Severn River Commission
Lina Vlachos 03

ANNE ARUNDEL COUNTY
MARYLAND

Severn River Watershed Management Master Plan Phase I Final Report

Vol. 2: Appendices



KCI TECHNOLOGIES

CH2MHILL

February 28, 2002

CONTENTS

FIGURES

TABLES

APPENDIX A: PUBLIC INVOLVEMENT MATERIALS

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ANNAPOLIS, MARYLAND 21401

Severn River Watershed Management Master Plan Study

ATTENDEES:

Lina Vlavianos, Severn River Commission
Sally Hornor, Severn River Commission

Grover Bussey, Severn Small Area Planning Committee
Ray Ringold, Severn Small Area Planning Committee

Don Curtian, Health Department

Melanie Parker, Arlington Echo, AACPS
Stephen G. Barry, Arlington Echo AACPS

Marie Halka, Anne Arundel Economic Development Corp.

Rob Schnabel, Annapolis Environmental Committee

Ron Etzel, Anne Arundel County DPW
Ron Bowen, Anne Arundel County DPW
Caroline Gaulke, Anne Arundel County DPW MGI

Janis Markusic, Anne Arundel County P&Z Env. Planning
Charlie Abrahamson, Anne Arundel County P&Z GIS
Mary Searing, Anne Arundel County P&Z Development Div

Nate Beil, KCI Technologies
Bill Frost, KCI Technologies

Laurens van der Tak, CH2M HILL
Tara Ajello, CH2M HILL
Valerie Ross, CH2M HILL

FROM: CH2M HILL

DATE: May 4, 2001

The purpose of the stakeholder meeting held at 7:00pm on May 3, 2001 was to introduce the stakeholders to the Severn River Watershed project, gain their inputs on environmental concerns and problems within the watershed, and identify any additional key stakeholders to be included in future meetings.

1. Mr. Bowen opened up the meeting by welcoming all stakeholders, ~~iving~~ providing a brief background on the project, and inviting the input and involvement of all meeting attendees.

2. Mr. Van der Tak briefed the audience with a PowerPoint presentation of various aspects of the Severn River Watershed Master Plan. It included some historical facts of the watershed, the vision of the project, an overview of the schedule and steps, and an overview of the GIS Tool.

3. Ms. Ross facilitated a discussion with the stakeholders to identify overall watershed issues and concerns. The stakeholders spent approximately half an hour brainstorming issues in the watershed and/or within their expertise that concerned them. A list of these concerns is included at the end of these meeting minutes.

4. Ms. Ajello facilitated a discussion with the stakeholders to identify specific problems within the watershed. Stakeholders were given colored dots and were asked to identify specific problems by placing the dots on a large watershed GIS map. The dots were color coded according to category (water quality, flooding and erosion, impacted uses, and critical areas or special protection areas). These specific problems are listed at the end of these meeting minutes.

5. Ms. Ross and meeting attendees grouped the overall watershed concerns identified in item 3 into six major categories: hydrology, institutional/regulatory/funding, water quality, habitat, recreational use, and economic use. The stakeholders were each given three votes and allowed to vote for what they consider to be the most important issue(s) facing the Severn River Watershed. The relative importance according to the audience was as follows: habitat (12 votes), water quality (11 votes), hydrology (9 votes), recreational use (5 votes), institutional/regulatory/funding (5 votes), and economic use (0 votes).

6. The meeting concluded with a short question and answer period. At that same time, the stakeholders were asked to fill out a survey regarding their preference for meeting days and times and any suggestions for additional organizations to be included in future meetings. The next stakeholder meeting will be held on May 17, 2001.

We believe that the above accurately reflects what transpired at this meeting. However, we will appreciate comments involving a difference in understanding of what occurred. Unless we are notified in writing to the contrary within ten (10) days after receipt, we will assume that all in attendance concur in the accuracy of this transcription.

Overall Watershed Issues (Item 3)

1. losing origins (springs) of the smaller tributaries - they are being developed over
2. lack of stormwater management, need to look for opportunities for retrofits, more innovative approaches
3. algal blooms caused by nutrient loadings
4. high counts of bacteria and coliform after rain events
5. balance between regulatory and incentive-based approaches in dealing with business
6. relationship between TMDL and the watershed plan
7. habitat areas - submerged aquatic vegetation, loss of open water, marshes and wetlands
8. loss of natural shoreline
9. boating-related impacts
10. quantification of habitat losses and compensation/mitigation for those losses
11. impacts of development (especially housing) and the rapid growth (quantity and type)
12. funding retrofits
13. reassessment of subdivision regulations as it relates to low impact development
14. Severn River listed as an area of special concern due to high metals content (copper, zinc, lead, arsenic); would like to see sediment sampling for metals
15. sewer lift stations near river beds, potential for failure and overflow during storms and flooding
16. special protection area needed for the trout stream and bogs
17. deforestation of the watershed
18. concern for impacts on air quality due to transportation patterns within the watershed
19. coliform results in uses of the watershed being impacted - contact recreation, and fisheries
20. dredging needed due to development and related siltation - boating access vs. environmental affect
21. nonpoint source pollution
22. lack of public access to waterways
23. lack of fish access to headwaters
24. commercial fisheries (shellfish)

Specific Watershed Issues by Geographic Area(Item 4)

Categories: Water Quality (WQ), Flooding & Erosion including hydrology type issues (F&E), Impacted Uses (IU), Habitats/Special Protection Areas (SRA)

1. SRA - Jabez Branch - Special Protection Area
2. WQ / F&E - Old Mill/Burns Crossing North - Pump station
3. WQ / F&E - Burns Crossing - Pump station
4. WQ / F&E - Dicus Mill Road - Pump station
5. SRA - Arden Bog / Gumbottom Bog
6. SRA - Indian Creek bog / marsh - White Cedar Stands

7. WQ – Spa Creek - Sewage leaks
8. WQ - David Taylor Research Center – flooding issues because no stormwater management
9. WQ - Coliform levels in Valentine Creek – onsite sewage
10. SRA - Severn Run – natrual resource area, yellow perch spawning area
11. WQ – Little Round Bay - Coliform levels – onsite sewage
12. IU – near John Hanson Highway - New road
13. WQ – Little Round Bay - Sewage disposal area – on site
14. WQ – Severn Run / Indian Creek - High coliform levels
15. WQ – Whitehall Creek near Whitehall Road - Sewage disposal area onsite
16. WQ – Spa Creek by Eastport Marina - High coliform levels
17. WQ – on edge of watershed, near Sandy Point State Park - Septic
18. F&E – Severn Run / Indian Creek - Beach erosion, dredging issues
19. SRA – Cool Spring Cove - Endangered species habitat (tiger beetle)
20. F&E – Weems Creek - Erosion at outfall
21. SRA – Dreams Landing - Habitat loss due to hardening of shoreline
22. SRA – Maynadier Creek - Submerged aquatic vegetation
23. IU – Back Creek - Boating industry
24. F&E – near B& A Road - Springs covered over by development
25. F&E - David Taylor Research Center – flooding issues because no stormwater management
26. SRA – College Creek near USNA - Oyster bar – remnants and proposed restoration bar
27. SRA – in between Brewer Creek and Clements Creek - Sherwood Forest – oyster restoration bar
28. F&E – Severn Run near Disney Road - Dry strem beds / hydrology
29. SRA – eastern half of watershed - Less developed – some agriculture
30. Fish blockage along Severn Run

Note: meeting attendees felt that geographic areas where problems were not identified was a result of attendees lack of knowledge of the areas, rather than an absence of problems.

Severn River Watershed Management Master Plan Study

ATTENDEES:

Sally Hornor, Severn River Commission
R.W. Biddle, Severn River Commission

David Wallace, Severn River Association

Jim Martin, Severn River Land Trust

Evan Belaga, Weems Creek AHIA

Mark Moran, Anne Arundel County Public Schools

Melanie Parker, Arlington Echo, AACPS

Marie Halka, Anne Arundel Economic Development Corp.

Ron Etzel, Anne Arundel County DPW
Ron Bowen, Anne Arundel County DPW
Caroline Gaulke, Anne Arundel County DPW MGI

Janis Markusic, Anne Arundel County P&Z Env. Planning
Charlie Abrahamson, Anne Arundel County P&Z GIS
Mary Searing, Anne Arundel County P&Z Development Div

Nate Beil, KCI Technologies
Bill Frost, KCI Technologies
Mike Pieper, KCI Technologies

Laurens van der Tak, CH2M HILL
Tara Ajello, CH2M HILL
Jed Campbell, CH2M HILL

FROM: CH2M HILL

DATE: May 18, 2001

The purpose of the stakeholder meeting held at 7:00pm on May 17, 2001 was to introduce the stakeholders to the Severn River Watershed project, gain their input on environmental concerns and problems within the watershed, help to prioritize future data analysis in Phase II, and identify additional key stakeholders to be included in future meetings.

1. Mr. Bowen opened up the meeting by giving some introductory remarks. He welcomed all stakeholders and gave a brief background to the project.

2. Mr. Van der Tak briefed the audience further with a PowerPoint presentation of various aspects of the Severn River Watershed Master Plan. This presentation incorporated a shortened version of the presentation given at the stakeholder meeting on May 3, 2001. In addition, it included a summary of the issues heard from the stakeholders at that previous meeting.

3. Mr. Martin brought up the concern that the community associations within Anne Arundel County are not being informed and included in this project. He suggested taking the presentation given in item 2 and creating an article to post on the Severn River Land Trust website. We informed him that a website is being created for this project and links could be created between the Severn River Land Trust website and the project website to facilitate awareness.

4. Ms. Ajello facilitated a discussion with the stakeholders to identify specific problems within the watershed. This discussion was a continuation of the one held at the last meeting, with the goal of gaining new information from the attendees who were not at the previous meeting. Stakeholders were given colored dots and were asked to identify specific problems by placing the dots on a large watershed GIS map. The dots were color coded according to category (water quality, flooding and erosion, impacted uses, and critical areas or special protection areas). The additional list of specific problems is listed at the end of these meeting minutes.

5. In addition to watershed problems, Ms. Ajello also facilitated a discussion regarding watershed data sources. Another large watershed map was presented which had points on it symbolizing reports or studies gathered by the project team. A listing of those data sources was handed out for the attendees to review. Additional studies were described by attendees and potential contact agencies given. This list is included at the end of these meeting minutes.

6. Mr. Campbell introduced the community survey, another public involvement facet of the project. This survey is currently in draft form and is expected to be distributed in early June. They will be distributed to a random sampling of 2,500 residents throughout the watershed. The attendees were asked if they would be willing to take a particular number of surveys and distribute them among their membership. A list was circulated and several attendees offered to distribute surveys to their respective organizations. A suggestion was also made by Mr. Belaga that we include the survey as a flyer in The Capital – and that The Capital would probably be willing to do an article about the project. Mr. Martine mentioned that the Chamber of Commerce has a local cable television show that may be willing to do a segment on the project as a good method of targeting the development community within Anne Arundel County.

7. Mr. Campbell facilitated a series of discussions regarding the prioritization of Phase 2 data collection.

   a. The first type of data mentioned was stream assessment data. Mr. Campbell briefly described the field work occurring in Phase 2, the data to be collected, and why. All streams within the watershed would receive an initial walkthrough, and then certain streams would receive a more detailed study. The attendees of the meeting were asked to prioritize particular streams that they would like to see studied in detail. The list of streams was generated from issues raised at the last stakeholder meeting. The list is as follows: Jabez Branch (9 votes), Spa Creek and Weems Creek (7 votes each), Indian Creek Bog and Arden Bog (4 votes each), College Creek and Severn Run (3 votes each), and Maynadier Creek and Little Round Bay (1 vote each). Valentine

Creek, Whitehall Creek, Cool Spring Cove, and Dreams Landing did not receive any votes.

b. Mr. Campbell discussed some of the modeling to be performed in the second phase to develop a better understanding of flooding and erosion issues. Bothhydrologic and hydraulic models will be used. ing. The attendees helped identify particular streams that they have known to have experienced flooding and erosion: Maynadier Creek near Riva Road, Severn Run near Old Mill Road and Rte 170 and Burns Crossing, Herald Harbor, Valentine Creek, Plum Creek, Weems Creek, Cowhide Branch (flloding at Admiral and Jennifer near the Rte 50 overpass), near the headwaters of College Creek, and Spa Creek by Spa Road and Truxton Park. This information can help direct the field collection efforts in Phase 2.

c. Mr. Campbell continued with a brief overview of some of the pollutant loading and estuary modeling that would be done in Phase 2. The attendees brainstormed and then prioritized a list of pollutants of concern that would be potentially modeled later on in the project. The list is as follows: TSS (6 votes), nitrogen (4 votes), fecal coliform (3 votes) metals (2 votes), and phosphorus, TPH, and Oil and grease (1 vote each).

d. The attendees brainstormed a list of outfalls where they have observed pollution in the receiving stream. The list is as follows: Admiral Drive at Weems Creek, in the Sherwood Forest / Beech Drive area (high nitrate discharge), Porter Drive and Admiral Drive by the stadium parking lot.

8. The meeting concluded with a short question and answer period. At that same time, the stakeholders were asked to fill out a survey regarding their preference for meeting days and times and any suggestions for additional organizations to be included in future meetings.

We believe that the above accurately reflects what transpired at this meeting. However, we will appreciate comments involving a difference in understanding of what occurred. Unless we are notified in writing to the contrary within ten (10) days after receipt, we will assume that all in attendance concur in the accuracy of this transcription.

Specific Watershed Issues by Geographic Area(Item 4)

Categories: Water Quality (WQ), Flooding & Erosion including hydrology type issues (F&E), Impacted Uses (IU), Habitats/Special Protection Areas (SRA)

Items 1 - 30 were discussed at the May 3, 2001 meeting and can be found in those meeting minutes.

31. SRA - Burley Creek - bulkheaded shoreline
32. WQ - Whitehall Creek - sedimentation
33. SRA - Whitehall Bay - oyster bar
34. F&E - College Creek erosion problems
35. SRA - Sullivan's Cove - White Cedar Habitat
36. SRA - Shadey Lake - juvenile fish habitat
37. SRA - Whitehurst Lake - juvenile fish habitat
38. SRA - Brewer Pond - juvenile fish habitat
39. SRA - Crouchs Pond
40. SRA - Asquith Creek - redhead gras
41. SRA - Protected peninsula along Greenbury Point - wildlife refuge survival areas
42. WQ - Millersville landfill leachate
43. WQ - Pesticides from USNA Golf Course
44. WQ Pesticides from Sherwood Forest Golf Course
18. modified F&E - Herald Harbor - stormwater runoff issues

Specific Data Sources (Item 5)

1. Baltimore Gas & Electric - studies along Maynadier Bog
2. MD State Highway Association - studies along Weems Creek
3. MD State Highway Association - depth surveys at Weems Creek and College Creek Bridges
4. International Paper - thermal studies at Picture Spring Branch
5. MD State Highway Association - study near Routes 32 and 175
6. Other sources of valuable data:
    a. Severn River Environmental Area
    b. USGS - historical depth data
    c. Defense Mapping Agency and USDA - historical aerial photographs
    d. US Naval Academy oceanography data and midshipmen studies
    e. State Biannual Section 305 (b) Report, "Water Quality Inventory", Sherm Garrison at MD DNR
    f. Information on priority pollutants - TMDL information by tributary, Bob Summers at MDE
    g. Bay Tributary Strategy Teams
    h. Anne Arundel County Health Department for sanitary sewer survey information
    i. Ask MDE for any recent "intensive survey" data collected to support NPDES permit decisions in the Severn, Bob Summers at MDE
    j. USNA Environmental Office, contact - Moran

ANNE ARUNDEL COUNTY
MARYLAND
DEPARTMENT OF PUBLIC WORKS

2662 RIVA ROAD
ANNAPOLIS, MARYLAND 21401

June 4, 2001

Dear Interested Resident of the Watershed:

In our desire to preserve and protect the natural resources that define our community, contribute to our economic well-being, and sustain the quality of life that we enjoy, we have initiated an evaluation of the Severn River Watershed. When complete, this evaluation will allow us to outline strategies for the prevention and control of pollution impacts within the Severn River and its tributaries. This study will assess existing environmental conditions and their relationship to both current and future land use.

We need your help. The ultimate success of this planning process depends on input from people like you who use and appreciate our resources on a daily basis and care about preserving our environmental heritage for future generations.

The enclosed survey is one of our first steps to learn about your observations and knowledge of the watershed. The information that you share with us will help guide future focus of our study.

Please take a few moments to review the questions and share your insights as a resident and user of our water resources. With your help, the Severn River Watershed Master Plan will enable us to make smarter decisions about how we use our land and how we can improve water quality and the unique environmental features of the watershed. Such steps will help us do our part in making significant contributions toward improvement of the Chesapeake Bay.

Please share a copy of these materials with your neighbors to help us reach as many people as we can. We have enclosed a self-addressed stamped envelope to facilitate your response. Thank you in advance for your help.

Sincerely,

Ronald E. Bowen, P.E.
Deputy Director
Bureau of Engineering

J:\Retzel\D406922\SevernRiver\AASLetr.doc

Phone: 410-222-7337 Mail Stop: 7301 FAX: 410-222-7589
Web Site: www.aadpw.org

1a. In the past five years, your enjoyment of the County's streams, rivers, lakes and ponds has... (Choose one)

❑ Increased ❑ Decreased ❑ Stayed the same ❑ Don't use ❑ Don't know

1b. If you answered "Decreased" to 1a, your enjoyment has decreased because... (Check all that apply.)

❑ Less time for leisure activities ❑ No longer live near water body ❑ Pollution in river

❑ River traffic too heavy ❑ Other _____

1c. How do you use the County's streams, rivers, lakes, and ponds? (Check all that apply.)

❑ Fishing ❑ Boating ❑ Swimming ❑ Nature activities ❑ Don't use ❑ Other _____

2a. Have you noticed any specific evidence of pollution in the County's water bodies? ❑Yes ❑No

If yes, what did it look like? (Check all that apply)

❑ Muddy Water ❑ Foam ❑ Trash/litter ❑ Oily scum ❑ Strange odors ❑ Other _____

2b. Under what conditions was the pollution occurring? (Check all that apply)

❑ During rainfall ❑ After rainfall ❑ Warm weather ❑ Dry weather ❑ Other _____

2c. Where was the pollution occurring? Please be as specific as possible. (Example: After it rains, I notice that the water in the Severn Run is muddy at points between Burns Crossing Road to Telegraph Road.)

_____

_____

_____

3. Which streams and rivers appear to be more polluted than others? (Circle only one number 1-5, where 1 is not polluted and 5 is the very polluted)

	Not Polluted				*Very Polluted*	
Severn River	1	2	3	4	5	❑ Don't Know
Jabez Branch	1	2	3	4	5	❑ Don't Know
Severn Run	1	2	3	4	5	❑ Don't Know
Weems Creek	1	2	3	4	5	❑ Don't Know
Spa Creek	1	2	3	4	5	❑ Don't Know
Other_____	1	2	3	4	5	❑ Don't Know

4. Please list below any streams that you have observed to be obstructed by debris.

A. Stream: _____, Location: _____,

Indicate the type(s) of blockage (Select all that apply):

❑ Trash ❑ Sandbar ❑ Beaver Dam ❑ Fallen Trees ❑ Other: _____

B. Stream: _____, Location: _____,

Indicate the type(s) of blockage (Select all that apply):

❑ Trash ❑ Sandbar ❑ Beaver Dam ❑ Fallen Trees ❑ Other: _____

C. Stream: _____, Location: _____,

Indicate the type(s) of blockage (Select all that apply):

❑ Trash ❑ Sandbar ❑ Beaver Dam ❑ Fallen Trees ❑ Other: _____

5. Are there any of the following types of areas that are routinely flooded after a storm?
(Check all that apply)

❑ Roads ❑ Parking lots ❑ Driveways ❑ Private Property ❑ Other:_____

Please describe where these flood prone areas are located. _____

_____

_____

_____

6a. Have you seen examples of erosion or sediment transport during rain events within the watershed?

❑ Yes ❑ No

6b. Please list below any streams that you have observed to be eroded.

A. Stream: _____, Location: _____,

B. Stream: _____, Location: _____,

C. Stream: _____, Location: _____,

Please note any additional observations you have noted regarding degraded environmental conditions in the watershed: (Please be as specific as possible.)

_____

_____

_____

_____

_____

➢ To help us better evaluate our survey results and to be added to our project mailing list, please fill in the following information:

Name:_____

Address:_____

City:_____

State:_____

Zip:_____

E-mail address:_____

➢ Can we call you if we have questions about your survey? (daytime calls only) Phone:_____

➢ How would you like to be kept informed about the progress of the watershed management master plan? (Please rate 1 through 5, with 1 being the most favored and 5 the least favored method).

___ Anne Arundel County Web site

___ Periodic Mailings

___ Telephone calls & county Staff

___ Public meeting

___ Announcements in local newspapers (The Capital, The Maryland Gazette)

➢ Please return this survey in the enclosed self-addressed stamped envelope or to the address below by June 27, 2001.

Completed surveys should be sent to: Mr. Ron Etzel Project Manager, Bureau of Engineering, Department of Public Works, Heritage Office Complex 2662 Riva Road, Annapolis, MD 21401-7374

Severn River

Watershed Management Master Plan Study

Introduction

Anne Arundel County is beginning to develop a Watershed Management Master Plan for the Severn River. A watershed management plan utilizes information from a watershed assessment and integrates it into a comprehensive plan for the future. This plan will provide a blueprint of environmental conditions to facilitate land use and development decisions to protect the resources of the Severn River. Information gathered from the public will be utilized in the evaluation of the watershed and development of watershed management recommendations. The project is expected to be complete within 24 months, in the Spring of 2003.

Project Overview

The purposes of this master plan are to: 1) prevent or control adverse impacts to the Severn River and its tributaries from stormwater runoff and other sources, 2) to provide a computerized tool to guide the County as it makes decisions regarding landuse and infrastructure improvements, and 3) to protect, enhance, and restore the Severn River watershed's habitat.

The project will:

- Through field work, characterize the watershed's land use, natural resources, water quality, and physical conditions
- Assess future conditions with computer models of drainage and water quality
- Identify and rank problems
- Recommend potential improvement projects
- Develop an Information Tool to aid the County in managing the watershed.

Public Involvement

The County is committed to incorporating public input throughout the plan. The County has several meetings planned with representative stakeholder groups within the watershed, including examples such as the Severn River Commission, Severn River Association, Small Area Planning Committees, and Severn River Land Trust, to solicit public input. In addition to these meetings, the County is distributing a survey to solicit input on watershed issues as observed by members of the public. The public involvement program is intended to deliver accurate and timely information to interested parties and build a foundation of public education and dialogue to facilitate watershed management protection.

How Will the Master Plan Be Used?

The Master Plan will be used by the County to:

- Enhance protection of the environment
- Guide future development in the watershed
- Guide planning and construction of stream restoration and stormwater management projects
- Provide information on watershed conditions to the citizens that live, work, and recreate in the Severn River Watershed.

The Master Plan will identify areas within the watershed where resources should be focused and improvements can be made, such as:

- Where stream channels have been eroded
- Where there are water quality problems
- Where habitat has been degraded
- Where there is a high potential for flooding

For More Information

For more information about the Severn River Watershed Management Master Plan or upcoming public meetings, please visit the Anne Arundel County web site at:

www.severn-river-watershed.com

Or contact:

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Mr. William Frost, Project Manager
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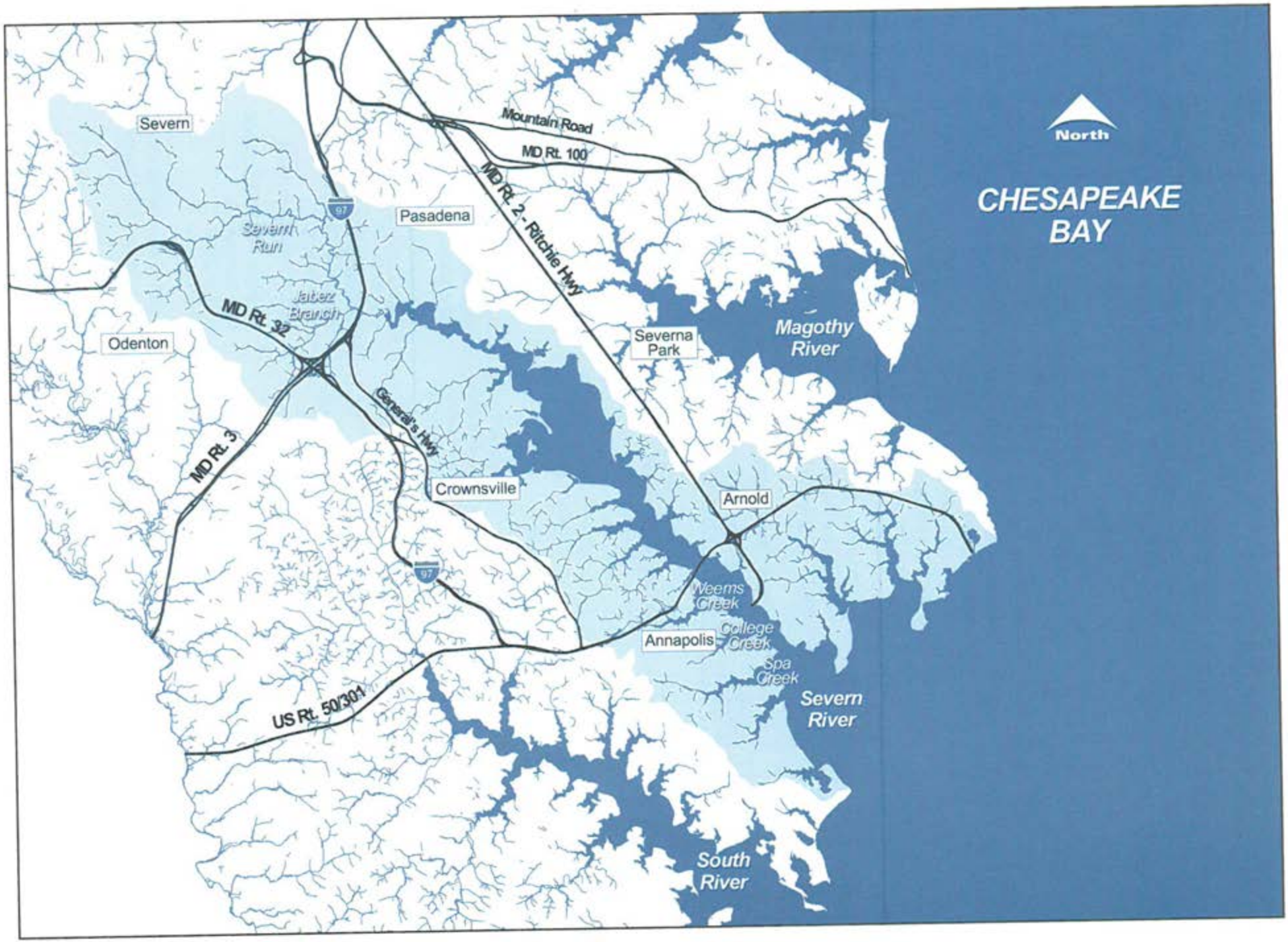
wfrost@kci.com

Dates for public meetings will also be advertised in The Capital and Maryland Gazette newspapers.

