

Virginia DEQ and Citizen Bacteria Monitoring

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What is Fecal Bacteria

- Bacteria associated with warm-blooded animal waste
 - **E. coli (freshwater)**
 - **Enterococcus (fresh and/or saltwater)**
 - **Fecal Coliform (freshwater, saltwater, shellfish)**
- Presence above specified levels correlates to an increased risk of illness when swimming or eating raw shellfish



Terence Baggett: What's that smell?

Lt. Frank Drebin: Oh, that would be me. I've been swimming in raw sewage. I love it!

Why Virginia Monitors for Fecal Bacteria

- Fecal bacteria can be one of the largest impairment sources of streams
 - **For example in Virginia; >9,154 miles**
- Waterbodies with high levels of fecal bacteria often have other issues (e.g. high sediment and nutrients)
- High levels of fecal bacteria in waterbodies increase the risk of illness



www.youtube.com/watch?v=fyY6YF9xtzc

Popular Bacteria Methods

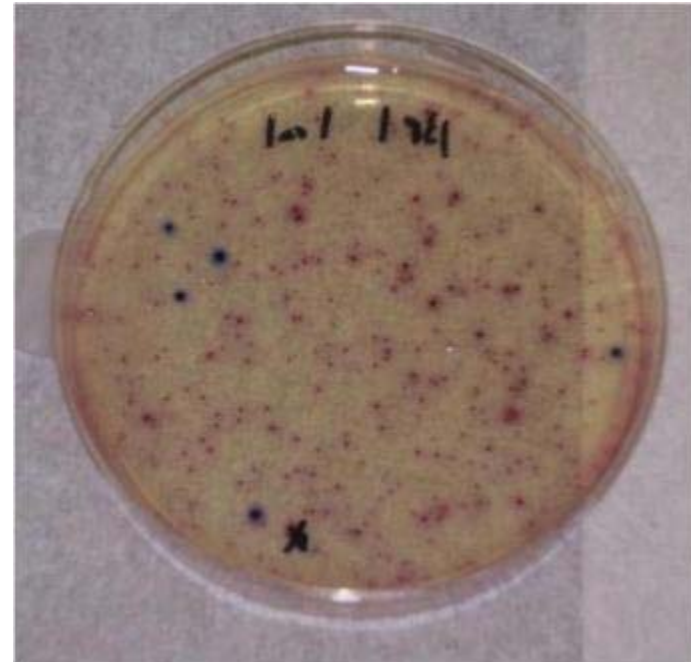
- Presence/Absence
- Petrifilm
- Multiple Tube
- Membrane Filtration
- Coliscan Easygel
- Colilert/Enterolert



So simple even high school students can do it

Coliscan Easygel

- No laboratory needed
- Tests 1 to 5 ml of sample
- Results in 24 to 48 hours
- Low cost (~\$3/sample)
- Good to locate bacteria 'hot spots' and track overall trends
- Not EPA approved



1 ml sample with 5 *E. coli* colonies

Coliscan Method

- Samples collected using sterile sample bottles
- A known quantity of sample (1.0 – 5.0 ml) is placed into a bottle of thawed Coliscan media and mixed
- The mixed media is poured into a treated Petri dish and turns into a gel (~45 min)
- Incubate for 24 hours at ~35 °C or 48 hours at ~25 °C
- Incubated plates are scored
 - **E. coli is dark blue to royal purple dots**
- Training video:
www.youtube.com/watch?v=1c59nedG9So

