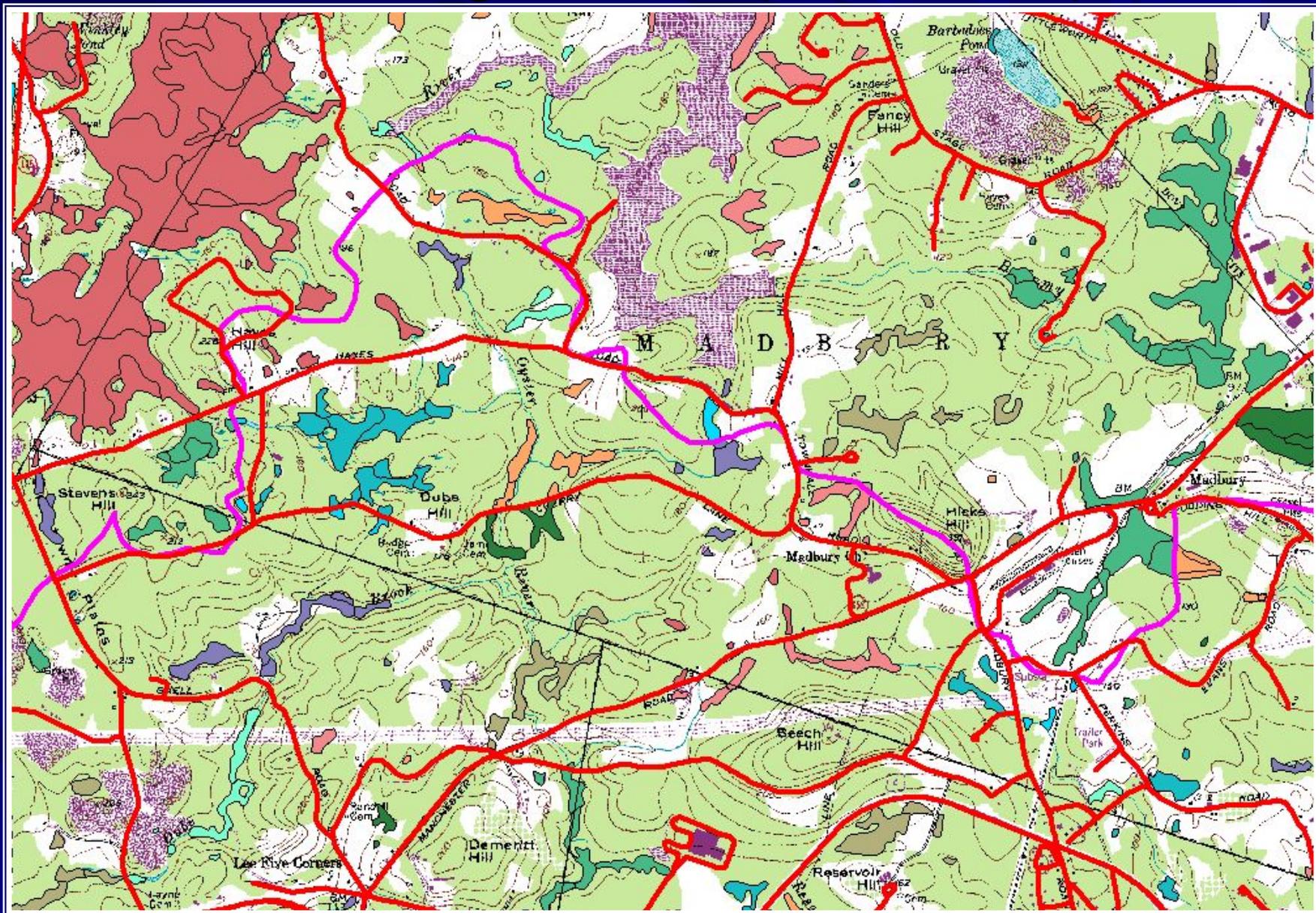Concord, NH 03302
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Resulting AUIDs (n=23,626)

Weighting Impacts of Land Cover Classes

- Based on event mean concentrations calculate estimated total pollutant load per year (lbs/yr) for each parameter
- Determine load ratio for each parameter and land cover class

Load ratio = (Total Annual Pollutant Load/Total Annual Pollutant Load for High Density) X 100

e.g.   Load ratio for Agriculture → 34

          Load ratio for Low Density Developed → 50

Land Cover Class Weighted Scores

General Group	Detailed Class	NHDES Wetlands Level 1 Assessment Score
Developed	High Intensity Developed	100
Developed	Medium Intensity Developed	79.6
Developed	Low Intensity Developed	50.5
Developed	Open Space Developed	11.9
Agricultural Land	Cultivated Land	15.8
Agricultural Land	Pasture/Hay	15.8
Agricultural Land	Grassland	11.9
Forested	Deciduous Forest	0
Forested	Evergreen Forest	0
Forested	Mixed Forest	0
Forested	Shrub/Scrub	0
Wetlands	Palustrine/Forest Wetland	0
Wetlands	Palustrine Scrub Shrub Wetland	0
Wetlands	Palustrine Emergent Wetland	0
Wetlands	Estuarine Forested Wetland	0
Wetlands	Estuaruine Shrub/Scrub Wetland	0
Wetlands	Estuarine Emergent Wetland	0
Wetlands	Unconsolidated Shore	0
Barren Land	Snow/Ice	0
Water	Water	0

Weighting Impacts of Land Cover Classes

	Forest Rural Open	Water Wetland	Agricult Pasture	High Intensity Developed	Medium Intensity Developed	Low Intensity Developed	Developed Open Space
Impervious Fraction	0.00	0.00	0.15	1.00	0.79	0.49	0.20
Proposed Level 1 Wetland Assessment Score							
	0	0	15.8	100	79.6	50.5	11.9
Developed High Intensity Impact → 100% Impervious Surface At 10% Impervious Surface Water Quality Violations Likely (Center for Watershed Protection/NHDES Coastal Impervious Surface Mapping)							
Any wetland buffer with >10% Impervious Surface → Potentially Not Supporting							
Per Cent Coverage to be PNS	0	0	64	10	13	20	84