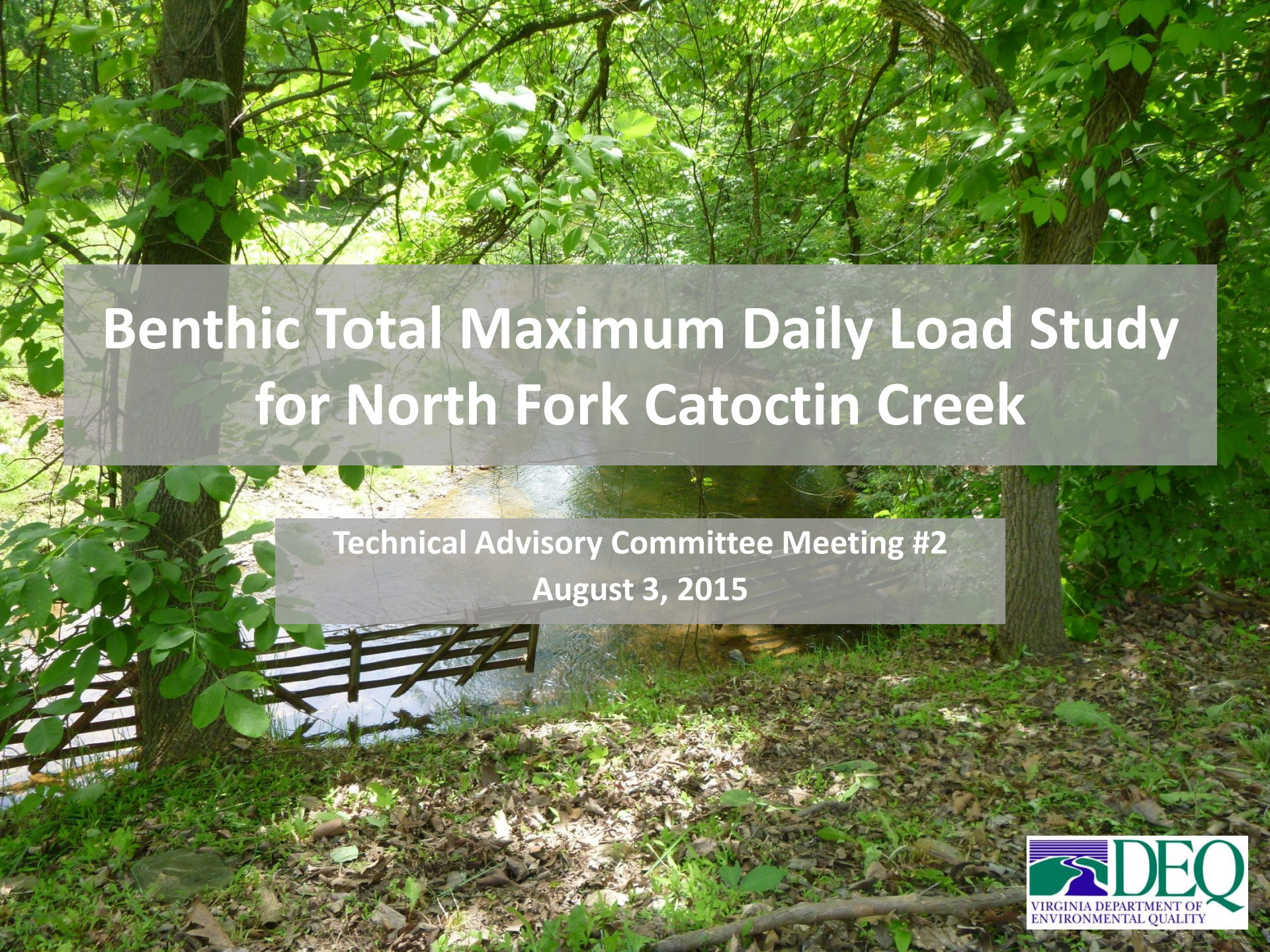


Benthic Total Maximum Daily Load Study for North Fork Catoctin Creek

Technical Advisory Committee Meeting #2

August 3, 2015

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Meeting Agenda

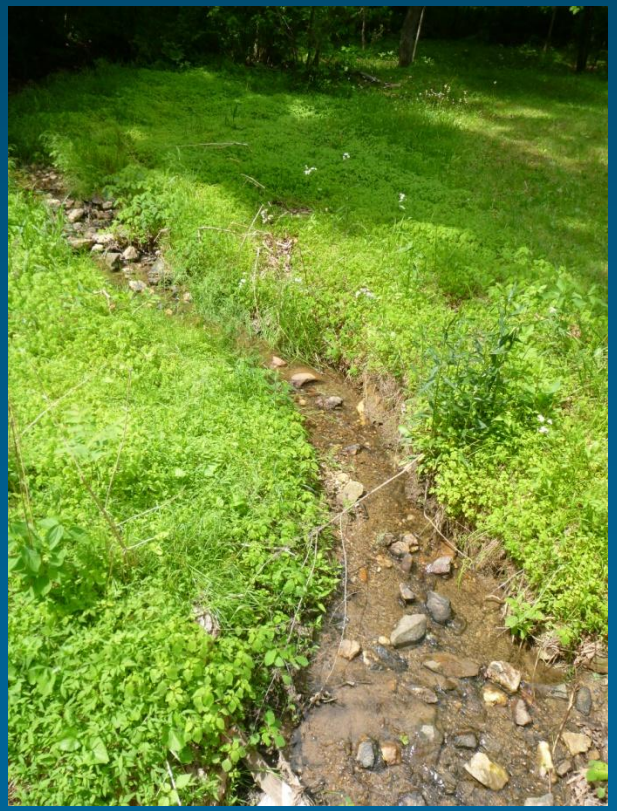
1. Introductions

2. Background
   a. Benthic Impairments
   b. Overview of Stressor Analysis

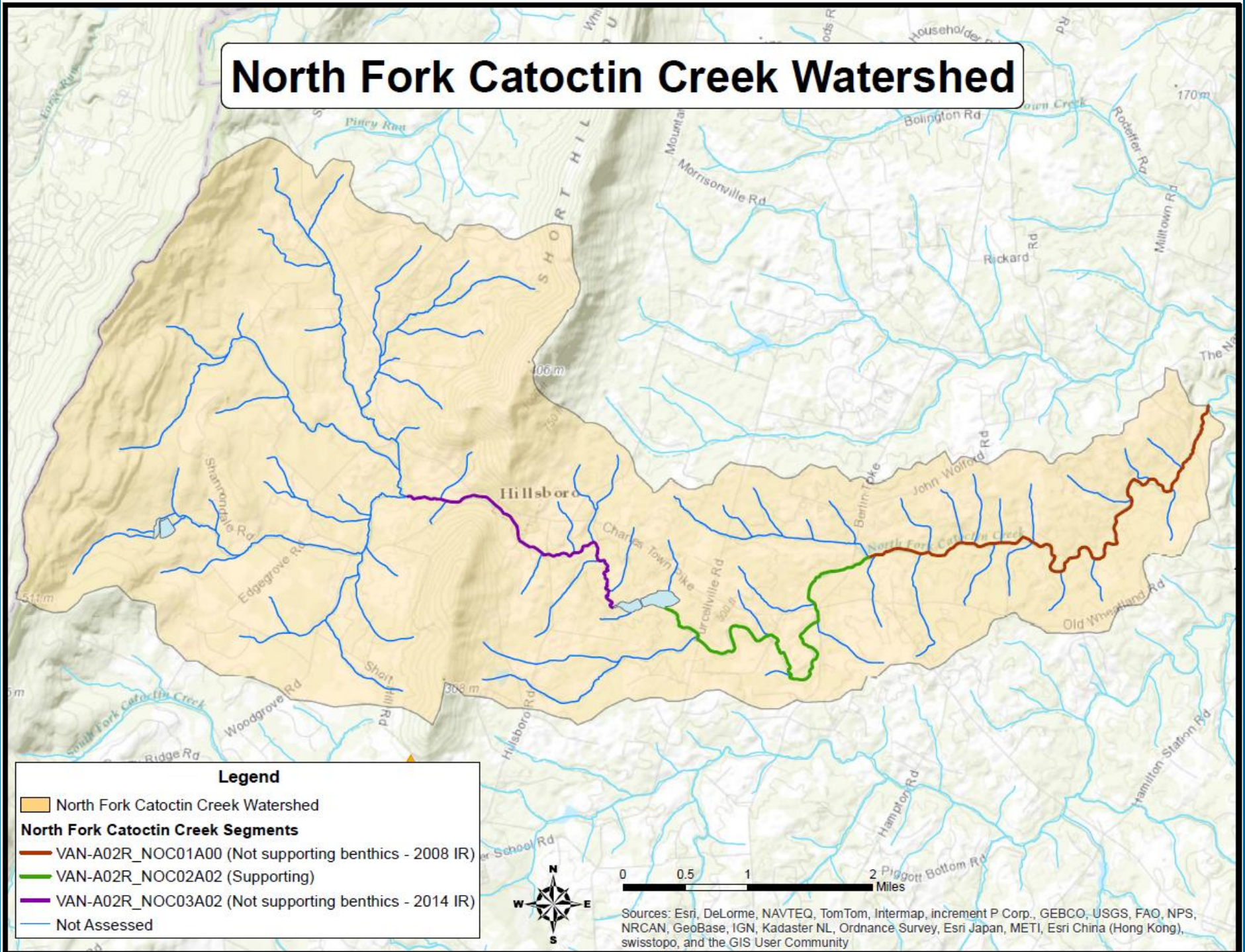
3. Results of Draft Stressor Identification Analysis
   a. Data Sources
   b. Eliminated Stressors
   c. Possible Stressor
   d. Most Probable Stressors

4. Summary & Next Steps

5. Questions & Discussion



North Fork Catoctin Creek Watershed



What is a Stressor Analysis?

