

## 4.0 ASSESSMENT OF WATER QUALITY PROBLEMS

The focus of this watershed assessment is to assess existing conditions in the Lower Linganore Creek watershed, identify water quality problems, and describe opportunities to improve water quality and stream habitat. The assessment of current conditions presented in Section 2 indicates a wide range of potential stressors, including both urban and agricultural land use activities. In addition, projections of future development, estimates of future impervious surface, and SWMM modeling scenarios highlight the need to consider potential future impacts.

Within the last 20-30 years, and more rapidly within the last 10 years, development around the City of Frederick has expanded eastward, replacing rural, agricultural, and undeveloped lands in the south-central and western portions of Lower Linganore Creek watershed. Projections of future development predict that medium- and high-density residential land use, currently at approximately 5 percent, will expand substantially, to about 18.5 percent. Impervious surface in the watershed is currently approaching a level where stream impacts are typically observed, and an increase brought about by additional development is likely to place additional stress on Lower Linganore Creek's water quality, biological integrity, and physical habitat. SWMM modeling also predicts considerable increases in future pollutant loadings.

Common stresses associated with urbanization include the loss of natural vegetation throughout the watershed and particularly the loss of riparian vegetation, which supports many important stream processes. Riparian vegetation stabilizes both streambanks and lake shorelines, and reduces the inputs of nutrients, sediment, and other pollutants. Riparian vegetation also provides shade and contributes to shoreline and stream habitat quality by supplying rootwads and other woody debris that serve as cover for amphibians, reptiles, mammals, fish, and invertebrates. Other effects of urbanization can include more variable stream flows, increased erosion and sedimentation, habitat degradation caused by channel instability, increased nonpoint source pollutant loading, elevated air and water temperatures, and losses of biological diversity.

A list of water quality problems, including some non-urban problems, in Lower Linganore Creek watershed was developed by integrating information gleaned from the environmental assessment, visual inspection for potential watershed stressors, and other analyses compiled for this report. These problems may have a low benefit/cost ratio or occur on private lands that may not be feasible for the County to address. The objective was to identify a range of problems and their likely causes as a basis for identifying opportunities to improve water quality. As discussed in the next section, problems were ranked based on extent, severity, and potential for environmental restoration benefit to prioritize those observations and eliminate those that are not feasible because of land ownership or little opportunity for restoration.

Problems affecting water quality in Lower Linganore Creek and its tributaries are predominantly those arising from both urban and agricultural nonpoint sources. General problem types evident in the watershed include alterations of natural flow regimes (i.e., rapid conveyance of stormwater into stream channels), sediment deposition, and physical habitat degradation. In many cases, problems are minor, particularly where the presence of extensive

forest buffer or existing stormwater management facilities provides some protection from the impacts of nearby land uses. Taken individually, many of the activities in the watershed likely have little detrimental effect; however, the cumulative effect of these activities throughout the watershed can be of greater concern.

Water quality problems within Lower Linganore Creek loosely fall into ten general groups centered around the following issues: cumulative impacts, hydrologic modification, livestock access to stream, cropland runoff, failing septic systems, new construction, future development, industrial/ commercial development, existing structures, and inadequate SWM controls.

#### **4.1 RANKING OF WATER QUALITY PROBLEMS**

In order to prioritize the water quality problems, specific criteria were developed to assess and rank problems identified. For each problem, scores of 1 to 5 were assigned for the following factors:

- Extent: the spatial extent of the problem, ranging from local (1) to widespread (5)
- Severity: the degree to which the problem is a detriment to stream quality, ranging from mild (1) to most severe (5)
- Potential for environmental restoration benefit: this factor answers the questions “Would action likely bring about improvement in the condition of the environmental resource?” and “Overall, would restoration action likely be successful and cost-effective at this site?” Answers were scaled from little potential restoration benefit (1) to great potential benefit (5).

An average of the extent, severity, and restoration potential scores was then calculated to produce an overall water quality problem rating (1-5). Problems with an overall rating score of 3.0 or higher were then selected as priority issues because they present the greatest opportunities for improving water quality.

A summary of specific problems under each of the ten general groups, along with rankings, is given in Table 4-1.

##### **4.1.1 Watershed Perspective**

A prioritized list of water quality problems for the entire Lower Linganore Creek watershed is listed in Table 4-2. This prioritized list of problems was developed by sorting the water quality problems identified in Table 4-1 by their respective Overall Rating scores.