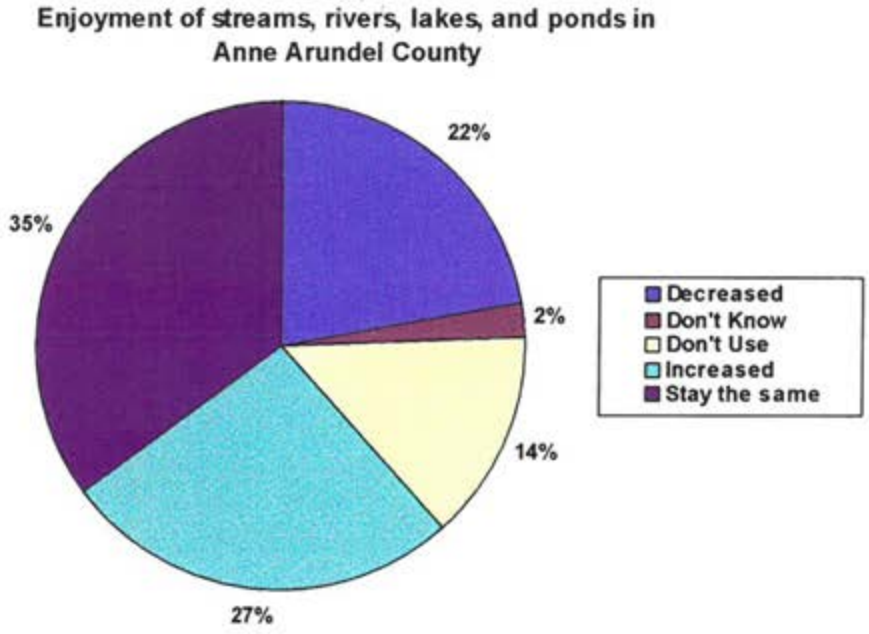


SEVERN RIVER WATERSHED

1a.) In the past five years, your ability to enjoy the County's streams, rivers, lakes and ponds has...

Increased	27%
Decreased	22%
Stay the same	35%
Don't Use	14%
Don't Know	2%

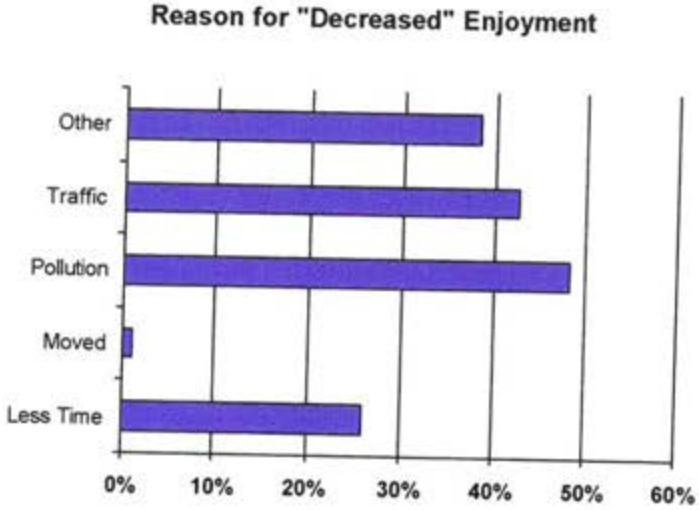
Number of Responses for 1a: 432



1b.) Enjoyment of the County's streams "decreased" because...

Number of Responses for 1b: 97

Other:	38%
Traffic	43%
Pollution:	48%
Moved:	1%
Less Time:	26%



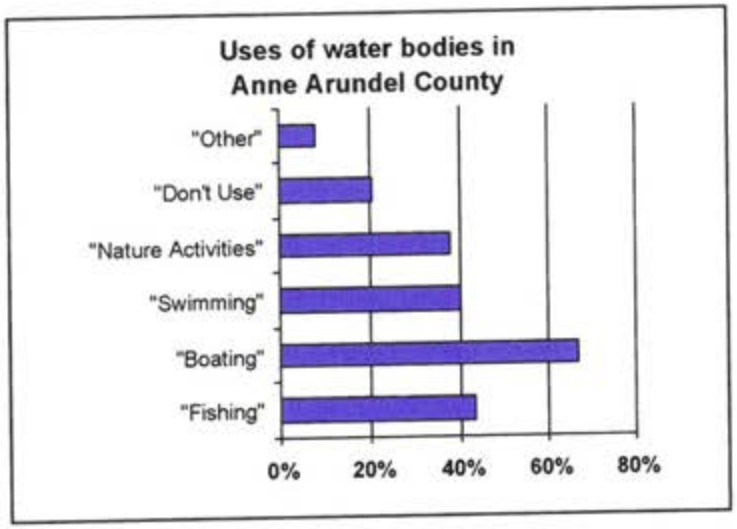
Other Reasons:	Number of Responses:
30 minute canoe ride once a year	1
Age	4
Boat speeds and wake	1
Boat use tax increase	1
Death in family	1
Decrease in native waterbird population	1
Did not put boat over	1
Few river accesses for canoes, kayaks, dingeys	1
Handicapped	1
Inexperienced boaters	1
Jet noise (planes line up for landing and takeoff at BWI)	1
Jet skis	1
Less crabs and fish	1
Less time in area	1
Media reports of pfisteria and reduction in shellfish	1
No longer live near water body	1
No public access to water	1
Personal health	1
Sediment made water too shallow	1
Sedimentation	4
Silting	2
Sold boat	1
Sold my boat	1
Water too silted to use boat	1

Note: Percentages may not add up to 100% because of multiple responses.

1c.) How do you use the County's streams, rivers, lakes, and ponds?

Number of Responses for 1c: 424

Other:	8%
Don't Use:	21%
Nature Activities:	38%
Swimming:	40%
Boating:	67%
Fishing:	43%



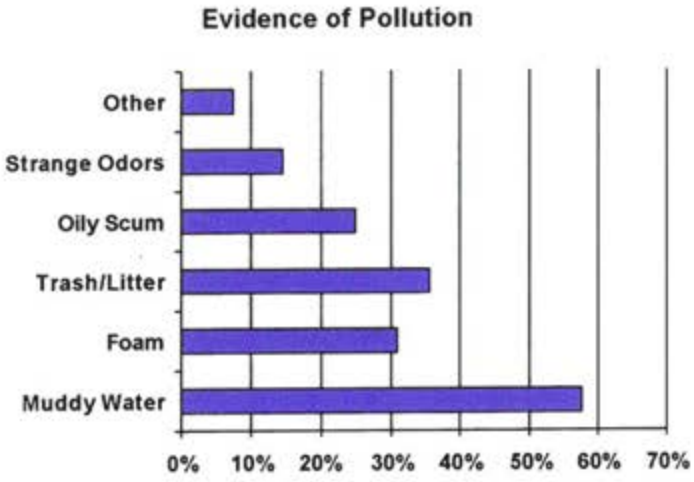
Other Uses:	Number of Responses:
Canoeing	1
Crabbing	8
Enjoying the view	1
Golfing	1
Kayaking	2
Live on it	1
quiet enjoyment	1
Sightseeing	1
USCG Aux	1
Visual enjoyment	6
Walking	2
Walks	1
Watching	2
Water Skiing	2
Work	1

2a.) Have you noticed an specific evidence of pollution in the County's water bodies? If yes, what did it look like?

Number of Responses for 2a:	*417*

Yes	75%
No	25%

Other:	7%
Strange Odors:	15%
Oily Scum:	25%
Trash/Litter:	36%
Foam:	31%
Muddy Water:	57%

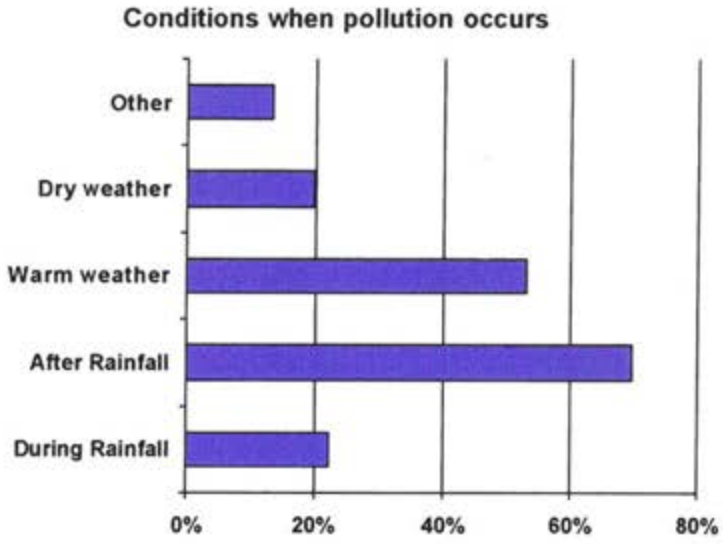


Other Pollution:	**Number of Responses:**
Algae	5
Big wakes	1
Brown floaters on top of water	1
Child became sick	1
Clear water in very cloudy water	1
Contaminants	1
Dead fish	1
Ducks and geese	1
Fallen trees and hunks of wood	1
Gas	1
Grasses, leaves, and branches	1
Jet skiers and mute swans	1
Lack of grasses	1
Looks like septic residue	1
Not Specified	1
Partially sunk boats	1
Pollen	1
Red tides	1
Sediment	4
Sewage	2
Stain on clothing	1

2b.) Under what conditions was the pollution occuring?

Number of Responses for 2b:	*280*

Other:	13%
Dry weather	20%
Warm weather	53%
After Rainfall:	70%
During Rainfall:	22%



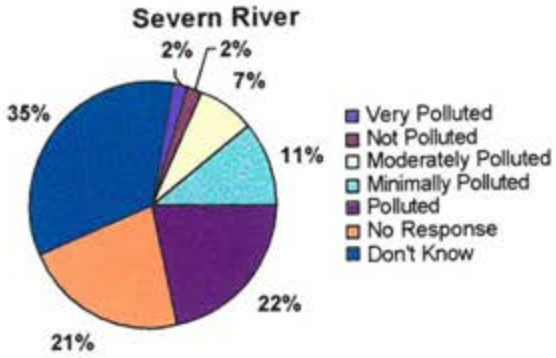
Other Conditions:	Number of Responses:
After major storm	1
All	1
Always	7
Boating season	1
Constantly	1
Construction	3
General conditions	1
Heavy Traffic	1
Hot weather	1
Houshold graywater discharge	1
Jet skis	1
Low Wind, Still Tide	1
Morning	1
Normal conditions	1
Normal Day	1
Not Specified	9
Not specified.	1
Trash at any time	1
When people litter	1
Windy conditions	2

3.) Which streams and rivers appear to be more polluted than others...

Severn River

Number of Responses for Severn River: 337

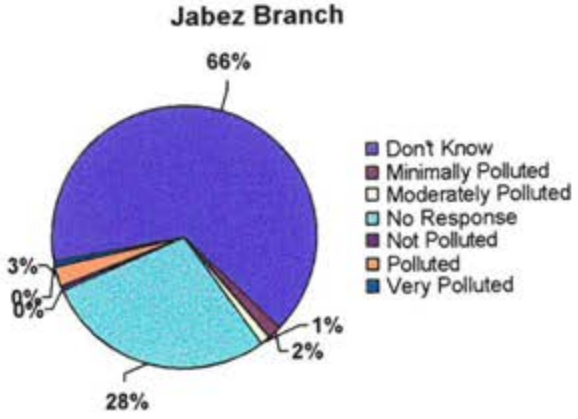
No Response	21%
Not Polluted	2%
Minimally Polluted	11%
Polluted	21%
Moderately Polluted	7%
Very Polluted	2%
Don't Know	34%



Jabez Branch

Number of Responses for Jabez Branch: 306

No Response	28%
Not Polluted	0%
Minimally Polluted	2%
Polluted	3%
Moderately Polluted	1%
Very Polluted	0%
Don't Know	65%

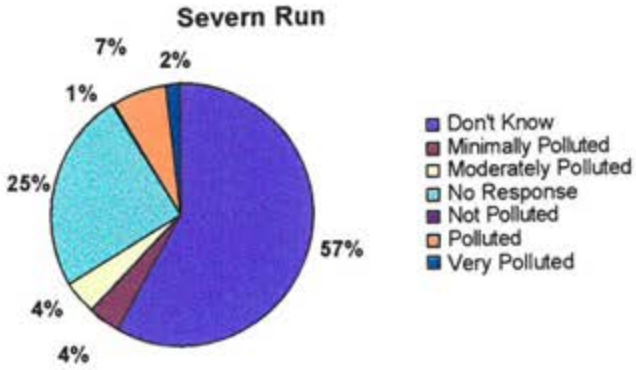


3.) Which streams and rivers appear to be more polluted than others...

Severn Run

Number of Responses for Severn River: 319

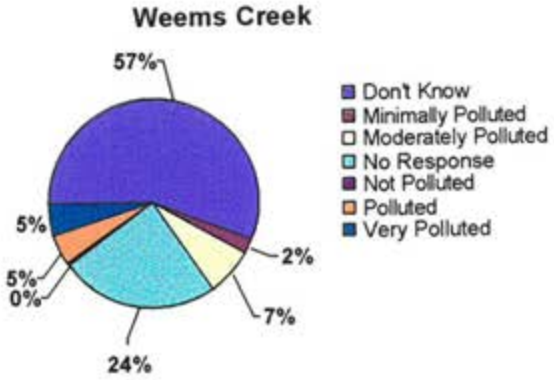
No Response	25%
Not Polluted	1%
Minimally Polluted	4%
Polluted	7%
Moderately Polluted	4%
Very Polluted	2%
Don't Know	58%



Weems Creek

Number of Responses for Severn River: 324

No Response	24%
Not Polluted	0%
Minimally Polluted	2%
Polluted	5%
Moderately Polluted	7%
Very Polluted	5%
Don't Know	56%

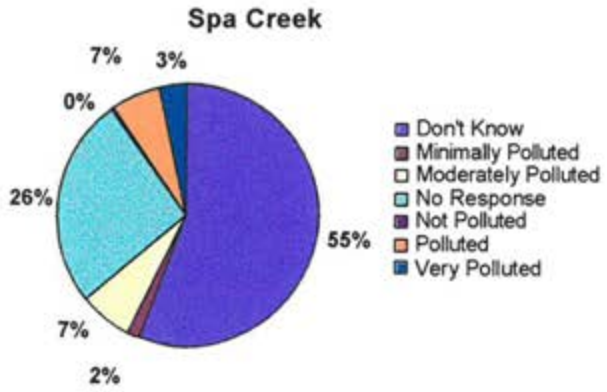


3.) Which streams and rivers appear to be more polluted than others...

Spa Creek

Number of Responses for Severn River: 316

No Response	26%
Not Polluted	0%
Minimally Polluted	2%
Polluted	7%
Moderately Polluted	7%
Very Polluted	3%
Don't Know	56%



Other Streams and Rivers

Other Stream:	Number of Other Responses:	Rating:
Back Creek	4	Moderately Polluted
Back Creek	1	Very Polluted
Clements	2	Minimally Polluted
Clements Creek	1	Polluted
College Creek	1	Moderately Polluted
College Creek	1	Very Polluted
Cove next to Ben Oa	1	Very Polluted
Forked Creek	1	Moderately Polluted
Lake Ogleton	2	Minimally Polluted
Lake Ogleton	1	Polluted
Luce & Howard Cre	1	Moderately Polluted
Luce Creek	1	Moderately Polluted
Marley Creek	1	Moderately Polluted
Saltworks	2	Polluted
Saltworks	1	Very Polluted
Saltworks Creek	2	Moderately Polluted
Saltworks Creek	2	Polluted
Saltworks Creek	3	Very Polluted
Valentine Creek	2	Moderately Polluted
Valentine Creek	1	Very Polluted

4.) Please list below any streams that you have observed to be obstructed by debris.

Strea	Locatio	Trash:	Sandbar:	Beaver Dam:	Fallen Trees:	Other:	Other Specified:
Back Creek							
	Near Headwaters	☑	☐	☐	☐	☑	Waste and Boats
	Number of Responses	1	0	0	0	1	
Clements Creek							
	Headwaters	☐	☑	☐	☐	☐	
	Headwaters	☐	☐	☐	☐	☑	Heavy Siltation
	Headwaters by Saefern	☐	☐	☐	☑	☑	Siltation
	South Shore near Saefern, headwaters	☐	☑	☐	☑	☐	
	Number of Responses	0	2	0	2	2	
College Creek							
	South of Rowe Blvd.	☐	☐	☐	☐	☑	Not Specified
	Number of Responses	0	0	0	0	1	
Entrance channel to Lake Ogleton							
	Mouth of Severn River	☐	☑	☐	☐	☐	
	Number of Responses	0	1	0	0	0	
Forked Creek							
	Severn Forest Association	☑	☐	☐	☐	☐	
	Number of Responses	1	0	0	0	0	
Jabez Branch							
	Upstream of Hog Farm Rd.	☐	☐	☑	☐	☐	
	Number of Responses	0	0	1	0	0	
Lake Marion							
	Provinces Park-Citadel Drive	☑	☐	☐	☑	☑	Silt
	Number of Responses	1	0	0	1	1	
Lake Ogleton							
	Annapolis	☐	☑	☐	☐	☐	
	Landsend Point	☐	☑	☐	☐	☑	Sand is building up on SE side of Landsend Point
	Se side of Landsend point	☐	☑	☐	☐	☐	
	Number of Responses	0	3	0	0	1	
Maynadier Creek, Hopkins Creek,Ditch Branch							
	Along River Road between Old Generals Highway and Bayberry Hill	☑	☑	☐	☑	☐	
	Number of Responses	1	1	0	1	0	
Saltworks Creek							
	Between Best Gate and Epping Forest Rd	☐	☐	☐	☐	☑	Grass, leaves, and branches

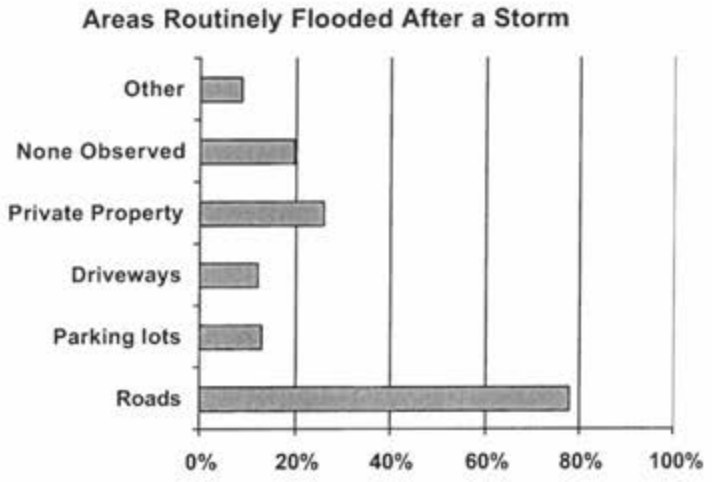
Strea	Locatio	Trash:	Sandbar:	Beaver Dam:	Fallen Trees:	Other:	Other Specified:
Saltworks Creek							
	Headwaters	☐	☐	☐	☐	☑	Heavy Siltation
	headwaters by Saefern	☐	☐	☐	☐	☑	Siltation
	Headwaters on north side of creek	☐	☑	☐	☑	☑	Silt
	Headwaters to first bight	☐	☑	☐	☑	☐	
	Headwates	☐	☑	☐	☐	☐	
	Near Saefern Community Pier	☐	☐	☐	☑	☐	
	Number of Responses	0	3	0	3	4	
Severn River							
	Annapolis Area	☐	☐	☐	☐	☑	Crab pots
	Annapolis City Dock	☑	☐	☐	☐	☐	
	Arnold	☑	☐	☐	☑	☐	
	At Burns Crossing Rd.	☐	☐	☐	☐	☑	Not Specified
	Before Bayberry Community in Crownsville by River Rd.	☐	☐	☑	☐	☐	
	Between 170 and Burns Crossing	☑	☐	☐	☐	☐	
	Crownsville	☐	☐	☐	☑	☐	
	End of Shore Road, Severna Park	☐	☐	☐	☐	☑	Construction Fill in
	Fairwinds	☐	☐	☐	☑	☐	
	Mouth of Clements and Saltworks Creeks	☐	☑	☐	☐	☐	
	Near Annapolis Inner Harbor	☐	☐	☐	☑	☐	
	Near Pines on Severn	☐	☑	☐	☐	☐	
	North of the mouth of Clements Creek	☐	☑	☐	☑	☐	
	Old Mill Rd and Burns Crossing Rd	☑	☐	☐	☐	☐	
	Ridge Rd. Area	☑	☐	☐	☐	☐	
	River Road	☐	☐	☑	☐	☐	
	Several	☑	☐	☐	☐	☐	
	Severn	☑	☐	☐	☐	☐	
	South of Rt. 50	☑	☐	☐	☑	☐	
	Number of Responses	8	3	2	6	3	
Severn Run							
	0.5 mile east of Burns Crossing Rd	☑	☑	☐	☑	☐	
	at Burns Crossing Rd	☑	☐	☐	☑	☐	
	At the Reece Rd crossing, North of Ft. Meade	☑	☐	☐	☐	☐	
	Below Lake Marion	☑	☐	☐	☑	☐	
	Between Reece Rd. and Jacob's Rd.	☑	☐	☐	☑	☐	
	Burn's to Telegraph	☑	☑	☐	☐	☐	
	Burns Crossing	☐	☑	☐	☑	☐	
	Burns Crossing	☑	☐	☐	☑	☐	
	I-90 Crossing	☐	☐	☐	☑	☐	
	JCT W/ Veterans Hwy	☑	☐	☐	☐	☐	
	Near Aurora Hill Comm. Park off Ashburton Dr.	☑	☐	☐	☑	☐	
	Near Provinces/ Disney Estates, Severn Water management area	☑	☐	☐	☐	☐	
	New Cut Rd	☑	☐	☐	☐	☐	
	New Cut Rd.	☑	☐	☐	☐	☐	
	None specified	☐	☑	☑	☐	☐	
	North of Dicus Mill Rd	☐	☑	☐	☐	☐	
	Old Mill Bottom Rd	☑	☐	☐	☑	☐	

Strea	Locatio	Trash:	Sandbar:	Beaver Dam:	Fallen Trees:	Other:	Other Specified:
Severn Run							
	Old Mill Rd	☑	☐	☐	☐	☐	
	Plum Creek Drive - Crownsville	☑	☐	☐	☐	☐	
	Several	☑	☐	☐	☐	☐	
	Still Meadows Housing	☑	☐	☐	☐	☐	
	Number of Responses	17	5	1	9	0	
Spa Creek							
	Headwaters of Spa Creek	☑	☐	☐	☐	☐	
	Number of Responses	1	0	0	0	0	
Sullivans Cove on Severn River							
	Sullivan's Cove	☐	☐	☑	☐	☐	
	Number of Responses	0	0	1	0	0	
Un-named Tributary of Whitehall Creek							
	Turf Farm / 609 Holly Drive North	☐	☐	☑	☑	☐	
	Number of Responses	0	0	1	1	0	
Valentine Creek							
	at end of Valentine Rd. - Herald Harbor	☐	☑	☐	☐	☐	
	Crownsville	☐	☐	☐	☐	☑	Foam
	Number of Responses	0	1	0	0	1	
Weems Creek							
	Below 50/301	☐	☑	☐	☐	☑	Siltation
	Headwaters	☐	☐	☐	☐	☑	SHA Memorial Mud Bank
	Near Bridge	☑	☐	☐	☐	☐	
	North of Rt 70 Bridge	☑	☐	☐	☐	☑	Other Natural Debris
	Number of Responses	2	1	0	0	3	
Yantz Cove							
	Severn River	☑	☐	☐	☐	☐	
	Number of Responses	1	0	0	0	0	
Yantz Creek							
	Near Severn River	☐	☑	☐	☐	☐	
	Number of Responses	0	1	0	0	0	
	Total Number of Responses	**33**	**21**	**6**	**23**	**17**	

5a.) Are there any of the following types of areas that are routinely flooded after a storm?

Number of Responses for 5a: 128

Roads	78%
Parking Lots:	13%
Driveways:	12%
Private Property:	26%
None Observed:	20%
Other:	9%



Other Areas:	Number of Responses:
Arden Park	1
Beach Area	1
Common Area, County Owned	1
County Easement in front of house	1
Navy Owned	1
See attached list	1

5b.) Please describe where these flood prone areas are located.