Answers the question: ***What is causing the aquatic life impairment?***

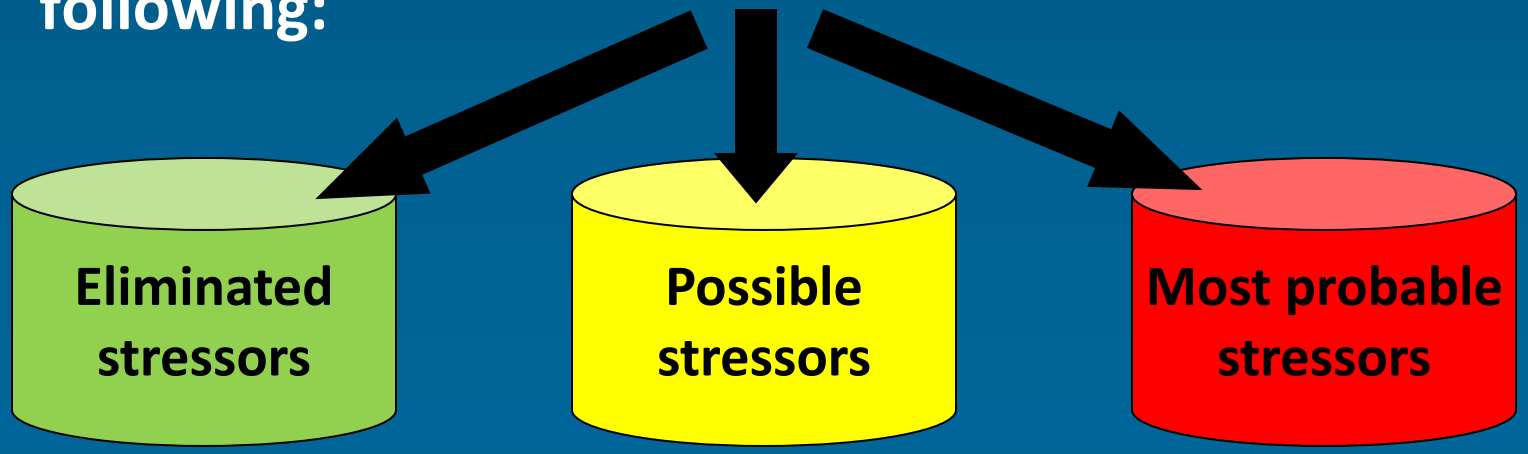
1. List all potential causes, for example:

   Dissolved oxygen, nutrients, pH, sediment, temperature, toxics, etc.

2. Analyze the evidence for and against each cause:

   Biological, habitat, water quality, historic data, etc.

