November 2015

2015 Shenandoah River *E. coli* Monitoring Report
Friends of the North Fork of the Shenandoah River and Friends of the Shenandoah River

1. Executive Summary

This project looked at the bacteria levels in the Shenandoah River at locations on the North Fork and Main Stem where people are likely to come in contact with the water through swimming and tubing. We found a number of locations where the state water quality standard for recreational use of the river was violated. In some instances, the level of bacteria was over the standard by a factor of 10.

While the presence of high levels of bacteria in a number of locations on the Shenandoah River is known to the state agencies responsible for water quality and public health, little is done to inform the users of the river of the levels of bacteria and the health implications of those levels.

We ask that state government authorities make an effort to raise community awareness of the health risk associated with using the river when bacteria levels are over the state water quality standard. Options to consider include greater outreach to the community, posting signs at locations where excess bacteria have been observed, and real time sampling and reporting as is currently done at Virginia beaches.

2. Acknowledgements

This joint project by the Friends of the North Fork of the Shenandoah River (FNFSR) and the Friends of the Shenandoah River (FOSR) was developed by the Science Committee of the Friends of the North Fork of the Shenandoah River under the leadership of John Holmes. FNFSR sought and received funding for this project from the Dominion Foundation. The sampling and laboratory protocol and laboratory testing of samples were completed by Karen Andersen and Molly Smith of the Friends of the Shenandoah River. River water samples were collected by Karen Andersen and by Nancy Carr, Bria Bryant, and Amy Johnson with assistance from Concha Mendoza and Megan Church, at the direction of John Eckman of the Friends of the North Fork of the Shenandoah River.

3. Background

3.1. Objective of the Project

While DEQ and our organizations have done *E. coli* monitoring of the Shenandoah River in the past, that monitoring has not focused on when and where the river is actually used by the public. This study focused on collecting and analyzing samples at locations and times of the year when the river is being used for floats and swimming. This project will inform the public on the risk of *E. coli* exposure and can be a basis for action by government agencies to inform the public of the relative risks due to exposure when they are in the river.

3.2. Health Effects of *E. coli* and Bacteria More Generally

The US EPA sets national standards for water quality and the Virginia standards for bacteria match those of the EPA. When setting the standards for bacteria, EPA considers studies that show a link between illness and fecal contamination in recreational waters. Gastro intestinal illness can occur when exposed to fecal contamination. The illness is often manifested by vomiting, diarrhea with fever or a disabling condition (remained home, remained in bed or sought medical advice because of symptoms), or stomach ache or nausea accompanied by a fever. Because fecal contamination is made up of mix of bacteria and viruses, the EPA standards are based on the use of two bacterial indicators of fecal contamination, *E. coli* and enterococci. In this study we use the *E. coli* level as the

indicator. The EPA *E. coli* standard is 126 "colony forming units" (cfu) per 100 ml of water. Colony Forming Unit (cfu) is an estimate of viable bacteria in a sample, determined by growing bacteria on a nutrient medium. The EPA set the standard at a level designed to protect primary contact recreation, including swimming, bathing, tubing, water play by children, and similar water contact activities where a high degree of bodily contact with the water, immersion and ingestion are likely.

3.3. Sources of *E. coli* in the River

Microbial pollution sources include fecal matter from wildlife, humans, and livestock. Other sources of bacteria may include improperly functioning wastewater treatment plants, leaking septic systems, storm water runoff, animal carcasses, and runoff from animal manure and manure storage. Of course if cattle are standing in the river, their fecal matter ends up in the river and this can contribute to high levels of *E. coli*.

3.4. The State Water Quality Standard for *E. coli*

The state standard is the same as the one developed by US EPA. Therefore, this project examined *E. coli* levels to determine potential for exposure. In Virginia, fresh water bodies are determined to be impaired if they exceed 126 "colony forming units" (cfu) per 100 ml for an average of 5 samples collected over 30 days, or 235 cfu per 100 mL for a single grab sample.[1] Because we did not collect samples as frequently as five or more samples over 30 days, we have applied the 235 cfu per 100 ml standard to our data.

3.5. River Impairment Designations for *E. coli*

Every two years the Virginia Department of Environmental Quality reviews the available water quality data to determine which rivers and lakes are not meeting the state water quality standards. The most recent report is titled: Virginia Water Quality Assessment 305(b)/303(d) Integrated Report 2014. This report is required under the national Clean Water Act. (The numbers in the title refer to the provisions in the Act.)

