The Lake Linganore Source Water Protection Plan

Executive Summary

The Source Water Protection Project was initiated by the U.S. Environmental Protection Agency (EPA) in order to help communities such as Frederick protect their drinking water sources. Although many municipalities share common drinking water sources, protection strategies are often approached independently, leading to redundancy in effort and wasted conservation resources. If municipal drinking water systems were able to combine resources and develop a common, unified protection strategy, conservation efforts would be more effective, leading to better drinking water quality. The Linganore Source Water Taskforce ("Taskforce") was created under the Source Water Protection Project to determine how to better protect Lake Linganore and Linganore Creek as important drinking water sources.

There are both quantity and quality problems with the drinking water supplied by Lake Linganore. The Lake is currently threatened by sediment deposition and phosphorous inputs mainly from agriculture, but also as a result of poor development practices in the watershed. There has been a Total Maximum Daily Load (TMDL) issued for Lake Linganore for both phosphorous and sediment. Additionally, as a result of sediment infill, the capacity of Lake Linganore has decreased –calling in to question the ability of the Lake to continue to meet the growing drinking water needs of the City of Frederick.

The Taskforce met over the course of two years to gather the necessary data and expertise and to construct this report. The following recommendations represent the key findings of this Taskforce.

Recommendations and Implementation Strategies

Agriculture:
Modifications to existing agricultural programs:

Redesign the County ranking system to better reflect the quality and implementation of the required soil and water conservation plan.

Create an incentive payment plan for farmers enrolled in an agricultural preservation program who expedite the implementation of the soil and water conservation plan within 2 years of the adoption or revision of their plan.

Institute a follow-up procedure to check if the required soil and water conservation plan has been written by the Soil Conservation District (SCD) for the Installment Purchase Program (IPP), Maryland Agricultural Land Preservation Foundation (MALPF) and Critical Farms (CF) programs.

Emphasize the importance of the installation or adoption of devices, structures or practices that address water quality problems or potential water quality issues during the update or revision of soil and water conservation plans for farms in the Linganore watershed.

Include the installation or adoption of devices, practices, and systems to reduce nutrient enrichment of ground and surface water as well as sediment pollution entering waterways as key components of new or revised soil/water conservation plans for farms in the Linganore watershed.

Establish a local cover crop program within the Linganore watershed to create an incentive and to encourage farmers to participate in the planting of cover crops.

Require yearly survey forms for farms in the three agricultural land preservation programs, created by the Planning Department, that address soil/water conservation plan status, implementation schedule and any outstanding water quality/soil erosion issues.

Explore the development of a system that creates tax incentives for large landowners to implement best management practices (BMPs) that protect and restore water quality.

Development:

Adopt the Development Review/Planning Staff's recommendation that a majority of the Fee-in-Lieu funds over the next 10-20 years be spent stabilizing agricultural creeks and streams in the portions of the Upper and Lower Linganore watersheds that drain into Lake Linganore.

Institute a phasing plan that limits the amount of land disturbed on any Linganore Community development site at a given time. Super-silt fence should be used for all lot development, road and utility installation within 200 feet of waterways and on moderate to steep slopes. In addition, perched culverts/spanning bridges for stream crossings should be used to help maintain fish passages and wildlife corridors.

Develop a new educational program for 'spot-lot' developers that explains the importance of sound land grading, clearing and development practices in the Linganore source water protection area. These educational materials should be distributed to building/grading permit applicants at County offices.

Incorporate low impact development (LID) principles, contained in the County's Community Design Guidelines and Development Principles Document into all new development in the Linganore source water protection area.

Make the Linganore watershed a priority when the County is deciding where to recreate pervious surfaces under NPDES requirements.

Incorporate the recommendations contained in the Linganore Small Area Plan with regard to expanded stream buffer requirements in the Linganore community.

Modify Eaglehead on the Lakes' homeowners association covenants and Environmental Control Committee (ECC) Guidelines to include: 1) a requirement for stream/lake buffer

zone maintenance; 2) a limitation of impervious surface; and 3) a minimum criteria for woody plantings – the minimum landscaped areas, or retained existing vegetation on an individual lot, should not be less than 20% of the land area of the lot.

Institute a system whereby the Lake Linganore Environmental Control Committee (ECC) approves all building permits for individual lot development within the Linganore Planned Unit Development (PUD) prior to final issuance by Frederick County

Allow County staff-level approval in lieu of Planning Commission approval for modifications to setback lines in the current PUD zoning district to preserve sensitive environmental features, to minimize grading and vegetation disturbance and to protect the water quality and quantity of Lake Linganore.

Employ an adequate number of County staff for plan/permit review, inspection and enforcement.

Infrastructure and Maintenance

Adopt the standards and practices put forth in the "County Pavement Management Program" for private roads and roads owned by the LLA.

Follow the recommendations made in the report made by Versar Inc. with regard to exploring the use of alternative salts and modifications to the use of herbicides and pesticides on roads within the Linganore watershed.

Explore the possibilities for dredging the lake and installing a forebay as recommended in the study done by Whitman, Requardt & Associates, LLP.

Homeowners

Increase the awareness of the need for protection of the lake as a drinking water source among homeowners in the watershed, especially those in and around the lake. Building upon ongoing outreach and education efforts is the most cost effective way to do this. Outreach efforts need to be expanded with the help of the County as well as local businesses and community groups. Several specific recommendations for how to accomplish this are included. Enforcement of existing rules and regulations geared towards protecting the lake is also necessary.

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I. Background

Protecting Our Drinking Water: There are both quantity and quality problems with the drinking water supplied by Lake Linganore. The Lake is currently threatened by sediment deposition and phosphorous inputs mainly from agriculture, but also as a result of poor development practices in the watershed. There has been a Total Maximum Daily Load (TMDL) issued for Lake Linganore for both phosphorous and sediment. Additionally, as a result of sediment infill, the capacity of Lake Linganore has decreased –calling in to question the ability of the Lake to continue to meet the growing drinking water needs of the City of Frederick.

The Source Water Protection Project was initiated by the U.S. Environmental Protection Agency (EPA) in order to help communities such as Frederick protect their drinking water sources. Although many municipalities share common drinking water sources, protection strategies are often approached independently, leading to redundancy in effort and wasted conservation resources. If municipal drinking water systems were able to combine resources and develop a common, unified protection strategy, conservation efforts would be more effective, leading to better drinking water quality.

The following section provides background information on the characteristics of the Linganore watershed and the Lake Linganore community. It also describes the legal and practical reasons for protection of the lake and its major water supply systems.

Chapter 1 – Introduction to the Source Water Protection Project

The Linganore Source Water Protection Taskforce ("Taskforce") was created under the Unified Source Water Protection Project to determine how to protect Lake Linganore and Linganore Creek as important drinking water sources. Lake Linganore was initially constructed in 1971 as a recreational amenity for the private community of Lake Linganore at Eaglehead. However, for many years both Frederick County and the City of Frederick have relied on Linganore Creek and the Lake as a drinking water source. Since flow-by rates along the creek have always been a concern for both municipalities, the lake became a way to stabilize, and increase, the amount of water flowing through the Linganore Creek Water Treatment Plant. Though the reservoir has stabilized flows to the treatment plant, excessive sediment runoff – the result of agriculture and development in the watershed – is threatening the capacity of the 883 million gallon lake.

The Taskforce was primarily composed of representatives from Frederick County, the City of Frederick and the citizens of the Lake Linganore area. In addition, there were representatives from agencies such as Natural Resource Conservation Service (NRCS) and Maryland Department of the Environment (MDE), as well as regional non-profit organizations, farmers, local landowners, and consulting agencies. A complete list of Taskforce participants and their affiliations is included in Appendix A. The Taskforce met monthly over the course of two years to produce this series of recommendations collaboratively. Each participant contributed considerable time, energy and expertise towards this final product.

One priority of the Taskforce has been to include members of the agricultural community in the process. Much of the watershed that drains into Lake Linganore is agricultural, and any plan to control the flow of sediment into the lake must include implementing agricultural best management practices (BMPs). While agricultural inputs to the lake are an important consideration of this plan, they are only a part of a larger picture. The significant impact of urban and suburban areas must also be included. This Source Water Protection Plan attempts to address the threats to the Lake Linganore watershed as a drinking water source from all angles and to make concrete and specific recommendations for how to address those threats based on the expertise of the members of the Taskforce.

Chapter 2 – Description of the Lake Linganore Watershed

General Description of a Watershed: A watershed is the land area that drains to a single body of water such as a stream, lake, wetland or estuary. Physical boundaries such as hills, ridges and valleys define the movement of water and delineate a watershed. Watersheds, also known as catchments or basins, describe geography at many different scales – they may be as small as a few acres draining to a small stream or as large as all the land that drains into a major river or estuary.

The Linganore Creek Watershed: The Linganore Creek watershed encompasses 83.1 square miles. It is split into two sub-watersheds, Upper Linganore (45.3 square miles) and Lower Linganore (37.8 square miles). The Linganore Creek watersheds are part of the Lower Monocacy River watershed, which is located in the larger Middle Potomac River watershed of the Chesapeake Bay drainage basin. So, the Linganore Creek watershed is part of the larger Chesapeake Bay watershed, which covers 64,000 square miles and stretches into the state of New York.

Lake Linganore is the largest impoundment in the Monocacy River basin and stores 883 million gallons of water captured from its 83 square mile catchment for recreational use and water supply (Versar, 2002). Because Linganore Creek is one of the largest tributaries to the Monocacy River, which is one of Maryland's nine Scenic and Wild Rivers, it is especially noteworthy that Linganore Creek has been placed on the Maryland Department of the Environment's (MDE) list of waters impaired by non-point source pollution.

Linganore Creek is designated by the state as a recreational trout waters and public water supply. The designation includes warm or cold waters which have the potential for, or are: a) capable of holding or supporting adult trout for put-and-take fishing; b) managed as a special fishery by periodic stocking and seasonal catching (COMAR).

Named tributaries to Linganore Creek include:

Dollyhyde Creek	Talbot Branch	South Fork
Oldfield Branch	Bens Branch	Town Branch
Weldon Creek	Woodville Branch	Cherry Run
Long Branch	Hazlenut Run	North Fork

GreenPrint Program: In the spring of 2001, the Maryland Department of Natural Resources (DNR) announced a progressive and ambitious program to preserve environmentally sensitive land called the GreenPrint Program. In Maryland's green infrastructure, DNR identified an extensive intertwined network of biologically diverse landscapes vital to the long-term survival of native plants, wildlife, ecological processes, and of certain industries that rely on a clean, healthy environment and abundant natural

resources. 'Green Hubs' are large blocks of contiguous forest, mountain lands or marshes with multiple natural resource features such as wetlands and river or stream systems, etc connected by 'Green Links'---wildlife corridors or linkages. The GreenPrint Program was designed to protect these unique and valuable lands by creating a focused and sustained conservation initiative among the State and local governments, citizens, land trusts and conservation groups that targets properties for acquisition and easements.

Although all state funding for the GreenPrint Program was canceled in October 2003 DNR identified two 'Green Hubs' in the Linganore Watershed. DNR believes that is vitally important to keep these areas protected because they play an important role in regulating water quality in downstream areas. These 'Green Hubs' should therefore still be a priority protection areas for Frederick County.

1) South Fork Of Linganore Creek – This 470-acre, high quality forest complex includes 71 acres of wetlands, approximately 19,000 linear feet of streams and floodplain soils. This large contiguous forest tract is unique not simply for its ecological value but also because it exists in a landscape dominated by active agriculture.

2) Lake Linganore - The second 'Green Hub' is located northwest of Lake Linganore, south of Gas House Pike. A large portion of this 500-acre forested site has slopes of 30%--40%, and contains three first-order streams that flow into Lake Linganore or Linganore Creek. *

***It should be noted however, that the 1973 and 2003 Phase II PUD Land-Use Plan approved this area for primarily residential and limited commercial development.**

References

An Assessment of Road Maintenance Activities in Frederick County and Their Effect on Stormwater Runoff Quality. 2002. Prepared for the Division of Public Works by Versar Inc

COMAR 26.08.02.03. http://www.dsd.state.md.us/comar/26/26.08.02.03.htm

Chapter 3 – The Importance of Watersheds to Drinking Water

A Watershed Approach: A 'watershed approach' to source water protection uses hydrologically defined areas (watersheds) to coordinate the management of water resources. This approach is advantageous because it considers all activities and land uses within a landscape that affect watershed health. Ideally, a watershed approach integrates biology, chemistry, economics and social considerations into decision-making. It considers local stakeholder input and national and state goals and regulations. A watershed approach recognizes needs for water supply, water quality, flood control, fisheries, biodiversity, habitat preservation and recreation, although it is recognized that these needs often compete. The challenge to using a watershed approach for source water protection is that watersheds often do not fit neatly into existing municipal or legislative boundaries, which can make planning and enforcement difficult.

