Contamination of Frederick City’s Drinking Water with Polluted County Surface Water

2011-2014

THE MONOCACY RIVER: muddy source for 28.6% of Frederick City’s drinking water

You can't make a silk purse out of a sow’s ear.
Executive Summary

In 2013 City of Frederick tap water violated federal health standards for carcinogenic chlorination byproducts\(^1\). Three of the 8 official sampling sites had contaminant levels above what is considered safe for drinking. This health hazard is a result of polluted source water (streams, rivers, lake); it is not due to any deficiency on the part of the Frederick City water treatment. Frederick County has a history of polluted surface water, Frederick City has a history of tap water contamination from the chemicals used to clean the polluted water. The two are naturally linked.

A review of tap water tests submitted to the State of Maryland by the City of Frederick reveal widespread contamination of city tap water with dangerous levels of chlorination byproducts. During the water treatment process chlorine mixes with organic material in the water (soil/sediment) and forms disinfectant byproducts (DBPs) that are known to cause adverse health effects\(^2\) and are regulated as carcinogens. Two of the most well-studied DBPs, Trihalomethanes (THMs) and Haloacetic Acids (HAAs)\(^3\) are found in Frederick City’s drinking water posing a potential health risk to Frederick City residents. The Maximum Contaminant Level (MCL) for safe drinking water established by the U.S. Environmental Protection Agency (EPA) is 80 parts per billion (ppb) for THMs and 60 ppb for HAAs.

Results from a Public Information Act request to the Maryland Department of the Environment for Frederick City water sampling data between 2011-2014 revealed that:

- 22\% of the 83 samples collected had greater than the 60 ppb safe drinking water standard (MCL) for HAA
- 8 \% of the 83 samples collected had greater than the 80 ppb safe drinking water standard (MCL) for THM.
- 42\% of the 83 samples collected had greater than 40 ppb HAA, which is below the MCL yet still in the range associated with health risks in peer-reviewed studies, including results indicating that exposure at these levels can impact the developing fetus and result in babies that are small for their gestational age when exposures occur during the 3rd trimester of pregnancy
- 11 \% of the 83 samples collected had greater than 60 ppb THM, which is below the MCL yet well within the range associated with health risks like birth defects, bladder cancer, stillbirth and small for gestational age babies
- MDE provided no data for the Fall 2011, Winter 2012, Spring 2012 and Summer 2012 and it is unclear if samples were collected\(^4\)


\(^2\) [http://www.ewg.org/research/water-treatment-contaminants](http://www.ewg.org/research/water-treatment-contaminants)

\(^3\) [http://water.epa.gov/drink/contaminants/](http://water.epa.gov/drink/contaminants/)

The Maximum Contaminant Levels (MCL) are set to protect against long term exposure. Frederick City drinking water violated the MCL at 3 of 8 sampling sites in 2013. Shorter-term, legal spikes above the MCL, like those mentioned above, may also be associated with serious health consequences, especially during pregnancy. The percentages of individual samples listed above that are above the MCL don’t translate directly into illegally high levels, however the spikes, which may be short-term and legal, could still be harmful (see Figure 1).

THMs and HAAs are the result of organic material in the water reacting with chlorine products used to treat it. The higher the levels of organic pollution in the source water the more difficult it is to treat, and the higher the levels of chlorinated by-products that are typically found in treated tap water.

Lake Linganore and Lower Linganore Creek provide 42.4% of the total surface water sourced for Frederick City’s drinking water (see Map 1). Current erosion levels at the Lake are 5 times the state standard, clearly contributing to Frederick City’s tap water contamination problem. In 2007 the Gardner Board of County Commissioners (BOCC) strengthened the county’s protective stream buffer ordinance so that it reflected the scientific recommendations to protect our source waters, streams and wetlands. In 2013 the Young BOCC reversed that and weakened the county’s protective stream buffer ordinance substantially. In addition, the Young BOCC has approved rezoning 1346 acres for residential development in the Lower Linganore Creek drainage, with 913 additional acres on the agenda for approval this summer (see Map 2).