Coliscan Resource: Colifind

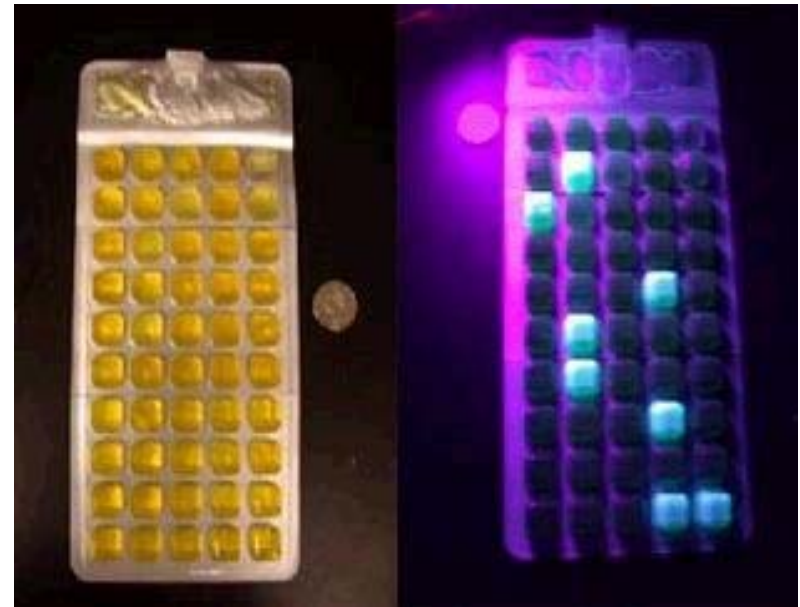
- Online App to identify Coliscan E. coli using photographs
- Over 95% accurate
- Developed by a Virginia High School Junior
- Available at:
<http://colifind.com/>



Created by Ana Humphrey

Colilert/Enterolert

- Popular lab-based method
- Low cost and easy to use
- Results in 18 to 24 hours
- Colilert- Total coliform/
E. coli
- Enterolert- Enterococcus
- EPA approved
- Test is susceptible to
optical brightener/
pesticide interference



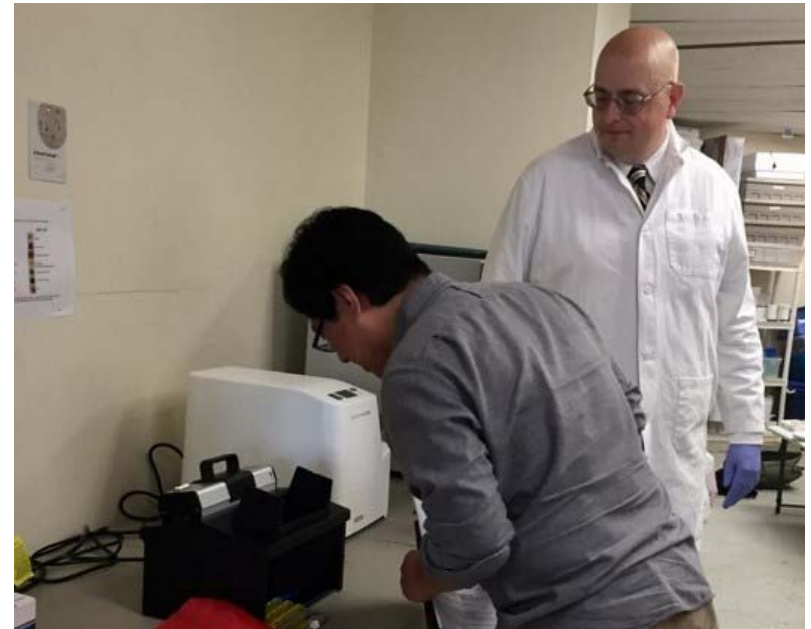
>200.5 coliform

8.7 E. coli

Colilert

Colilert/Enterolert Method

- Add media to 100 ml of water
- Pour into multi-well tray
- Seal tray
- Incubate for 18 to 24 hours
- Samples read
 - **E. coli yellow and glow in UV**
 - **Enterococcus glow in UV**
- Training video:
www.youtube.com/watch?v=2sjsD088p2o

