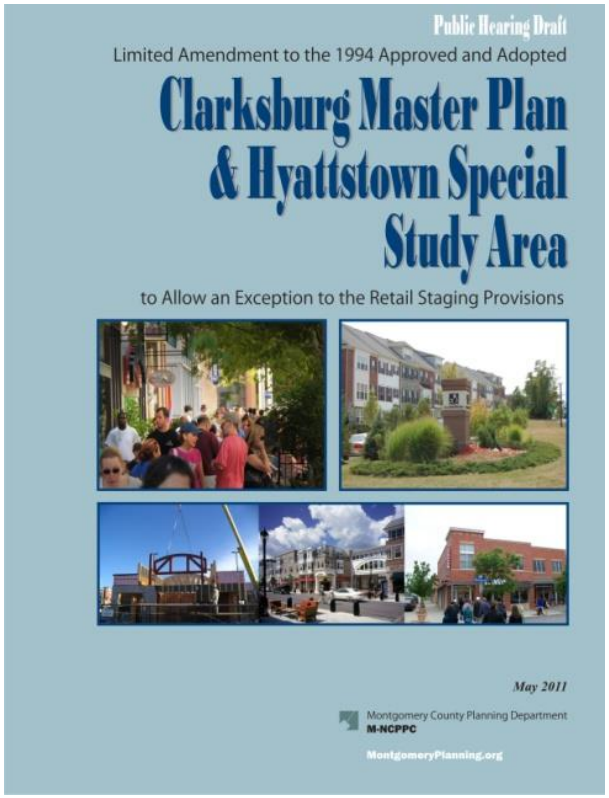
10 Mile Creek Area Limited Amendment



Planning Board Worksession
March 14, 2013

10 Mile Creek Area Limited Amendment

Agenda

- Introductions
- Schedule/process/public involvement
- Existing 10 Mile Creek watershed conditions
- Scenario 1 - 1994 Master Plan
- SWM/ESD what has changed between 1994 and today
  - Current practices
  - Research results
- Break
- Scenario analysis tools
- Review 1994 Plan Analysis Results
- Discussion

10 Mile Creek Area Limited Amendment

Environmental Team

Brown and Caldwell/Biohabitats/Center for Watershed Protection

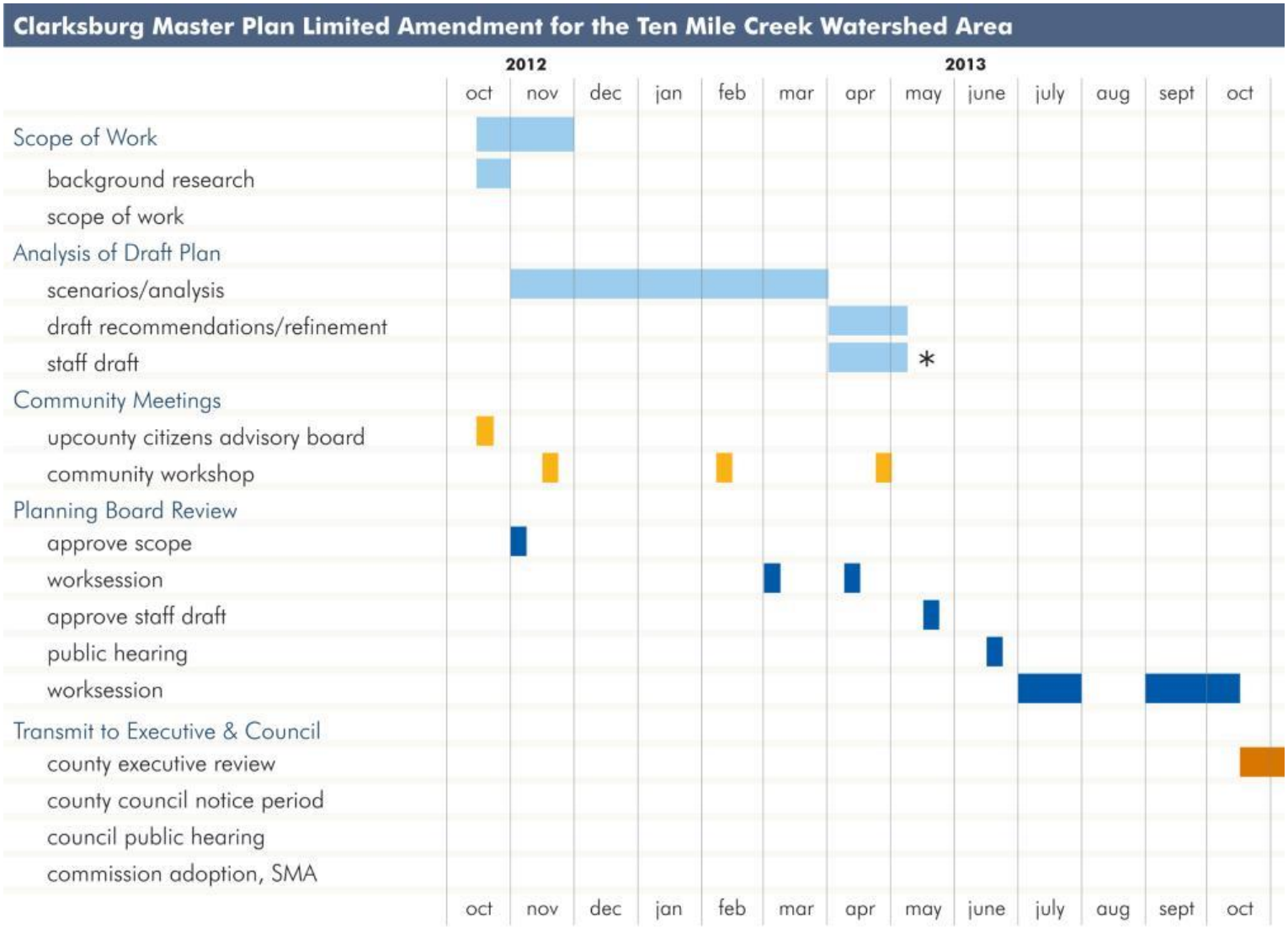
- Analyze current conditions - natural resources and water quality
- Model potential impacts of development
- Recommend protective measures, guidance for development, and ways to mitigate potential impacts

Government agencies

- Department of Environmental Protection
- Department of Permitting Services
- Environmental Protection Agency
- U.S. Geological Survey

10 Mile Creek Area
Limited Amendment

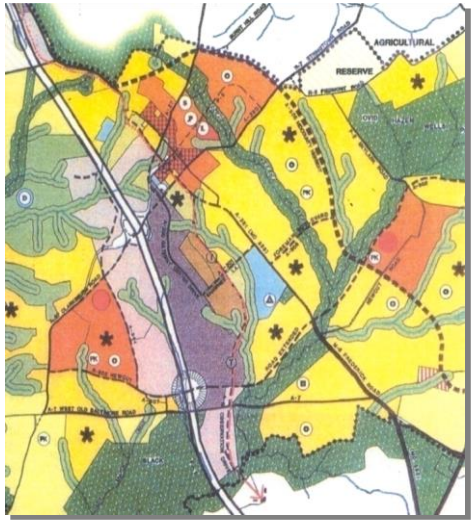
Schedule



10 Mile Creek Area Limited Amendment

Project Parameters

- Limited to the Ten-Mile Creek watershed
- Involve the public
- Commitments regarding Town Center remain intact - protect the vision while protecting stream quality
- Do not make land use or zoning changes outside the area and do not affect approved development
- Adequately protect creeks
- Base planning decisions on science
- Consider scenarios that include impact avoidance, mitigation and offsets, and guidelines to arrive at recommendations



10 Mile Creek Area Limited Amendment

Public Involvement

- Upcounty Citizen Advisory Board
- Clarksburg Civic Association
- Meetings with key property owners and consultant teams
- Two community workshops – over 200 participants

10 Mile Creek Area Limited Amendment

Priority Topics

Community Building

- Provide promised town center services
- Protect the historic district
- Provide parkland
- Maintain a rural agricultural nature

Environment

- Protect water quality, Ag Reserve and wildlife habitats
- Protect Ten Mile Creek and the lake
- Protect forest cover
- Apply improved environmental technologies
- Balance development and environment
- Negotiate flexibility on locations

10 Mile Creek Area Limited Amendment

Priority Topics

Transportation

- Improve walkability
- Too auto dependent
- No transit = no development
- Bicycle lanes on Clarksburg Rd.
- Provide a sufficient flow of traffic

Economy

- Ensure town center is viable
- Support additional development
- Provide stores, restaurants and employment
- Limit retail to a town scale - similar to Kentlands
- Measured residential growth and businesses

10 Mile Creek Area Limited Amendment

Public Concerns

ESD is an experiment, it is untested, and has not been done in the County or elsewhere in the country

- It is not an experiment and it has been done, even here in Montgomery County
- To our knowledge it has not been applied to an entire watershed and with a full scientific analysis
- It does some things very well but it cannot replicate all the natural environments (and their functions) within Ten Mile Creek
- Its efficiency is related to how well it is maintained

10 Mile Creek Area Limited Amendment

Key Questions

How do we balance policies that support the 1994 plan vision?

- Clarksburg at a town scale and with a transit orientation
- Protection of natural features
- Importance of I-270 high tech corridor with employment options

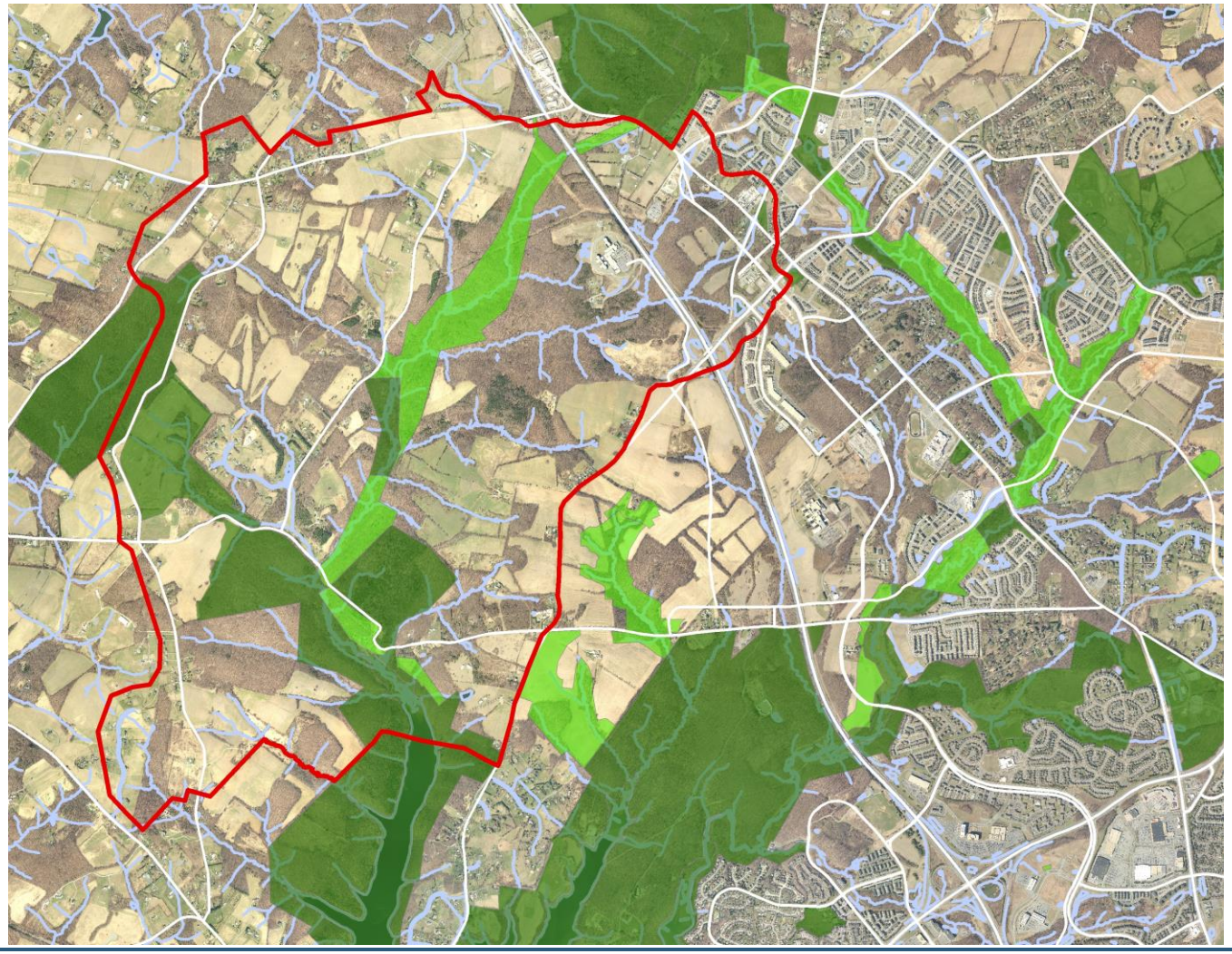
How significantly could the watershed be impacted by development?

How well can those impacts be mitigated?

What constitutes an acceptable level of stream quality decline?

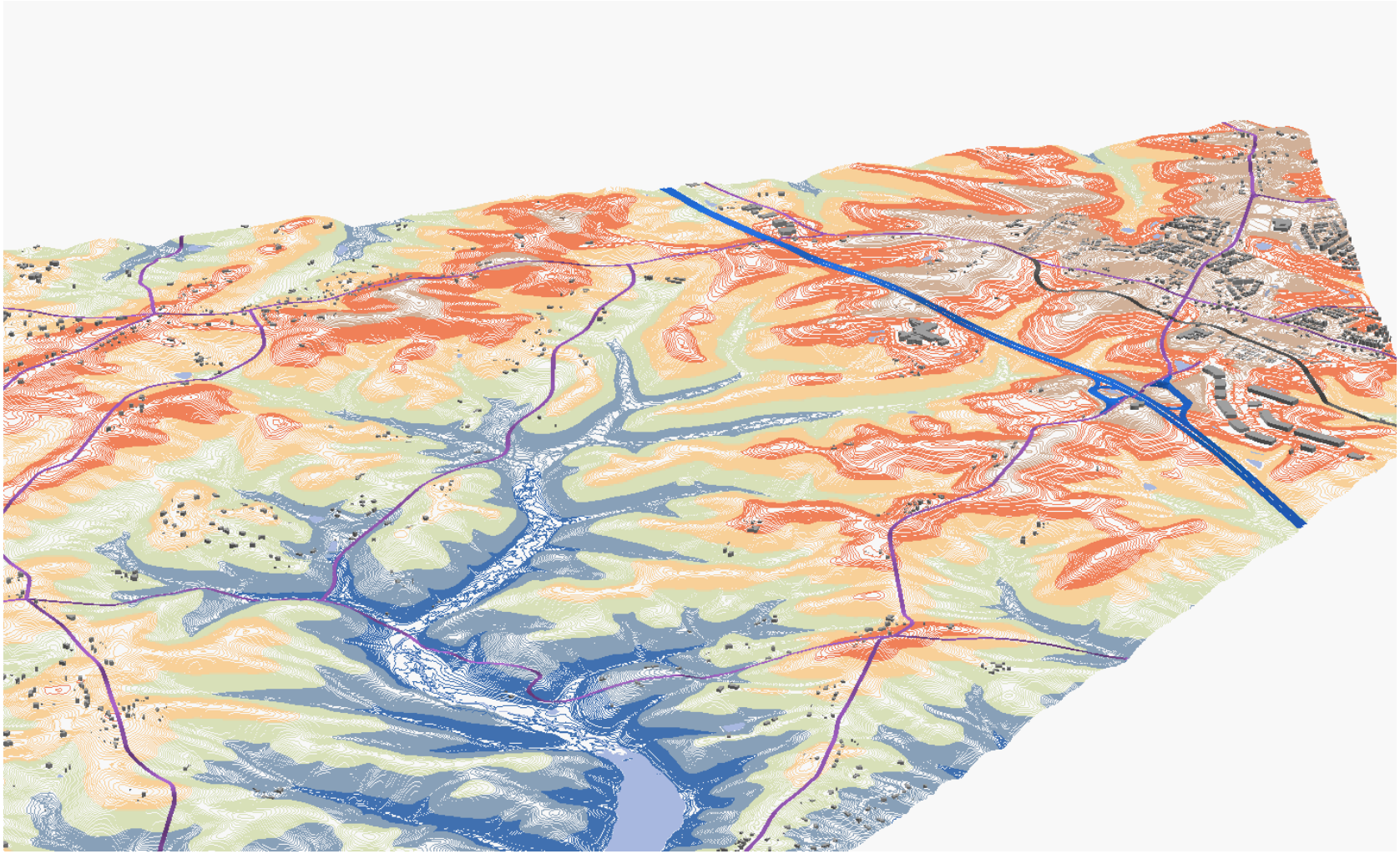
What other development options should be considered?

Orientation



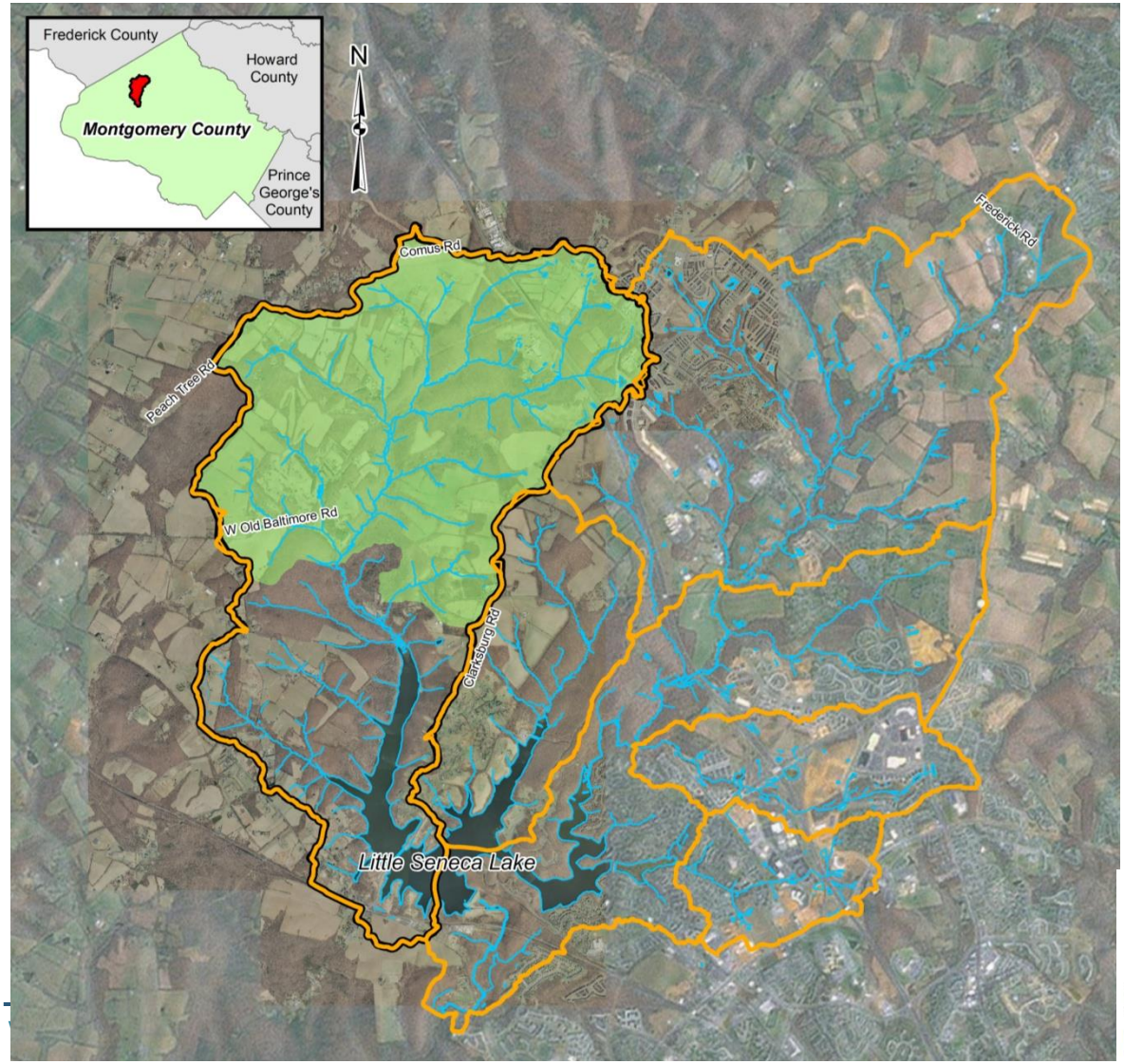
10 Mile Creek Area
Limited Amendment

Isometric Topography



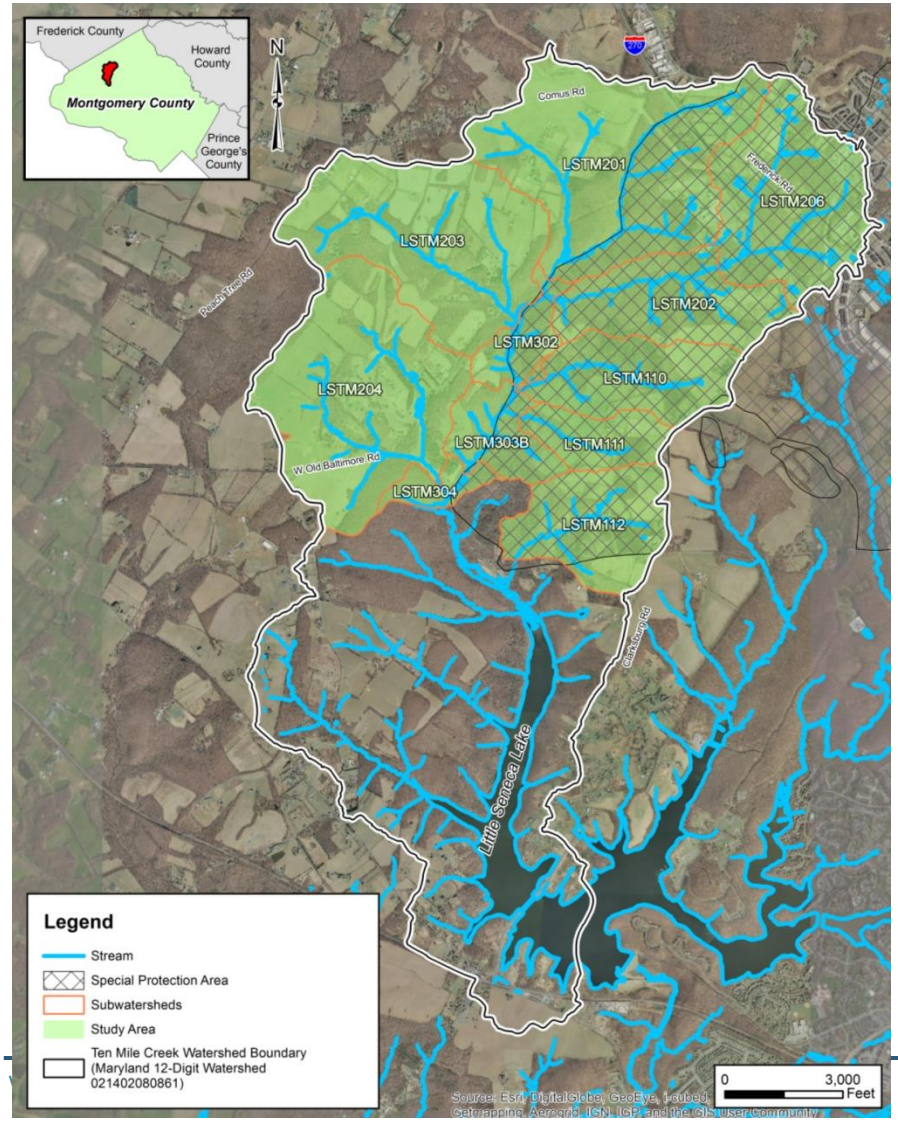
10 Mile Creek Area Limited Amendment

Little Seneca Lake & 10 Mile Creek



- Originates just north of Frederick Road
- Drains to Little Seneca Lake
- 4.8 square miles with 22 miles of stream
- Dominated by forest cover & agricultural land uses west of I-270
- Eastern portion within Clarksburg Special Protection Area (SPA)

Understanding Existing Conditions



Land Use and Land Cover

Community Features

- Existing Infrastructure
- Stormwater Management

Natural Features

- Hydrology
- Geomorphology
- Water Quality
- Habitat
- Biology

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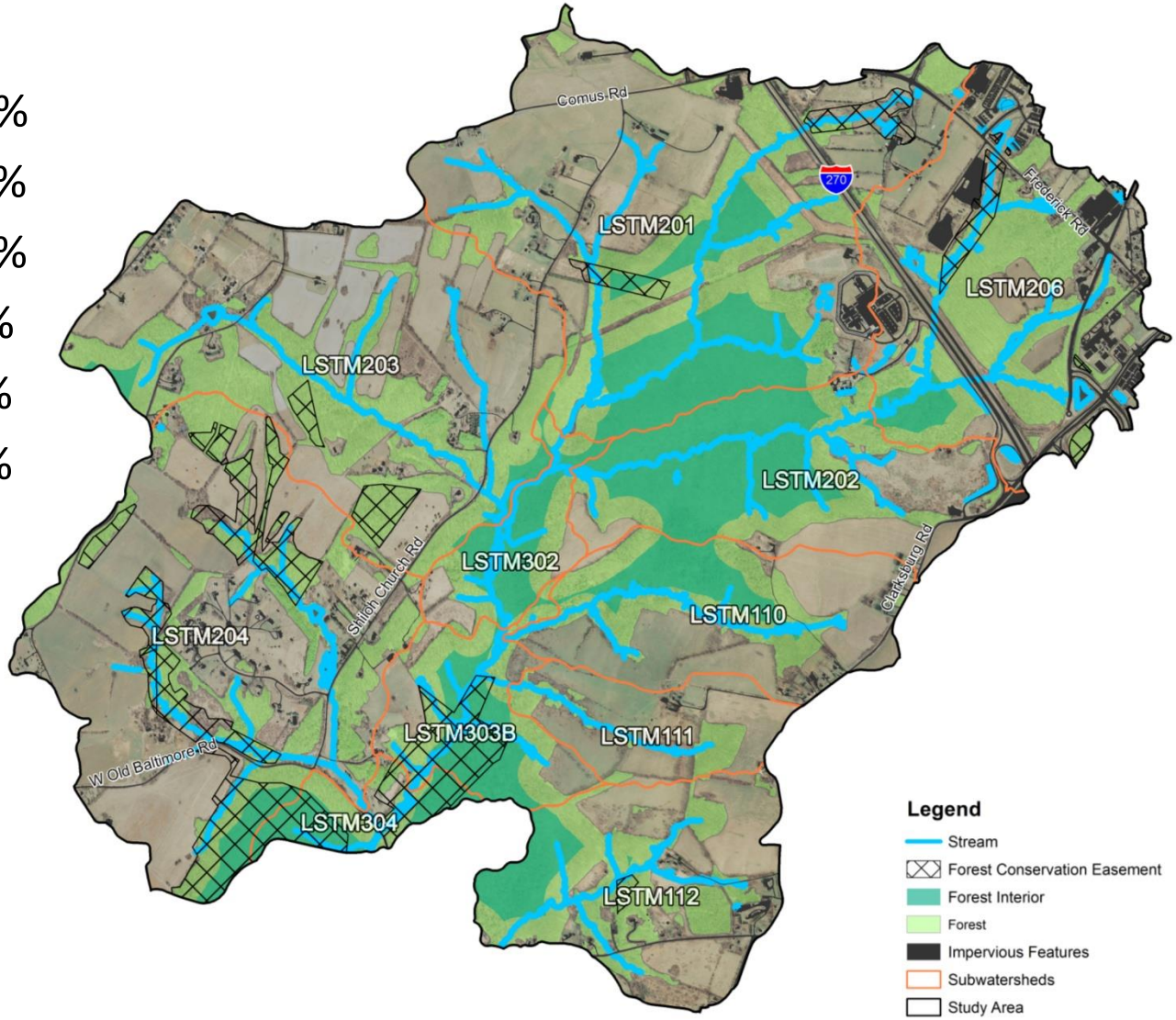
Existing Land Cover