Why a Watershed Approach is Necessary: Small streams and their watersheds are the ultimate source of drinking water, whether it is obtained from the surface or ground water. They also supply the water used to irrigate lawns, crops or golf courses. Small streams, and their floodplains, serve as a conduit for dangerous floodwaters, act as a natural flood control and are the single most important habitat for both terrestrial and aquatic wildlife in any landscape. Not only do streams provide the waters that sustain life, but also they create a critical wildlife corridor that links downstream habitats with upland ones. The stream itself supports a diverse aquatic community and performs the vital ecological role of processing carbon, sediments and nutrients (CWP, 2000).

The health of each stream is fundamentally influenced by how the land in its small watershed is managed. The services provided by small watersheds are maximized when their land area is maintained in a natural condition. The value of watershed services begins to diminish when the land within a watershed is altered such as when forests are converted to farms or ranches. While these losses are detectable, they tend to fairly subtle, particularly if landowners adopt good farming or ranching practices. However, watershed services begin to decline very rapidly when poor agricultural practices are used or these lands are converted to urban uses. As urban development diminishes many of the watershed services that were once plentiful and free, expensive substitutes such as flood controls, storm-water pipes or drinking water treatment plants must be constructed. These losses can be sharply reduced when good watershed protection practices are applied, even in urbanizing areas. The health of a watershed can be maintained by protecting it from the impact of development, using a common set of basic tools: watershed planning, land conservation, aquatic buffers, low-impact development principles, sediment/erosion control, storm-water management practices, control of non-stormwater discharges and watershed stewardship (CWP, 2000).

Reference

Center for Watershed Protection. 2000. *The Practice of Watershed Protection*.

Chapter 4 – How the Lake Linganore Watershed Fits into the Frederick County Comprehensive Plan and the 1992 State Planning Act

The protection of ecological resources such as the Linganore watershed is called for under the 1992 State Planning Act and the Frederick County Comprehensive Plan.

Economic Growth, Resource Protection And Planning Act Of 1992: On October 1, 1992, the *Maryland Economic Growth, Resource Protection and Planning Act of 1992* took effect. The *Planning Act*, as it is called, amended *Article 66 B* of the *Annotated Code of Maryland*. The 1992 *Planning Act* requires local governments to incorporate and implement a comprehensive set of principles called the *Seven Visions* through their comprehensive plans. The visions describe how and where growth and development should occur, and call for a land and water stewardship ethic to guide individual and group action. These visions have been adopted as official State policy. The major components of the *Seven Visions* that deal with natural resource preservation are:

- Environmentally sensitive areas are protected
- Conservation of resources, including a reduction in resource consumption, is practiced
- Stewardship of the Chesapeake Bay and the land is a universal ethic

Sensitive Areas Element: Maryland's *1992 Planning Act* also states that Comprehensive Plans shall include a "Sensitive Areas Plan" that contains goals, objectives, principles, policies, and standards designed to protect sensitive areas from the adverse effects of development, including:

- Streams and their buffers;
- 100-year floodplains;
- Habitats of threatened and endangered species; and
- Steep slopes

The *1992 Planning Act* also permits Sensitive Areas Plans to include other areas that the County determines are in need of protection (COMAR). As such, Frederick County has designated the following areas as Sensitive Areas:

- Monocacy Scenic River;
- Areas of prime agricultural soils outside of planned community growth boundaries;
- Groundwater resources, particularly with regard to wellhead protection areas;
- Wetlands;
- Limestone conglomerate/carbonate rock areas; and
- Historic and archaeological resources.

Countywide Environmental Resource Policies from the Frederick County Comprehensive Plan (Excerpts):
The following Frederick County Environmental Resource Policies are extracted from Frederick County's Comprehensive Plan, Volume I, adopted October 1998.

1. Surface Water-Related Policies

- Frederick County will acquire, through easement and/or fee simple acquisition, lands that are critical to the quality of key water supplies.
- Frederick County will establish specific development standards for construction activities adjacent to Class III or IV streams.
- Public water impoundments will be protected from the danger development represents to the quality and quantity of water in such areas. Surface water resources must be managed effectively to provide for continued use by future generations.
- The County will develop and implement watershed management plans, including wetland protection and wetland restoration elements, for guiding land use decisions.

2. Stream Valley Buffers/Corridors Policies

Frederick County shall undertake a study to delineate stream valley buffers/corridors, which require special considerations. Once such buffers/corridors have been identified, the County will develop policies which may limit building or disturbance of land within the defined stream valley corridors unless this activity is necessary to alleviate an undue hardship that would otherwise be suffered by the property owner (e.g. installation of a drain field or construction of a road crossing to ensure that a property may develop to its potential under County policy). Linganore Creek is among the major stream systems to be considered for these studies.

3. Steep Slopes and Moderately Steep Slopes Policies

- The County will study for possible implementation, the regulations to prohibit development on slopes with a grade of 25% or more.
- The County will establish special performance standards for development in areas with grades ranging from 15% to 25%, comprised of severely erodible soils.

4. Vegetation and Wildlife Habitat Policies

- Efforts to minimize soil erosion on construction site are required. The disturbed areas shall be revegetated as quickly as possible with native plant species to ensure permanency and low upkeep.
- The County shall encourage the retention of a concentration of trees in vegetative buffer zones for use by game/migratory birds and mammals.
- The County will continue to encourage and direct Forest Conservation Act planting to stream valley/buffer areas.

References

Annotated Code of Maryland Section 3.05 (a)(2), Article 66B

Frederick County Comprehensive Plan, Volume I: Countywide Plan, October 1998

Maryland Economic Growth, Resource Protection, and Planning Act of 1992, October 1992. Codified at Section 3.05 (a)(1) Article 66B, Annotated Code of Maryland.

Chapter 5 – How the Lake Linganore Watershed Fits Into the Chesapeake Bay Agreement

Background: In 1983 and 1987, the States of Virginia, Maryland, and Pennsylvania, the District of Columbia, the Chesapeake Bay Commission and the U.S. Environmental Protection Agency signed historic agreements that established the Chesapeake Bay Program partnership to protect and restore the Chesapeake Bay's ecosystem. The partnership has explicitly encouraged protection and restoration of the subwatersheds (such as Linganore Creek) that make up the larger Chesapeake Bay watershed.

The signatories of these original agreements reaffirmed the commitments to restore the Chesapeake Bay in June of 2000. This agreement, called *Chesapeake 2000*, contains ambitious goals, action plans and policies. The section entitled, 'Vital Habitat Protection and Restoration' states:

> "The Chesapeake Bay's natural infrastructure is an intricate system of terrestrial and aquatic habitats, linked to the landscapes and the environmental quality of the watershed. It is composed of the thousand miles of river and stream habitat that interconnect the land, water, living resources and human communities of the Bay watershed."
>
> "In managing the Bay ecosystem as a whole, we recognize the need to focus on the individuality of each river, stream and creek and to secure their protection in concert with the communities and individuals that reside within these small watersheds…. Our efforts to preserve the integrity of this natural infrastructure will protect the Bay's waters and living resources and will ensure the viability of human economies and communities that are dependent upon those resources for sustenance, reverence and posterity."

Selected watershed goals in *Chesapeake 2000* include:

- By 2002, each jurisdiction will work with local governments and communities that have watershed management plans to select pilot projects that promote stream corridor protection and restoration.
- By 2004, each jurisdiction, working with local governments, community groups and watershed organizations, will develop stream corridor restoration goals based on local watershed management planning.
- By 2010, work with local governments, community groups and watershed organizations to develop and implement locally supported watershed management plans in two-thirds of the Bay watershed covered by this Agreement. These plans would address the protection, conservation and restoration of stream corridors, riparian forest buffers and wetlands for the purposes of improving habitat and water quality, with collateral benefits for optimizing stream flow and water supply.

Chapter 6 – The Lake Linganore Community and Its Three Major Organizations

In General: Lake Linganore at Eaglehead was approved as a Planned Unit Development (PUD) in July 1968. The original area of 2,200 acres was subsequently increased to 3,256 acres in 1970, and finally increased to its present size of approximately 3,730 acres in 1972. The PUD plan provided for a mixture of residential housing types including single-family, villas, garden apartments and towers. In addition to the residential activities the plan proposed areas for village centers, community facilities, commercial activities, open space areas as well as the primary amenity of one large lake and five smaller lakes.

As of June 2002, a total of 3,300 lots had been formally created and recorded in the land records. Approximately 2,200 of these lots have been developed. An additional 5,700 lots are in varying stages of the approval process, but the creation, recordation and ultimate development of many of these have been constrained for a number of reasons.

A number of forested stream valleys with slopes of 40% and greater present in the PUD, and significant forested lands, including those listed in the State's GreenPrint Program, are limiting factors in the extent and amount of future development that may be permitted. Additionally, development is constrained by the County's Adequate Public Facilities Ordinance (APFO) which states that "...new residential, industrial and other development take place in accordance with the Frederick County Comprehensive Plan and the Capital Improvements Program to ensure that adequate public facilities and services are available concurrent with new development so that orderly development and growth can occur....".

Description of the Three Primary Lake Linganore Organizations: There are three major organizations within the Lake Linganore community with significant responsibilities for the Linganore Creek watershed, including Lake Linganore and the smaller lakes within the PUD, as well as several miles of large and small streams:

1) **The Lake Linganore Association (LLA)** is the governing body of the community, with members elected by owners of property in the PUD.
2) **The Lake Linganore Conservation Society (LLCS)** is a 501(c)3 non-profit corporation established to implement storm-water management improvements within several of the villages in the PUD and address problems within the Linganore Creek watershed that affect the Lake Linganore community.
3) **Land Stewards, Inc**. is currently the major developer in the Lake Linganore PUD and, as such, is responsible for managing most of the undeveloped land within the PUD.

Lake Linganore Association (LLA): Members of LLA's Board of Directors are elected for two-year terms on a staggered basis. The Board is responsible for gathering homeowners' association dues from property owners and spending those fees on management, maintenance, improvements and other activities that would be expected for a private community of about 8,000 residents. LLA is also responsible for enforcing homeowners' association covenants, including several that are designed to protect and preserve the natural environment. In particular, the LLA owns a narrow buffer of land along most of the shorelines of the lakes and streams, and has the authority to regulate how that land is used. LLA's ability to control how that land is used is subject to formal restrictions related to county water and sewer easements along the lake's shores and to informal habits of usage by lakefront landowners who are accustomed to using the land as they choose.

Lake Linganore Conservation Society (LLCS): The LLCS is a separate and distinct organization from the Lake Linganore Association. LLCS was created in response to several serious problems with privately developed and maintained roads in many of the villages that were in need of major repairs or reconstruction. These problems occurred in large part because the roads had been constructed without sufficient storm-water management techniques in place, and those that were built in at the outset had been allowed to deteriorate. LLCS' scope extends beyond the boundaries of the immediate community, to the entire watershed feeding the lakes of Lake Linganore at Eaglehead.

Community Development Authorities (CDAs): The LLCS worked with elected county and state representatives to create a community development authority (CDA) through which residents could tax themselves to pay for necessary stormwater management and road improvements. Petition drives, followed by supporting votes by residents of several villages led to approval and funding of the CDA. It does not cover all or even most of the PUD, but it does cover the older villages where most of the residents live.

Land Stewards, Inc.: In 2002, Land Stewards purchased the development rights to the balance of the PUD from Eaglehead Development Corporation – the major developer for 16 years. Eaglehead Development generally took a pro-conservation stance toward development, working with LLA and LLCS to find ways to build out the community while practicing good conservation principles.

As the primary developer, Land Stewards is responsible for about 40 percent of the 3,811 acres of land within the PUD, including land in undeveloped villages at the head of Lake Linganore (the Hamptons and the Isles of Balmoral), along the north shore near the main dam (Aspen), on most of the south shore west of "Quiet Cove," and below the dam on Linganore Creek (Woodridge).