Table 4-1. Assessment of water quality problems in Lower Linganore Creek watershed. Shading indicates problems with the greatest opportunity for improving water quality

Problem ID	Location	Description of Problem	Stream Affected	Subwatershed(s) Affected	Extent of Problem	Severity of Problem	Potential for Environmental Restoration Benefit	Overall Rating	Opportunities to Improve Stream Water Quality
<b>Cumulative impacts</b>									
C11	Lake Linganore	Cumulative effects of upstream impacts have degraded lake water quality and caused significant sedimentation	Linganore Creek and tributaries	Chestnut Grove, Horseshoe Farms, Westwinds, New London, Detrick, Bens Branch, and Hazelnut Run	5	5	5	5.0	See HM1, MH2, HM3, LA1, LA2, CR1, FSS1, NC1, NC2, FD1, ES1, ES3
<b>Hydrologic modifications</b>									
HM1	Watershed-wide (e.g., Bens Branch at Jessie Smith Road)	Sediment, trash, and other materials from road surface discharged directly into stream channel at road crossings	Entire watershed	Entire watershed	5	4	3	4.0	Continue coordination with Highway Dept. to implement recommendations from the recent Road Maintenance Assessment report
HM2	Bens Branch across from Millime Court	Braided stream channel likely caused by historical disturbances	Bens Branch	New London	3	5	4	4.0	Monitor stream conditions to determine if channel has reached equilibrium at this location
HM3	Bens Branch at Gas House Pike	Channel instabilities caused by historical disturbances	Bens Branch	New London	3	5	4	4.0	Monitor stream conditions to determine if channel has reached equilibrium at this location

Table 4-1. (Continued)

Problem ID	Location	Description of Problem	Stream Affected	Subwatershed(s) Affected	Extent of Problem	Severity of Problem	Potential for Environmental Restoration Benefit	Overall Rating	Opportunities to Improve Stream Water Quality
<b>Livestock access to stream</b>									
LA1	Gas House Pike	Unrestricted livestock access to stream	Bens Branch	New London	3	4	5	4.0	Implement previously established coordination procedures with NRCS or SCD conservation specialists about problem area so that they can try to help farmers limit livestock access to streams with streambank fencing, and develop alternate watering and stream crossing facilities. Planning and Zoning may also be able to contribute staff time and knowledge to help obtain funding and encourage landowner participation. Follow up to confirm how problems have been addressed
LA2	Boyers Mill Road	Unrestricted livestock access to stream	Unnamed tributary to Hazelnut Run	Hazelnut Run	2	4	5	3.7	Implement previously established coordination procedures with NRCS or SCD conservation specialists to report problem area so that they can try to help farmers limit livestock access to streams with streambank fencing, and develop alternate watering and stream crossing facilities. Planning and Zoning may also be able to contribute staff time and knowledge to help obtain funding and encourage landowner participation. Follow up to confirm how problems have been addressed

Table 4-1. (Continued)									
Problem ID	Location	Description of Problem	Stream Affected	Subwatershed(s) Affected	Extent of Problem	Severity of Problem	Potential for Environmental Restoration Benefit	Overall Rating	Opportunities to Improve Stream Water Quality
<b>Cropland runoff</b>									
CR1	Watershed-wide	General agricultural impacts arising from agriculture - sediment, excess fertilizers, narrow/absent riparian buffers	Entire watershed	Entire watershed	3	3	4	3.3	NRCS or SCD conservation specialists can help farmers implement current agricultural BMPs to manage nutrients, prevent soil erosion, trap sediment, and plant riparian buffers. Implement previously established coordination procedures with NRCS or SCD staffs to report specific problems (see LA1 above)
<b>Failing septic systems</b>									
FSS1	Watershed-wide	Older houses may have failing septic systems that could affect water quality	Entire watershed	Entire watershed	2	2	1	1.7	Coordinate with Health Department and Division of Solid Waste to develop educational materials for residential property owners, provide technical assistance for upgrades and maintenance and investigate grants, loans, or other funding for septic improvements. Additional efforts could include monitoring for fecal coliform, conducting dye studies of suspect systems, and connection to nearby public sewers.
<b>New construction</b>									
NC1	Woodridge area of Lake Linganore	Sediment and dust eroded from unpaved construction roads can impair adjacent streams	Unnamed tributary to Linganore Creek	Mainstem Linganore Creek	4	3	4	3.7	Inspect site and work with construction manager to improve site conditions and maintenance efforts. Require developers to implement BMPs for unpaved roads such as those discussed in the County's Road Maintenance Assessment report. Take opportunity to educate manager about the need and importance of these BMPs and their continued upkeep.