Forest	46%
Cropland & Pasture	38%
Other Pervious	10%
Imperviousness	4%
Bare Ground	1%
Water & Wetlands	1%



10 Mile Creek Area Limited Amendment

Existing Imperviousness

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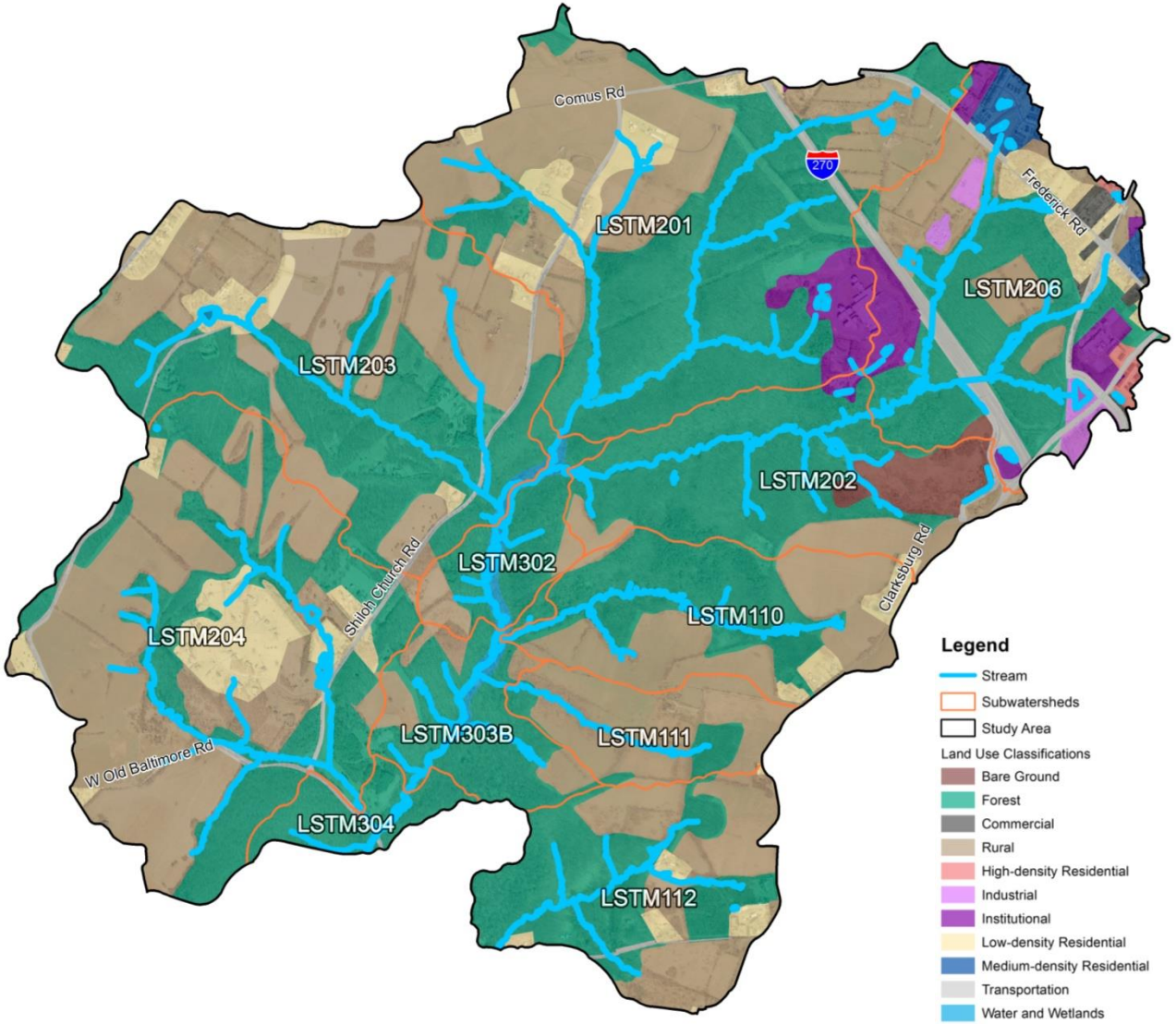
Existing Land Use

Forest	46%
Rural	38%
Low Density Res.	7%
Transportation	3%
Institutional	2%
Bare Ground	1%
Water & Wetlands	1%
Medium Density Res.	1%
Industrial	1%
Commercial	<1%
High Density Res.	<1%



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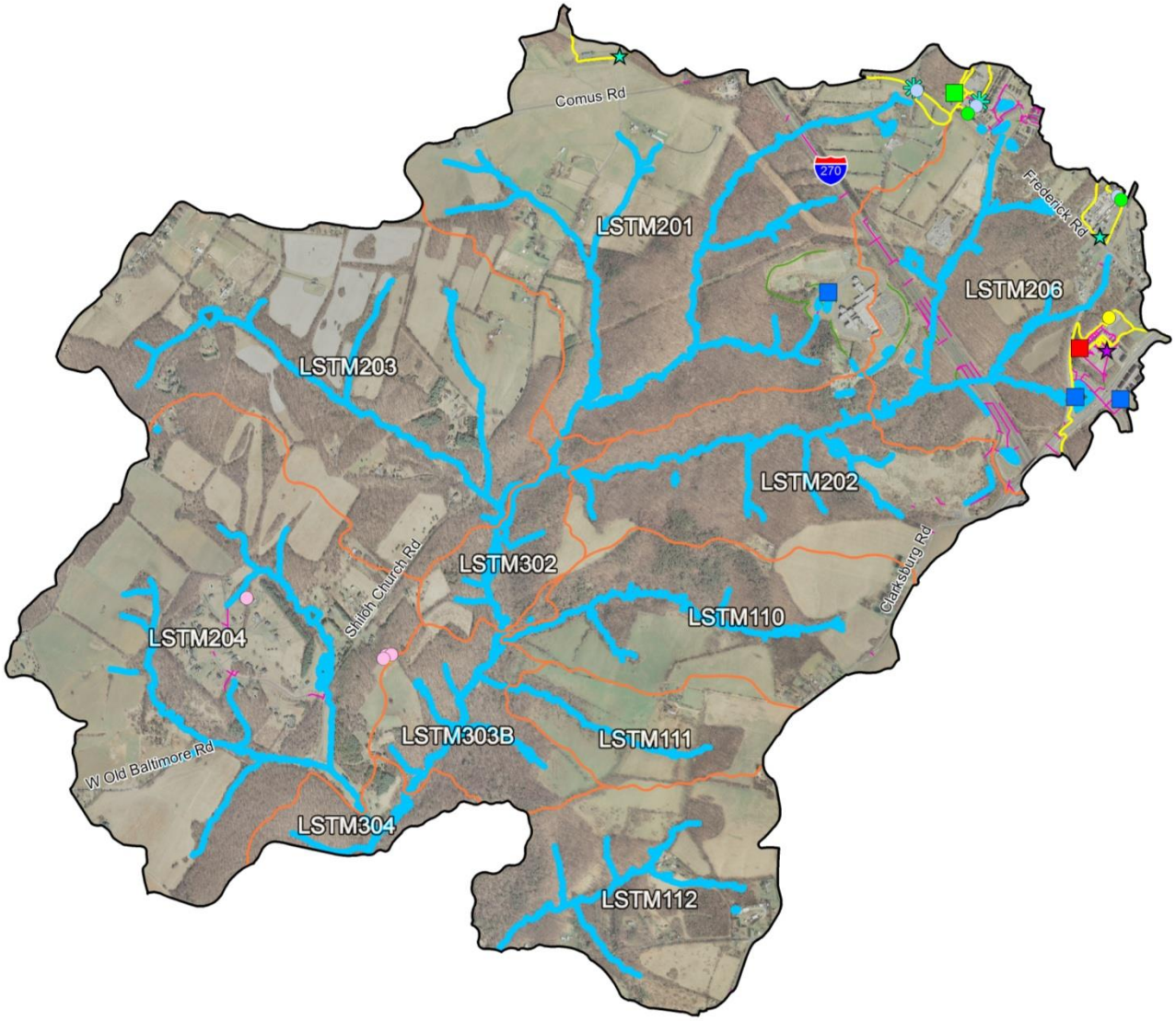
Stormwater Management



Legend

Stormwater Facilities

- Bioretention, Quality Control
- Dry Well
- Flow Splitter
- InfiltrationTrench
- InfiltrationTrench, Underground
- Oil/ Grit Separator
- Pond - Dry Extended Detention
- Pond - Wet Extended Detention
- Sand Filter
- Underground Detention

- Stormwater Channel
- Stormwater Pipe
- Stormwater Facilities Drainage Areas
- Stream
- Subwatersheds
- Study Area

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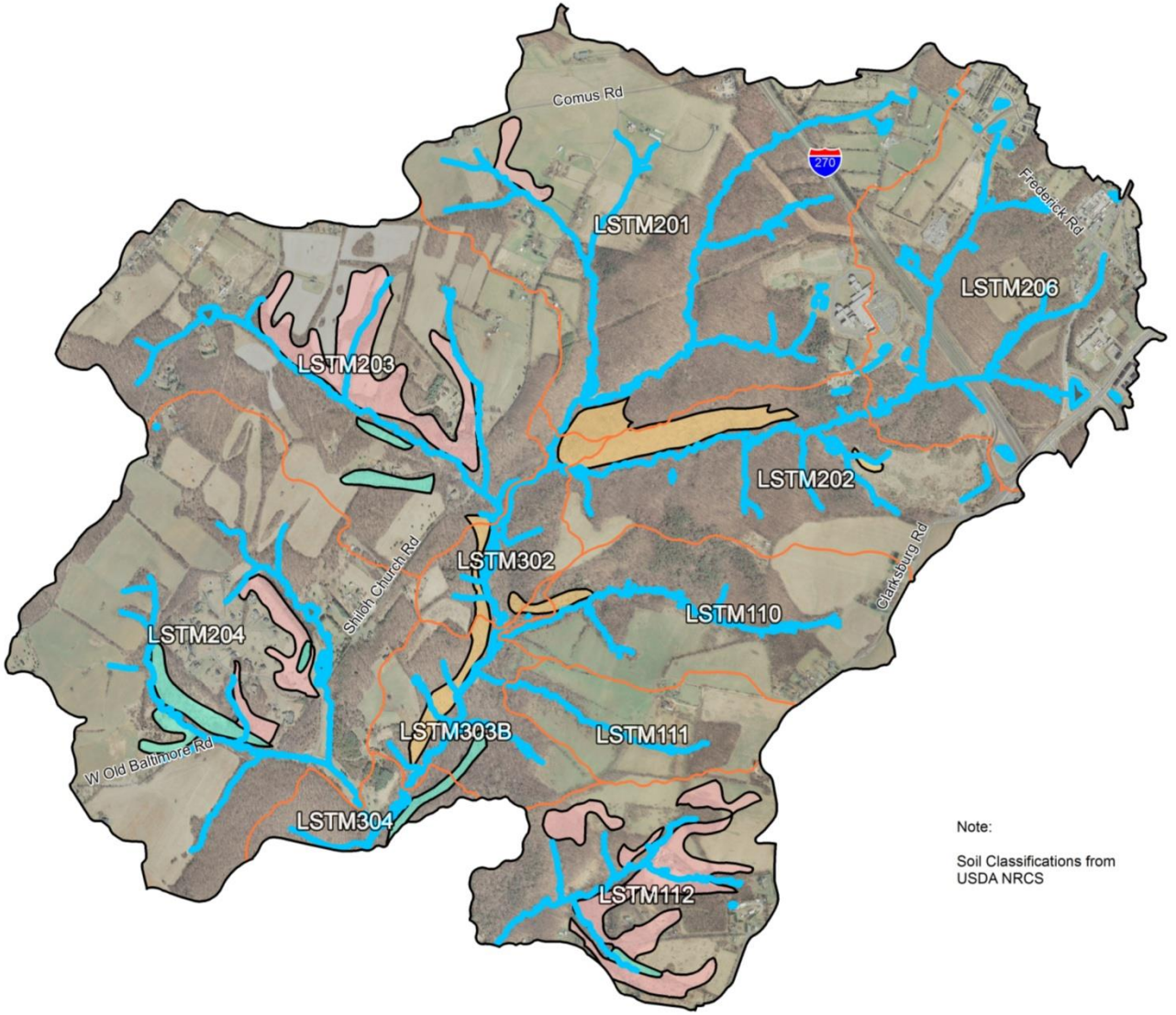
Topography, Geology & Soils

Steep slopes

Shallow bedrock

Erodible soils



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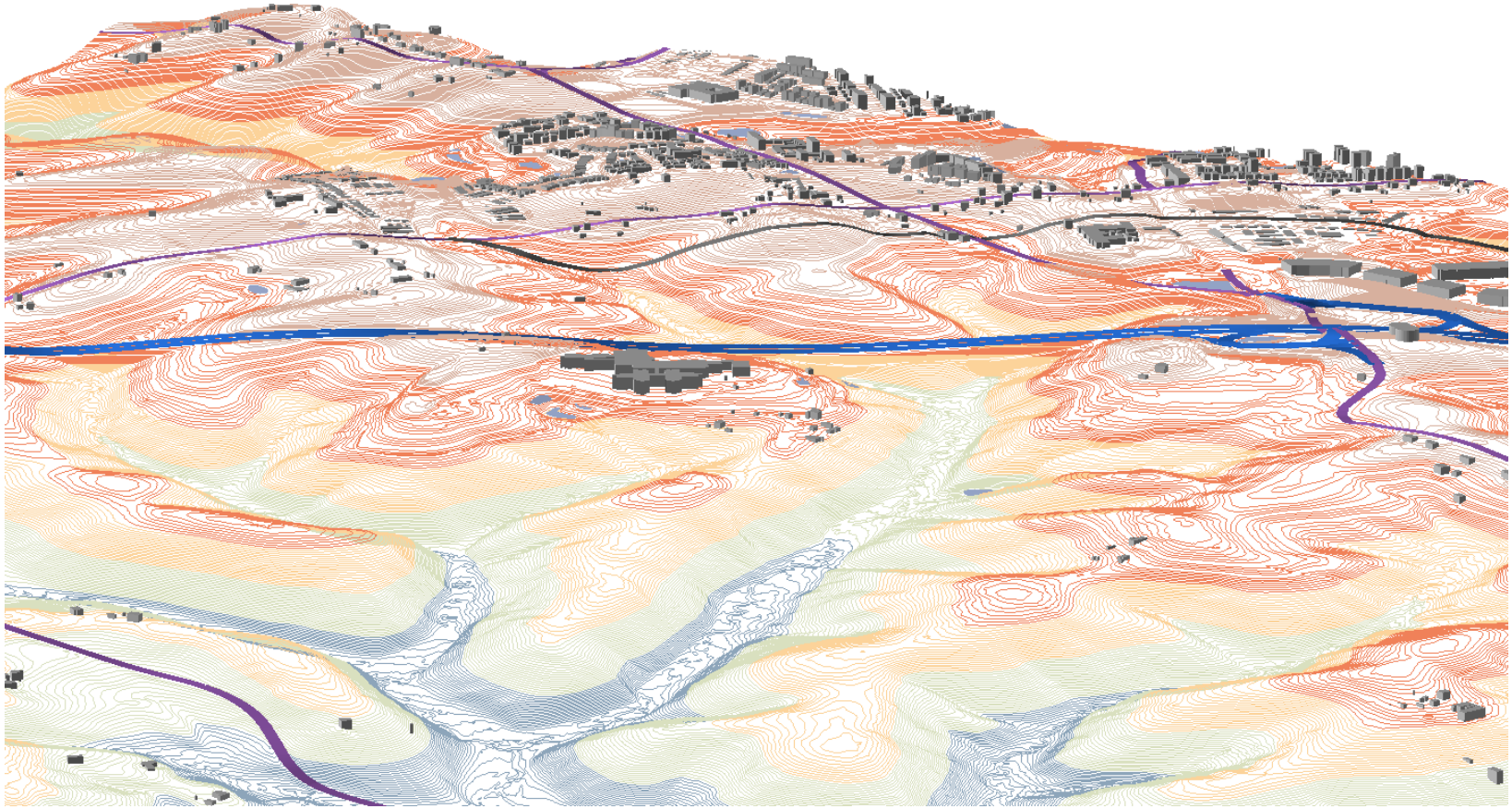
Limited Amendment

Topography, Geology & Soils



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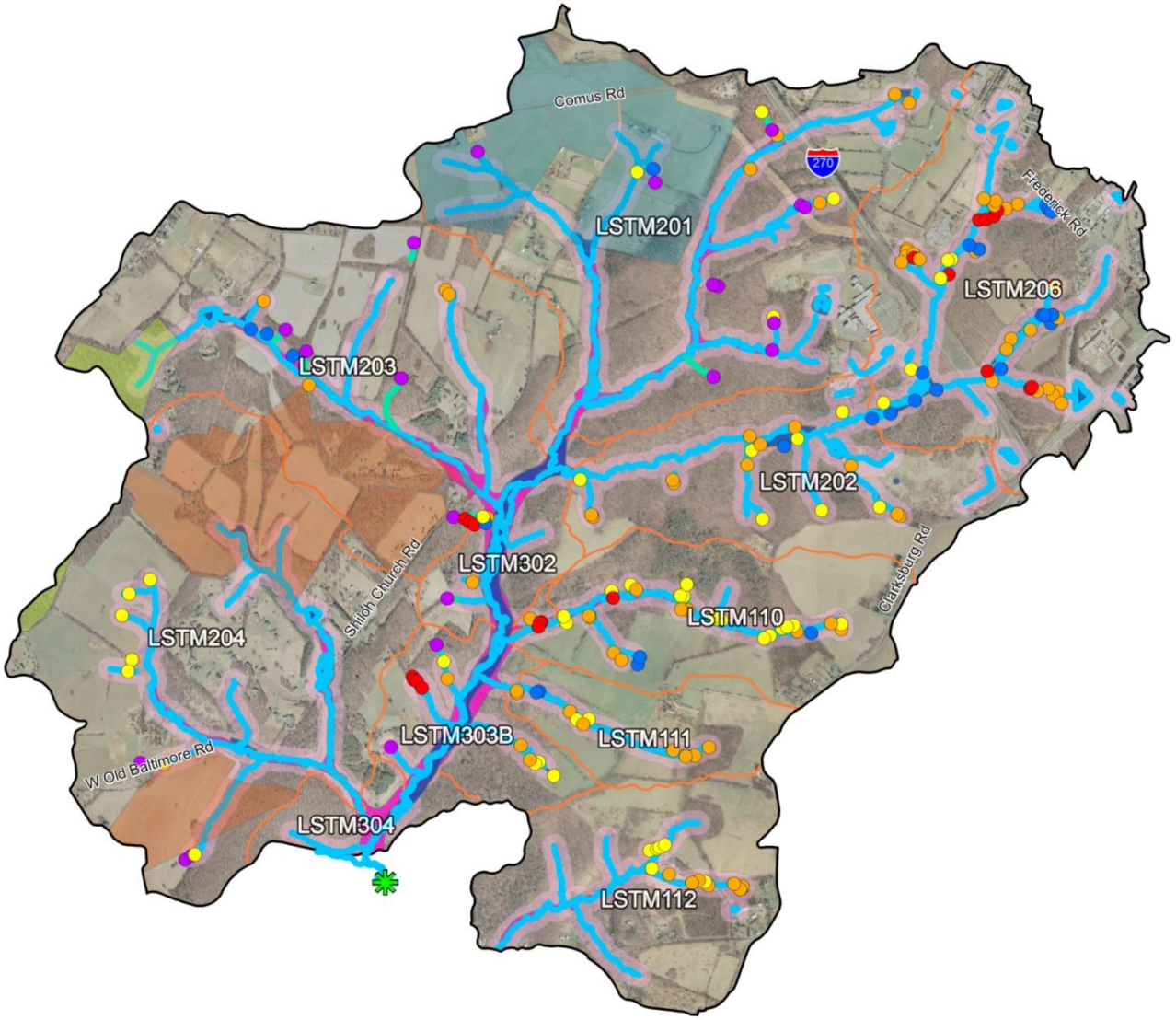
Hydrology

Streams

Wetlands

Springs & Seeps



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Geomorphology (Stream Form)

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Water Quality

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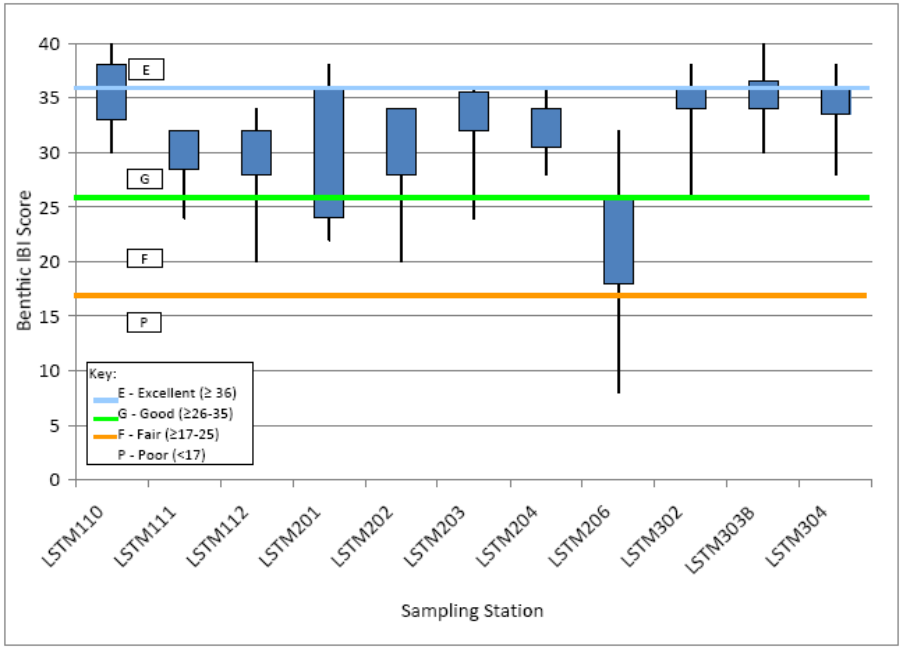
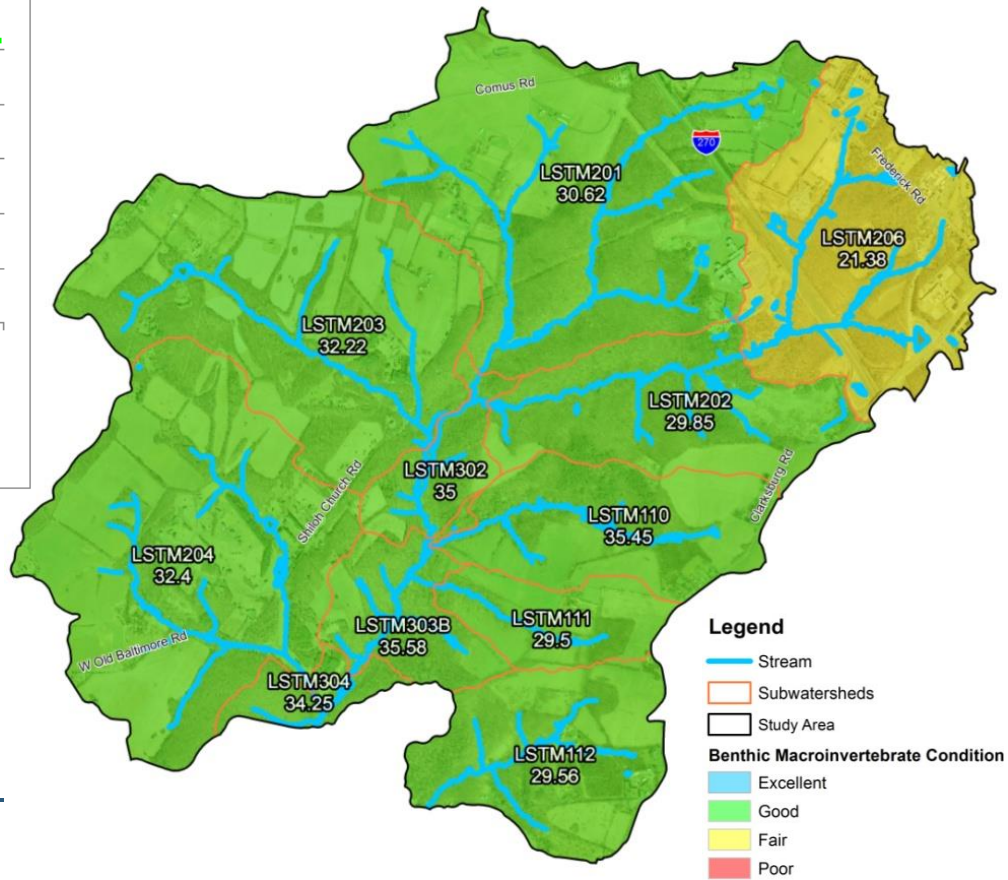
Aquatic Habitat & Biology