A large part of the Shenandoah River is considered "impaired" for exceeding the state standards for one or more pollutants. The most common problem is exceeding the standard for bacteria. As noted elsewhere in this report a number of the sites we sampled have already been classified as exceeding the state limit for safe levels of *E. coli*, relative to recreational use of the river.

The DEQ 2014 report summarizes the situation by combining the data for the Potomac and the Shenandoah Rivers. The summary is startling. First, DEQ reports that of the 13,233 miles of river and tributaries in the Potomac/Shenandoah watershed, less than 25% has been assessed. Of the 3,181 miles that have been assessed, roughly 1,800 miles of the river are impaired for recreational use due to high levels of *E. coli*. Based on the areas assessed, over 50% of the watershed is not meeting the *E. coli* limits. In our view, this represents an important water quality issue that deserves attention.

Interestingly, there is a section in the report titled "Public Health /Aquatic Life Concerns." This section logically would address the public health risk posed by the large parts of the watershed that

[1]For a full discussion of methodology, please see section 5. Sampling and Analysis Methods

exceed the state standard for bacteria. However, it does not. It addresses only the risks associated with the consumption of contaminated fish.

The monitoring we have done as a part of this study will be provided to DEQ as is all the data produced by FOSR monitoring programs. DEQ will use the data in subsequent assessments.

3.6. Virginia Department of Health Advisories

The Virginia Department of Health (VDH) has a role in protecting the health of the public. They have a program for the beaches of Virginia to determine if the bacteria at the beaches are too high and to alert the public. Sampling is carried out weekly during the swimming season (Mid-May through September) at 46 beaches. If there is a violation of the state standard, the beach is posted with a swimming advisory sign. A press release is also issued.

There is no comparable program for fresh water swimming and recreation areas. Their website provides the following general guidance.

"Prevent illness and injury when swimming in natural waters by following these steps:

- Avoid swimming in natural waters for a few days after a heavy rain event.
- Avoid swallowing water when swimming.
- Avoid getting water shot up your nose when swimming, especially in warm shallow water.
- Avoid swimming or wading in with open wounds or cuts.
- Look for posted signs near the swimming area.
- Don't swim in areas where there are dead fish present.
- Don't swim if you are ill.
- Shower with soap and clean water after swimming.
- Avoid swimming in muddy water of lakes, ponds, and rivers.
- Avoid swimming in unfamiliar ponds, streams, creeks, ditches, and canals."

We did not observe any signage with warnings about the risks of swimming or tubing or wading at any of the sites that we studied, even though a number of them are on parts of the river that the DEQ has declared as impaired for *E. coli*.

4. Sampling Locations, Sampling Intervals and Sampling Period

4.1. Sampling Period and Frequency

Sampling was carried out in 2015 over the period of time when water temperatures were such that people would be likely to use the river in ways that result in direct contact with the water (swimming and tubing). The sampling was scheduled for Tuesdays, once a month. The first round of samples was taken on May 19th and the last round was taken on September 8th and 9th On two occasions limited sampling was done a week after the monthly sampling to determine if the results were sustained. Also, the sampling dates were shifted to deal with high water events and project staff schedules. No samples were collected during high water events when swimming and tubing could not have occurred.

4.2. Sampling Locations

We selected sampling locations along the North Fork and the Main Stem of the Shenandoah River that are commonly used for swimming and tubing. In selecting them, we received nominations from local groups and agencies. The number of sites was constrained by our budget for the lab work. Locations on the South Fork were not included due to both budget and logistics. We feel a study of this nature on the South Fork and other rivers in Virginia would be of merit. We collected samples at a total of thirteen sites. Here is an overview of the sites

4.2.1. Upper North Fork

4.2.1.1. Blue Hole Near Bergton (EC01)[2]

This site is owned by the Forest Service. It is listed on their website as a day use area for picnicking and swimming. This site has some notoriety. It is listed on a "Swimming Holes" website (http://www.swimmingholes.org/va.html).

4.2.1.2. Plains District Memorial Park in Timberville (EC02)

The Town of Timberville owns and maintains Plains District Memorial Park along the North Fork in the heart of the community. The site is just downriver from two meat processing plants; however, both direct their effluent to the Broadway/Timberville sewage treatment plant. A number of confined animal feeding operations are also directly upstream.

The river is the primary natural feature of the park, which lies on a flat terrace below steep bluffs. A baseball field, young childrens' play area, and stone picnic pavilion are the primary amenities. River access is relatively easy at several points along the park and families with young children, anglers, and paddlers are often enjoying time in the water on warm days. VDGIF is working with the Town to install a new canoe/kayak launch site at the downstream end of the park where boats could more easily access the main river channel during dry spells.