Survey ID	StreetAddress:	MajorRoad:	CrossRoad:
209		Pasadena Rd.	Obrecht Rd.
192			
251		Old Mill Rd.	
25		Old Mill	Burns Crossing
77			
202			
192			
196	1043 Tudor Drive, Arden on the Severn	Tudor Drive	
128	1438 Bretton View Rd, Annapolis MD	Bretton View Rd	
201	1819 Manet Ct	Manet Ct.	
163	182 Tan Glade, Severna Park	Tan Glade	
648	21032 Herald Harbor area	Eddy Road	From North Riverside to Valentine Creek
275	303 Forest Ct., Severna Park	Forest Ct.	
149	309 Buckingham Ct.	Severna Park	
110	327 South River Dr, Crownsville MD		
3	772 Barger Dr., Arden on the Severn	Evergreen Rd	
76	8142 Harvest Court, Severn MD	Harvest Court	
662	892 Coachway Dr		
182	Admiral Rd, Severna Park	Admiral Park	
11	Annapolis	City Dock	
223	Annapolis	Rt 450	
32	Annapolis	Rte 450	
623	Annapolis	Roads near Harbor	
599	Arden		
35	Arden Park	Sunrise Beach Rd.	
311	Arden, MD	Plum Creek Dr.	
69	Arden, MD	Cedarview Lane	
193	Arnold Station	Rt. 2	
120	Arundel Beach Rd, Severna Park MD	Arundel Beach Rd.	
298	B+A Blvd at Rt 2 Near Arnold Post Office	B&A Blvd.	
204	B+A Blvd between Cypress Creek Rd and Round Bay		
268	B+A Blvd.	B+A Blvd	
304	Ballpark, Sunrise Beach Rd.	Sunrise Beach Rd.	
137	Benfield Rd, Annapolis	Benfield Rd	

276	Between 9 and 11 Ridout Rd, Round Bay	Ridout Rd.	
218	Between Jumpers Hole and Severna Park High School	Benfield Rd.	
645	Between Rt 3 in Crofton and Annapolis	Rt 450	
295	Brock Bridge Rd.	Brock Bridge Rd.	
216	Burns Crossing and Old Mill Rds.	Burns Crossing Rd.	
118	Buskin Court, Severn MD	Buskin Court	
257	City Dock, Annapolis		
611	Clubhouse Parking, Epping Forest	Epping Forest Rd.	
299	Community Beach, Round Bay		
224	Crownsville	Rt. 450	
609	David Taylor Research Center	Beech Rd	
124	Dead end of Sands Ave, Bayridge	Sands Ave.	
615	Defense Highway	Defense Highway	Church Rd.
184	Defense Highway, Annapolis	Defense Highway	
85	Defense Hwy Annapolis	Defense Hwy	
273	Defense Hwy. Near state inspection center	Defense Hwy.	
52	Dicus Mill Rd at Severn River	Dicus Mill Rd	
242	Dicus Mill Rd at Severn Run	Dicus Mill Rd.	
615	Dicus Mill Rd at Severn Run	Dicus Mill Rd	
154	Dicus Mill Rd crossing of Severn Run	Dicus Mill Rd	
6	Dicus Mill Rd.	Dicus Mill Rd.	
124	East Lake Drive, Bayridge	East Lake Drive	
91	End of 5th St. Annapolis	Parking lot	
91	End of 5th St., Annapolis	5th St.	
143	Epping Forest Clubhouse		
141	Epping Forest, MD	Severn Rd	
268	Evergreen Rd	Evergreen Rd	
246	Ft. Meade, Odenton	Hwy 175	
599	Herald Harbor		
53	Herald Harbor	Valentine Rd.	
199	Herald Harbor	Eddy Rd	
174	Herald Harbor	Various Roads	
105	I-70 between 32 and 174	I-74	
94	Indian Creek School	Evergreen Rd.	
195	Indian Creek School	Evergreen Rd.	
206	Indian Creek School		
312	Jumpers Hole Rd, Severna Park	Jumpers Hole Rd.	
72	Kinder Rd	Kinder Rd.	
197	Lindamore on the Severn	Rt 50	

218	Md 175 adjacent to Ft. Meade	Md 175	
213	Monard Ave, Severn MD	Monard Ave.	Telegraph Rd.
31	Near Round Bay		
292	New Cut Rd between Severn Run and Rt. 97	New Cut Rd	Rt 97
314	Old Mill Rd	Old Mill Rd	
154	Old Mill Rd between 170 and Burns Crossing	Old Mill Rd	
111	Omar Drive		
106	Parts of Bay Ridge	Bay Ridge	
180	Pin Oak Rd, Severna Park	Pin Oak Rd.	
228	Pines on Severn	Joyce Lane	Other roads in Pines on Severn
651	Pleasant Plains Turf Farm	Holly Drive North	
211	Powell Drive, Annapolis	Powell Drive	Saefern Way
595	Quarterfield Rd.	Quarterfield Rd.	Danza Rd.
614	Ridgely Avenue at Church Catch Basin	Ridgely Avenue	Luce Creek Drive
171	Ridout Rd. in Roundbay Community	Ridout Rd.	
663	Riggs Avenue	Riggs Avenue	Evergreen Road
234	Ritchie Hwy, English Heights	Ritchie Hwy.	
626	River Rd	River Rd	Rt. 178
596	River Rd, Annapolis	River Rd	Generals Highway
597	River Rd, Crownsville	River Rd	
624	River Rd, Crownsville	River Rd	
304	River Rd, Crownsville	River Rd.	
110	River Rd. before Bayberry Community	River Rd.	
282	River Rd. between Herald Harbor and General Hwy.	River Rd.	
178	River Rd. Crownsville	River Rd.	
270	River Rd. Crownsville	River Rd.	
669	River Road		
286	River Road between Sherwood Forest and Herald Harbor	River Rd.	
99	River Road, Crownsville	River Road	
114	River Road, Crownsville MD	River Road	
588	Rose Path, Annapolis	Rose Path	
123	Round Bay Community	Severn River Rd.	
165	Rt 450 west of Annapolis	Rt. 450	
193	Rt. 2 South	Rt. 2 South	Arnold Rd.
99	Rt. 98 at Little Pat. River	Rt. 98	
27	Severn	Severn Rd	
103	Severn Grove Properties	Severn Grove Rd.	
599	Severn Inn, Annapolis	Academy Bridge	

17	Severn Md.	Quartefield Rd.	Meadows Rd.
110	Severn Rd at bottom of Bonaparte Rd.	Severn Rd.	
9	Severn/Odenton	Telegraph Rd.	
10	Severna Park	Tower Bank Court	Tewksbury Lane
110	Shelton Rd. by Elm	Shelton Rd	
590	Shore Rd, Severna Park	Shore Rd	
80	Shore Rd, Severna Park MD	Shore Rd.	
602	State Court of Appeals, Rowe Blvd.	Rowe Blvd.	
293	Still Meadows Area		
111	Sunrise Beach and Whitneys Landing		
33	Sunrise Beach Rd	Sunrise Beach Rd	
604	Sunrise Beach Rd, Crownsville	Sunrise Beach Rd.	Wintergreen Rd.
35	Sunrise Beach Rd.	Sunrise Beach Rd.	
72	Track House Rd.	Track House Rd.	
234	Veterans Hwy.	Veterans Hwy.	
195	Waterbury Park	Sunrise Beach Rd.	
585	Whitney's Landing Rd, Arden	Whitney's Landing Rd	

Erosion and Sediment Transport

6a.) Have you seen example of erosion or sediment transport during rain events within watershed?

Yes 52%
No 48%

Number of Responses for 6a: 301

6b.) Please list below any streams that you have observed to be eroded.

Any streams in area	Between Annapolis and Crownsville
Back Creek	
Back Creek	At Watergate Construction
Brewers Creek	Downs on the Severn
Clements Creek	Downs
Clements Creek	Head waters
Clements Creek	Headwaters
Clements Creek	headwaters and alongside the downs
Clements Creek	North and South Shores
Clements Creek	Western Side of Severn North of Rt. 50 bri
Cove of Cork	facing Route 50
Cove of Cork	Near Severn River Bridge
Deep Ditch Branch	Crownsville, General Highway
Every stream	Main streams and tributaries.
Forked Creek	Bluff Point
Forked Creek	End of Forked Creek near Benfield
Forked Creek	Near Construction
Forked Creek	Severn Forest Association
Howard Creek	
Indian Creek	Lower Reaches
Lake Ogleton	Bayridge; End of Sands Ave.
Lake Ogleton	West shore of first cove to right from Sev
Lake Ogleton (entering from Severn)	West shore of first cove to R, after enteri
Luce Creek	
Maynadier Creek, Hopkins Creek,Ditch Bra	River Road btwn Old Generals Hwy and B
Not specified	Sediment collects at boat slips
Plum Creek	Stony Lane, Section 4
Saltworks	lower 1/3 of creek
Saltworks Creek	
Saltworks Creek	below 1719 S. Harbor Lane, Annapolis
Saltworks Creek	End of Kindswood Ct.
Saltworks Creek	Epping Forest Rd
Saltworks Creek	Headwaters
Saltworks Creek	Mouth of Saltworks

Erosion and Sediment Transport

Saltworks Creek	Western Side of Severn North of Rt. 50 bri
Severn River	1.5 miles fromt the mouth
Severn River	Above Beach 5, Arden
Severn River	Access road to Beach 5 off Oakview Roa
Severn River	Across from Indian Landing, from watersk
Severn River	Along Shore line of Sherwood and Epping
Severn River	Arden
Severn River	Arden Beach 5
Severn River	Arden Herald Harbor
Severn River	Arden on the Severn
Severn River	at Crabaway Pier in Carrollton Manor
Severn River	Beach at Arden Section 5
Severn River	by Carrolton Manor
Severn River	Chase Creek
Severn River	Fairwinds on the Severn
Severn River	Mills Run
Severn River	Naval Academy, Annapolis
Severn River	North Shore Redio
Severn River	River Rd
Severn River	Rt. 50 W on Right of Severn River Bridge
Severn River	Shore Rd, Severna Park
Severn River	Shoreline in Round Bay
Severn River	South shore at Sherwood Little Roundbay
Severn Run	
Severn Run	1 mile downstream of Burns Crossing Rd.
Severn Run	After Burns Crossing Rd.
Severn Run	at Dicus Mill Rd.
Severn Run	Between Reece Rd. and Jacob's Rd
Severn Run	Burns Crossing Rd Area
Severn Run	Burns Crossing Rd.
Severn Run	Dicus Mill Rd
Severn Run	Dicus Mill Rd. crossing
Severn Run	Gambrills Road and Sleepy Hollow.
Severn Run	Near Aurora Hill Comm. Park off Ashburto
Severn Run	Near Dicus Mill Rd
Severn Run	North of Marker 13
Severn Run	Old Mill and Burns Crossing
Severn Run	Old Mill Bottom - past Burns Crossing goin
Severn Run	Old Place Creek
Severn Run	Rt. 97

Erosion and Sediment Transport

Severn Run	surrounding area
Severn Run	Telegraph to Dicus Mill
Severn Run	Upstream of Jabez Branch
Severn Run	West Benfield Rd
Spa Creek	
Spa Creek	Truxton Park
Sullivan Cove	Outer parts near Lustead and round Bay
Sullivan Cove	silting in below Severn School
Valentine	Plum Drive, Section 4
Valentine Creek	Snodgrass Rd
Weems Creek	
Weems Creek	@ Headwaters on Route 50
Weems Creek	above Rt. 50 bridge
Weems Creek	Annapolis
Weems Creek	Annapolis, Admiral heights
Weems Creek	From Ridgely Ave Bridge area
Weems Creek	Head
Weems Creek	Headwaters
Weems Creek	Headwaters-Runoff from Matt at Hindson
Weems Creek	Moreland Parkway, behind Capital News
Weems Creek	Mud Slide under ciy sewer pipe on Willam
Weems Creek	Near Bestgate Rd.
Weems Creek	near the mouth
Weems Creek	Source of Weeks Creek
Weems Creek	Storm Drain from Naval Academy drains t
Weems Creek	Upper reach
Weems Creek	Upper Weems Creek
Wetlands	Bluff Point
Yantz cove	161 Boone Trail
Yantz Cove	Outside of entrance on east side
Yantz Creek	At Severn River

Stream:	Number of Responses:
Any streams in area	1
Back Creek	2
Brewers Creek	1
Clements Creek	6
Cove of Cork	2
Deep Ditch Branch	1
Every stream	1

Erosion and Sediment Transport

Forked Creek	4
Howard Creek	1
Indian Creek	1
Lake Ogleton	2
Lake Ogleton (entering fr	1
Luce Creek	1
Maynadier Creek, Hopkin	1
Not specified	1
Plum Creek	1
Saltworks	1
Saltworks Creek	7
Severn River	22
Severn Run	21
Spa Creek	2
Sullivan Cove	2
Valentine	1
Valentine Creek	1
Weems Creek	17
Wetlands	1
Yantz cove	2
Yantz Creek	1

Please note any additional observations you have noted regarding degraded environmental conditions in the watershed.

Survey ID:	Condition:
15	Riprap on Severn River - Loss of natural shore line
34	Severn Run from Telegraph Rd. to Dicus Mill Rd.
57	too many bulkheads on Spa Creek - reduced habitat
57	headwater of Spa Creek get high peak rain induced flows due to impervious cover
57	Back Creek - toxics characteriztion data report elevated levels of metals in creek's sediments
65	Severn Run is muddy at Dicus Mill Rd. crossing
65	Severn River is muddy 1.5 miles from the mouth after a hard rain
77	Steep slope erosion in Arden Herald Harbor
80	Major tree and shrub removal on Bluff Point
85	Perception of unclean conditions and obvious overcrowding.
86	Loss of wildlife, birds, ducks, etc.
90	Increasing sediment transport at headwaters of Saltworks Creek
91	Storm drain to spa creek from Silopanna/Streamwood Court.
91	Headwater are filling in, pragmites dominate marshlands.
	Lake Marion has filled with Sediment from the storm drain that feeds it.
96	Dead grasses in Saltworks Creek
96	Dead grasses in Clements Creek
103	Jet Skis causing danger and pollution.
107	An absence of frogs in the Little Severn Run in the woods behind my house (7866 Manet Way, Severn MD).
124	During rainstorms, most of Sands Ave drains into Lake Ogleton
134	The area of wood between Reece and Jacob's Rd is being used as a dump, bikes, old car parts, and general trash.
138	Large cabin cruisers create 3 foot bow wake and create tremendous erosion.
141	Fewer crabs, yet still see people crabbing illegally (keeping small crabs / females, etc.)
148	Water quality in the county would improve by better educating the public and enforcing the programs already in place.
151	Beach at Yantz Cove erodes into the River
158	Tides appear higher, causing more erosion
159	Sand washes onto streets goes into storm drains and into the Severn River.
169	Old Place Creek is overrun with overdevelopment.
173	Bluff Point, house has filled in Marsh - Paid fine but was never made to restore site - new house under construction - will probably fill in the other little marsh.
175	Muddy waters frequency of Severn River is increasing.
178	Fish and crab population has decreased
184	Admiral Cochrane Drive - New road construction
185	Siltation at South Harbor Lane Docks (Saefern Community) has reduced depth from 6 feet (mean tidal) to less than 4 feet in last 5-6 years.
192	Motorized vehicles on DNR property (I.E. Dirt Bike/Four wheelers)

Please note any additional observations you have noted regarding degraded environmental conditions in the watershed.

Survey ID:	Condition:
192	Failed septic systems in Arden on the Severn
198	Bank erosion accelerated by speed boat traffic
202	In winter water is clear, in summer one cannot see feet when wading in 3 feet of water - river needs copper suflate to kill algae and muck dregged out
206	Upper Severn near I 97 is much shallower than 20 years ago.
206	Beachs along upper Severn are eroded due to water skier wake.
206	Valentine Creek is beginning to silt up.
215	A lot of dead fish due to pollution.
217	The increased use of rip-rap along the shoreline.
224	River Rd, Crownesville- Water run off on road is down from elevated area alongside road - there is nothing planted to hold soil.
225	No enforcement of anti-erosion measures.
228	Cove around pines on Severn very muddy, smelly
231	Sediment transport has reduced the depth of Lake Marion from 10 feet to less than 3 feet.
233	It is obvious that development along Generals Hwy and Bestgate RR have significantly contributed too the detriment of Saltworks and Clements Creeks in terms of silting (The average depth has significantly decreased, especially at the headwaters).
233	I wonder about the large pipes that are obvious from the water that you see running down slopes into the river and creeks from homes along the watershed.
234	Some people seem to leave trash cans out in the street for several days- discarded trash along Benfield Blvd - dogs or other animals turning over trash cans.
243	We have virtually no contact with our county's streams.
249	Weems Creek seems to have silted in some. Canals were dredged, but "bumps" remain in waterway.
251	Murky water in Severn River, scum floating on top of water in some areas.
252	Severe shoreline erosion in Severn cause by high speed boats.
253	The area between 170 and Burns Crossing Rd, Severn Run along Old Mill Rd is basically a swamp. An excellent breeding ground for bugs. Has an odor.
257	The river appears to be clear for fewer months and becomes cloudy and thick earlier in spring and stays that way longer through the winter.
263	Too much home building. "I cannot sat this too strongly, 'Stop home building in the Severn River Watershed.'"
269	High coliform counts
269	Too many houses/septic tanks
271	Outfalls on Weems Creek are catch basins for the erodable soils high velocity water has brought to them. Collington soil is eroded by high velocity water due to the shove it gets from paved surfaces.
272	In extended hot periods there is a "Red Tide" condition which I don't think has any relationship to pollution.
274	Drainage system behind Westminster Way is eroded.
274	Drainage systerm located South of 1483 Downham Market is eroded.

Please note any additional observations you have noted regarding degraded environmental conditions in the watershed.

Survey ID:	Condition:
275	Oily water on a walking trail
276	You can see stream bed behind Severn River Rd from Old Station to between 9 and 11 Ridout Rd.
277	Headwaters of Saltworks Creek have been silting in for years. The creek seems to be getting more narrow and shallow each year.
280	Less crabs and fish
280	Marsh grass dying and receding
282	Too much littering
290	Plant waste from yards and general litter ends up in streets and is washed down storm drains.
292	Severn Run near Gambrills Rd. The runoff washes sediment into the stream and erodes the stream bed terribly.
299	Storm water runoff in area
341	Aged storm drains in Fairwinds on the Severn.
342	Aged storm drains
343	Noise from water craft
343	Speeding from water craft
65	Status of SAV and under-water grasses.
588	My pier floods with some frequency, rotting the pier boards. I believe numerous piers are the experiencing similar rotting, contaminating the water with partially submerged wood containing harmful preservatives.
599	1)Sediment and erosion controls are uniformly inadequate and shoddily maintained.
599	2)Forest clearing in the buffer of the critical area is pervasive.
599	3)Non-native vegetative species are proliferating.
599	4)Rock revetments are fast eliminating all "soft" shorelines.
599	5)The proliferation of piers and boats is killing the river.
599	6)Nitrogen runoff from lawns and septic systems is precipitating anoxic conditions.
602	Poperty on New State Court of Appeals site on Rowe Blvd has never been properly graded or poperly covered with vegetation. A heavy rain sends muddy water directly into the storm drain and Weems Creek.
604	I have noticed increase residential development in Crownsville. I am concerned about the destruction of too many trees.
607	The Saltworks Creek near 1719 S. Harbor Ln. is very silted in. For half of the day it has many mudflats. It is always muddy and sometime has brown things floating on it.
611	Construction occurs near head of Saltworks Creek, runoff from Condos, etc. into Saltworks Creek
613	Property owners using chemicals that wash into bay through drains.
613	Some property owners rent pier space out to too many boat owners.
614	The advent of malls and shopping centers along Generals Highway has cause multiple sources of oil and garbage flow into Luce and Saltworks Creeks

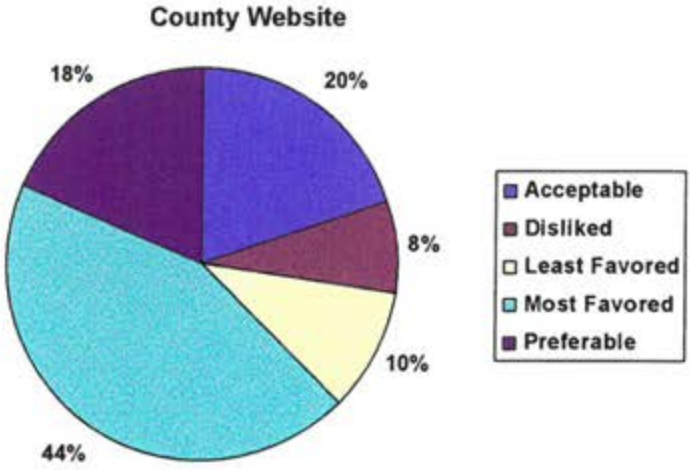
Please note any additional observations you have noted regarding degraded environmental conditions in the watershed.

Survey ID:	Condition:
616	There is a reduced amount of aquatic life in Saltworks Creek. This is particularly true at the headwaters. Development on Bestgate Rd. and surrounding areas seems to be the main cause.
617	Weems creek is silting in to where there is only a channel where open water once was.
627	A stream on the east edge of Fairwinds on the Severn community beach is riprapped and needs cleaned out.
631	There has a been a precipitous dropoff in the frog and toad population in the "headwaters" of Severn Run, after the development of Seven Oaks and the loss of snall wetland areas there.
632	Lack of under water grasses
632	Excessive use of beach walls by waterfront property owners
633	Storm drains channel lawn chemicals, animals waste, and exhaust residues into the Severn.
633	When children swim in water, we see raging ear infections and have heard of skin rashes and lesions.
634	Upper Spa Creek (Annapolis) south fortk (to Wodden foot bridge) often gets filled with flotsum from boating activities - oil, empty cans
634	All trash thrown from cars on Route 50 goes directly into Weems Creek with no mechanism for catchment and trash removal. A number of entry points are involved which need high priority attention.
640	Saltworks has silted in significantly over the last 4.5 years
642	Water flows over the property of Crab Away pier and 677 Shore Rd and carries soil down to the pier area.
643	Clements Creek is suffering from landslides along steep slopes, especially where land owners have been cutting trees and underbrush- there are several areas wher landslides occurred in last 2-4 years.
644	Waters from streets are diverted into gutters and drainpipers. That flow could be used to recharge the ground water by use of sheet drainage, for the benefit of both the bay and our ground water resource.
645	Storm drain on Sunrise Beach Rd at Whitney Landing and Sunrise Beach and Waterbury Rd
648	Heavy petrochemical runoff along Eddy Road
665	I've seen more wildlife - herons, osprey, ducks, swan, than used to be here.
666	There is a small stream in the cove next to Ben Oaks that is going to be destroyed by a new builder.
667	Lots of sedimentation due to construction. Lax enforcment of sediment laws. Various streams
669	Construction of homes, topsoil has been stripped away.
673	All high occupancy marinas and community docks are loaded with gas and oil slicks. Any area where water skiing takes place is eroded. If you want to save the Severn River than stop the water skiing.
675	Property owners are clearing trees to improve their view
676	Loss of SAV

How would like to be kept informed about the progress of the watershed management master plan? (Please rate 1 through 5, with 1 begin the most favored and 5 the least favored method).

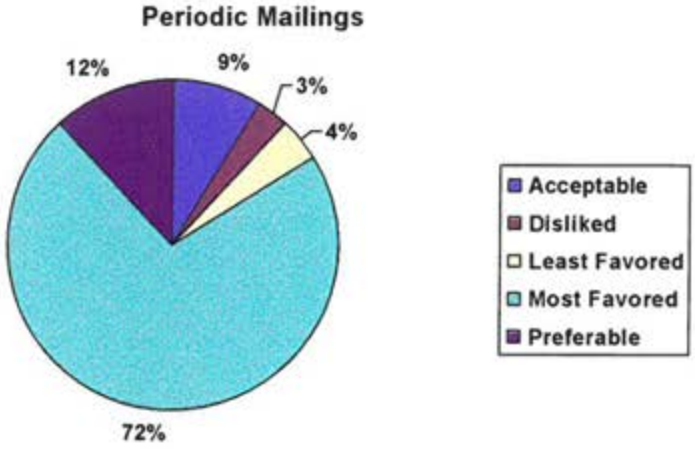
Anne Arundel County Web Site

Most Favored	44%
Preferable	18%
Acceptable	20%
Disliked	8%
Least Favored	10%



Periodic Mailings

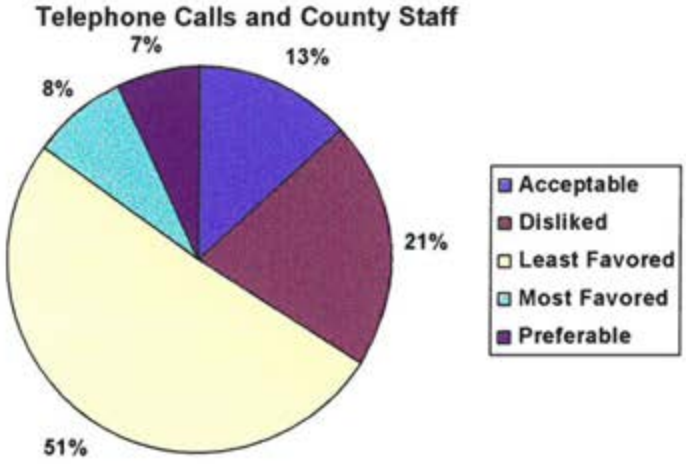
Most Favored	72%
Preferable	12%
Acceptable	9%
Disliked	3%
Least Favored	4%



How would like to be kept informed about the progress of the watershed management master plan? (Please rate 1 through 5, with 1 begin the most favored and 5 the least favored method).