Community Interest: There has long been interest among the residents of Lake Linganore to address environmental problems affecting the community. This interest, prior to the mid-1990s, took the form of ad hoc committees (e.g., the "lake ecology committee"), which were able to document problems but did not have the resources to address them. Beginning in the mid-1990s, however, several of these committees were

able to secure support by working with appropriate government agencies and by raising the issue to the level of LLA action. Two examples are significant:

1) The state's dam safety inspectors determined that Lake Merle's dam was structurally not strong enough due to additional homes built within its danger reach. An ad hoc committee actively supported by the LLA Board of Directors developed a cost-effective solution that was approved by the dam safety inspectors, and the residents of the PUD agreed to pay additional fees to make the repairs.
2) A few residents of the Summerfield village determined that a15-acre field, a major portion of the watershed for a small stream flowing into Lake Linganore, should be reforested. The residents obtained the cooperation of the state forester's office and formed a partnership with an elementary school. The result was a major reforestation and environmental education project. Residents of the village and school children have maintained the project with support from LLA.

Friends of the Lake (FOL): In March 1999, the LLA Board of Directors approved the charter of an environmentally focused committee, the Friends of the Lake (FOL), and subsequently approved the committee's broad mandate "to serve to protect, preserve and restore our community's land, water, forests and wildlife by promoting environmental awareness, community involvement, and good environmental practices." FOL is a committee of the Lake Linganore Association and has no independent authority.

FOL and LLCS have also worked closely to identify environmental problems in the community and potential resources to address them. Environmental education has been a significant part of the mission for LLCS and FOL; both organizations disseminate environmental information through monthly columns in the LLA monthly newsletter.

Other projects since the mid 1990s have been the reforestation and planting of stream buffers in four villages, with the FOL committee working closely with the state forester's office and winning a Maryland 2000 grant to create and maintain a native plant garden to demonstrate the value of native plants in the landscape. FOL has worked with other LLA committees to improve trails in the community and reduce erosion.

Chapter 7 - History of the Linganore Creek Water Supply Systems

Linganore

The Linganore Creek Water Treatment Plant (WTP) was originally constructed in 1932 and was upgraded in 1993. This WTP relies on Linganore Creek for its source water, and the safe yield prior to the construction of Lake Linganore was severely limited by the amount of water available from the creek. The construction of the 883 million gallon Lake Linganore in 1971 augmented the flow in Linganore Creek, and increased the capacity of this system to a permitted safe yield of 3.2 million gallons per day (MGD). A December 2000 agreement among the City, County, Lake Linganore Association (LLA) and the State, allows the City to secure enough water from the lake to provide their required flow-by, and increased the City's Linganore Creek water supply safe yield to 6.0 MGD. The agreement requires the LLA to increase the flow-by as needed from the lake to ensure that the City has 6.0 MGD for its WTP as well as 4.46 MGD to maintain flow-by at the City's Linganore Creek WTP.

Through this agreement, the County also evaluated the safe yield of Lake Linganore. The result of this analysis indicated that Lake Linganore could also provide a safe yield of 2.4 MGD for the County. The County has a permit to withdraw .75MGD of water (maximum 1MGD) from Lake Linganore. However, the 1996 Memorandum of Agreement with the Lake Linganore Association limited the drawdown of the lake to no more than 15 inches below the spillway. This condition does not allow the County to define a safe yield for the Lake Linganore supply. The use of the lake as a County water supply is further complicated by the impact of years of sediment deposition in the lake. Because of the limitations of the lake as a safe source of water during times of drought, the County has increased its reliance on the Potomac as the primary water resource, and after the Ballenger Creek water line is constructed into this service area, Lake Linganore will be considered a backup resource.

Monocacy River

The City's Monocacy River WTP was constructed in 1960 with an initial design capacity of 2.0 MGD. The treatment facility's capacity was increased to 3.0 MDG in 1988. During periods of low river flow, the City has to cease all water withdrawal from the Monocacy River to maintain its flow-by requirement. This means that this water supply has no safe yield, and therefore only provides a backup for the City's two other water supplies.

Potomac River

The City has agreed to purchase water from the County's Potomac source to augment its current and future needs. They have requested 8 MGD "immediately" and 12 MGD in the future, and have budgeted a proportionate share of the expansion of the New Design WTP and transmission main needed for delivery. The construction of an inter-connection point is anticipated by early 2005. In the meantime, the City of Frederick has drilled a production well with a yield of 365,000 GPD, which is being permitted through MDE, although the actual permitted withdrawal amount is still undetermined.

II. Source Water:

Studies and Assessments

The Linganore watershed has been the subject of many studies and assessments over the years. Although the studies were conducted by different entities, at different times, and for different specific purposes, they reached many of the same conclusions.

They have all found that sediment and the nutrient phosphorus associated with this sediment are key problems for Lake Linganore. Most of this sediment is coming from agriculture, although development in the watershed is also a contributing factor. Future development slated for this steeply sloped area will likely exacerbate the problem.

The following section describes five of the most important assessments done in the Linganore watershed and makes recommendations for how to address the issues that they identify.

Chapter 8 - Siltation and Sedimentation Engineering Study

In General: In 2002, Whitman, Requardt & Associates, LLP (WRA) conducted a capacity study for Lake Linganore at the request of the County. According to their report, they estimate that the lake lost 13% of its capacity as a result of sedimentation between its construction in 1972, and 1999. This equals 320 acre-feet of siltation and a loss of 104.5 million gallons in volume. They based their estimates on a comparison of pre 1972 topography with aerial photographs that were taken in 1999, during a period when the water level in the lake was especially low. While this methodology does not precisely measure the amount of siltation in the lake, it uses available data to make its estimations, and it is the only report of its kind for Lake Linganore. The Lake Linganore Association believes that the report understates the siltation problem in the lake.

Possible Solutions: The Whitman and Requardt team estimated the costs for several possible solutions to the volume capacity problem in the lake. Although they concluded that the installation of a rubber dam at the spillway was the most cost-effective solution, they recommend dredging and the installation of a forebay to address the problem more thoroughly. Future sedimentation problems would be ameliorated by the forebay and dredging.

WRA acknowledged its draft study estimating the loss of capacity in Lake Linganore due to siltation was not based on comprehensive direct field measurements. The method they used subtracted the lake volume implied by elevation contours taken from limited 1999 data (obtained during a 15-foot draw-down) from the lake volume implied by elevation contours taken (at all depths of the 38-foot deep lake) from pre-1972 data. WRA's estimate assumed that most of the original capacity below 14-foot depth has been lost due to siltation. The Lake Linganore Association (LLA) questioned this methodology, and their reviewer recommended two corrections. First, that WRA adjust the pre-1972-contour height assignments to produce an area at the normal pool elevation equal to the 215 acres found at the normal pool elevation in 1999. WRA's calculation implies that the lake surface area actually grew by 20.7 acres between 1972 and 1999 – contrary to observation. Second, the reviewer questioned the study's assumption that most of the deep water capacity has been lost to siltation, observing that silt deposits are heavily concentrated at more shallow depths in the upper half of the lake and that in the lower end of the lake current sonar depth soundings show many readings in the 22 to 38-foot range. Furthermore, the LLA requested that WRA assess the impacts of raising lake levels by installing a rubber dam on top of the existing spillway on LLA trails, beaches, and other property as well as the County's sewer pipe system as a preliminary step to determining the option's feasibility. No final report of the Whitman and Requardt study has been approved by Frederick County.

References

Lake Linganore Frederick County, MD Siltation & Capacity Report. December 9, 2002. Whitman, Requardt & Associates, LLP Baltimore, MD.

Chapter 9 – Maryland Department of the Environment (MDE): Summary of Source Water Assessment

In 2002 MDE conducted a survey of the three surface drinking water sources for the City of Frederick– the Monocacy River, Linganore Creek, and Fishing Creek Reservoir. Concerns and observations for Linganore Creek include:

- Sedimentation and siltation in the lake are major concerns.
- Geese migration/activities around Lake Linganore pollute the lake.
- A sewer line owned and operated by the County along the shore and above Lake Linganore has experienced some leakage in the past.
- The water treatment plant yard and roof storm drains discharge storm water to the creek above the intake.
- There is an abandoned dumpster and discarded construction material located in the city-owned property above the intake.
- Development in the watershed, specifically the Spring Ridge development that is located contiguously with the Linganore Creek east of the City's intake, may negatively impact water quality. A sediment trap pond from this large development drains to the creek approximately three hundred yards above the intake.
- Lake Linganore Association members expressed concerns that under existing local regulations the watershed is not protected and is subject to development and other land use changes.

Non-Point Concerns: According to 1997 Department of Planning land use data, 61% of the watershed is used for agricultural purposes (54.4% cropland, 6.6% pasture). Land used to grow crops can be a source of nutrients (from fertilizer), synthetic organic compounds (herbicides) and sediment load. Pastures used to graze livestock can be sources of nutrients and pathogenic protozoa, viruses and bacteria from animal waste. Careful farm management in the Linganore watershed is especially important due to potential impacts on drinking water quality.

Less than 13% of the watershed is listed as residential, but there are two areas of concern based on their size and location:

1) Lake Linganore at Eaglehead, a Planned Unit Development (PUD) community, is located between I-70 and Gas House Pike and is approximately 3,730 acres. The PUD and surrounding area consist of a mixture of housing types. The population of Lake Linganore at Eaglehead is approximately 6,300 persons with an ultimate potential of 9,000 units and a population of 20,000-25,000 persons.

2) Another large development is the Spring Ridge PUD located southwest of Lake Linganore, on both sides of I-70 and west of Quinn Road. A 1,534 lot, 1,880-unit subdivision, first granted preliminary approval in 1989, Spring Ridge has reached full build-out. The Spring Ridge Community contains a variety of housing

types—including senior apartments plus a school, swimming pool, a small commercial/employment area and a soon-to-be constructed fire station. Spring Ridge also contains an extensive linear park and trail system along Long Branch, which flows through the development and empties into Linganore Creek

Pollution due to non-point runoff from these large housing developments can be a major concern because of their close proximity to Lake Linganore and Linganore Creek and their location above the City's intake.

In addition to the above residential areas, there are two incorporated municipalities, the Towns of New Market, Mount Airy, two unincorporated communities, New London and Libertytown. There are also several rural subdivisions and housing developments in the watershed with on-site septic systems.

Point Source Concerns: The only point source of pollution located in Linganore Creek watershed is the Libertytown Wastewater Treatment Plant (WTP). The Libertytown WTP was built by the County in 1986 and has a capacity of 50,000 GPD. It treats an average flow of 30,000 GPD. The projected population of Libertytown is expected to be 1,050 by the year 2010. The wastewater plant will need to be expanded to 100,000 GPD to meet this projected population growth. The County has hired a consultant to examine two alternatives to the capacity issue at the Libertytown WTP: replacement or the construction of an interceptor to the Lake Linganore sewer system.

Transportation Related Concerns: Major roads in the Linganore Creek source water protection area include: Route 75 extends from the southern to northern boundaries of the watershed; Route 26 runs along the northern boundary for most of the watershed; and sections of Route 31 and Route 27 are also located within the watershed boundary. There are also numerous secondary roads and residential access roads throughout the watershed. Concentration of residential access roads with heavy traffic within Lake Linganore at Eaglehead and lack of proper stormwater management practices in some areas of the development can increase siltation of Lake Linganore.

Several local roads in the watershed are adjacent to and/or cross the tributaries of Lake Linganore and may be of concerns for spills. These include Boyers Mill Road (bridge over Lake Linganore), Gas House Pike, Old Annapolis Road, Woodville Road and Buffalo Road (bridges over Linganore Creek).

Land Use Planning Concerns: The most significant change is the increase in residential land use over the past several years. The changes in agricultural (cropland and pasture) land use appear to be modest (approximately 740 acres). A significant percentage of the land slated for new development on the south side of Lake Linganore, however, is currently forested and the potential residential or commercial developments of large tracts of forested land in the watershed threaten the water quality in streams and Lake Linganore.

Turbidity and Sediment: High levels of turbidity in the creek can result from storm events (rainfall) and snowmelt. The sediment loads into Lake Linganore are severe because of the high-density residential development surrounding the lake and the high percentage of agricultural land in the watershed coupled with the highly erodible soils and steep slopes typical of this watershed.

Future land use changes in the Linganore Creek watershed will likely increase turbidity contamination. Development of forested land will increase the amount of exposed surfaces that can lead to erosion.

Inorganic Compounds (IOCs): Several IOCs have been detected below the maximum contaminant level in the finished water from Linganore Creek WTP. Nitrate was the most common IOC detected with only one result exceeding 50% of the Maximum Contaminant Level (MCL)*. Unless livestock numbers, fertilizer usage and number of homes using on-site disposal drastically increase, it is unlikely that nitrate concentration will increase in the future.