4.2.1.3. Covered Bridge at Meems Bottom (EC03)

This is one of six public access points to the North Fork that is owned or co-managed by the Virginia Department of Game and Inland Fisheries. It is listed on their website. It is also listed on the Shenandoah County tourism page under public river access. As such, floating (tubing and canoeing) is promoted. Swimming is not. However, our person collecting samples observed folks in the water.

4.2.1.4. Little Wolf Hole on Stony Creek (EC04)

This swimming hole is near Route 675 west of Columbia Furnace in the mountains of western Shenandoah County. The area is heavily forested and rural, with George Washington National Forest as the predominant landowner upstream. There are some smaller farms and older homes nearby. Local young people and families can number in the dozens on a summer weekend, cooling off in the mountain stream.

[2] Later in the report data are presented with the site number listed here.

4.2.2. Lower North Fork

4.2.2.1. Seven Bends State Park (EC05)

Sampling for this location was done at the Lupton Bridge that crosses the North Fork as an entrance to the park. The Park is still under development. While use of the site is presently limited, the Master Plan for the site calls for developed access for recreational use of the river, including floating and swimming.

4.2.2.2. Below Burnshire Dam (EC12)[3]

This location near Woodstock is listed on the Shenandoah County tourism page under public river access. It is listed as suitable for wading and launching hand carried boats and canoes.

4.2.2.3. Strasburg Park (EC06)

The Strasburg Town Park has a variety of recreational facilities and a boat ramp and parking area for access to the river. The town's website promotes its use for floats and tubing; noting another location five miles upriver were a float can be started. It is also listed on the Shenandoah County tourism page under public river access. Our person gathering samples observed people in the river on a number of occasions.

4.2.2.4. Elizabeth Furnace Recreational Area on Passage Creek (EC07)

This site is owned by the Forest Service. It is listed on their website as a location for camping, fishing and hiking. While it is not promoted as a swimming location, our person gathering samples observed people swimming at the site and a YouTube posting shows people playing in the water. It is also listed on the "Swimming Holes" website.

4.2.2.5. Riverton Landing Near Front Royal (EC08)

This is one of six public access points to the North Fork that is owned or co-managed by the Virginia Department of Game and Inland Fisheries (DGIF). It is listed on their website. As such, floating (tubing and canoeing) is promoted. Swimming is not.

4.2.3. Main Stem

4.2.3.1. Morgan's Ford Road Low Water Bridge (EC09)

This is a public access point on the Main Stem of the Shenandoah River that is operated by the DGIF. It is listed on their website as a location where canoes can be launched and taken out. Persons were observed in the water on two occasions when samples were being taken.

4.2.3.2. Lockes Landing above Watermelon Park (EC10)

This is a public access point on the Main Stem of the Shenandoah River that is operated by the DGIF. It is listed on their website as a location where canoes or trailered boats can be launched or taken out. It is also listed on the Clarke County visitor's page. Watermelon Park is a private camp site where canoes, kayaks and inner tubes are rented. The camp ground shuttles customers up river and they float

[3] This was originally site EC05. After the first sample was collected, it was determined that sampling at this location would not be appropriate in consideration of the safety of the person taking the sample. EC05 was reassigned as noted above and the data for the site below Burnshire Dam were relisted under EC12.

down to the camp. As a result, on most sampling days, folks tubing near this site were observed.

4.2.3.3. Craig Run above Lockes Landing (EC10 trib)

Craig Run is a tributary feeding into the Shenandoah River above Lockes Landing. Craig Run originates within the town boundaries of Berryville and then flows through residential and agricultural land before the confluence with the Shenandoah. Although during the course of the project individuals were not observed in the tributary sampling was carried out at this location in an effort to understand the elevated *E. coli* levels observed Lockes Landing, EC10.

4.2.3.4. Below Watermelon Park (EC11)

This site is located on the main of the Shenandoah River below a privately owned park that borders the river. During the summer months this park and adjacent areas experiences heavy usage by day-visitors, campers and extended stay visitors. There was concern of potential exposure to high *E. coli* levels for park visitors and others utilizing the river for recreational use.