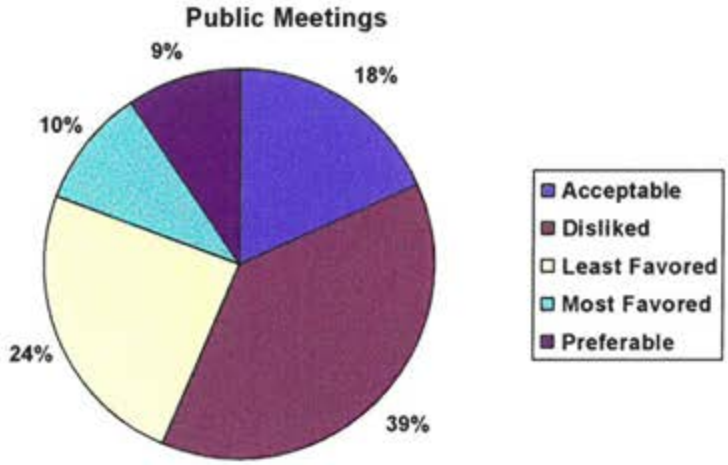
Telephone Calls and County Staff

Most Favored	8%
Preferable	7%
Acceptable	13%
Disliked	21%
Least Favored	51%



Public Meetings

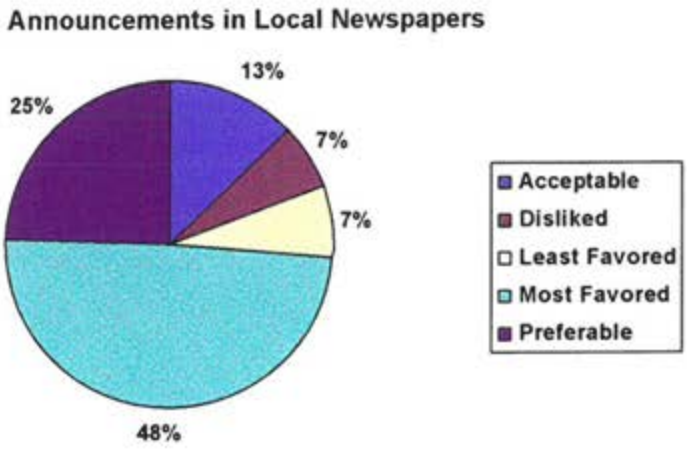
Most Favored	10%
Preferable	9%
Acceptable	18%
Disliked	38%
Least Favored	24%

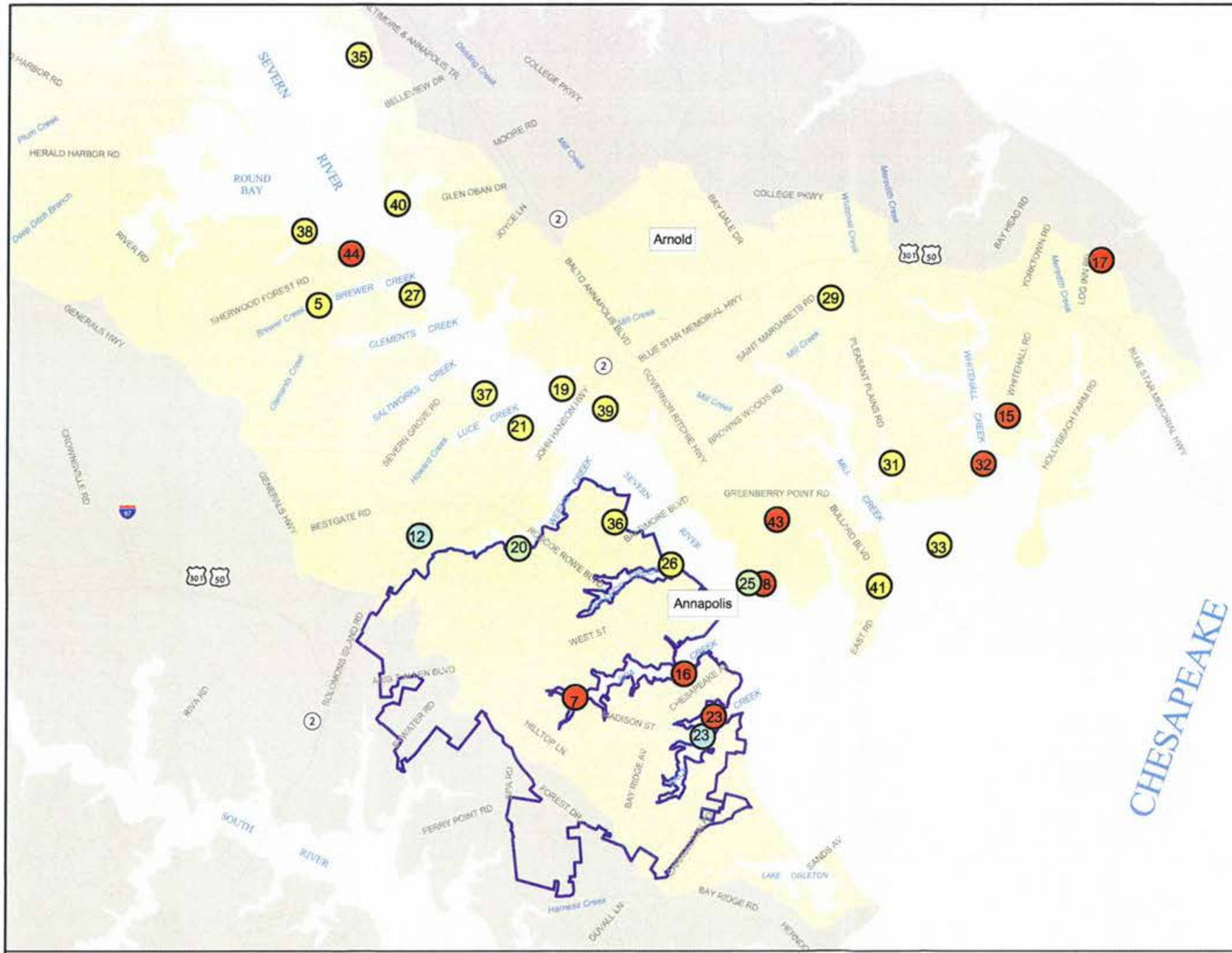


How would like to be kept informed about the progress of the watershed management master plan? (Please rate 1 through 5, with 1 begin the most favored and 5 the least favored method).

Announcements in Local Newspapers

Most Favored	49%
Preferable	25%
Acceptable	13%
Disliked	7%
Least Favored	7%





Watershed Issues

5 Arden Bog/Gumbottom Bog
7 Spa Creek - Sewage leaks
8 David Taylor Research Center - flooding issues because lack of stormwater management
12 near John Hanson Highway - New road
15 Whitehall Creek near Whitehall Road - Sewage disposal area onsite
16 Spa Creek by Eastport Marina - High coliform levels
17 on edge of watershed, near Sandy Point State Park - Septic
19 Cool Spring Cove - Endangered species habitat (tiger beetle)
20 Weems Creek - Erosion at outfall
21 Dreams Landing - Habitat loss due to hardening of shoreline
23 Back Creek - Boating industry
25 David Taylor Research Center - flooding issues because lack of stormwater management
26 College Creek near USNA - Oyster bar - remnants and proposed restoration bar
27 in between Brewer Creek and Clements Creek - Sherwood Forest - oyster restoration
29 eastern half of watershed - Less developed - some agriculture
31 Burley Creek - bulkheaded shoreline
32 Whitehall Creek - sedimentation
33 Whitehall Bay - oyster bar
34 College Creek erosion problems
35 Sullivan's Cove - White Cedar Habitat
36 Shady Lake - juvenile fish habitat
37 Whitehurst Lake - juvenile fish habitat
38 Brewer Pond - juvenile fish habitat
39 Crouchs Pond
40 Asquith Creek - redhead grass
41 Protected peninsula along Greenbury Point - wildlife refuge survival areas
43 Pesticides from USNA Golf Course
44 Pesticides from Sherwood Forest Golf Course

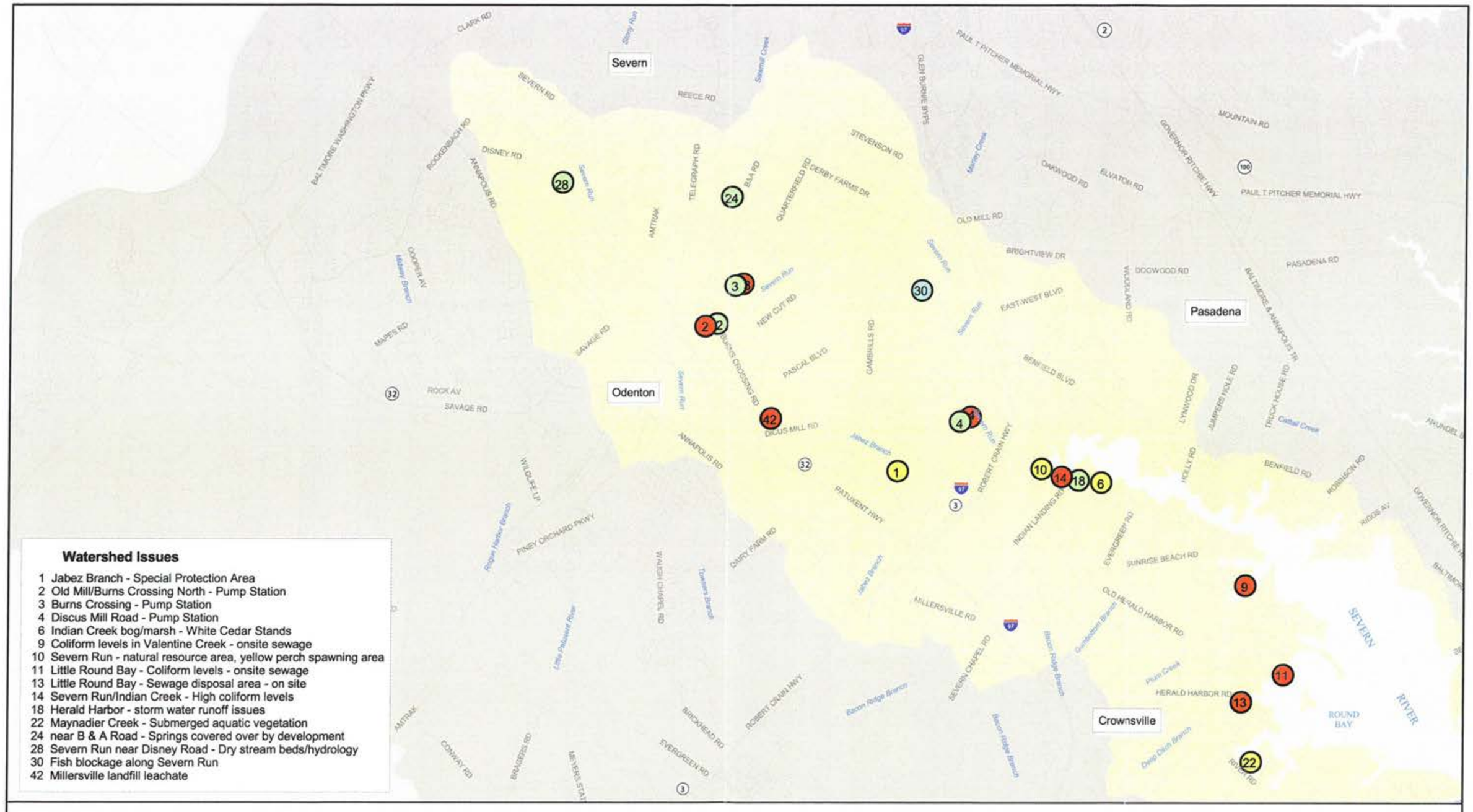
LEGEND

- Water Quality
- Special Protection Area/Habitat
- Impacted Uses
- Other including flooding, erosion, hyrdology
- Hydrography
- Roads
- Severn River Watershed
- Anne Arundel County

N

4000 0 4000 8000 Feet

Lower Severn River
Watershed Management
Master Plan
Anne Arundel County
Maryland



Watershed Issues

1 Jabez Branch - Special Protection Area
2 Old Mill/Burns Crossing North - Pump Station
3 Burns Crossing - Pump Station
4 Discus Mill Road - Pump Station
6 Indian Creek bog/marsh - White Cedar Stands
9 Coliform levels in Valentine Creek - onsite sewage
10 Severn Run - natural resource area, yellow perch spawning area
11 Little Round Bay - Coliform levels - onsite sewage
13 Little Round Bay - Sewage disposal area - on site
14 Severn Run/Indian Creek - High coliform levels
18 Herald Harbor - storm water runoff issues
22 Maynadier Creek - Submerged aquatic vegetation
24 near B & A Road - Springs covered over by development
28 Severn Run near Disney Road - Dry stream beds/hydrology
30 Fish blockage along Severn Run
42 Millersville landfill leachate

LEGEND

- Water Quality
- Special Protection Area/Habitat
- Impacted Uses
- Other including flooding, erosion, hyrdology
- Hydrography
- Roads
- Severn River Watershed
- Anne Arundel County

N

4000 0 4000 8000 Feet

Upper Severn River
Watershed Management
Master Plan
Anne Arundel County
Maryland

APPENDIX B: DESCRIPTION OF WISE MODEL

PLOAD™/WISE™: AN INNOVATIVE MODEL FOR WATERSHED MANAGEMENT AND THE DEVELOPMENT OF NARRATIVE TMDLS

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ABSTRACT

Section 303(d) of the Federal Clean Water Act requires states to develop a Total Maximum Daily Load (TMDL) allocation plan for water bodies determined to have limited water quality. A TMDL allocation plan documents the amount of a pollutant that a waterbody can assimilate without exceeding a state's water quality standards, and allocates that amount as loads to point and nonpoint sources. TMDLs are defined in 40 Code of Federal Regulations (CFR) Part 130 as the sum of the individual waste load allocations for point sources and load allocations for nonpoint sources, including a margin of safety and natural background conditions.

Water quality standards, which are intended to provide protection for designated uses, form the basis of TMDL targets. In cases where numeric water quality standards are not available, narrative standards are used to develop TMDLs. These narrative standards cannot be allocated; hence, there is a need to link the narrative standards to pollutant loads generated from the watershed.

The PLOAD/WISE Model has been designed to link the watershed pollutant loads to narrative standards, i.e., biological indices. Specific biological standards based on biological indices such as Index of Biological Integrity (IBI), Fish Score, and Invertebrate Community Index (ICI) are used as measurement tools and are linked to various pollutant loads from the watershed. The model blends two components: PLOAD—a GIS application developed for pollutant load modeling, and WISE—a tool developed for statistical evaluation of pollutant loads versus biological indices. The model allows the user to view various scenarios based on desired goals and make technically sound decisions for developing narrative TMDLs.

BACKGROUND

Proposed rules being developed by the U.S. Environmental Protection Agency (EPA) to revise requirements related to TMDLs distinguish, for the first time, waters that are impacted by "specific pollutants" and those that are impacted by "pollution". Waters that are impacted by specific pollutant(s) are considered to not be meeting the uses associated with that pollutant (e.g., aquatic life, water supply, recreation, etc., depending on specific state water quality standards) and must be included on state impaired waters lists [303(d) lists]. TMDLs must be developed and implemented for these listed waters in accordance with a prioritization established by states and the EPA in accordance with the rules. Waters that are considered

impaired because of assessments *not* related to specific pollutants or water quality criteria, such as impaired biotic criteria, are also required to be included on the 303(d) lists, but a specific schedule for assessing and correcting the impairment is not required by the proposed rules.

In Georgia, the state agency requires local governments to conduct detailed watershed assessments and develop management plans in order to continue to expand municipal point source discharges. The agency requires the assessments for specific 303(d) listed waters as well as all watersheds associated with the service areas (sewersheds) for the specific wastewater facilities. The watershed assessments include watershed characterizations (water quality monitoring, biological monitoring, and habitat assessments) and various levels of watershed pollutant modeling.

Watershed characterization data and modeling results have been used to develop statistical relationships between biological conditions and various watershed parameters. Indices of benthic macroinvertebrate and/or fish community biotic integrity (as dependent variables) versus habitat conditions, watershed imperviousness, and pollutant loads have been developed for the various watersheds. The best statistical relationships resulted in cases where there is a wide range of biological impairment, including severely degraded urban streams.

The PLOAD/WISE Model has been designed to link the watershed pollutant loads to narrative standards, i.e., biological indices. Specific biological standards based on biological indices such as Index of Biological Integrity (IBI), Fish Score, and Invertebrate Community Index (ICI) are used as measurement tools and are linked to various pollutant loads from the watershed. The model is a conglomeration of two components: PLOAD—a GIS application developed for pollutant load modeling, and WISE—a tool developed for statistical evaluation of pollutant loads versus biological indices. The model allows the user to view various scenarios based on desired goals and make technically sound decisions for developing narrative TMDLs.

MODEL OVERVIEW

PLOAD

A GIS application model, PLOAD was developed to calculate pollutant loads from watershed basins. The application estimates average annual nonpoint source and point source pollution loads for user-specified pollutants. The user may calculate the nonpoint source loads using either the export coefficient or simple method approach. Optionally, best management practices (BMPs), which serve to reduce both nonpoint source loads and point source loads, can also be evaluated. Point source loads are an additional option for the pollutant loading calculation. There are several post-processing options available to depict and tabulate pollutant-loading results.

PLOAD was designed to be generic, so that it can be applied as a screening tool in typical NPDES stormwater permitting, watershed management, or reservoir protection projects. The organization and structure of the application facilitates modification and customization. PLOAD was developed using the menu-driven ArcView® desktop GIS. Custom scripts were written with ArcView's object-oriented Avenue® programming language.

Inputs

The PLOAD application requires several inputs, including pre-processed GIS and tabular data (developed by the user), prior to calculating the pollutant loads of a watershed. The data requirements include:

- GIS land use data
- GIS basin delineation
- GIS BMP site and drainage delineation
- GIS point source location
- Land use pollutant loading rates or Event Mean Concentrations (EMCs)
- Land use impervious surface factor tables
- BMP pollutant reduction factors
- Annual point source pollutant loads
- Annual rainfall amounts

GIS Data

PLOAD requires watershed basin and land use GIS data coverages. The basins define the areas for which the pollutant loads are calculated. The land use file is essential for calculating the nonpoint source pollutant loads. Prior to calculating the pollutant loads, PLOAD digitally overlays the basin and land use coverages to determine the areas of the various land use types for each basin.

BMPs serve to reduce the pollutant loads for each BMP area of influence. Most BMP areas of influence are the drainage area of that BMP. BMP input is optional, since BMPs may not exist for the area of evaluation or may not be desired for analysis. Point source loads may be added throughout the watershed, wherever they exist. Point source loads are optional, since they may not exist in the watershed or may not be desired for analysis.

Tabular Data

Pollutant loading rates, impervious surface factors, BMP pollutant reduction percentages, and point source loading rates must be compiled in tabular files for use in the PLOAD application. Each input tabular file may be formatted as a Microsoft Excel® spreadsheet, a comma- delimited text file, a dBASE® file, or an INFO® database table.

Pollutant Loading Rate Tables

The pollutant loading rate tables list either the loading rate for each pollutant type by land use type or the EMC for each land use type, depending on the calculation method chosen by the user. The table may contain any number of land uses and pollutant types. The rates in the export coefficient table must be inputted as pounds per acre, and the EMC table must be inputted as mg/L. Fecal coliform values must be specified prior to the calculation of the pollutant loads.

For the Simple Calculation Method, an impervious surface factor table must be inputted into the application. It is used to calculate the runoff coefficient for each land use type. The runoff

coefficient is used with the annual average rainfall to calculate the total stormwater runoff for each watershed.

The optional BMP table contains, for each BMP type, the percent efficiency multipliers that are used to calculate load reductions. The table may contain any number of BMPs that have a known or calculated reduction ratio.

The optional point source table contains the pollutant loading rate of each point source in the watershed. The loading rate can be for any pollutant parameter and must be inputted as a total pollutant load per year.

Pollutant Loading Calculations

Annual pollutant loads may be calculated for each watershed basin using either the Export Coefficient or Simple Methods. Optionally, the pollutant loads derived from these methods may be refined based on the remedial effects of BMPs and point sources. Descriptions of the equations used to calculate the pollutant loads are as follows:

Export Coefficient Method

If the Export Coefficient Method is designated for calculating pollutant loads in PLOAD, then the loads are calculated for each specified pollutant type by basin using the following equation:

$$L_P = \Sigma_U(L_{PU} * A_U)$$

Where: L_P = Pollutant load, lbs;
L_{PU} = Pollutant loading rate for land use type u, lbs/acre/year; and
A_U = Area of land use type u, acres

The loading rates are derived from the Export Coefficient tables, while the land use areas are interpreted from the land use and basin GIS data.

Simple Method

If the Simple Method is designated for calculating pollutant loads in PLOAD, then two equations are required to calculate the loads for each specified pollutant type. First, the runoff coefficient for each land use type must be derived with the equation:

$$R_{VU} = 0.05 + (0.009 * I_U)$$

Where: R_{VU} = Runoff coefficient for land use type u, $inches_{run}/inches_{rain}$
I_U = Percent imperviousness (extracted from the impervious terrain factor table)

The pollutant loads are then calculated with the following equation:

$$L_P = \Sigma_U (P * P_J * R_{VU} * C_U * A_U * 2.72 / 12)$$

Where: L_P = Pollutant load, lbs
P = Precipitation, inches/year (default = 40.86)
P_J = Ratio of storms producing runoff (default = 0.9)
R_{VU} = Runoff coefficient for land use type u, $inches_{run}/inches_{rain}$
C_U = Event mean concentration for land use type u, milligrams/liter
A_U = Area of land use type u, acres

The precipitation and storm ratio values are entered by the PLOAD user interactively. The loading rates are derived from the EMC tables, while the land use areas are interpreted from the land use and basin GIS data.

BMP Computations

BMPs serve to reduce pollutant loads, and PLOAD has an option to calculate loads based on the remedial effects of the various BMP types. This section describes the equations that are used to calculate pollutant loads influenced by BMPs. BMP types may be represented as either area or site features, but the approach is similar for both. After the raw pollutant loads are calculated using the Export Coefficient or Simple Methods, three equations are used to recalculate the pollutant loads:

First, the percent of the basins area serviced by BMPs are determined using the following equation:

$$\%AS_{BMP} = AS_{BMP}/A_B$$

Where: $\%AS_{BMP}$ = Percent area serviced by the BMP (entered as a decimal)
AS_{BMP} = Area serviced by the BMP, acres
A_B = Area of basin, acres
Note: The BMP and basin areas are derived from the BMP and basin GIS data.

Next, the pollutant loads for each BMP are calculated:

$$L_{BMP} = (L_P * \%AS_{BMP}) * (1 - \%EFF_{BMP}/100)$$

Where: L_{BMP} = BMP load, lbs
L_P = Raw basin load, lbs
%EFF = Percent load reduction of BMP (entered as a decimal)

The raw basin pollutant loads are derived from the results of the Export Coefficient or Simple Methods, while the percent load reduction comes from the BMP efficiency tables.

Finally, the total pollutant loads accounting for BMPs are computed by basin. Each basin load is a cumulative total of areas that *are* and *are not* influenced by BMPs.

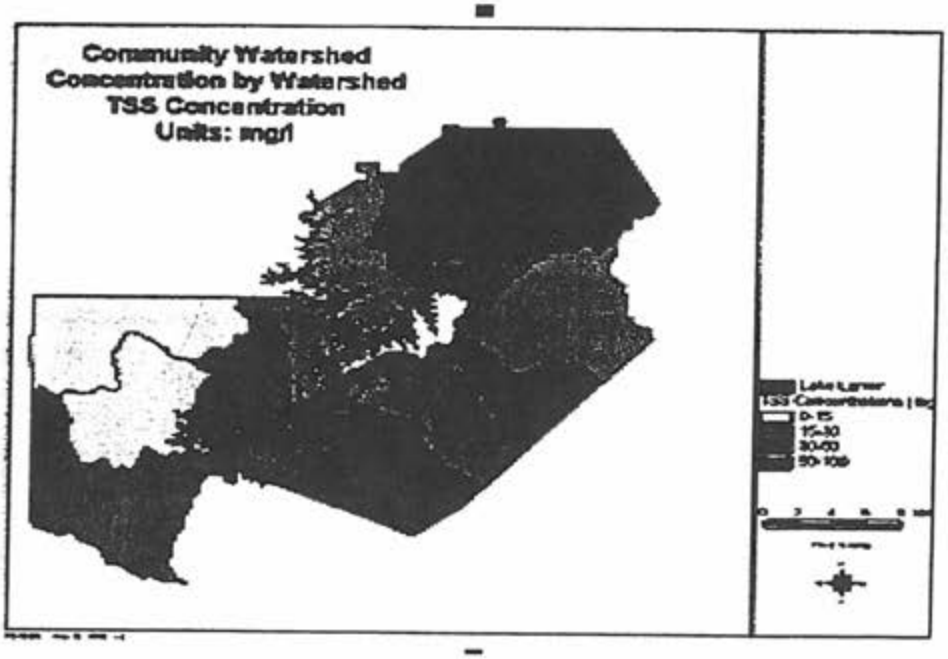
$$L = (\Sigma_{BMP} (L_{BMP})) + L_P * (A_B - (\Sigma_{AS} (AS_{BMP}))$$

PLOAD Output

After the pollutant loads have been determined for each land use and the BMP scenario has been chosen, PLOAD may be used to generate a variety of graphic plots and tabular reports that are used as input into the WISE portion of the application. Listed below are the output options for the application for each land use scenario calculated. Figure 1 presents an example of the outputs for total suspended solids (TSS).

- Total Pollutant Loads by Basin – Map and Table
- Pollutant Loads Per Acre by Basin – Map and Table
- Pollutant Concentration by Basin – Map and Table
- Pollutant Loads by BMP, Land use, and Basin – Table
- PLOAD Data Sources and Parameters – Table

Figure 1 - PLOAD Output for TSS



Watershed Improvements through Statistical Evaluations (WISE)

Prediction is an important component of any management plan to determine the effect of changes in the landscape on aquatic integrity (i.e., cause and effect). Regression and correlation analyses are essential to evaluate the cause-and-effect relationship between potential stressors (e.g., land uses) and stream degradation (habitat and biota). The results of these assessments can be used with predictive modeling for developing future management scenarios and establishing goals and success criteria.

The WISE Model was designed to bridge modeled watershed pollutant loads and biological indices. WISE reads output from the PLOAD Model; uses correlation and regression techniques to develop narrative TMDLs or watershed improvement guidelines for pollutants of concern based on the desired biotic integrity; and evaluates the practicability of these criteria through a preliminary screening of watershed management strategies.