Benthic IBI, Average, 1994-2012





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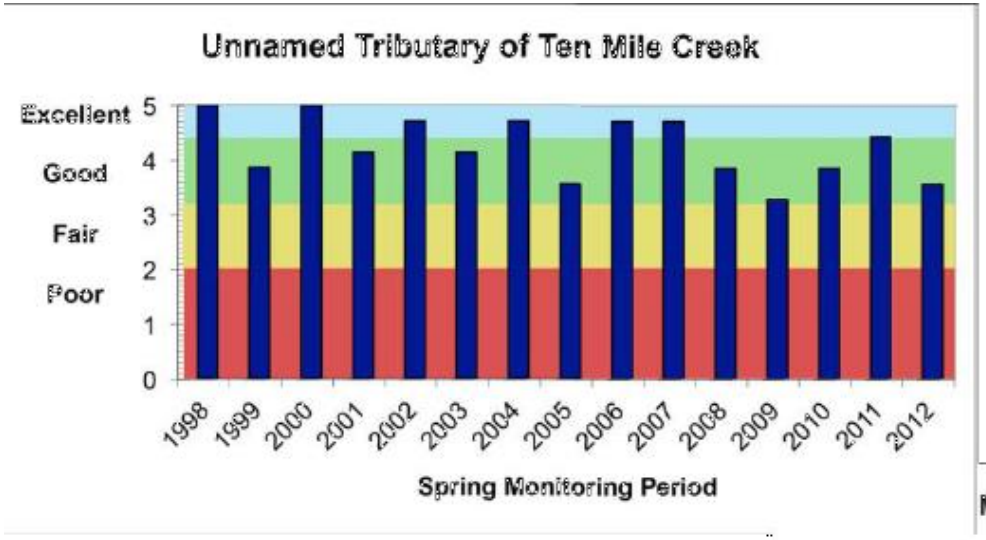
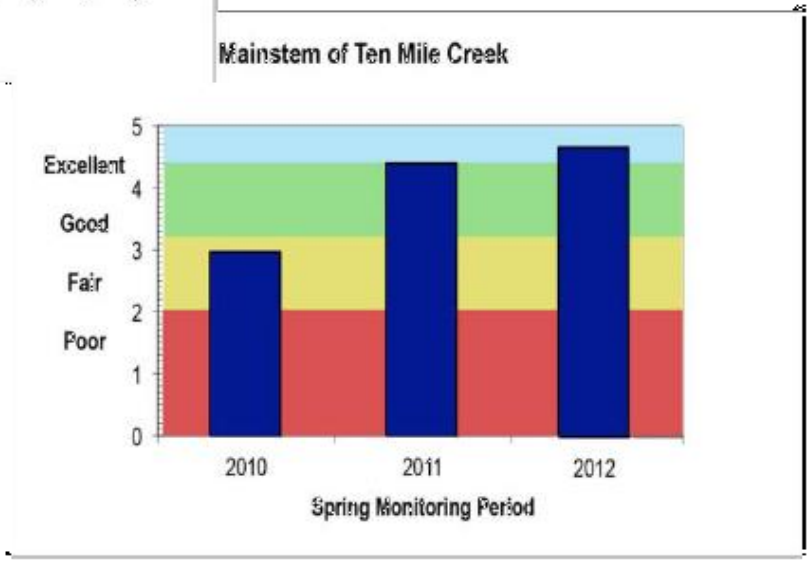
Independent Monitoring





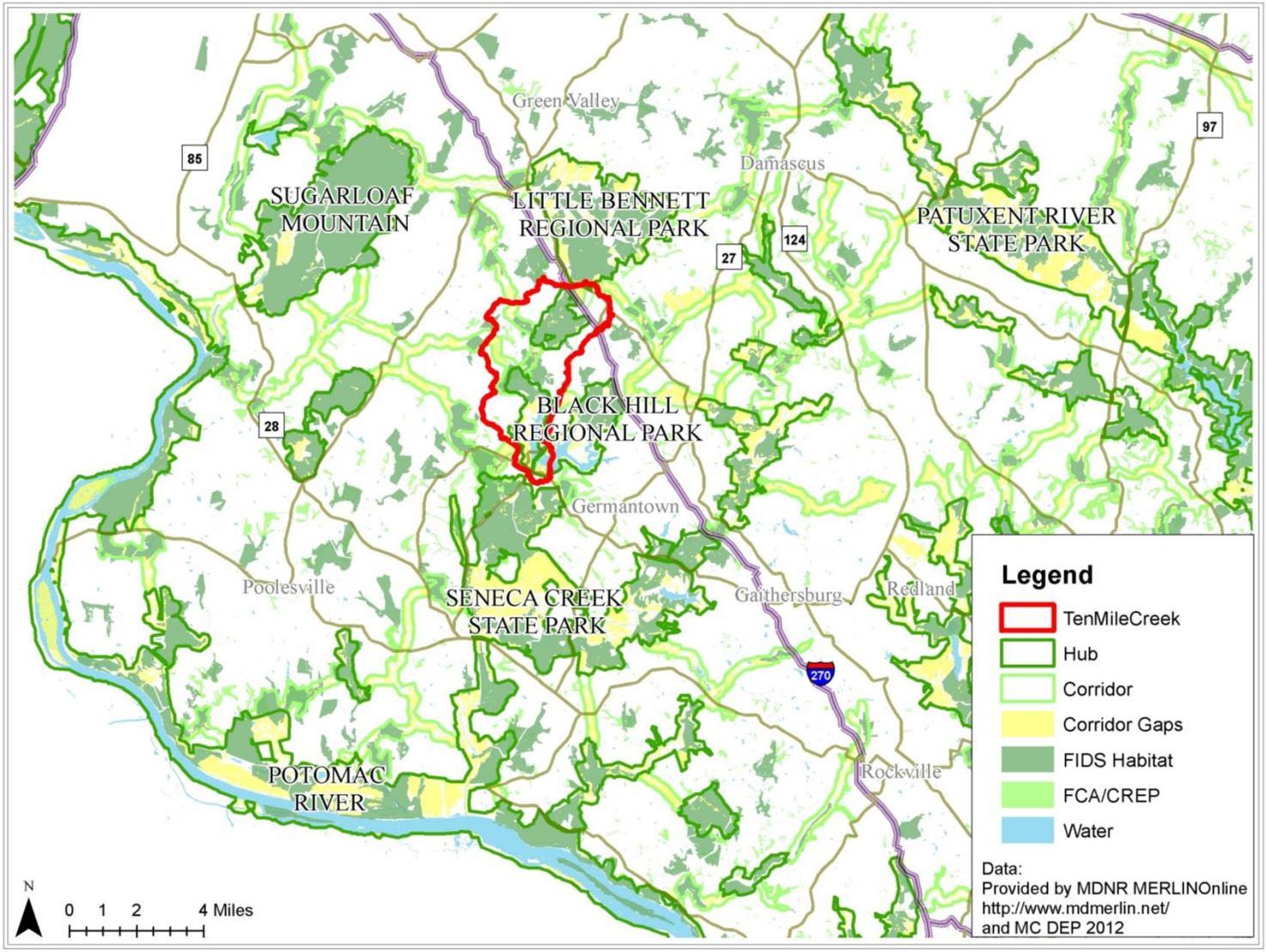
10 Mile Creek Area Limited Amendment

Upland Habitat & Biology

Hubs

Corridors

Gaps



10 Mile Creek Area Limited Amendment

Ten Mile Creek Existing Conditions

- Reference stream in Montgomery County.
- Overall biological condition is healthy & diverse.
- Sensitive 'indicator' organisms that occur in few other areas
- Part of a small group of high quality watersheds still remaining
- Streams are small and spring fed with cool, clean groundwater.
- Mainstem has high concentrations of interior forest and wetlands.
- No evidence of widespread, long-term channel instability
- Flood flows still naturally access the floodplain.
- Stream bed material is ideal to support a benthic macroinvertebrates
- Slopes are steep and soils are generally rocky, with shallow to moderate depth to bedrock.

10 Mile Creek Area
Limited Amendment

Ten Mile Creek Area

"Balanced approach": protect resources and provide housing/jobs

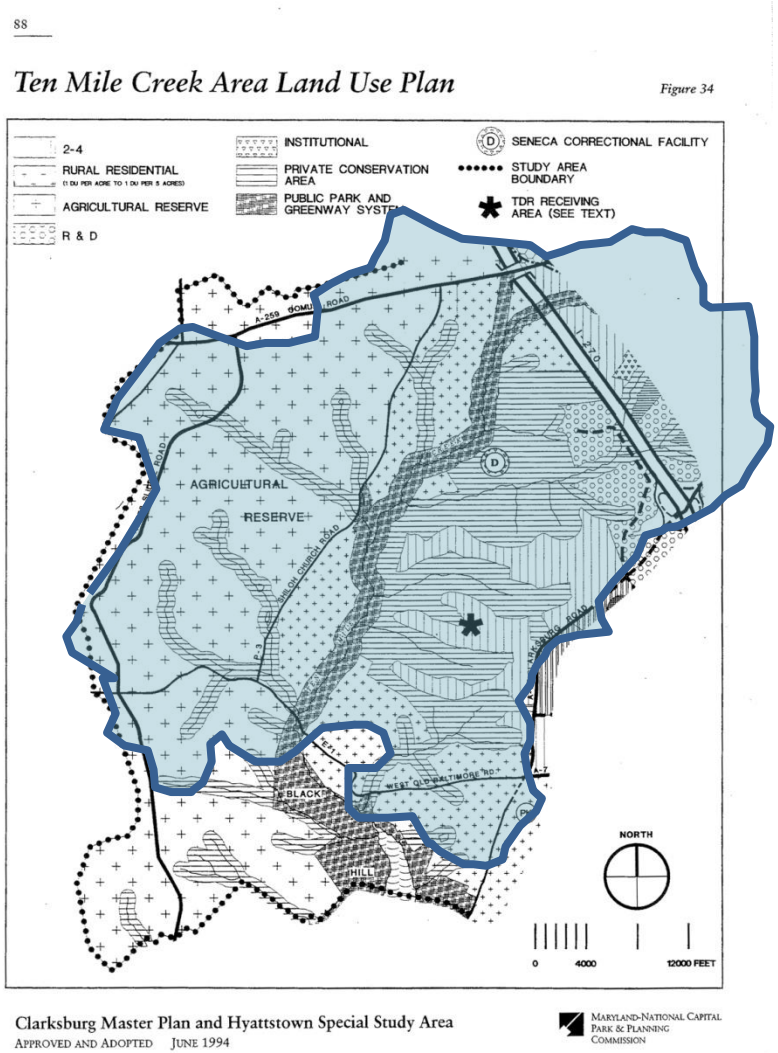
Agricultural Reserve - RDT

Low density residential - Rural (1unit/5 acres)

Low density RE1/TDR2 - 900 units for 600 acres

Employment at I-270

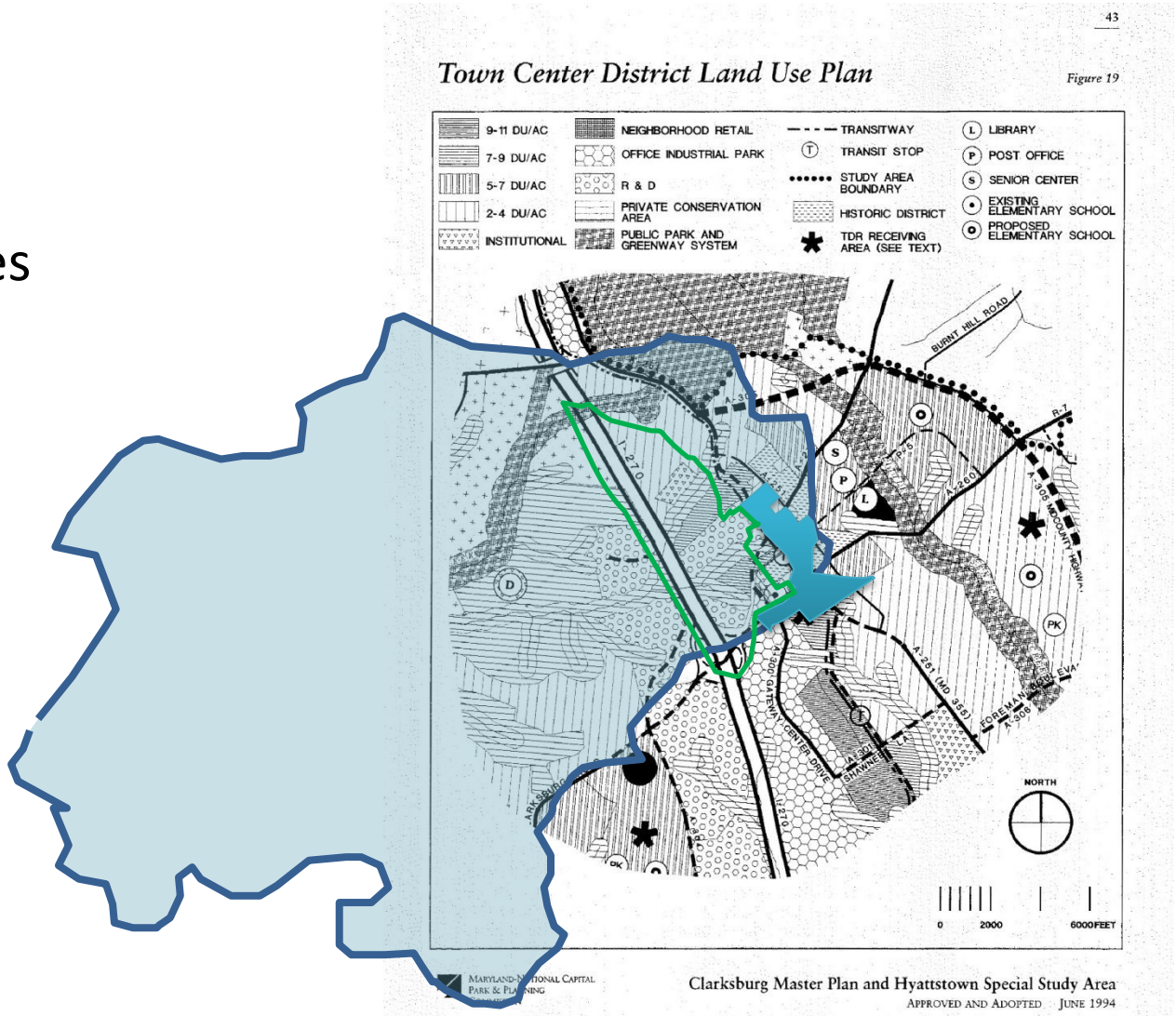
- Caps on density and imperviousness



10 Mile Creek Area Limited Amendment

Town Center District

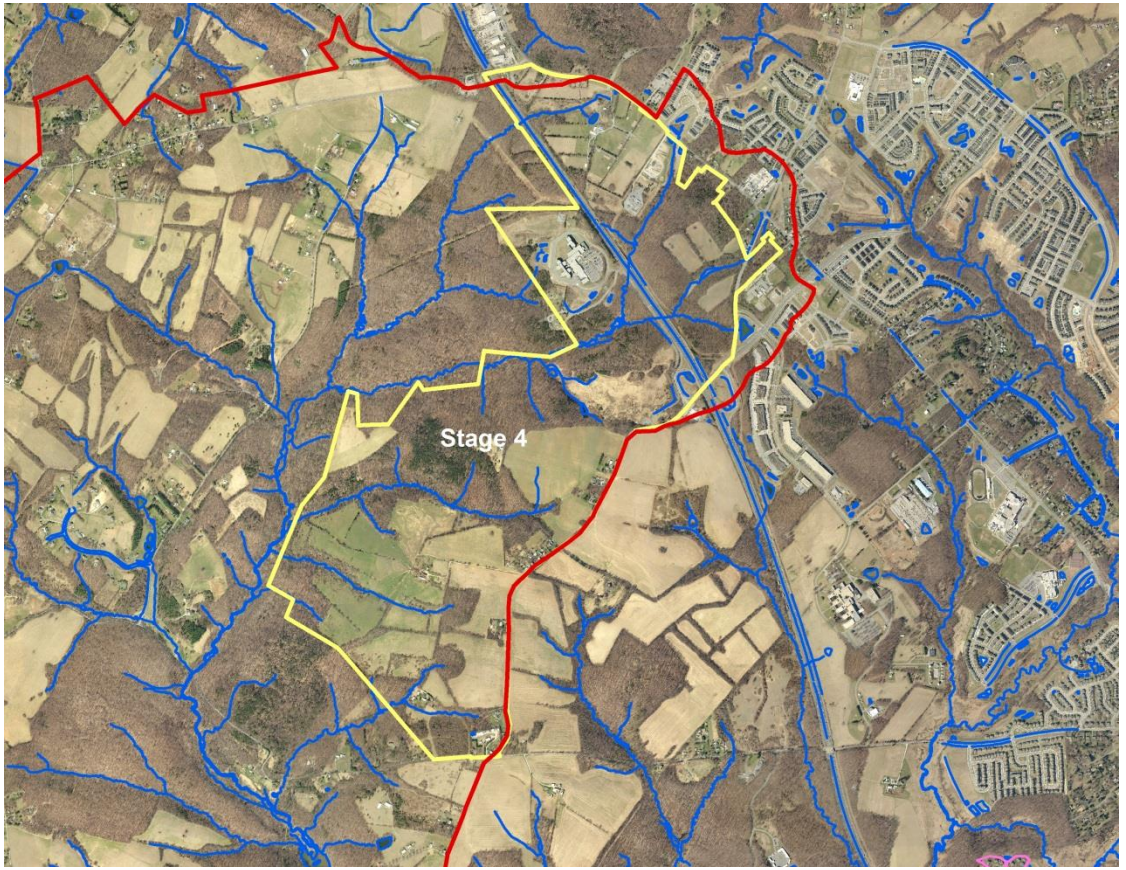
- Floating PD zones chosen to achieve mixed use objectives
- Lower densities nearer Comus
- Development focused nearer transit



10 Mile Creek Area Limited Amendment

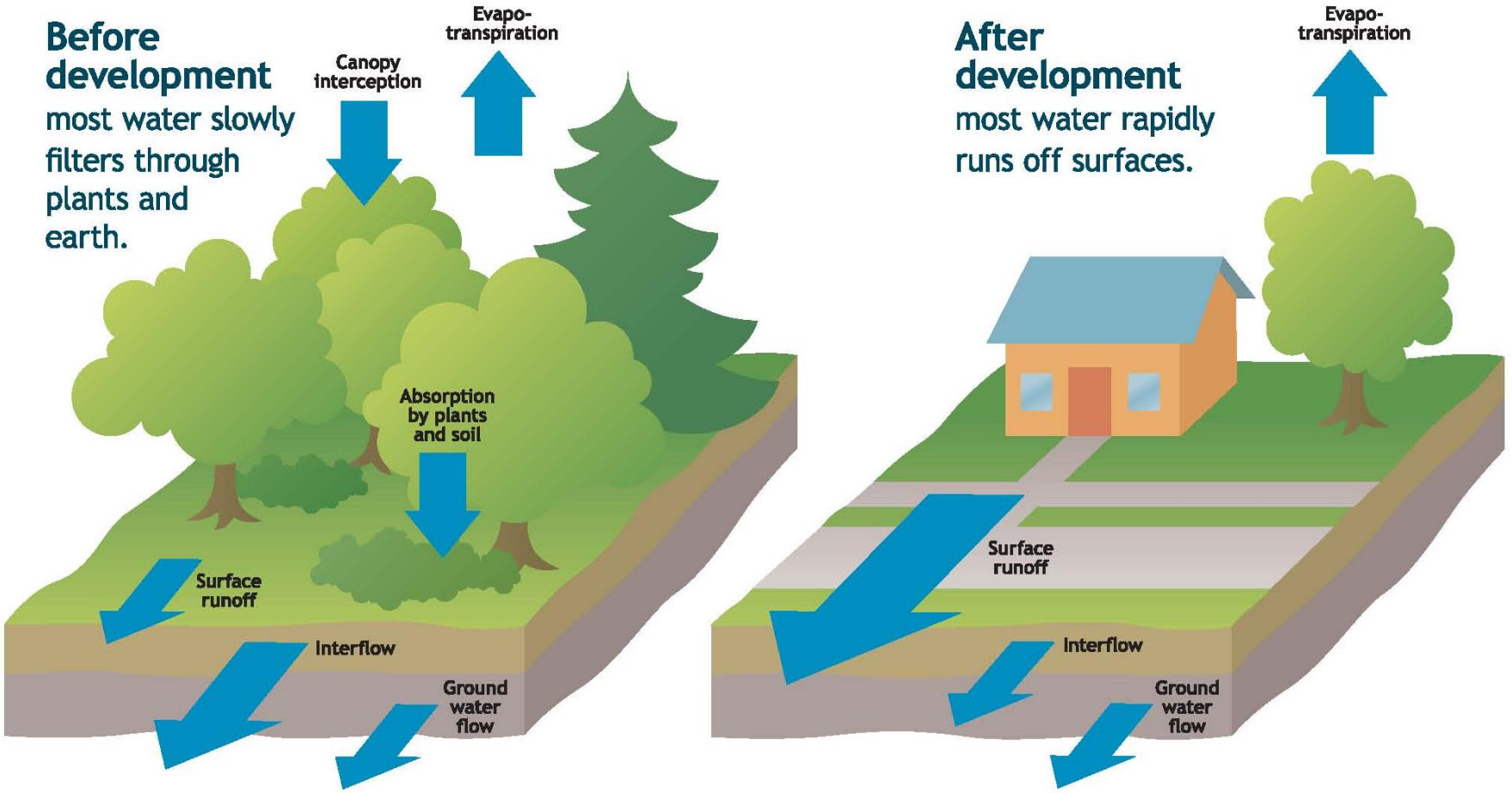
Staging

- Stage 4 triggers have been met
- Water quality evaluations complete, but inconclusive
- Council has therefore opted to prepare master plan amendment