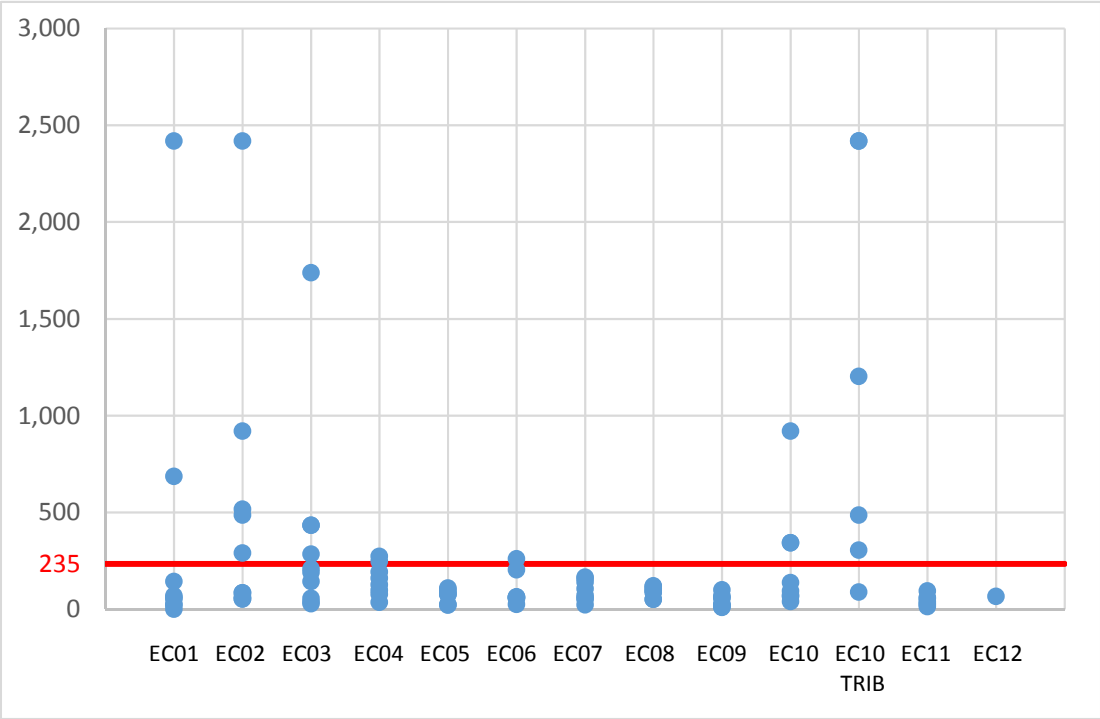
5. Sampling and Analysis Methods

The persons collecting the samples for this project were trained under a protocol prepared by the staff of the Friends of the Shenandoah River. The samples were analyzed at the Friends of the Shenandoah River laboratory located at Shenandoah University. The laboratory method used in this study has an automated counting system and the results are reported as the "Most Probably Number" (MPN) of viable cells. Most Probable Number reflects the fact that the method uses multiple cultures and a probability calculation to determine the approximate number of viable cells in a given volume of sample. The figures are comparable to cfu. For example: 50 MPN/100 mL means that the Most Probable Number of viable cells in 100 mL of sample is 50. You will see the use of MPN in the presentation of results in this report. It should also be noted that this analytical method for *E. coli* requires some prior knowledge of the range of result to be expected. In some instances the level of *E. coli* was higher than expected. In those instances the results are simply reported here as being at the maximum range of the test, which is 2,419.6 cfu per milliliter. This means that in some instances the reported levels are conservatively low.

6. Discussion of Results

6.1. Locations with Levels over DEQ Standards

The results of the *E. coli* analyses for all the sites are presented in Appendix A of this report. The figure below presents all the data for each of the sites. As can be seen in the figure, a number of sites recorded *E. coli* levels well in excess of the state impairment criteria of 235 cfu per 100ml. Remember that the highest level of detection in the lab is 2,419 cfu per ml. Where this number is shown, the *E. coli* level was at least that high and probably higher.



The table below provides an "unofficial" classification of each sampling location, using the data we collected, according to the criteria used by the state when it determines impairment[4]. An exceedance is a measured value greater than 235 cfu per 100 ml (*E. coli* in fresh water). To classify a waterway as "impaired," there must be at least two exceedances when the sample is small (2-9), as was the case in this study. We have also noted whether the site is categorized as impaired for bacteria in the latest DEQ assessment, which is discussed in Section 3.5 of this report.