Minimizing stream protection and adding additional pollution to Frederick City’s source water will make a problem that is already five times worse than it should be - even worse for the City. And, we should expect higher levels of these carcinogenic treatment by-products in Frederick City water.

Map 1: Lower Linganore Creek drainage, an important source for Frederick City’s tap water.

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5 Lake Linganore’s average sediment loading rate is more than 5 times higher than the MDE / USEPA TMDL of 7,073 tons/year (~4,700 cubic yards/year) based on 2012 USGS study average annual loading = 1 million cubic yards/40 years = 25,000 cubic yards/year. Water Volume and Sediment Volume and Density in Lake Linganore between Boyers Mill Road Bridge and Bens Branch, Frederick County, Maryland 2012, Scientific Investigations Report 2013-5082 ISBN 978 1-4113-xxxx-x

6 includes acreage waived by BOCC for annexation into the Town of New Market; town officials subsequently approved land development
Map 2: Development approved in 2013 and 2014, and development proposed for approval in 2014 in the Lower Lake Linganore drainage area

This is not only a public health burden but also one for taxpayers. In 2013 Frederick County and City announced intent to pursue a project to dredge part of Lake Linganore to increase water holding capacity lost from sedimentation. The City’s Public Works Department is looking at maximizing this effort while minimizing the cost to taxpayers; yet according to the Frederick News Post the estimated cost to dredge falls between $4 and $8 million.\(^7\)

Treating fouled water with chemicals can be more expensive than reducing pollution before it gets to the treatment plant. “The EPA found that every dollar spent to protect source water reduced water treatment costs by an average of $27. Philadelphia officials have estimated that every dollar they invest in green infrastructure to reduce storm water flows will more than double the economic benefits.”\(^8\)

**Friends of Frederick County and Cleanwater_Linganore recommend that the following actions be taken to protect the public drinking water for Frederick City:**

- Frederick County should establish source water protection areas with strict enforcement to protect drinking water and minimize health risks to City residents.
- The Maryland Department of the Environment should mandate that Frederick County once again strengthen its buffer zone ordinance to provide maximum protection for Frederick City’s drinking water sources.
- The Maryland Department of the Environment, Frederick County and City should monitor land use and organic matter in the source water drainage areas, rivers and streams, and make that information public on websites and in the Annual Drinking Water Report.
- Frederick County and City should do a thorough economic analysis of the public financial burden of revising the drinking water plans versus protecting the source water.

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Background

Frederick City get its water from Linganore Creek (42.4 %), the Monocacy River (28.6 %), the Potomac River (16.4 %) and from Fishing Creek (12.6 %). Because it is a surface-supplied system, it is vulnerable to pollution from runoff, soil erosion, development and agriculture. Lake Linganore and the Lower Linganore Creek are particularly vulnerable to soil erosion due to highly erodible soils, steep slopes, deforestation and poor existing land management. Given this vulnerability, Frederick County’s approvals or plans for rezoning 2259 acres for development is of serious concern. Approximately 67% of the acreage rezoned around Lake Linganore will be cleared for housing development there, and that means clearing forests and stream protective buffers on erodible slopes. Of the total 2259 acres rezoned for development in the Lake Linganore drainage it is expected that approximately 1514 acres will become impervious surfaces and altered natural landscapes, impacting our waterways with an increase of organic matter, pollution, and flash flooding that further damage stream banks and stream beds.

Citizens are concerned because Frederick City has a history of high levels of contamination in drinking water, and Frederick County has a history of high levels of pollution in some source water. In 2013 Frederick City violated federal health standards (Maximum Contaminant Level /MCL) of 60 part per billion (ppb) for Haloacetic Acids (HAAs) following the August 2013 quarterly monitoring period. The MCL was exceeded at 3 of the 8 mandated sample sites during that quarter. A study commissioned by Frederick County showed 70% of the Lower Linganore Creek and 40% of the Upper Linganore Creek tributaries to Lake Linganore had severe erosion problems, and the Lake Linganore’s average sediment loading rate is more than 5 times higher than the Environmental Protection Agency’s allowable limit. Irrespective of this sediment problem, in October 2013 the Young Board of County Commissioners weakened the county’s protective stream buffer ordinance substantially by lessening stream buffer requirements on moderate slopes from 150 feet to 125 feet, on steeply sloped hillsides from 150 feet to 125 feet and by allowing driveways, structures and recreational activities to occur within stream

