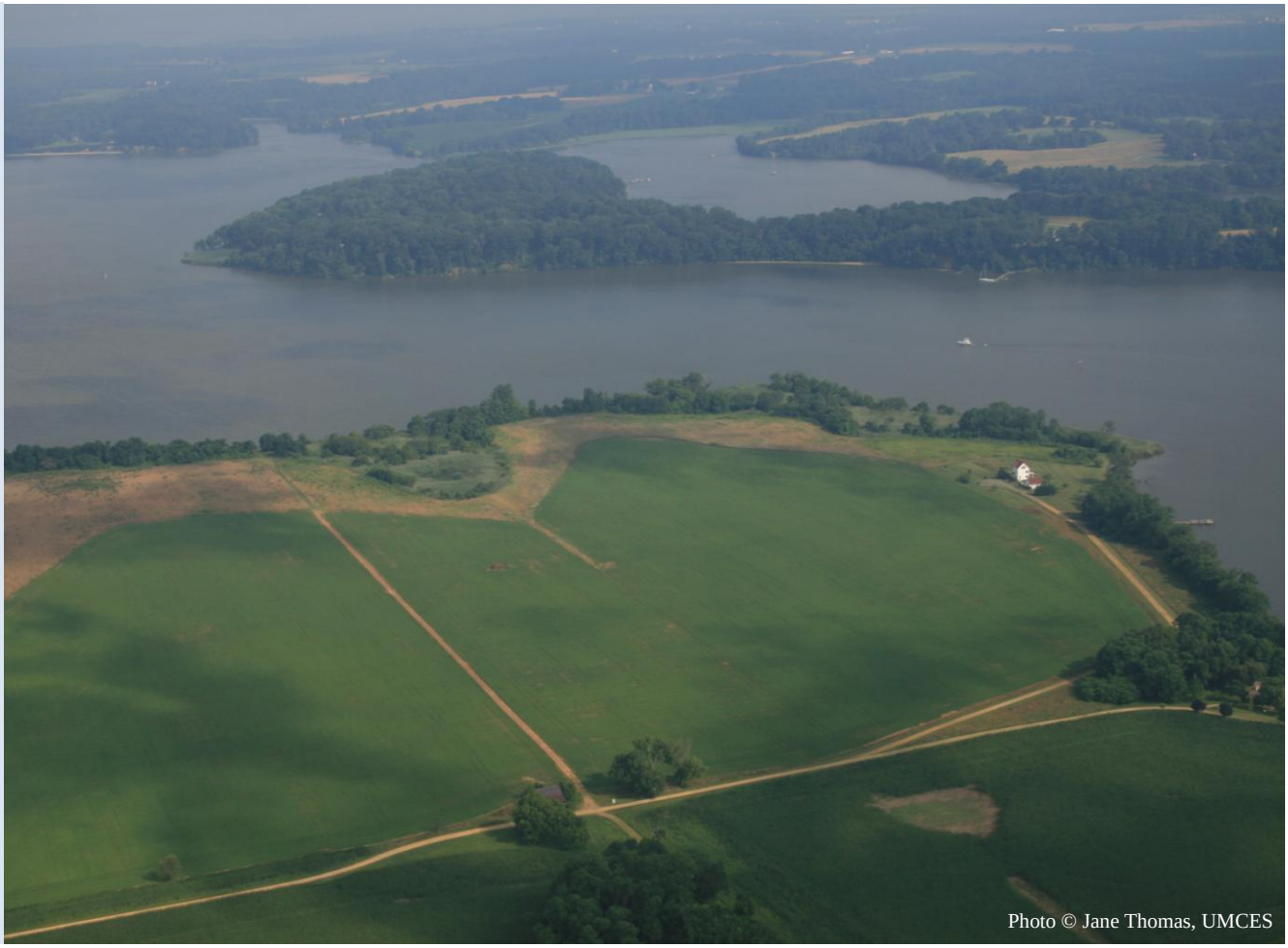
Sassafras Watershed Action Plan



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Thank you for your support.

STATEMENT OF PURPOSE AND COMMITMENT

The Sassafras Watershed Action Plan, sponsored by the Sassafras River Association and supported by a scientific advisory committee known as the Core Team and wide and active stakeholder interests, sets forth a blueprint for the sustainable environmental health of the Sassafras River. The SWAP is based upon a comprehensive and scientific assessment of the Sassafras River Watershed. This assessment supports the Sassafras River's designation as impaired under Maryland's Clean Water Action Plan and demonstrates why it is given the highest priority for restoration. The SWAP science draws upon the historic data contributing to that designation, while updating and expanding that knowledge with a host of new data. These data describe and document water quality, shoreline characteristics, development and farming impacts and a number of other impairments. These data show that considerable restoration is needed.

By comprehensively assessing the Sassafras River's present state and by reaching deeply into its future, this plan and its background studies chart a clear course toward watershed improvements. That course is made up of specific action strategies that include:

- Assisting our towns in achieving the maximum feasible reduction of nitrogen and phosphorus in the municipal wastewater stream;
- Partnering with agriculture to increase participation in cost-share programs and implementation of best management practices such as cover crops, no till farming and buffer strips;
- Educating our residents of the environmental danger of poorly maintained septic systems, over-fertilized lawns, eroding shorelines and unbuffered streams;
- Educating our children of the benefits of a healthy watershed, promoting the next generation of environmental stewardship.