Waterway Classification for *E. coli* Impairment					
Sampling Location	Number of Samples	Number of Exceedances	Percent of Samples Over the Standard	Impaired, based on these data?	Designated As Impaired By the DEQ?[5]
EC01 Blue Hole	9	2	22%	Yes	No
EC02 Plains Dist. Park	10	5	50%	Yes	Yes B45R-04-BAC[6]
EC03 Meems Bottom	10	4	40%	Yes	Yes B45R-04-BAC
EC04 Little Wolf Hole	8	2	25%	Yes	Yes B49R-01-BAC
EC05 Seven Bends Park	7	0	0%	No	No
EC06 Strasburg Park	8	1	12%	No	No
EC07 Elizabeth Furnace	8	0	0%	No	Yes B50R-02-BAC
EC08 Riverton Landing	8	0	0%	No	Yes B51R-02-BAC
EC09 Morgan's Ford Rd.	9	0	0%	No	No
EC10 Lockes Landing	8	3	37 %	Yes	Yes B58R-05-BAC
EC10 Trib Craig Run	6	5	83%	Yes	No[7]
EC11 Below Watermelon Park	7	0	0%	No	Yes B58R-05-BAC
EC 12 Below Burnshire Dam	1	0	0%	NA	No

[4] DEQ Document: "Water Quality Assessment Guidance Manual for Y2010, 305(b)/303(d) Integrated Water Quality Report"

[5] Remember that some parts of the river system have not been evaluated. If they have not been evaluated, they will not have been listed as impaired.

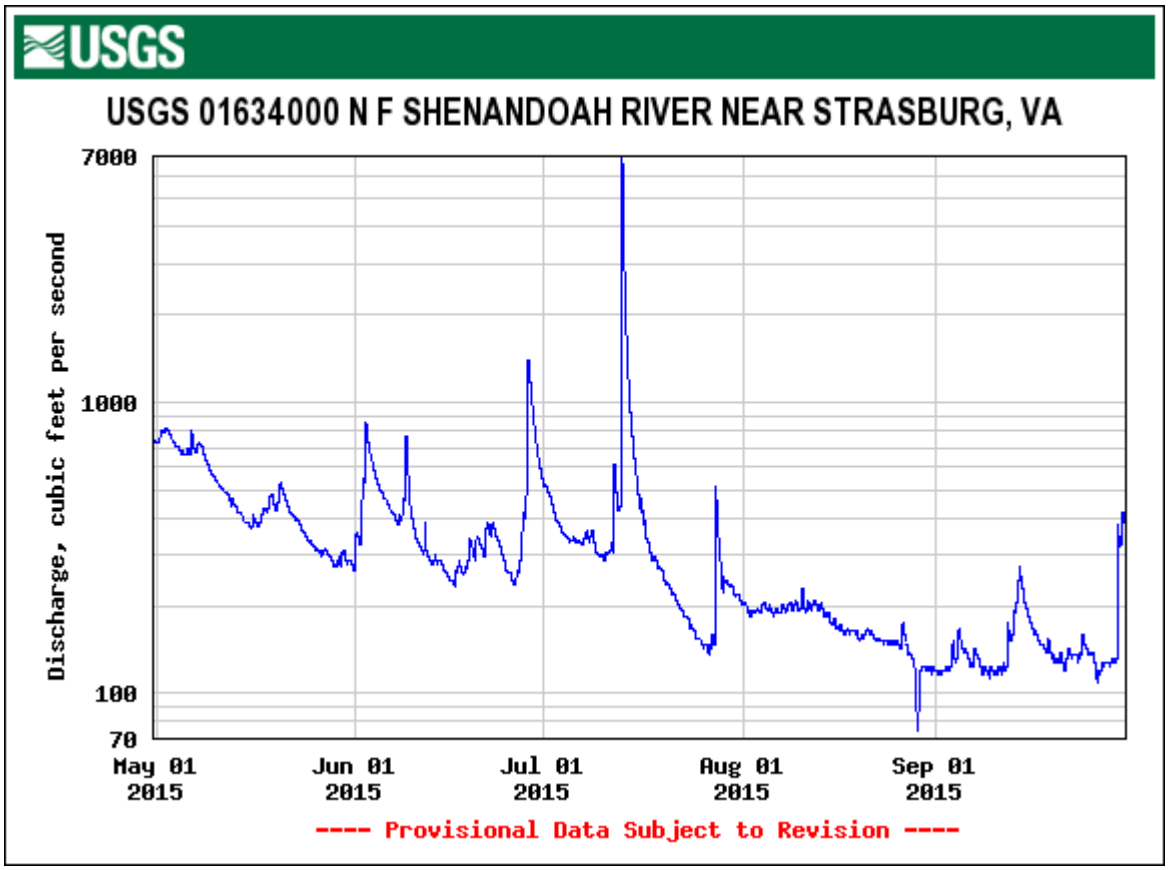
[6] This is the reference code for the segment that is impaired as it appears in the DEQ inventory.