The following characteristics describe the WISE Model:

- Is in user-friendly Microsoft Excel format
- Once data are entered, automates the watershed improvement guideline derivation process
- Allows decisions to be based on multi-parameter relationships
- Works as a preliminary screening tool for BMP scenario evaluation

The WISE Model has two components:

- Watershed improvement guideline derivation
- BMP scenario analysis

Watershed Improvement Guideline Derivation

Purpose

The purpose of the watershed improvement guideline derivation analysis is to identify meaningful relationships between in-stream biological conditions (representing stream health) and subbasin conditions (including habitat and pollutant loadings). The ultimate objective of this component is to use the findings to develop guidelines for meeting the community's watershed protection and/or improvement goals. The correlation and regression analyses are based on the assumption that good biological conditions depend on both good water quality and adequate habitat.

Methods

The impacts analysis consists of a series of correlation and regression analyses. These analyses are performed using biological, habitat, and pollutant loading data from the two study areas and the four reference stations used in both studies. In-stream biological conditions (including fish and macroinvertebrate scores) are classified as dependent variables, and subbasin characteristics (including pollutant loadings and habitat scores) are classified as independent variables.

Independent Variables. Independent variables are those that can influence or limit the dependent variables (i.e., in-stream biological conditions). The following parameters were evaluated as independent variables for each monitoring point in the study:

- Stream habitat score (raw score)

- Subbasin area effective imperviousness (percent)
- Annual pollutant loading rates for each pollutant of interest (in pounds per acre per year)

Dependent Variables. Two basic dependent variables were considered in this analysis: fish score using the IBI, and macroinvertebrate score using the Georgia Biological Protocols. These two dependent variables are measures of stream aquatic integrity. The IBI, which is an aggregate of several fish metrics, comprises the fish score. The sum of seven community and population metrics makes up the macroinvertebrate score.

Overview

This component of the model uses a four-step process: data entry, correlation analysis, regression analysis, and derivation.

Data Entry. The main objective of this step is to compile all information in ***one*** database. The Excel sheet format allows data from biological and modeling results (PLOAD) to be linked with ease. Linking restores the data integrity and minimizes the QA/QC process considerably. The data entry module allows easy export into Microsoft Access® for web-site and database purposes. Figure 2 illustrates the data entry module.

Figure 2 - Data Entry Module

Database for Correlation Analysis Back to Main Menu

Station/ Subbasin	Total Upstream Acreage	Total Flow (MG)	Fish Raw Score[2]	Fish Rating	Benthic Score	Benthic Rating	TSS (lb/ac/yr)
STN 1	3,832	2,841	NA	NA	7	Poor	1,815
STN 2	5,922	4,205	40	Fair	18	Good	1,744
STN 3	5,192	3,486	NA	NA	16	Poor	2,086
STN 4	3,357	2,027	32	Poor	16	Poor	2,116
STN 5	14,094	8,841	NA	NA	19	Good	1,649
Reference Stations							
REF-1	46,372	29,053	46	Fair-Good	30	–	590
REF-2	5,146	5,146	42	Fair	28	–	687
REF-3	4,894	4,894	46	Fair-Good	30	–	856

Correlation Analysis. The correlation analysis is used to review and evaluate relationships between dependent and independent variables. The results of this analysis are exported in a correlation matrix (Figure 3), which is based on a strictly linear correlation and shows the degree of association between the various dependent and independent variables.

The correlation coefficients (r-values) shown on Figure 3 range between negative 1 and positive 1. A correlation value of 0 indicates no correlation between the independent and dependent variables, and a value of either –1 or +1 indicates full correlation. A positive correlation coefficient indicates that as one variable increases, the other variable also increases; conversely, a negative correlation indicates that as one variable increases, the other variable decreases. Correlations greater than 0.5 (absolute values) indicate a strong relationship and are shown in boldface print in the correlation matrix.

Figure 3 – Correlation Matrix

Correlation Analysis — Baseline Main Group

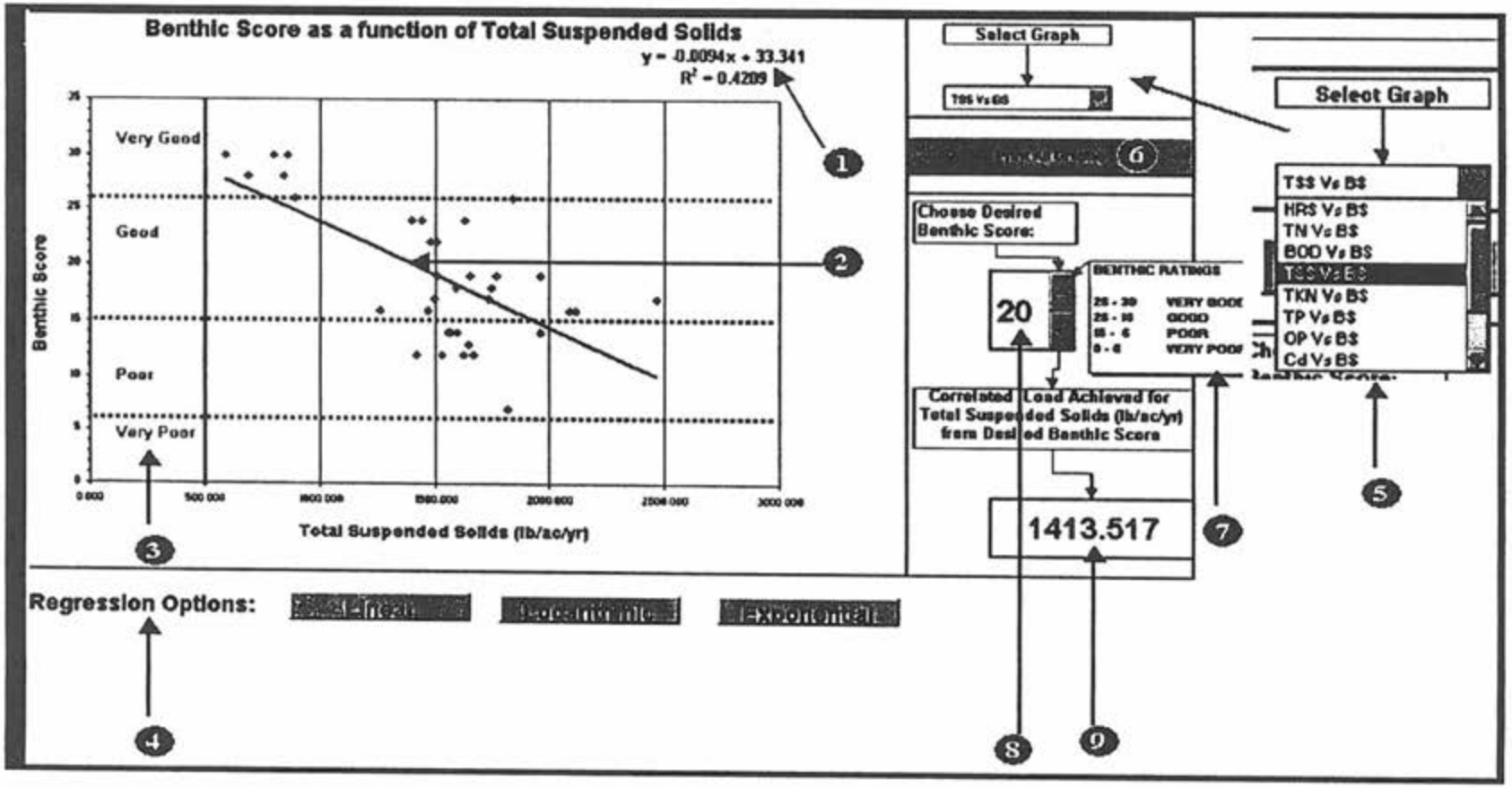
Correlation Matrix	TSS (lb/ac/yr)	Zinc (lb/ac/yr)	Habitat Raw Score	Benthic Raw Score	Fish Raw Score
TSS (lb/ac/yr)	1.00				
Zinc (lb/ac/yr)	0.59	1.00			
Habitat Raw Score	-0.48	-0.33	1.00		
Benthic Raw Score	-0.65	-0.59	0.47	1.00	
Fish Score	-0.62	-0.64	0.47	0.61	1.00

Regression Analysis. Using one or a few numerical summaries to characterize the relationship between dependent and independent variables runs the risk of missing important features and making erroneous conclusions. Graphical interpretation of scatter plots captures the salient features of the relationship among variables that may otherwise be missed. One major feature of a scatter plot is that it shows *all* the data. Figure 4 presents the graphical interface designed for the regression analysis and explains each feature.

Guideline Derivation. The Guideline Derivation Module brings together the results for the correlation and regression modules and displays them in a user-friendly interface. This module allows the guidelines to be based on the benthic macroinvertebrate, fish, and habitat data using each variable's relationship with the pollutant parameters. Figure 5 presents the Guideline Derivation interface.

The "Choose Guideline" function in the Guideline Derivation Module allows guidelines to be based on several statistics. For example, if the TSS relationship with macroinvertebrates, fish, and habitat is strong, the user can derive a guideline using a mean or a median of the three. However, if the TSS relationship with fish and habitat is strong, but with macroinvertebrates is weak, then the user has an option of deriving the guidelines based on only the fish and habitat. Figure 6 presents a snapshot of the "Choose Guideline" function.

Figure 4 – Graphic Interface for Regression Analysis



Notes:

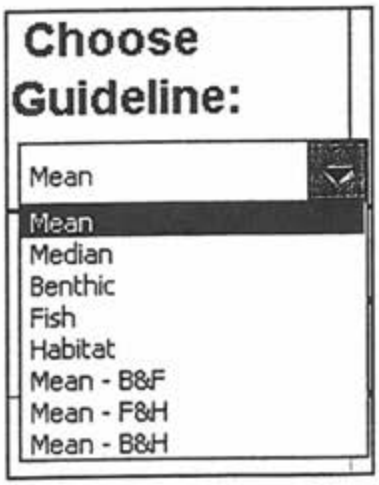
1. The regression equation and the regression coefficient are presented to assess the relationships among the variables.
2. The regression plots are automated.
3. Integrity ratings for the benthic macroinvertebrates and fish are presented in the graphical output.
4. Regression lines can be plotted using linear, logarithmic, and exponential relationships.
5. Various relationships can be viewed within this graphical interface.
6. The print option allows the user to print all the graphs with the push of a button.
7. Integrity ratings are documented with the interface.
8. This option allows the user to choose the desired aquatic integrity rating as a goal for watershed management.
9. This function uses the regression curve (1) to predict the required pollutant loading rate based on the desired aquatic integrity goal (8).

Figure 5 – Watershed Improvement Guideline Derivation

Automated Tool for Watershed Improvement Guideline Derivation

	TSS (lb/acre/yr)	BOD (lb/acre/yr)	TP (lb/acre/yr)	Lead (lb/acre/yr)	BOD (lb/acre/yr)	TSS (lb/acre/yr)
Benthic Score						
18	1,625.418	16.254	1.053	0.041	16.254	1,625.418
Correl Coef	-0.649	-0.511	-0.637	-0.483	-0.511	-0.649
Fish Score						
36	1,594.902	14.931	1.020	0.037	14.931	1,594.902
Correl Coef	-0.619	-0.673	-0.589	-0.637	-0.673	-0.619
Habitat Score						
65	1,808.119	17.515	1.153	0.044	17.515	1,808.119
Correl Coef	-0.478	-0.352	-0.399	-0.364	-0.352	-0.478
Choose Guideline: Benthic	1,625.418	16.254	1.053	0.041	16.254	1,625.418

Figure 6 – "Choose Guideline" Function



BMP Scenario Analysis

The BMP Scenario component is a tool designed to evaluate scenarios for watershed management planning. It allows users to choose BMPs for the different land use types in a study area, and outputs the loads for the scenario using the future modeled loads from PLOAD. This component realistically evaluates the validity of the improvement guidelines by comparing existing and futureloads (i.e., worst-case scenarios without any controls) with the loads predicted for each scenario. The main characteristics of this component are described below:

- Analysis can be performed on any delineated sub-watershed in a study area (Figure 7).

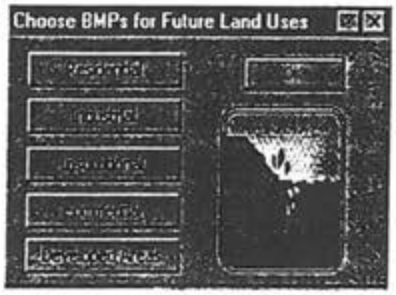
Figure 7 – Screen Capture of "Choose Watershed" Dialog Box

- The "Choose BMPs" function allows users to select BMPs (including multiple combinations) for various land-use types. This function analyzes implications of guidelines and scenarios on new developments and allows screening of scenarios for retrofitting of existing developments.

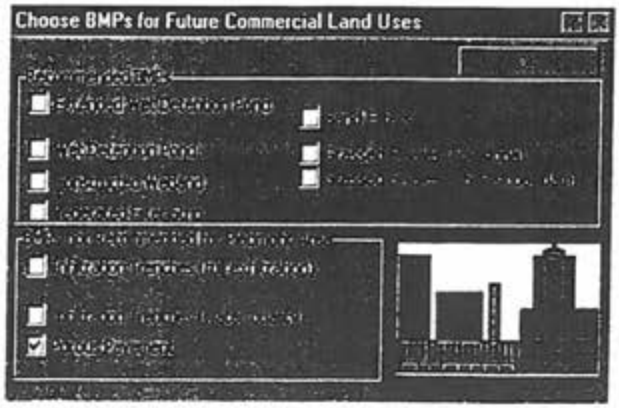
  Figure 8a presents the BMP analysis menu and Figure 8b presents the types of BMPs used in the model. Note that the option for "Developed Areas" on Figure 8a allows for screening retrofit scenarios.

Figure 8 – BMP Analysis Options

(a)

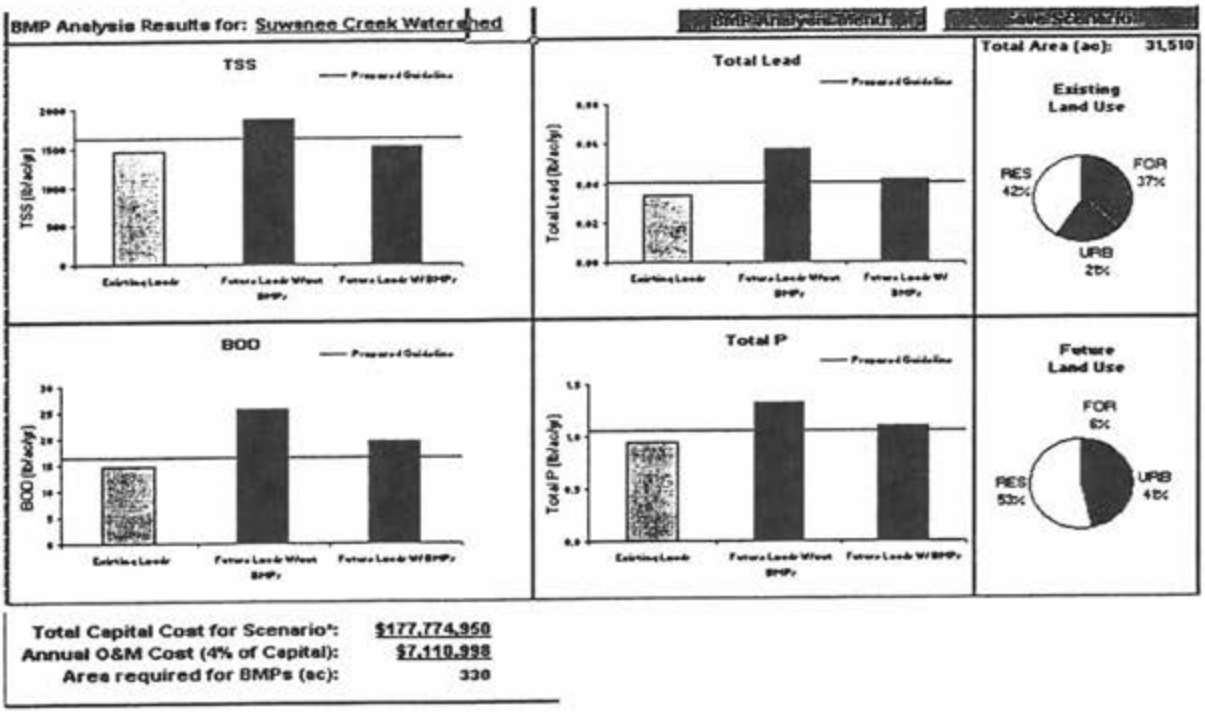


(b)



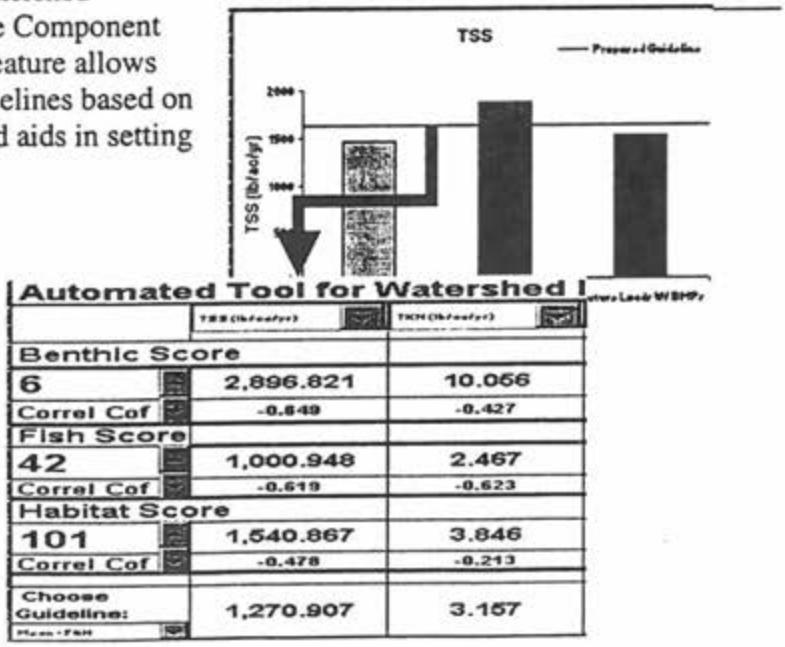
- Figure 9 presents the results display of the BMP Analysis Component. This interface presents scenario results in comparison with baseline and worst-case conditions, and provides a planning level cost analysis. The results interface also presents the current and future land-use distribution for the chosen study area.

Figure 9 – BMP Analysis Component Results



- The BMP analysis component allows interaction with the Watershed Improvement Guideline Component (See Figure 10). This feature allows the user to edit the guidelines based on a predicted scenario and aids in setting realistic goals.

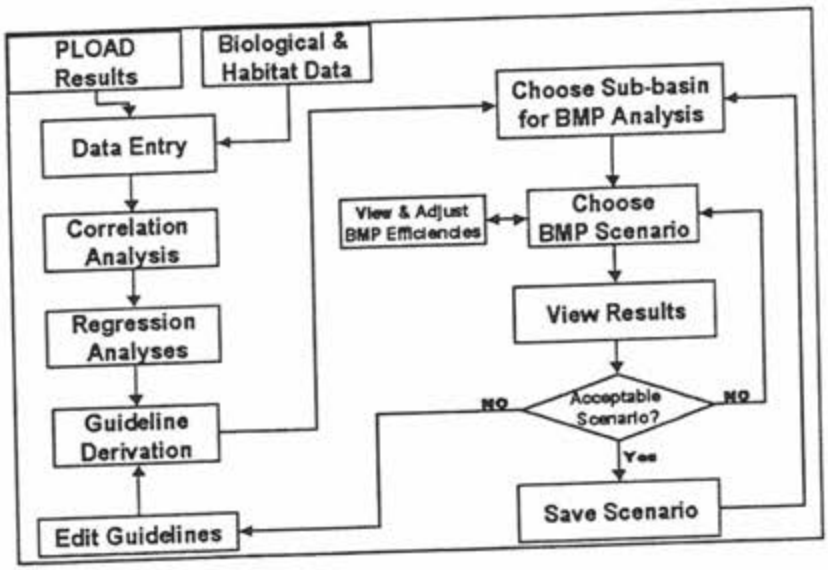
Figure 10 – Interaction of BMP Analysis and Watershed Improvement Guideline Components



CONCLUSION

The development of guidelines for watershed characteristics is largely driven by imperviousness and land use. Use of this approach allows watershed management strategies to be targeted for biotic integrity. It also allows integration of "pollution control" strategies for specific pollutants where characterization and subsequent assessment show that pollution control is necessary. Figure 11 presents the flow chart for the PLOAD/WISE Model.

Figure 11 – Flow Chart for PLOAD/WISE Model



In conclusion, the PLOAD/WISE Model offers the following benefits:

- Is a user-friendly model that helps develop narrative TMDLs by linking pollutant loads to biological indices. This model is ideal for all stakeholders and state agencies responsible for developing TMDLs.
- Allows users to view various management scenarios based on desired goals.
- Allows users to make technically sound decisions for watershed protection.

The PLOAD/WISE model is an excellent tool for evaluating watershed protection strategies. It allows the user to set realistic goals for watershed protection using existing and future loadings, biotic and habitat data, and costs.

APPENDIX C: ENVIRONMENTAL AND GIS METADATA

Table I - General Characteristics

Document Code	Land Use	Pot. Pollutant Sources/and Stormwater Loading	Areas of Erosion	Areas of Sedimentation	Potential Flooding Problems	BMPs Charaterization	Retrofit/Restoration Plans	Estuarine Dynamics	Mapping and GIS
AACC 1987		X							
AACC 2000									
AACo 1996	X						X		
AACo 1997A	X								X
AACo 1997B	X								X
AACo 1998									X
AACo 1999A	X				X Open Space Zoning				X

Notes:

Open Space Zoning -- Small Area Plan zoning category based on land use features including flooding potential

Table I - General Characteristics

Document Code	Land Use	Pot. Pollutant Sources/and Stormwater Loading	Areas of Erosion	Areas of Sedimentation	Potential Flooding Problems	BMPs Charaterization	Retrofit/Restoration Plans	Estuarine Dynamics	Mapping and GIS
AACo 1999S	X				X				X
					Open Space Zoning				
AACo 2000	X	X							
		runoff							
AACo 2000C	X				X				X
					Open Space Zoning				
AACo 2000O	X				X				X
					Open Space Zoning				
AACo 2000S	X				X				X
					Open Space Zoning				
AACo 2001	X				X				X
					Open Space Zoning				
ACB 2000	X	X							

Notes: CEES 1992 -- in reference to boating issues

Open Space Zoning -- Small Area Plan zoning category based on land use features including flooding potential

Table I. General Characterization

Document Code	Land Use	Pot. Pollutant Sources/and Stormwater Loading	Areas of Erosion	Areas of Sedimentation	Potential Flooding Problems	BMPs Charaterization	Retrofit/Restoration Plans	Estuarine Dynamics	Mapping and GIS
ACM 2001		X					X	X	
							Really General		
CEES 1992	X	X							
CBP 1999									
CRG 1998	X	X	X				X		
		decline in trout due to thermal poll.							
EPA 2000									
GI 1992									
JCR 2000			X	X					

Notes: CEES 1992 -- in reference to boating issues

Table I - General Characterization

Document Code	Land Use	Pot. Pollutant Sources/and Stormwater Loading	Areas of Erosion	Areas of Sedimentation	Potential Flooding Problems	BMPs Charaterization	Retrofit/Restoration Plans	Estuarine Dynamics	Mapping and GIS
MD-DNR 1982	X	X	X boat wake effects	X			X		
MD-DNR 1984	X	X	X	X					
MD-DNR 1987									
MD-DNR 1990		X							
MD-DNR 1990a	X	X	X	X				X	X
MD-DNR 1991	X	X							
MD-DNR 1992	X								

Notes:

Table I - General Characterization

Document Code	Land Use	Pot. Pollutant Sources/and Stormwater Loading	Areas of Erosion	Areas of Sedimentation	Potential Flooding Problems	BMPs Charaterization	Retrofit/Restoration Plans	Estuarine Dynamics	Mapping and GIS
MD-DNR 1996				X					
MD-DNR 1997	X	X silt and nutrient loading							X site map
MD-DNR 1997A	X	X	X	X		X			
MD-DNR 1999	X								X
MD-DNR 2000	X		X soil erodibility				X acres of permitted mitigation		X site map
MD-DNR 2001									
NOAA 2001					X				

Notes:

Table I - General Characterization

Document Code	Land Use	Pot. Pollutant Sources/and Stormwater Loading	Areas of Erosion	Areas of Sedimentation	Potential Flooding Problems	BMPs Charaterization	Retrofit/Restoration Plans	Estuarine Dynamics	Mapping and GIS
PP 1994			X				X		
SRA 2000	X	X							X
SRA 2001		X							
SRC 1995	X	X				X	X	X	X
SRC 1989	X	X	X	X			X bank stablilization on Jabez		
SRC 2000									X
SRC 2000A	X	X	X	X			X		

Notes:

Table I - General Characterization

Document Code	Land Use	Pot. Pollutant Sources/and Stormwater Loading	Areas of Erosion	Areas of Sedimentation	Potential Flooding Problems	BMPs Charaterization	Retrofit/Restoration Plans	Estuarine Dynamics	Mapping and GIS
SRLT 2000	X								
TPL 2000	X								
TT 2000	X	X	X	X					X
TT 2000A	X		X	X					X
USGS 1999	X	X					X Nutrient Control Strategy		
USGS 2000	X	X				X			
USGS 2001		X							

Notes:

Table I - General Characterization

Document Code	Land Use	Pot. Pollutant Sources/and Stormwater Loading	Areas of Erosion	Areas of Sedimentation	Potential Flooding Problems	BMPs Charaterization	Retrofit/Restoration Plans	Estuarine Dynamics	Mapping and GIS
EA 1999	X	X							
EPA 2001		X							
MCI 2000	X	X				X	X		
MD-DNR 1994	X								
MD-SOS 1991									
NADP 2001									
NWS 2001									