With diligent application of the principles of the SWAP and implementation of its recommendations, the Sassafras River one day will be de-listed as an impaired waterway. Accordingly, the principal stakeholder entities proclaim the following ethic and commitment:

WHEREAS the Sassafras River is one of the most scenic rivers of the upper Chesapeake with its 30 foot cliffs and lush vegetation; with tranquil waters bearing recreational and commercial value; with shoreline providing habitat to rare, threatened and endangered species, and towns of Galena, Betterton and Cecilton deriving historical and cultural benefit from her tides; and,

WHEREAS the Sassafras River Watershed is stressed by the chemistry of human impact upon land, by tides, and from the air; and,

WHEREAS the future of the Sassafras River and its environs, including the management of rural growth and development, enhancement of its wildlife habitat and aquatic resources, preservation and conservation of its commercially vital farmlands, and protection of the quality of life along its shores and tributaries is of foremost concern to the undersigned stakeholders;

THEREFORE IT IS RESOLVED that the undersigned stakeholders agree to work in concert to implement the recommendations of the Sassafras Watershed Action Plan, to hold each other accountable for the implementation of the recommendations, to take bold strides to influence the direction of environmental planning and practice, thinking forward to a healthy watershed and working towards achieving it without delay, and to engage every watershed citizen as a steward of the Action Plan and the Watershed and to achieve the goals set forth herein.

Signed:

Sassafras River Association
Center for Watershed Protection
Appoquinimink River Association
Cecil County Planning and Zoning
Cecil Soil Conservation District
Delaware Department of Natural Resources and Environmental Control
Kent County Planning, Housing, and Zoning
Kent Soil and Water Conservation District
Maryland Department of the Environment
Maryland Department of Natural Resources
McCrone Inc.
University of Maryland Center for Environmental Science
University of Maryland Environmental Finance Center
University of Maryland Sea Grant Extension
Upper Eastern Shore Tributary Strategy Team
Washington College Center for Environment and Society

EXECUTIVE SUMMARY

ES1.0 Introduction

The Sassafras River Watershed is located in the Lower Elk River Basin, with its headwaters in Delaware and its mouth on the Eastern Shore of the Chesapeake Bay. Its geographic location lies across three counties: Cecil to the north, Kent to the South and New Castle to the east in Delaware. Since early colonization, the Sassafras Watershed has been a place rich in both land based and water based resources. When Captain John Smith's crew sailed the Sassafras River in 1607, "fish were so plentiful that Smith and his men jokingly attempted to catch them with frying pans," (Wennersten 2001, 23). Sassafras roots were a popular Chesapeake export in the seventeenth and eighteenth centuries, from which it was sold and boiled into teas that were thought to be good for "purifying the blood." The Sassafras River owes its name to "colonial root grubbers who believed they had found the magic cure all for disease" (Wennersten 2001, 53). However, much has changed since those times. Today the river is challenged by nutrient pollution from urban stormwater, agricultural runoff, sewage effluent and aging septic systems. This excess nutrient loading results in eutrophication which promotes unfavorable plant growth such as phytoplankton (algal blooms) over other types of plants, degrading water quality. This enhanced growth disrupts the normal function of the ecosystem by choking out submerged aquatic vegetation and decreasing oxygen, making survival difficult for the aquatic species that once thrived (Bartram *et al.,* 1999).

The Sassafras River is roughly 20 navigable miles long and the watershed covers approximately 97 square miles. The watershed is mostly rural with land use comprised of 57% agriculture, 24% forest, and only about 5% developed (residential and industrial). There are two municipalities within the boundaries of the Sassafras watershed, Betterton and Galena in Kent County, MD; and one municipality partially within the watershed, Cecilton in Cecil County, MD. Using year 2000 census blocks within the Sassafras Watershed boundary, the total population is estimated at 4,318 people. This is roughly 52 people per square mile of land within the watershed.

The Sassafras River is on the United States Environmental Protection Agency's (EPA's) list of federally impaired waters and the State of Maryland *303(d)* impaired list for nutrients, sediment (total suspended solids) ,and PCB's in the tidal portions as well as biological impairment in the non-tidal portions. The Sassafras is also on Delaware's *303(d)* list of impaired waters for biological and habitat impairment in the non-tidal portions of Delaware. These impairments were designated as a result of the Federal Clean Water Act established in 1972 which required all states, territories, and authorized tribes to: 1) develop water quality standards for all jurisdictional surface waters; 2) monitor these waters; and 3) identify and list those waters not meeting water quality standards. Known sources of pollution include two point source waste water treatment plants that serve residents within the towns of Betterton and Galena. Non-point sources of pollution dominate the remainder of the nutrient and sediment loads by more than half, and are a result of low density residential development, on-site septic systems, stormwater and agriculture runoff, as well as shoreline erosion and water resource based industry such as marinas and a very dense boating population. Through woodland gullies, a mixture of stable and

unstable streams and a historic wetland loss of 11,651 acres, these nonpoint sources have delivered nutrients and sediment at an accelerated pace.

The Sassafras River Association (SRA), recognizing the need for an action plan to address the impairments in the River, secured private funding and organized an independent effort to create a blueprint for positive improvements to the health of the river and watershed. The Sassafras Watershed Action Plan (SWAP) includes prioritized restoration recommendations, milestone timelines and potential funding opportunities to begin implementation of the recommendations. In order to restore the fragile system of the Sassafras Watershed, sources of pollution must be directly addressed and the historical resiliency of the system must be revitalized. This can be achieved by recreating the natural kidneys of the system such as wetlands and forested buffers, both of which have been lost due to human altered landscapes.