10 Mile Creek Area Limited Amendment

Changes in Watersheds Resulting from Development



10 Mile Creek Area Limited Amendment

Pathway of Runoff to Streams

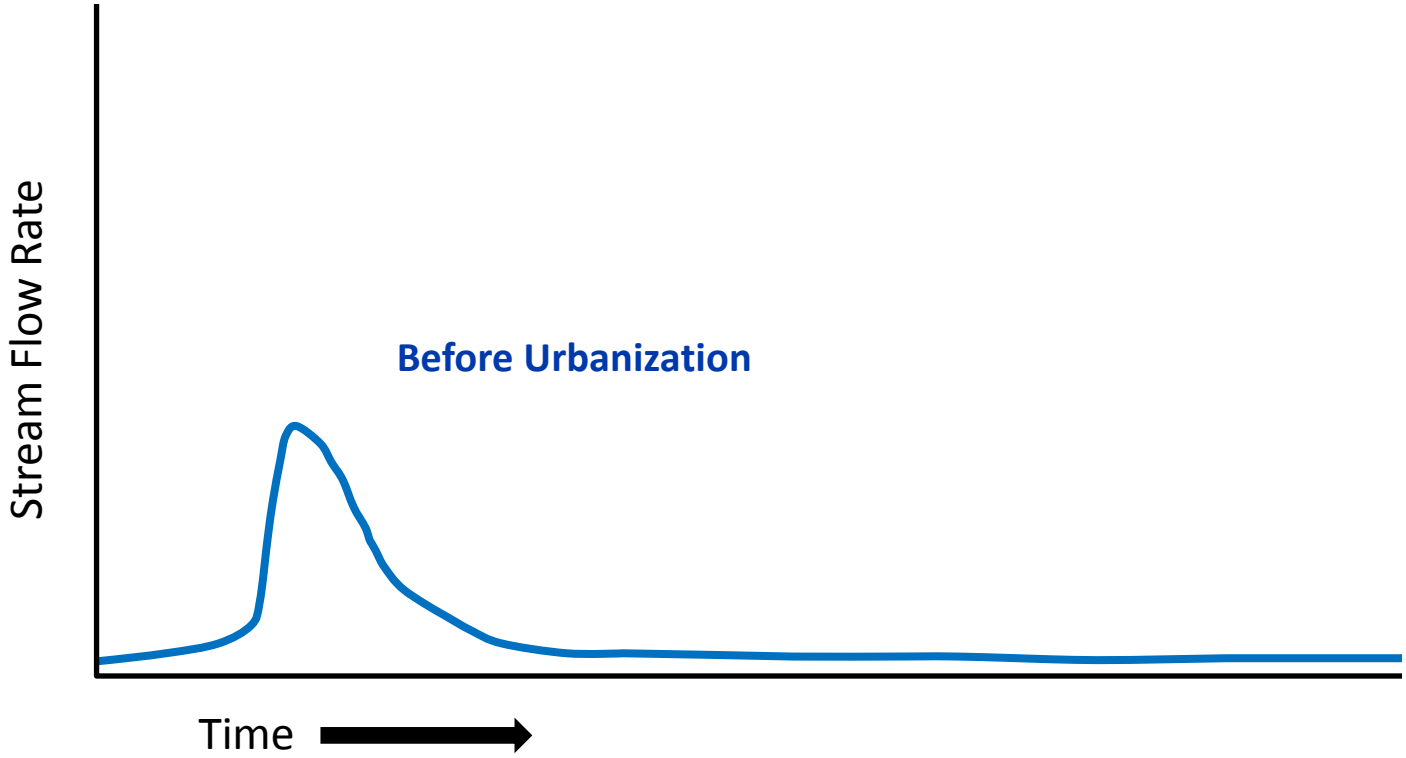
RUNS OFF IMPERVIOUS SURFACE

FLOWS INTO STORM DRAIN

DISCHARGES TO STREAMS

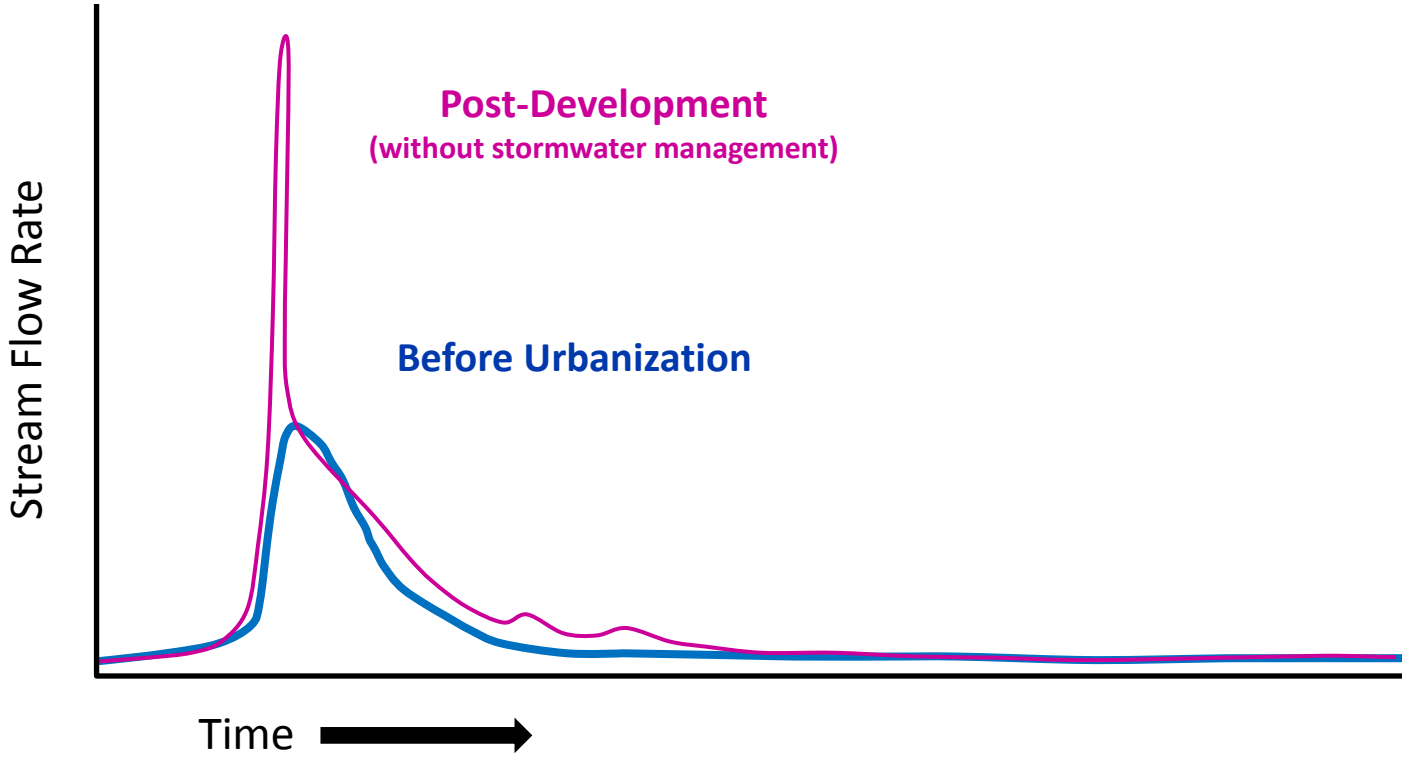
10 Mile Creek Area Limited Amendment

Change in Volume and Rate Affects the Hydrograph



10 Mile Creek Area Limited Amendment

Change in Volume and Rate Affects the Hydrograph



10 Mile Creek Area Limited Amendment

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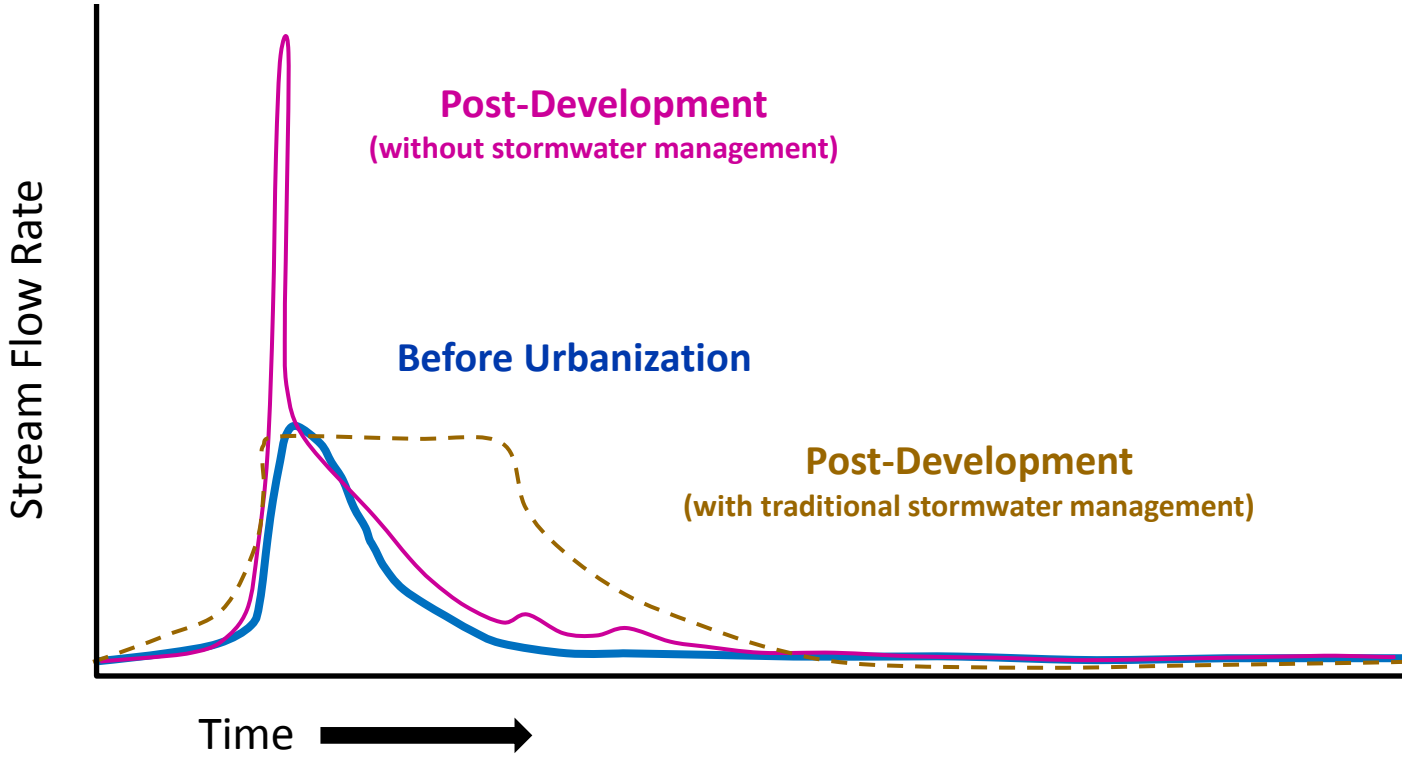
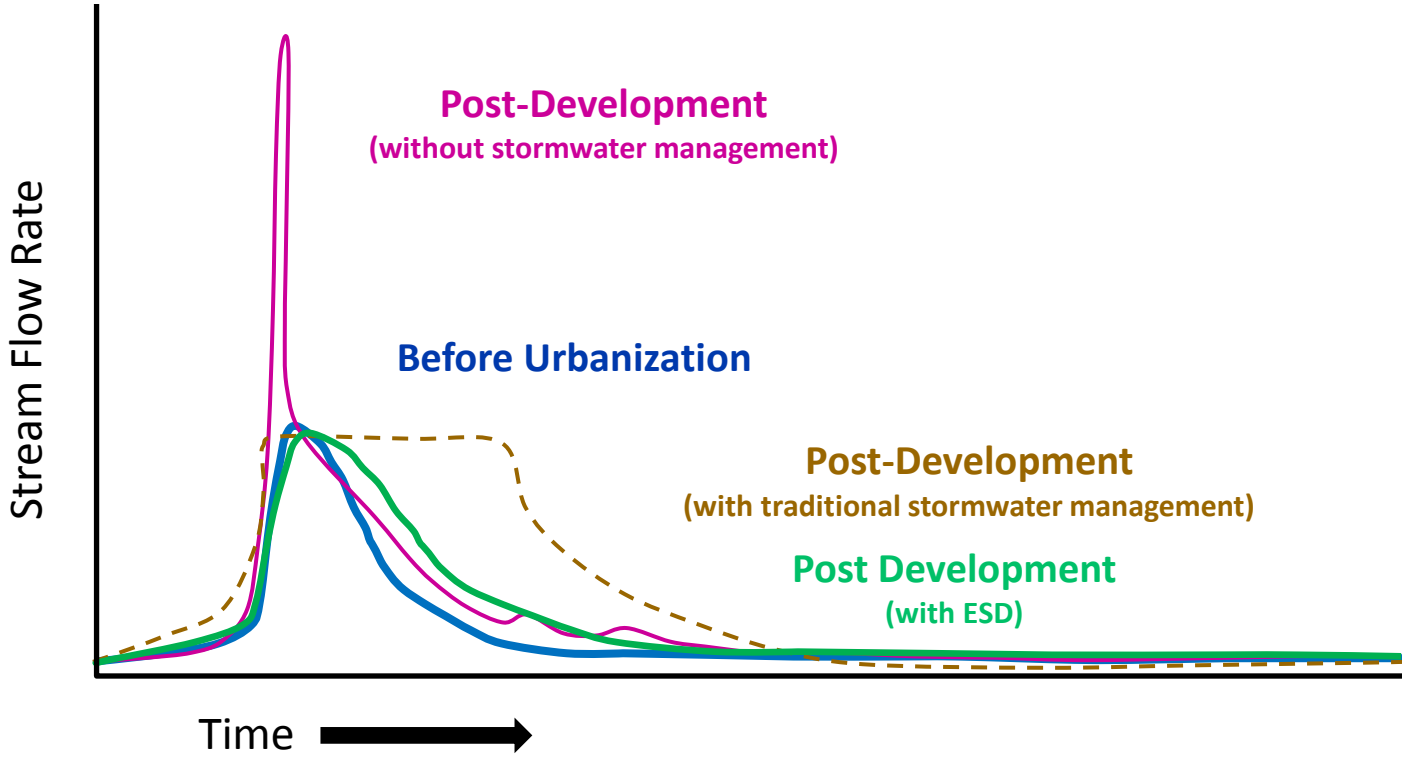


10 Mile Creek Area Limited Amendment

Change in Volume and Rate Affects the Hydrograph



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Hydrology

More frequent flooding

Changes in baseflow

Increased flood peaks

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Geomorphology (Stream Form)

INCREASING DEVELOPMENT IN WATERSHED

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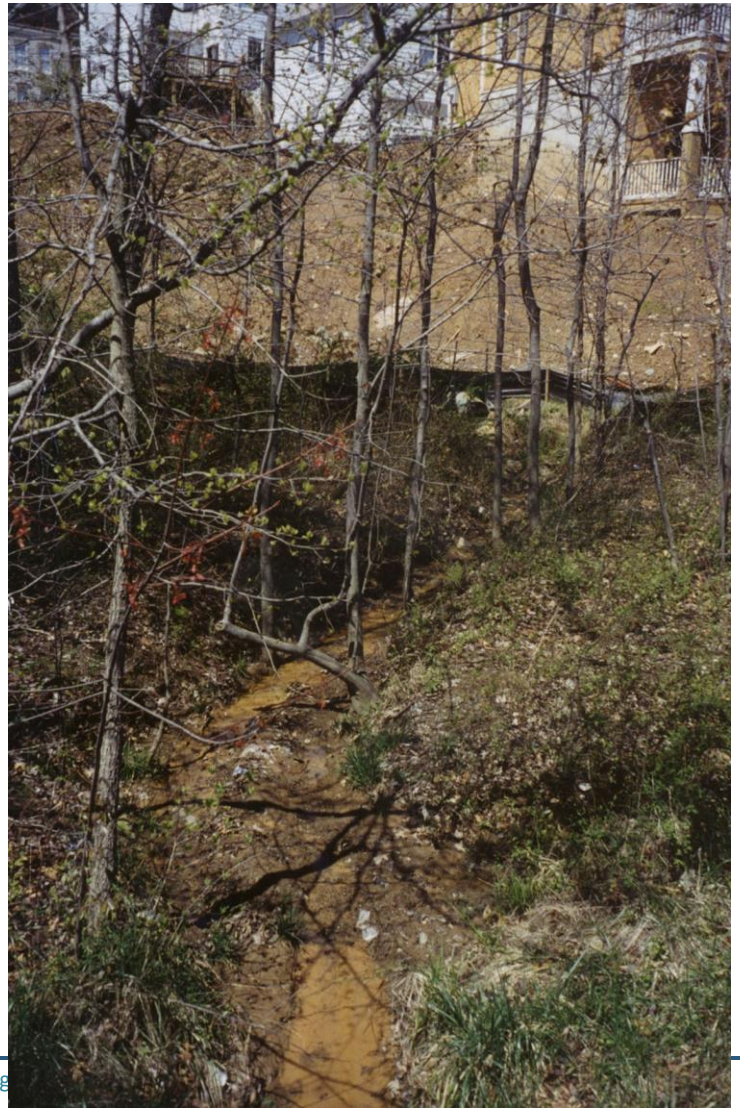
Water Quality



10 Mile Creek Area
Limited Amendment

Habitat and Aquatic Life

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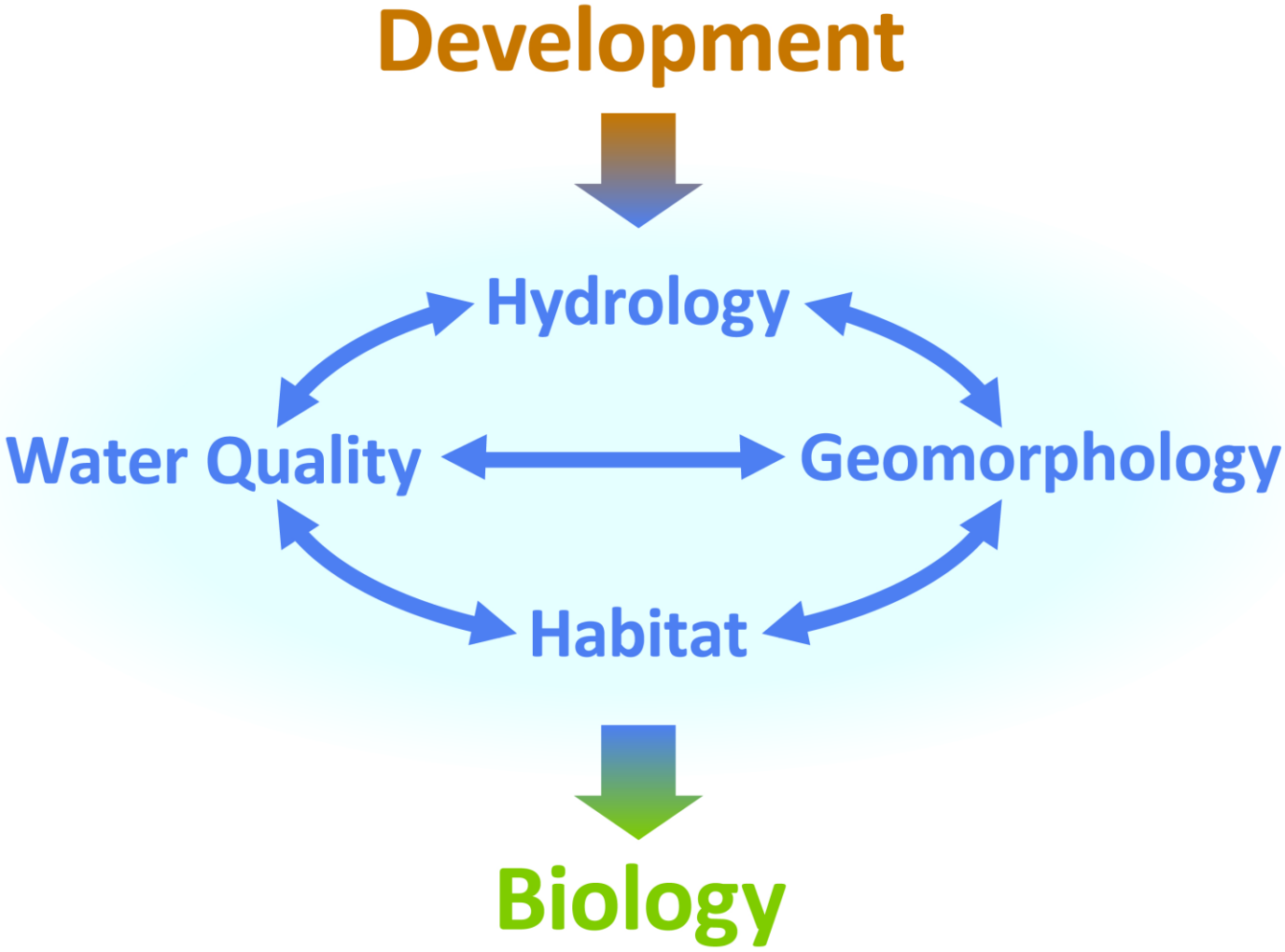
Limited Amendment

Changes in Watersheds Resulting from Development



10 Mile Creek Area Limited Amendment

Environmental Impacts from Development

- Carbon sequestration
- Return of water to the air by evapotranspiration
- Release of oxygen to the air
- Habitats
- Terrestrial and aquatic plant and animal communities
- Natural soil structure and biology
- Infiltration of rainwater
- Surface and ground water flow
- Moderation of air and water temperature
- Minimal pollution inputs
- Water quality treatment

Limiting Development footprint and Impervious Cover helps to reduce impacts to all of the above, not just infiltration

10 Mile Creek Area Limited Amendment

Different Stormwater Practices

- Stormwater Before in Clarksburg
  - Focused on retention, detention and filtering
  - Gradual release of water to stream to reduce immediate impact
  - Special Protection Area requirements also included measures in series
- Environmental Site Design
  - Designed to more closely mimic natural systems in terms of how water gets to the stream to reduce impacts from stormwater runoff
  - More, smaller treatment systems closer to the source of the runoff
  - Cannot replace all the biological and nutrient cycling components of natural systems (plants, animals, carbon sequestration, cooling effects)
  - Cannot eliminate the impact of development

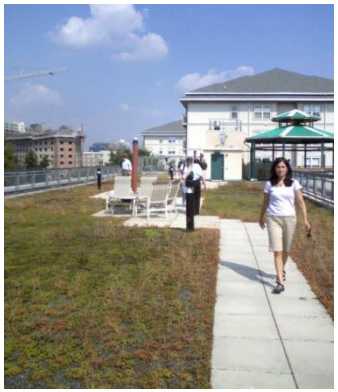
10 Mile Creek Area Limited Amendment

Introduction to ESD

- Conserve natural features
- Better site planning
- Minimize impervious surfaces
- Slow down runoff
- Mimic natural hydrology

- Infiltrate and evapotranspirate
- Non-structural techniques
- Small scale stormwater management
- Innovative technologies

Typical Centralized Detention Pond



Small Scale, Integrated ESD Practices

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ESD Practices

Alternative Surfaces

Green Roofs

Permeable Pavements

Reinforced Turf

Non-Structural Practices

Disconnection of Rooftop Runoff

Disconnection of Non-Rooftop Runoff

Sheetflow to Conservation Areas

Microscale Practices

Rainwater Harvesting

Submerged Gravel Wetlands

Landscape Infiltration

Infiltration Berms

Dry Wells

Micro-Bioretention

Rain Gardens

Swales

Enhanced Filters

10 Mile Creek Area Limited Amendment

Rooftops →Green Roofs

Gibbs Elementary, LEED, Germantown

University of Maryland Shady Grove

Eastern Village Condo Green Roof

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Around Buildings → Microscale ESD Practice

Lafayette College, PA, Source: Biohabitats Photo Simulation

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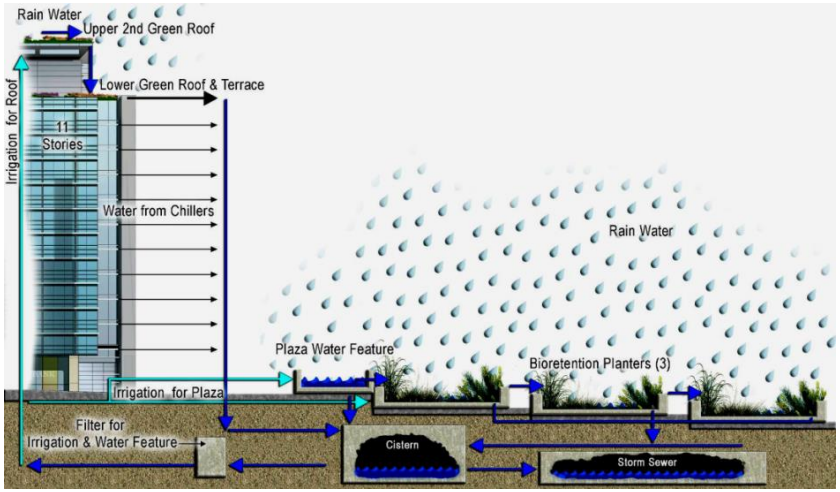
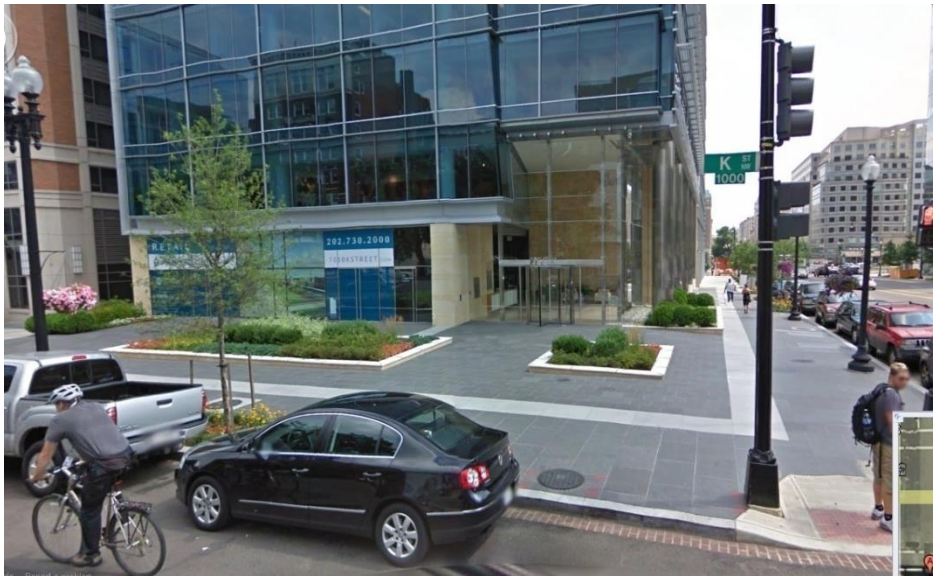
Around Buildings → Bioretention





1050 NW K St, D.C. by Timmons Group

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Streets and Streetscapes → Swales, Stormwater Planters, Curb Extensions

Cloverly Elementary

Streets and Streetscapes → Swales, Stormwater Planters, Curb Extensions

Gaithersburg, MD, Source: Gallagher, Christine. 2009. “Green Streets Low Impact Development Initiative in Gaithersburg, MD”

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Parking Lots → Micro-bioretention, Swales

Portland, OR, Source: Portland 2004 Bureau of Environmental Services Manual

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Landscape → Microscale Practices

Dennis Avenue, Source: MC DEP

Sligo Creek Recreation Center, Source: MC DEP

10 Mile Creek Area Limited Amendment

Parking Lots → Permeable Pavements

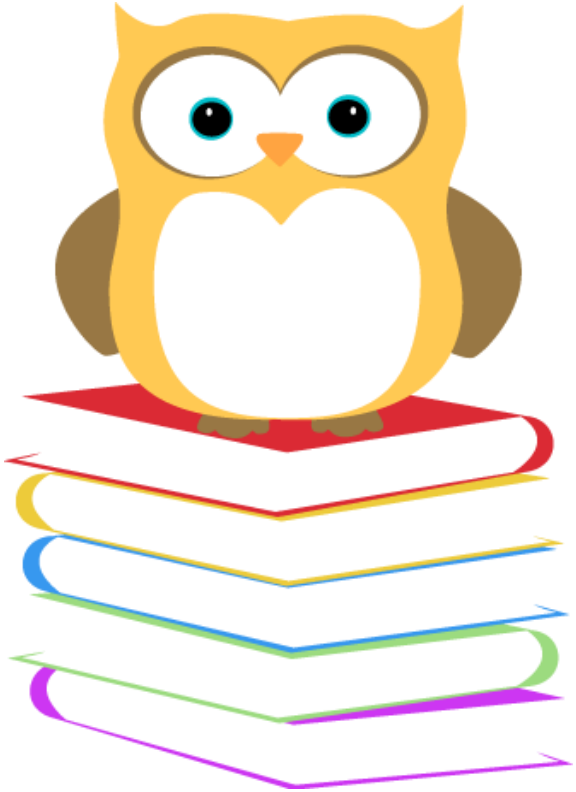
Bethesda Methodist Church pervious concrete

Navy Yard, Washington, DC

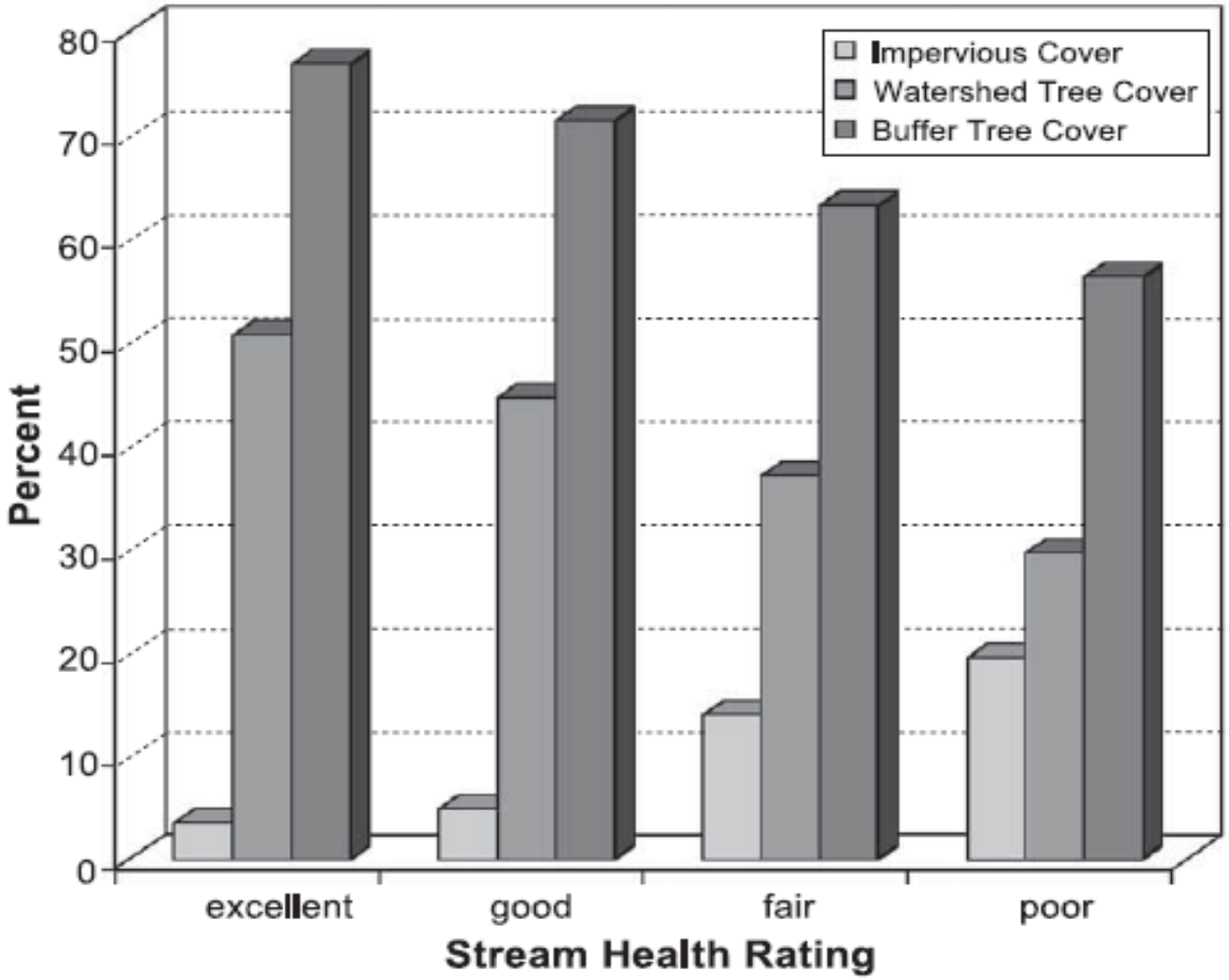
ESD Literature Review

Overview:

- Reviewed over 140 documents
- Focused on Impacts of Impervious Cover and Benefits of ESD on:
  - Hydrology
  - Water Quality
  - Habitat/Geomorphology
  - Biology



Impact of Montgomery County Land Cover on Stream Quality



(Goetz, 2003)

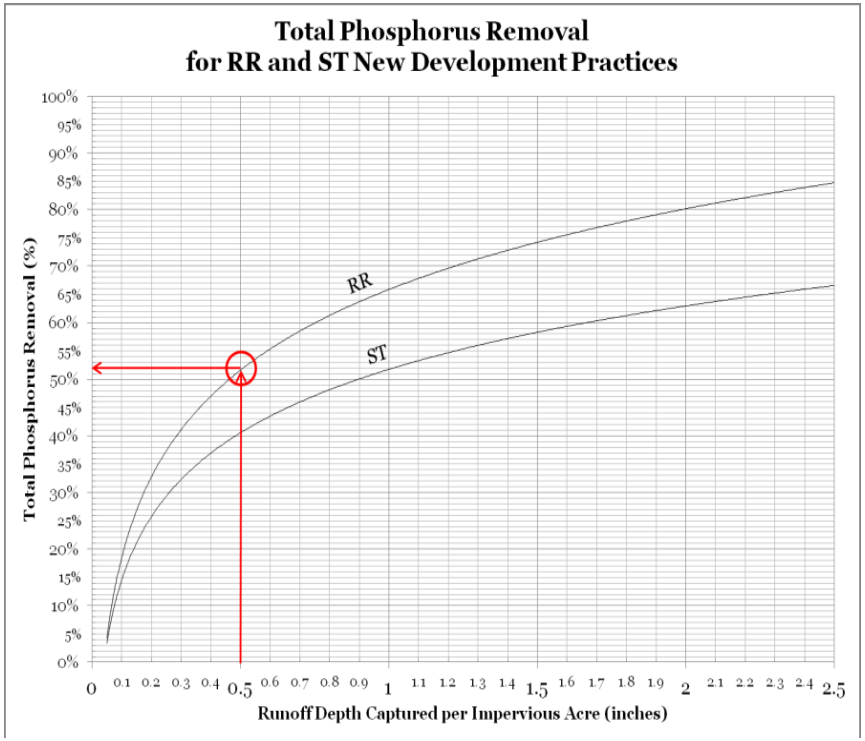
What is ESD Good At?