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9 http://www.cityoffrederick.com/DocumentCenter/Home/View/347

10 http://frederickcountymd.gov/index.aspx?NID=2023, Staff Report for Rezoning Case R-12-01


12 http://www.cityoffrederick.com/DocumentCenter/Home/View/347

13 June 2013, Versar. Frederick County Stream Survey, 2008-2011 Four-year Report

14 Lake Linganore’s average sediment loading rate is more than 5 times higher than the MDE / USEPA TMDL of 7,073 tons / year (~4,700 cubic yards / year) based on 2012 USGS study average annual loading = 1 million cubic yards /40 years = 25,000 cubic yards / year. Water Volume and Sediment Volume and Density in Lake Linganore between Boyers Mill Road Bridge and Bens Branch, Frederick County, Maryland 2012, Scientific Investigations Report 2013-5082 ISBN 978 1-4113-xxxx-x
buffer protection areas. This is in sharp contrast to the 2007 Gardner Board of County Commissioners decision to strengthen the county’s protective stream buffer ordinance so that it reflected the scientific recommendations to protect our source waters, streams and wetlands.

There is a direct link between soil and sediment and toxic disinfection byproducts. When soil erodes from cleared land and scoured stream banks, it carries with it decaying vegetation and other organic matter; up to 20,000 pounds for every inch of soil from an eroded acre. Compounds called humic and fulvic acids dissolve from the soil’s organic matter. In water treatment plants the acids react with disinfectants like chlorine to form toxic byproducts that include hundreds of unique chemicals. Wastewater treatment plant discharge contains chemicals that form DBPs in downstream water treatment plants. And this discharge as well as lawn fertilizer chemicals in water can spur massive algae blooms that decay and also form DBPS in treatment plants (J Houlinhan, pers comm June 2014).

**Method**

Frederick City is required to test quarterly at selected sites around the City and send those results to the Maryland Department of the Environment. Friends of Frederick County analyzed the city’s quarterly compliance samples, the samples used to ensure that tap water meets all relevant health and safety standards.

Results from a Public Information Act request to the Maryland Department of the Environment for Frederick City water sampling data between January 31, 2011 and February 1, 2014 produced 84 samples taken from 21 sites (not uniformly each season) and tested for both THM and HAA. Standard sampling technique is to collect one sample per season per site throughout the year. The data received from the PIA request did not include any sampling results from the Fall 2011, Winter 2012, Spring 2012 and Summer 2012; it is unclear if samples were collected or not.
Results

EPA first set legal limits, the Maximum Contaminant Level (MCL), for disinfection by-products in 1979, limiting THM levels to a maximum of 100 parts per billion to help reduce cancer risks. EPA proposed lowering the limit even further in the late 1990s. Utilities were required to meet this new, stricter limit of 80 parts per billion beginning in 2001 (per the Stage 1 Disinfectants/Disinfection Byproducts Rule). At the same time, utilities also had to meet EPA’s newly imposed limit for HAAs of 60 parts per billion. These limits were based on an average THM or HAA level across the entire distribution system. The latest update to the limits went into effect beginning in 2012 (the Stage 2 Disinfectants/Disinfection Byproducts Rule) – utilities had to meet the MCL at each individual sampling location along their distribution system pipes, not just across the system as a whole\textsuperscript{15}.