The Sassafras Watershed Action Plan (SWAP) details the actions necessary to improve conditions in the watershed, based on a series of fieldwork assessments and a stakeholder process. The SWAP was developed through a partnership between 16 public and private entities which formed a Core Team including: the Sassafras River Association; Center for Watershed Protection; Appoquinimink River Association; Cecil County Planning and Zoning; Cecil Soil Conservation District; Delaware Department of Natural Resources and Environmental Control; Kent County Planning, Housing and Zoning; Kent Soil and Water Conservation District; Maryland Department of the Environment; Maryland Department of Natural Resources; McCrone Inc.; Upper Eastern Shore Tributary Strategy Team; University of Maryland Center for Environmental Science; University of Maryland Environmental Finance Center; University of Maryland Sea Grant Extension Program; and Washington College Center for Environment and Society.

Existing geographic information system (GIS) data were the basis for much of the initial compilation of data. Field work assessments, Core Team meetings and stakeholder meetings provided additional data. The Core Team, consisting of representatives from each partnering agency, met monthly and served as a technical advisory committee, guiding the watershed planning process. In addition, three stakeholder meetings were held to provide community input to the process. A series of fieldwork assessments were conducted and included a stream impact assessment (Stream Corridor Assessment), an upland pollution source assessment of neighborhoods, institutions, hotspots and pervious areas (Unified Subwatershed and Site Reconnaissance), a tidal shoreline assessment, as well as a synoptic nutrient survey of the non-tidal streams. The protocols and results of the assessments are presented in Section 4.0, and complete data sets can be found in Appendix B. Overall watershed recommendations are first presented in Section 2.0 and later in Section 5.0 with associated costs, location, responsible parties, and milestones. A draft schedule for implementation and the expected benefits of implementation are also presented.

ES2.0 Priority Pollutants and Concerns

As part of this report, a number of priority pollutants and concerns were identified for the Sassafras River watershed. Table ES.1 lists each pollutant and concern, data source, potential sources of contamination and the negative effects it has on the watershed.

Table ES.1 Priority Pollutants and Concerns in the Sassafras River Watershed

Pollutant or Concern	Data Source	Potential Sources of Contamination	Watershed Effects
1. Nutrients (Nitrogen and Phosphorus) (TMDL written for phosphorus[2])	MD 303d list[1]	• Point sources • Urban runoff • Agricultural runoff • Turf grass and lawns • Atmospheric deposition • Septic systems • Pet waste	• Eutrophication • Contribution to Chesapeake Bay pollution and dead zones • Harmful algal blooms • Decrease in SAV
2. Sediment (TSS – total suspended solids)	MD 303d list[1]	• Streambank erosion • Urban runoff • Construction sites • Agricultural runoff	• In-stream habitat loss • Reduced depth in tidal creeks • Reduced light penetration for SAV growth
3. Bacteria	County Health Departments have issued beach advisories and closures	• Urban runoff • Pet waste • Wildlife • Failing septic systems • Improper disposal of boat waste	• Swimming and water contact related illnesses • Shellfish harvesting concerns
4. Biological Impairment	MD 303d list[1] DE 303d list[4]	• Streambank erosion • Agricultural runoff • Urban runoff • Point sources	• Loss of sensitive species • In-stream habitat loss

Table ES.1 Priority Pollutants and Concerns in the Sassafras River Watershed			
Pollutant or Concern	**Data Source**	**Potential Sources of Contamination**	**Watershed Effects**
5. Polychlorinated Biphenyls (PCBs)	MD 303d list[1]	• Old electrical transformers • Landfills • Point sources • Resuspension of bottom sediments[3] • Tidal influence of the Upper Chesapeake Bay • Atmospheric deposition	• Fish and biological contamination cautioning human consumption
Reference: [1] (MDE, 2008); [2] (More detail on the TMDL can be found in the Watershed Characterization Report in Appendix F); [3](MDE, 2009a); [4](DNREC, 2008)			

ES3.0 Goals and Recommendations

After receiving input from residents, farmers, and a broad array of other watershed stakeholders, the following set of strategies were drafted in coordination with the Core Team to guide recommendations of the Sassafras Watershed Action Plan.

Overall Stakeholder Goal: A healthy clean river that is safe for swimming, fishing, and crabbing and meets the TMDL for all impairments.

Stakeholder Strategies:

1. Quantify problems and chart a path to measure progress
2. Increase the knowledge and awareness of homeowners, developers and children of ways to improve conditions in the Sassafras – including Best Management Practices (BMPs), reduced impervious cover and improved lawncare practices
3. Increase forest buffers
4. Understand the causes of erosion and increase restoration efforts including State Highway and other potential stream restoration and shoreline stabilization efforts
5. Improved sewage treatment in Galena and Betterton
6. Increase the number of people pumping out their septics and upgrading their septics to remove nitrogen – also identify failing and leaking septics particularly in shared group systems
7. Improved enforcement and regulations including those pertaining to septic systems and pumpouts
8. Reduced impact of boaters on the Sassafras – increase awareness of need and access for sewage pump outs from boats
9. Continue to have the Sassafras as a priority funding area for cover crops

10. Increase availability of Agriculture Cost-Share programs to land and farmers that currently do not qualify
11. Increase peer-to-peer farmer interaction to make additional gains in conservation practices
12. Increase preservation of farmland in the watershed
13. Increase public access and public interaction with the River and the watershed
14. Monitor and track the measured results to insure conditions are improving in the River.
15. Use the SRA and the Stakeholder process as a model for other watersheds in the area

ES4.0 Implementation Costs and Schedules

Table ES.2 sets forth the goals to be achieved, locations, responsible parties, and long-term milestones for implementation of each recommendation. Each recommendation has been linked to a Stakeholder Strategy, identified in Section 2.0. Table ES.3 provides a draft implementation schedule over a 10 year period and associated costs for implementing each recommendation. The cumulative estimate for implementing the 30 recommendations presented in Section 2.0 over the next ten years exceeds $13 million. The overarching goal which is aimed at achieving swimmable, fishable, and water contact recreation by 2020, aligns with all of the recommendations as it takes a multi-faceted approach to achieve this goal. Preliminary cost estimates and responsible partners have been identified so that financial resources can be allocated and staff roles can be defined. Real watershed restoration requires a multi-faceted approach, which combines land use decisions with on-the-ground implementation, education, and protection and restoration of watershed functions.