*MCLs are standards set by the U.S. Environmental Protection Agency to ensure safe drinking water.

Disinfection Byproducts (DPBs): Trihalomethanes, also known as THMs, are formed along with other disinfection byproducts when chlorine is added to drinking water during the water treatment process. The amount of THMs allowable in drinking water has been restricted by the EPA and the State of Maryland because of possible links to cancer. THMs and haloacetic acids (HAAs) both exceeded 50% of the MCL.

The watershed is a major source of THM precursors. Lake Linganore's watershed includes approximately 86% agricultural and forested areas, and runoff from these areas contributes to the delivery of particulate and dissolved organic matter to the lake. Since phosphorus appears to be the limiting nutrient for algae growth in Lake Linganore, watershed management efforts should concentrate on control of this nutrient to reduce aquatic growth. A comparison between phosphorus loading (in terms of pounds per acre per year) from the discharge of the Libertytown Wastewater Plant and agricultural land in the watershed revealed that the contribution from the wastewater plant is rather insignificant compared to agricultural activities in the watershed.

Microbiological Contaminants: The fecal coliform data from different sources shows that counts periodically exceeded the level set by the State water quality. Sampling data indicates that highest fecal and *cryptosporidium* levels are associated with storm-water runoff. Sampling locations indicate that high levels are present prior to entering the reservoir, thus indicating that agricultural sources are likely to be significant.

Reference
Source Water Assessments for City of Frederick. Frederick County, Maryland October 2002. Prepared by: Water Supply Program, Water Management Administration, Maryland Department of the Environment 1800 Washington Blvd. Baltimore, Maryland 21230.

Chapter 10 – Total Maximum Daily Loads (TMDL)

In 1996, the Lower Monocacy River watershed, including Lake Linganore, was identified on Maryland's list of water quality limited segments impaired by nutrients and sediments. As a result, the EPA established Total Maximum Daily Loads (TMDLs) for phosphorus and sediments entering Lake Linganore. Analysis suggests that phosphorus is the limiting nutrient for the production of algae in Lake Linganore. The lake experiences frequent seasonal algal blooms, which interfere with water supply and recreational uses. The death and decay of excessive algae can cause violations of the water quality standard for dissolved oxygen resulting in a disruption of the lake's ecosystem balance and causing fish kills. Due to the propensity of phosphorus to bind to sediments, the overall suggested strategy is to simultaneously address the water quality problems associated with phosphorus and sediments.

The Technical Memorandum prepared by the MDE for the EPA and approved May 2003 identified the sources of sedimentation and nutrients based on land-use models. Table 1 provides estimates of loads by source, and Table 2 provides estimates of sediment loads.

Table 1: Phosphorus loads attributed to significant point and nonpoint sources for average annual phosphorus TMDL

Source		Percent of Total	Source Load (Lbs/yr)
Nonpoint	Agriculture	75.2%	3,577.5
	Developed Land	11.5%	547.8
	Forest	0.5%	24.9
Point	Libertytown WWTP	12.8%	609.0
TOTAL		100.0%	4,759.2

Table 2: Sediment loads attributed to significant point and nonpoint sources for average annual sediment TMDL

Source		Percent of Total	Source Load (Tons/yr)
Nonpoint	Agriculture	80.3%	5,660.6
	Developed Land	7.6%	533.1
	Forest	2.1%	152.3
Point	Libertytown WWTP	10.0%	707.0
TOTAL		100.0%	7,053.0

The water quality goal of the TMDL is to reduce long-term phosphorus and sediment loads to acceptable levels. Based on an initial assessment of current loadings, which may be refined as better data become available, it is estimated that a 90% reduction in phosphorus loads would be necessary to meet the TMDL for phosphorus. This reduced loading rate is predicted to resolve excess algal problems and maintain a dissolved oxygen concentration above the State's water quality standard, and should preserve about 48% to 79% of the lake's design volume over a period of 40 years.

Reference

Total Maximum Daily Loads of *Phosphorus* ***and Sediments for Lake Linganore, Frederick County, MD [DRAFT].*** Executive Summary. Prepared by: Maryland Department of the Environment, Montgomery Park Business Center, 1800 Washington Boulevard, Suite 540, Baltimore, MD 21230-1718, November 2002.

Chapter 11 – Frederick County and Maryland's Statewide Stream Survey (MBSS) Assessments

Frederick County and MBSS Assessments: In June 2002, the Frederick County Government published a "***Watershed Assessment of Lower Linganore Creek, Frederick County, Maryland."*** The assessment was required under the EPA's National Pollutant Discharge Elimination System (NPDES) portion of the Clean Water Act. The purpose of the County's assessment was to evaluate conditions in the watershed, identify water quality problems, describe opportunities to improve water quality, and develop a water quality plan. In addition, this study included computer modeling to assess watershed and subwatershed runoff and pollutant loading characteristics. Ten long-term stream monitoring stations were established to characterize aquatic resources within Lower Linganore Creek and its tributaries. Field activities included testing water quality, quantifying physical conditions through geomorphic surveys, completing qualitative habitat assessments, sampling benthic macroinvertebrates, and conducting electrofishing surveys.

The results of these surveys were generally good. Spring, summer and fall 2001 surveys indicated that the stream supports a variety of fish and macroinvertebrate biota, including several sportfish species. Analysis of habitat condition, benthic Index of Biotic Integrity (IBI), and fish IBI scores were within the second highest category (i.e., fair). Half of the stations received fish IBI scores of poor and very poor, which is indicative of high numbers of tolerant fish species. To some degree, these conditions are typical for streams in this region, and reflect the area's long agricultural history as well as more recent urban development.

Results of water quality tests from April and July/August 2001 indicated healthy stream conditions. Water temperatures were within a normal range for cool water streams. Dissolved oxygen concentrations were in a range considered healthy for aquatic biota. As expected in typical Maryland Piedmont streams, pH values indicated that the streams are well buffered from acid deposition. Turbidity readings in April were generally normal; however, summer readings were somewhat elevated. Spring and summer turbidity readings at the three mainstem sites indicate that water below the dam is less turbid than above.

Consistent with other studies that have shown that sediment loading is the primary problem in the Linganore watershed, nearly every one of the County's ten stations showed signs of stream instability, such as sedimentation and bank erosion. As observed in the field, four of the ten stations had moderate to severe bank erosion, suggesting high sediment loads. Embeddedness scores were good at six of the ten stations; however embeddedness scores of 40 percent and above were recorded at four stations, which suggests high sediment loads in some parts of the watershed. Habitat scores in the Lower Linganore Creek watershed generally ranged from marginal to optimal in June and September 2001. Lower scoring stations generally had higher embeddedness. A general lack of habitat such as instream rootwads and woody debris, large cobble and boulders,

and undercut banks also lowers habitat scores. Trash ratings were good for most of the stations, indicating minimal dumping and littering.

Fish IBI scores for Linganore Creek ranged from fair to very poor at the ten stations in July 2001, with most of the stations receiving a score of fair. Tolerance refers to a species' known ability to tolerate a variety of types of environmental degradation such as siltation, lowered flows, low dissolved oxygen, and contaminants. The prevalence of tolerant species indicates that degradational stresses are widespread. In spite of the Recreational Trout Waters classification for Linganore Creek, no trout were observed in habitat likely to support them during field sampling activities at the ten monitoring

Problems affecting water quality in Lower Linganore Creek and its tributaries are predominantly those arising from both urban and agricultural nonpoint sources. General problems evident in the watershed include alteration of natural flow regimes (i.e., rapid conveyance of stormwater into stream channels), sediment deposition, and physical habitat degradation. In many cases, problems have resulted in minor or moderate impacts, particularly where vegetated or forested buffer or existing stormwater management facilities have provided 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 is of greater concern.

Chapter 12 –Soil Characteristics in the Lake Linganore Watershed

The topography and soil types present in the Linganore watershed exacerbate problems with soil erosion and sedimentation. Most of the land in the Linganore watershed is generally upland entrenched by deep, narrow stream valleys. It is characterized by short, steep slopes that tend to speed runoff of excess water, animal wastes and sediment. In addition, soils in the Linganore watershed tend to be highly erodible. The fertility of these soils ranges from low to high. Major problems can occur in areas where the topsoil has been severely eroded and hard bedrock is just below the soil surface or areas where the surface layer of the soil is predominantly course fragments and gravel. These areas can erode very easily if they are not carefully managed. Because of the topography in the watershed many animal operations are located near a watercourse. Conservation measures to control erosion and proper management of animal wastes are necessary in order to sustain the long-term productivity of these soils.

The sedimentation and erosion problem has been the subject of several studies, some dating as far back as the 1950s*. Recent Soil Conservation District (SCD) studies confirmed the presence of highly erodible soils and related erosion problems and included conservation measures needed to reduce erosion and sedimentation on agricultural land, reduce soil nutrient losses, reduce sediment and nutrient loading of watershed streams and Lake Linganore and reduce pollutants from agricultural wastes. The SCD created a ten-year installation plan that included activities geared toward benefiting "wetlands, wildlife, fisheries, prime farmland, and water quality of streams and Lake Linganore." – and which proposed to treat 12,800 acres of cropland, including converting 2,600 acres to pastureland and trees. Forty-five waste management systems were to be installed at an approximate cost of $3,508,900 "with the Public Law 83-566 share being $2,311,400" (Watershed Plan 1989). The project has continued to receive funding each year since 1999 for technical assistance to help offset the costs associated with implementing agricultural best management practices.

General soil information

The predominant soils occurring in the highly dissected upland areas of this watershed are Blocktown, Mt. Airy, and Glenelg. These soils are characterized as shallow, moderately deep, and very deep respectively. All are well drained. They are formed from phyllite and schist bedrock and are somewhat acidic in nature. Other soils occurring in the upland areas of this watershed include Linganore, Hyattstown, and Conestoga. These soils are characterized as shallow, moderately deep, and very deep and are all well drained. They are more basic soils than the Blocktown, Mt. Airy, and Glenelg map units due to the geology of the phyllite and schist. The topography in these upland areas ranges from nearly level to very steep.

The predominant soils occurring in the uplands controlled by Metabasalt Greenstone geology are Myersville, Catoctin and Mt. Zion. These soils are found on summits, backslopes, footslopes and to a lesser extent in draingeways. They are characterized as

moderately deep and very deep, moderately well drained to well drained soils. The topography ranges from nearly level to steep.

The predominant soils occurring in the uplands controlled by quartzite geology are Stumptown and Edgemont. These soils are found to occur on ridges and back slopes. They are characterized as moderately deep and very deep, moderately well drained to well drained soils. Surface stones and rock outcrops limit land use to woodlots. The topography in this region ranges from gently sloping to very steep.

*Prior studies include the "Linganore Creek Project" of the Frederick Soil Conservation District, which was used for a Rural Clean Water Program (RCWP) application in 1979 and a "Work Plan Linganore Creek Watershed: A Watershed Program for Soil and Water Conservation" prepared by the USDA SCS in 1951.

References

Watershed Plan- Environmental Assessment for Linganore Creek for Frederick and Carroll Counties, published in August 1989 by the USDA Soil Conservation Service, specifically the Frederick Soil Conservation District

III. Agriculture:

Recommendations and Implementation Strategies

Agriculture is the predominant land use in the Linganore watershed. As noted in previous sections, one of the most serious threats to Lake Linganore as a drinking water source is the high sediment and phosphorous inputs that come from agricultural activities upstream. Where agricultural land uses have had an adverse effect on water resources, due to outmoded or inadequate management practices, stream restoration and agricultural watershed management tools will be necessary to stop further degradation and improve water quality and watershed conditions.

The following section summarizes agricultural programs currently in place in the County and makes several specific recommendations for changes to these programs or modifications to their implementation in order to protect Lake Linganore as a drinking water source.

Chapter 13 – Analysis and Background: Source Water Protection and Agricultural Land Use in the Lake Linganore Watershed

Impact of Agricultural Activities on the Watershed: According to the EPA, nonpoint source (NPS) pollution includes agricultural run-off, atmospheric deposition, contaminated sediments, and certain land-use activities that generate polluted run-off such as logging, construction and on-site sewage disposal. Agricultural activities such as confined animal feeding facilities, grazing, plowing, pesticide spraying, irrigation, fertilizing, planting and harvesting can introduce sediment and nutrients such as nitrogen and phosphorous into surface and groundwater. Nutrients that seep into the groundwater or are deposited into surface waters by overland flow can contribute to eutrophication if they are present in excess quantities. Sediment deposited on the bottom of a stream smothers fish eggs and benthic macroinvertebrates, and reduces the diversity and density of aquatic insects by degrading suitable, available habitat.