Problem ID	Location	Description of Problem	Stream Affected	Subwatershed(s) Affected	Extent of Problem	Severity of Problem	Potential for Environmental Restoration Benefit	Overall Rating	Opportunities to Improve Stream Water Quality
NC2	Westwinds area of Lake Linganore	Unpaved road under construction channels runoff away from sediment basin and directly down long hill towards wooded edge of Lake Linganore; inadequate design and maintenance of erosion and sediment controls	Lake Linganore	Westwinds	2	4	5	3.7	Require developers to implement BMPs for unpaved roads such as those discussed in the County's Road Maintenance Assessment report. Take opportunity to educate manager about the need and importance of these BMPs and their continued upkeep. Identify ways to better educate designers and reviewers of E&S plans.
NC3	Hilltop west of Artie Kemp Road	Large expanse of bare soil may have uncontrolled erosion problems. Metal and other items may also have been improperly disposed of at this location	Unnamed tributary to Linganore Creek	Chestnut Grove	1	2	5	2.7	Request NRCS to inspect farm and address issues as needed.
<b>Future development</b>									
FD1	Watershed-wide	Regional growth associated with City of Frederick will increase population and development within the watershed	Entire watershed	Entire watershed	5	4	3	4.0	Continue to enforce planning and construction requirements for SWM controls, with the goal of not altering flows or pollutant loads from predevelopment conditions. Minimize short-term construction impacts. Identify locations for new structural BMPs in the watershed as new developments are proposed
<b>Industrial/Commercial development</b>									
ICD1	Countryside Auto Parts	Automobile scrapyards in headwaters of Bens Branch appeared to have inadequate stormwater controls. Soil contamination issues may also be likely	Bens Branch	Bens Branch	2	3	4	3.0	Contact MDE to determine jurisdiction and appropriate course of investigative action.

Table 4-1. (Continued)

Problem ID	Location	Description of Problem	Stream Affected	Subwatershed(s) Affected	Extent of Problem	Severity of Problem	Potential for Environmental Restoration Benefit	Overall Rating	Opportunities to Improve Stream Water Quality
<b>Existing structures</b>									
ES1	Drainage swale along Spring Forest Road, Spring Ridge PUD	Stormwater flows are eroding the drainage pathway, depositing gravel in the channel, and blocking a culvert. Concentrated flows are passing through a swale, and headcutting upon entry into a SWM pond	Unnamed tributary to Linganore Creek	Mainstem Linganore Creek	3	5	4	4.0	Inspect drainage network and structure and work with facility manager to improve self-inspection and maintenance efforts. Take opportunity to educate facility manager about the need and importance of these BMPs and their continued upkeep
ES2	Public Training Safety Facility	Herbicide used around SWM facilities may not be appropriate for use near surface water, potentially killing fish and contaminating water and sediments	Unnamed tributary to Monocacy River	Bartonsville	1	3	5	3.0	Check with facility maintenance staff to ensure that only USEPA approved herbicides are used and that application conforms to label directions
ES3	Linganore High School	Apparent herbicide use around drainage pathways (see ES1); trash and fines from parking lots washed through stormdrains into grassy swales below outlet structures	Unnamed tributary to Bens Branch	New London	1	3	5	3.0	Check with facility maintenance staff to ensure that only USEPA approved herbicides are used and that application conforms to label directions. Potential retrofit opportunity to improve water quality and quantity. Also educational opportunity with students and community.
ES4	Spring Ridge - SWM Pond #10 (Structure ID 463)	Trees are growing on the berm and around the outlet structure in this EDD facility	Unnamed tributary to Linganore Creek	Mainstem Linganore Creek	1	1	3	1.7	Inspect structure and work with facility manager to improve self-inspection and maintenance efforts. Take opportunity to educate facility manager about the need and importance of the BMP and its continued upkeep