This report looks at drinking water quality testing results for HAAs and THMs both before the Stage 2 Disinfectants/Disinfection Byproducts Rule and after (between January 31, 2011 and February 1 2014). Analysis of these data (see Table 1 and Table 2) showed:

- In July 2011 8 out of 11 samples had THM > 60 ppb; 7 of those were > 70 ppb
- The level of concern in July 2011 3 out of 11 samples had THM > 80 ppb
- In April 2011 6 out of 12 locations sampled had HAA > 60 ppb, and 11 out of 12 samples had HAA > 40 ppb
- In July 2011 4 of the 11 locations sampled had HAA > 60 ppb, and 9 of 11 had HAA > 40 ppb
- In November 2012 7 of the 8 sites sampled had HAA > 60 ppb and all 8 had HAA > 40 ppb
- In May 2013 all 8 sampling sites had HAA > 40 ppb; 1 of those had HAA > 60 ppb
- In July 2013 4 out of 8 samples taken showed THM > 80 ppb
- In August 2013 7 out of 8 locations had HAA > 40 ppb
- In November 2013 all 8 locations sampled had HAA > 40 ppb, one of those > 60 ppb
- Water quality testing stations in Ballenger Creek, at the Whittier Ball Field, and the Little League field on Staley Avenue in North Frederick showed consistently the worst contamination in tap water (see Map 3).

\textsuperscript{15} http://www.epa.gov/envirofw/html/icr/gloss_dbp.html
Map 3: Drinking water samples from Stage 2 Disinfectants/Disinfection Byproducts Rule. Not all the sample results exceed the EPA maximum contaminant level (MCL), however studies show that even those sample results falling short of the MCL could cause health risk to Frederick City residents drinking tap water.
<table>
<thead>
<tr>
<th>WATER TESTING STATION</th>
<th>ADDRESS</th>
<th>NUMBER of THM SAMPLES ABOVE MCL 80 ppb</th>
<th>NUMBER OF THM SAMPLES ABOVE 60 ppb</th>
<th>NUMBER OF HAA SAMPLES ABOVE MCL 60 ppb</th>
<th>NUMBER OF HAA SAMPLES ABOVE 40 ppb</th>
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<tr>
<td>Board of Education</td>
<td>115 E Church Street</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>(53.2 - 7/2011)</td>
</tr>
<tr>
<td>BP Service Station</td>
<td>300 South Jefferson</td>
<td>1 (97.5 - 7/2011)</td>
<td>0</td>
<td>1</td>
<td>(67.3 - 4/2011)</td>
</tr>
<tr>
<td>Eastgate CitGO</td>
<td>1111 E Patrick</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>(48.7 - 4/2011)</td>
</tr>
<tr>
<td>Exon Service Station</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>(57.7 - 4/2011)</td>
</tr>
<tr>
<td>Fred Co Health Dept</td>
<td>350 Montevue Ln</td>
<td>1 (86.59 - 7/2011)</td>
<td>0</td>
<td>1</td>
<td>(53.1 - 7/2011)</td>
</tr>
<tr>
<td>Jerry’s Subs</td>
<td>1305 W 7th</td>
<td>0 (67.13 - 7/2011)</td>
<td>1</td>
<td>1</td>
<td>(50.5 - 7/2011)</td>
</tr>
<tr>
<td>McDonalds</td>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>(57.4 - 4/2011)</td>
</tr>
<tr>
<td>Mt Olivet</td>
<td>515 S Market St</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>(52.8 - 7/2011)</td>
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<tr>
<td>Rice Field House</td>
<td></td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>(52.8 - 7/2011)</td>
</tr>
<tr>
<td>Rosedale Park Comm Bldg</td>
<td>551 Schley Avenue</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>(68.6 - 4/2011)</td>
</tr>
<tr>
<td>Rosehill Exxon</td>
<td>1561 Opossumtown Pike, Frederick</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Rosemont Service Station</td>
<td>1704 Rosemont Ave</td>
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</tr>
<tr>
<td>Somerford Assisted Living</td>
<td>2100 Whittier Drive</td>
<td>1 (106.75 - 7/2011)</td>
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<td>2</td>
<td>(61.6 - 7/2011)</td>
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<tr>
<td>WATER TESTING STATION</td>
<td>ADDRESS</td>
<td>NUMBER of THM SAMPLES ABOVE MCL 80 ppb</td>
<td>NUMBER OF THM SAMPLES ABOVE 60 ppb</td>
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<td>NUMBER OF HAA SAMPLES ABOVE 40 ppb</td>
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<td>----------------------------------</td>
</tr>
<tr>
<td>S1-Clustered Spires Golf Course</td>
<td>15 Gas House Pike, Frederick</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>S2 -Ballenger Center</td>
<td>5830 Ballenger Creek Pike, Frederick</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tr>
<tr>
<td>S3-West Pointe Plaza</td>
<td>4908 Ridge Crest Court Frederick</td>
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<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>S4-Whittier Ballfield Park</td>
<td>2206 Independence Street, Frederick</td>
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<td>0</td>
<td>1</td>
<td>4</td>
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<tr>
<td>S5-Frederick National LL</td>
<td>1204 Staley Avenue, Frederick</td>
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<td>0</td>
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<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(110.8 – 11/2012)</td>
<td>(80.6 – 2013)</td>
<td>(53.3 – 8/2013) (53.7 – 11/2013)</td>
</tr>
<tr>
<td>S6-Monarch Ridge Park</td>
<td>607 Swallowtail Drive</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>S7-Stonegate Park</td>
<td>1565 Andover Lane</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>S8-Lake Coventry Park</td>
<td>1321 Schaffer Drive</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
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</tbody>
</table>