Hydrology:

- Excellent performance for reducing runoff volumes

Water Quality

- Pollutant removal is typically better than traditional BMPs
- Better than ponds for in-stream temperature



What Can't ESD Do?

Hydrology/Water Quality:

- Mixed results in attaining actual "pre-developed condition" performance.
- Practices still can't remove all pollutants and chemicals

Habitat:

- Can't fix direct impacts, such as loss of natural drainage areas
- Can't reproduce all the functions of forest and undisturbed soils

Biology:

- No examples of ESD preserving or enhancing in-stream biology

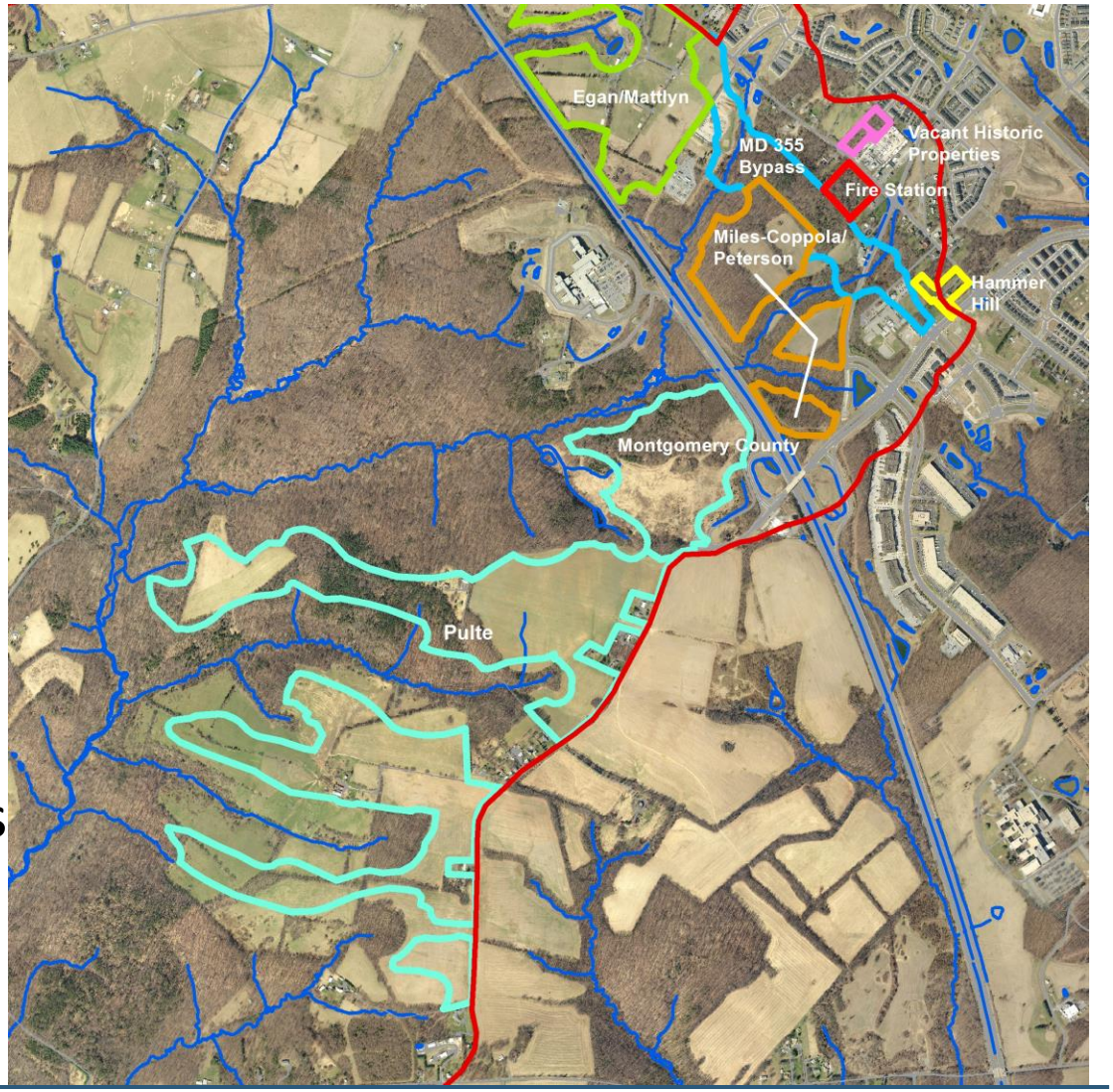
Concerns for Implementing ESD

- Long-Term Maintenance is more challenging
- Doesn't control the "Construction Phase"
- Soil Compaction During Development
- Overflows will not be treated
- Dissolved chemicals added to groundwater

10 Mile Creek Area Limited Amendment

Areas of Disturbance

- Removed stream buffers and conservation areas as shown in the 1994 Plan
- Used imperviousness of projects built under same zoning
- Applied to disturbed area
- Checked against standard imperviousness for zones



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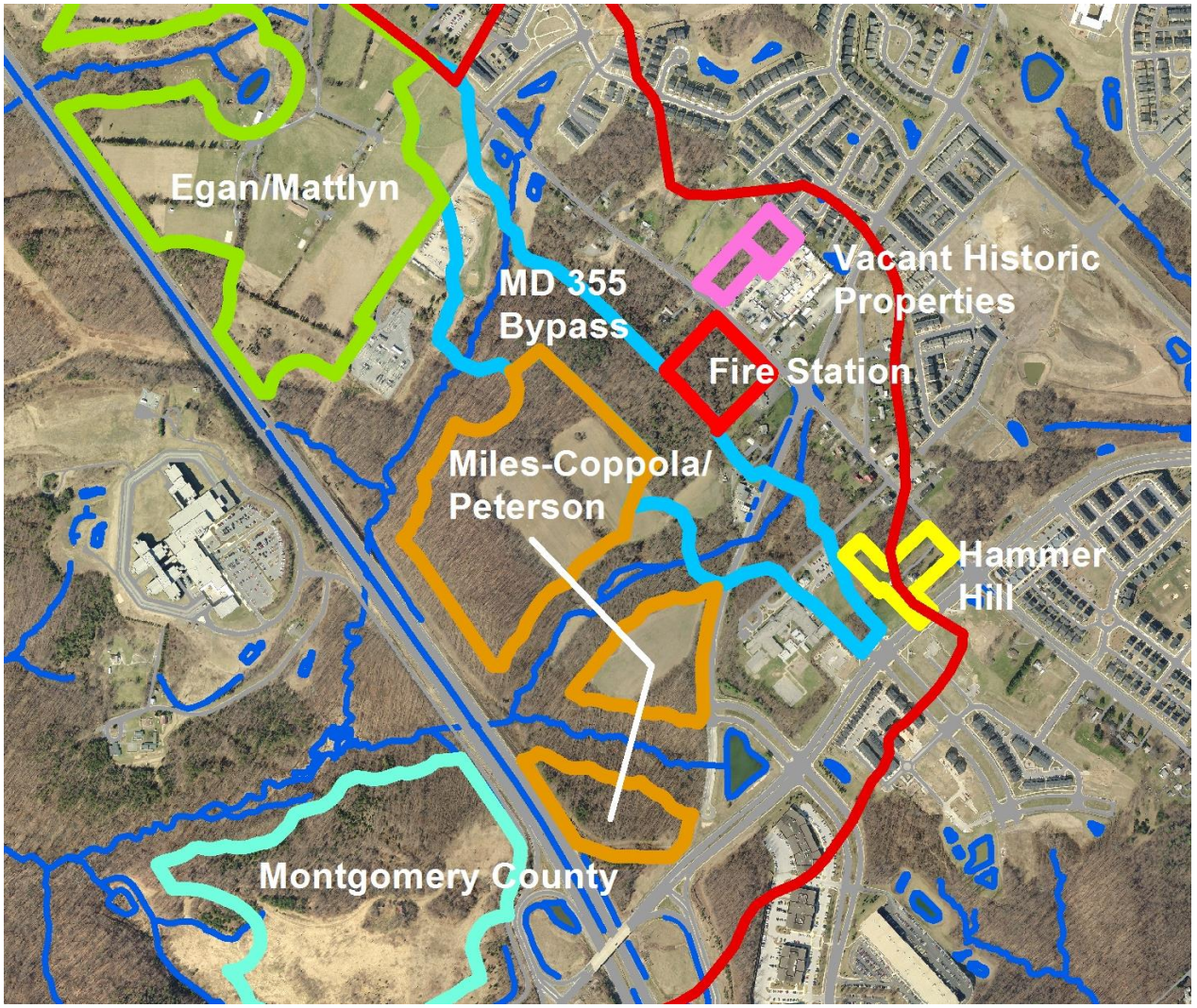
Areas of Disturbance



10 Mile Creek Area Limited Amendment

1994 Master Plan Scenario Analysis

Analysis Tool	Watershed Health Indicator				
	Hydrology	Geomorphology	Water Quality	Habitat	Biology
Hydrologic Modeling	X	O		O	O
Pollutant Load Modeling			X	O	O
Natural Resource Impacts	O	X	O	X	O
Spatial Watershed Analysis				X	O

X = Analysis tool projects potential impacts
O = Analysis results allow us to infer potential impacts

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1994 Master Plan Scenario Analysis

Hydrologic Modeling	
WHAT IT CAN DO	• **Predict changes to stream flow and stream velocity** • **Gauge likelihood of channel alteration**
WHAT IT CANNOT DO	• **Predict the effect on stream biology** • **Predict the effects of pollutants on the stream**

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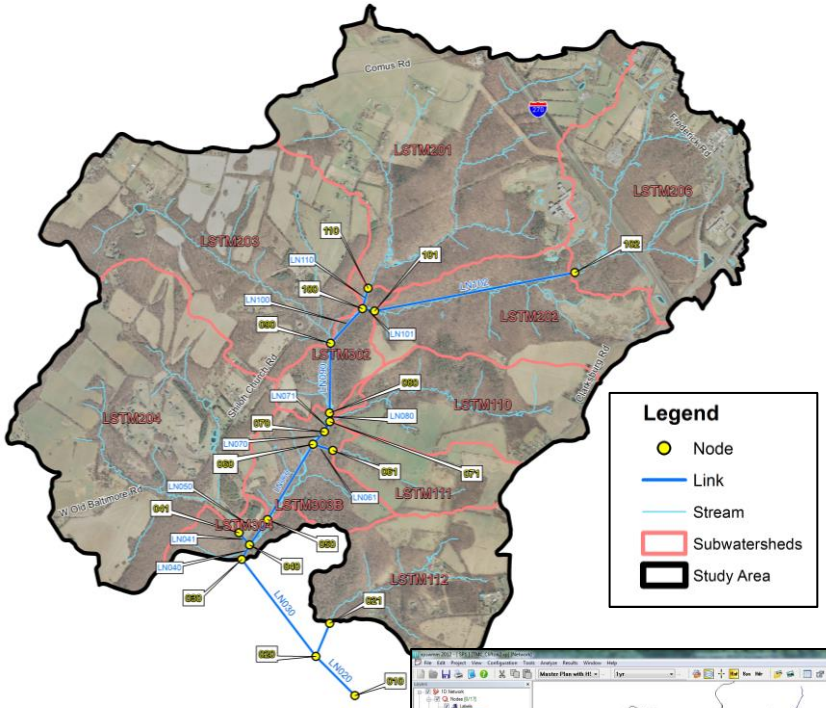
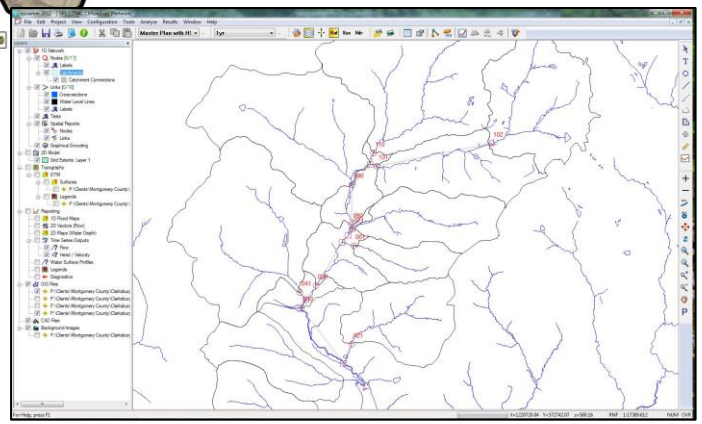
Method of H&H Analysis





- **XP-SWMM** - Dynamic rainfall-runoff modeling package
- **Base Conditions**
- **1994 Master Plan with ESD**
  - Development implemented with ESD per State and County regulations
  - Construction activities will reduce the infiltration capacity of soil

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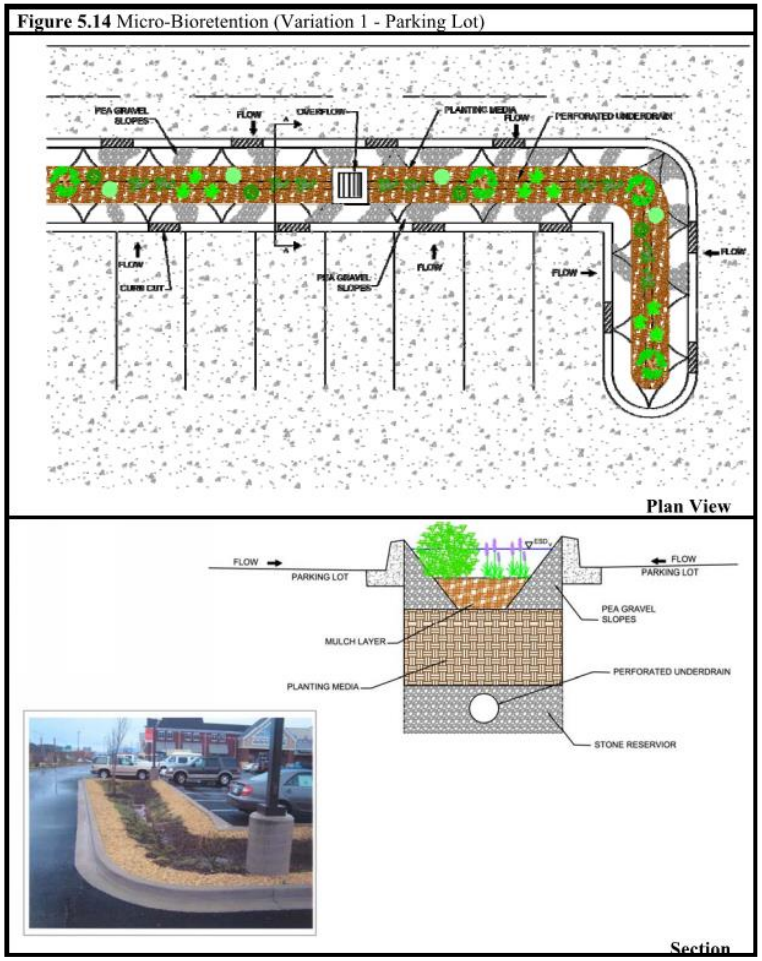
How ESD Was Modeled



Micro-Bioretention, Maryland Stormwater Design Manual

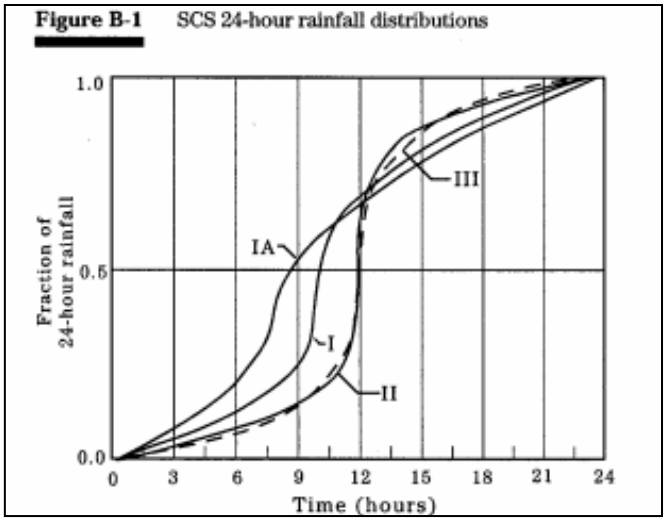
- Required storage volume computed from Maryland regulations
- Micro-bioretention used as representative practice
- Sized based on Montgomery County minimum requirements
- Partially full from prior rain event

Portland, OR, Source: Portland 2004 Bureau of Environmental Services Manual

10 Mile Creek Area Limited Amendment

1-year and 2-year Storms

- The model simulated two storm events:
  - 1-year, 24-hour storm (2.6 in.)
  - 2-year, 24-hour storm (3.2 in.)
  - Both storms modeled with SCS Type II distribution



- Why these storms?
  - 1-year storm is design basis for channel protection
  - Natural channels often sized to convey storms in this range.

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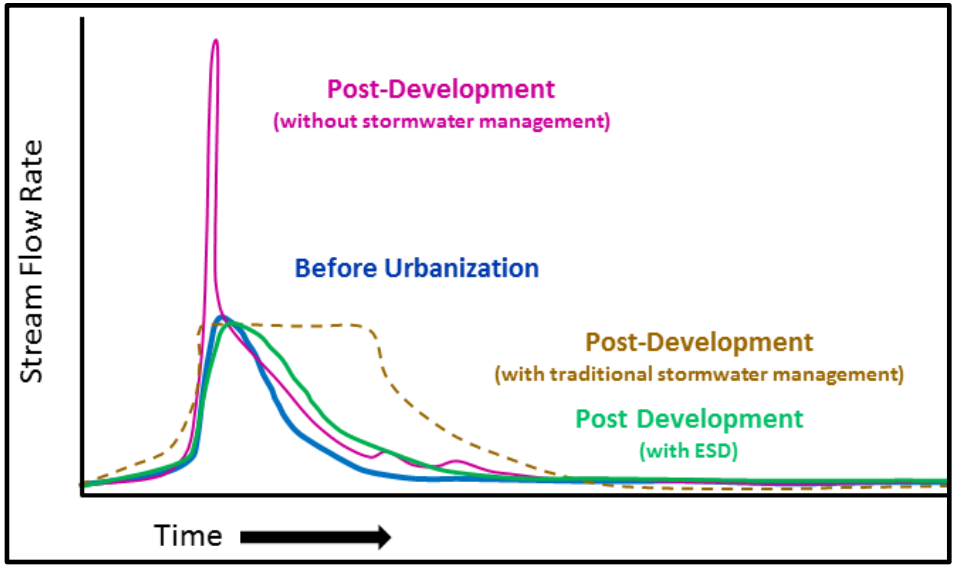
Key Metrics



- Total Streamflow Volume
- Peak Streamflow
- Peak Stream Velocity

- Also examine: *duration* elevated flow/velocity.

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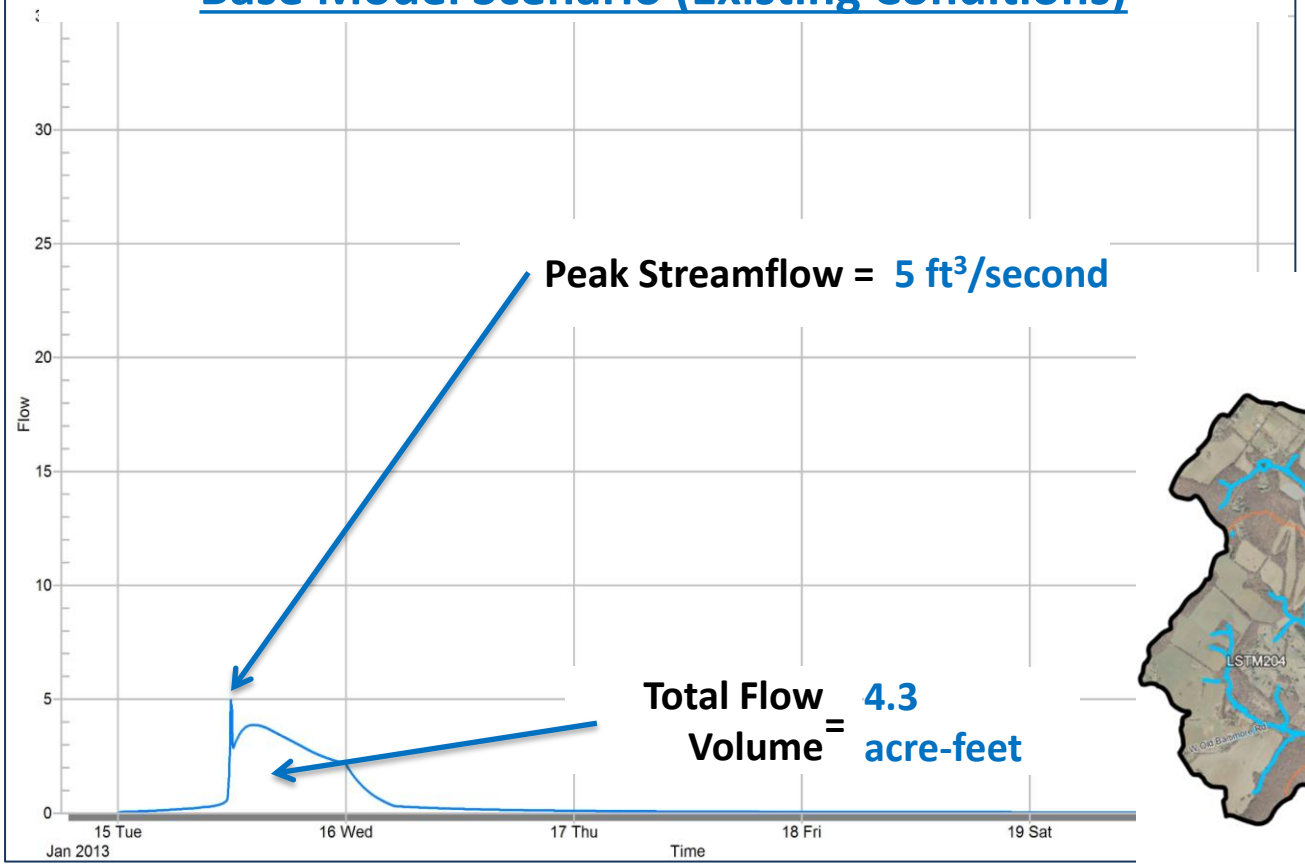
Example: Sub-basin with Significant Hydrology Response (LSTM111)

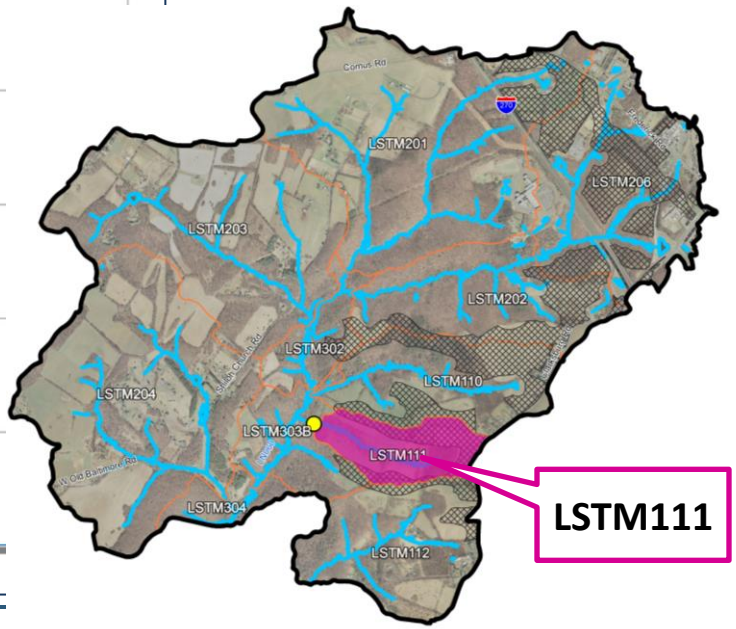
1-yr, 24-hr Storm Event

Base Model Scenario (Existing Conditions)



Existing Conditions:

- 103.5 total acres
- 1.2ac imp cover (1%)