[7] Craig Run has not been classified but it flows into a section that is classified as impaired.

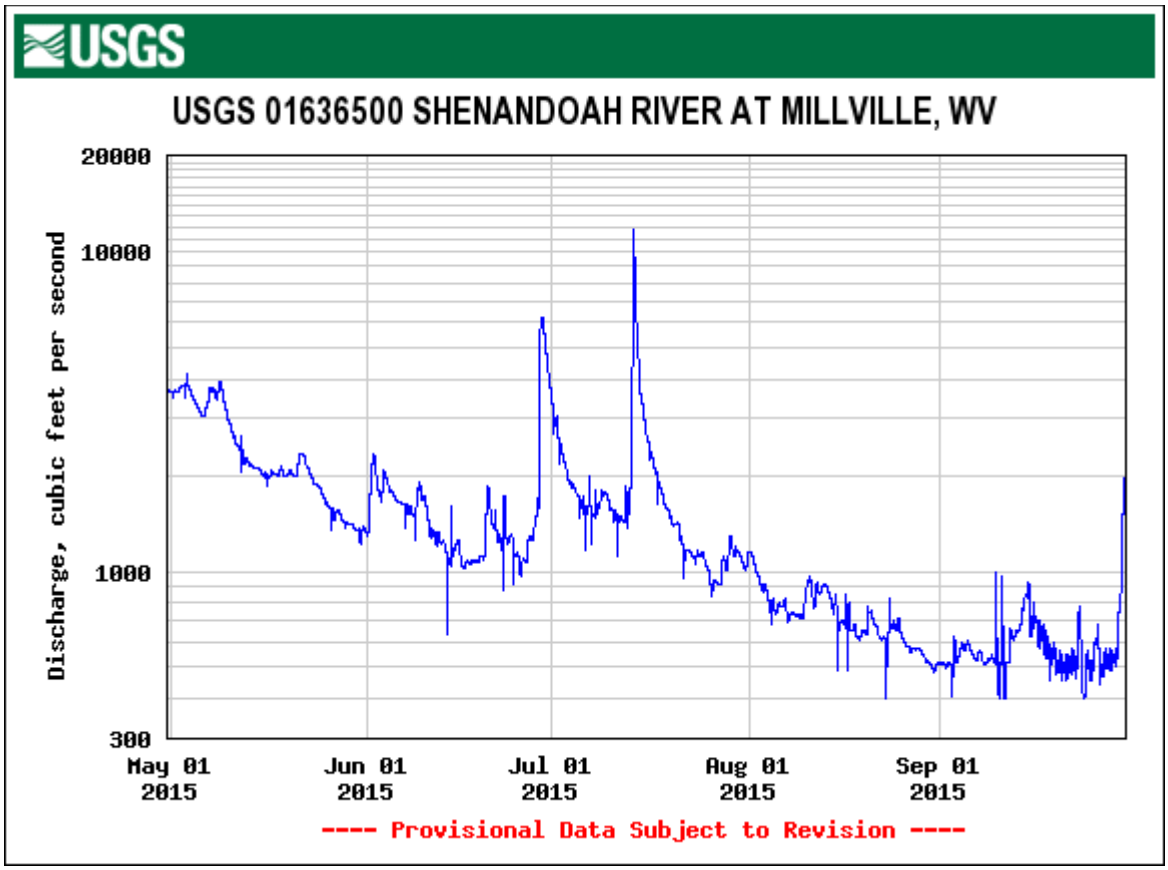
6.2. Correlations with rain events and river flow rates

This summer greater than average rain levels resulted in relatively higher flows in the river, particularly in the early part of the study period. As other research has shown (and we found in our own earlier study of *E. coli* levels at Lake Laura, available at: http://fnfsr.org/lake-laura-research/), higher levels of *E. coli* are often associated with runoff from rain events. This is logical since fecal matter due to wildlife or farm animals is on the surface and can get washed into the river in a rain event. Also, if the *E. coli* is coming from septic system failures, the waste is most likely to enter the river in a rain event.

The USGS operates river flow gauges on the North Fork and the Main Stem of the Shenandoah River. The data from these gauges can be used to examine whether the high *E. coli* levels that we observed were correlated with increases in river flow due to runoff. The figure below shows the variation in flow at the gauging station at Strasburg which is in the lower part of the sampling area for the North Fork. It shows about eight spikes in flow over the summer.



