Metropolitan Washington Council of Governments

MEMORANDUM

TO: Water Resources Technical Committee

FROM: Tanya Spano Chief, Regional Water Quality Management *TTS*

SUBJECT: Reassessing COG's Regional Water Quality Monitoring Program

DATE: March 1, 2018

The purpose of this memo is to provide background on one aspect of COG's current regional water quality monitoring program – specifically the long-term monitoring conducted by the Occoquan Water Quality Monitoring Lab; work that is work is funded by COG's members and implemented through a contract that COG manages. Because that contract is up for renewal this summer, this memo also provides provides several options for the WRTC's consideration regarding additional options for COG's water quality monitoring program. These options, which include continuation of the current monitoring program, should be viewed as illustrative and for discussion purposes only., as COG staff has not investigated detailed scopes of work or budgets for these options.

BACKGROUND

Since 1983, the Metropolitan Washington Council of Governments (COG) has sponsored a Potomac fall line monitoring station at Chain Bridge on the Potomac River to measure water quality from upstream sources in the Potomac Watershed. Operated by Virginia Tech's Occoquan Watershed Monitoring Laboratory (OWML), the monitoring program uses a different method to estimate the amounts of nutrients, sediment and other constituents than the one employed by the U.S. Geological Survey (USGS) to estimate the same parameters for purposes of monitoring the Bay TMDL. COG's program thus has provided a long-term estimate of nutrient and sediment loads entering the Potomac estuary independent of the estimates made by USGS and the Chesapeake Bay Program, which uses the USGS data to calibrate its watershed model. Based on a recent OWML study (*Chain Bridge Data Analysis Report*) that COG directed OWML to produce, the analysis has shown that there is general agreement between the load estimates and trends generated by the two sampling programs.

COG's current contract with OWML for this program expires June 30, 2018; and the average annual cost over its five-year life is $154,000. Based on the study results, and the current contract period, COG staff is asking the WRTC for guidance on if/how to proceed with this monitoring work at the March 9th WRTC meeting and members-only work session that will follow. That input will guide our FY 2019 RWQM Work Program development.

Reassessing COG's Regional Water Quality Monitoring Program
Initial Options for WRTC Consideration (3/1/18)

OPTION 1:

CONTINUE THE OWML PROGRAM WITH NO CHANGES

- Extends the 35-year sample record using composite sample analysis
- Continues to provide a check on the USGS-Chesapeake Bay Program load estimation methods for nutrients

OPTION 2:

CONTINUE THE CURRENT OWML PROGRAM, BUT CHANGE SOME OF THE WATER QUALITY PARAMETERS BEING SAMPLED

- Extends the 35-year sample record (for some parameters) using composite sample analysis
- Continues to provide a check on the USGS-Chesapeake Bay Program load estimation methods for nutrients
- Provides some insight into watershed-wide levels of new compounds of interest

OPTION 3:

CONDUCT NITROGEN ISOTOPE ANALYSIS OF THE SOURCES OF NITROGEN IN AREA STREAMS, EXPANDING UPON AN EXISTING EFFORT IN FAIRFAX COUNTY

- Provides information from several watersheds on the sources of elevated nitrogen concentrations; could provide the region as a whole with representative data on the relative importance of different sources of nitrogen loads in the urban environment
- Informs the selection of management options under the Phase III watershed implementation plans for the Bay TMDL

OPTION 4:

CONDUCT A LONG-TERM ANALYSIS OF THE LEVELS OF SODIUM CHLORIDE AND OTHER SALTS IN AREA STREAMS

- Provides a more comprehensive analysis of the trends in chloride and other salts in the region's water, particularly its smaller stream network
- Informs managers implementing salt management practices with water quality data on the effectiveness of their actions

OPTION 5:

CONDUCT A REGION-WIDE ANALYSIS OF THE SOURCES OF BACTERIA IN AREA WATERS, USING THE LATEST MICROBIAL SOURCE TRACKING TECHNOLOGY

- Enhances method development and regional laboratory capacity for newer microbial source tracking methods
- Provides water quality data to evaluate the success of management actions to minimize bacteria pollution
- Provides information that can be used to adjust current bacterial TMDL requirements and better inform any new ones being established

Reassessing COG's Regional Water Quality Monitoring Program
Initial Options for WRTC Consideration (3/1/18)