Problem ID	Location	Description of Problem	Stream Affected	Subwatershed(s) Affected	Extent of Problem	Severity of Problem	Potential for Environmental Restoration Benefit	Overall Rating	Opportunities to Improve Stream Water Quality
<b>Inadequate controls</b>									
IC1	North Shore Way	Roadway and lawns drain directly to Lake Linganore without passing through vegetated riparian buffers	Lake Linganore	Mainstem Linganore Creek	4	5	4	4.3	Contact citizen stakeholder groups (e.g., LLCS, Friends of the Lake) to develop ways in which the County can assist their efforts to improve riparian buffers on private property around the lake, perhaps through grant or incentive partnerships. In addition, the County may be able to provide input for LLCS's stormwater and road design study currently underway that would improve road runoff conditions
IC2	Boyers Mill Road	Residential areas have narrow or absent riparian buffer to protect Lake Linganore from fertilizers, herbicides, pet wastes, and other NPS pollutants	Lake Linganore	Mainstem Linganore Creek	4	5	4	4.3	See IC1 above
IC3	Pinehurst area of Lake Linganore	Area of older development with few controls to reduce stormwater flow volumes, velocities, and pollutants	Lake Anita Louise and unnamed tributary to Lake Linganore	Mainstem Linganore Creek	4	4	4	4.0	See IC1 above
IC4	Holly Hills Golf Course	Greens extend down to edge of streams, with little to no riparian buffers to filter nutrient runoff. In addition, silt fencing for construction of a golf cart path was collapsing into the stream	Long Branch	Long Branch	2	3	3	2.7	Take opportunity to educate facility manager about the need and importance of these BMPs, self-inspections, and their continued upkeep. In addition, contact citizen stakeholder groups (e.g., LLCS, Friends of the Lake, club members) to see if they could provide support of riparian buffer initiatives at the golf course
IC5	Horseshoe Farms Estates	Area of older development with few controls to reduce stormwater flow volumes, velocities, and pollutants	Unnamed tributary to Linganore Creek	Horseshoe Farms	2	2	4	2.7	Inspect existing swale and drain structures and work with facility manager to improve self-inspection and maintenance efforts. Take opportunity to educate facility manager about the need and importance of these BMPs and their continued upkeep. In addition, see IC1 above.

Table 4-2. Summary of water quality problems for the Lower Linganore Creek Watershed, sorted by Overall Rating. Shading indicates problems with the greatest opportunity for improving water quality

<b>Problem ID</b>	<b>Location</b>	<b>Overall Rating</b>
CI1	Lake Linganore	5.0
IC1	North Shore Way	4.3
IC2	Boyers Mill Road	4.3
ES1	Drainage swale along Spring Forest Road, Spring Ridge PUD	4.0
FD1	Watershed-wide	4.0
HM1	Watershed-wide; Bens Branch at Jessie Smith Road	4.0
HM2	Bens Branch across from Millime Court	4.0
HM3	Bens Branch at Gas House Pike	4.0
IC3	Pinehurst area of Lake Linganore	4.0
LA1	Gas House Pike	4.0
LA2	Boyers Mill Road	3.7
NC1	Woodridge area of Lake Linganore	3.7
NC2	Westwinds area of Lake Linganore	3.7
CR1	Watershed-wide	3.3
ES2	Public Training Safety Facility	3.0
ES3	Linganore High School	3.0
ICD1	Countryside Auto Parts	3.0
IC4	Holly Hills Golf Course	2.7
IC5	Horseshoe Farms Estates	2.7
NC3	Hilltop west of Artie Kemp Road	2.7
ES4	Spring Ridge - SWM Pond #10 (Structure ID 463)	1.7
FSS1	Watershed-wide	1.7

#### 4.1.2 Subwatershed Perspective

A prioritized list of water quality problems for Lower Linganore Creek’s subwatersheds is listed in Table 4-3. This prioritized list of problems was developed by sorting the water quality problems identified in Table 4-1 by their respective subwatersheds, and then again by their Overall Rating scores.

The water quality problems identified in this assessment stem from a wide range of interconnected stressors that often cannot be separated into individual stressors. However, the SWMM modeling can help focus future efforts to address these and yet to be discovered water quality problems by identifying locations and types of problems that are likely to need attention. For example, Table 3-13 indicates that pollutant loadings from urbanization are, and will continue to be, the greatest impact within the Mainstem Linganore Creek subwatershed. Chestnut Grove and Long Branch subwatersheds are also likely to be impacted to a similar degree by agricultural an urban nonpoint pollutants, respectively.