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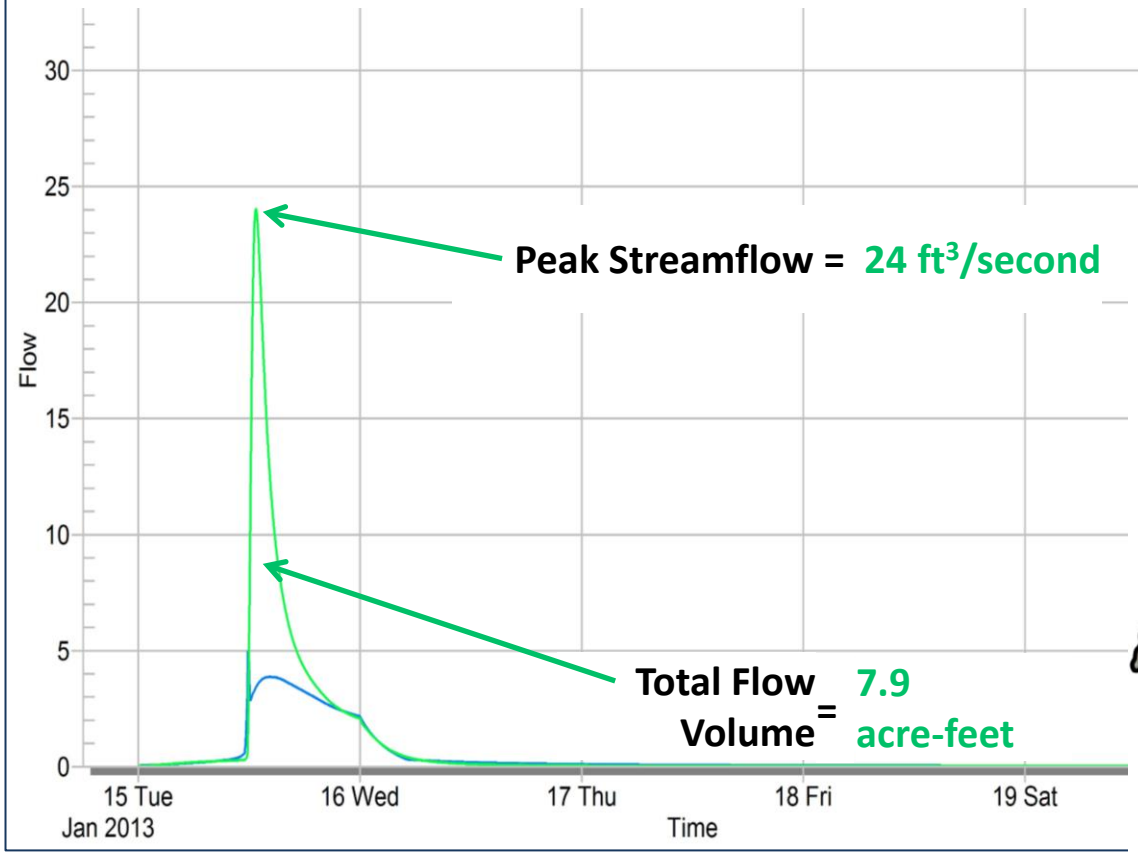
Example: Sub-basin with Significant Hydrology Response (LSTM111)

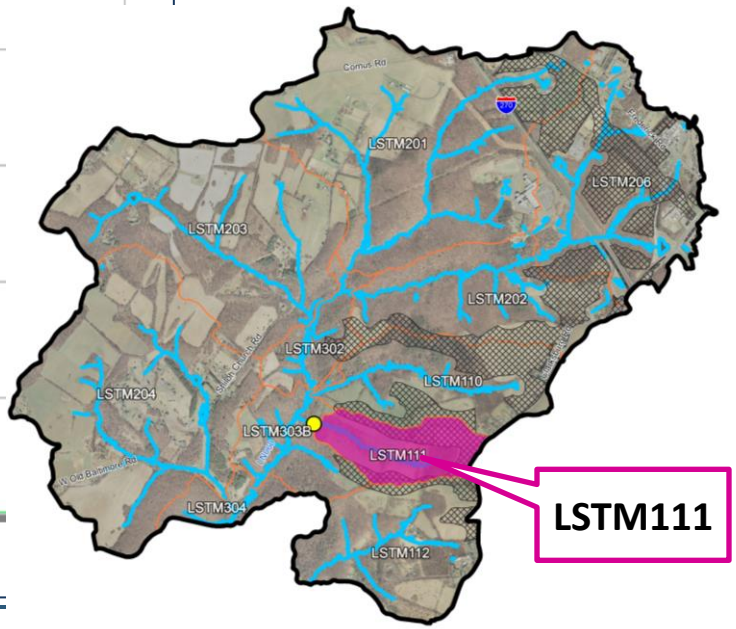
1-yr, 24-hr Storm Event

1994 Master Plan with ESD



1994 Master Plan:

- 14.6ac Imp cover (14%)
- +84% Increase in Total Stream Volume
- +378% Increase in Peak Stream Flow



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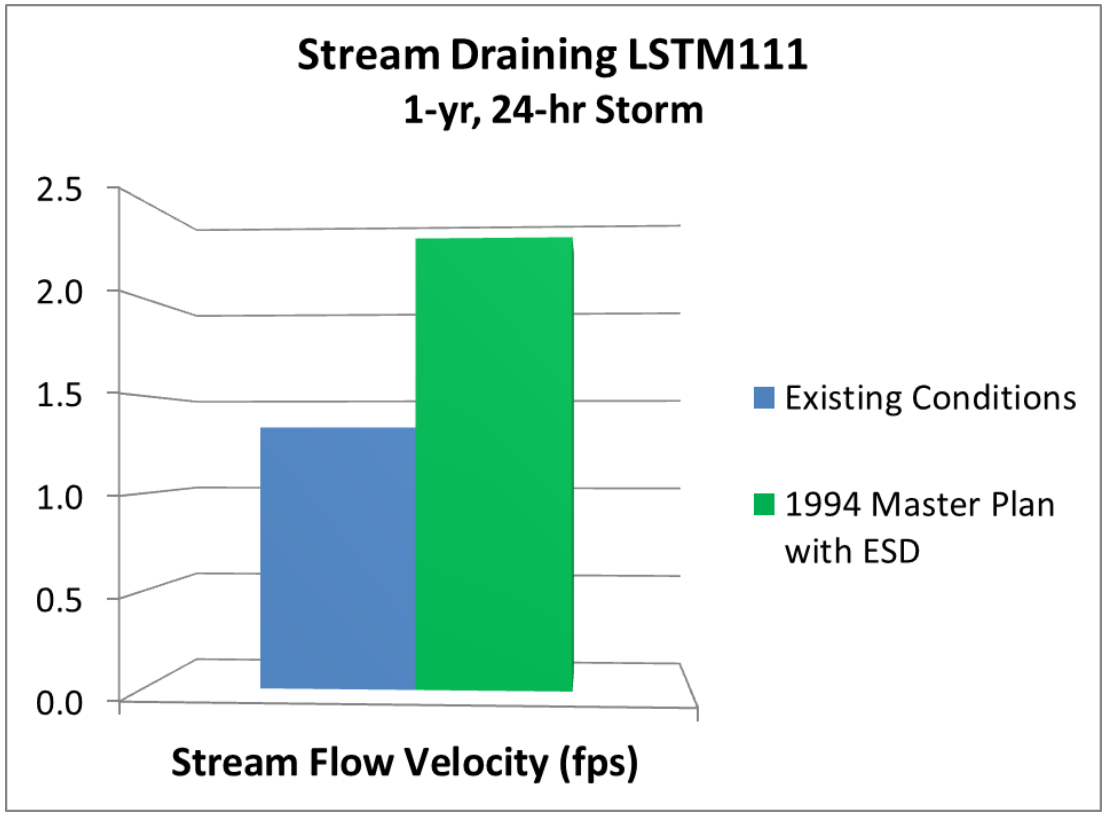
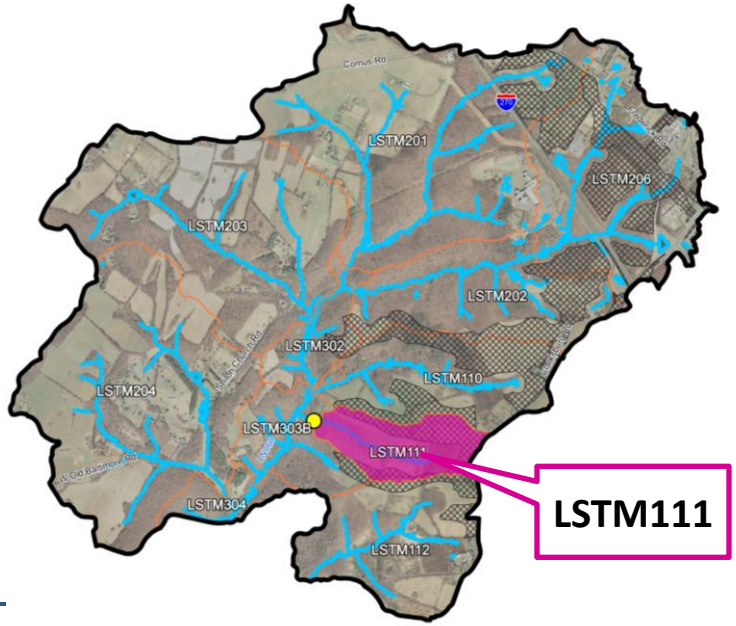
Example: Sub-basin with Significant Hydrology Response (LSTM111)

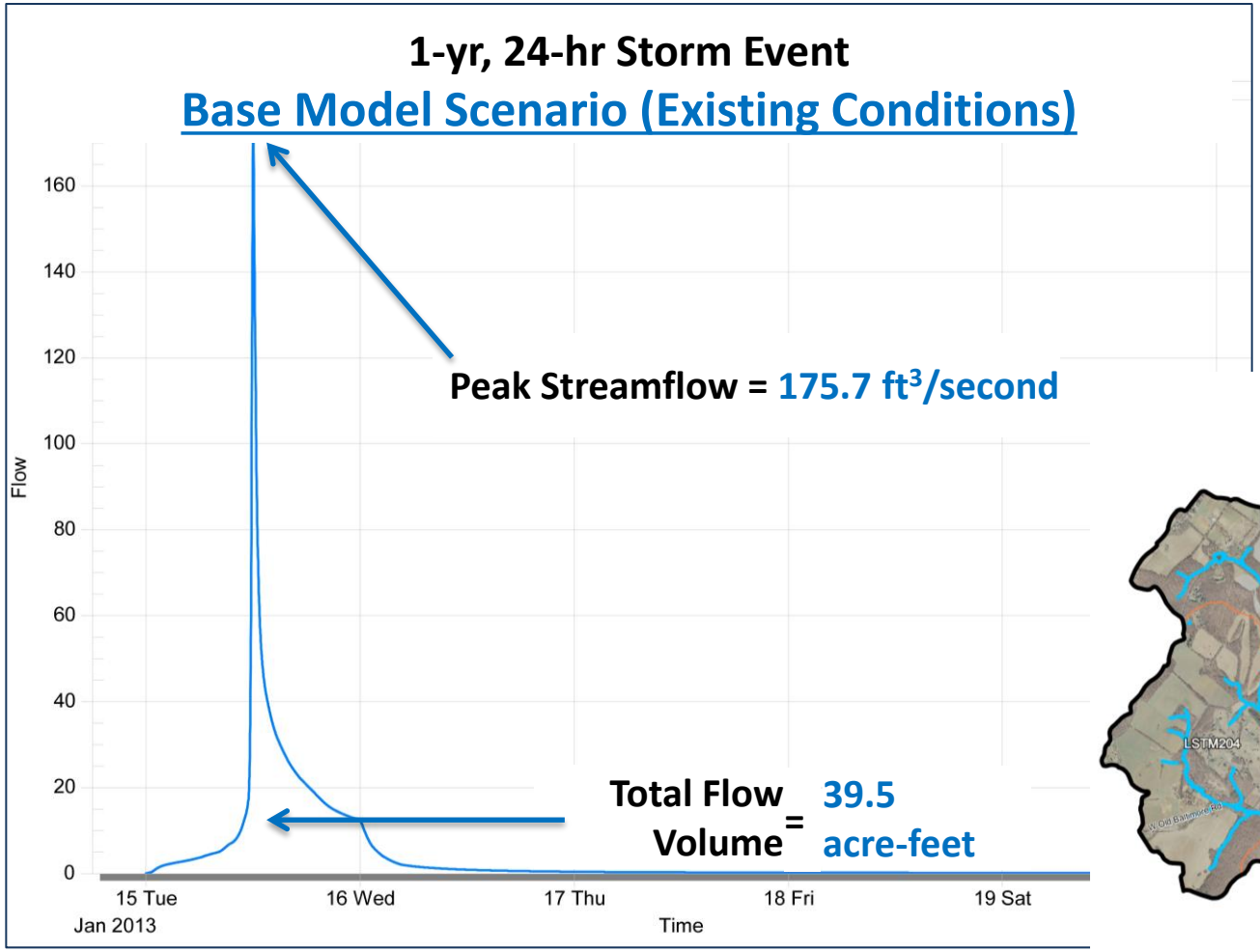
1994 Master Plan:

- +72% Increase in Stream Flow Velocity



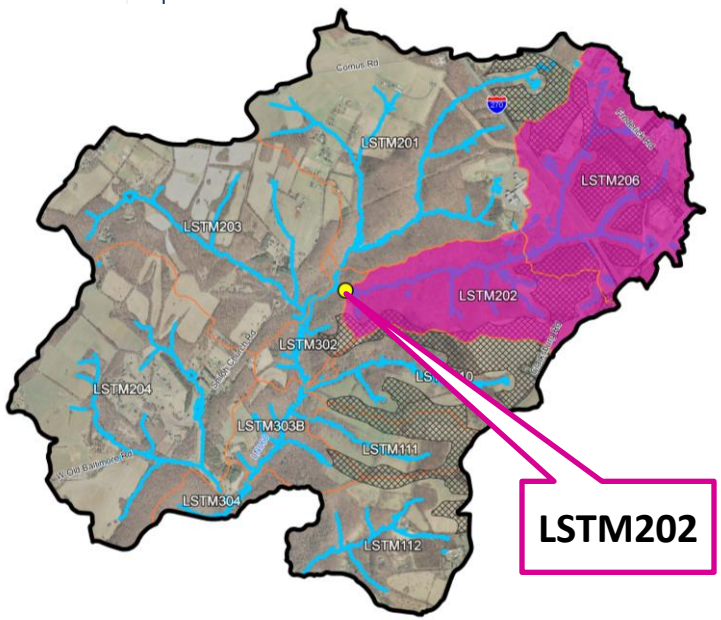


Example: Sub-basin with Low to Moderate Hydrology Response (LSTM202)



Existing Conditions:

- 613 Total Acres
- 65ac Imp Cover (11%)



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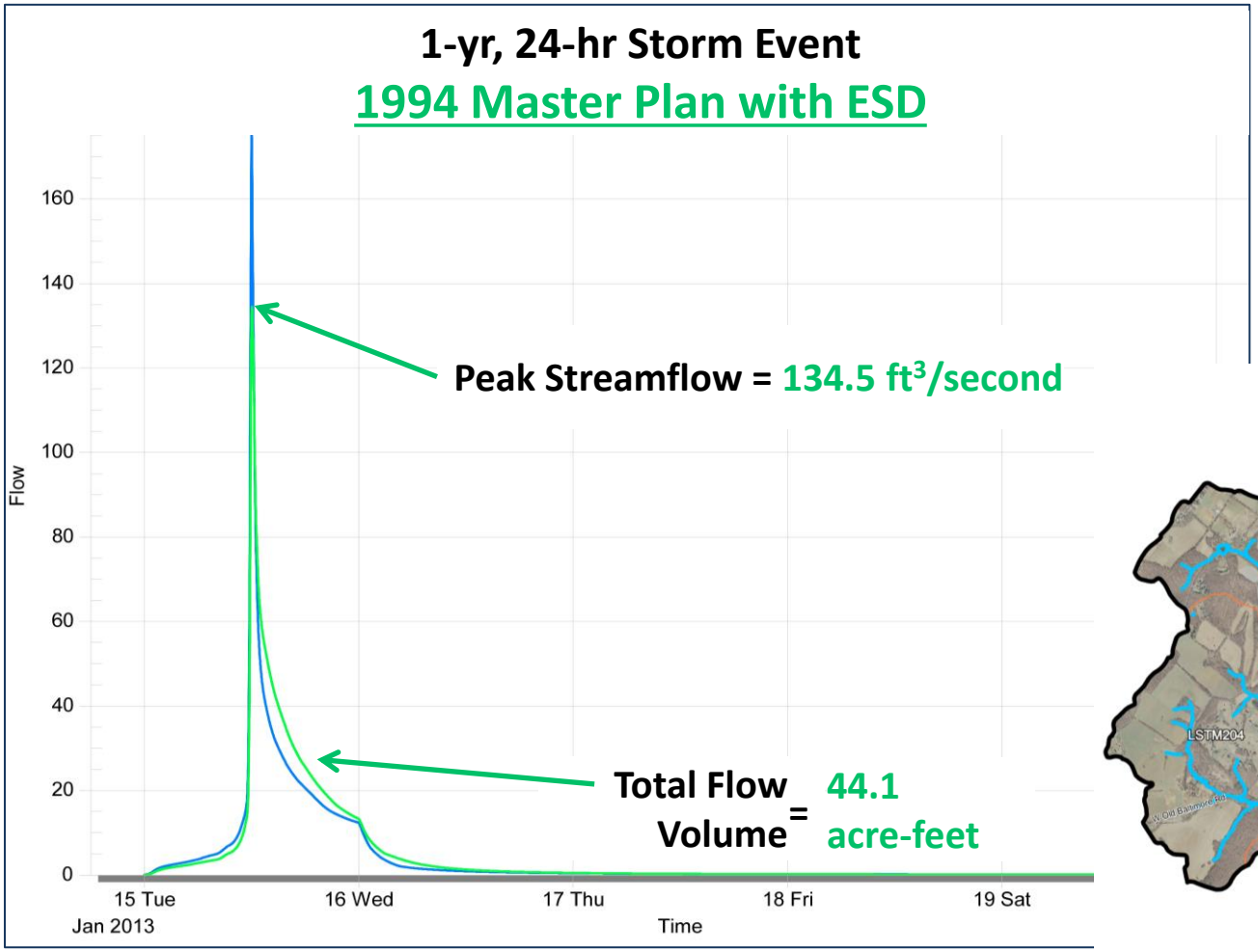
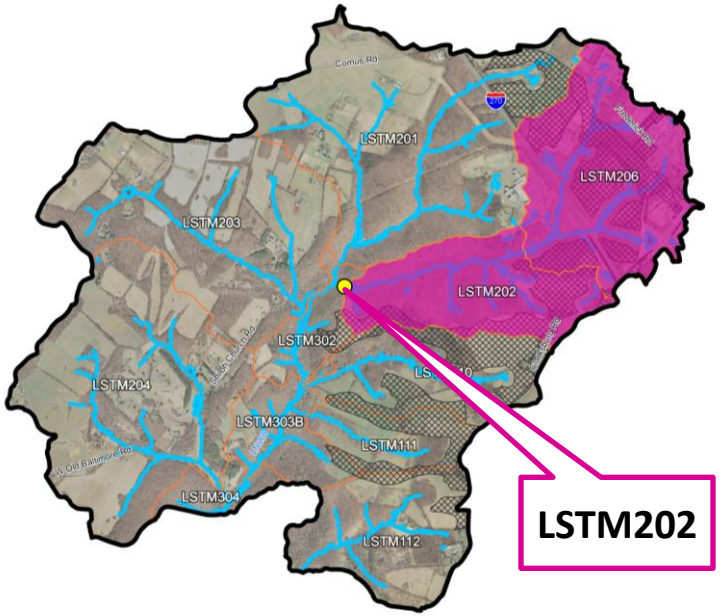
Example: Sub-basin with Low to Moderate Hydrology Response (LSTM202)



1994 Master Plan:

- 139ac Imp Cover (23%)
- +12% Increase in Total Stream Volume
- -23% Decrease in Peak Stream Flow



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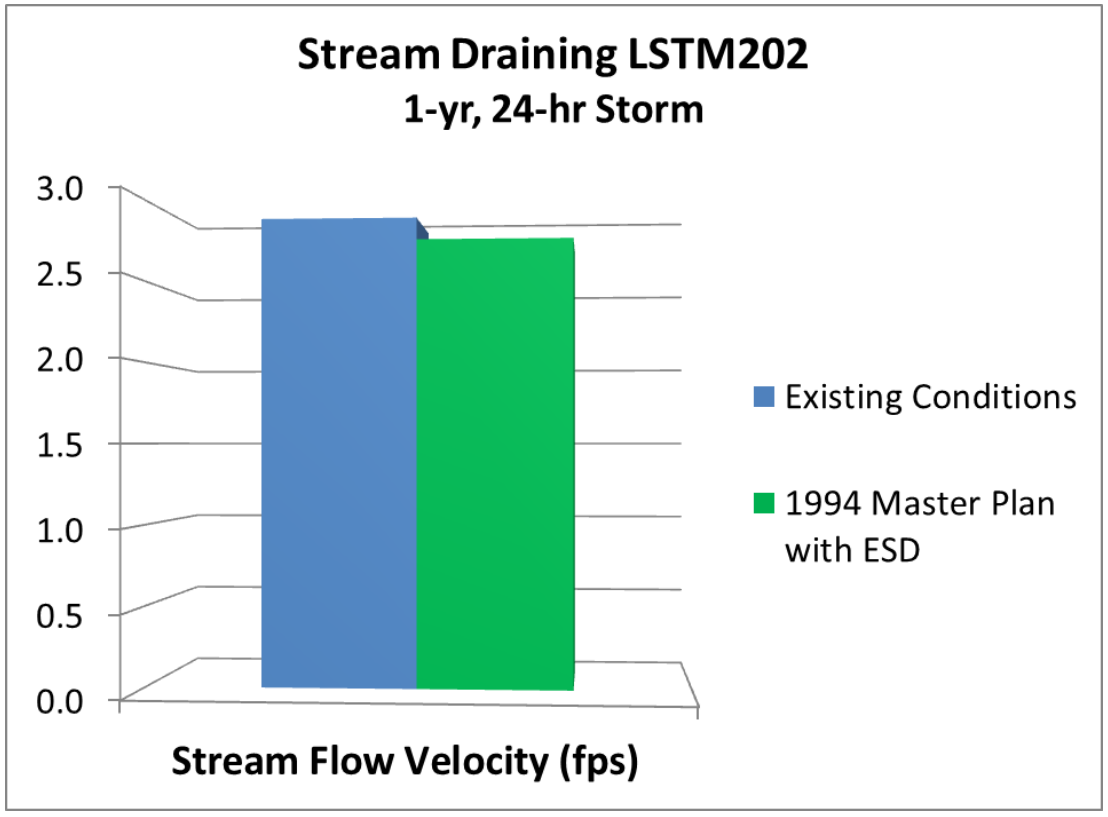
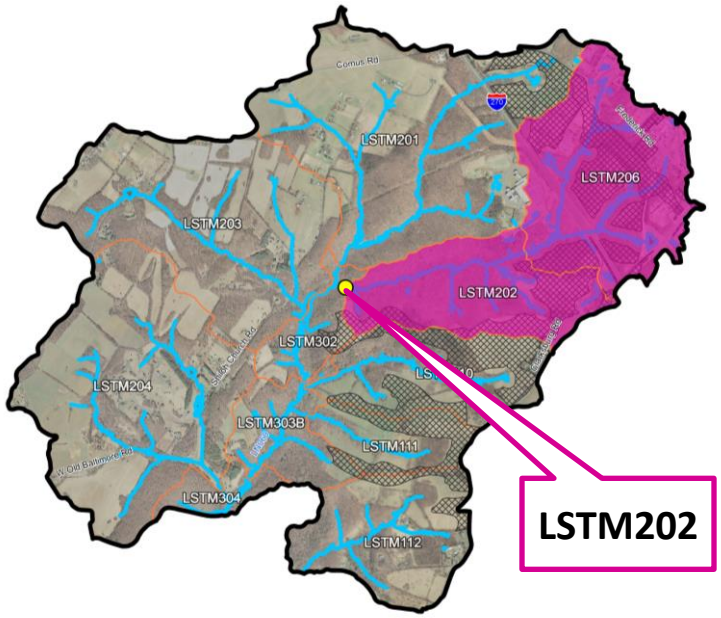
Example: Sub-basin with Low to Moderate Hydrology Response (LSTM202)

1994 Master Plan:

- -5% Decrease in Stream Flow Velocity





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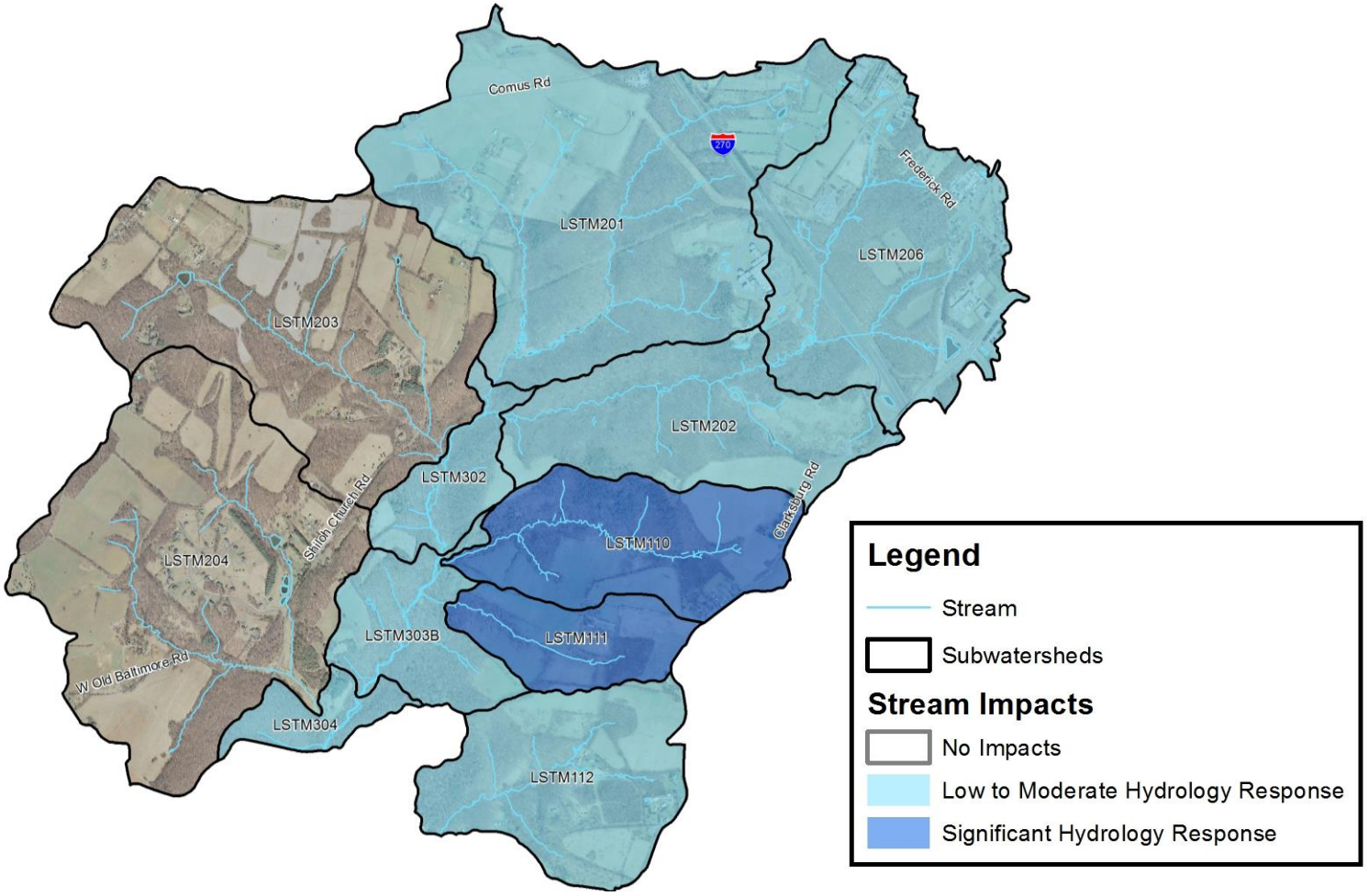
Overview of H&H results