A report issued in July 2002 entitled, "*Riparian Areas: Functions and Strategies for Management*" by the National Research Council, a branch of the National Academy of Sciences, found that agriculture is probably the largest contributor to the decline of riparian areas as forested streamside areas have been cleared either for crops or for pastures. Livestock have a disproportionately negative effect on riparian areas, the report said, because animals tend to congregate in and near streams for forage and water. Other human activities, such as development, mining and recreation have also taken their toll on riparian zones. The restoration of riparian areas adjacent to streams and other waterways should be a national goal if the country is to restore the health of its waterways and protect biological diversity.

Best Management Practices: Agricultural best management practices (BMPs) aimed at reducing NPS pollution have focused primarily on soil erosion control (Logan, 1993). BMPs include a variety of farm management practices that help control run-off, reduce soil erosion and manage the application and storage of animal manure, fertilizers and pesticides.

One of the most widely utilized BMPs is a vegetated buffer along the stream to help control erosion and absorb nutrients that would otherwise go into the water. In addition to problems with sediment and nutrients, unbuffered streams also have elevated water temperatures and a lack of woody debris and vegetation compromise their ability to support aquatic life. ***Unfortunately, the State Department of Natural Resources reports that the waterways in Frederick County have some of the lowest amounts of forest buffers of any county in the State*** (Feely, 1996, personal communication).

Land-Use - Agriculture in the Lake Linganore Watershed: Although urban and suburban areas in Frederick County are growing rapidly, land use in the Linganore watershed is still predominately agricultural--mainly cropland and pasture. According to the 2002 statistics on taxable properties there are 374 agriculturally assessed properties in the

watershed, with an average property size of 88.0 acres. The 1997 Agriculture Census, for Frederick County indicates the average animal herd size is 22 animals for beef operations and 110 for dairy farms. The table below, from the 1997 Agricultural Census lists the numbers of livestock operations located within the Linganore watershed and their average property size:

Type of Farm Operation	Numbers of Farms	Average Size of Farm (Acres)
Beef	36	140.1
Dairy	27	163.8
Horses	27	104.1

At present only approximately nine dairy operations have adequate waste management systems in place. The remaining eighteen dairy operations may have inadequate systems and potentially contribute to surface water quality degradation allowing nutrients, organic materials, and pathogens to reach streams and Lake Linganore. Dairy operations were identified because many of these farms are located near streams and waterbodies and often lack proper wastewater disposal, runoff water management and manure application and management.

References

Feeley, P.A. 1996. Personal Communication. Maryland Forest Service, Maryland Department of Natural Resources, Frederick, Maryland.

Logan, T.J. 1993. Agricultural Best Management Practices for Water Pollution Control: Current Issues. *Agriculture, Ecosystems and Environment*, 46:223-231.

Chapter 14 – Existing Agricultural Programs in the Linganore Watershed

Watershed Resource Protection Plan: A Watershed Resource Protection Plan was created by the USDA's Soil Conservation Service and sponsored by the Frederick Soil Conservation District (SCD). The purpose of the plan was to improve water quality, maintain the recreational value of Lake Linganore and ultimately sustain property and aesthetic values in the watershed. The plan was also designed to help farmers and landowners maintain the agricultural economy and surrounding rural countryside. This kind of plan was necessary because soil loss from excessive sheet, rill, and ephemeral gully erosion was depleting the long-term productivity of the soil resource base and increasing the cost to maintain current yield levels. Erosion was attributed to inadequate farming methods, lack of best management practices, and soil loss on moderately and steeply sloping cropland. Land in the watershed that was too steep to plow was historically farmed with an unsound and unsustainable percentage of cropland. Inadequate management of animal waste in the watershed had also been contributing to the degradation of water quality.

The Plan included an assessment of the conservation measures needed to reduce pollutants from agricultural lands – soil erosion, sedimentation and nutrient loading of watershed streams and Lake Linganore. The City of Frederick, the Lake Linganore Association and the Frederick County Commissioners were all instrumental in gathering data for this project, and they all endorsed the final plan.

During the Plan's 10-year implementation period, approximately 12,800 acres of cropland were to be treated. Forty-five livestock manure management systems would also be installed at an estimated cost of $3,508,900. The plan was projected to reduce erosion by 65 percent on 12,800 acres of cropland assuming an 80 percent participation rate. Approximately 116,700 tons of manure per year would be properly managed for animal operations. Overall, the estimated reduction of sediment delivered to the streams and Lake Linganore was 41,200 tons per year.

The Resource Protection Plan was completed by September 30, 1999. Since September 1999, the project has continued to receive funding each year of approximately $50,000 for technical assistance to help offset the costs associated with implementing agricultural best management practices.

The Frederick County Soil Conservation District will continue to work with and provide assistance to farmers and landowners in this watershed to promote water quality and the installation of conservation measures to protect the interests of the community. Soil and Water Quality Conservation Plans will be written and best management practices will be implemented with on-going programs.

Other Programs: There are several other programs presently available in the Linganore Watershed that are addressing non-point source pollution problems. These programs include the Food Security Act of 1985, the Conservation Reserve Enhancement Program (CREP), the Environmental Quality Incentive Program (EQIP), the Linganore Watershed PL-566 Project and the Maryland Agricultural Water Quality Cost Share Program (MACS). These programs will continue to provide technical and financial assistance to landowners along with any other federal, state and local cost share programs that may be available.

The USDA, Natural Resources Conservation Service has allocated $1,282,930.18 for the installation of best management practices to date. Of that money, $471,409.10 has been spent on the installation of BMPs. The table below summarizes the BMPs installed using Linganore funds.

Best Management Practice	Extent	Cost-Share Amount (US Government funded portion)
Conservation Cover *	214.6 ac.	$32,190.00
Cover Crop *	22.8 ac.	$262.20
Critical Area Planting	3.0 ac.	$1,875.00
Grassed Waterway*	7.9 ac.	$22,770.96
Heavy Use Protection	0.6 ac.	$34,722.12
Pasture Renovation	94.2 ac.	$7,877.82
Roof Runoff Management*	7 no.	$17,103.22
Soil Testing	30.0 ac.	$750.00
Stream Crossing *	3 no.	$8,484.60
Stream Fencing *	15,883 ft.	$18,959.90
Stripcropping	293.8 ac.	$3754.80
Waste Management System*	10 no.	$271,937.86
Water Well	1 no.	$750.00
Watering Facility *	17 no.	$49,996.37

* The implementation of these practices is greater than reflected by this table. Other cost share programs (i.e. MACS, CREP, EQIP) have been utilized for application.

The level of use of these programs indicates the willingness and cooperation of the farm community to adopt conservation measures to protect their natural resources and conserve for future generations. Progress has been made in efforts to control erosion, sediment, and animal waste runoff but implementation of these best management practices has also been met with some resistance.

Factors creating a reluctance to adopt new best management practices have limited the success of the project. They include a poor return on agricultural operations, the high cost of implementing these practices, tenant operators and the uncertainty of making an

initial investment and being able to continue with the operation, the ever increasing population and the associated high value for land development in the area.

The agricultural community is aware that protecting our natural resources is an environmental issue of national concern. Farmers have been conserving soil since the 1930s with changes in tillage operations and cropping practices. Unfortunately, because agricultural activities involve large land areas, they are often cited as major contributors of water contaminants. The Linganore Agriculture Project was intended to educate, promote and encourage the adoption of best management practices in the farm community. Much success has been achieved made but it has not met all of the resource needs in this watershed.

Local Program: In July of 2002, Governor Parris Glendening approved a Statewide Cover Crop Program, recognizing the importance of reducing nutrient runoff into rivers and streams in Maryland located far from the Chesapeake Bay. The winter cover crop program has been extended beyond just the Eastern Shore to farmers throughout the State. The $2.4 million program authorizes $1.6 million for the Eastern Shore and $800,000 for the remainder of the State.

Cover crops are any close-growing grasses, legumes, or small grains grown primarily for seasonal protection and soil improvement. They are usually grown for one year or less, except where there is permanent cover as in orchards. Their purpose is to reduce leaching of excess crop nutrients into groundwater during the fall and winter months. Cover crops immobilize unused nitrogen and phosphorous from the root zone as well as control erosion during periods when the major crops do not furnish adequate cover. In addition to protecting water quality, cover crops add organic matter to the soil; improve infiltration, aeration, and soil tilth.

Chapter 15 – Agricultural Land Preservation in the Lake Linganore Watershed

In General: A total of 23 farms (3972 acres) in the Linganore watershed are involved in some type of land preservation program (as of May 2004). The various programs are described below:

Agricultural Preservation Program: The Agricultural Preservation Program is a joint County/State program to preserve farmland. Initial enrollment in the program is creation of an 'Agricultural Preservation District.' Enrollment as a 'District' makes the farmer eligible to sell a development rights easement to the State, specifically the Maryland Agricultural Land Preservation Foundation (MALPF).

Installment Purchase Program: The Installment Purchase Program (IPP) is a County agricultural preservation program that utilizes installment purchase agreements to forward-fund land preservation easement purchases. The IPP gives Frederick County the ability to use future dedicated revenues to purchase preservation easements today. The County increased its recordation tax in 2000 to fund this program, which pays farmers yearly interest payments with the principal amount of the purchased easement paid to the farmer at the end of the term, usually 10-20 years.

Upon formal establishment of an agricultural preservation easement in the County's IPP, a landowner must agree 'to implement and maintain a soil and water conservation plan as prepared by the Soil Conservation District Staff.' The soil and water conservation plan must be fully implemented within 10 years. Language in the County's IPP ordinance states, 'The Frederick County Agricultural Land Preservation Program Installment Purchase Program ranking system may be amended or revised from time to time.'

Critical Farm Program: This is a County program available only to full-time farmers who are contract purchasers of a farm or have purchased a farm within the last six months. The Frederick County Board of Commissioners votes to approve/deny an option to purchase an easement on a particular farm.

The County payment for the option to purchase an easement obligates the applicant to make all reasonable efforts to have the farm approved by the Maryland Agricultural Land Preservation Foundation as an Agricultural Preservation District. For a period of five years, the applicant must actively pursue the sale of an easement to the Foundation or another governmental/land preservation entity at a price no lower than the County option payment.

If the applicant successfully sells an easement to the State Foundation, the full amount of the County option must be repaid when easement settlement with the State occurs.

If the applicant is unable to sell an easement to the State Foundation within 5 years from the recordation of the option agreement, the applicant may elect to permit the County to record an easement similar to the MALPF easement or will have 60 days to cancel the option agreement by repaying the County the full amount of the price of the option, plus the interest for the entire period of the option.

If the Frederick County Board of Commissioners votes to approve an option to purchase an easement on the farm, it will be conditioned upon the creation and acceptance of a soil and water conservation plan on the farm. Commitment to the implementation schedule contained in the soil and water conservation plan will be a major factor in the County's decision to record an easement similar to a MALPF easement if the applicant is unable to sell an easement to the State Foundation within 5 years from the recordation of the option agreement and the County acquires the easement.

A summary of protected agricultural lands in the Linganore watershed:

Lower Linganore Watershed:

Agricultural Preservation Program		
Districts	5 farms	750 acres
Easements Purchased	0	--
Critical Farms	0	--
IPP	2 farms	564 acres
Maryland Environmental Trust Easements	0	--
TOTALS	**7 farms**	**1,314 acres 5.4% of watershed**

Upper Linganore Watershed:

Agricultural Preservation Program		
Districts	3 farms	471 acres
Easements Purchased	9 farms	1,635 acres
Critical Farms	1 farm	178 acres
IPP	1 farm	238 acres
Maryland Environmental Trust Easements	2 farms	136 acres
TOTALS	**16 farms**	**2,658 acres 9% of watershed**

Chapter 16 – Local Criteria and Recommended Programmatic Changes

Current MALPF Criteria: The State sets minimum eligibility standards for enrollment in MALPF and the program is administered by Frederick County and the State in an equitable partnership. Each farm property that is submitted for easement sale is required to have a soil conservation and water quality plan. This requirement began in 1985 and is intended to identify existing erosion and water quality problems on the land and to recommend BMPs or other conservation measures necessary to address them, along with a schedule for implementation.

The landowner is responsible for implementing the plan according to the schedule contained within the plan if an easement is purchased on the property. The implementation responsibility will be included as a special condition within the Deed of Easement.