Table 2: Frederick City tap water samples taken from 2012 - February 2014 (per Stage 2 Disinfectants/Disinfection Byproducts Rule)
Health Implications of Contaminated Tap Water

EPA first set legal limits, the Maximum Contaminant Level (MCL), for disinfection by-products in 1979, limiting THM levels to a maximum of 100 parts per billion to help reduce cancer risks. EPA proposed lowering the limit even further in the late 1990s. Utilities were required to meet this new, stricter limit of 80 parts per billion beginning in 2001 (per the Stage 1 Disinfectants/Disinfection Byproducts Rule). At the same time, utilities also had to meet EPA’s newly imposed limit for HAAs of 60 parts per billion. These limits were based on an average THM or HAA level across the entire distribution system. The latest update to the limits went into effect beginning in 2012 (the Stage 2 Disinfectants/Disinfection Byproducts Rule) – utilities had to meet the MCL at each individual sampling location along their distribution system pipes, not just across the system as a whole.

A series of peer reviewed studies show that drinking Trihalomethanes and Haloacetic Acids in excess of the MCL can increase the risk of liver, kidney, and central nervous system problems, birth defects and cancer\textsuperscript{16}. Trihalomethanes have been found to cause neural tube defects, small body lengths, and small head circumference at levels as low as 40 ppb. Figure 1 shows research findings on the health risks associated with drinking water THM and HAA contamination.

The MCL is the highest contaminant level allowable for public drinking water. Although the legal limits for these byproducts are set at 80 ppb for THMs and 60 ppb for HAAs, research shows that these may be set too high and that adverse health effects can be observed at lower exposure levels\textsuperscript{17} (see Figure 1). The MCL is set as close as possible to the Maximum Contaminant Level Goal (0 ppb for both THMs and HAAs) considering current disinfection techniques and cost \textsuperscript{18}. “In 2005, the EPA considered lowering the legal limit for trihalomethanes to 40 parts per billion, calculating that this move would prevent nearly 1,300 bladder cancer cases each year and save the U.S. between $2.9 and $7.1 billion (EPA 2005). The agency did not attempt to establish this lower standard as a regulation with the force of law. Instead it made marginal improvements in the way it would measure trihalomethanes for compliance with existing regulations and gave water treatment facilities until 2016 to comply with these modest changes”\textsuperscript{19}.