SUPPORTING BACKGROUND MATERIALS

OPTION 1:
CONTINUE THE CURRENT OWML PROGRAM WITH NO CHANGES

COG would continue to fund the OWML's Chain Bridge monitoring program as is (see COG Chain Bridge fact sheet for details) at the same approximate funding level (as adjusted for inflation). This would extend the sample record and continue to provide an independent check on the USGS-Chesapeake Bay Program data for Chain Bridge

OPTION 2:
CONTINUE THE CURRENT OWML PROGRAM, BUT CHANGE SOME OF THE WATER QUALITY PARAMETERS BEING SAMPLED

COG would continue to fund the OWML's Chain Bridge monitoring program with changes (to be discussed by OWML Director Adil Godrej at COG's Water Resources Technical Committee meeting of March 9) at the same approximate funding level (as adjusted for inflation). For example, OWML could discontinue its analysis of certain constituents, such as various carbon species, and take on new compounds of interest, such as endocrine disruptors and toxicants.

OPTION 3:
CONDUCT NITROGEN ISOTOPE ANALYSIS OF THE SOURCES OF NITROGEN IN AREA STREAMS, EXPANDING UPON AN EXISTING EFFORT IN FAIRFAX COUNTY

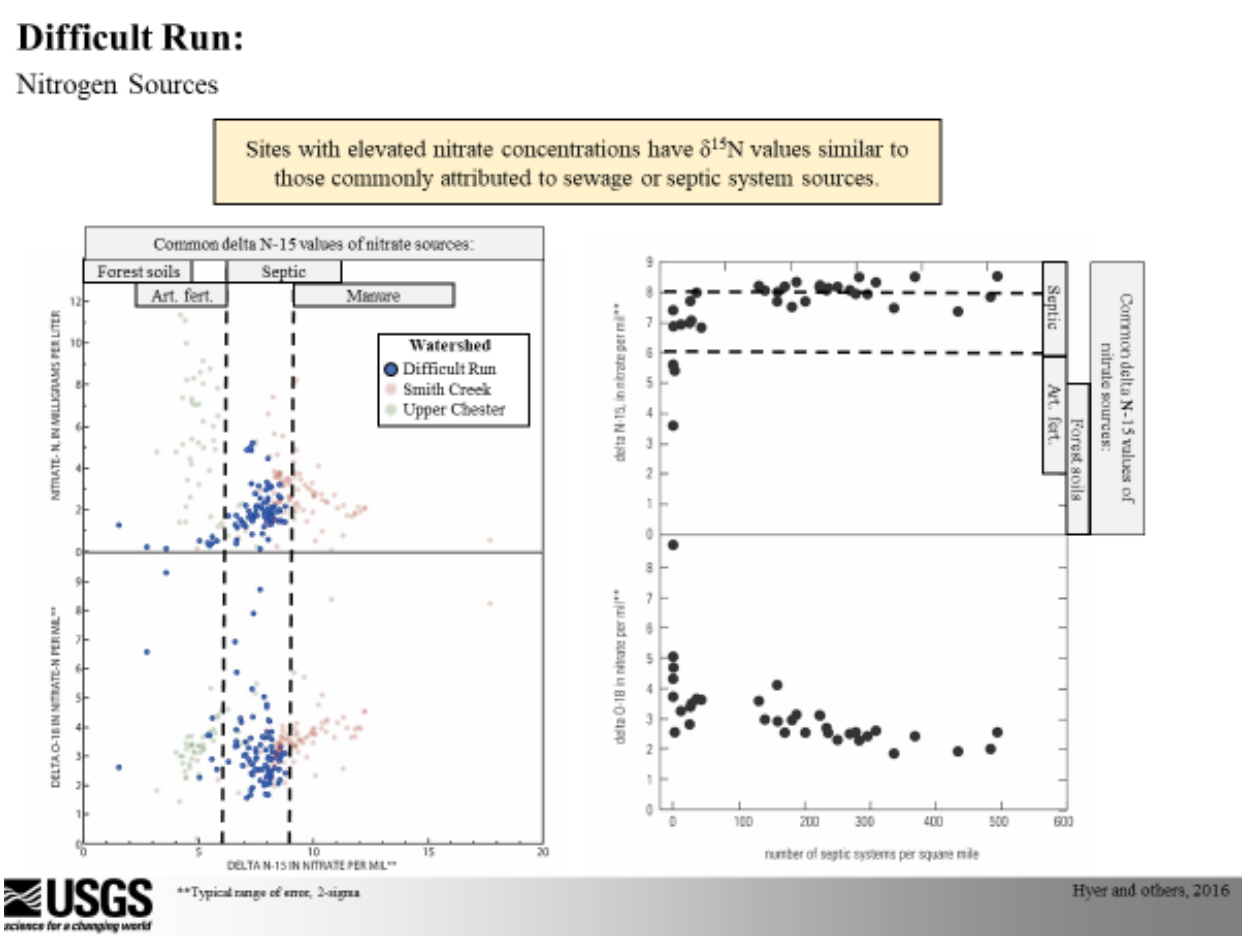
COG could explore opportunities for redirecting the monitoring efforts to instead address specific nitrogen issues in local streams.