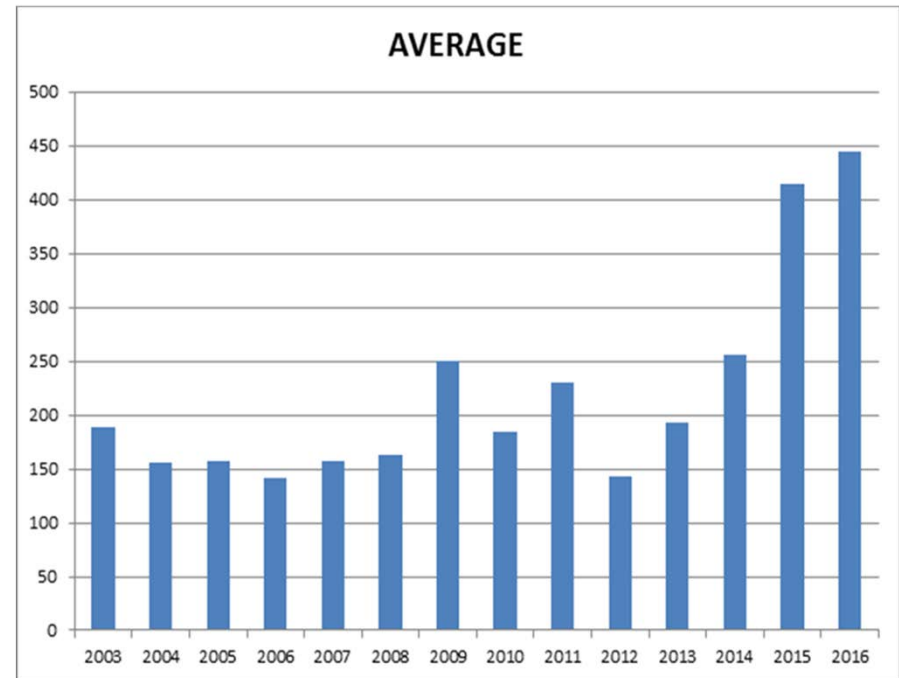


Training video developed in partnership between Virginia DEQ and Rivanna Conservation Alliance

Test Method	Presence/ Absence	Petrifilm	Multiple Tube	Membrane Filtration	Coliscan Easygel	Colilert/ Enterolert
Lab Required	No	No	Yes	Yes	No	Yes
Min Detection Limit	0	<100	<1	<1	<20	<1
Max Detection Limit	1	>6,000	>10,000	>10,000	>6000	>241,960
Unit of Measurement	N/A	CFU	MPN	CFU	CFU	MPN
Consumable Cost	\$7.00	\$3.50	\$2.50	\$3.00	\$3.00	\$5.50
Startup Equipment Cost	\$100	\$100	>\$25,000	>\$25,000	\$100	\$7,000
Time Spent Per Sample	1 min	1 min	>10 min	>10 min	1 min	2 min
Incubation Time (Hrs)	24	24	72 to 120	18 to 24	24 to 48	18 to 24
EPA Approved	Yes	No	Yes	Yes	No	Yes

If Adopting A New Method Beware...

- New method can have a different detection limit or accuracy/precision
- Keep records of when methods change for future reference
- Account for step trends when analyzing and reporting results



VADEQ statewide yearly average E. coli.
New method adopted in late 2014.

Benefits of Citizen Monitoring to DEQ

- Increase water quality assessment
- Total Maximum Daily Load (TMDL) monitoring
- Identify sewer spills and other pollution “Hot Spots”
- High return on agency funding and staff investment