Table ES.2 Recommendations, Responsible Parties, and Desired Outcomes for Restoration				
Stakeholder Strategies	**Recommendation**	**Location**	**Responsible Parties**	**Outcome**
4	1. Rt. 301 highway retrofits and stream restoration	3 locations near town of Sassafras	• Maryland Dept of Transportation • Kent County • SRA	• 3 projects constructed • Reduce sediment loading
2,13	2. Stormwater retrofitting demo projects including rain gardens and rain barrels	Stormwater retrofits in specific locations then additional watershed wide	• SRA • CWP	• 4 retrofit projects • Reduce sediment and pollutant loads
2,14	3. Outreach and education of residents on lawn care practices through workshops	Target high nutrient areas identified in neighborhood assessments then watershed wide	• SRA • Cooperative Extension	• Reach 500 residents through annual workshops, spring and fall • 300 soil tests with results logged by SRA • 100 acres of urban nutrient management • Reduce total phosphorous
2	4. Advocate for phosphorous free fertilizers throughout the watershed	Watershed wide then county wide	• SRA	• All business in watershed carry P-free fertilizers • County and State legislation prohibiting or limiting residential use of fertilizers • Reduce total phosphorous
2,6	5. Assistance with inspections and outreach to homeowners on denitrifying septic upgrades	Target critical area then watershed wide	• MD Dept of Environment • Cecil and Kent County Health Departments • SRA	• 300 tests performed • 150 septic upgrades • Increase septic system maintenance • Reduce total nitrogen

Table ES.2 Recommendations, Responsible Parties, and Desired Outcomes for Restoration				
Stakeholder Strategies	**Recommendation**	**Location**	**Responsible Parties**	**Outcome**
2,6,7	6. Fix failing septics in Sassafras	Critical area then watershed wide	• MD Dept of Environment • Cecil and Kent County Health Departments • SRA	• Repair 25 failing septics • Reduce total nitrogen
5	7. Upgrade Galena WWTP to ENR	Galena, MD	• Town of Galena • MD Dept of Environment • SRA	• 1 ENR municipal WWTP • Reduce total phosphorus, total nitrogen and ammonia
5	8. Upgrade Betterton WWTP to ENR	Betterton, MD	• Town of Betterton • MD Dept of Environment • SRA	• 1 ENR municipal WWTP • Reduce total phosphorus, total nitrogen, ammonia and bacteria
2,6,7	9. Identify and test major combined community septic systems	Watershed wide	• Kent and Cecil County Health Departments • SRA	• Identify all major systems • Test 5 systems • Reduce nutrient discharge
2,6,7	10. Upgrade appropriate combined community septics to enhanced denitrification technology	Watershed wide	• Kent and Cecil County Health Departments • SRA	• Upgrade 50% of identified systems to enhanced denitrification technology • Reduce total nitrogen
1,4,10	11. Identify eroding wooded ravines	Watershed wide	• Natural Resource Conservation Service • Resource Conservation District • CWP • SRA	• Inventory of woodland gully issues that can be addressed
1,4,10	12. Prioritize and restore multiple sites of eroding stream and wooded ravines	Watershed wide	• Natural Resource Conservation Service • Resource Conservation District • CWP • SRA	• 1 mile of stream and wooded ravine restored • Reduce sediment loading

Table ES.2 Recommendations, Responsible Parties, and Desired Outcomes for Restoration				
Stakeholder Strategies	**Recommendation**	**Location**	**Responsible Parties**	**Outcome**
4	13. Stabilize actively eroding shorelines, tidally induced and topdown induced	Lloyds Creek and Knights Island	• Eastern Shore Resource Conservation & Development • SRA	• Stabilize 1/2 mile of shoreline • Slow rate of erosion • Reduce sediment loading
4	14. Increase shoreline buffers and outreach to residents on buffer management	Critical Area	• SRA • Eastern Shore Resource Conservation & Development • Town of Betterton	• Increase 1 mile of shoreline buffers • Slow rate of erosion • Reduce sediment loading
2,3	15. Additional stream buffers for landowners (ag and residential)	Watershed wide (see Table 4.7)	• Natural Resource Conservation Service • SRA	• Increase stream buffers by 2 miles • Reduce sediment and nutrient loading
1, 9, 11	16. Needs assessment to understand impediments to cost-share participation	Watershed wide	• SRA • U MD Cooperative Extension • UDEL	• Identify and address impediments to increase participation
1,9,11	17. Increased outreach and cost-share to farmers in locations with high nutrient concentrations	High nutrient areas as identified by MD Synoptic Survey, then watershed wide	• SRA • UMD Cooperative Extension • UDEL	• 5,000 acres of additional cover crops • Increase awareness of programs and environmental benefits • Reduce nutrient loading
9,11	18. Work on farm source control and nutrient export in high nutrient export areas	High nutrient areas	• UMD Cooperative Extension • UDEL • SRA	• 5 farms create and implement on-site measures to reduce loads including installing gutters on poultry houses and diverting clean flow away from the houses, cover crops and crops that remove phosphorus, continuous no-till, subsurface application of manures, • Reduce nutrient loading