COG's FALL 2016 WATER QUALITY WORKSHOP
New Approaches to Water Quality Monitoring and Research
https://www.mwcog.org/events/2016/12/12/new-approaches-to-water-quality-monitoring-and-research/

The USGS has used isotope tracer analysis (Nitrogen -15, Oxygen -18) to identify the origins (whether from fertilizer, septage or sewage, atmospheric deposition or manure) of the nitrate found in water quality samples. As part of an extensive stream monitoring effort in Fairfax County, Va., USGS has used isotope tracer analysis in combination with other lines of evidence to point to septic systems as the most likely cause of elevated concentrations of nitrate in various sub-watersheds of Difficult Run in Fairfax County.[1]

The following information summarizes key points from that work.

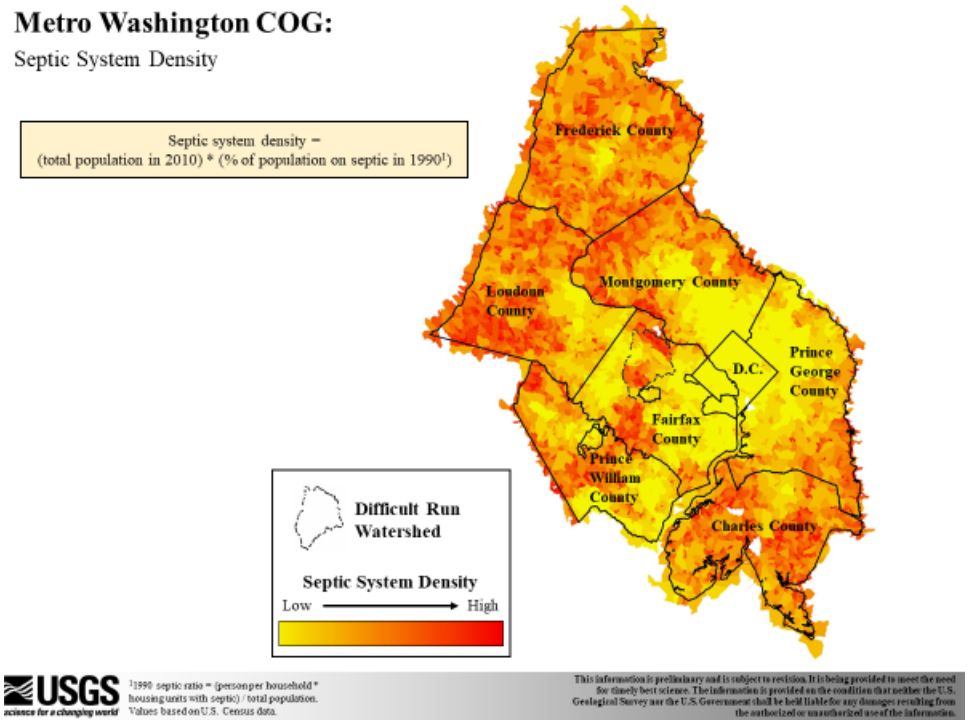
[1] U.S. Geological Survey (USGS) Science Summary—"Spatial and temporal variation of stream chemistry associated with contrasting geology and land-use patterns in the Chesapeake Bay watershed—Summary of results from Smith Creek, Virginia; Upper Chester River, Maryland; Conewago Creek, Pennsylvania; and Difficult Run, Virginia, 2010–2013" https://pubs.usgs.gov/sir/2016/5093/sir20165093.pdf