\textsuperscript{16} http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1740151/

\textsuperscript{17} http://www.ewg.org/research/chlorine-pollutants-high-levels-dc-tap-water/thm-levels-often-higher-what-studies-show-

\textsuperscript{18} http://water.epa.gov/drink/contaminants/

\textsuperscript{19} http://static.ewg.org/reports/2013/water_filters/2013_tap_water_report_final.pdf, pg 4
FREDERICK CITY TAP WATER CONTAMINATION

A review of tap water tests submitted to the State of Maryland by the City of Frederick reveals widespread contamination of city tap water with dangerous levels of chlorination by-products. During the water treatment process chlorine mixes with organic material in the water (soil/sediment) and forms disinfectant byproducts (DBPs) that are known to cause adverse health effects and are regulated as carcinogens.

The higher the levels of organic pollution in the source water the more difficult it is to treat, and the higher the levels of chlorinated bi-products that are typically found in treated tap water.

At right are the associated health risks with concentrations of trihalomethanes (THM) and haloacetic acid (HAA).

This chart is modeled after the chart on page 5 of "Water Treatment Contaminants: forgotten toxics in American water," Environmental Working Group, February 2013. Health risk research citations can be found in that report at the following link: http://static.ewg.org/reports/2013/water_filters/2013_tap_water_report_final.pdf.

Figure 1: Peer reviewed health risks for THMs and HAAs

Additional references for health risks of HAAs and THMs in drinking water:
EPA, 2002 The Occurrence of Disinfection By-products (DBPs) of Health Concern in Drinking Water: Results of a Nationwide DBP Occurrence Study. Available: www.epa.gov/athens/publications/reports/EPA_600_RO2_068.pdf
Recommendations

Recommendations from citizens in Frederick City and County represented by Friends of Frederick County and Cleanwater_Linganore:

- Frederick County should establish source water protection areas with strict enforcement to protect drinking water and minimize health risks to the City’s residents. Using the current treatment regime and system, there is little Frederick City can do when the source water delivered to the city for purification is polluted with sediments, manure and decomposed organic matter. However there is much more to be done to protect the sources from becoming polluted in the first place. Conversion of naturally vegetated lands to urban and agricultural uses can result in serious impacts to streams and aquatic life. Urban and suburban areas, impervious surfaces (roads, parking lots, sidewalks, and rooftops) cause a rapid increase in water transport rate to stream channels. The effects of that are increased stream bank erosion, stream channel instability, increased pollutant runoff, elevated stream temperatures, and loss of biological diversity.

- The Maryland Department of the Environment should mandate that Frederick County once again strengthen its buffer zone ordinance to provide maximum protection for Frederick City’s drinking water sources. In 2007 the Gardner Board of County Commissioners strengthened the county’s protective stream buffer ordinance so that it reflected the scientific recommendations to protect our source waters, streams and wetlands. In 2013 the Young Board of County Commissioners reversed that and weakened the county’s protective stream buffer ordinance substantially. Current and planned development in the source water “protection” areas will exacerbate the problem and make drinking water worse for the residents of Frederick City.

- The Maryland Department of the Environment, Frederick County and City should monitor land use and organic matter in the source water drainage areas, rivers and streams, and make that information public on websites and in the Annual Drinking Water Report. Friends of Frederick County, with support from the National Fish and Wildlife Foundation and Wells Fargo, will support continued and advanced testing for e coli bacteria, phosphorus and Total Suspended Solids (TSS) in 17 tributaries to Lake Linganore in 2014 and 2015. This and additional testing should be part of an ongoing public program for Lake Linganore, the Monocacy, and Potomac Rivers, and Fishing Creek.

- Frederick County and City should do a thorough economic analysis of the public financial burden of revising the drinking water plans versus protecting the source water. As the Young Board of County Commissioners continues to approve the stripping of thousands of acres of land for housing development in the Lower Linganore Creek drainage area (Map 2) and source water protection area (see Map 2), it is highly likely that there will be an increase in erosion, sedimentation, stream water pollution and flooding. Since 2012 1346 acres have been approved for development in the Lower Linganore Creek drainage to Lake Linganore, and 913 acres are up for approval (Map 3). Cleared land that becomes roadways, paved surfaces and rooftops is impervious to rainwater infiltration exacerbating flooding during weather events. The floods carry additional pollutants and sediments to the source surface waters.