According to MALPF guidelines, the County may impose criteria that could be in addition to or more stringent than the state criteria. Frederick County requires landowners to have a soil and water conservation plan developed within 1 year of enrolling in MALPF, or 'District' creation. The easement priority ranking system for farms applying to sell an easement contains a section on farm management. However, this section currently accounts for only 15 out of a possible 200 ranking points.

The purchase of an easement represents a significant investment in a farm by the County and State. The management practices applied to a farm in the past as well as the future will significantly impact the interests that the County and State share in a property following an easement purchase. In addition, the level of involvement in the farm from a particular property owner represents a contribution to the agricultural industry in Frederick County. The scoring is based upon soil conservation practices required and implemented, tenure and involvement in the farm, general farm maintenance and usage of land and other factors related to farm management.

Upon formal establishment of an agricultural preservation easement in the County's Installment Purchase Program, a landowner must agree 'to implement and maintain a soil and water conservation plan as prepared by the Soil Conservation District' but the application to initially enroll in the IPP simply asks if a soil/water conservation plan has been fully implemented or not yet fully implemented or revised. There are no questions on any specifics of the soil and water conservation plan. Language in the County's IPP ordinance states, "The Frederick County Agricultural Land Preservation Installment Purchase Program ranking system may be amended or revised from time to time."

The following are items of concern:

- Individuals that receive public monies to preserve the farming culture and way of life should be required to exhibit superior stewardship of the land and water resources.

- Farmers have a vested interest in maintaining the productivity and fertility of the soil. Water quality, in-stream and riparian habitat must also receive priority attention.

- With Frederick County's commitment to preserving agriculture should come a concomitant benefit to the aquatic resources of the County. The County should have full assurance that water quality is being protected when farms are in preservation.

- The Frederick County Board of Commissioners has the authority to amend, revise, rescind, or change a local program for the preservation of agricultural land when practices are needed to solve or address imminent threats to water quality.

- New stewardship requirements are needed for agricultural lands in the Linganore watersheds to address the water quality and water quantity of Lake Linganore.

- Higher priority should be placed on the installation or adoption of devices, practices, or structures that address water quality problems or potential water quality issues in the soil and water conservation plans on farms in the three Agricultural Preservation Programs. This will be achieved by:

Recommendations for Programmatic Changes:

- Modify/change the ranking forms used in the programs to better incorporate and reflect compliance with water quality components of a soil/water conservation plan—reallocate the weight given to the farm management section on the MALPF ranking system, taking into consideration timeliness of soil/water conservation plan and adoption of recommended BMPs, especially practices addressing water quality problems or potential water quality issues.

- Redesign the IPP evaluation form--elaborate on the water quality components of the soil/water conservation plan and assign points based on the date of plan creation and last revision; what BMPs has been adopted/implemented; and the timetable for adoption.

- Require yearly survey forms, sent by the Planning Department, that address plan status, implementation schedule and any outstanding water quality/soil erosion issues to be completed by landowner and returned to the Planning Department.

Chapter 17 – Recommended Changes to Land Preservation Program Applications

Maryland Agricultural Land Preservation Foundation (MALPF):

Recommendation:
The Taskforce recommends adding the following items to the "Frederick County Easement Priority Ranking System Form, Section IV Farm Management":

1) Preparation date of soil and water conservation plan.
2) When was plan last updated or revised.
3) How does plan address water quality issues associated with farm management?
4) To what degree or extent has the soil and water conservation plan been implemented?
5) Describe timetable for implementation of BMPs addressed in plan.

Installment Purchase Program:

Recommendation:
The Taskforce recommends expanding question #15 (*Is there a soil and water conservation plan on the property*) on the Program Application from to include:

If 'yes' supply the following information:

- Preparation date of the soil and water conservation plan.
- When was the plan last updated?

Chapter 18 - Further Recommendations

Recommendation:

- Establish a local cover crop program within the Linganore watershed to create an incentive and to encourage farmers to participate in the planting of cover crops.
- Create an incentive payment plan for farmers in the Agricultural Preservation Program who expedite the implementation of the soil and water conservation plan within 2 years of the plan's adoption.
- Institute a follow-up procedure to check if required soil and water conservation plan has been written by SCD for the MALPF, IPP, CF programs.
- Identify, using GIS, streams and their lengths; size and type of wetlands; and forest cover on farms enrolling in the 3 programs and keep with applications. In addition to simple documentation, this information could be used to identify possible future sites for voluntary environmental enhancement or restoration projects.
- Require yearly survey forms, sent by the Planning Department, that address plan status, implementation schedule and any outstanding water quality/soil erosion issues, to be completed by landowner in the 3 programs and included in their file.
- Emphasize the importance of the installation or adoption of devices, structures or practices that address water quality problems or potential water quality issues during the update or revision of soil and water conservation plans for farms in the Linganore watershed.
- Focus all soil/water conservation plans written for farms in the Linganore Watershed on the protection and restoration of water quality.
- Include the installation or adoption of devices, practices, and systems to reduce nutrient enrichment of ground and surface water as well as sediment pollution entering waterways as key components of new or revised soil/water conservation plans for farms in the Linganore watershed.
- Explore the development of a system that creates tax incentives for large landowners to implement BMPs that protect and restore water quality.

NRCS, local governments, NGOs and local SCDs should continue to aggressively pursue funding for conservation programs in the Linganore watershed. The federal government has acknowledged the importance of environmental conservation programs in conjunction with agriculture and significantly increased funding for a myriad of programs sensitive to the impact that agricultural practices can have on environmental systems.

IV. Development:

Recommendations and Implementation Strategies

Development around Lake Linganore has had negative water quality impacts. Ongoing and slated future development will only increase these impacts, however there are many things that can be done at the County level to mitigate these negative environmental impacts. The following section covers recommended changes to the Development Review processes and programs in Frederick County.

Chapter 19 – Forest Fee-in-Lieu Program

In General: The Fee-in-Lieu Program is a component of the Frederick County Forest Resource Ordinance (FRO). Developers who are subject to FRO have the option of paying into a County forest fund ("Fee-in-Lieu" Program) instead of planting forest on their development sites, *if* no priority areas exist on the development site. The County is then obligated by Maryland State law to plant forest, primarily in ecological priority areas with the collected monies.

In a nine year period since the full applicability date of the FRO, approximately $361,000 has been spent, principally in the 100-year floodplain along the Potomac River in the Monocacy Natural Resources Management Area.

Greatest Ecological Benefit: The Development Review and the Comprehensive Planning Staffs of the Frederick County Planning & Zoning Department believe that the greatest ecological benefit derived from future forest plantings can be obtained by planting forest buffers along agricultural streams in both the Upper and Lower Linganore watersheds.

These watersheds contribute to municipal water supplies for Frederick City and to a limited extent to Frederick County. Also, the residents of Lake Linganore Planed Unit Development (PUD) live in close proximity to Lake Linganore, which collects water from farms in the Upper and Lower Linganore watersheds. Improvement of these watersheds with riparian buffers can improve water quality at the main drinking water intake for 60,000 people in Frederick City and Frederick County. These watersheds directly affect the ecological health of the lake and the sedimentation loads.

The Planning Staff intends to recommend to the Board of County Commissioners that a majority of the Fee-in-Lieu funds over the next 10-20 years be spent stabilizing agricultural creeks and streams in these two watersheds. Staff estimates that these expenditures may range from $250,000 to $500,000 over the course of a 10-year period.

If this policy is approved, the County and/or other governmental agencies would have to initiate outreach and easement acquisition to/from private landowners. The Staff intends to structure the dollar values of the payment schedule between CREP payments and Forest Banking Program payments, in order to entice agricultural land owners in the target areas into the Fee-in-Lieu Program, but not to out-price Forest Banking Program payments.

[Incidentally, an exhaustive review of County Parks, Board of Education, and Maryland Department of Natural Resources land holdings and various town land holdings has been performed over the last 9 years. Most of the public lands in Frederick County available for Fee-in-Lieu plantings have either already been planted or are being reserved for obligatory FRO plantings, and therefore, no more substantial areas of public lands are available for Fee-in-Lieu plantings.]

This re-direction of Fee-in-Lieu expenditures to the Upper and Lower Linganore watersheds is independent of, but supports the efforts of the:

1) Source Water Protection Task Force (sponsored by the University of Maryland's Environmental Finance Center), which is focusing on ideas to improve the quality (and secondarily, the quantity) of drinking water supplies from the Linganore watersheds, and
2) Watershed Restoration Action Strategy (WRAS) for the Lower Monocacy River Watershed (sponsored by the Division of Public Works and the Department of Planning and Zoning), which is funded by an EPA Section 319 grant with physical assistance from the Maryland Department of Natural Resources.

Recommendation:
The Taskforce recommends that Board of County Commissioners adopt the Development Review/Planning Staff's recommendation that a majority of the Fee-in-Lieu funds over the next 10-20 years be spent stabilizing agricultural creeks and streams in the portions of the Upper and Lower Linganore watersheds that drain into Lake Linganore. The Staff intends to structure the payment schedule between the dollar values of CREP payments and Forest Banking Program payments, in order to entice agricultural land owners in the target areas into the Fee-in-Lieu Program, but not to out-price Forest Banking Program payments.

Chapter 20 – Development Plan and Construction Review

Linganore Small Area Plan

Recent History: In 2003, approximately 20 Lake Linganore citizens worked with the Frederick County Planning Department to create a Small Area Plan for the Linganore Community as part of the update to the New Market Region Plan. The Small Area Plan identified Areas of Environmental Concern and created Special Protection Areas in the Linganore Community. It also set goals and objectives to help protect the water quality of Lake Linganore in light of the development of thousands of lots adjacent to and near the lake, and specified actions needed to address water quality problems.

The Linganore PUD contains a wide variety of landscapes, landforms, and unique environmental features. Wooded stream valleys, wetlands, rock outcrops and steep, forested hillsides are ecologically valuable, contribute to high quality of life for Linganore residents and are also in need of special protection because they are adjacent to a drinking water supply for County and City residents. Instead of being considered only after development plans have already been submitted, these environmental features should be treated as a primary factor in the design and development of the Linganore PUD.

Recommendations:
The Taskforce recommends a phasing plan that limits the amount of land disturbed on any Linganore Community development site at a given time be required as part of all development plans. Super-silt fence should be used for all lot development, road and utility installation within 200 feet of waterways and on moderate to steep slopes. In addition, perched culverts/spanning bridges for stream crossings should be used to help maintain fish passages and wildlife corridors.

Special Protection Areas (SPAs): SPAs are areas in the Linganore Small Area Plan that are critical to the protection of the quality and quantity of the Lake Linganore drinking water supply and other related environmental features, such as steep slopes and forested lands. Protection of these areas should be accomplished cooperatively through the control of land use, site design, and protection of sensitive areas by the Planning Commission, and the provision of effective design, implementation, maintenance and monitoring of best management practices by the Division of Public Works and other County departments.

Special Protection Area Buffers: A 125-foot waterway buffer should be established in the Linganore Community to protect all components of the aquatic system.

Other Recommendations of the Taskforce:

Conflicting Agency Responses: The departments within the county responsible for issuing environmental permits, regulating development and storm-water management sometimes operate under conflicting or contradictory environmental principles and standards. There is a need to improve communication and coordination of policies among these departments. The County has consolidated a Development Review Department, which may help alleviate this problem.

There is also a need to educate those who are making the decisions on issues such as road design, stream set backs, storm water management, low impact development design principles and the importance of these issues in protecting water quality in the Linganore watershed.

Recommendation:
Grading: The Taskforce finds that the County inspects larger development sites but does not have adequate staff capacity to inspect smaller "spot lot" developments. These small-scale developments may be done hastily and without adequate care taken to minimize negative environmental impacts. This kind of impact is a concern due to the increasing conversion of land in the watershed from agriculture to residential development. It is the recommendation of this Taskforce that the County develop a new educational program for spot lot developers. The County could distribute these educational materials when the permit applicant comes in to the County offices for a permit.

Efforts to develop this kind of educational materials are already underway. The Frederick County Division of Public Works sediment and erosion control inspectors in the Environmental Compliance Section, the NPDES Program and the County video production staff are planning to create a video that will be available when developers apply for permits, and will also be shown on the county cable channel 19. The County is planning to create a handout to distribute in the interim until the video is complete. Until the County's materials are ready, the Lake Linganore Association (LLA) can also develop guidance for spot lots and should give information and support to small-scale developers. In a worst-case scenario, the LLA has the authority to remove a developer for breaking the rules.