3. Categorize each of the causes as being one of the following:



North Fork Catoctin Creek Benthic Stressor Analysis

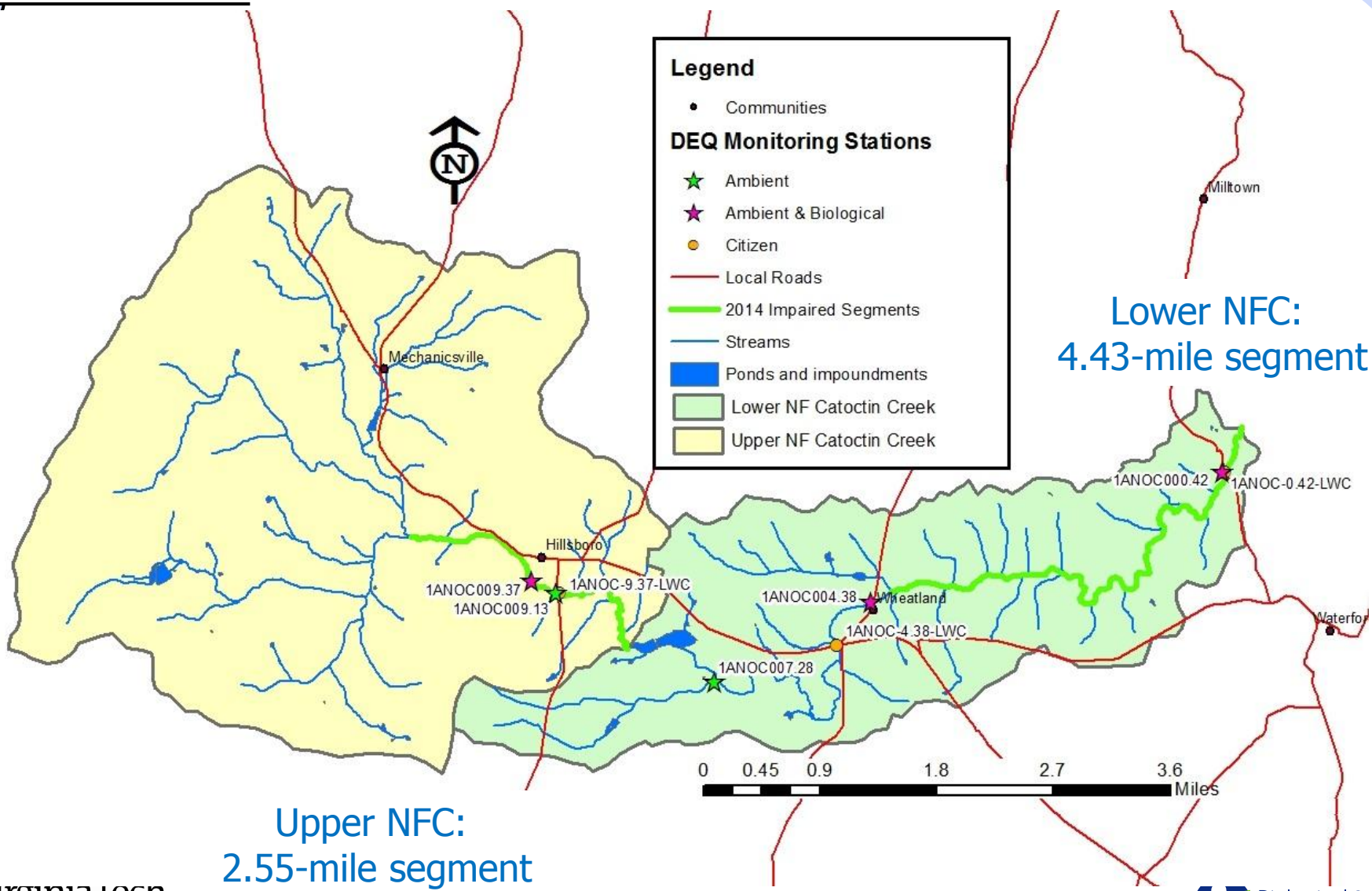
Technical Advisory Committee Meeting

Gene Yagow

Virginia Tech, Biological Systems Engineering Department

August 3, 2015

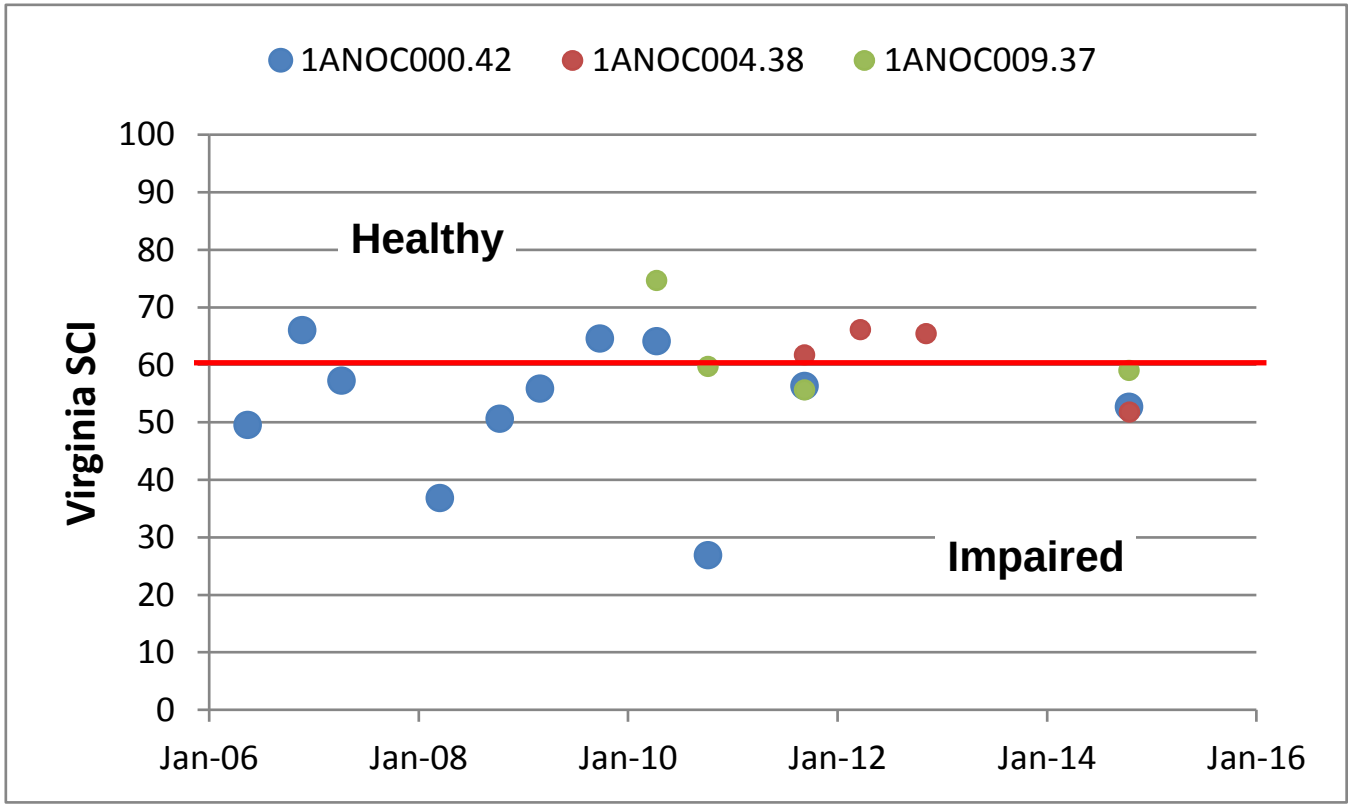
NF Catoctin Creek Monitoring Stations



Lower NFC:
4.43-mile segment

Upper NFC:
2.55-mile segment

Basis for Impairment



VSCI = Virginia Stream Condition Index

Potential Pollutants

- ammonia,
- pH,
- temperature,
- metals,
- toxic organic compounds,
- nutrients (dissolved oxygen),
- organic matter,
- streambed sedimentation,
- ionic strength (sulfates, conductivity, total dissolved solids), and
- flow/hydrologic modification.

Potential Pollutant Sources

- Agriculture
- Construction
- Stormwater runoff
- Permitted discharges
- Livestock in the creek
- Septic systems
- Spills and illegal discharges

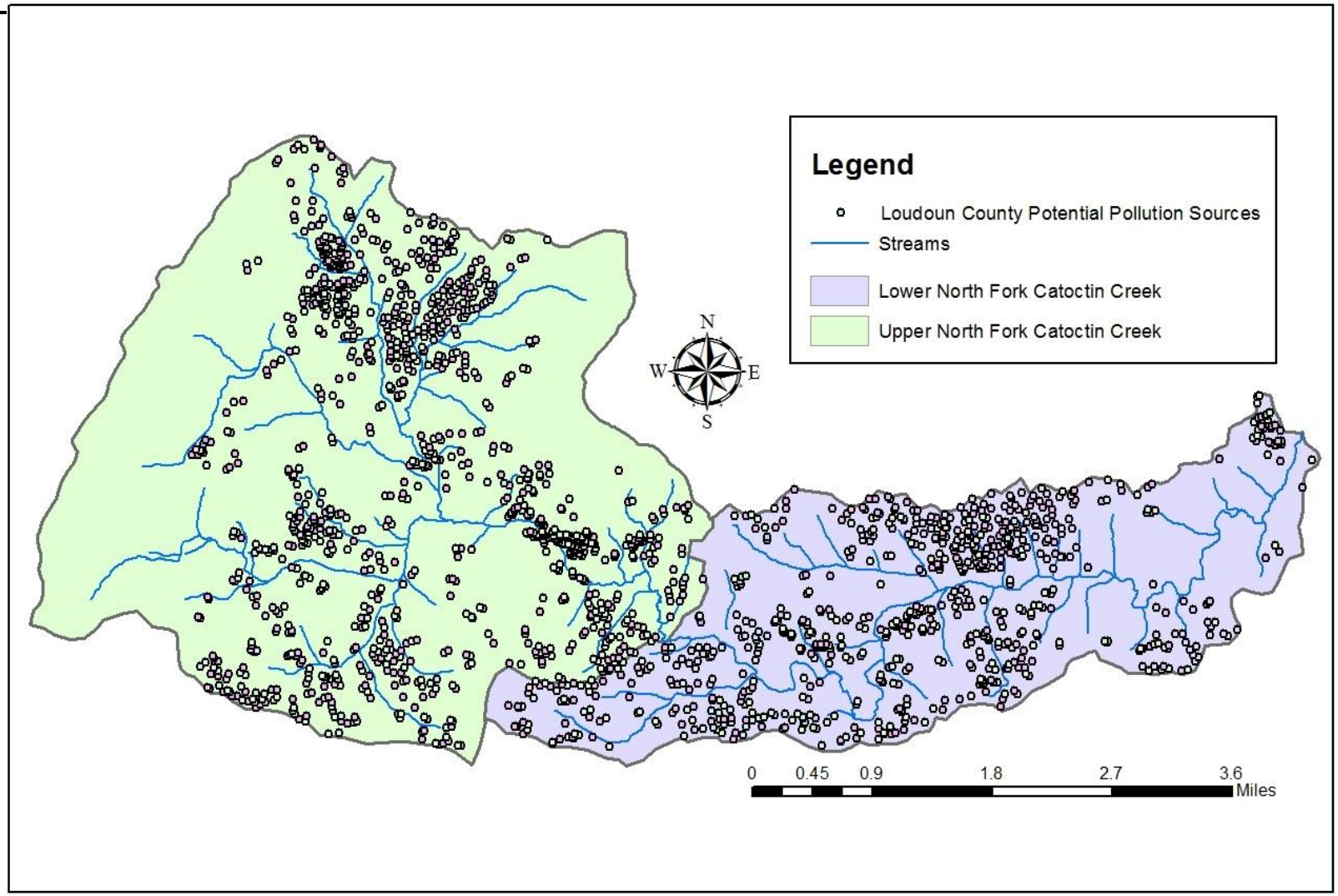
Known Permitted Sources

- VPDES Individual Permits - none
- Industrial Stormwater General Permits – none
- SFH domestic sewage discharge permits – 5
- No current permits for biosolids land application

Pollution Response (PReP) Reports

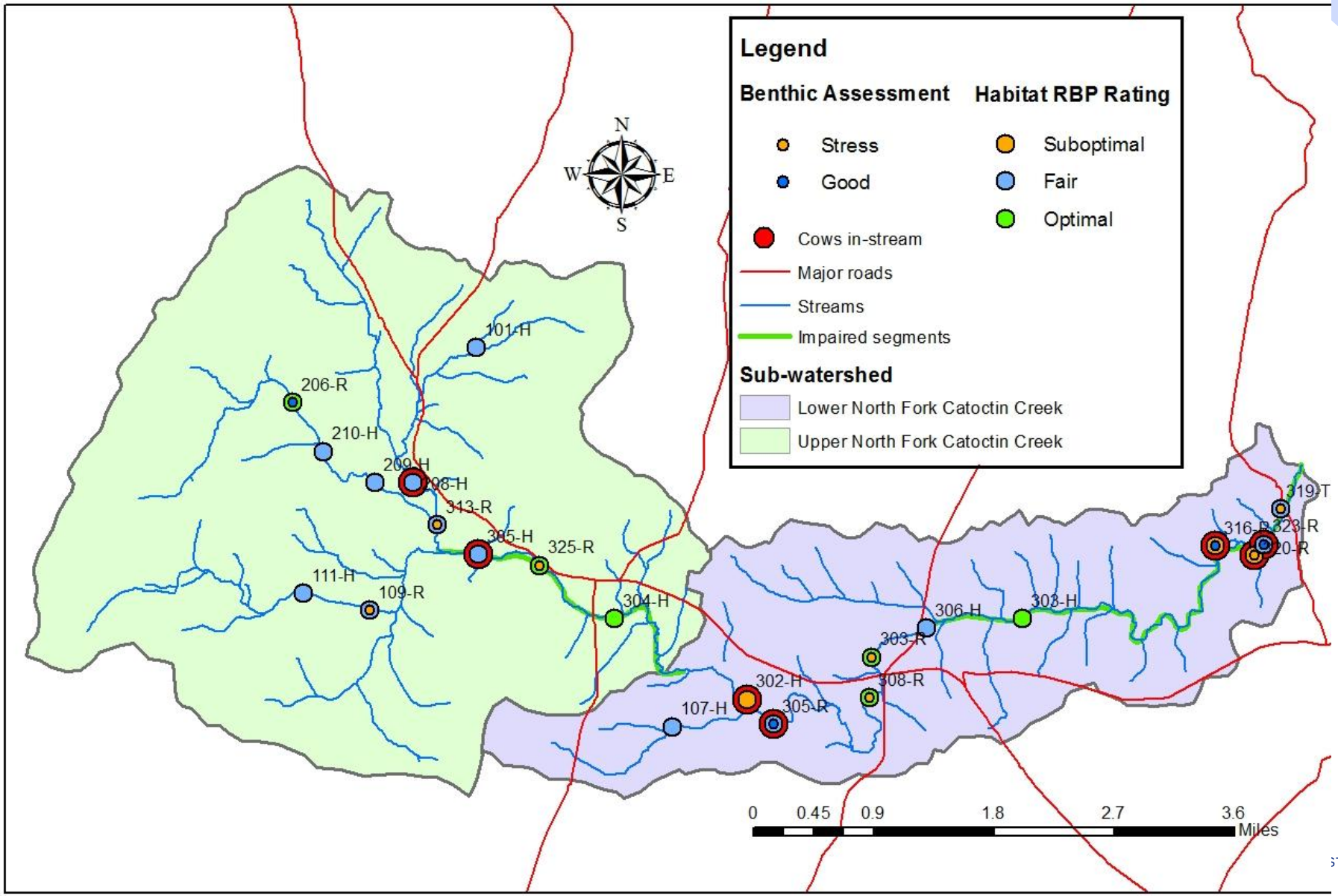
Incident Date	Site Name	Incident Type	Original Call Incident Description
07/13/99	Route 287	Petroleum	Vehicle Accident - hydraulic fluid spill
05/02/01	Hillsboro VDOT	Petroleum	Discovered at night - bull dozer set on fire, released hydraulic fluid to land only, VDOT and State Police investigating VDOT clean up area. No further action required.
05/03/06	Hawkins	Water	Failing multi-flow system used for church/antique shop/house & possibly another connection house/convenience store.
06/29/07	Charles Planck	Fish Kill	Fish kill in private pond. 12-15 dead fish.
10/26/12	Poultry Liter Storage	Agriculture	Stored poultry manure
05/17/13	Poultry litter - Wheatland area	Agriculture	Toxic odor from spread poultry litter
03/04/14	Poultry Litter Storage	Agriculture	Uncovered poultry litter storage
06/27/14	Propane Release	--	Bulldozer struck 500-gal underground propane tank, estimated 400-gal released.