Slide #12 from "Water-Quality Monitoring in an Urban Watershed: The Influence of Septic Systems on Nitrate Concentrations and Spatial Patterns," a presentation by Jimmy Webber of USGS at COG's water quality monitoring workshop of Dec. 12, 2016

The USGS data indicated that "the mass of nitrogen available from septic system leachate could be approximately an order of magnitude greater than that from fertilizer," according to principal investigator Jimmy Webber. This finding, especially if replicated in other streams across the region, would have significant management implications for water quality managers who are currently investing tens of millions in various types of BMPs, in part to reduce nitrogen loads to the Potomac and the Chesapeake Bay. Currently, managers rely on the Chesapeake Bay Program's watershed model to determine BMP strategies. But the watershed model, while reasonably accurate at the overall basin level, relies on generalized assumptions to quantify the contribution of different sources to loads within smaller watersheds.

The isotope tracer analysis work in the Difficult Run watershed picked up a nitrogen signal from septic systems, which cover a good portion of the COG region's land area, although far more people are served by centralized wastewater systems. The same tracer analysis could be used in areas dominated by wastewater infrastructure to separate the nitrogen signal from sewage from other sources in urban streams.



Slide #18 from "Water-Quality Monitoring in an Urban Watershed: The Influence of Septic Systems on Nitrate Concentrations and Spatial Patterns," a presentation by Jimmy Webber of USGS at COG's water quality monitoring workshop of Dec. 12, 2016

Although analyzing all of the HUC 12 watersheds in the COG region with such techniques would be prohibitively expensive, a combination of synoptic studies to identify sub-watersheds with elevated nitrate levels and tracer analysis to pinpoint the source of the problem could be accomplished in much of the region at a budget level about the same as what COG currently spends.
The information would help local and state water quality managers prioritize practices for nitrogen removal, whether in the Phase III watershed implementation plans for the Chesapeake Bay TMDL, local TMDLs or MS4 permit compliance.

OPTION 4:

CONDUCT A LONG-TERM ANALYSIS OF THE LEVELS OF SODIUM CHLORIDE AND OTHER SALTS IN AREA STREAMS

COG could explore opportunities for redirecting the monitoring efforts to instead address sodium chloride issues in local streams.

COG's SPRING 2016 WATER QUALITY WORKSHOP
Salt Management in the Washington Region Environmental and Transportation Perspectives
https://www.mwcog.org/events/2016/6/27/salt-management-in-washington-region-environmental-and-transporation-perspectives/