Notes:

Table I - General Characterization

Document Code	Land Use	Pot. Pollutant Sources/and Stormwater Loading	Areas of Erosion	Areas of Sedimentation	Potential Flooding Problems	BMPs Charaterization	Retrofit/Restoration Plans	Estuarine Dynamics	Mapping and GIS
PBS&J 1998	X	X				X	X		
PBS&J 1999	X	X		X	X	X	X		
PBS&J 1999A	X	X		X	X	X	X		
TT 2001	X	X							

Notes:

TABLE II - REGULATORY CRITERIA

Document Code	Fecal Coliform	D.O.	Temp.	pH	Turb.	Total Residual Chlorine	Priority Poll. and other Toxics	TSS	BOD	COD	Oil & Grease	Sensitive Areas				Forests	TP	TN	25' - 75' Buffer to Non-Tidal Wetlands	Natural Vegetation	Soils	Tidal Wetlands	Storm water
												100-Yr Flood plain	Streams & their Buffers	T & E Species Habitat	Steep Slopes (>15%)								
AACC 1987		X	X		X			X															
		salinity	secci depth		conduc tivity		& settleable solids																
AACC 2000	X																						
AACo 1996																							
AACo 1997A																							
AACo 1997B												X	X	X	X	X						X	
																						non-tidal	
AACo 1998		X	X	X																			
AACo 1999A															X	X					X	X	

Notes:

TABLE II - REGULATORY CRITERIA

Document Code	Fecal Coliform	D.O.	Temp.	pH	Turb.	Total Residual Chlorine	Priority Poll. and other Toxics	TSS	BOD	COD	Oil & Grease	Sensitive Areas				Forests	TP	TN	25' - 75' Buffer to Non-Tidal Wetlands	Natural Vegetation	Soils	Tidal Wetlands	Storm water
												100-Yr Flood plain	Streams & their Buffers	T & E Species Habitat	Steep Slopes (>15%)								
AACo 1999S												X	X	X	X								
AACo 2000			X	X																			X
AACo 2000C														X		X							
AACo 2000O												X		X	X	X							
AACo 2000S												X	X	X	X	X							
														None Found									
AACo 2001												X	X	X	X	X						X	
														None Found								non-tidal	
ACB 2000																							

Notes: CEES 1992 -- also measured salinity, chlorophyll a, light attenuation coefficient

TABLE II - REGULATORY CRITERIA

Document Code	Fecal Coliform	D.O.	Temp.	pH	Turb.	Total Residual Chlorine	Priority Poll. and other Toxics	TSS	BOD	COD	Oil & Grease	Sensitive Areas				Forests	TP	TN	25' - 75' Buffer to Non-Tidal Wetlands	Natural Vegetation	Soils	Tidal Wetlands	Storm water
												100-Yr Flood plain	Streams & their Buffers	T & E Species Habitat	Steep Slopes (>15%)								
ACM 2001																							
CBP 1999							X																
CEES 1992			X					X									X	X					
CRG 1998																							
EPA 2000	X						X	X									X	X					
GI 1992		X	X	X	X		X	X	X								X	X					X
JCR 2000																							

Notes: CEES 1992 -- also measured salinity, chlorophyll a, light attenuation coefficient

CRG 1998--also discusses conductivity

EPA 2000 --TMDL's for Severn River

GI 1992 -- also measured metals, salinity, inorganic ions and other pollutants

TABLE II - REGULATORY CRITERIA

Document Code	Fecal Coliform	D.O.	Temp.	pH	Turb.	Total Residual Chlorine	Priority Poll. and other Toxics	TSS	BOD	COD	Oil & Grease	Sensitive Areas				Forests	TP	TN	25' - 75' Buffer to Non-Tidal Wetlands	Natural Vegetation	Soils	Tidal Wetlands	Storm water
												100-Yr Flood plain	Streams & their Buffers	T & E Species Habitat	Steep Slopes (>15%)								
MD-DNR 1982					X										X				X		X		
																			non-existant				
MD-DNR 1984	X		X		X										X						X		
MD-DNR 1987				X	X																		
MD-DNR 1990		X	X	X			X																
		conductivity & salinity					DBT TBT																
MD-DNR 1990a												X			X							X	
																						non-tidal	
MD-DNR 1991		X	X	X																			
		conductivity																					
MD-DNR 1992		X																					

Notes:

TABLE II - REGULATORY CRITERIA

Document Code	Fecal Coliform	D.O.	Temp.	pH	Turb.	Total Residual Chlorine	Priority Poll. and other Toxics	TSS	BOD	COD	Oil & Grease	Sensitive Areas				Forests	TP	TN	25' - 75' Buffer to Non-Tidal Wetlands	Natural Vegetation	Soils	Tidal Wetlands	Storm water
												100-Yr Flood plain	Streams & their Buffers	T & E Species Habitat	Steep Slopes (>15%)								
MD-DNR 1996			X																				X
																							temp effect
MD-DNR 1997		X			X																		
MD-DNR 1997A		X	X	X			X										X	X					
MD-DNR 1999		X	X	X			X											X					
MD-DNR 2000													X			X	X	X					
													%unfor-ested			%fore-sted							
MD-DNR 2001		X	X	X	X			X									X	X					
NOAA 2001																						X	
																						tidal data	

Notes:

TABLE II - REGULATORY CRITERIA

Document Code	Fecal Coliform	D.O.	Temp.	pH	Turb.	Total Residual Chlorine	Priority Poll. and other Toxics	TSS	BOD	COD	Oil & Grease	Sensitive Areas				Forests	TP	TN	25' - 75' Buffer to Non-Tidal Wetlands	Natural Vegetation	Soils	Tidal Wetlands	Storm water
												100-Yr Flood plain	Streams & their Buffers	T & E Species Habitat	Steep Slopes (>15%)								
PP 1994															X								
SRA 2000																							
SRA 2001	X																						
SRC 1995																							
SRC 1989			X																				X
SRC 2000							X																
SRC 2000A			X	X																			X

Notes: SRC 1989 -- 120 acres of Jabez watershed is within Severn Run Natural Environmental Area

TABLE II - REGULATORY CRITERIA

Document Code	Fecal Coliform	D.O.	Temp.	pH	Turb.	Total Residual Chlorine	Priority Poll. and other Toxics	TSS	BOD	COD	Oil & Grease	Sensitive Areas				Forests	TP	TN	25' - 75' Buffer to Non-Tidal Wetlands	Natural Vegetation	Soils	Tidal Wetlands	Storm water
												100-Yr Flood plain	Streams & their Buffers	T & E Species Habitat	Steep Slopes (>15%)								
SRLT 2000												Notes Environmentally Sensitive Areas											
TPL 2000																							
TT 2000			X	X																			
TT 2000A													X										
USGS 1999							X										X	X					
USGS 2000																	X	X					
USGS 2001																							X

Notes: TT 1997--Also measured conductivity

TABLE II - REGULATORY CRITERIA

Document Code	Fecal Coliform	D.O.	Temp.	pH	Turb.	Total Residual Chlorine	Priority Poll. and other Toxics	TSS	BOD	COD	Oil & Grease	Sensitive Areas				Forests	TP	TN	25' - 75' Buffer to Non-Tidal Wetlands	Natural Vegetation	Soils	Tidal Wetlands	Storm water
												100-Yr Flood plain	Streams & their Buffers	T & E Species Habitat	Steep Slopes (>15%)								
EA 1999																							
EPA 2001		X	X	X	X		X	X	X	X	X						X	X					
MCI 2001	X	X	X	X	X		X	X									X	X					X
MD-DNR 1994		X	X	X	X		X	X					X			X	X	X		X			
MD-SOS 1991							X						X	X								X	
NADP 2001																	X	X					X
NWS 2001																							

Notes:

TABLE II - REGULATORY CRITERIA

Document Code	Fecal Coliform	D.O.	Temp.	pH	Turb.	Total Residual Chlorine	Priority Poll. and other Toxics	TSS	BOD	COD	Oil & Grease	Sensitive Areas				Forests	TP	TN	25' - 75' Buffer to Non-Tidal Wetlands	Natural Vegetation	Soils	Tidal Wetlands	Storm water
												100-Yr Flood plain	Streams & their Buffers	T & E Species Habitat	Steep Slopes (>15%)								
PBS&J 1998		X	X	X	X		X	X	X	X							X	X					X
PBS&J 1999		X	X	X	X		X	X	X	X							X	X					X
PBS&J 1999A		X	X	X	X		X	X	X	X							X	X					X

Notes:

TABLE III - LIVING RESOURCES HABITAT DATA

Document Code	Instream Habitat				Riparian Habitat and Stream Buffers				Additional Freshwater Quality Data	Estuarine Water Quality Data
	Bottom Conditions	Flow Rate	Stream Characteristics	Blockages	Bank Stability	Stream Canopy	% Forest Cover	Buffer Width		
AACC 1987	X		X							
AACC 2000										
AACo 1996										
AACo 1997A										
AACo 1997B										
AACo 1998	X	X	X		X	X	X	X		
AACo 1999A										

Notes: AACo 1998 -- utilized Rosgen and Pfankuch stream assessments

TABLE III - LIVING RESOURCES HABITAT DATA

Document Code	Instream Habitat				Riparian Habitat and Stream Buffers				Additional Freshwater Quality Data	Estuarine Water Quality Data
	Bottom Conditions	Flow Rate	Stream Characteristics	Blockages	Bank Stability	Stream Canopy	% Forest Cover	Buffer Width		
AACo 1999S										
AACo 2000										
AACo 2000C										
AACo 2000O										
AACo 2000S										
AACo 2001										
ACB 2000					X sources of deterioration					

Notes:

TABLE III - LIVING RESOURCES HABITAT DATA

Document Code	Instream Habitat				Riparian Habitat and Stream Buffers				Additional Freshwater Quality Data	Estuarine Water Quality Data
	Bottom Conditions	Flow Rate	Stream Characteristics	Blockages	Bank Stability	Stream Canopy	% Forest Cover	Buffer Width		
CEES 1992										
ACM 2001										
CBP 1999										
CRG 1998										
EPA 2000									X	
GI 1992										
JCR 2000	X									

Notes:

TABLE III - LIVING RESOURCES HABITAT DATA

Document Code	Instream Habitat				Riparian Habitat and Stream Buffers				Additional Freshwater Quality Data	Estuarine Water Quality Data
	Bottom Conditions	Flow Rate	Stream Characteristics	Blockages	Bank Stability	Stream Canopy	% Forest Cover	Buffer Width		
MD-DNR 1982					X					
MD-DNR 1984										X
MD-DNR 1987										X anions and cations
MD-DNR 1990										
MD-DNR 1990a										
MD-DNR 1991		X								
MD-DNR 1992										X

Notes:

TABLE III - LIVING RESOURCES HABITAT DATA

Document Code	Instream Habitat				Riparian Habitat and Stream Buffers				Additional Freshwater Quality Data	Estuarine Water Quality Data
	Bottom Conditions	Flow Rate	Stream Characteristics	Blockages	Bank Stability	Stream Canopy	% Forest Cover	Buffer Width		
MD-DNR 1996	X									
MD-DNR 1997					X	X		X		
MD-DNR 1997A	X	X	X	X	X	X	X	X	X	
MD-DNR 1999	X	X	X	X	X	X riparian vegetation	X	X		
MD-DNR 2000										
MD-DNR 2001										X salinity
NOAA 2001										

Notes:

TABLE III - LIVING RESOURCES HABITAT DATA

Document Code	Instream Habitat				Riparian Habitat and Stream Buffers				Additional Freshwater Quality Data	Estuarine Water Quality Data
	Bottom Conditions	Flow Rate	Stream Characteristics	Blockages	Bank Stability	Stream Canopy	% Forest Cover	Buffer Width		
PP 1994										
SRA 2000										
SRA 2001										
SRC 1995	X									
SRC 1989						X				
SRC 2000		X only mentioned								
SRC 2000A										

Notes:

TABLE III - LIVING RESOURCES HABITAT DATA

Document Code	Instream Habitat				Riparian Habitat and Stream Buffers				Additional Freshwater Quality Data	Estuarine Water Quality Data
	Bottom Conditions	Flow Rate	Stream Characteristics	Blockages	Bank Stability	Stream Canopy	% Forest Cover	Buffer Width		
SRLT 2000										
TPL 2000										
TT 2000	X	X	X	X	X	X	X	X		
TT 2000A	X		X	X	X			X		
USGS 1999		X								
USGS 2000		X								
USGS 2001		X								

Notes:

TT 2000A -- utilized Rosgen and Pfankuch stream assessments

USGS 2001 -- gauge data for four streams for various time periods back to 1931

TABLE III - LIVING RESOURCES HABITAT DATA

Document Code	Instream Habitat				Riparian Habitat and Stream Buffers				Additional Freshwater Quality Data	Estuarine Water Quality Data
	Bottom Conditions	Flow Rate	Stream Characteristics	Blockages	Bank Stability	Stream Canopy	% Forest Cover	Buffer Width		
EA 1999	X		X		X	X			X	
EPA 2001									X	
MCI 2000		X							X	
MD-DNR 1994			X		X	X	X	X	X	
MD-SOS 1991	X		X	X	X	X	X	X	X	
NADP 2001										
NWS 2001										

Notes:

TABLE III - LIVING RESOURCES HABITAT DATA

Document Code	Instream Habitat				Riparian Habitat and Stream Buffers				Additional Freshwater Quality Data	Estuarine Water Quality Data
	Bottom Conditions	Flow Rate	Stream Characteristics	Blockages	Bank Stability	Stream Canopy	% Forest Cover	Buffer Width		
PBS&J 1998		X	X						X	
PBS&J 1999		X	X						X	
PBS&J 1999A		X	X		X				X	
TT 2001			X		X	X	X	X	X	

Notes:

Table IV - Biological Community Measures

Document Code	Fish Community		Benthic Community		Herptofauna Community		Avifauna Community		SAV		Threatened &Endangered Species	
	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative
AACC 1987												
AACC 2000												
AACo 1996												
AACo 1997A												
AACo 1997B												
AACo 1998				X								
AACo 1999A	X				X		X				X	

Notes: AACo 1999A: List also includes Insect/Spider, Mammal, Plant and Reptile Lists

Table IV - Biological Community Measures

Document Code	Fish Community		Benthic Community		Herptofauna Community		Avifauna Community		SAV		Threatened &Endangered Species	
	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative
AACo 1999S											X*	
AACo 2000		X brook trout/ thermal pol										
AACo 2000C												
AACo 2000O												
AACo 2000S												
AACo 2001												
ACB 2000	X										X*	

Notes: *species are noted to exist but not listed or discussed in detail

Table IV - Biological Community Measures

Document Code	Fish Community		Benthic Community		Herptofauna Community		Avifauna Community		SAV		Threatened &Endangered Species	
	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative
ACM 2001												
CBP 1999				X								
CEES 1992										X		
CRG 1998		X										
EPA 2000												
GI 1992												
JCR 2000									X	X		
									Main subject of the report			

Notes:

Table IV - Biological Community Measures

Document Code	Fish Community		Benthic Community		Herptofauna Community		Avifauna Community		SAV		Threatened &Endangered Species	
	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative
MD-DNR 1982												
MD-DNR 1984												
MD-DNR 1987	X	X										
MD-DNR 1990												
MD-DNR 1990a	X				X		X					
MD-DNR 1991												
MD-DNR 1992	X	X										

Notes:

Table IV - Biological Community Measures

Document Code	Fish Community		Benthic Community		Herptofauna Community		Avifauna Community		SAV		Threatened &Endangered Species	
	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative
MD-DNR 1996		X										
MD-DNR 1997	X			X							X none found	
MD-DNR 1997A		X		X		X				X		
MD-DNR 1999		X		X	X presence absence							
MD-DNR 2000		X		X			X					
MD-DNR 2001									mentions abundance of algae			
NOAA 2001												

Notes: MD-DNR 1997A -- also quantifies mussel and vegetation populations

MD-DNR 1999 -- reptiles, amphibians and mussels were surveyed on a presence/absence basis

Table IV - Biological Community Measures

Document Code	Fish Community		Benthic Community		Herptofauna Community		Avifauna Community		SAV		Threatened &Endangered Species	
	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative
PP 1994							X mentions habitat areas					
SRA 2000											X*	
SRA 2001												
SRC 1995	X	X	X	X			X	X	X	X		
SRC 1989		X										
SRC 2000												
SRC 2000A		X										

Notes:

Table IV - Biological Community Measures

Document Code	Fish Community		Benthic Community		Herptofauna Community		Avifauna Community		SAV		Threatened &Endangered Species	
	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative
SRLT 2000												
TPL 2000												
TT 2000				X								
TT 2000A			X	X								
USGS 1999												
USGS 2000												
USGS 2001												

Notes:

Table IV - Biological Community Measures

Document Code	Fish Community		Benthic Community		Herptofauna Community		Avifauna Community		SAV		Threatened &Endangered Species	
	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative
EA 1999			X	X								
EPA 2001												
MCI 2000												
MD-DNR 1994	X		X		X				X			
MD-SOS 1991												
NADP 2001												
NWS 2001												

Notes:

Table IV - Biological Community Measures

Document Code	Fish Community		Benthic Community		Herptofauna Community		Avifauna Community		SAV		Threatened &Endangered Species	
	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative	Descriptive	Evaluative
PBS&J 1998												
PBS&J 1999												
PBS&J 1999A												
TT 2001			X									

Notes:

COVERAGES USED

Notes	File Name	Short Description	Previous File Name	Source Scale	Last Update	Feature Type	Process Description	Estimated Accuracy
	manholes	manholes	n/a	1" = 200'	varies	Point	Heads-down digitizing in ARC/INFO of As-Builts, SWAMP overlays	1" = 200'
	sewer	sewer mains	n/a	1" = 200'	varies	Line	Heads-down digitizing in ARC/INFO of As-Builts, SWAMP overlays	1" = 200'
	road	road edges from 1995 planimetrics	n/a	1" = 200'		Line		
	pace911	E911 street file with only street name in database	nodata			Vector	Modified 1999 P&Z Pace911 file	
	miscplan	Miscellaneous Planimetric data (fences, ponds, etc..)	n/a	1" = 200'		Vector		
	bd	Building outlines from 1995 Planimetrics	n/a	1" = 200'		Vector		
	adc_page	ADC Map Book Index	adcind	1" = 2 miles	2/1/1995	Polygon		
	ac00306f	Current Sewer Service Timing Categories, sewer service designations	SWPARKP	1" = 2000 feet	1993	Polygon	1993 sewer maps corrected by DPW. Heads-down digitization using AutoCAD. Topolgically corrected and attributed using PC Arc/Info.	topologically correct
place in land use folder (?), now in	ag00701f	GDP land use polygons	gdpp	1" = 1 mile	1996	Polygon	Heads-down digitzation of drawing (AutoCAD); Topologic correction (PC Arc/Info); Attribution (MapInfo)	
attributes may	ai00901f	Major county watersheds	mjctsd		3/14/1996	Polygon		
	ai00903f	MD State Major watersheds	stmjsd		12/23/1994	Polygon		
not attributed with	ai00906f	State Subwatersheds	stwatshd		12/23/1994	Polygon		
source: 95	ai00909f	Hydrography layer from 1995 planimetrics	countyhy	1"=200'	1995	Line	from 95 planimetrics	1"=200'
source: FEMA	ai00910f	FEMA Q3 Flood Plain Data	coastfp	1"=2000'	1985	Polygon	see FEMA metadata (q3spec.txt)	1"=2000'
source: 95	ai00912f	Streams - Detailed layer from 1995 planimetrics		1"=200'	1999	Line	heads-up digitizing	1"=200'
appears to be most	al01204f	1995 Landuse	lu95p	1" = 1150 feet	3/95	Polygon	Traced landuse changes from 1995 air photo onto hardcopy map	1" = 1150 feet
update incomplete	al01217f	1998 vacant land use	vacant98	1"=1550'	1999	Polygon	remove developed vacant land use areas from 95 file using 98 ph	1"=1550'
	an01404f	100 year non-tidal floodplain	fldplain	1" = 600 feet	1983	Polygon	Heads-down digitizing using AutoCAD. Topologically corrected	1" = 600 feet
several incorrect	aq01701f	County Best Management Plan Sites	bmp1	?	11/2/1995	Point	?	?
several incorrect	aq01704f	Outfall sites	outfall	?	2/5/1997	Point	?	?
not completely	as01942f	Stormwater management inspection areas	stormwaa	?	2/14/1997	Polygon	?	?
do not have original file from	bb02801f	100 foot buffer around critical wetlands	100ftbuf	?	2/23/1996	Polygon	Buffered bb02818f in Arc/Info.	?
have original file from which buffer	bb02802f	25 foot buffer around noncritical wetlands	25bufp	?	2/28/1996	Polygon	Buffered bb02822f in Arc/Info.	?
a stream buffer	bb02815f	NWI wetland buffers	nwilbp	?	12/1/1996	Polygon	?	?
	bb02818f	wetlands of critical state concern	statcon	?	2/28/1996	Polygon	?	?
	bb02824f	Wetlands - unclipped, NWI, more attribution, use to replace	wetp	?	11/28/1995	Polygon	?	?
	bb02826f	Wetlands - NWI plus digitized wetlands clipped on	wetaddp & bb02822f	varied, 1"=1 mi., 600'	1994	Polygon	digitized tidal wetlands, see metadata file NWI_WET.TXT	varied, 1"=1 mi., 600'
from 95 topo & 98	bb02828f	County bogs		1"=200'	2000	Polygon		1"=200'
	bb02847f	*County Bogs 100 foot buffer (of county bogs & protected streams)*	*Buffer100.shp*	1"=200'	2000	Polygon	buffers in ArcInfo of bb02828f	1"=200'
	bb02848f	*County Bogs 300 foot buffer - land acquisition/protection*	*Bogbuff300.shp*	1"=200'	2000	Polygon	buffers in ArcInfo of bb02828f	1"=200'
	bg03403f	Culverts in the Odenton Town Center (OTC)	culvert	?	7/1/1996	Polygon	?	?
	bg03409f	Storm water management ponds in the Odenton Town	pond	?	7/1/1996	Polygon	?	?
Use instead of bb02823f & bg03422f, do these	bg03476f	Wetland Polygons for OTC (updated 01/18/01)		gps	2001	Polygon	plot GPS points & connect	

Notes	File Name	Short Description:	Previous File Name	Source Scale	Last Update	Feature Type	Process Description	Estimated Accuracy
	aa00101f	Agricultural & Woodland Preservation Properties	AGP	1" = 600 feet	06/01/95	Polygon	Heads-Up digitization using MapInfo. Topologic correction using Arc/Info. Attribution using MapInfo	
	aa00173f	**Soils Master Table**		n/a		Table		
	aa00199f	Current Rural Legacy Boundary		varied	current	Polygon	created from roads and land features	1"=600'
	aa00235f	Proposed Rural Legacy Boundary		varied	current	Polygon	created from roads and land features	1"=600'
	ab00202f	Census Block Groups	blocksp	?	1/26/1996	Polygon	?	?
	ac00306f	Current Sewer Service Timing Categories, sewer service designations	SWPARKP	1" = 2000 feet	1993	Polygon	1993 sewer maps corrected by DPW. Heads-down digitization using AutoCAD. Topolgically corrected and attributed using PC Arc/Info.	topologically correct
	ae00508f	Proposed shopping centers	propshp	n/a	10/4/1996	Point	Geocode addresses from database using Anne Arundel County's street file as the base table	
	ae00512f	Shopping centers	shops	n/a		Point	Geocode addresses from database using A.A.Co.'s	
	ae00519f	Steep slope variances 1993-1997	n/a		7/30/97	Point	geocode taxmap-block-parcel & lot data or geocode	
	ae00521f	Multi-family dwellings			1999	Point	geocoded from access database address ranges	approx. 1"=200'
	ae00558f	Subdivision Activity Layer (Majors and Minors)	ae00506f & ae00507	1"=600'	continual	Polygon	Heads-up digitizing-tax maps	1"=600'
	ae00559f	1999 Apartment Inventory	1999Apartments			Point	geocoded address ranges	approx. 1"=200'
place in land use folder (?), now in agricultural	ag00701f	GDP land use polygons	gdpp	1" = 1 mile	1996	Polygon	Heads-down digitzation of drawing (AutoCAD); Topologic correction (PC Arc/Info); Attribution (MapInfo)	
attributes may	ai00901f	Major county watersheds	mjctsd		3/14/1996	Polygon		
	ai00902f	Aquifer recharging areas	recharp		2/28/1996	Polygon		
	ai00903f	MD State Major watersheds	stmjsd		12/23/1994	Polygon		
do not use, use	~~ai00904f~~	Streams	streamsc		3/20/1996	Line		
	ai00905f	Sub-Watersheds	subwatp		3/29/1995	Polygon		
not attributed with	ai00906f	State Subwatersheds	stwatshd		12/23/1994	Polygon		
source: 95	ai00909f	Hydrography layer from 1995 planimetrics	countyhy	1"=200'	1995	Line	from 95 planimetrics	1"=200'
source: FEMA	ai00910f	FEMA Q3 Flood Plain Data	coastfp	1"=2000'	1985	Polygon	see FEMA metadata (q3spec.txt)	1"=2000'
P&Z Instream	ai00911f	Stream Sampling Points			1998	Point	GPS	1 meter
source: 95	ai00912f	Streams - Detailed layer from 1995 planimetrics		1"=200'	1999	Line	heads-up digitizing	1"=200'
source: 95	ai00913f	Open Water - ponds, etc...		1"=200'	1999	Polygon	heads-up digitizing	1"=200'
NOT IN SEVERN	~~ai00914f~~	Citizen Benthic Macroinvertebrate Monitoring Sites				Point		
	ai00916f	Bog CDA's (Contributing Drainage Areas)		1"=200'	1995	Polygon	heads-up digitizing of 1995 topo	1"=200'
from 95 topo - 5' contours	ai00917f	South River Watershed Subbasins by PBS&J study (436 subbasins)		1"=200'	1997	Polygon	digitized in ArcInfo	1"=200'
NOT IN SEVERN	~~ai00920f~~	Stream Sampling Points	mbss2000a			Point		
test project in spatial analyst	ai00921f	Eastern portion of Severn Watershed as defined by AV Spatial Analyst	severneast	1"=200'		Polygon	watershed boundary as defined by spatial analyst	1"=200'
	ai00922f	South River Watershed with AA County Subbasins	southws	1"=600'		Polygon	digitized from 1984 topo	1"=600'
NOT IN SEVERN	~~ai00925f~~	*Possible Stream sampling points*				Point		
	ai00926f	*Bog related Protected Streams - (contributing 'bog' streams)*	*bogstream.shp*	1"=200'	2000	Line	from 95 planimetrics	1"=200'
find out what this	aj01001f	1" = 1000 feet index	1000indr		2/9/1995	Polygon		
same as supplied	aj01002f	1995 1" = 200 feet topo grid index	200grdln		2/15/1997	Polygon		
do we have these	aj01003f	1" = 600 feet index or tax map index	600ind_r		6/15/1995	Polygon		
do we have 1990	aj01004f	1990 Aerial Photograph Index	90phind		1/20/1995	Polygon		
do we have these	aj01005f	ADC Map Book Index	adcind		7/31/1998	Polygon		
do we have these	aj01007f	1987 200 scale topography index	twoind_r		12/13/1994	Polygon		
This is the 2000' index used for the	aj01008f	1"=2000 Feet index (sewer maps)	2000grid					
do we have these	aj01010f	ADC grid index		Unknown	7/31/1998	Polygon		