Loudoun Co. Potential Pollution Sources



717 sewage disposal systems, 44 springs, and 773 wells

Loudoun Co. 2009 Stream Assessment



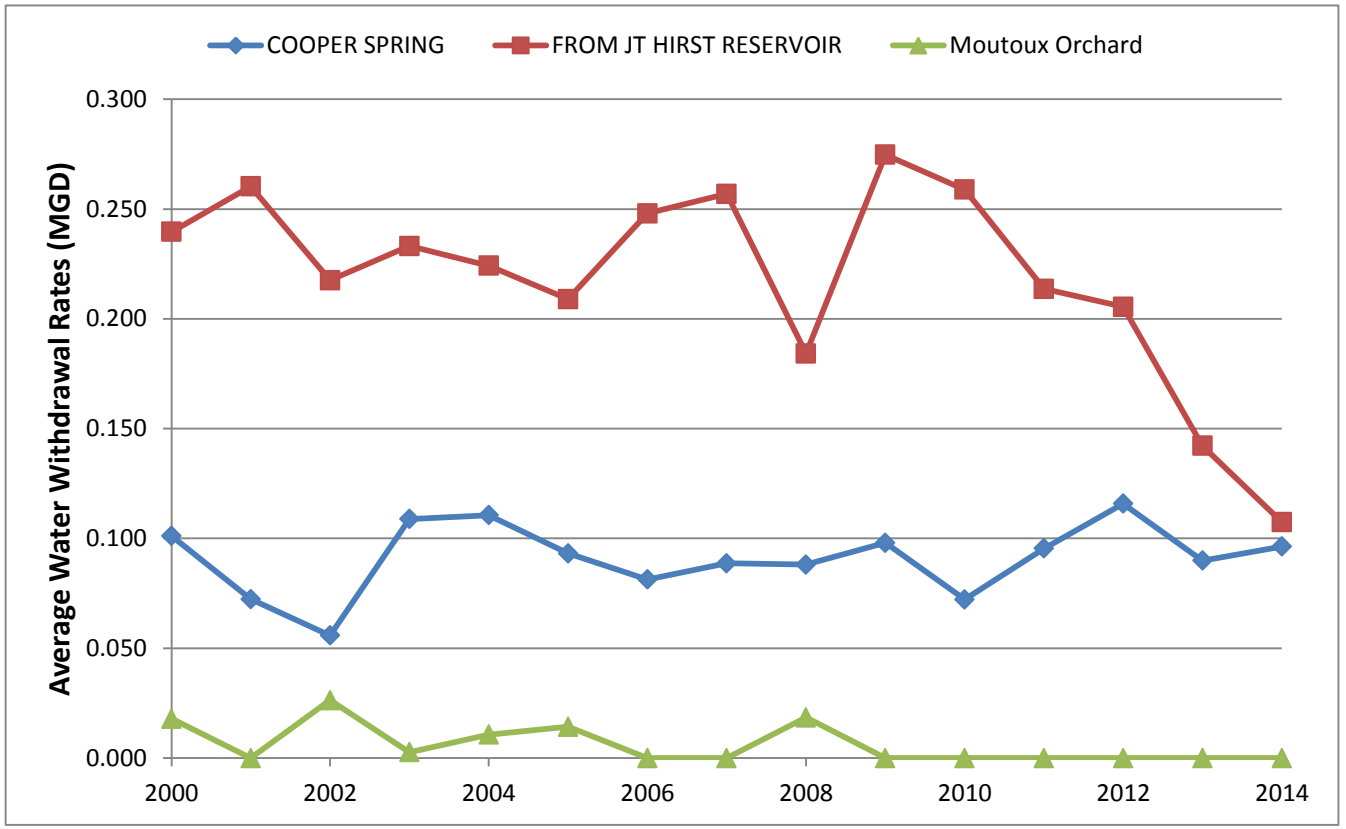
Flow/Hydrologic Modifications

- 8 dams in DCR inventory

ID	Name of Dam	Dam Owner	Classification Description	Length of Impoundment (ft)	Year Completed
10712	Godfrey Dam	M H F LLC	Significant	842	1956
10719	J.T. Hirst Dam	Town of Purcellville	Significant	600	1962
00297	Upper Godfrey Dam	M H F LLC	Significant	519	1990
00300	15164 Berlin Pike Dam	Faith & Family foundation Inc.	Low	1,754	1990
10775	Shanondale Road Dam	Williams, Michael & Gina Schaecher	Significant	575	
10776	Ashbury Church Road Dam	Baker, Daniel L	Significant	1,376	
10777	Koerner Lane Dam	Michie, Thomas H & Jean Ann R/S	Significant	561	
10731	Upper Purcellville Dam	Town of Purcellville	Significant	1,165	1940

- 2 reported water withdrawals
  - Town of Purcellville
  - Moutoux Orchards
- Town of Hillsboro water supply
- Average 10.5 days per year with no-flow at USGS 01638420 (1ANOC000.42).