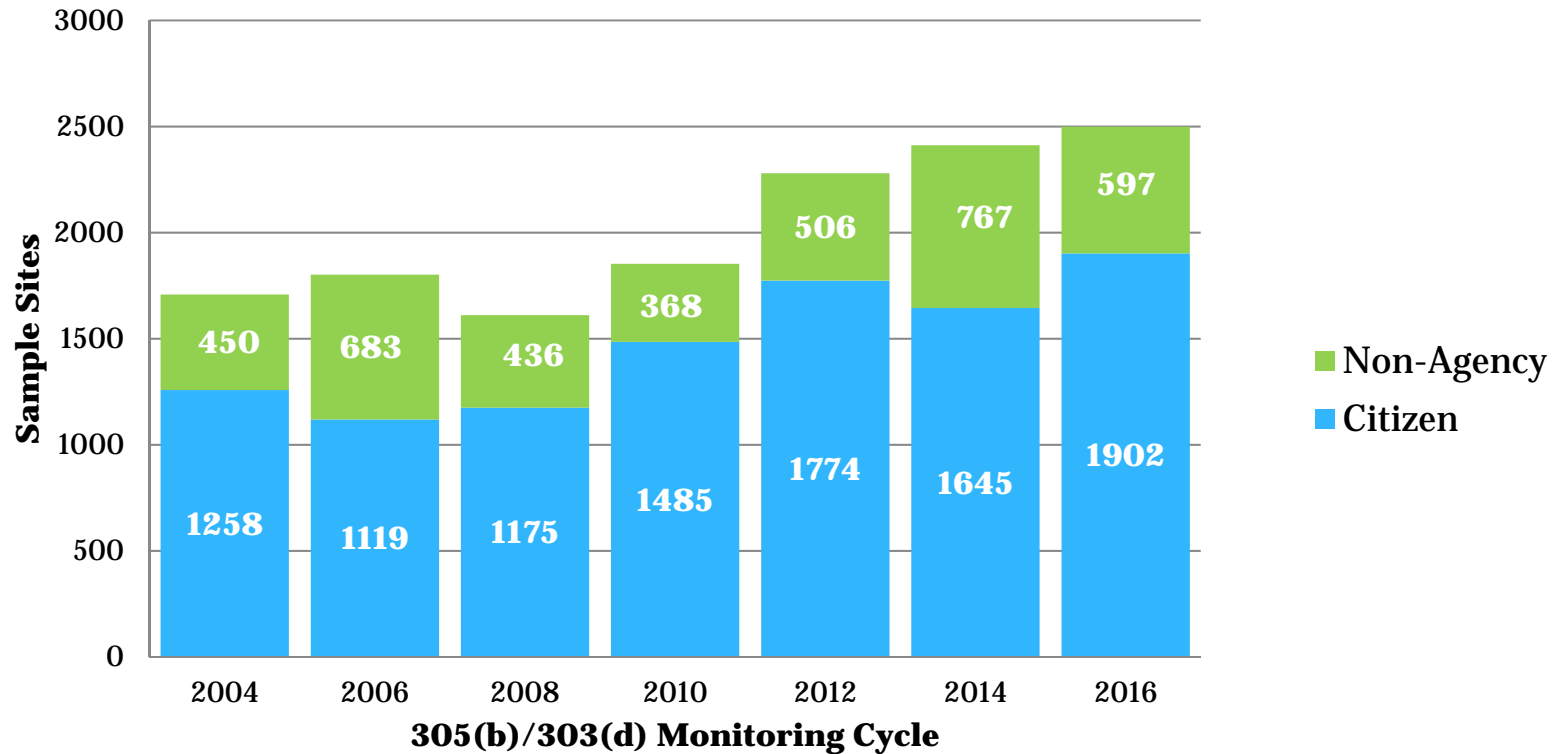
How DEQ Does Not Use Submitted Data

- Submitted data is not used by DEQ for enforcement or similar “regulatory” actions
 - **Codified in [§ 62.1-44.19:11](#)**
- Data is not assessed if it was collected in permitted mixing zones or at discharge pipes
- Submitted data not used by itself to develop TMDL Implementation Plans