Table ES.2 Recommendations, Responsible Parties, and Desired Outcomes for Restoration				
Stakeholder Strategies	**Recommendation**	**Location**	**Responsible Parties**	**Outcome**
9,10,11	19. Increase acreages of cover crops via incentive payment	Watershed wide	• SRA	• 2,500 acres of additional cover crops (part of 5,000 above) • Reduce nutrient loading
1,11	20. Innovative ways of more efficient and effective use of nutrients	Watershed wide	• U MD Cooperative Extension • UDEL	• 100 acres implementing new and improved strategies
1	21. Identify and prioritize locations for up to 10 constructed wetlands in high input areas	High input areas	• Eastern Shore Resource Conservation & Development • SRA	• 5 wetlands constructed • Reduce nutrient loading
9,10,11	22. Extension of BMPs to farms with absentee owners and others that do not qualify for cost share	Watershed wide	• Kent and Cecil Soil Conservation Districts • SRA	• 500 acres with BMPs applied • Reduce nutrient loading
2,8	23. Encourage marinas to participate in the Maryland Clean Marina Program	Watershed wide	• SRA • Department of Natural Resources	• 2 additional marinas enrolled • Increase awareness of program and environmental/social benefits
2,13	24. Education and outreach to local school system and community youth groups	Watershed wide	• SRA	• Raise environmental awareness and develop next generation of stewardship

Table ES.2 Recommendations, Responsible Parties, and Desired Outcomes for Restoration				
Stakeholder Strategies	**Recommendation**	**Location**	**Responsible Parties**	**Outcome**
2,13	25. Engage local community in kayaking, bird watching and fishing	Watershed wide	• SRA	• Behavioral change increasing responsible recreation • Increased awareness and engagement
1,2	26. Participate in local codes and ordinance review	Kent, Cecil and New Castle Counties	• SRA • CWP	• Reduce future impacts from development • Develop a state of the knowledge
12	27. Advocate for preservation of forest and well-managed farmland	Watershed wide	• SRA	• No decrease in well-managed farmland • Additional 10% of forest and farmland preserved
1,7	28. Advocate for or create TMDLs for all impairments	Watershed wide	• SRA • MD Department of Natural Resources • MD Department of Environment	• TMDLs are developed for sediment and other impairments
1,14	29. Monitor efforts to improve the water quality conditions in the watershed	Watershed wide	• SRA • U MD Center for Environmental Science • CWP	• Identify and quantify problems • Process and impact monitoring implemented
15	30. Support and engage with established and start-up watershed organizations	Eastern Shore then Chesapeake Bay Region	• SRA	• Share best practices • Increase knowledge • Partner on advocacy efforts

Table ES.3 Logical Framework: Inputs, Activities, Outputs

Shading indicates projects have already been submitted for partial funding. Staff time represents costs associated with Sassafras River Association full and part-time staff.

Recommendation	Input	Activity	Output (year 1)	Output (years 2-4)	Output (year 5+)
1. Rt. 301 Highway retrofits and stream restoration	• Staff time • Approximately $ 1,000,000 per project for 3 projects = $ 3,000,000	• Meet with State Highway Authority • Implement highway retrofits	• Identify funding • SHA design and plan	• 2 projects constructed	• 1 project constructed
2. Stormwater retrofitting demo projects including rain gardens and rain barrels.	• Staff time • 5 workshops @ $2,500 = $12,500 • 4 projects @ $40,000 = $ 160,000 (see Table 4.9) • 100 rain barrels @ $ 75 = $ 7,500	• Identify site, recruit volunteers, design and construct 5 community projects • Annual workshops on rain gardens and rain barrels	• 1 workshop • 1 project • 15 rain barrels	• 4 workshops • 2 projects constructed • 85 rain barrels	• 1 project constructed
3. Outreach and education of residents on lawn care practices through workshops.	• Staff time • 8 workshops @ $ 2,500 = $ 20,000 • 300 Soil tests @ $ 15 = $ 4,500	• Annual workshop on lawn care • Distribute soil tests and log results	• 2 workshops • 150 soil tests	• 6 workshops • 150 soil tests	• Workshops as needed
4. Advocate for phosphorous free fertilizers throughout the watershed	• Staff time • Workshops (noted above)	• Identify suppliers and ensure P-free products are available • Educate landowners in workshops • Lobby for changes in legislation	• Local suppliers carry P-free products	• Change in legislation	
5. Assistance with inspections and outreach to homeowners on septic upgrades to enhanced denitrification technology	• Staff Time • 8 workshops @ $ 2,500 = $ 20,000 • 300 septic tests @ $ 100 =$ 30,000 • 150 upgrades @ $ 18,000 = $2,700,000	• Host septic workshops • Identify septics in critical area for testing • Identify septic consultant for testing	• 2 workshops • 75 septic tests	• 6 workshops • 225 septic tests • 50 septic upgrades	• 100 septic upgrades

Table ES.3 Logical Framework: Inputs, Activities, Outputs

Shading indicates projects have already been submitted for partial funding. Staff time represents costs associated with Sassafras River Association full and part-time staff.