The next graph is for flow at the Millville gauge on the Main Stem of the Shenandoah River. It of course reflects contributions of flow from both the North Folk and the South Forth, so it does not automatically match the pattern in the North Fork alone. However, it does show the same two major rises in flow in late June and mid-July plus a few smaller and less dramatic increases. At both gauges, the flow was greater in the first half of the sampling period.



With this data and data from other gauges on the North Fork in hand, we examined the relationship between high *E. coli* levels and river flow. The DEQ impairment level of 235 cfu per 100 milliliters was exceeded at one or more sites during each sampling round. The largest number of exceedances occurred with the samples taken on May 19th (four exceedances, all on the upper North Fork) and July 28th (five exceedances with at least one in each of the three segments of the river.) We examined river flows just prior to and during sampling on those two dates to see what impact river flow, reflective of runoff, may have had on the high bacteria levels we observed. On both of these days, the river was on the rise. It was not so high as to deter recreational use but it was rising. This suggests that the rising water due to runoff carried a higher than average *E. coli* level into the river. The increases in flow were relatively modest.

Two much larger increases in river flow occurred at the end of June and in the middle of July. We did sampling shortly after the peak in June and did not find a greater number of excesses. We did not sample before or during the July peak. In fact, the May 19th and July 28th samples were the only ones taken during rising flows.

From this review of the data, we conclude that a rising river is more likely to be accompanied by an increase in *E. coli*. However, we also observed *E. coli* levels over the impairment level during steady and dropping flow. Further, the river was swimmable on all the sampling days. Even though the samples were always taken during the week, swimmers were observed during sampling on five occasions at sites that were found to exceed the impairment level for *E. coli*.

6.3. Correlation with potential sources

There are some logical correlations to be made with obvious potential sources of bacterial contamination at the affected sites, however we have no documented scientific evidence as proof of the sources. We believe the Virginia Departments of Environmental quality and Public Health have an obligation to inquire further.

The sites with the highest *E. coli* levels are: Blue Hole, Timberville Park, Meems Bottom, and Lockes Landing. Blue Hole, while in a generally forested area, is also downstream from small settlement areas, mountain farmsteads, and hunting camps that may have older, failing, or nonexistent septic systems. Timberville Park is downstream from an area of high intensity livestock production. Meems Bottom, which is characterized by large floodplains and intensive cropland, is near some of the larger farms in Shenandoah County including dairy operations. Lockes Landing provides access to the main stem of the Shenandoah River. As noted Craig Run feeds directly into the river just above the landing. In addition the river flows past areas of agricultural use.

6.4. Recommended Actions

6.4.1. Department of Environmental Quality (DEQ)

DEQ has responsibility for determining which parts of the river are impaired for *E. coli* and taking action to clean up the river so that it is meets the *E. coli* standard. With so much of the river over the standard, a more concerted effort is warranted. In addition, DEQ should do a better job of informing the public of the levels of *E. coli* they have observed and the implications for recreational use of the river. This may be in the form of signage at the river, public meetings or news articles

6.4.2. Virginia Department of Health (VDH)

VDH has a shared responsibility with the DEQ and needs to increase its efforts as well. VDH has a real time sampling and reporting program for bacteria levels at the state beaches. That program or something similar is needed for the fresh water recreational areas as well. At a minimum, more sampling and analysis is needed and signage should be posted at locations with known high levels of bacteria.

6.4.3. River Users

River users should insist on government action to inform the public of the risks of bacteria exposure in the river and to clean up the river so that all of us can use the river safely. In the meantime, river users will need to consider the data in this report when deciding where and when to swim, wade and tube in the river.