Water Quality Assessment - Submitted Data Totals

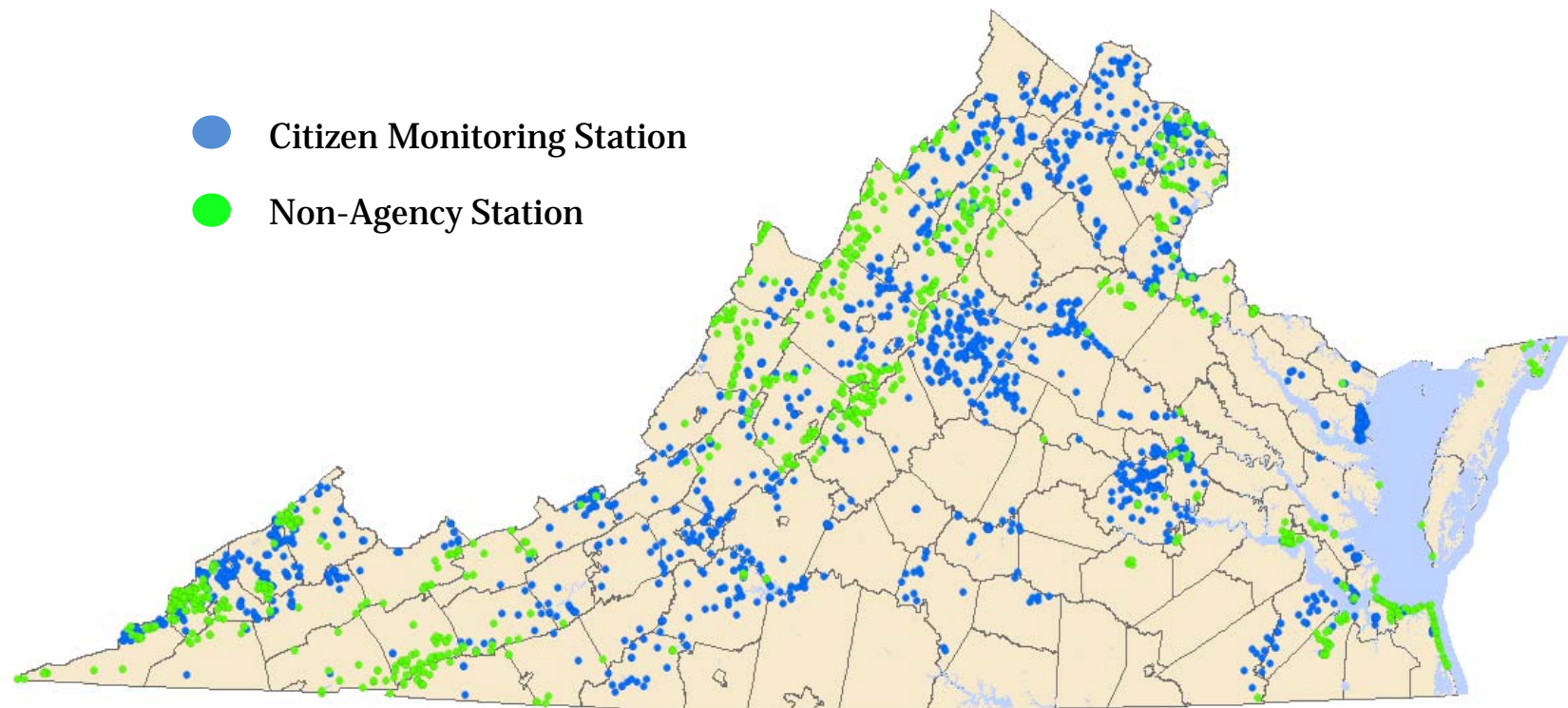
Non-DEQ Stations Submitted



Water Quality Assessment- Citizen Volunteer Data

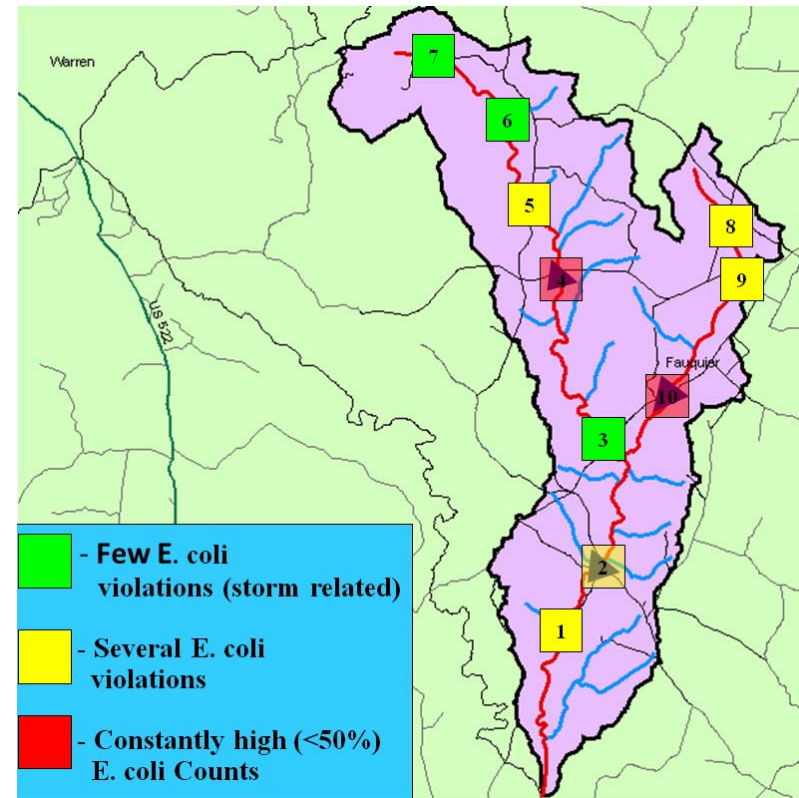
Assessment Cycle	Monitoring Year	Citizen Stations Submitted	Sample Events	Stream Miles	Estuary Mi²	Lake Ac²
2008	2001-2006	1,175	15,605	2,371.61	73.74	9,726.15
2010	2003-2008	1,485	23,420	3,499.45	37.48	30,052.98
2012	2005-2010	1,774	30,829	4,124.44	40.15	27,975.46
2014	2007-2012	1,645	31,871	3,559.96	34.48	24,860.47
2016	2009-2014	1,902	32,859	3,766.89	89.31	15,477.64