Recommendation	Input	Activity	Output (year 1)	Output (years 2-4)	Output (year 5+)
6. Fix failing septics in Sassafras	• 25 septics repaired @ $ 15,000 = $ 375,000	• Hire contractor to design and install retrofits	• Shortlist of septic repairs from septic testing	• 15 septic systems repaired	• 10 septic systems repaired
7. Upgrade Galena WWTP to ENR	• Staff time • $ 1,500,000 for upgrade	• Identify funding opportunities for upgrade	• Secure funding	• Approve design and construct ENR plant	
8. Upgrade Betterton WWTP to ENR	• Staff time • $ 20,000 for design • $ 1,500,000 for upgrade	• Ensure ENR design • Identify funding opportunities for upgrade	• Secure funding	• Design	• Construct ENR plant
9. Identify and test major combined and community septic systems	• $ 2,000 per test for approximately 5 sites = $ 10,000	• Identify community septics watershed-wide • Test systems	• Inventory systems	• Test systems in critical area	• Test systems outside critical area
10. Upgrade appropriate combined and community septics to enhanced denitrification technology	• Cost will depend on size and number of units	• Upgrade combined and community septics to enhanced denitrification technology	• Determine appropriate technology and estimate cost	• Design and construct one system	• 1 - 2 septics upgraded
11. Identify eroding wooded ravines	• $ 30,000 based on 300 hours technical expertise	• Catalogue wooded ravines and recommend mitigation effort	• Identify wooded ravines	• Identify wooded ravines/ prioritize for restoration/ stabilization	• Technical memo containing restoration strategies for various scenarios

Table ES.3 Logical Framework: Inputs, Activities, Outputs

Shading indicates projects have already been submitted for partial funding. Staff time represents costs associated with Sassafras River Association full and part-time staff.

Recommendation	Input	Activity	Output (year 1)	Output (years 2-4)	Output (year 5+)
12. Prioritize and restore multiple sites of eroding stream and wooded ravines	• Staff time • $ 150-$ 200 per linear foot for 1 mile = $ 1,000,000	• Restore high priority sites of eroding stream and wooded ravines	• Ground truth and prioritize candidate sites	• Secure funding • Design restoration project	• Restore 1 mile of eroding steam and wooded ravines
13. Stabilize actively eroding shorelines, tidally induced and topdown induced	• Staff time • Approximately ½ mile of shoreline over 7 projects. Sum of 7 projects = $ 1,823,480	• Ground truth potential candidate sites, secure funding and construct sills, breakwaters, buffers	• Ground truth and prioritize candidate sites	• Secure funding and construct 1 project	• Secure funding and construct 5 – 6 additional projects
14. Increase shoreline buffers and outreach to residents on buffer management	• Staff time • 1 mile = 60 acres of buffer strips @ $ 3,000 per acre = $ 180,000	• Outreach to homeowners • Identify and implement buffer strips	• Target home owners with turf adjacent to shoreline • Outreach to waterfront residents to educate on buffer BMPs	• Plant 1/2 mile shoreline buffer strips	
15. Additional stream buffers for landowners (ag and residential)	• Staff time • 2 miles = 121.38 acres of buffer strips @ $ 3000 per acre = $ 364,140	• Promote buffer strips for residential and ag lands • Secure permission and funding for one community project(s)	• Secure landowner permission • Promote residential and ag buffers through media and workshops	• Plant 1 mile of buffer strips	• Plant 1 mile of buffer strips

Table ES.3 Logical Framework: Inputs, Activities, Outputs

Shading indicates projects have already been submitted for partial funding. Staff time represents costs associated with Sassafras River Association full and part-time staff.

Recommendation	Input	Activity	Output (year 1)	Output (years 2-4)	Output (year 5+)
16. Needs Assessment to understand impediments to cost-share participation for ag BMPs	• Staff time • Workshop (included below*)	• Poll farmers on participation in cost share programs	• Identify barriers to participation and work to resolve	• Identify barriers to participation and work to resolve	• Identify barriers to participation and work to resolve
17. Increased outreach and cost-share to farmers in locations with high nutrient concentrations	• Staff time • 1 annual workshop* @ $ 2,500 for 10 years = $ 25,000	• Peer to peer networking to farmers in areas with high nutrient concentrations initially, then watershed wide	• 1000 additional acres in cover crops • 1 annual workshop • Targeted outreach to 50 % of ag community in priority areas	• 2500 additional acres in cover crops • 3 workshops • Targeted outreach to 50% of ag community in priority areas	• 1500 additional acres in cover crops • 6 workshops • Watershed wide outreach to ag community
18. Identify farms with high nutrient export based on synoptic sampling work directly with farms to control nutrient losses	• $ 10,000 per plan for 5 farms = $ 50,000	• Work directly with 5 farms to construct source reduction and transport reduction methods	• Identify and target key farm areas	• Identify farms and implement 2 plans	• Identify farms and implement 3 plans
19. Increase acreages of cover crops via incentive payment	• Staff time • $ 10 per acre for $2,500 acres for 5 years = $ 125,000 • 1 annual workshop* (same as above)	• Peer to peer networking to farmers in areas with high nutrient concentrations initially then watershed wide	• 1000 additional acres in cover crops (part of total acres above) • 1 annual workshop • Targeted outreach to 50% of ag community in high nutrient areas	• 500 additional acres in cover crops (part of total acres above) • 3 workshops • Targeted outreach to 100% of ag community in high nutrient areas	• 1000 additional acres in cover crops (part of total acres above) • 6 workshops • Watershed wide outreach to ag community

Table ES.3 Logical Framework: Inputs, Activities, Outputs

Shading indicates projects have already been submitted for partial funding. Staff time represents costs associated with Sassafras River Association full and part-time staff.