Appendix A: *E. coli* Monitoring Data

Site ID	Date H2O Sample Collected	Time H2O Sample Collected	*E. coli* MPN per 100ml Sample
EC01	5/19/2015	9:49	686.7
EC01	5/26/2015	10:43	28.5
EC01	6/16/2015	9:20	53.8
EC01	6/30/2015	8:38	143.9
EC01	7/21/2015	8:45	21.3
EC01	7/28/2015	8:49	2419.6
EC01	8/11/2015	9:00	62.7
EC01	8/26/2015	8:30	70.3
EC01	9/9/2015	9:01	1.0
EC02	5/19/2015	10:38	2419.6
EC02	5/26/2015	10:00	517.2
EC02	6/16/2015	10:01	290.9
EC02	6/30/2015	9:23	488.4
EC02	7/21/2015	9:36	85.7
EC02	7/28/2015	9:33	920.8
EC02	8/11/2015	9:50	86.2
EC02	8/26/2015	9:20	54.8
EC02	8/26/2015	9:20	65.0
EC02	9/9/2015	9:41	54.6
EC03	5/19/2015	11:20	1739.2
EC03	5/26/2015	9:35	209.8
EC03	6/16/2015	10:42	435.2
EC03	6/30/2015	10:26	285.1
EC03	7/21/2015	10:30	57.3
EC03	7/28/2015	10:34	435.2
EC03	8/11/2015	10:42	191.8
EC03	8/26/2015	10:28	30.5
EC03	8/26/2015	10:29	38.9
EC03	9/9/2015	10:17	143.9
EC04	5/19/2015	12:02	248.1
EC04	6/16/2015	9:39	79.4
EC04	6/30/2015	9:51	193.5
EC04	7/21/2015	9:51	161.6
EC04	7/28/2015	10:00	127.4
EC04	8/11/2015	10:03	275.5
EC04	8/26/2015	9:50	36.8
EC04	9/9/2015	10:56	98.8
EC05	6/16/2015	9:06	76.2
EC05	6/30/2015	9:21	101.9
EC05	7/21/2015	9:16	85.7

Site ID	Date H2O Sample Collected	Time H2O Sample Collected	*E. coli* MPN per 100ml Sample
EC05	7/28/2015	9:29	79.4
EC05	8/11/2015	9:34	111.2
EC05	8/26/2015	9:20	25.9
EC05	9/9/2015	11:34	23.1
EC06	5/19/2015	13:49	62.4
EC06	6/16/2015	11:24	65.7
EC06	6/30/2015	11:42	64.4
EC06	7/21/2015	11:12	56.3
EC06	7/28/2015	11:49	261.3
EC06	8/11/2015	12:11	204.6
EC06	8/26/2015	11:14	62.4
EC06	9/9/2015	12:19	26.2
EC07	5/19/2015	14:14	60.2
EC07	6/16/2015	11:46	141.4
EC07	6/30/2015	11:23	72.3
EC07	7/21/2015	11:36	107.1
EC07	7/28/2015	11:29	166.4
EC07	8/11/2015	11:49	160.7
EC07	8/26/2015	11:43	23.3
EC07	9/9/2015	12:41	52.0
EC08	5/19/2015	14:51	118.7
EC08	6/16/2015	10:04	95.9
EC08	6/30/2015	10:51	122.3
EC08	7/21/2015	10:05	52.9
EC08	7/28/2015	10:08	98.5
EC08	8/11/2015	11:36	108.1
EC08	8/26/2015	12:18	52.9
EC08	9/8/2015	8:56	85.7
EC09	5/19/2015	15:30	101.7
EC09	6/16/2015	10:27	22.8
EC09	6/30/2015	11:17	61.3
EC09	6/30/2015	11:21	58.3
EC09	7/21/2015	10:35	19.7
EC09	7/28/2015	10:31	71.2
EC09	8/11/2015	11:57	30.5
EC09	8/26/2015	13:13	11.0
EC09	9/8/2015	9:20	13.4
EC10	5/19/2015	16:24	67.0
EC10	6/16/2015	11:03	920.8
EC10	6/30/2015	12:25	95.9
EC10	7/21/2015	11:20	344.8
EC10	7/28/2015	11:32	72.2

Site ID	Date H2O Sample Collected	Time H2O Sample Collected	*E. coli* MPN per 100ml Sample
EC10	8/11/2015	13:13	344.8
EC10	8/26/2015	14:10	139.6
EC10	9/8/2015	10:07	41.4
EC10 Trib	6/30/2015	12:16	488.4
EC10 Trib	7/21/2015	11:29	2419.6
EC10 Trib	7/28/2015	11:39	307.6
EC10 Trib	8/11/2015	13:24	90.6
EC10 Trib	8/26/2015	14:04	1203.3
EC10 Trib	9/8/2015	10:12	2419.6
EC11	6/16/2015	11:18	62.4
EC11	6/30/2015	12:40	96.0
EC11	7/21/2015	11:43	55.6
EC11	7/28/2015	11:54	31.3
EC11	8/11/2015	13:42	41.0
EC11	8/26/2015	14:35	14.8
EC11	9/8/2015	10:28	24.1
EC12	5/19/2015	13:01	67.7