Notes	File Name	Short Description	Previous File Name	Source Scale	Last Update	Feature Type	Process Description	Estimated Accuracy
source: USGS	aj01011f	USGS quads index	quads_poly	1"=2000'		Polygon	digitized from corner coordinates	1"=2000'
files located in	aj01018f	Index for DPW's topo shapefiles	dpw_topoindex			Polygon		
This is a point file similar to ak01102f	ak01101f	Major Communities	cities2			Line/text		
From ADC Labels	ak01102f	Subdivisions (Sheckell's layer)	cities	1"=2000'		Line/text	digitized points from ADC	1"=2000'
Labels - no	ak01103f	Hydrology labels for entire county	hydrolabels			Line/text	created labels	
Labels - no	ak01104f	Major River labels for county	rivers			Line/text	created labels	
	al01201f	1986 GDP Landuse	landco_r	?	12/28/1994	Polygon	?	?
	al01202f	pre 1990 Landuse	landusp	?	3/10/1995	Polygon	?	?
	al01203f	1990 Landuse	lu1990p	1" = 600 feet	1990	Polygon	Traced new landuse polygons from 1990 photo	1" = 600 feet
appears to be most	al01204f	1995 Landuse	lu95p	1" = 1150 feet	3/95	Polygon	Traced landuse changes from 1995 air photo onto	1" = 1150 feet
	al01206f	County landfill	dumpcell	?	?	Polygon	?	?
place in land use	al01207f	A.A. County Forest cover	forest	28.8 meter	1991	Polygon	Classificiation of vectorization of leaf on LandSAT	1:24000
	al01208f	County golf course parcels	golfcour	1" = 600 feet	6/95	Polygon	Heads-down digitization of parcels using	1" = 600 feet
Do not use	~~al01209f~~	County marinas	marinap	?	5/13/1997	Polygon	?	?
use other sources if	al01210f	MOP Land Cover (1995)	stlndu_r		1/4/1995	Polygon	From satellite photograph	
Need metadata	al01212f	Annapolis City Land Use	m_land2_poly	?	?	Polygon	?	?
From 95 LU/photos	al01213f	Government Property (1995 Land Use)	govprop	1"=1550'	1997	Polygon	digitized from paper photo interpretation	1"=1550'
use instead of	al01214f	County business locations	aamef95	1"=200'	1997	Point	geocoded address ranges	approx. 1"=200'
From 95 LU/photos	al01216f	1995 vacant land use	vacant95	1"=1550'	1997	Polygon	digitized from paper photo interpretation	1"=1550'
update incomplete	al01217f	1998 vacant land use	vacant98	1"=1550'	1999	Polygon	remove developed vacant land use areas from 95 file	1"=1550'
do not use, use	~~al01218f~~	commercial businesses countywide	revallsic	?	?	Point	?	?
attributed with tax	al01219f	County Owned Property	propertaa	1"=600'	1997	Point	plotted centroids of county-owned property (from M	1"=600'
source and project	al01220f	County Cemeteries		?	?	Point	?	?
souce and project	al01221f	Council District 1 Tree coverage	council1tree_poly	?	?	Polygon	?	?
from 95	*al01227f*	*Landcover for Bog CDA's*		1"=200'	2000	Polygon	heads-up digitizing of 95 planimetrics &98 vargis pl	1"=200'
	an01404f	100 year non-tidal floodplain	fldplain	1" = 600 feet	1983	Polygon	Heads-down digitizing using AutoCAD.	1' = 600 feet
from 95	an01416f	Shoreline - Digitized using 1995 planimetrics base and 1998 Vargis	an01416f	1"=200'	2000	Polygon	heads-up digitizing of 95 planimetrics &98 vargis pl	1"=200'
	ap01604f	Color County Logo	cntylogo	n/a	12/21/1994	n/a	n/a	n/a
several incorrect	aq01701f	County Best Management Plan Sites	bmp1	?	11/2/1995	Point	?	?
several incorrect	aq01704f	Outfall sites	outfall	?	2/5/1997	Point	?	?
	as01905f	Annapolis City Boundary (Preferred Boundary)	citybdry	?	9/20/1995	Polygon	?	?
not completely	as01942f	Stormwater management inspection areas	stormwaa	?	2/14/1997	Polygon	?	?
	as01946f	Zip Codes	zipcode	?	2/14/1995	Polygon	?	?
	as01953f	Development Review Team Areas - use instead of as01950f	devlin	?	5/1/1996	Polygon	?	?
	at02005f	Parks & trails	parksp	1" = 600 feet	6/1/95	Polygon	Heads down digitization of park parcels from tax maps in AutoCAD. Add topology & attributes using Arc/Info.	1" = 600 feet
source: EPA	at02020f	Water Access Points (public) credit Environmental Protection Agency		?	?	Point	?	?
	az02601f	Polygons from AACo reforestation program boundary	ref1	1" = 40 feet	variable	Polygon	Heads-down digitization using AutoCAD. Forest line obtained from 1995 digital topo. Refoestation area designed by county forestor.	1" = 40 feet
do not have original file from	bb02801f	100 foot buffer around critical wetlands	100ftbuf	?	2/23/1996	Polygon	Buffered bb02818f in Arc/Info.	?
have original file from which buffer	bb02802f	25 foot buffer around noncritical wetlands	25bufp	?	2/28/1996	Polygon	Buffered bb02822f in Arc/Info.	?
	bb02803f	Steep slopes	aageo2p	?	3/26/1996	Polygon	?	?
	bb02805f	Colonial Nesting Sites	cns	?	5/31/1995	Polygon/Point	?	?
	bb02806f	Critical Areas	crit	1" = 1000 feet	2/7/1997	Polygon	Heads down digitization of Critical Area maps. Add topology & attributes in Arc/Info.	1" = 1000 feet

Notes	FileName	Short_Description	Previous File Name	Source Scale	Last Update	Feature Type	Process Description	Estimated Accuracy
	bb02807f	Waterfowl staging areas	eagbnd	?	1/5/1996	Polygon	?	?
	bb02808f	Eagle nesting sites	eagle	?	3/25/1996	Point	?	?
	bb02809f	General significant habitat areas	habtat	?	4/8/1996	Point	?	?
	bb02810f	Hazardous waste sites	hazwaste	?	2/27/1995	Point	?	?
	bb02812f	Habitat protection areas (points)	hpa	?	5/31/1995	Polygon/Point	?	?
	bb02813f	Habitat protection areas (polys)	hpa2	?	1/5/1996	Polygon	?	?
	bb02814f	Natural heritage areas	nha	?	5/31/1995	Polygon/Point	?	?
a stream buffer	bb02815f	NWI wetland buffers	nwilbp	?	12/1/1996	Polygon	?	?
	bb02817f	Significant habitat areas	sha		5/31/1995	Polygon/Point	?	?
	bb02818f	wetlands of critical state concern	statcon	?	2/28/1996	Polygon	?	?
	bb02819f	Upland natural areas	una	?	5/31/1995	Polygon	?	?
	bb02820f	Waterfowl nesting sites	watbird	?	3/25/1996	Polygon/Point	?	?
If a buffer is needed, must be recreated using file	~~bb02821f~~	Odenton Town Center wetland buffer	wetbuf	1" = 100 feet	6/96	Polygon	Buffer wetlands in Arc/Info.	1" = 100 feet
do not use -- use	~~bb02823f~~	Odenton town center wetlands	wetland	1" = 100 feet	6/96	Polygon	Heads down digitization of hand drawing using	1" = 100 feet
	bb02824f	Wetlands - unclipped, NWI, more attribution, use to replace 2816	wetp	?	11/28/1995	Polygon	?	?
	bb02826f	Wetlands - NWI plus digitized wetlands clipped on (wetaddp) no U	wetaddp & bb02822	varied, 1"=1 mi.	1994	Polygon	digitized tidal wetlands, see metadata file NWI_WE	varied, 1"=1 mi., 600'
from 95 topo & 98	bb02828f	County bogs		1"=200'	2000	Polygon		1"=200'
from state layers	bb02830f	Sensitive Species Protection Area	sspra & sspra83_region			Polygon	see metadata file SSPRA.TXT	
from 1990 photos	bb02841f	Buffer Exemption polygons	buffer_poly	1"=600'	1995?	Polygon	digitized from paper photo interpretation	1"=600'
	bb02847f	*County Bogs 100 foot buffer (of county bogs & protected streams)*	*Buffer100.shp*	1"=200'	2000	Polygon	buffers in ArcInfo of bb02828f	1"=200'
	bb02848f	*County Bogs 300 foot buffer - land acquisition/protection*	*Bogbuff300.shp*	1"=200'	2000	Polygon	buffers in ArcInfo of bb02828f	1"=200'
	bc02901f	Acidic soils	acidsop	?	3/12/1996	Polygon	?	?
	bc02902f	Erodible soils	erodep	?	4/9/1996	Polygon	?	?
	bc02903f	Hydric soils	hydricp	?	4/9/1996	Polygon	?	?
	bc02906f	Major Soil Classifications countywide		1" = 4-5 miles	9/9/94	Polygon	Interpolate polygons from existing soil layer to most accurately reflect new basemap information.	1" = 4.5 miles
from 95 planimetrics, different from	bd03038f	County Streets		1"=200'	continual	Line	digitized/interpretation	1"=200'
	bg03403f	Culverts in the Odenton Town Center (OTC)	culvert	?	7/1/1996	Polygon	?	?
	bg03409f	Storm water management ponds in the Odenton Town Center (OTC)	pond	?	7/1/1996	Polygon	?	?
	bg03413f	Odenton growth management area	odgma	?	3/22/1995	Polygon	?	?
	bg03416f	Parole Town Center Boundary		1" = 600'	9/8/94	Polygon	Heads up digitization from rasterized tax maps. Boundary originally defined in Parole Urban Design Concept Plan	1" = 600'
	bg03417f	Parole Core Area		1" = 600'	9/8/94	Polygon	Heads up digitization from rasterized tax maps. Boundary defined by Parole Urban Design Concept Plan	1" = 600'
	bg03418f	Parole Town Growth Management Area - PGMA		1" = 600'	9/8/1994	Polygon	Heads up digitization from rasterized tax maps in Mapinfo 4.0.	1" = 600'
If a buffer is needed, must be recreated using file	~~bg03421f~~	Odenton Town Center Wetland Buffers		?	4/25/1997	Polygon	?	?
do not use -- use bg3476f instead	~~bg03422f~~	Odenton Town Center Wetland		?	4/25/1997	Polygon	?	?
	bg03423f	Parole Area Land Use		?	8/6/1997	Polygon	?	?
	bg03429f	Existing Commercial Points in PGMA	pgmacomm	1"=600'	2000	Point	plot centroids from MD Property View	1"=600'

Notes	File Name	Short Description	Previous File Name	Source Scale	Last Update	Feature Type	Process Description	Estimated Accuracy
	bg03444f	New Buildings from submitted plats	parolenewbds	varied	2000	Polygon	heads-up digitizing from scanned plats	varied
	bg03445f	New road ROW's from submitted plats	parolenewrds	varied	2000	Line	heads-up digitizing from scanned plats	varied
	bg03449f	Road ROW's within PTC	parrds	varied	2000	Line	heads-up digitizing from scanned plats	varied
	bg03472f	OTC - Proposed South Shore Trail (to BWI Trail and Annapolis)	SouthShoreTrail	?	2000	Line	heads-up digitizing from scanned map images	?
	bg03473f	OTC - Proposed Town Center Blvd	TownCenterBlvd	?	2000	Line	heads-up digitizing from scanned map images	?
	bg03474f	OTC - West County Trail	WestCountyTrail	?	2000	Line	heads-up digitizing from scanned map images	?
	bg03475f	OTC - Proposed West Town Center Blvd	WestTownCenterBlvd		2000	Line	heads-up digitizing from scanned map images	?
Use instead of bb02823f & bg03422f, do these do we have zoning	bg03476f	Wetland Polygons for OTC (updated 01/18/01)		gps	2001	Polygon	plot GPS points & connect	
	bh03521f	**ZONING - these are our most up-to-date Zoning Polygons**	bh03521f83	1"=200'	2001	Polygon	digitized from 1"=200' scale official zoning maps	1"=200'
	bh03524f	Non Conforming Uses **(768 Points - most current)**	NCbycase		2000	Point	geocoded by address	approx. 1"=200'
	bi03601f	Small Planning Areas boundaries (most recent) - use instead of as01949f		1"=200'	6/23/1905	Polygon	heads-up digitizing of scanned maps	1"=200'

DPW COVERAGES

Notes	File Name	Short Description	Previous File Name	Source Scale	Last Update	Feature Type	Process Description	Estimated Accuracy
	manholes	manholes	n/a	1" = 200'	varies	Point	Heads-down digitizing in ARC/INFO of As-Builts, SWAMP overlays	1" = 200'
	sewer	sewer mains	n/a	1" = 200'	varies	Line	Heads-down digitizing in ARC/INFO of As-Builts, SWAMP overlays	1" = 200'
	swr_tp	sewer treatment/water reclamation facilities	n/a		11/15/2000	Point		
	swr_pump	sewer pumping stations	n/a		11/15/2000	Point		
	tree	tree coverage from 1995 planimetri	n/a	1" = 200'		Line		
	road	road edges from 1995 planimetrics	n/a	1" = 200'		Line		
	pace911	E911 street file with only street name in database	nodata			Vector	Modified 1999 P&Z Pace911 file	
	miscplan	Miscellaneous Planimetric data (fences, ponds, etc..)	n/a	1" = 200'		Vector		
	cntr	Road Centerline from 1995 Planimetric data	n/a	1" = 200'		Vector		
	bd	Building outlines from 1995 Planimetrics	n/a	1" = 200'		Vector		
"Color Tif index" metadata	color_tifs_layout	Index for Color Ortho's by tif image	n/a			Polygon		
	adc_page	ADC Map Book Index	adcind	1" = 2 miles	2/1/1995	Polygon		
	ab_grid	Asbuilt grid index (1/64 of 200 scale	n/a			Polygon		
	40index	40 scale operating map index (1/16 of 200 scale)	n/a			Polygon		
	200index	200 scale operating map index	n/a	1" = 200'		Polygon		

APPENDIX D: SUMMARY OF ENVIRONMENTAL REPORTS

Summary of Environmental Reports

numbers in parenthesis refer to mapping labels in Appendix E

DOCUMENT CODE	DOCUMENT
AACC 1987 (59-69)	Bird, B., D. Bleil, and S. Wildberger. 1987. Weems Creek: Trends in Water Quality and Surface Water Color Observations, Summer 1987. Anne Arundel Community College Environmental Center. Arnold, MD.
AACC 2000 (99-124, 132-138)	Hornor, S.G. 2000 Operation Clearwater, fecal coliform data for 1989-2000. Prepared for Anne Arundel County Department of Planning and Zoning. Anne Arundel Community College Environmental Center. Arnold, MD.
AACo 1996	Anne Arundel County. 1996. Looking at Alternatives: Scenarios for the Anne Arundel County General Development Plan. Anne Arundel County Department of Planning and Code Enforcement. Annapolis, MD
AACo 1997A	Anne Arundel County Department of Planning and Code Enforcement. 1997. Anne Arundel County General Development Plan; Part 1: Summary and Recommendations. Adopted September 1997. Anne Arundel County Department of Planning and Code Enforcement, Annapolis, MD.
AACo 1997B	Anne Arundel County Department of Planning and Code Enforcement. 1997. Anne Arundel County General Development Plan; Part 2: Background Goals & Policies. Adopted September 1997. Anne Arundel County Department of Planning and Code Enforcement, Annapolis, MD.
AACo 1998 (43-48)	Gerardi, C.G., E.W. Leppo, and J. Stribling. 1998. *Baseline Biological Assessment of Streams Draining the Parole (MD) Town Center.* Prepared by Tetra Tech, Inc., Owings Mills, MD and Laurel, MD, for Anne Arundel County, Department of Planning and Code Enforcement, Annapolis, MD. AA-PACE Report No. 98-02.
AACo 1999A	Anne Arundel County Department of Planning and Code Enforcement. 1999. Annapolis Neck Small Area Plan (Draft). Anne Arundel County Department of Planning and Code Enforcement, Annapolis, MD.
AACo 1999S	Anne Arundel County Department of Planning and Code Enforcement. 1999. Severna Park Small Area Plan (Draft). Anne Arundel County Department of Planning and Code Enforcement, Annapolis, MD.
AACo 2000	Anne Arundel County Department of Planning and Code Enforcement. 2000. Discussion of Watershed Area Imperviousness and Subsequent Affects on Receiving Streams. Anne Arundel County Department of Planning and Code Enforcement, Annapolis, MD.
AACo 2000C	Anne Arundel County Department of Planning and Code Enforcement. 2000. Crownsville Small Area Plan (Draft). Anne Arundel County Department of Planning and Code Enforcement, Annapolis, MD.
AACo 2000O	Anne Arundel County Department of Planning and Code Enforcement. 2000. Odenton Small Area Plan (Draft). Anne Arundel County Department of Planning and Code Enforcement, Annapolis, MD.
AACo 2000S	Anne Arundel County Department of Planning and Code Enforcement. 2000. Severn Small Area Plan (Draft). Anne Arundel County Department of Planning and Code Enforcement, Annapolis, MD.
AACo 2001	Anne Arundel County Department of Planning and Code Enforcement. 2001. Broadneck Small Area Plan (Draft). Anne Arundel County Department of Planning and Code Enforcement, Annapolis, MD.
ACB 2000	The Alliance for the Chesapeake Bay. 2000. Severn River Fact Sheet. http://acb-online.org/factshts/severn.htm
ACM 2001	Annotated Code of Maryland – Environment. 2001. References and Addresses specifics within the Severn River Watershed.
CBP 1999	Chesapeake Bay Program. 1999. Targeting Toxics: A Characterization Report, A Tool for Directing Management and Monitoring Actions in the Chesapeake Bay's Tidal Rivers. Chesapeake Bay Program. Annapolis, MD.
CEES 1992 (70-72)	Dennison, W. C. 1992. Submersed Aquatic Vegetation and Water Quality in the Severn River, MD, Final Report to Boating Administration Maryland Department of Natural Resources. Horn Point Environmental Laboratory, Center for Environmental and Estuarine Studies, University of Maryland System. Cambridge, MD.

Summary of Environmental Reports

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DOCUMENT CODE	DOCUMENT
CRG 1998	Gougeon, C.R. 1998. Record of Jabez Branch Chronology. Maryland Department of Natural Resources Fisheries Service. Annapolis, MD.
EA 1999	EA Engineering Science and Technology Inc. 1999. Biological Monitoring of Church Creek, Anne Arundel County, Maryland, Spring 1999. Prepared for McCrone Engineering. Sparks, MD.
EPA 2000	Environmental Protection Agency. 2000. Severn River Watershed. Surf Your Watershed -- Watershed Information -- Severn -- 02060004. http://www.epa.gov/surf2/hucs/0206004.
EPA 2001 (39,41,125, 126)	EPA Storage and Retrieval Database (STORET). 2001 Data for four stations in Severn River watershed. Washington, D.C.
GI 1992 (73-78)	Greiner Inc. 1992. Water Quality Results for Severn River Bridge. Prepared for Maryland State Highway Administration, Permits Section. Greiner. Timonium, MD.
JCR 2000	Arnold, R.R., J.C. Cornwell, W.C. Dennison, and J.C. Stevenson. 2000. Sediment-Based Reconstruction of Submersed Aquatic Vegetation Distribution in the Severn River, a Sub-Estuary of Chesapeake Bay. Journal of Coastal Research: Vol. 16, No. 1, pp. 188-195.
MCI 2000	McCrone Inc. 2000. Stormwater NPDES monitoring for Parole Plaza and Church Creek Stations, supplement to the 1999 annual report for Comlpiance with NPDES permit number MS-AA-1999-003. Prepared for Anne Arundel County, Department of Public Works Infrastructure. Annapolis, MD.
MD-DNR 1982	Weems Creek Conservancy. 1982. A Greenway Strategy for Weems Creek. Maryland Department of Natural Resources, Land Planning Services, Wild and Scenic River Program. Annapolis, MD.
MD-DNR 1984	El-Hemry, I.I., and B.S. Goldberg. 1984. Surface Erosion of the Severn Run Watershed. Department of Natural Resources, Capital Programs Administration. Annapolis, MD.
MD-DNR 1987 (139,141-153,188)	Janicki, A. and H. Greening. 1987. An Evaluation of Stream Liming Effects on Water Quality and Anadromous Fish Spawning in Maryland Coastal Plain Streams: 1987 Results. Maryland Department of Natural Resources, Power Plant Research Program. Annapolis, MD.
MD-DNR 1990	Hall, L.W.Jr., M.A. Unger, M.C. Ziegenfuss, J.A. Sullivan, and S.J. Bushong. 1990. Butylin and Copper Monitoring in a Northern Chesapeake Bay Marina and River System in 1989: An Assesment of Tributylin Legislation. Maryland Department of Natural Resources, Chesapeake Bay Monitoring Division, University of Maryland Agricultural Experiment Station, Wye Research and Education Center. Queenstown, MD.
MD-DNR 1990a	Maryland Department of Natural Resources. 1990. Maryland Scenic Rivers: The Severn. Maryland Department of Natural Resources. Annapolis, MD.
MD-DNR 1991 (79-93)	Yetman, K. 1991. Study of Non-Point Source Thermal Pollution in Jabez Branch. Department of Natural Resources, Tidewater Administration. Annapolis, MD.
MD-DNR 1992 (94-98)	Carmichael, J.T., B.M. Richardson, M. Roberts, and S.J. Jordan. 1992. Maryland Department of Natural Resources, Tidewater Administration, Chesapeake Bay Research and Monitoring Division. Annapolis, MD.
MD-DNR 1994 (16-38)	Maryland Biological Stream Survey. 1994. Spring and Summer 1994 database for Severn River Watershed. Maryland Department of Natural Resources, Monitoring and Non-Tidal Assessment Division. Annapolis, MD.
MD-DNR 1996 (154-158)	Stinefelt, H., K. Pavol and C. Gougeon. 1996. Survey and Management of Maryland's Fishery Resources, Management of Maryland's Coldwater Streams, Federal Aid Project: F-48-R-6, Study No.B. Maryland Department of Natural Resources, Fisheries Service, Freshwater Fisheries Division. Annapolis, MD.
MD-DNR 1997	Maryland Department of Natural Resources. 1997. West Chesapeake Basin Report. Maryland Department of Natural Resources. Annapolis, MD.
MD-DNR 1997A (digital, 1-15)	Maryland Biological Stream Survey. 1997. Spring and Summer 1997 database for Severn River Watershed. Maryland Department of Natural Resources, Monitoring and Non-Tidal Assessment Division. Annapolis, MD.