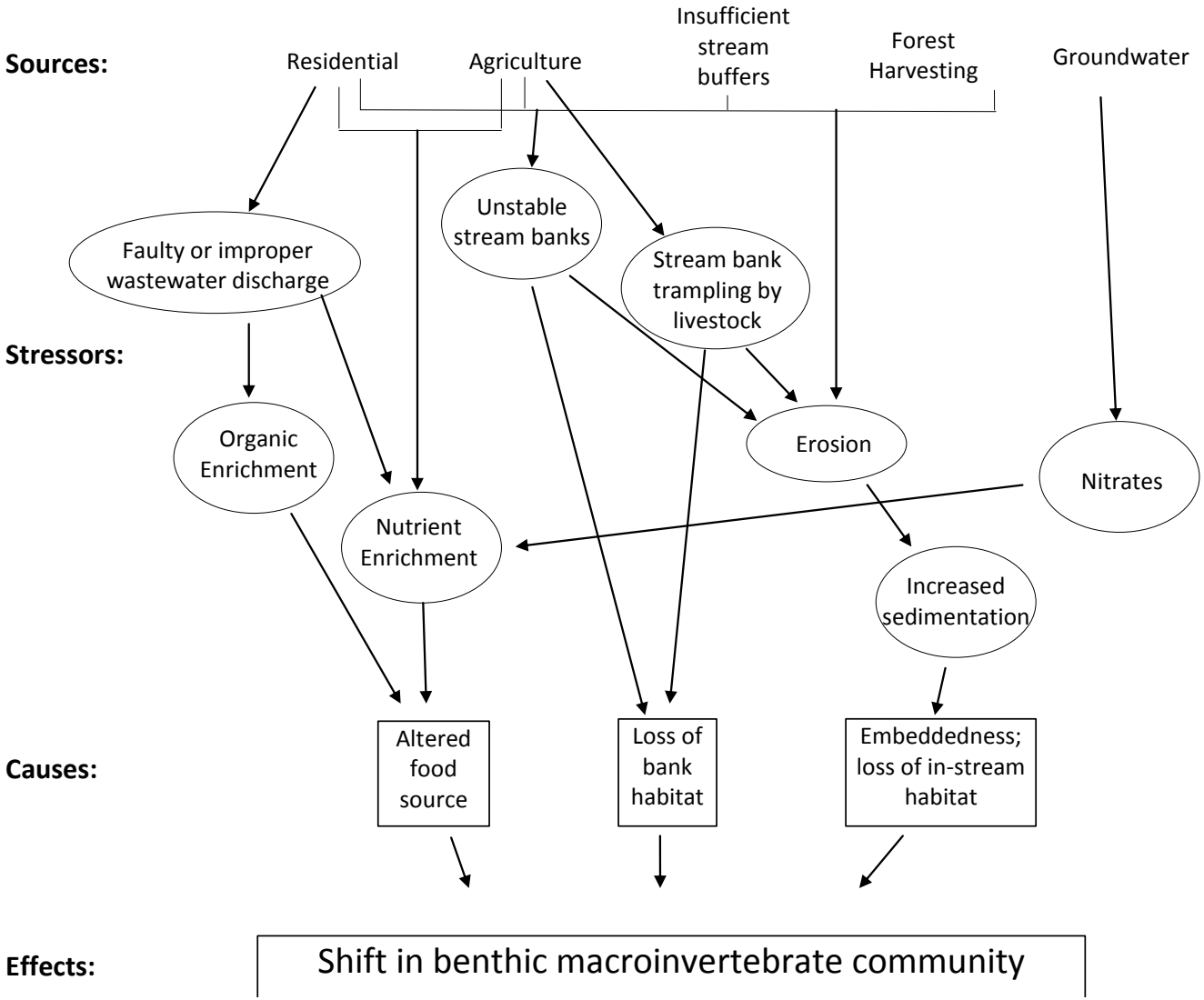
Reported Surface Water Withdrawals



Stressor Analysis

- Benthic impairment does not specify pollutant(s)
- Review existing data
- Weight-of-evidence approach
- Identify “most probable” source(s)

Interaction of Multiple Stressors



Eliminated Stressors

- Ammonia
- pH
- Temperature
- Dissolved Metals
- Toxic organic compounds

DEQ Monitoring Data

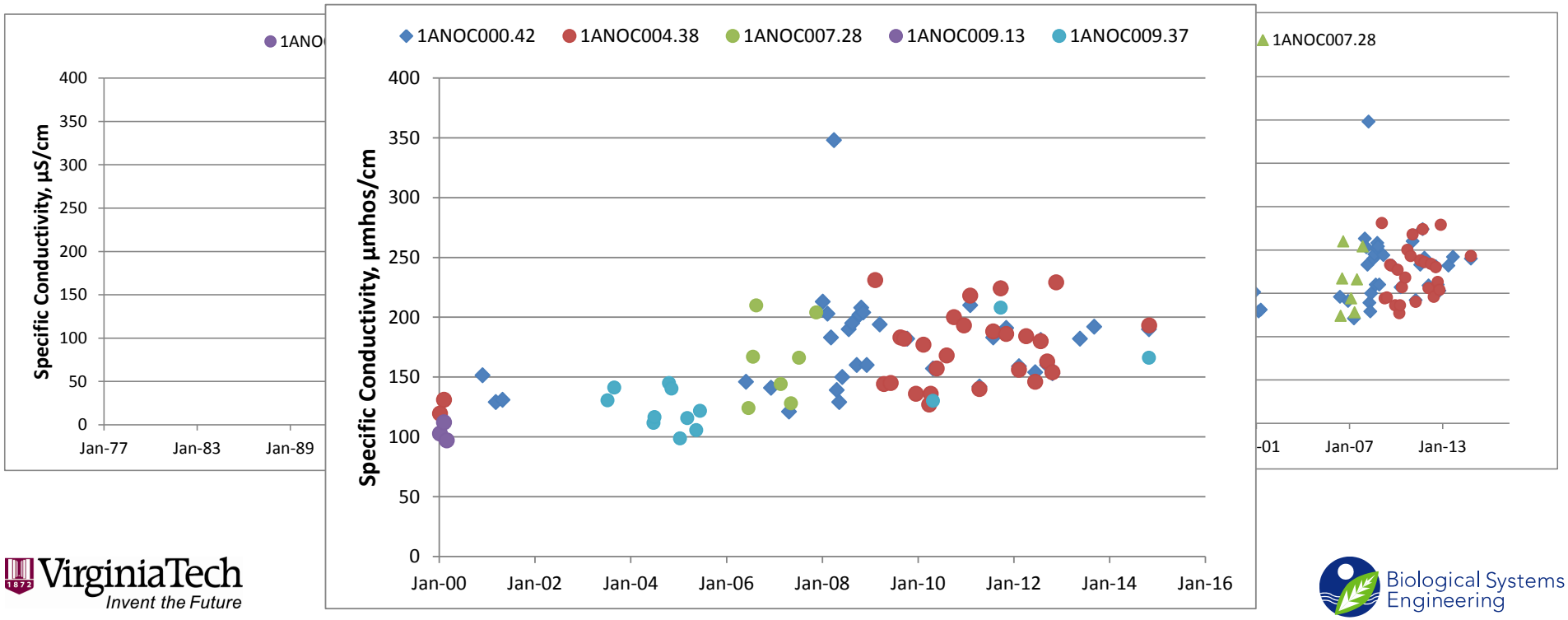
- No ammonia WQS exceedances
- No pH WQS exceedances
- No Temperature WQS exceedances
- 3 stream tests for dissolved metals (1ANOC000.42) – no exceedances of any applicable human health or aquatic life criteria
  - 05/01/07: partial suite of dissolved metals
  - 06/03/13 and 09/19/13: full suite of dissolved metals
- Toxic organic compounds
  - No suspected sources.
  - One localized minor fish kill in a pond.
  - Abundant benthic organisms and some fish.

Possible Stressors

- Ionic strength

Upper NF Catoctin Creek

Lower NF Catoctin Creek



Possible Stressors (con't.)

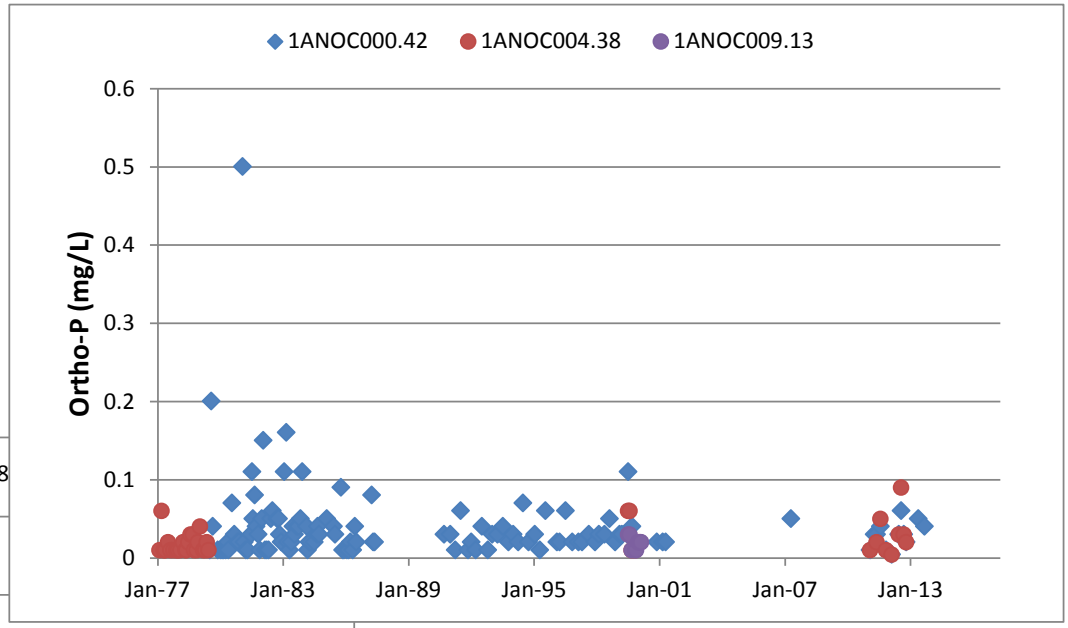
- Organic Matter
  - Dominant hydropsychids and chironomids in most benthic samples, some asellids

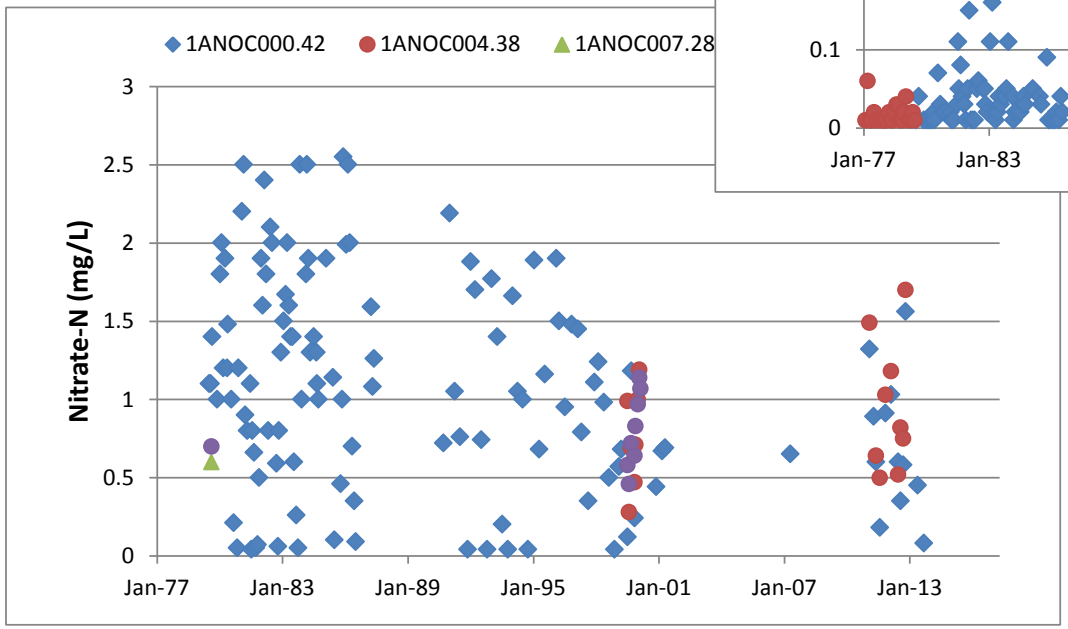
Metric	Upper	Mid	Lower
MFBI > 5	0/4	0/4	6/11
TKN:TN	0.26	0.32	0.44

  - Only 1 DO standard exceedance – lower
  - Limited BOD_5 data – only 1/11 samples above the limit of detection.