Recommendation	Input	Activity	Output (year 1)	Output (years 2-4)	Output (year 5+)
20. Innovative ways of more efficient and effective use of nutrients	• Research funding $ 100,000	• Evaluate critical issues on farms with high nutrient exports – research and test methods to control nutrients	• Identify key subwatersheds and farm areas	• Secure funding and begin UMD Cooperative Ext meetings with selected farmers	• 100 acres with reduced nutrient export and data on enhanced practices
21. Identify and prioritize locations for up to 10 constructed wetlands in high input areas	• Staff time • $ 50,000 per wetland for approximately 100 acres per site for 10 sites = $ 500,000	• Ground truth candidate sites, secure funding, design and construct wetlands	• Construct 1 treatment wetland	• Construct 3 treatment wetlands	• Construct 6 treatment wetlands
22. Extension of BMPs to farms with absentee owners and others that do not qualify for cost share	• Staff time • $ 100 per acre for 500 acres = $ 50,000	• Identify funding gaps and farms without BMPs	• Begin outreach and relationship building with these landowners/ tenant farmers	• 300 additional acres in cover crops	• 200 additional acres in cover crops
23. Encourage marinas to participate in the Maryland Clean Marina Program	• Staff time	• Targeted outreach to marina owners and boaters	• One on one outreach to 5 non participating marinas and 2 boatyards	• 2 additional marinas sign on	• 1 additional marina sign on
24. Education and outreach to local school system and community youth groups	• Staff time • Supplies @ $ 1,000 per year for 10 years = $ 10,000	• Participate in school based programs to educate youth on water quality and stewardship	• Reach every 4th grader in Kent and Cecil county	• Reach every 4th grader in Kent and Cecil county	• Reach every 4th grader in Kent and Cecil county

Table ES.3 Logical Framework: Inputs, Activities, Outputs					
Shading indicates projects have already been submitted for partial funding. Staff time represents costs associated with Sassafras River Association full and part-time staff.					
Recommendation	**Input**	**Activity**	**Output (year 1)**	**Output (years 2-4)**	**Output (year 5+)**
25. Engage local community in kayaking, bird watching and fishing	• Staff time • $ 5,000 per large event for advertising, rentals, supplies = $ 50,000	• Create event(s) and activities that raise awareness and engage public in responsible recreation	• River festival with activity (kayaking, etc.) embedded within	• One large event and two smaller activities per year	• One large event and two smaller activities per year
26. Participate in local codes and ordinance review	• Staff time	• Review stormwater plans, water and sewer plans, comp. plans, permit renewals, etc. for water quality issues	• Increase knowledge • Reduce future impacts from development	• Increase knowledge • Reduce future impacts from development	• Increase knowledge • Reduce future impacts from development
27. Advocate for preservation of forest and well-managed farmland	• Staff time	• Participate in public hearings, commission meetings, issue letters of support etc. to advocate for forest and farmland preservation	• No decrease in forest or well-managed farmland	• No decrease in forest or well-managed farmland	• No decrease in forest or well-managed farmland

Table ES.3 Logical Framework: Inputs, Activities, Outputs

Shading indicates projects have already been submitted for partial funding. Staff time represents costs associated with Sassafras River Association full and part-time staff.

Recommendation	Input	Activity	Output (year 1)	Output (years 2-4)	Output (year 5+)
28. Advocate for or create TMDLs for all impairments	• Staff time	• Review and comment on Bay-wide TMDL for phosphorus, nitrogen and sediments • Monitor biological impairments through Maryland Biological Stream Survey and Maryland Stream Waders Programs	• Input on Bay-wide TMDL • Continue to monitor biological impairments through MBSS and MD Stream Waders programs	• Loading estimates for Sassafras impairments • Regulate impacts from discharge permits • Continue to monitor biological impairments through MBSS and MD Stream Waders programs	• Regulate impacts from discharge permits • Continue to monitor biological impairments through MBSS and MD Stream Waders Programs
29. Monitor efforts to improve the water quality conditions in the watershed	• Staff time • $ 3,000 per year for equipment costs for 10 years = $ 30,000 • $ 3,000 per year for lab tests for 10 years = $ 30,000	• Continue and increase monitoring efforts that track water quality improvements and issues	• Results are analyzed and publicized	• Results are analyzed and publicized	• Results are analyzed and publicized
30. Support and engage with established and start-up watershed organizations	• Staff time	• Participate in watershed meetings and events and issue letters of support to promote grassroots environmentalism	• Increase awareness of grassroots watershed planning and restoration	• Increase awareness of grassroots watershed planning and restoration	• Increase awareness of grassroots watershed planning and restoration
Grand Total	**$ 13,697,120**				

ES5.0 Pollutant Load Reductions

Table ES.4 shows the pollutant load reduction estimates based on the recommendations outlined in Section 2.0 as well as on-going implementation actions by the Sassafras River Association, Kent County and Cecil County. The load reductions are based on realistic implementation scenarios over the next ten years. Citations are provided for each of the load reduction calculations and are based on conservative assumptions. Each recommendation in Table ES.4 is followed by the implementation goal, and the assumption leading to the load reduction. Table ES.5 shows the annual pollutant loads to the Sassafras watershed post implementation and the percent of nutrient load reduction achieved through restoration strategies. The overall effect of restoration implementation would result in a 34 % reduction in total phosphorus, a 9% reduction in total nitrogen, and close to a 15% reduction in total suspended solids.

This restoration strategy will allow implementation partners to meet the load allocation of 13,875 lbs/yr of phosphorus. The Sassafras Watershed Action Plan TMDL strategy focuses on both reducing nutrients from urban sources including sewage treatment plants, septic systems and rural sources including agriculture. TMDLs for nitrogen and sediment have not been set for this watershed although load reductions for these pollutants have been calculated based on management practices for meeting the TMDL for phosphorus. In addition, known sources of nitrogen and sediment such as septic systems, WWTPs, lawn care and cover crops have been targeted in the recommendations.