Table 4-3. Summary of water quality problems for subwatersheds of Lower Linganore Creek, sorted by Overall Rating. Shading indicates problems with the greatest opportunity for improving water quality		
<b>Problem ID</b>	<b>Location</b>	<b>Overall Rating</b>
<b>Bartonsville</b>		
ES2	Public Training Safety Facility	3.0
<b>Bens Branch</b>		
ICD1	Countryside Auto Parts	3.0
<b>Chestnut Grove</b>		
NC3	Hilltop west of Artie Kemp Road	2.7
<b>Hazelnut Run</b>		
LA2	Boyers Mill Road	3.7
<b>Horseshoe Farms</b>		
IC5	Horseshoe Farms Estates	2.7
<b>Long Branch</b>		
IC4	Holly Hills Golf Course	2.7
<b>Mainstem Linganore Creek</b>		
IC1	North Shore Way	4.3
IC2	Boyers Mill Road	4.3
ES1	Drainage swale along Spring Forest Road, Spring Ridge PUD	4.0
IC3	Pinehurst area of Lake Linganore	4.0
NC1	Woodridge area of Lake Linganore	3.7
ES4	Spring Ridge - SWM Pond #10 (Structure ID 463)	1.7
<b>New London</b>		
HM2	Bens Branch across from Millime Court	4.0
HM3	Bens Branch at Gas House Pike	4.0
LA1	Gas House Pike	4.0
ES3	Linganore High School	3.0
<b>Westwinds</b>		
NC2	Westwinds area of Lake Linganore	3.7
<b>Entire watershed</b>		
CI1	Lake Linganore	5.0
FD1	Watershed-wide	4.0
HM1	Watershed-wide; Bens Branch at Jessie Smith Road	4.0
CR1	Watershed-wide	3.3
FSS1	Watershed-wide	1.7

## 4.2 OPPORTUNITIES TO IMPROVE WATER QUALITY

In the last several years, Frederick County has expended considerable resources and effort to expand its NPDES stormwater management programs. These efforts have resulted in

strong facility inspection, GIS and database management, permit review, stormwater sampling, and watershed assessment components. The County's recent efforts to update its stormwater management ordinance to reflect recent changes in State requirements represents a significant step in improving stormwater management.

In order to increase the effectiveness of the County's SWM management programs, an adaptive management process is being followed, with refinements continuously considered and implemented. As such, a number of recommended opportunities that would enable the County to better address SWM issues and improve water quality in Lower Linganore Creek watershed have been included with the problem identification and rankings table (Table 4-1). These opportunities include site-specific activities as well as general programmatic refinements that could apply to many areas and thus address cumulative effects throughout the Lower Linganore Creek watershed.

Many of the programmatic approaches recommended in the County's two previous watershed assessments (Roth et al. 2001a, 2001b) are applicable to the problems noted here and opportunities recommended in this report build upon or take advantage of the earlier recommendations. As funding and staff resources allow, implementation of these approaches, especially those pertaining to education/outreach and agricultural issues, will bring about Countywide improvements and therefore help conditions in Lower Linganore Creek.

Several of the recommendations presented in this report involve issues within the Lake Linganore community. The entire community is represented by a homeowners association, Lake Linganore Association; each village around the lake is also represented by individual homeowners associations. Also, the Linganore CDA is an additional authority within the area. Implementation of any recommendations in this area is likely to be a complex task requiring close coordination and approval of each of these entities. It is therefore important for the County to establish a working relationship with these groups as well as the citizen stakeholder groups, which may prove to be a valuable advocate for stormwater management improvements.

Even with strict adherence to the practices specified the recently adopted 2000 Maryland Stormwater Design Manual, and implementation of BMPs for erosion and sediment control, it will be difficult to prevent any diminishment of the current level of stream water quality and habitat integrity in the watershed, especially given the projected level of development within the watershed. For example, most construction sites within Frederick County meet current erosion and sediment control requirements; however, not all sediment is contained given the limits of existing technology. Therefore, the County may want to find ways to improve the efficiency of site controls in order to better retain topsoil and protect water resources. Given that no SWM practices are 100 percent effective in reducing runoff, sediment, and erosion, some degree of stream degradation is also likely to occur, as indicated by the expected increase in the amount of impervious surface within the watershed. However, without such stormwater control measures, far greater degradation would likely result. In addition, promotion of low impact development techniques can reduce stormwater runoff volumes and velocities, and nonpoint pollution at its source, thereby reducing stresses to water quality and stream habitat within the watershed.