10 Mile Creek Area Limited Amendment

Summary of H&H Impacts

- Some Ten Mile Creek sub-basins could experience
  - Lower peak flow due to ESD storage
  - Higher streamflow volume
  - Higher duration of elevated flow
- More vulnerable sub-basins could experience
  - Higher peak flow/velocity
  - Higher streamflow volume
  - Higher duration of elevated flow

10 Mile Creek Area Limited Amendment

1994 Master Plan Scenario Analysis

Pollutant Load Modeling	
WHAT IT CAN DO	• Predict the amount of certain pollutants that will be delivered to surface water
WHAT IT CANNOT DO	• Predict the effects of all pollutants on stream biology • Predict the effects of pollutants on groundwater

Overview of Water Quality Modeling

- Used the Watershed Treatment Model (CWP, 2010)
  - A simple spreadsheet-based model
  - Models Nitrogen (TN), Phosphorus (TP), Sediment (TSS) and Annual Runoff Volume
  - Includes loads from septic systems and urban lawns
  - Includes ESD as required by Maryland

Water Quality

- Agriculture contributes mostly nutrients as pollutants, which affect the Chesapeake Bay, but do not significantly affect the health of local streams
- Most of the County's highest quality streams are in agricultural areas
- Except for nitrogen, TMC is considered to have unusually high water quality
- Urbanized areas contribute less nutrients, but also other pollutants, such as metals, hydrocarbons, pesticides, bacteria and salt—which do affect local water quality and health

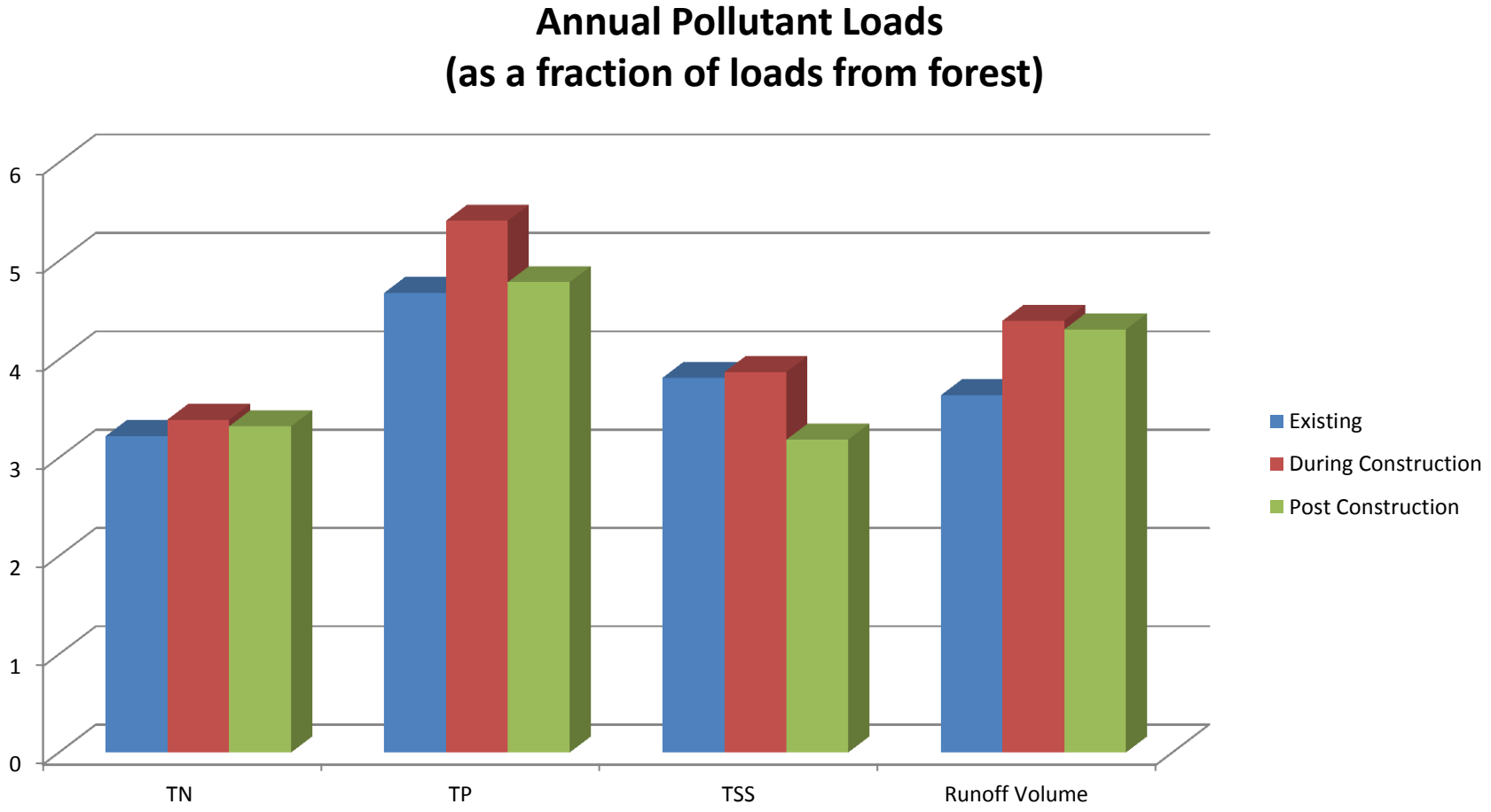
Three Scenarios

- Scenario 1: Existing Conditions
  - Current Land Use
  - Some Assumptions for “Cropland” (½ Hay and ½ Row Crops)

- Scenario 2: Post Construction
  - Build-Out according to 1994 Master Plan
  - Reforestation of non-forested land in the forested buffer

- Scenario 3: During Construction
  - Scenario 2, but with 10% of urban land in Active Construction

Results: Watershed-Wide



Water Quality Modeling: Conclusions

- Nutrient loadings are overall moderate due to the conversion from cropland in the watershed
- Sediment appears to increase during the construction phase, and decline after development has occurred, but this model does not include channel erosion.
- Annual runoff volume increases both during construction and in the post-construction phase in all watersheds.
- Loadings are more dramatic in some subwatersheds, with

10 Mile Creek Area Limited Amendment

1994 Master Plan Scenario Analysis

Spatial Watershed Analysis	
WHAT IT CAN DO	• Distinguish areas of high ecological value within the watershed • Identify areas of high ecological value that overlap with proposed limits of disturbance
WHAT IT CANNOT DO	• Predict aquatic and terrestrial biota population numbers directly impacted by development • Account for "site fingerprinting" integrated into development design

10 Mile Creek Area Limited Amendment

Spatial Watershed Analysis

Attribute	Score	
	Present	Absent
Steep Slopes, >15% – presence/absence	1	0
Steep Slopes, >25% – presence/absence	1	0
Erodible Soils – presence/absence	1	0
Hydric Soils– presence/absence	1	0
Forest – presence/absence	1	0
Interior Forest – presence/absence	1	0
FEMA 100-Year Floodplain – presence/absence	1	0
Perennial/Intermittent Streams – presence/absence	1	0
Ephemeral Channels – presence/absence	1	0
Wetlands – presence/absence	1	0
Springs, Seeps, and Pools – presence/absence	1	0
Stream Condition rating	Excellent = 2 Good = 1 Fair = 0	
Maximum Possible Score	**13**	

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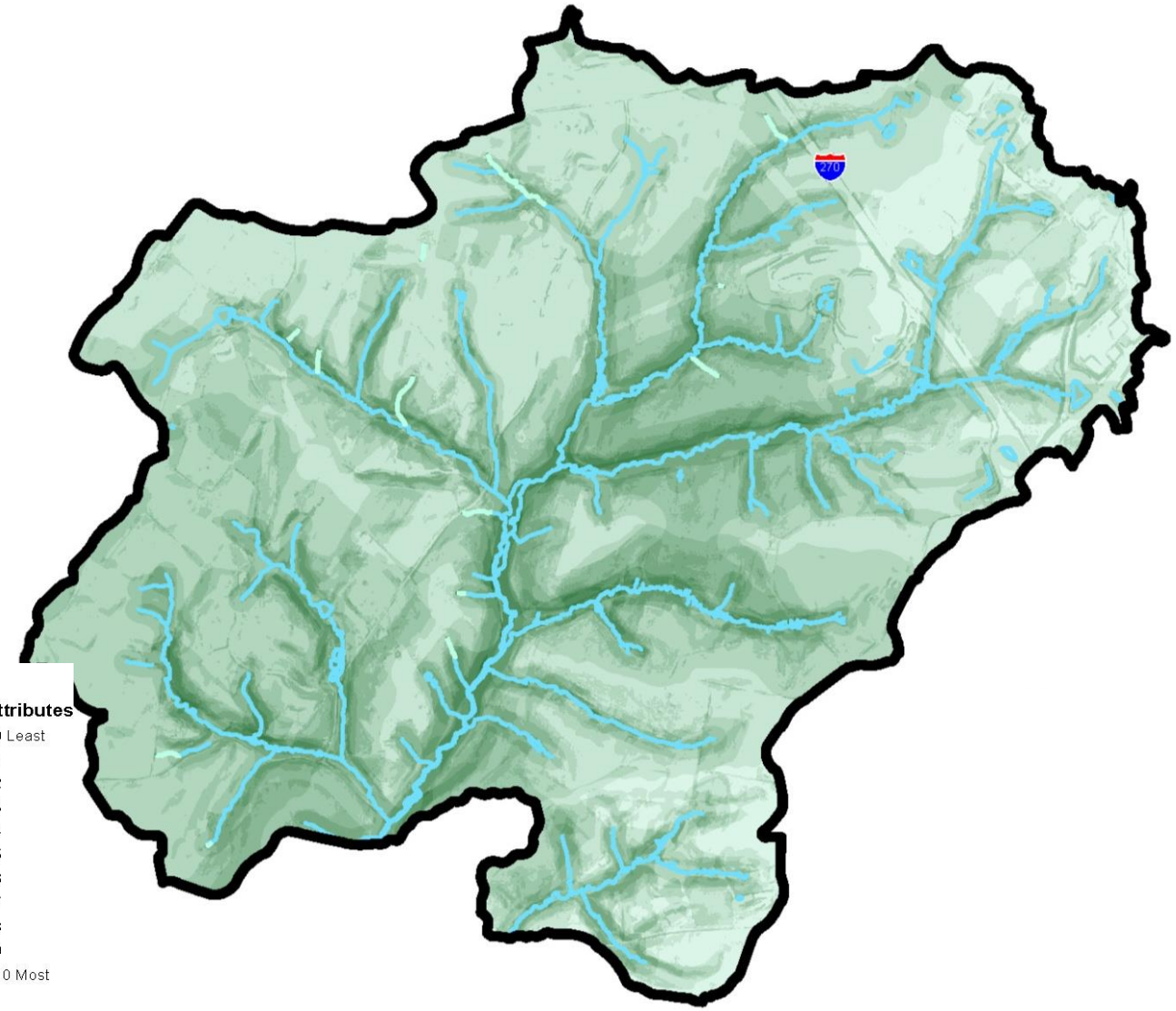
Spatial Watershed Analysis



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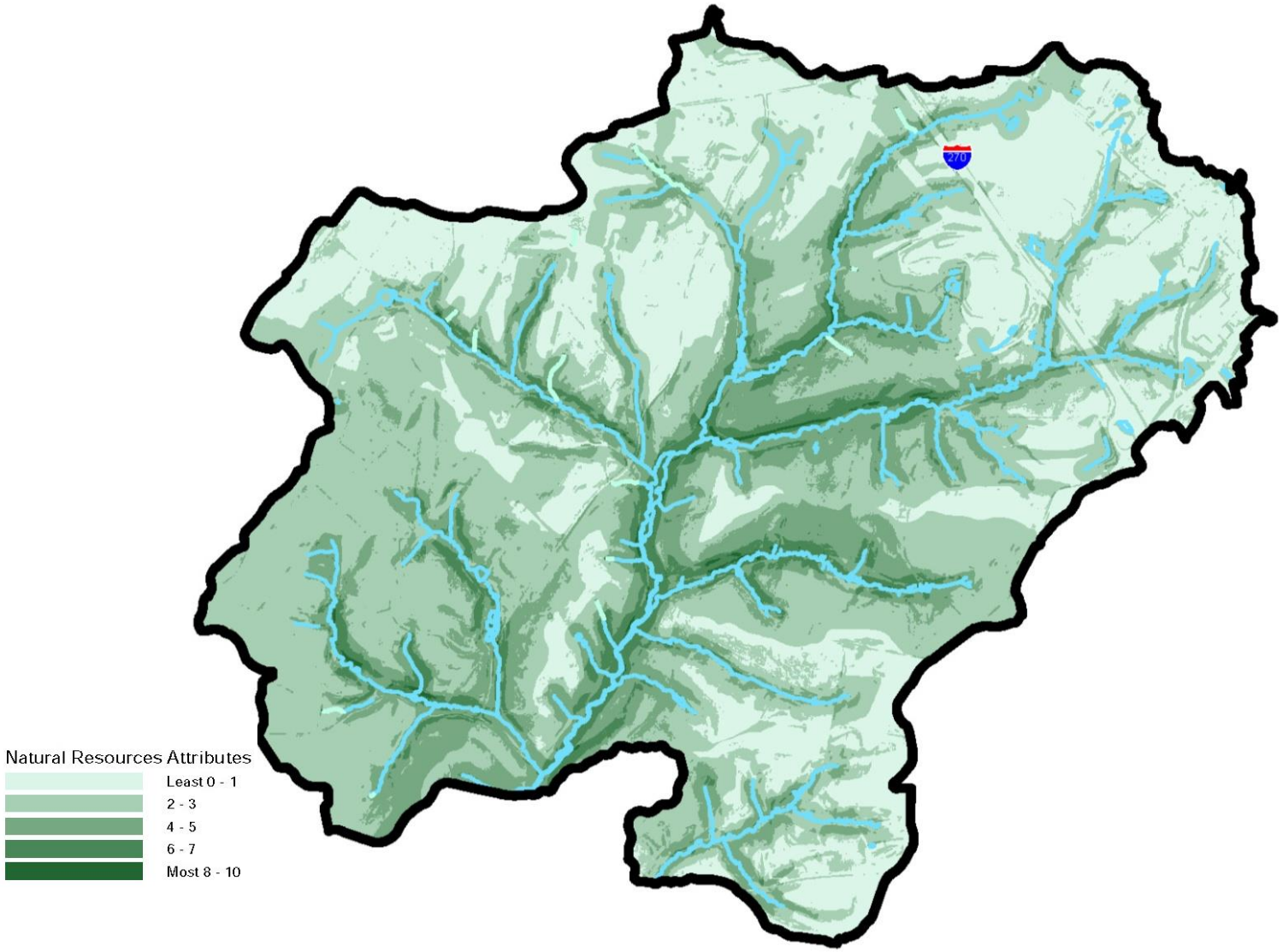
Spatial Watershed Analysis



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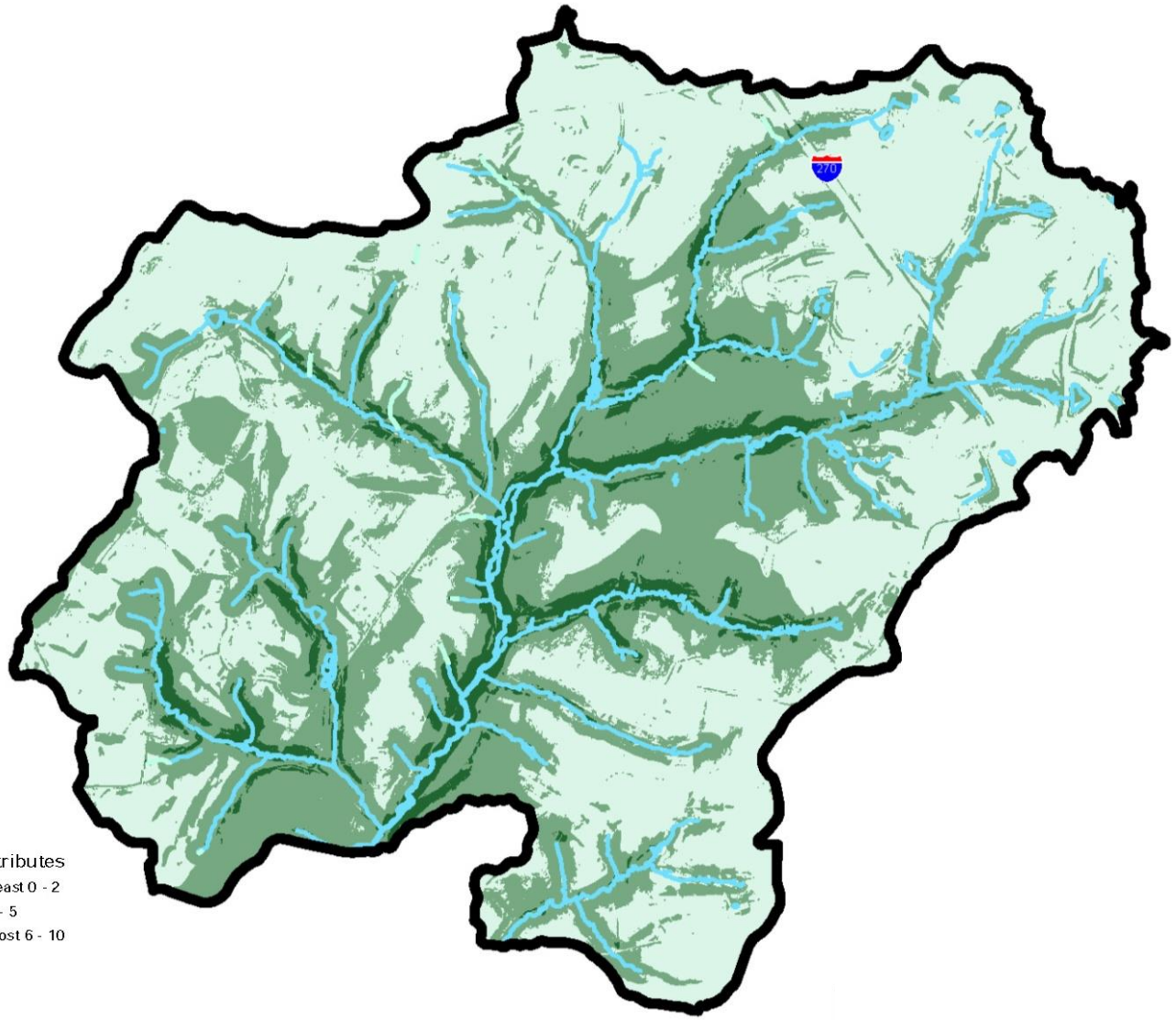
Spatial Watershed Analysis



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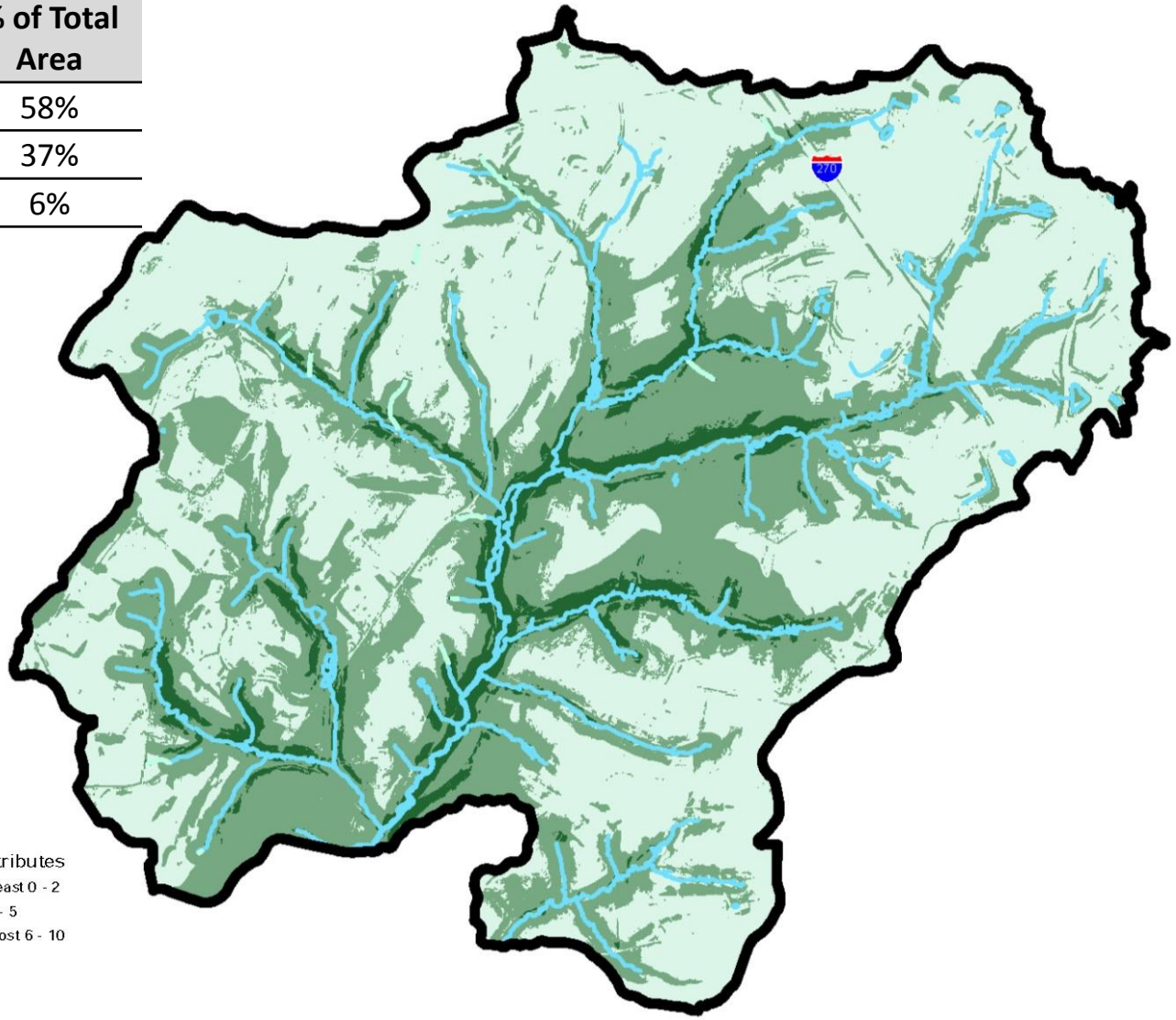
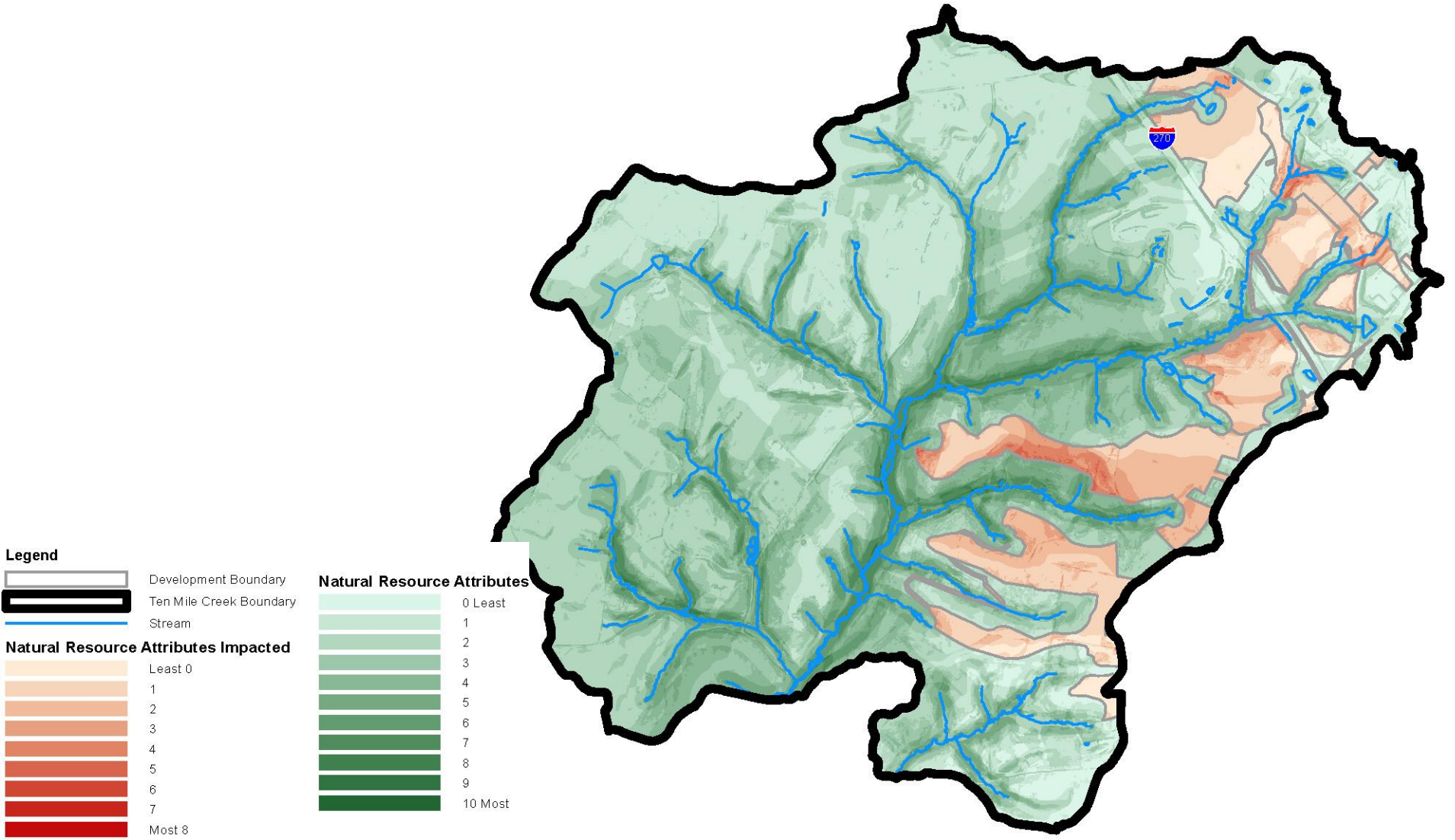
Spatial Watershed Analysis

Natural Resource Attributes	Area (Acres)	% of Total Area
0 to 2	1,758	58%
3 to 5	1,117	37%
6 to 10	173	6%