Possible Stressors (con't.)

- Nutrients





DEQ ProbMon Screening Values

- Not water quality criteria
- Useful for interpreting data

DEQ Stressor Parameters	Alternate Name	Units	Suboptimal	Optimal	Reference
Total Nitrogen	Total Nitrogen	mg/L	>2	<1	VDEQ, 2006a
Total Phosphorus	Total Phosphorus	mg/L	>0.05	<0.02	VDEQ, 2006a
Habitat Degradation	Total Habitat Score	unitless	<120	>150	USEPA, 1999
Streambank Sedimentation	LRBS siltation Index	unitless	<-1.0	>-0.5	Kaufmann, 1999
Ionic strength	TDS	mg/L	>350	<100	VDEQ, 2006b
Metals Water Column	Metals Cumulative Criterion Unit (CCU)	unitless	>2	<1	Clements, 2000

ProbMon Condition Classes– upper NFC

Parameter	Units		1ANOC009.13		Condition Class	1ANOC009.37		Condition Class	1ANOC011.74		Condition Class
			average	no. of samples	Average	average	no. of samples	Average	average	no. of samples	Average
Total dissolved solids (TDS)	mg/L	pre-2006									
		2006-2014									
Total nitrogen	mg/L	pre-2006				1.18	11	Fair			
		2006-2014									
Total phosphorus	mg/L	pre-2006	0.037	9	Fair	0.050	11	Fair	0.100	1	Suboptimal
		2006-2014									
Dissolved metals Cumulative Criterion Unit (CCU)	unitless	2006-2014									
Total Habitat	unitless	2006-2014				158.00	4	Optimal			
Relative Bed Stability (LRBS)	unitless	2006-2014				0.247	1	Optimal			
Summary Statistics											
Suboptimal					0			0			1
Fair					1			2			0
Optimal					0			2			0
Total No. of Metrics					1			4			1

ProbMon Condition Classes– lower NFC

Parameter	Units		1ANOC000.42		Condition Class	1ANOC004.38		Condition Class	1ANOC007.28		Condition Class
			average	no. of samples	Average	average	no. of samples	Average	average	no. of samples	Average
Total dissolved solids (TDS)	mg/L	pre-2006									
		2006-2014	70.00	1	Optimal						
Total nitrogen	mg/L	pre-2006									
		2006-2014	0.98	1	Optimal	1.16	12	Fair	1.35	7	Fair
Total phosphorus	mg/L	pre-2006	0.117	112	Suboptimal	0.053	7	Suboptimal	0.100	2	Suboptimal
		2006-2014	0.072	13	Suboptimal	0.048	22	Fair	0.104	7	Suboptimal
Dissolved metals Cumulative Criterion Unit (CCU)	unitless	2006-2014	0.59	2	Optimal						
Total Habitat	unitless	2006-2014	114.55	11	Suboptimal	133.75	4	Fair			
Relative Bed Stability (LRBS)	unitless	2006-2014	-0.520	1	Fair	0.586	1	Optimal			
Summary Statistics											
Suboptimal					3			1			2
Fair					1			3			1
Optimal					3			1			0
Total No. of Metrics					7			5			3

1ANOC000.42: (2011-2013) TN = NO3-N + NO2-N + TKN
Average = 1.19 mg/L (n=13) "Fair"

Possible Stressors (con't.)

- Nutrients
  - Loudoun County Comparison

	Sampling Period	EPA Guidance Thresholds	
		N > 0.69 mg/L	P > 0.037 mg/L
county-wide	2013	85%	41%
upper NFC	2000-2006	100% (n=11)	50% (n=14)
mid NFC	2009-2014	95% (n=19)	84% (n=24)
lower NFC	2000-2014	100% (n=1)	81% (n=16)

  - DEQ Probabilistic Monitoring (ProbMon) Condition Class Ratings

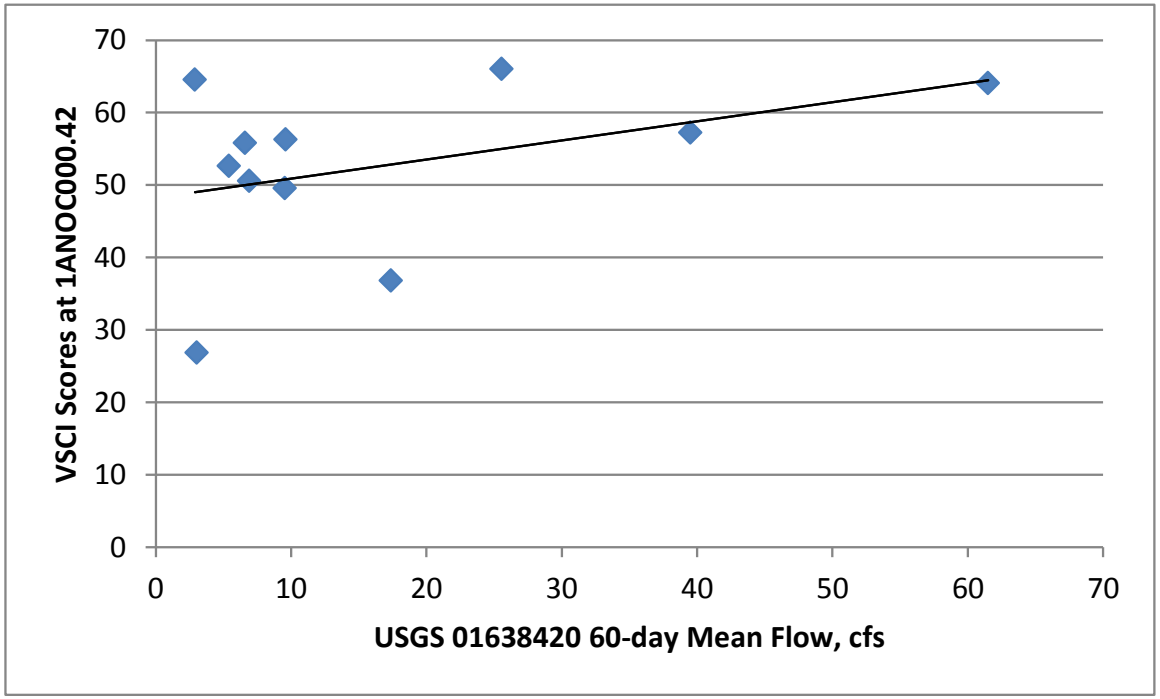
		TN	TP
Upper NFC	pre-2006	Fair	Fair
	2006-2014	--	--
Mid NFC	pre-2006	--	Suboptimal
	2006-2014	Fair	Fair - Suboptimal
Lower NFC	pre-2006	--	Suboptimal
	2006-2014	Fair	Suboptimal

Possible Stressors (con't.)

- Nutrients (con't.)
  - Abundance of nutrient-loving organisms
  - Direct deposition from livestock in stream
  - Observed algae and sewage odor (1ANOC004.38 on 12/03/12)
  - 1 DO exceedance (2.5 mg/L at 1ANOC000.42 on 08/10/11)

Most Probable Stressors

- Hydrologic Modifications/Flow
  - Correspondence between VSCI scores and 60-day mean flow – lower NFC



Hydrologic Modifications (con't.)