Table ES.4 Pollutant Load Reduction Calculations for Total Nitrogen, Total Phosphorus, and Total Suspended Sediment

Recommendation	Project Goal	TN Reduction (lbs/year)	TP Reduction (lbs/year)	TSS Reduction (lbs/year)	Citation
1. Rt. 301 Highway retrofits and stream restoration	• 3 projects constructed	35	465	211,000	Caraco, 2001
2. Stormwater retrofitting demo projects including rain gardens and rain barrels.	• 4 retrofit projects • 100 rain barrels • 100 acres of urban nutrient management	35	15	3,300	Caraco, 2001
3. Outreach and education to residents on lawn care practices through workshops.	• Reach 500 residents, • 300 soil tests	4,000	103		Caraco, 2001

Table ES.4 Pollutant Load Reduction Calculations for Total Nitrogen, Total Phosphorus, and Total Suspended Sediment

Recommendation	Project Goal	TN Reduction (lbs/year)	TP Reduction (lbs/year)	TSS Reduction (lbs/year)	Citation
4. Advocate for phosphorous free fertilizers throughout the watershed	• Ensure P-free products are available and landowners educated		500		Barten *et al*., 2006
5. Assistance with inspections and outreach to homeowners on septic upgrades to enhanced denitrification technology	• 300 tests performed • 150 septic upgrades	900			MDE, 2008
6. Fix failing septics in Sassafras	• Repair 25 failing septics	150	25		Caraco, 2001
7. Upgrade Galena WWTP to ENR	• 1 ENR municipal WWTP	5,658	1,100		MDE, 2004
8. Upgrade Betterton WWTP to ENR	• 1 ENR municipal WWTP	1,200	160		MDE, 2004
9. Identify and test major combined and community septic systems	• Test 5 systems	Not Applicable			
10. Upgrade appropriate combined and community septics to enhanced denitrification technology	• Upgrade 50% of identified systems to BNR	5,000			MDE, 2008
11. Identify eroding wooded ravines	• Inventory of woodland gully issues that can be addressed	Not Applicable			
12. Prioritize and restore multiple sites of eroding stream and wooded ravines	• 1 mile of stream and wooded ravine restored		450	211,000	Caraco, 2001
13. Stabilize actively eroding shorelines, tidally induced and top down induced	• Stabilize ½ mile of shoreline	Primary load reduction will be TSS and will be calculated on a per project basis.			
14. Increase shoreline buffers and outreach to residents on buffer management	• Increase 1 mile of shoreline buffers	155	10	3500	CWP/DNR, 2005

Table ES.4 Pollutant Load Reduction Calculations for Total Nitrogen, Total Phosphorus, and Total Suspended Sediment

Recommendation	Project Goal	TN Reduction (lbs/year)	TP Reduction (lbs/year)	TSS Reduction (lbs/year)	Citation
15. Additional stream buffers for landowners (agricultural and residential)	• Increase stream buffers by 2 miles (50' width)	352	30	20,000	CWP/DNR, 2005
16. Needs assessment to understand impediments to cost-share participation	• Identify and address impediments to increase participation	Not Applicable			
17. Increased outreach and cost-share to farmers in locations with high nutrient concentrations	• 5,000 acres of additional cover crops	21,490	2,700	495,000	CWP/DNR, 2005
18. Identify farms with high nutrient export based on synoptic sampling, work directly with farmers to control nutrient losses.	• 5 farms create and implement measures to reduce nutrient losses	Nutrient load reductions will be estimated on a per farm basis, based on BMPs implemented.			
19. Increase acreages of cover crops via incentive payment	• 2,500 acres of additional cover crops (part of 5,000 above)	Portion of reductions included in #17 above.			
20. Innovative ways of more efficient and effective use of nutrients	• 100 acres implementing new and improved strategies	500	100		Frink, 1991
21. Identify and prioritize locations for up to 10 constructed wetlands in high input areas	• 10 wetlands constructed	5,000	500	450,000	CWP/DNR, 2005
22. Extension of BMPs to farms with absentee owners and others that do not qualify for cost share	• 500 acres additional cover crops	2,000	300	50,000	CWP/DNR, 2005
23. Encourage marinas to participate in the Maryland Clean Marina Program	• 2 additional marinas				

Table ES.4 Pollutant Load Reduction Calculations for Total Nitrogen, Total Phosphorus, and Total Suspended Sediment

Recommendation	Project Goal	TN Reduction (lbs/year)	TP Reduction (lbs/year)	TSS Reduction (lbs/year)	Citation
24. Education and outreach to local school system and community youth groups	• Raise environmental awareness and develop next generation of stewardship	Not Applicable			
25. Engage local community in kayaking, bird watching and fishing	• Behavioral change increasing responsible recreation				
26. Participate in local codes and ordinance review	• Reduce future impacts from development				
27. Advocate for preservation of forest and well-managed farmland	• No decrease in well-managed farmland • Additional 10% of forest and farmland preserved from development	Not Applicable			
28. Advocate for or create TMDLs for all impairments	• TMDLs are developed for all impairments				
29. Monitor efforts to improve the water quality conditions in the watershed	• Identify and quantify problems • Process and impact monitoring implemented				
30. Support and engage with established and start-up watershed organizations	• Share best practices • Increase knowledge • Partner on advocacy efforts				

Table E.5 Sassafras Watershed Annual Loads and Anticipated Restoration Strategy Reductions			
Loads	**TN (lb/year)**	**TP (lb/year)**	**TSS (lb/year)**
Sassafras Watershed total current loads	508,700	19,060	9,730,599
Restoration strategy	**46,475**	**6,458**	**1,443,800**
Watershed loading post implementation	**462,225**	**12,602**	**8,286,799**
Percent load reduction	**9.1%**	**33.9%**	**14.8%**
TMDL Loading Allocation		***13,875***	