Summary of Environmental Reports

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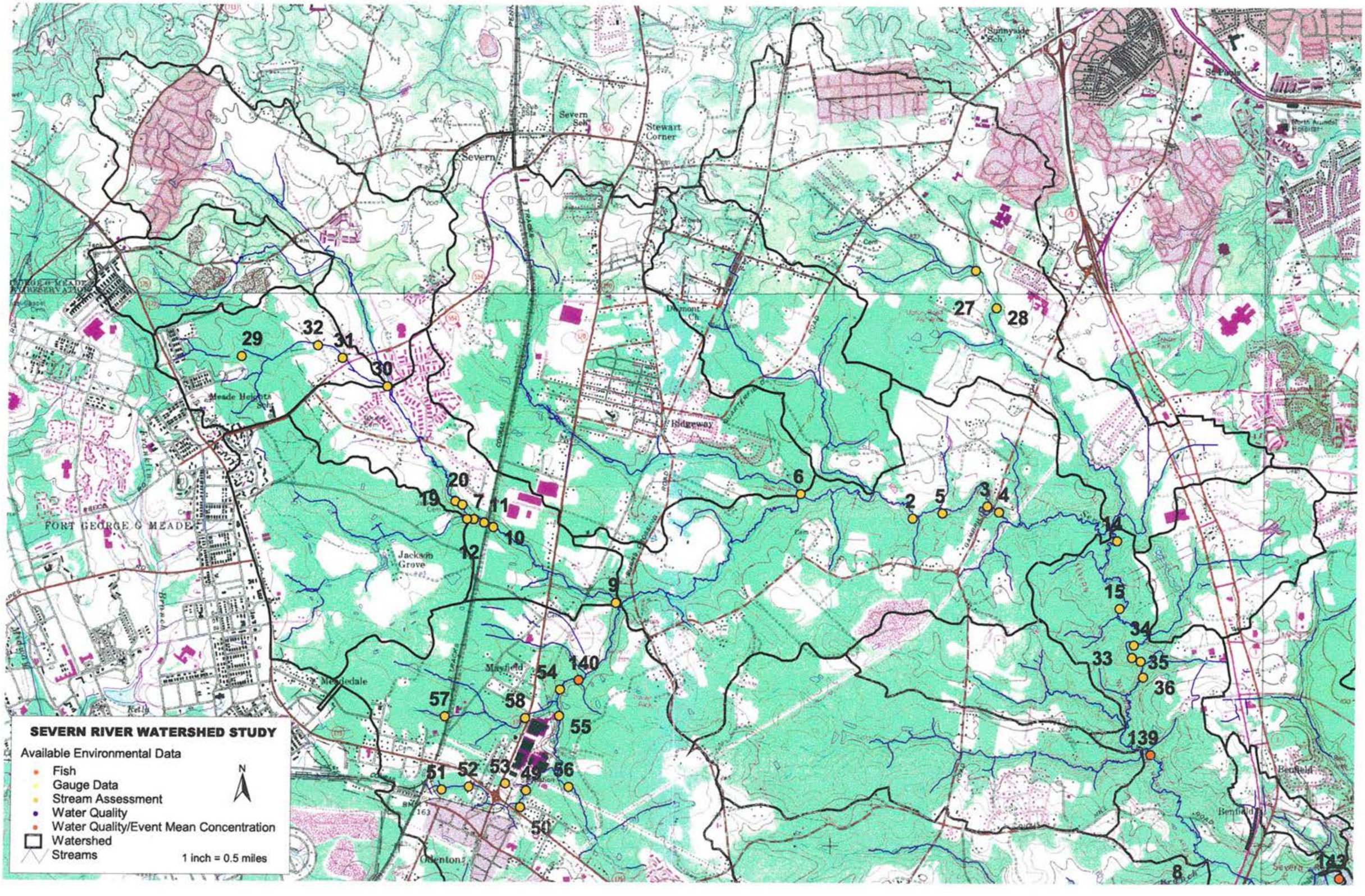
DOCUMENT CODE	DOCUMENT
MD-DNR 1999	Ostrowski, D.T., C.J. Millard, P.F. Kayzak and D.M. Boward. 1999. West Chesapeake Basin, Environmental Assessment of Stream Conditions. Maryland Department of Natural Resources, Resource Assessment Service, Monitoring and Non-Tidal Assessment Division. Annapolis, MD.
MD-DNR 2000	Maryland Department of Natural Resources. 2000. Maryland's Surf Your Watershed – Watershed Profile, Severn River. http://www.dnr.state.md.us/watersheds/surf/prof/02131002_prof.html
MD-DNR 2001 (130)	Maryland Department of Natural Resources, Lower Western Shore Team, Friends of the Annapolis' Creeks. 2001. Current Projects, Status and Trends, Recommendations and Priorities. http://www.dnr.state.md.us/bay/tribstrat/low_west/low_west_shore.html
MD-SOS 1991	Maryland Save Our Streams. 1991. The Great Severn River Stream Survey, Report Findings. Prepared for the Severn River Project by Maryland Save Our Stream and Westinghouse Electronic Systems Group and Anne Arundel County.
NADP 2001 (127)	National Atmospheric Deposition Program. Rainfall water quality data for Wye River Station MD13. National Atmospheric Deposition Program, National Trends Network. Champaign, IL.
NOAA 2001 (digital) (42)	National Oceanic and Atmospheric Administration. 2001. Tidal Data and Benchmark Stamping for Annapolis (U.S. Naval Academy), Severn River. National Oceanic and Atmospheric Administration, National Ocean Service, Center for Operational Oceanographic Products and Services. Silver Spring, MD.
NWS 2001 (131)	National Weather Service. 2001. Daily Weather Data for Baltimore Washington Airport 1997-2001. National Weather Service, National Oceanic and Atmospheric Administration. Sterling, VA.
PBS&J 1998 (159-175)	PBS&J. 1998. Stormwater Master Plan for the Portion of Parole Town Center within the South River Watershed. Prepared for Anne Arundel County Department of Public Works. Bowie, MD.
PBS&J 1999 (176-187)	PBS&J. 1999. Gingerville Creek Stream Restoration and Pond Retrofit Phase I-Development of Stream Restoration and Pond Retrofit Alternatives. Prepared for Anne Arundel County Department of Public Works Bureau of Engineering. Bowie, MD.
PBS&J 1999A	PBS&J. 1999. Anne Arundel County Stormwater Retrofit Assessment and Final Report. Prepared for Anne Arundel County Bureau of Engineering Department of Public Works. Annapolis, MD.
PP 1994	The Peninsula Project. 1994. Attempt to preserve the Peninsula Which Delineates Brewer Pond.
SRA 2000	Severn River Association, Inc. 2000. Anne Arundel County Legislative Initiative for Bog Preservation. Prepared for Anne Arundel County Council, Annapolis, MD.
SRA 2001	Severn River Association, Inc. 2001. http://www.severnriver.org
SRC 1995	Severn River Commision. 1995. Living With The River: A Management Sutdy for the Severn River Watershed to the Year 2020. Prepared by Land Ethics and Dodson Associates, and Environmental Resources Management, INC.
SRC 1989	Vlavianos, Lina. 1989. Jabez Branch. Severn River Commission. Annapolis, MD.
SRC 2000	Henkart, Pierre. 2000. Toxics in the Severn River. Severn River Commission. Annapolis, MD.
SRC 2000A	Vlavianos, Lina. 2000. Considerations for an Environmental Overlay Zone. Severn River Commission. Annapolis, MD.
SRLT 2000	The Severn River Land Trust. 2000.Where We Are. http://www.srlt.org/geograph.htm
TPL 2000	The Trust for Public Land. 2000. Easement to Protect Nearly 300 Acres Along the Severn River (MD). http://www.tpl.org/tier3_cd.cfm?content_item_id=1861&folder_id=628

Summary of Environmental Reports

numbers in parenthesis refer to mapping labels in Appendix E

DOCUMENT CODE	DOCUMENT
TT 2000 (49-58, 140)	Victoria, C. J. 2000. Summary of Water Quality Sampling and Hydrologic Data Collection for Picture Spring Branch, 1999. Prepared by Tetra Tech, Inc., Owings Mills, MD and Laurel, MD, for Anne Arundel County, Department of Planning and Code Enforcement, Annapolis, MD.
TT 2000A (49-58)	Stribling, J. B., C.J. Victoria, and J.M. Smith. 2000. Biological and stream stability assessment of the Picture Spring branch Watershed. Prepared by Tetra Tech, Inc., Owings Mills, MD and Laurel, MD, for Anne Arundel County, Department of Planning and Code Enforcement, Annapolis, MD. AA-PACE Report No. 00-01.
TT 2001	Tetra Tech. 2001. Parole Town Center Area Ecological Assessment. Prepared for Anne Arundel County Office of Planning and Zoning. Annapolis, MD.
USGS 1999	Belval, D.L., and L.A. Sprague. 1999. Monitoring Nutrients in the Major Rivers Draining to the Chesapeake Bay. United States Geological Survey: Water Resources Investigations Reports. 99-4238.
USGS 2000	Sprague, L.A., M.J. Langland, S.E. Yochum, R.E. Edwards, J.D. Blomquist, S.W. Phillips, G.W. Shenk, and S.D. Preston. 2000. Factors Affecting Nutrient Trends in Major Rivers of the Chesapeake Bay Watershed. United States Geological Survey. Water Resources Investigations Report 00-4218.
USGS 2001 (digital) (40, 128, 129)	United States Geological Survey. 2001. Historical Water Data for the Severn River Basin. http://waterdata.usgs.gov/nwis-w/MD/search.components/textsearch.cgi?mode=search&basin=severn&state=MD&exact=1

APPENDIX E: ENVIRONMENTAL DATA LOCATION


SEVERN RIVER WATERSHED STUDY
Available Environmental Data
Fish
Gauge Data
Stream Assessment
Water Quality
Water Quality/Event Mean Concentration
Watershed
Streams
1 inch = 0.5 miles
N
Severn
Severn Sch
Stewart Corner
Sunnyside Sch
Dorsey Ch
Ridgeway
Meade Heights Sch
FORT GEORGE G MEADE
Jackson Grove
Maryland
Odenton
Benfield
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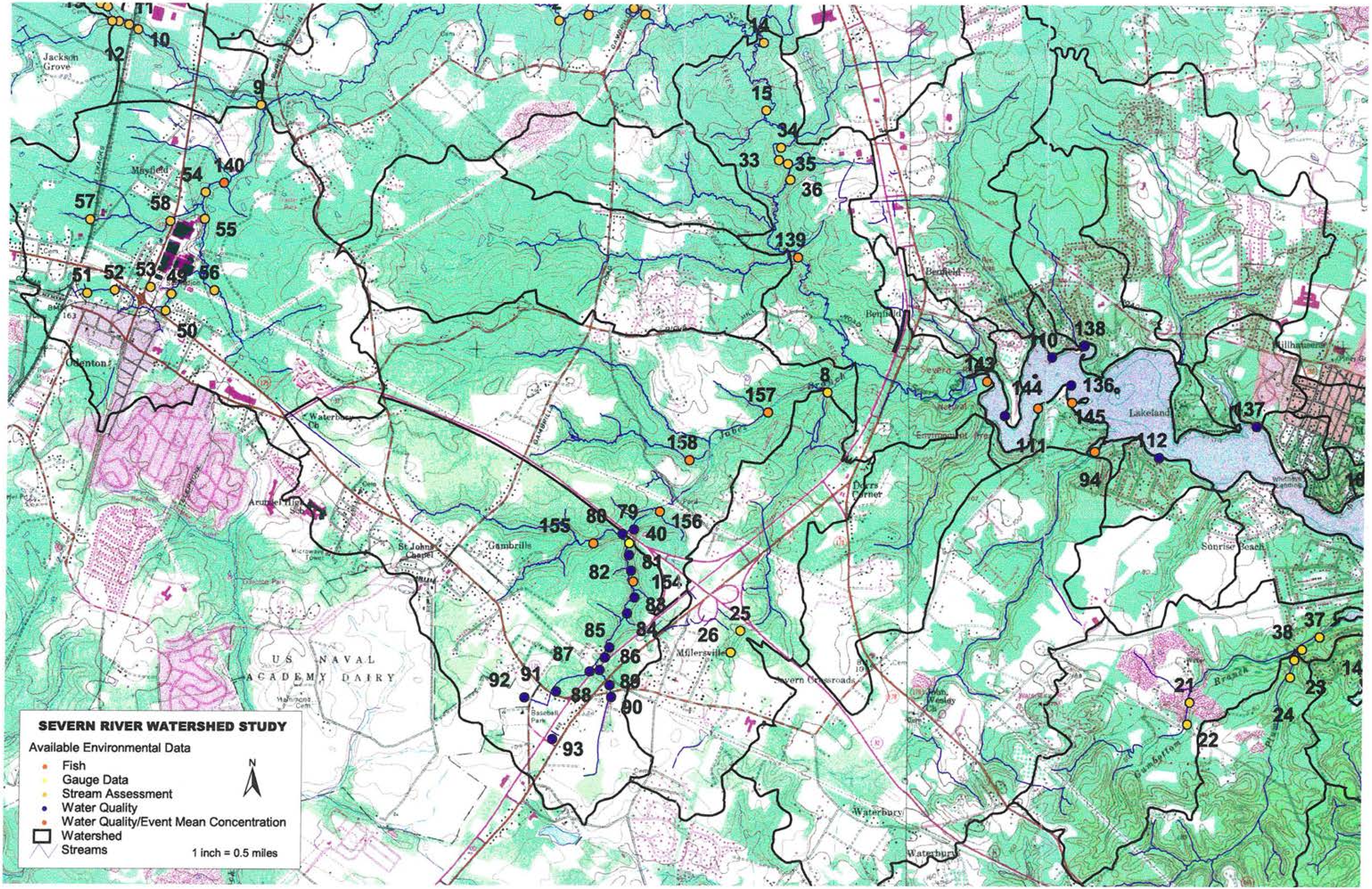
SEVERN RIVER WATERSHED STUDY
Available Environmental Data
Fish
Gauge Data
Stream Assessment
Water Quality
Water Quality/Event Mean Concentration
Watershed
Streams
1 inch = 0.5 miles
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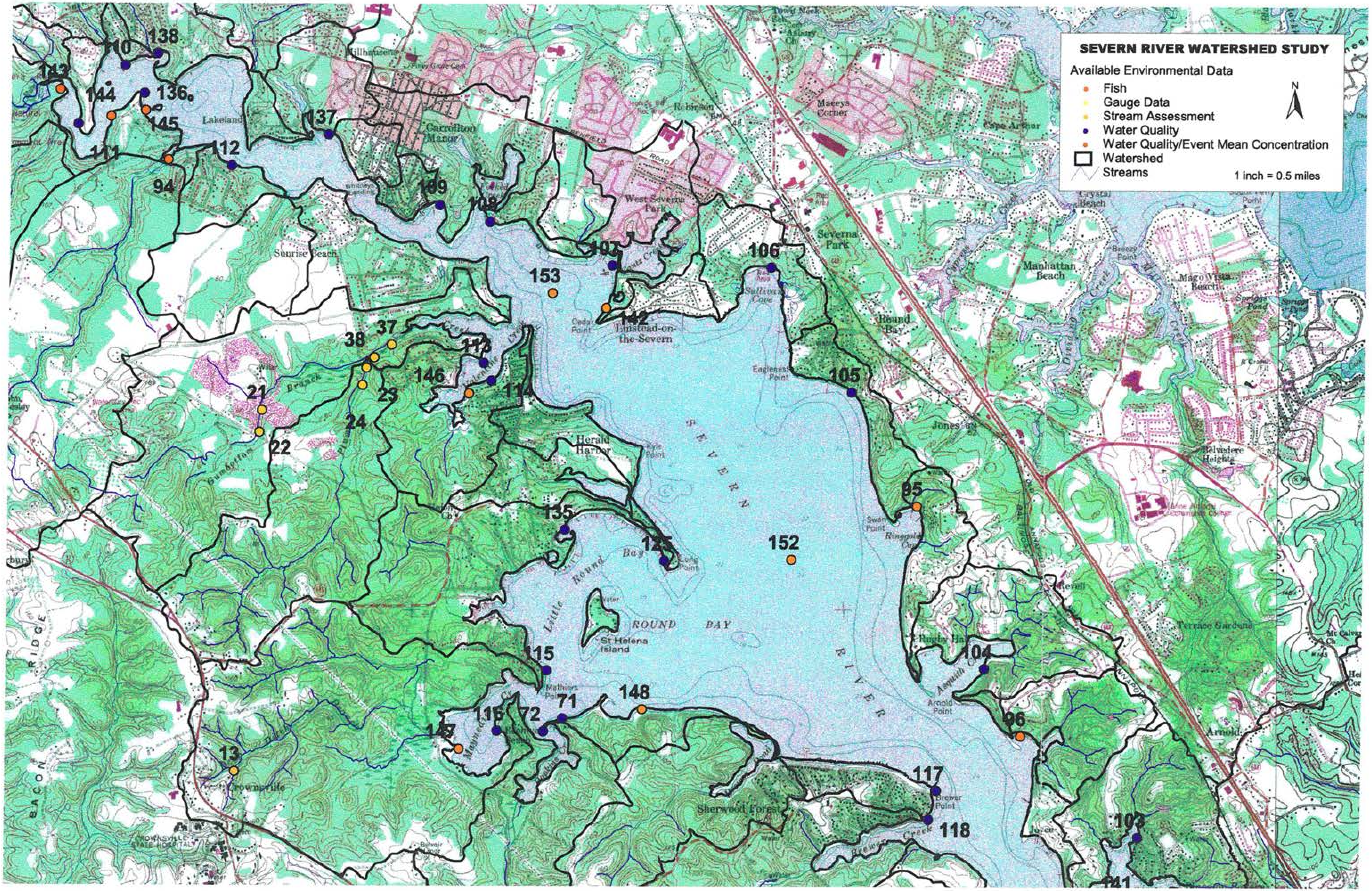
Jackson Grove
Mayfield
Odenton
Arundel High Sch
Gambrills
St Johns Chapel
U S NAVAL ACADEMY DAIRY
Millersville
Severn Crossroads
Benfield
Lakeland
Sunrise Beach
Waterbury
Baseball Park


SEVERN RIVER WATERSHED STUDY
Available Environmental Data
Fish
Gauge Data
Stream Assessment
Water Quality
Water Quality/Event Mean Concentration
Watershed
Streams
1 inch = 0.5 miles
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SEVERN
RIVER
ROUND BAY
Little Round Bay
St Helena Island
Herald Harbor
Severna Park
Round Bay
Manhattan Beach
Crownsville
Sherwood Forest
Arnold
Carrollton Manor
West Severna Park
Linstead-on-the-Severn
Sunrise Beach
Lakeland
Terrace Gardens
Belvedere Heights
Mago Vista Beach
Millhausen
Jones
Brewer Point
Arnold Point
Mathiers Point
Long Point
Cedar Point
Eaglenest Point
Swan Point
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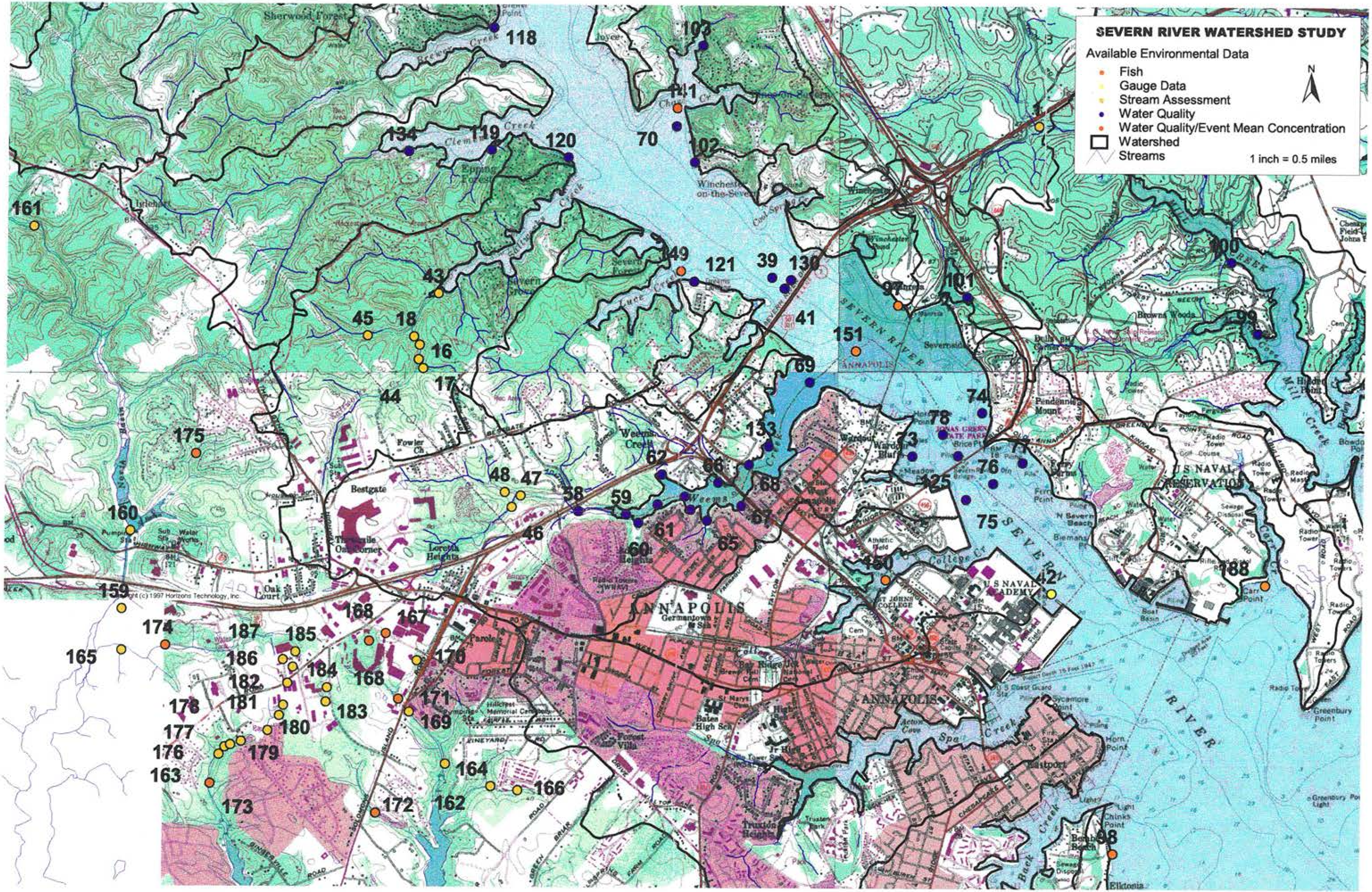
SEVERN RIVER WATERSHED STUDY
Available Environmental Data
Fish
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Stream Assessment
Water Quality
Water Quality/Event Mean Concentration
Watershed
Streams
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1 inch = 0.5 miles
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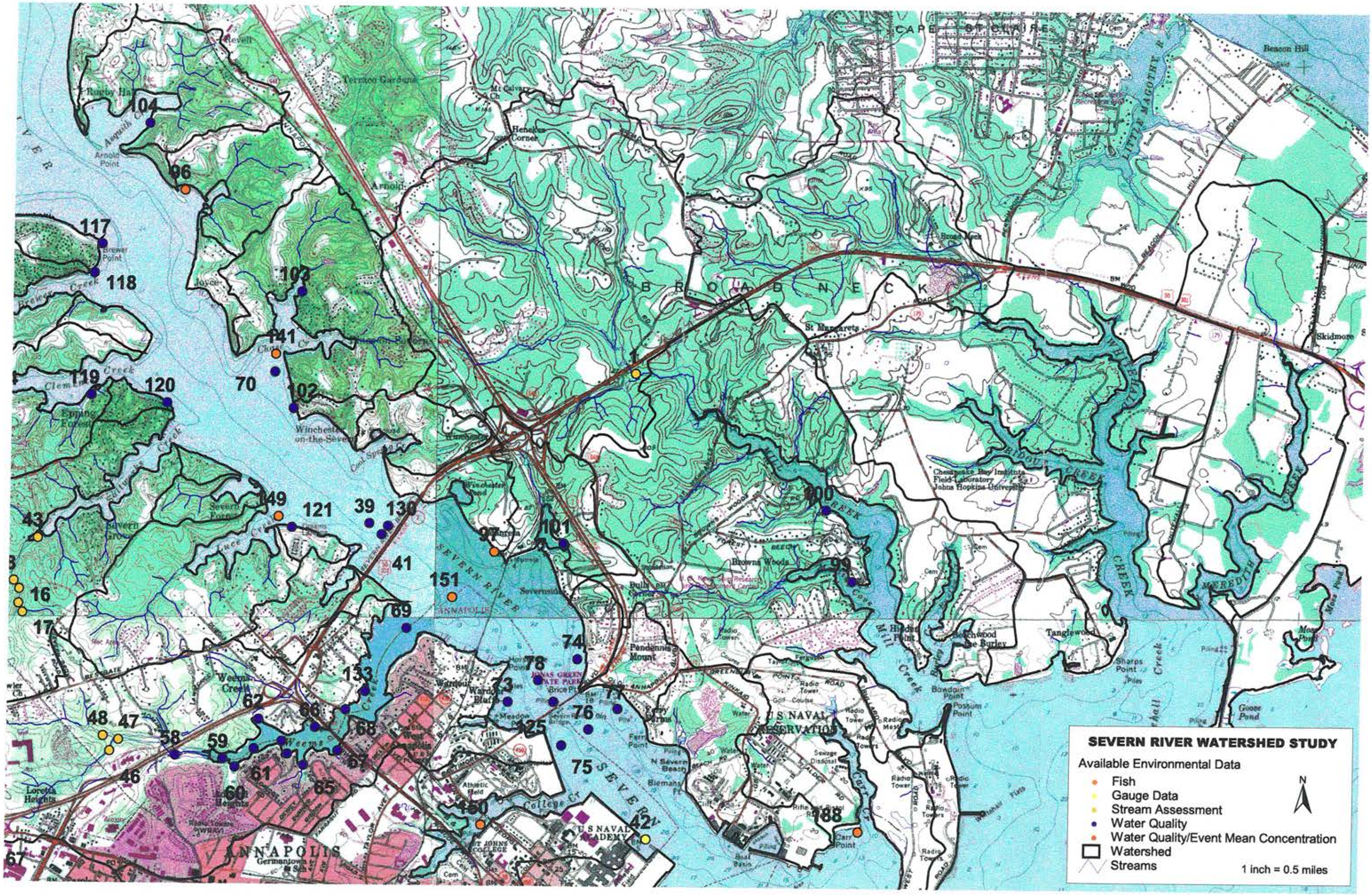
ANNAPOLIS
SEVERN RIVER
U S NAVAL ACADEMY
U S NAVAL RESERVATION
ST JOHNS COLLEGE
Bestgate
Parole
Eastport


SEVERN RIVER WATERSHED STUDY
Available Environmental Data
Fish
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Water Quality/Event Mean Concentration
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1 inch = 0.5 miles
N
BROADNECK
SEVERN RIVER
ANNAPOLIS
U S NAVAL RESERVATION
U S NAVAL ACADEMY
ST JOHNS COLLEGE
CAPE ST CLAIRE
Arnold
Winchester on-the-Severn
St Margarets
Skidmore
Beacon Hill
Chesapeake Bay Institute Field Laboratory Johns Hopkins University
Browns Woods
Pendennis Mount
Tanglewood
Sharps Point
Possum Point
Carr Point
Weems Creek
Mill Creek
Meredith Creek
Whitehall Creek
Clements Creek
Cool Spring Cr
College Cr
Germantown
Loretto Heights
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