- Correspondence between VSCI and "no-flow" periods – upper NFC and lower NFC

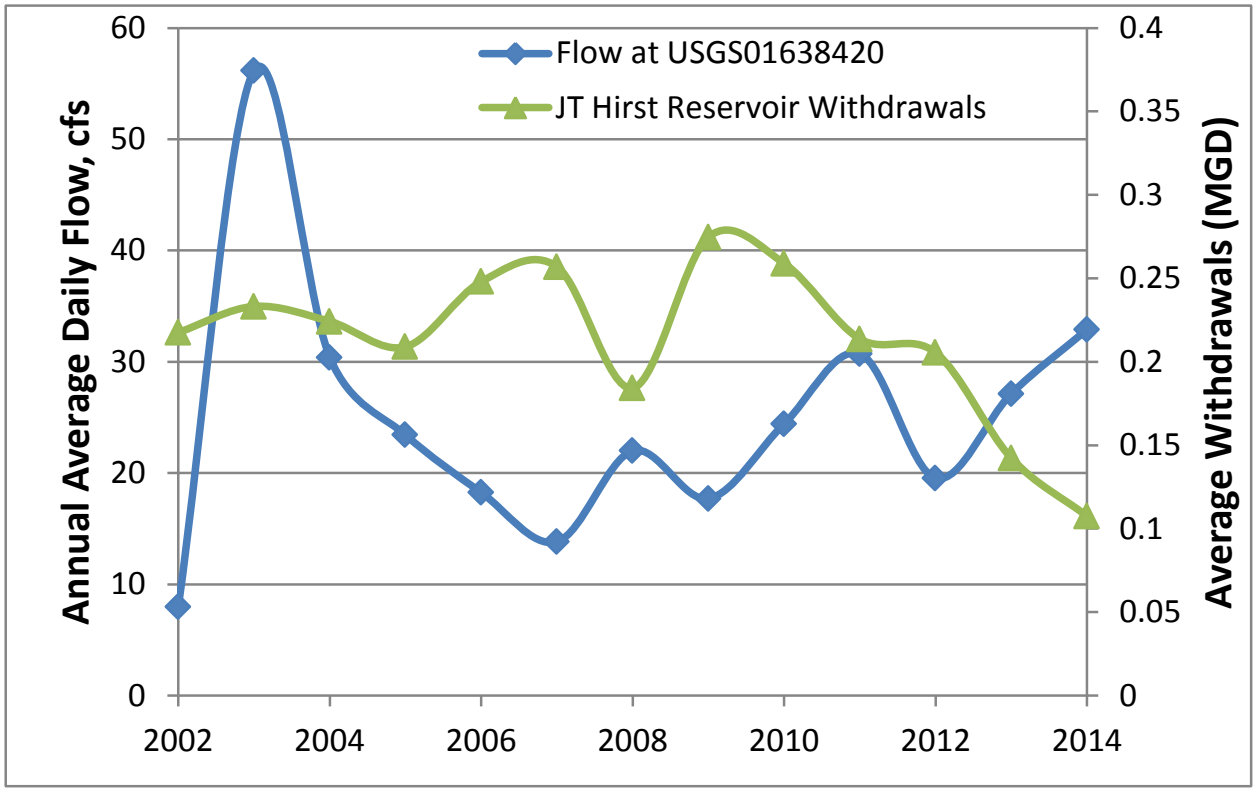
Year	No. Days with No Flow	Dry Months	VSCI Scores					
			1ANOC000.42		1ANOC004.38		1ANOC009.37	
			Spring	Fall	Spring	Fall	Spring	Fall
2001	0							
2002	**37**	Aug, Sept						
2003	0							
2004	0							
2005	0							
2006	0		49.5	66.0				
2007	**47**	Sept, Oct	57.2	NS				
2008	0		**36.8**	50.6				
2009	0		55.8	64.5				
2010	**26**	Sept	64.1	**26.9**			74.7	**59.7**
2011	0		NS	56.3		61.7	NS	55.6
2012	0		NS	NS	66.1	65.4	NS	NS
2013	0		NS	NS	NS	NS	NS	NS
2014	0		NS	52.6	NS	51.8	NS	59.0

NS = no sample taken, after the initiation of biological monitoring at each site.

Values are high-lighted in red for Fall and Spring samples that followed no-flow periods.

Hydrologic Modifications (con't.)

- Increasing annual flow with decreasing withdrawals since 2009 – lower NFC



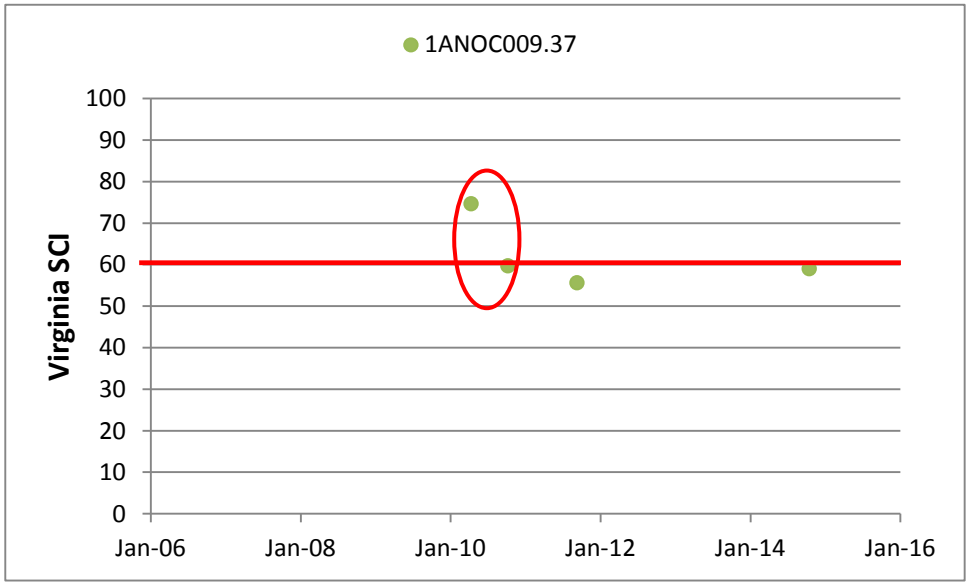
Most Probable Stressors (con't.)

- Sediment

Metric	Upper	Mid	Lower
Habitat "poor" or "marginal"			
embeddedness	0/4	1/4	1/11
bank stability	0/4	3/4	9/11
vegetative protection	0/4	0/4	9/11
riparian vegetative zone width	2/4	0/4	10/11
sediment deposition	0/4	2/4	10/11
LRBS Siltation Index metrics			
percent sand & fines	11%	19%	53%
embeddedness	44%	54%	76%
LRBS rating	optimal	optimal	fair
livestock in-stream	2	2	3

Summary

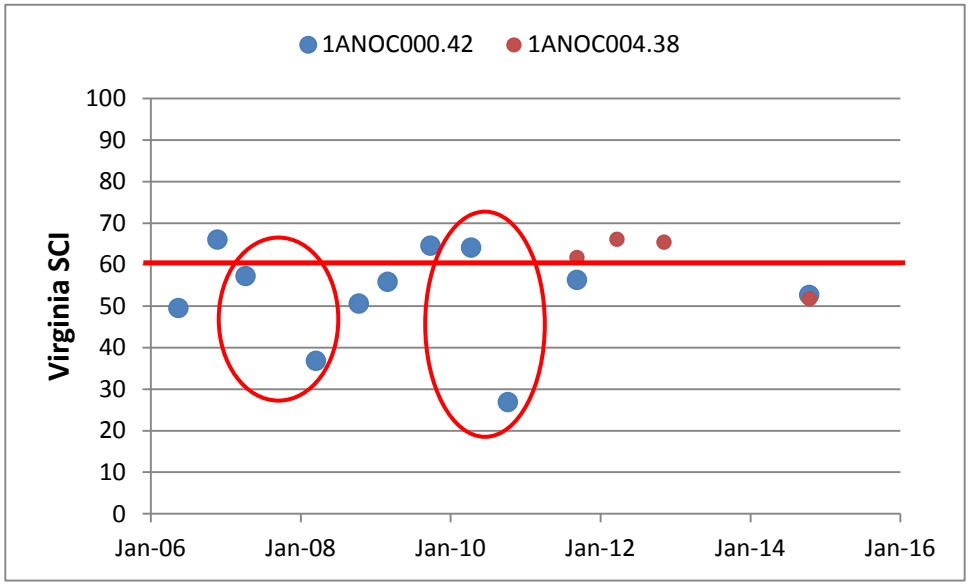
- Upper NF Catoctin Creek (VAN-A02R_NOC03A02)
  - Benthic impairments solely related to low-flow conditions.



  - Recommend reclassification as a Category 4C water.
  - No TMDL required – impairment is not caused by a pollutant.

Summary (con't.)