While education is important, enforcement of permits is also necessary in order to ensure compliance with environmental regulations. The number of county inspectors needs to be increased so that they can inspect these smaller-scale developments. A staff increase is not an insignificant expense for the County and can be paid for in a variety of ways. If the protection of the water quality in the County is really a priority, then the funding for the new position(s) should be written into the County budget. An alternative, would be to set up a stormwater utility in the County, and use part of the funds collected to pay for additional inspectors. Beyond the ability to hire additional staff, the benefits of such a dedicated funding stream are numerous and there are many hundreds of examples of such utilities from around the country that can be used as models.

Recommendation:
Low Impact Development (LID) Processes: The Taskforce recommends that LID principles, contained in the County's Community Design Guidelines and Development Principles document, should be incorporated into all new development in the Linganore source water protection area to minimize stormwater pollution and water quality degradation. Frederick County's National Pollution Elimination Discharge System Municipal Separate Storm Sewer System "NPDES MS4" Permit requires that the County treat 10% of the impervious surfaces in the County 's urban areas. This Taskforce recommends that the Linganore watershed be a priority when the County is deciding where to recreate these pervious surfaces. We also recommend that pilot projects be conducted to demonstrate the efficacy of LID techniques in this particular geographic region.

Recommendation:
Stream Setbacks: The Taskforce recommends an increase in the stream buffer requirement from 50 feet to 125 feet for first and second order stream systems when un-mitigatable steep slopes are immediately adjacent the stream buffer. The Taskforce also recommends incorporation of the recommendations of the Linganore Small Area Plan with regard to expanded buffers.

Recommendation:
Suggestions for Home Owners Association Covenant Restrictions: The Taskforce recommends that the homeowners associations in the watershed modify covenants and Environmental Control Committee (ECC) Guidelines that they may have to include:

1. A requirement for stream/lake buffer zone maintenance;
2. A limitation of impervious surface;
3. and a minimum criteria for woody plantings- within the Linganore source water protection area, minimum landscaped areas or existing vegetation on an individual lot should not be less than 20% of the land area of the lot.

Recommendation:
Sign-off by LLA for Permits: The Lake Linganore ECC management recently hired a consultant to begin the process of revamping the Association's storm-water management guidelines for development on the remaining vacant lots in the older sections of Eaglehead. All building applications will have to have to include stormwater management in their site plan and have it reviewed and certified by a licensed engineer. In addition, the Taskforce recommends that the ECC approve all building permits for individual lot development within the Linganore PUD prior to final issuance by Frederick County

Recommendation:
Improving the Process for Obtaining a Variance on Setback Lines to Facilitate Avoidance of Natural Features: The Taskforce recommends that County Staff-level approval be allowed in lieu of Planning Commission approval for modifications to setback lines around important natural features. This will better accommodate the flexibility inherent in the current PUD district to preserve sensitive environmental features and to minimize grading and vegetation disturbance. This change would also accommodate any citizen's wish to preserve natural features such as rock outcroppings and trees on their property. Also, an exception should be made to allow staff authority to modify grading requirements and soil disturbance - for the purpose of protecting Lake Linganore as a drinking water source for Frederick City and County.

Recommendation:
Enforcement: The Taskforce recommends that the County employ an adequate number of staff to monitor and enforce the rules and regulations that are currently in place. If protecting drinking water is to be a reality in Frederick County, funding should be included in the budget for additional staff.

V. Infra-structure and Maintenance:

Recommendations and Implementation Strategies

Improperly controlled stormwater around Lake Linganore has caused erosion and damage to roads in the area. The following section identifies current practices that contribute to these problems and recommends steps that should be taken to help alleviate them.

Chapter 21 – Stormwater and Road Maintenance

Improperly Channeled Stormwater Runoff and Road Maintenance Issues: Poor stormwater management is one of the primary causes of damage to the roads in Lake Linganore at Eaglehead. Dirt and gravel roads erode where uncontrolled storm-water washes over them, impacting the condition of neighboring lakes and streams. Additionally, silt washed into the lake from these roads carries with it many contaminants such as motor oil and other fluids from vehicles.

Paving dirt and gravel roads is one possible solution to this problem. Unfortunately, asphalt is relatively impervious to water and so stormwater running over pavement tends to flow faster and in greater quantities than it would otherwise. The increased velocity and amount of stormwater runoff from paved surfaces often causes scouring and erosion of nearby soil and grassy areas. Properly designed roads should be designed to minimize width and reduce impervious surface in order to reduce storm-water run-off.

Current Efforts: In many communities, road standards have been adopted that reflect state and local highway construction. However, residential streets built to highway standards are excessively wide. The Linganore CDA is minimizing the width of roads and amount of pavement around the lake. They plan to design the roads within the CDA for the minimum pavement width needed to support travel lanes, on-street parking and emergency, maintenance, and service vehicle access. Narrow residential streets also reduce traffic speeds and thereby improve safety. Open section roads, without curbs and gutters, with grassed drainage channels are preferred over closed section roads. Because this type of road construction allows water to be filtered naturally by vegetation and soil, water can enter the soil over a large area, which can help maintain groundwater supplies. The principles used to guide the scope of improvements for the CDA mirror those promoted by conservation organizations such as the Center for Watershed Protection. and in the Model Development Principles Recommended by the Frederick County Site Planning Roundtable.

Funding for the first project of the Lake Linganore Conservation Society (LLCS), the construction of environmentally conscious roads and stormwater management systems within the Lake Linganore at Eaglehead community, is being provided by 30-year bonds being issued by Frederick County on behalf of the LLCS. The budget for this project was determined in 1997. At that time residents agreed to tax themselves to pay for the project based on these budget figures and this agreed upon tax rate may not be increased. However the County Commissioners did not approve the bond sale and sell the bonds until February 2001. During this delay, the County insisted on a change of scope not covered by the budget. Additionally, each individual village has its own budget due to concerns that the work in one village would be more costly than in another due to the state of the roads and topography. Once the work has been bid out under the new required change of scope, some of the villages may not be able to pay for the required upgrades.

Recommendation:
The Taskforce recommends that private road owners and the LLA adopt the standards and practices put forth in the "County Pavement Management Program" – keeping in mind that preventative maintenance saves money in the long run.

Alternative Salts: Road salt that washes into waterways can have many negative impacts including damage to aquatic life and ecosystems, salinization and contamination of drinking water supplies, and corrosion of concrete and metal materials used in bridges, roads and pipes. Frederick County currently uses sodium chloride for deicing in combination with cinders for added traction control. According to a report prepared for the county in 2002 by the consulting firm Versar Inc., there are already plans to add liquid magnesium chloride to the current deicing regimen. The report recommends that the County explore the economic feasibility of using alternative deicing chemicals, specifically suggesting calcium magnesium acetate and potassium acetate. Although these alternative chemicals are initially more costly, they are less corrosive to expensive infrastructure such pavement and pipes and are also more environmentally benign. Versar Inc. also recommend adding brine to salt mixtures to reduce the amount of salt needed to treat the road surface.

The savings accrued from the use of less chemicals as well as the reduction of damage to the living and manmade resources may very well offset the higher upfront cost of the alternative salts. The report also recommends that the County place barriers along streams and drainage areas to prevent salts from running or washing off into waterways.

Recommendation:
This Taskforce recommends that the County follow the recommendations made by Versar Inc. in their report

Herbicides for Weed Control: Herbicides applied to vegetation along roadways can be carried into nearby surface water by wind or runoff. According to the 2002 Versar Inc. report, Frederick County is using at least one herbicide (Pendulum) that is toxic to aquatic life. The County has in place a rule prohibiting the application of herbicides within 50 feet of a stream. The report recommends that this regulation be expanded to other aquatic areas such as wetlands and that the county invest in precision herbicide applicators, which would reduce the amount of herbicide, used and significantly reduce costs.

Recommendation:
This Taskforce recommends that the County follow the recommendations made by Versar Inc. in their report.

References

An Assessment of Road Maintenance Activities in Frederick County and Their Effect on Stormwater Runoff Quality. 2002. Prepared for the Division of Public Works by Versar Inc

Chapter 22 – Lake/Waterway Maintenance

Lake/Waterway Maintenance: Loss of volume from sedimentation is one of the main threats to the lake as a drinking water source. Most of the sedimentation (roughly 80%) comes from upstream agricultural sources. Future sediment loading needs to be reduced through agricultural best management practices (BMPs) and sediment control; however, sediment currently in the lake may need to be dealt with by dredging. Dredging is an expensive solution but may be eligible for inclusion in the Army Corps of Engineers Middle Potomac Process. Forebays should also be added to help capture sediment before it reaches the lake.

Dam Maintenance: The City, County and LLA have entered into a tri-party agreement dated December 14, 2000, which provides for shared responsibility for repairs and maintenance to the dam. Continued maintenance will be critical for the future of water supplies that depend on Lake Linganore.

Reference:

An Assessment of Road Maintenance Activities in Frederick County and Their Effect on Stormwater Runoff Quality. 2002. Prepared for the Division of Public Works by Versar Inc

VI. Homeowners:

Recommendations and Implementation Strategies

Lake Linganore was originally designed to provide recreational and aesthetic amenities such as fishing, swimming and boating for the Lake Linganore Community; however, the lake now serves as a drinking water supply for thousands of residents in Frederick City and Frederick County.

Unlike the Loch Raven, Pretty Boy and Liberty Reservoirs in Carroll and Baltimore Counties-- where thousands of acres of surrounding land are owned by a governmental entity--Lake Linganore did not function as a source of drinking water until the mid 1980's, so Frederick City and County do not own, control or manage the lake as a reservoir. All of the land surrounding the lake is privately owned and is subject to multiple impacts, including high sediment and phosphorus levels from storm-water runoff and agricultural runoff which exceeds state and federal water quality standards.

Specific threats posed by homeowners to the Linganore watershed as a drinking water source and suggested solutions are listed in the following section.

Chapter 23 – Lawn and Garden

In General: The runoff, excessive use and improper disposal of chemicals such as fertilizers, pesticides, herbicides and ice melting chemicals are a problem in the highly residential area around Lake Linganore. Education about the proper application and disposal of these chemicals is needed. Furthermore, the use of native vegetation that requires less maintenance should be encouraged. Partnerships with local nurseries and landscaping companies to promote the use of native plants should be explored. The Friends of the Lake and the Audubon Society both already hold annual native plant sales, and these efforts ought to be expanded.

Erosion from driveways and landscaping techniques that are inappropriate for this very hilly area is also a serious problem. Potential partners for outreach and education in this area include Frederick County Master Gardeners, the Alliance for the Chesapeake BayScapes Program, the Maryland Department of Natural Resources "Buffer in a Bag" partnership and the Friends of the Lake.

Some homeowners are consistently resistant to having vegetation between their homes and the lake for aesthetic reasons. Homeowners with little or no buffer who are opposed to planting trees need to be encouraged to plant shrubbery and grasses. This area of the County has the least variety of bird species. Perhaps homeowners who are not convinced to plant buffers solely for the water quality benefits they provide might be convinced to do so if there is also a benefit for birds or other wildlife. This may especially ring true with the homeowners who moved to the area for the feeling of living in "the country." Outreach avenues such as the community newsletter and targeted reminders need to be used to reach these homeowners. Stricter enforcement of buffer requirements by LLA is also needed.

Many homeowners are unaware that decomposing vegetative matter leaches nutrients and can clog storm systems and result in flooding. An educational campaign for the watershed should include a component on the importance of keeping storm gutters and drains clean of leaves and yard trimmings. Individual composting is forbidden by the community's covenants, however a community composting facility would give homeowners a place to dispose of yard trimmings.

Recommendation:
In addition to the education and outreach suggestions above, the Taskforce specifically recommends the establishment of a community compost facility, and educational activities to promote the idea of composting among homeowner's associations in the community. Alternatively the community could contract to have the trimmings picked up at their homes. This is clearly a more expensive and less ecologically friendly option than the community compost facility and should be considered as a second choice.

Chapter 24 – Vehicles, Pets and Home Improvement

Vehicles and Garages: Runoff from washing and repair of cars in the driveway or on the street, fluids allowed to leak from un-repaired vehicles and/or the inappropriate disposal of used motor oil and other fluids puts harmful chemicals into surface and ground water supplies. Most of the threat from inappropriate disposal of motor oil in this watershed probably comes from the more rural homeowners who are more likely to change their own oil or to use oil for dust laying.

Although this is not the most pressing threat to the lake, it is one that can be easily addressed through educational and outreach efforts. Homeowners need to be educated about the harmful effect of runoff that contains soap, oil and other automotive fluids and the use of commercial car washes and garages should be encouraged. Local media such as *Lake Talk*, the Frederick News Post, Frederick Gazette and local television stations are all good outlets for conveying this information to the public. In exchange for advertising space, local garages and service stations could fully or partially fund flyers that publicize who recycles oil locally and why that is dangerous and illegal to dispose of it in other ways.