10 Mile Creek Area
Limited Amendment

Spatial Watershed Analysis



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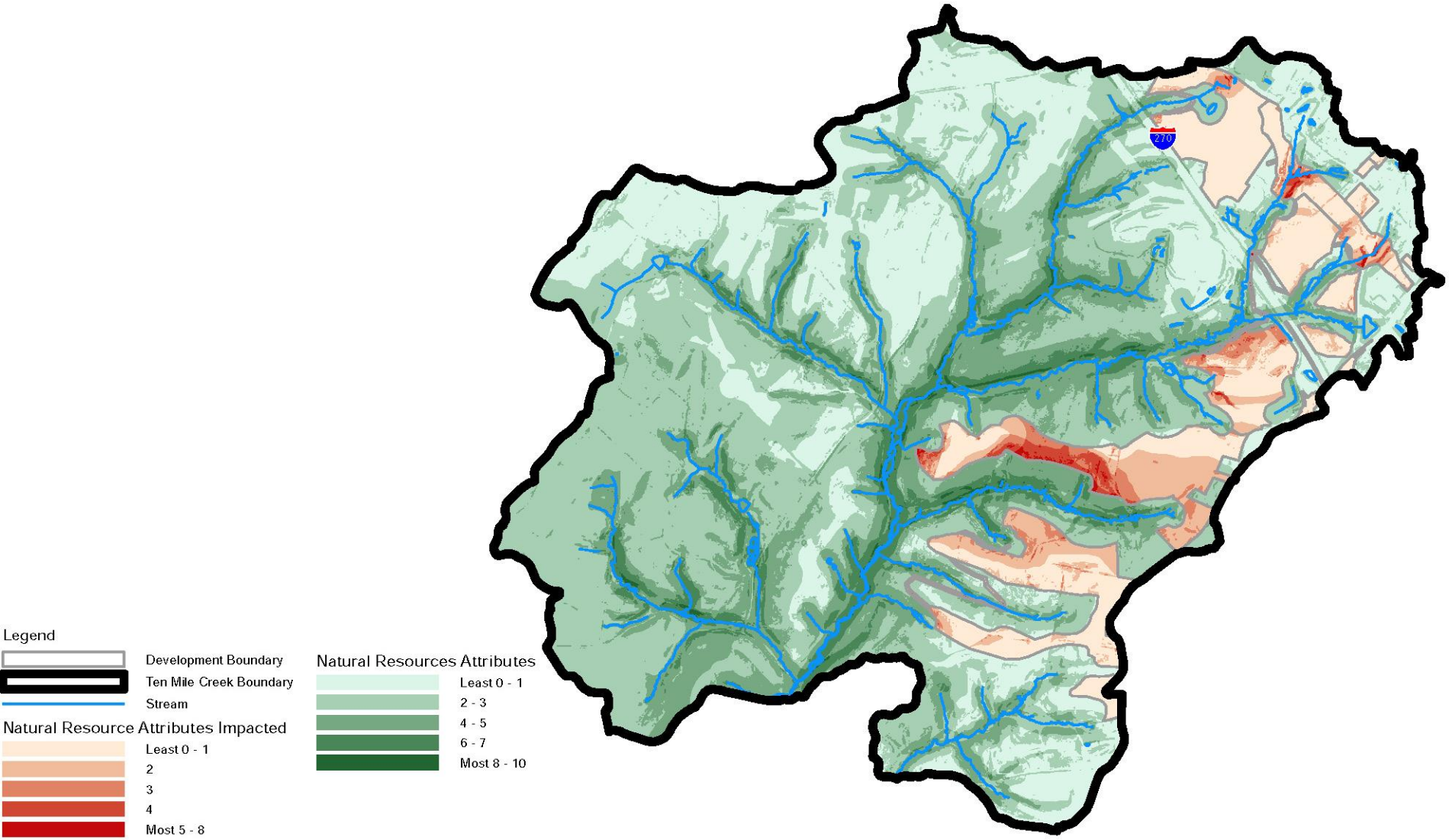
Spatial Watershed Analysis



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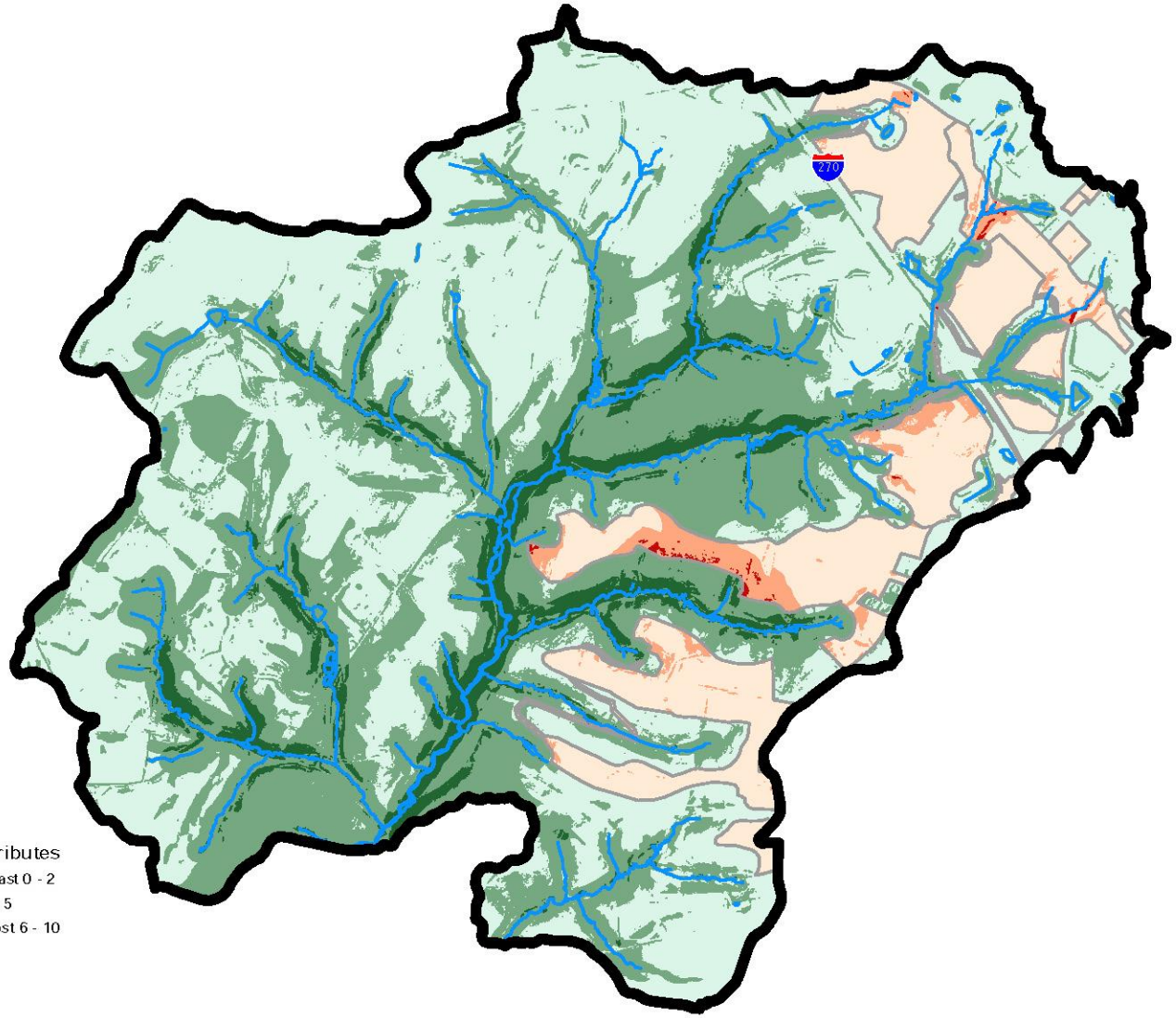
Spatial Watershed Analysis



10 Mile Creek Area
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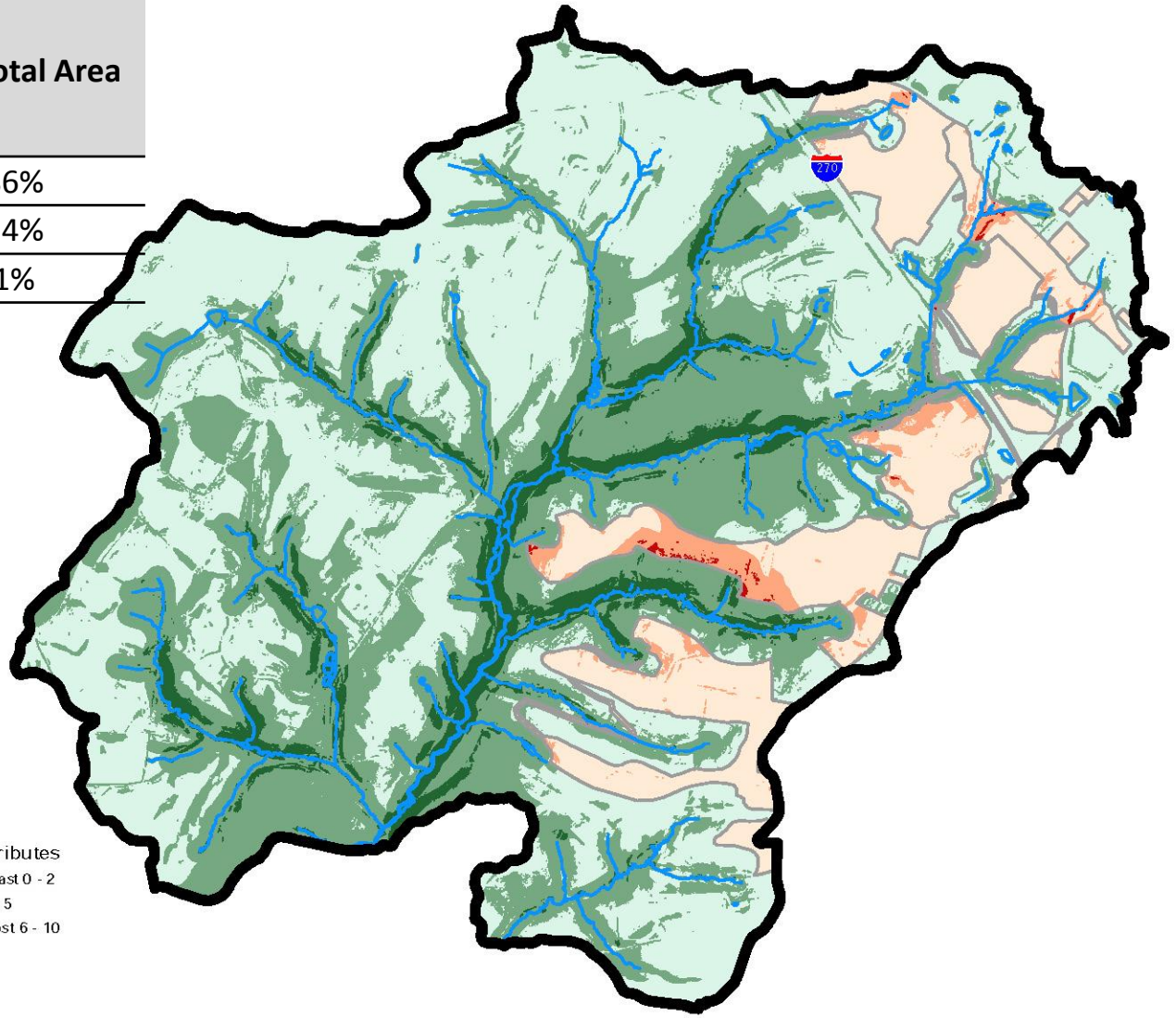
Spatial Watershed Analysis

Natural Resource Attributes Impacted	Area (Acres)	% of Total Area
0 to 2	353	86%
3 to 4	56	14%
5 to 8	3	1%



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Impacts on Natural Resources Under the 1994 Master Plan

Attribute	Existing	Within the Limits of Disturbance	% Affected
Forest Interior Area (acres)	409	64.2	16%
Forest Cover (acres)	1,389	119.5	9%
Areas with Slopes >15%	805	57.3	7%
Seeps, Springs & Seasonal Pools (#)	149	9.0	6%
Areas with Slopes >25%	183	5.6	3%
Stream Length (miles)	22	0.7	3%
Wetland Area (acres)	86	1.6	2%
Erodible Soils (acres)	231	1.0	0%
Study Area (acres)	3,046	412.0	14%

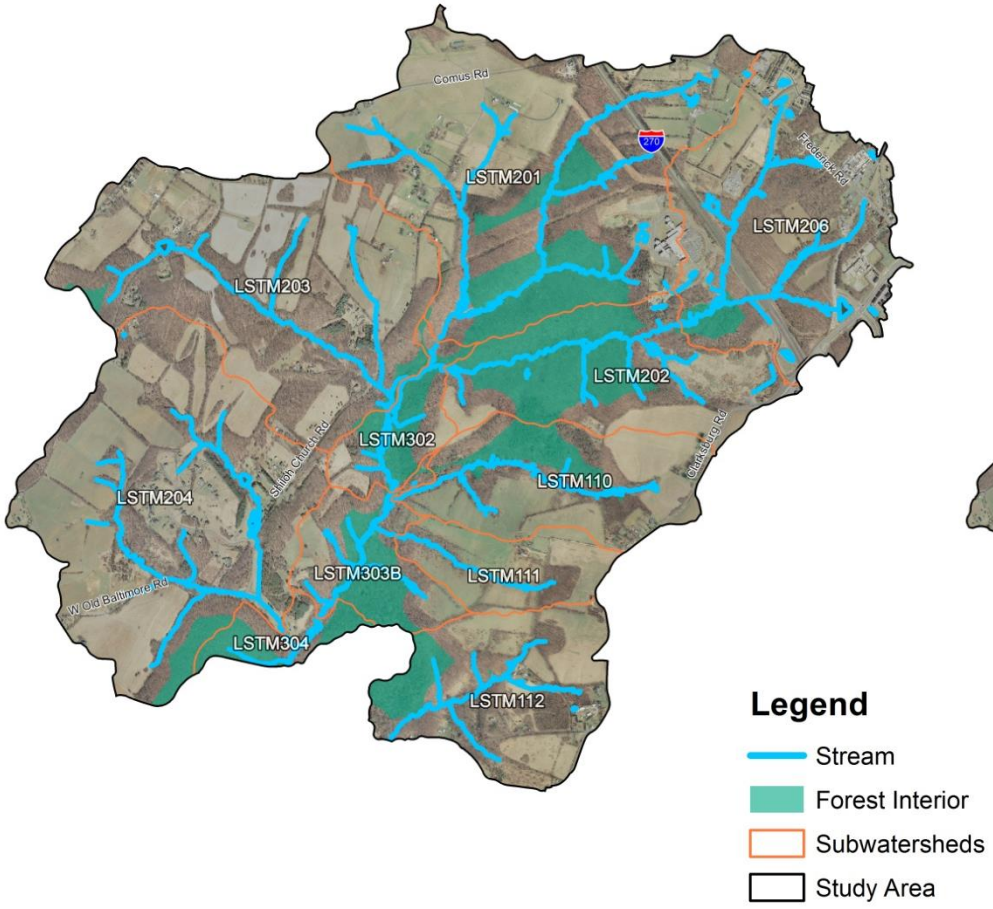
10 Mile Creek Area Limited Amendment

1994 Master Plan Scenario Analysis

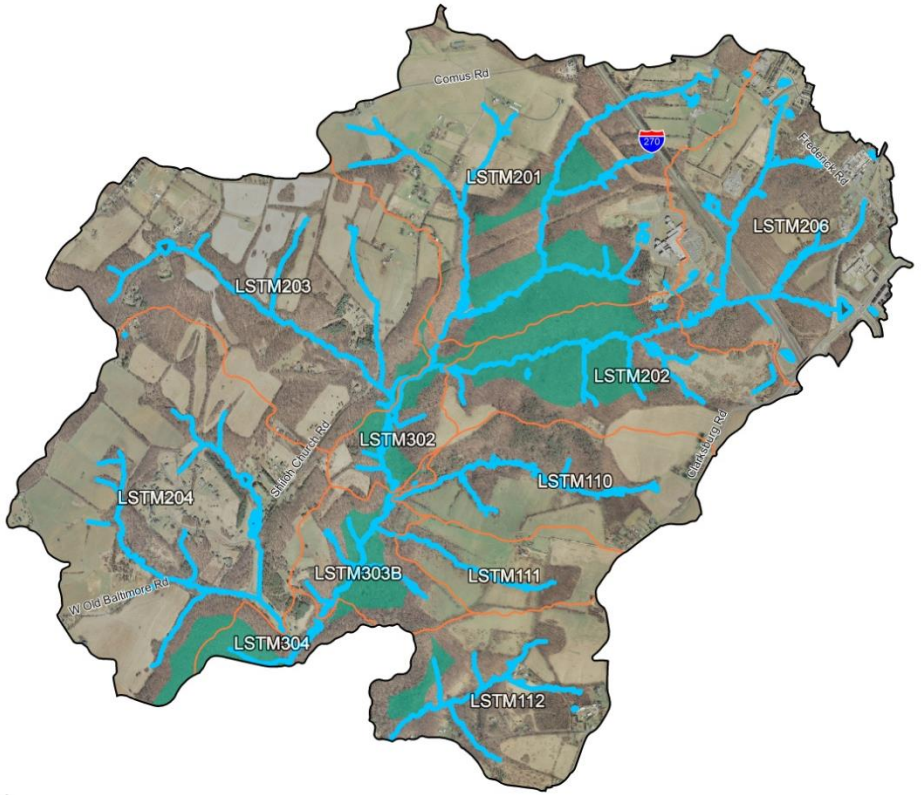
Natural Resource Impacts Identification	
WHAT IT CAN DO	• **Project direct impacts to natural resources within proposed limits of disturbance**
WHAT IT CANNOT DO	• **Project aquatic and terrestrial biota population numbers directly impacted by development** • **Account for "site fingerprinting" integrated into development design**

10 Mile Creek Area
Limited Amendment

Interior Forest, Existing



Interior Forest, 1994 Master Plan Scenario



10 Mile Creek Area Limited Amendment

Existing Imperviousness

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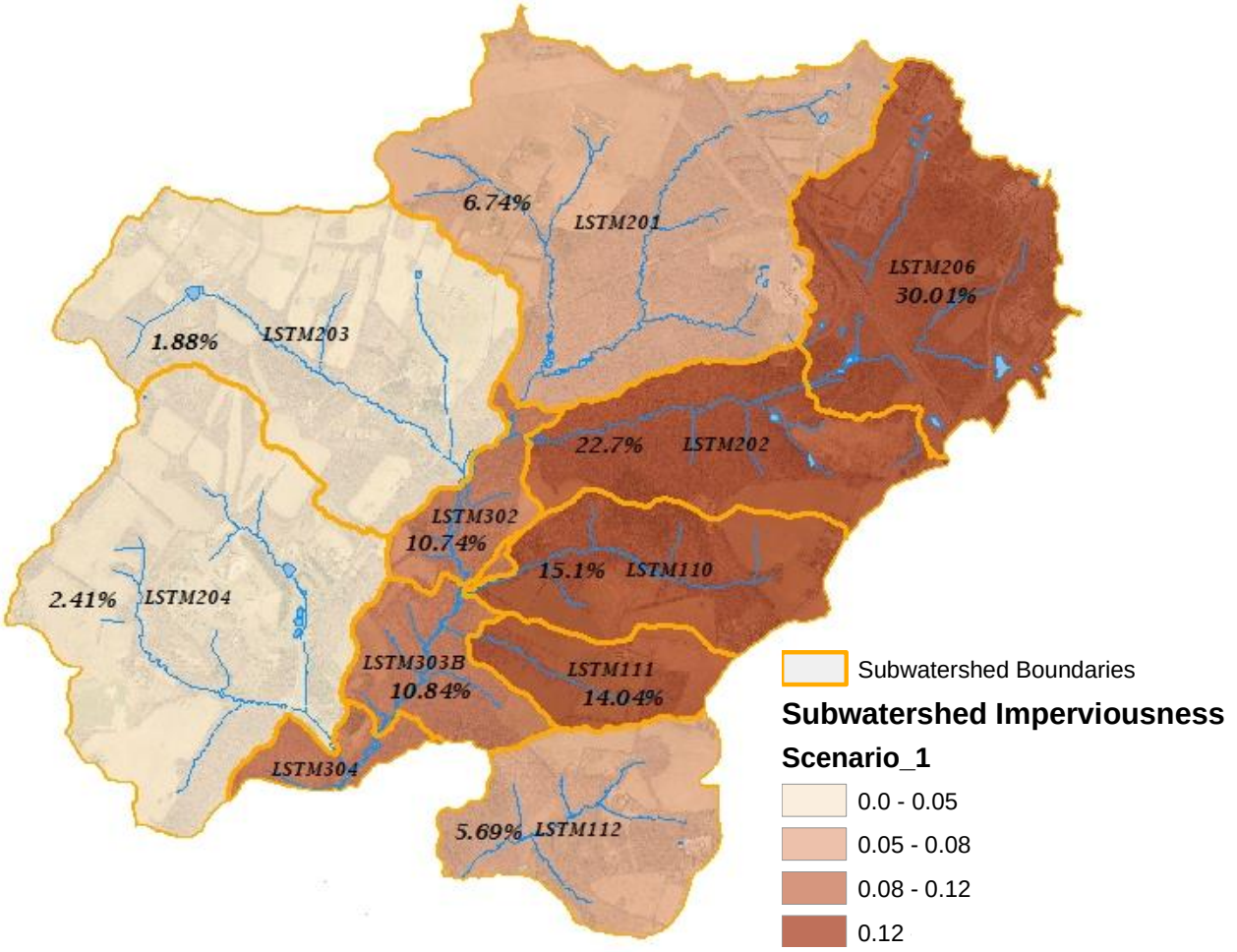
1994 Master Plan Imperviousness Analysis



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Summary of Results

Subwatershed	Watershed Health Indicator				
	Hydrology	Geomorphology	Pollutant Loads	Spatial	OVERALL
LSTM110	Significant	Moderate to Significant	Significant	Significant	Significant
LSTM111	Significant	Significant	Significant	Significant	Significant
LSTM112	Low to moderate	Low to Moderate	Moderate to Significant	Low	Moderate
LSTM201	Low to Moderate	Low to Moderate	Low	Low to Moderate	Low
LSTM202	Low to Moderate	Low to Moderate	Low	Moderate to Significant	Moderate
LSTM203	N/A	N/A	N/A	N/A	NA
LSTM204	N/A	N/A	N/A	N/A	NA
LSTM206	Low to Moderate	Low to Moderate	Moderate to Significant	Significant	Significant
LSTM302	Low to Moderate	Low to Moderate	Significant	Moderate to Significant	Significant
LSTM303B	Low to Moderate	Low to Moderate	Moderate	Low to Moderate	Moderate
LSTM304	Low to Moderate	Low to Moderate	N/A	N/A	Moderate

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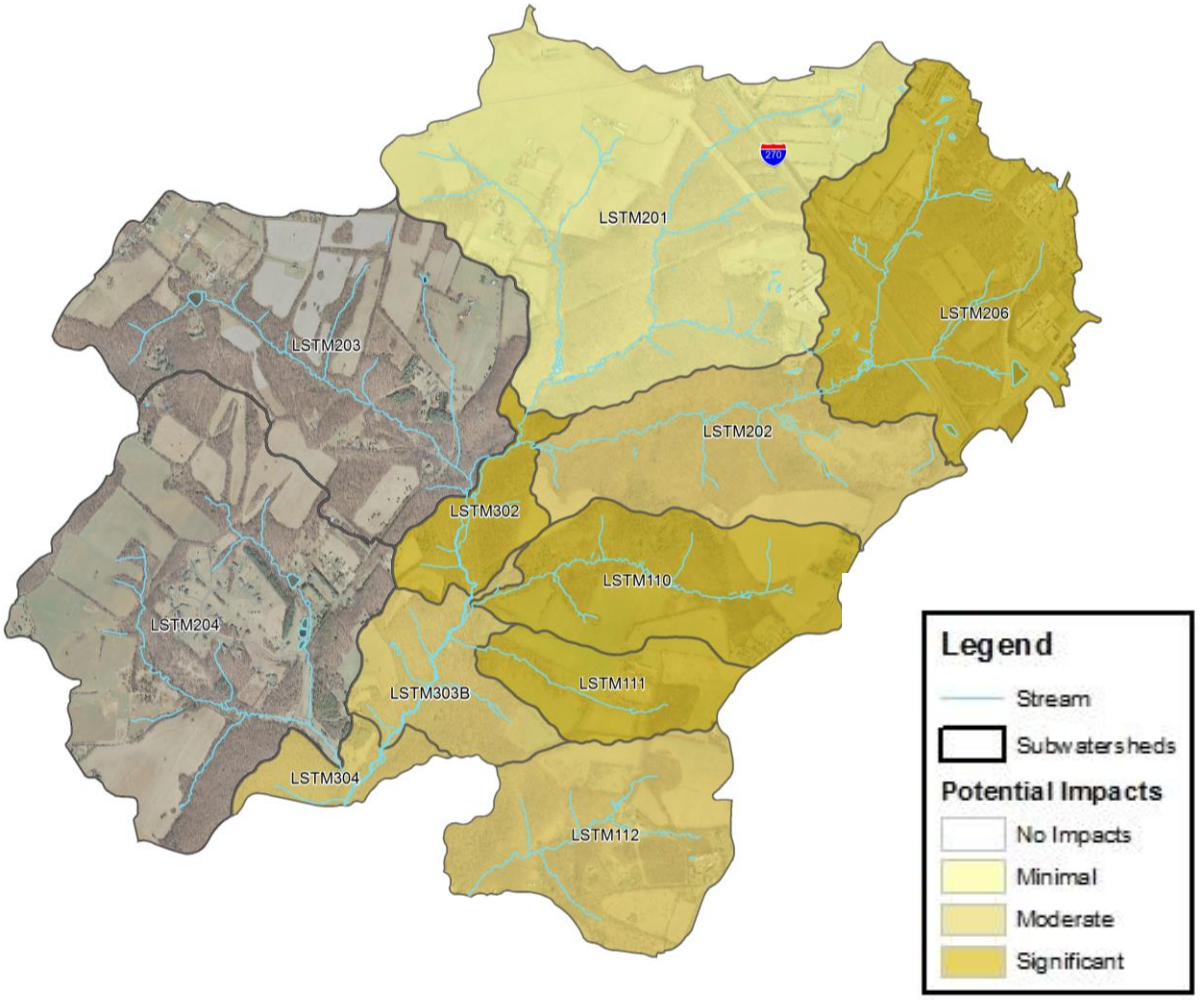
1994 Master Plan Scenario Analysis

- Probable loss of reference stream conditions
- Greatest impact in headwaters and small tributaries
- Imperviousness doubled in key watersheds



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Potential Scenarios

- East of I-270
  - Assess need for MD-355 bypass – review alternatives
  - Explore moving fire station out of headwater area or to an already disturbed area
  - Establish an impervious cap
- West of I-270
  - Do not develop County property and reforest site
  - Change development mix to increase resource protection
  - Expand protection areas to coincide with consultant findings
  - Establish an impervious cap

10 Mile Creek Area Limited Amendment

Discussion

How do we balance policies that support the 1994 plan vision?

- Clarksburg at a town scale and with a transit orientation
- Protection of natural features
- Importance of I-270 high tech corridor with employment options

How significantly could the watershed be impacted by development?

How well can those impacts be mitigated?

What constitutes an acceptable level of stream quality decline?

What other development options should be considered?