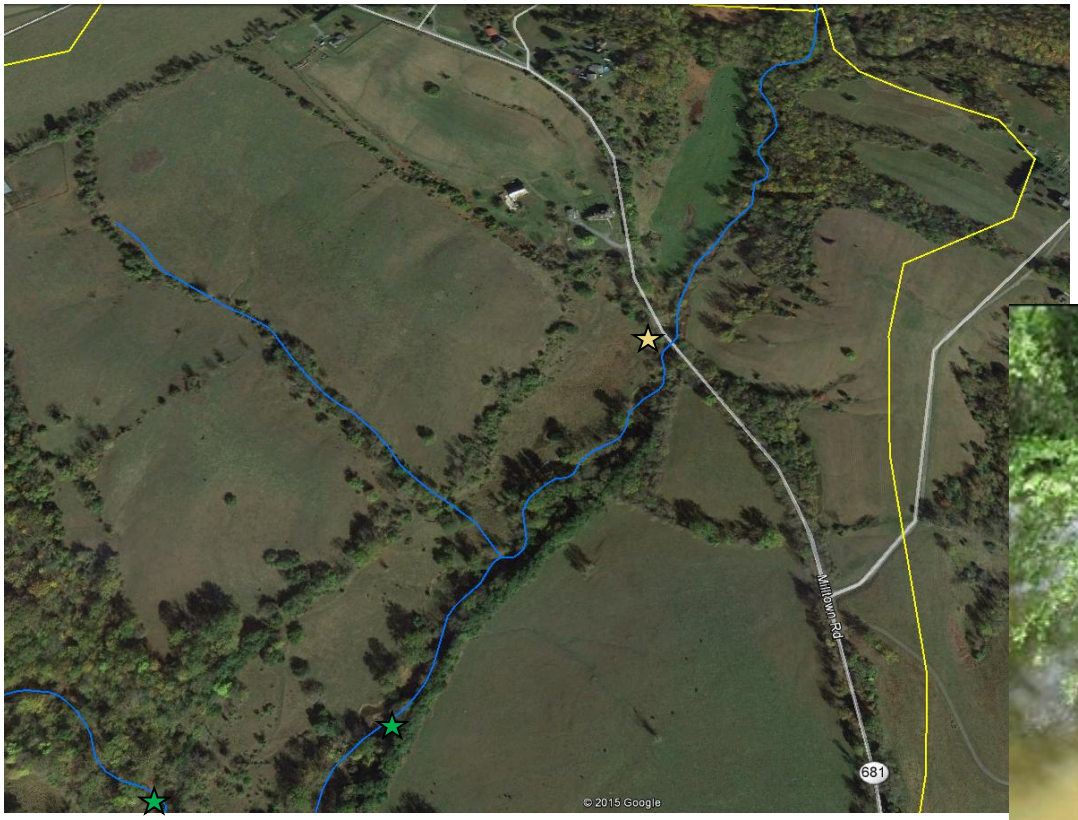
- Lower NF Catoctin Creek (VAN-A02R_NOC01A00)
  - Some VSCI scores affected by low-flow periods



  - But sediment is another "most probable stressor" during other flow conditions.
  - Recommendation: develop TMDL for sediment.

Pro-active Opportunities

- Remove livestock from creeks

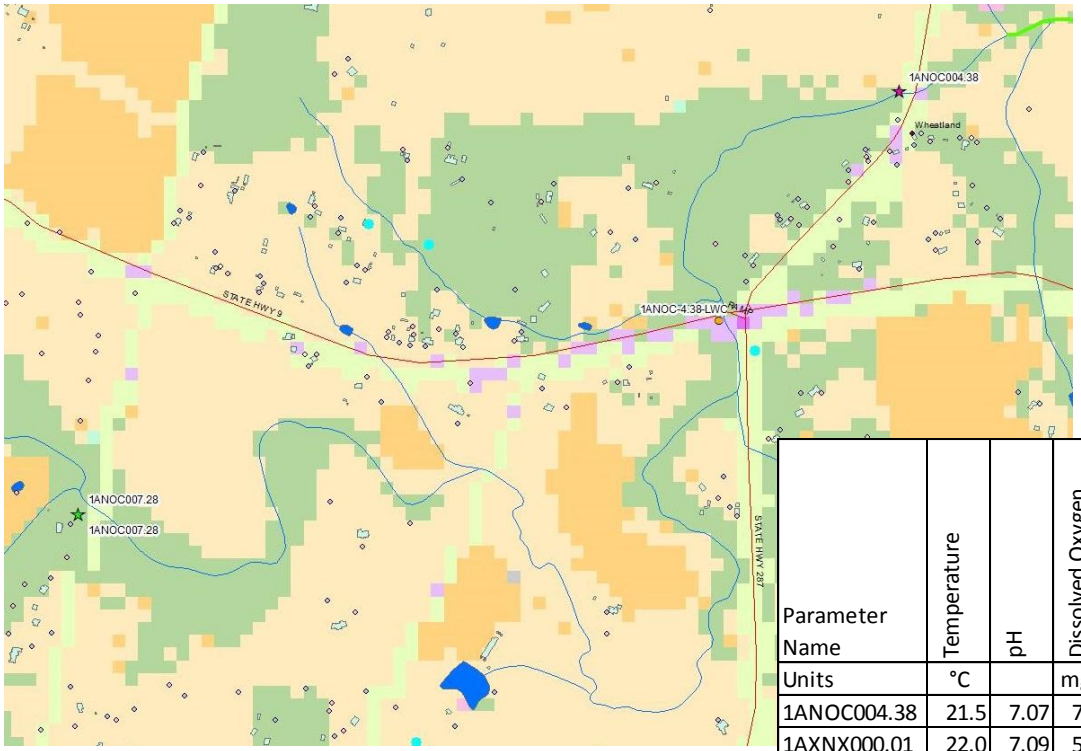


Loudoun Co. 2009 Stream Assessment observations

1ANOC000.42

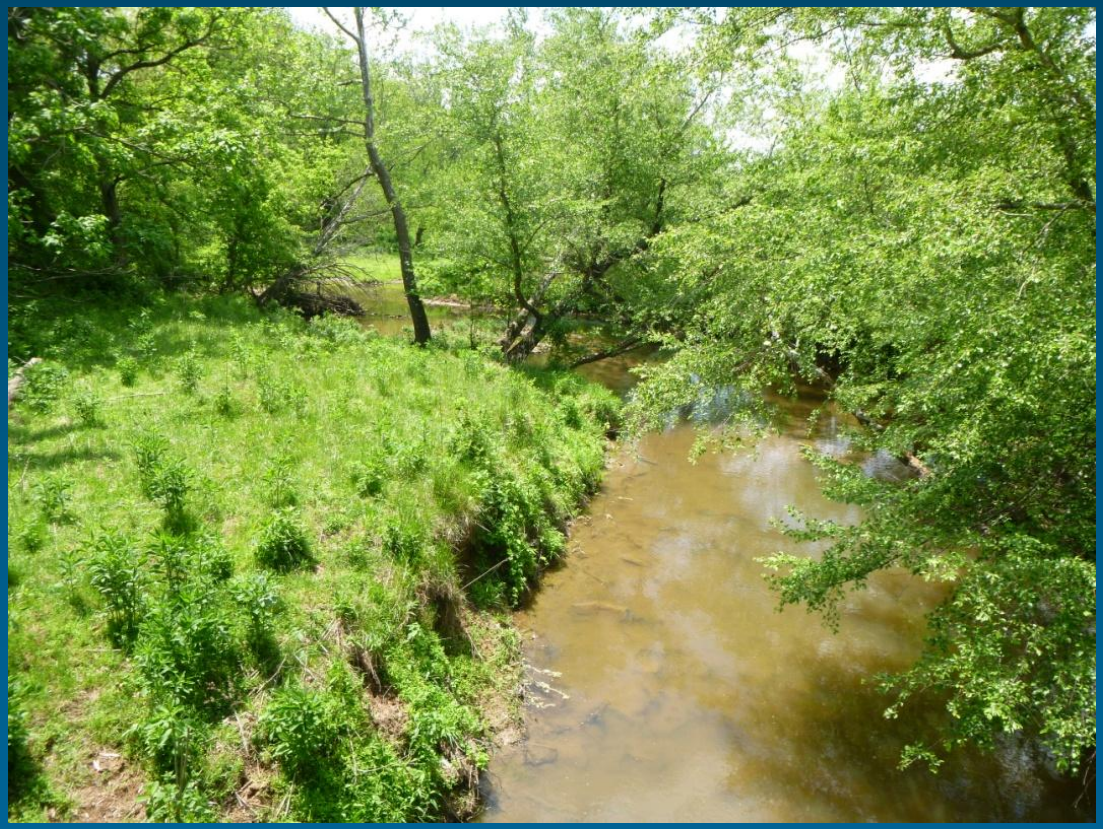
Pro-active Opportunities (con't.)

- Synoptic sampling to possibly isolate nutrient sources



Parameter Name	Temperature	pH	Dissolved Oxygen	Specific conductance	Ammonia-N	Nitrite-N	Nitrate-N	TKN	Total Phosphorus	Orthophosphate-P	*E. coli*	
Units	°C		mg/L	µS/cm	mg/L						cfu/100 mL	
1ANOC004.38	21.5	7.07	7.77	139	0.05	0.02	0.92	0.60	0.07	0.03	243	downstream
1AXNX000.01	22.0	7.09	5.98	279	0.03	0.004	0.14	0.40	0.05	0.02	86	tributary
1ANOC004.98	22.1	7.21	7.92	135	0.05	0.03	0.91	0.70	0.07	0.03	464	upstream

Stressor Analysis Conclusions



Address the benthic impairment in the lower segment by developing a sediment TMDL

Benthic TMDLs

Stressor Analysis

- Data gathering and watershed information
- Identification of most probable stressors

Target completion date – September 2015

TMDL

- Modeling and establishment of endpoints for pollutant stressors
- Determination of loads and reductions

Target completion date – Summer 2016

Implementation

- TMDL requirements implemented through permits for point source discharges
- Plans may be developed to address non-point sources
  - Collaborative process between stakeholders
  - Identification of best management practices and funding sources to address TMDL reductions

Next Steps

- Present stressor analysis information to the public

  First Public Meeting
  Monday, August 3, 2015 6:00 pm
  Purcellville Library – Robey Meeting Room
  9000 Burke Lake Road, Burke, VA 22015-1683
  703-978-5600

  Comment period ends September 2, 2015

Questions? Comments?

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