All-terrain Vehicles (ATVs): The County appointed a Citizens' Zoning Review Committee (CZRC) that met from April 2002 through July 2003 to analyze the County's current zoning regulations and recommend possible changes to the County's land use regulations. The CZRC offered the following suggestions pertaining to ATVs:

- Performance standards are needed for ATV activities to establish requirements in order to limit noise, dust and other nuisance impacts across property lines.
- The CZRC recommends that those standards should include frequency, amount of use, decibel levels, dust, erosion and minimum lot sizes.

Recommendation:
The Taskforce recommends that the suggestions made by the CZRC be implemented pertaining to addressing the use of ATVs, primarily due to the sedimentation and damage to stream systems that ATV usage can cause.

Pet Waste: Pet waste contains nutrients and pathogens that can contaminate surface water. Around Lake Linganore, there are signs posted to remind residents about picking up after their pets and bags are provided–although trashcans to dispose of the waste are not. More bag stations are needed in other areas of the watershed, and trashcans should be put in where possible to further encourage the use of the bag stations.

Home Repair and Improvement: Paints or other chemicals used in routine home repair and improvement projects can enter surface and groundwater through runoff or by direct dumping. Education of proper disposal methods for these kinds of household chemicals and better promotion of county collection days are recommended.

Chapter 25 – Septic Systems

Septic Systems: Analysis of existing infrastructure shows that the Spring Ridge and Lake Linganore communities in the central portion of the watershed are currently served by public water and sewer, and that in the near future, service will be extended into the south-central portions of the watershed. Approximately two-thirds of the households in the watershed are currently served by residential wells and septic systems. Failing septic systems contribute nitrates and bacteria to ground and surface water.

In 1999, an initiative from Maryland's Tributary Strategy Program resulted in the creation of an On-Site Sewage Disposal Task Force. The taskforce identified management practices and policies needed to reduce on-site sewage disposal system (OSDS) impacts to protect public health, the health of the environment and the overall quality of life in Maryland. The taskforce created a report entitled, "*Reducing the Nutrient Impacts from On-Site Sewage Disposal Systems*."

Recommendation:
The County should consider further study of the recommendations made by the On-Site Sewage Disposal Task Force for possible implementation. These include:

- Identify areas within the State that need immediate protection from OSDS impacts, to be designated "Areas of Special Concern."
- Outline management districts and management agreements that should be required for Areas of special Concern, community and shared systems and newly installed or shared systems that utilize non-traditional technologies.
- Broaden existing educational efforts to reach homeowners, local municipalities and other key audiences.
- Call for immediate measures to address the problems of communities with widespread septic system failure.
- Implement a program to adopt the use of nontraditional systems and specify maintenance requirements.
- Encourage the use of shared systems with nutrient reduction where appropriate.

Furthermore, many septic tank owners know little about their tanks, their location or how to maintain them. Some suggestions for outreach and education are:

- An environmental column in the local newspapers.
- A paragraph about septic pumping in the free shoppers/trader handout.
- Publish a "Do you know....?" with an environmental message to be published as a newspaper inset.
- Recruit septic system maintenance companies to sponsor an educational campaign advertising their prices and assistance in locating the tank.
- Homeowner associations or neighborhoods might organize to get a group price from a hauler.

Wasteful water usage: At all times, but especially in times of drought, wise water use clearly needs to be made a priority in the Linganore watershed. Enforcement of water restrictions during times of drought is critical. Although the drought of 2002 has passed, it is still relatively fresh in the minds of the residents of the Linganore watershed. There is still time to drive home the message that water is not an infinite resource and to provide information on water conservation. Nonprofit organizations such as the Chesapeake Bay Foundation have water conservation kits that can be distributed to homeowners. There are a variety of other educational resources available to distribute to homeowners, or the County could create their own packet. The County or the Linganore community could also contact local stores about promoting water saving devices such as low flow faucets, drip hoses and rain barrels through advertising or promotional sales.

VI. Outreach:

Recommendations and Implementation Strategies

An education and outreach campaign targeted to homeowners would address many of the behaviors that threaten Lake Linganore and its watershed as a drinking water source.

Following are several avenues for outreach that can be used to convey information to citizens in the watershed. Many of these outreach mechanisms are already in place and can be used without much if any additional cost.

Chapter 26 – Watershed Restoration Action Strategy (WRAS)

In General: The Frederick County Government received a one-year grant in the fall of 2002 to create a Lower Monocacy Watershed Restoration Action Strategy (WRAS). The Lower Monocacy watershed encompasses the entire southeastern portion of the county and includes the Upper and Lower Linganore subwatersheds. The county has chosen to focus significant efforts on the Upper and Lower Linganore watersheds due to the importance of the areas to source water protection, and to address the Total Maximum Daily Loads (TMDLs) of sediment and phosphorus from Linganore Creek to Lake Linganore.

The Maryland Department of Natural Resources (DNR) sponsors the WRAS grant with pass-through funds from the Environmental Protection Agency's (EPA's) Section 319 Clean Water Act program. The County was awarded $40,000 in reimbursable funds plus several hundred thousand dollars worth of services from DNR. In return, the county committed to a 40% cost-share, which came mostly from contributions of staff time on the project. The grant provides for three types of services from DNR to assess watershed conditions, public outreach and education on watershed-related issues and the creation of a strategy to protect the Monocacy and its watershed. DNR's three types of services are a Stream Corridor Assessment (SCA), Synoptic Survey and GIS Watershed Characterization (WC).

The SCA uses members of the Maryland Conservation Corps to walk one hundred miles of streams in the Lower Monocacy watershed (with landowner permission) and evaluate conditions like erosion points, fish blockages, and exposed pipes. The result of this assessment is a GIS map with problem areas identified along with pictures on a GIS map layer. The Upper Linganore watershed is a primary focus of the SCA. The county may pay to assess the Lower Linganore Watershed independent of the WRAS, using the SCA methods.

The Synoptic Survey includes chemical and biological monitoring at around 70 sites throughout the Lower Monocacy region. The sites provide a snapshot of stream health indicators at one point in time and are also mapped in a GIS layer. The County and DNR are combining the efforts of this assessment with a volunteer stream monitoring program through the Maryland Biological Stream Survey (MBSS) "Stream Waders" volunteer program to use volunteers to collect data in addition to DNR staff.

The WC is a digital data analysis and presentation. One sample analysis uses the new soils maps prepared by SCD/NRCS and looks for highly erodible/hydric soils that do not have adequate buffer, particularly in headwater streams areas. Studies have shown that nutrient and sediment releases from these types of areas can pose the greatest problems downstream. The WC also shows maps of interest, such as the distribution of trout fisheries throughout the watershed, forest cover and other information pertinent to the creation of a WRAS.

The results of these studies and collaborative stakeholder involvement will be the creation of an action strategy. This strategy will rank known problems and existing mechanisms for improvement. The Action Strategy will also make recommendations for programmatic improvements in the watershed. Identification of the mechanisms for improvement will be a collaborative process, and the County will ultimately decide which, if any programs to adopt. The County will use the results of this process to help identify CIP and non-capital projects in its Restoration/Retrofit Assessments as described in the section below; the projects will help the County to meet its 10% impervious area reduction goal with the second generation NPDES stormwater permit.

Restoration/Retrofit Assessments: Watershed assessments or a WRAS alone do not bring a list of potential projects to a point they could be designed and constructed. A middle step involves taking a closer look at potential stream restoration and stormwater management facility (SWMF) retrofit projects, evaluating their feasibility, and prioritizing them with a decision matrix. The Upper and Lower Linganore watersheds were subject to a restoration/retrofit assessment in the summer of 2003. The assessments made use of the County's watershed assessment in Lower Linganore, results of the WRAS, and information from the Source Water Action Plan. Projects prioritized by this assessment will be evaluated for feasibility, proposed for design/build with the County's capital funds, submitted to outside funders for cost-share/grant/loan support, and/or constructed with available funds and resources.

The WRAS process underway for the Lower Monocacy includes community meetings, workshops and programs that will help educate citizens in the watershed. Implementation of the WRAS will be an ongoing process. Any opportunity to coordinate with this initiative, or to leverage resources through strategic partnerships should be explored. Contact: Shannon Moore-County Division of Public Works (301) 694-1413.

Chapter 27 – Media and Community Groups

Print and News Media: The publication *Laketalk* goes out to the entire Lake Linganore community and includes an entire page called "EnviroLine" dedicated to environmental issues. This is a great resource for reaching the community surrounding Lake Linganore. (Contact : Joy Gurley 301-831-6400, jgurley@lakelinganore.org). A watershed-wide campaign is needed to reach homes outside of the immediate lake community however. The major local media outlets such as the Frederick News Post and Channel 10 could be better utilized by both the County and the various organizations in the Lake Linganore watershed to reach a wider audience. Advertisements for upcoming events and/or a general public awareness campaign could be run through these media outlets.

Schools: Schools in the watershed should incorporate local watershed ecology into their curricula. For example, Linganore High could use a biology or chemistry class to do water quality monitoring or elementary schools could take field trips to learn about watersheds and where their drinking water comes from. An educational program should be developed about the Linganore watershed that can be taken to the schools as well. Furthermore, schools can utilize programs that provide materials and technical support for riparian tree planting projects such as the Chesapeake Bay Trust's Schools and Streams Program or the Seed Growout Program run by Community Commons.

Local authorities: Homeowners associations and other municipalities in the watershed may already have avenues for community outreach that can be used to promote watershed events or disseminate information. The Town of New Market is one notable untapped partner.

Community Groups: Community groups such as churches and grange organizations in Linganore, Libertytown and New Market could promote events in the watershed as community service. Scout groups and the 4-H Club should be engaged to do projects in the watershed.

Nongovernmental Organizations: The Audubon Society operates the Audrey Carroll farm near Linganore High School as well as the Archibald Farm north of the Town of New Market, and should be approached about the potential for partnerships and promotional opportunities. Other natural resource or outdoor-based groups in the watershed such as the New Market Hunt Club and Ducks Unlimited should similarly be engaged. Partnership with the Isaac Walton League in particular should be encouraged since they own a tract of land in the watershed.

Local Businesses: Commercial interests such as local plant nurseries and lawn care companies should be used more to distribute information and products about watershed-friendly landscaping. Local wineries should also be engaged to help spread the word about protection of the watershed's natural resources.

Appendices

Appendix A – Participants in the Lake Linganore Source Water Protection Task Force

Federal
E.J. Fanning-U.S. Department of Agriculture –Natural Resource Conservation Service
Chad Wentz- U.S. Department of Agriculture –Natural Resource Conservation Service
Mark Seibert- U.S. Department of Agriculture –Natural Resource Conservation Service

State and University
Gul Behsudi-Maryland Department of the Environment
Dan Nees-University of Maryland Environmental Finance Center
Michelle O'Herron- University of Maryland Environmental Finance Center
Christine Rodick- Coordinator for the Hood College Monocacy Stream Monitoring Project

Frederick County
Donavan Corum-Frederick County Planning Department
Tim Goodfellow-Frederick County Planning Department
Carole Larsen-Frederick County Planning Department
Michael Marschner-Frederick County Division of Utilities and Solid Waste Management
Shannon Moore-Frederick County Division of Public Works
Liz VanHorn-Frederick County GIS Coordinator
Stephen O'Philips- Frederick County Planning Development Review Department- Principal Development Review Planner
Kay Shultz- Frederick County WRAS Coordinator

City of Frederick
Jeff Holtzinger-City of Frederick Engineering Department
Alice Miller-City of Frederick Engineering Department
Richard Lind-City of Frederick Engineering Department

Nongovernmental Organizations
Hilari Varnadore-Community Commons

Lake Linganore Groups
Stephen Hembree-Lake Linganore Association
Charlotte Dusold- Lake Linganore Conservation Society
Bill Strang-Lake Linganore – Friends of the Lake
John Snow-Lake Linganore Conservation Society
Alan Dinkelacker- Lake Linganore Association, President
Joy Gurley- Lake Linganore Association
Larry Dusold- Lake Linganore Conservation Society

Private Citizens
Jeff Burdette-Farmer
Denis Hood-Farmer
Lieutenant Colonel Donald Archibald-Director of Safety Environment and Integrated Planning for US Army Ft. Detrick
Frank Ellis- Linganore Resident-Former Lake Linganore Developer
Katherine Berkhousen- New Market representative