Sites Monitored by Citizen or Other Non-DEQ Groups



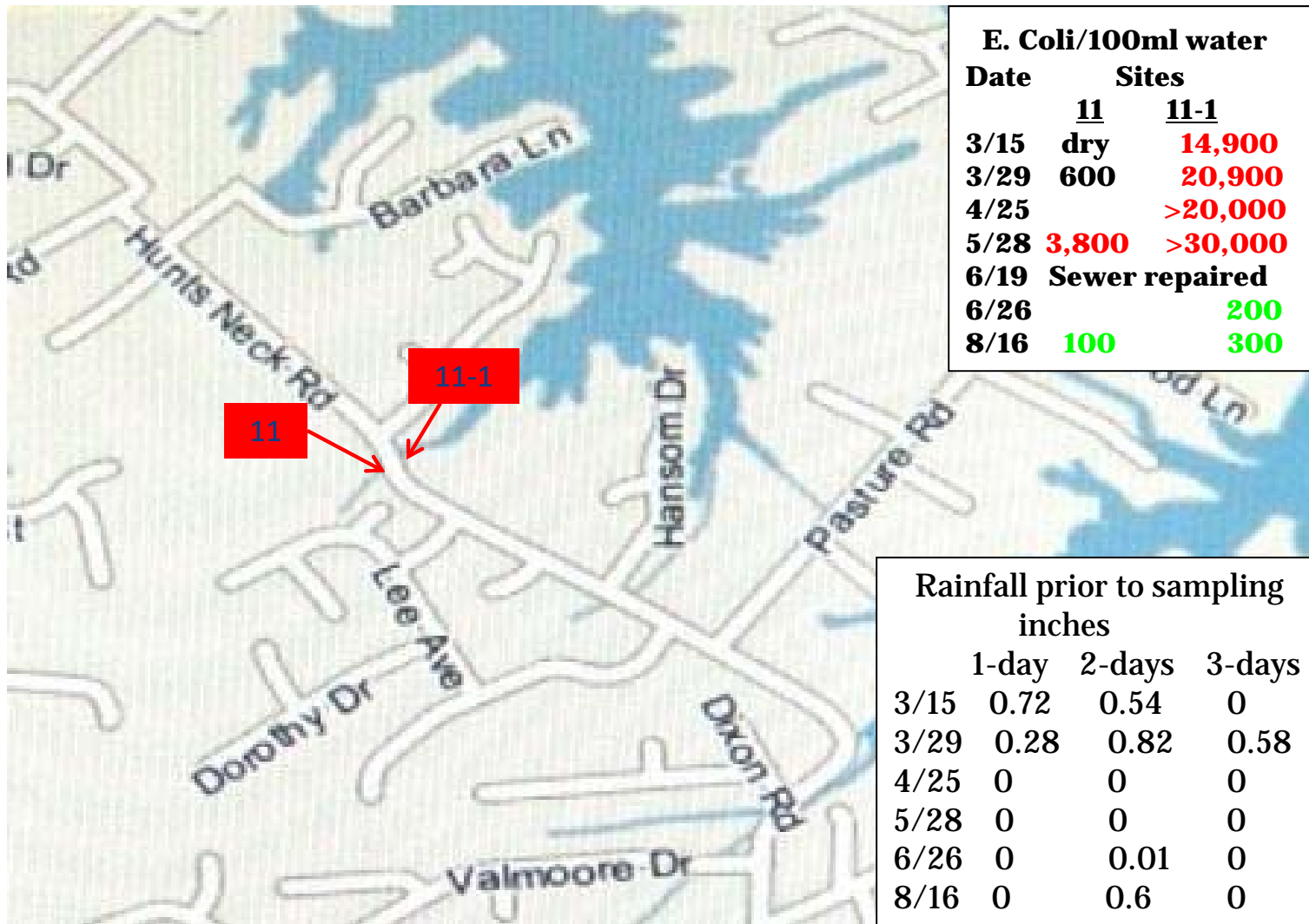
Citizen Monitoring and TMDLs

- Many opportunities for citizens to help with Total Maximum Daily Load projects
 - Provide background or additional data to develop a more targeted TMDL
 - Perform TMDL implementation and BMP monitoring
 - Help promote public education and involvement in the TMDL process



Thumb Run: One of our first Coliscan TMDL monitoring projects

Find Sewer Leaks and Other Sources



High Return of DEQ Investment

- There are over 1,200 Virginia citizen monitors
- Each volunteer spends about 24 hours a year sampling
- DEQ estimates over \$750,000 worth of data is collected
- DEQ invests ~\$200,000 through grants (\$88,000) and staff time (~1.5 FTE) to QA data and coordinate groups
- >275% Return on Investment (ROI) of agency resources



Quotes on the Citizen Volunteer and DEQ Partnership

- **“We would not have a McClure River TMDL without the McClure River Restoration Project”** - Martha Chapman SWRO TMDL Coordinator
- **“Of the 1230 monitoring stations utilized in the VRO 2016 assessment, 685 were from citizen monitors.”** - James Shiflet VRO Water Resources Planner
- **“In fact, Virginia is the only state to receive an A for volunteer engagement. The Virginia Department of Environmental Quality relies on volunteers to provide the most accurate picture of stream health across the state.”** - Izaak Walton League of America *Clean Water: Your Right to Know* report page 138.

Questions:

citizen monitoring



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Virginia DEQ - Citizen Water Quality Monitoring

www.deq.state.va.us/Programs/.../WaterQualityMonitoring/CitizenMonitoring.aspx ▾

Citizen Water Quality Monitoring. What impact can you have on your environment? Follow the lead of other concerned citizens within the Commonwealth and ...

Virginia DEQ - Citizen Monitoring Guidance

www.deq.virginia.gov/.../WaterQualityMonitoring/CitizenMonitoring/Guidan... ▾ Virginia ▾

How do you want DEQ to use your water quality data? We want to take this opportunity to clarify the ways in which DEQ would like to make use of citizen ...

Citizen water monitoring | Minnesota Pollution Control Agency

<https://www.pca.state.mn.us/water/citizen-water-monitoring> ▾

May 26, 2016 - Become a citizen lake or stream volunteer and help gather vital information about the health of our water resources. Volunteers measure the clarity of lakes and streams, collecting valuable data the MPCA uses to make decisions on watershed protection and restoration.