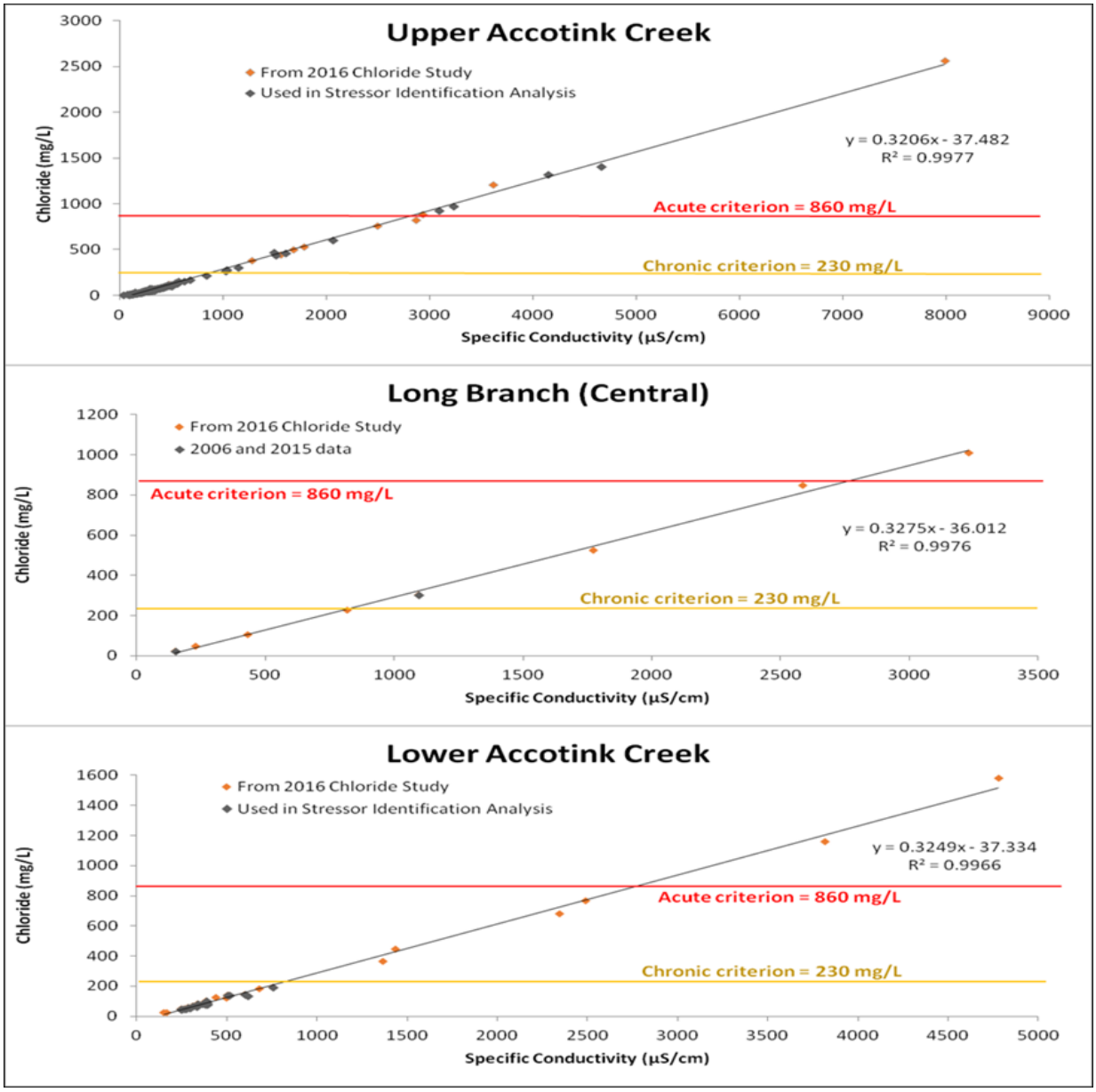
The issue of rising chloride levels in area water bodies[2] has become increasingly important as state regulatory agencies adopt new measures (a chloride TMDL in Accotink Creek) or propose new permit provisions (salt

[2] "Human-accelerated weathering increases salinization, major ions, and alkalinization in fresh water across land use," Sujay Kaushal, et al., Applied Geochemistry, Volume 83, 2017, 121-135, (http://www.sciencedirect.com/science/article/pii/S088329271

management plans in the proposed new permit for Maryland's Phase I MS4 jurisdictions). Increasing levels of chloride and other salts are also a major concern of the region's drinking water utilities.

USGS and the drinking water utilities currently have several monitoring locations on the Potomac River and at drinking water intakes on other major tributaries that provide a long-term record of chloride concentrations. However, most chloride monitoring of smaller streams in the region is done via electrical conductivity measurements, which does not distinguish chloride from other salts and which must be calibrated with actual concentration data

The following data was collected by Virginia's Department of Environmental Quality during its stressor analysis of Accotink Creek.



Slide #5 from "Results of the Stressor Analysis for Accotink Creek in Fairfax County," a presentation by Bryant Thomas of Virginia DEQ at COG's Salt Management workshop of June 27, 2016

Although the long-term monitoring efforts on large rivers and reservoirs will presumably continue and provide some evidence of the effectiveness of current and future remediation efforts, the region lacks a comprehensive trend analysis approach incorporating its smaller stream network. Because of the smaller flow volumes and flashier hydrology of these streams, they are more sensitive to management change than larger watersheds. They also are where high salt concentrations have the most impact on aquatic life.

Currently, Maryland's State Highway Administration and its Department of Natural Resources are collaborating on a three-year study of smaller streams statewide, including several sites in the COG region, but it is not clear whether this effort will continue on a long-term basis. The Stakeholder Advisory Committee for the fledgling Salt Management Strategy for northern Virginia has yet to decide on a long-term monitoring approach.

Using its current monitoring budget, COG could expand and supplement state efforts with a coordinated long-term regional approach that monitors both chlorides and other salts of interest. By focusing on trends in smaller stream, such an approach would provide monitoring data to evaluate the impact of the new management actions being put in place and thus would serve as a key component of adaptive management.

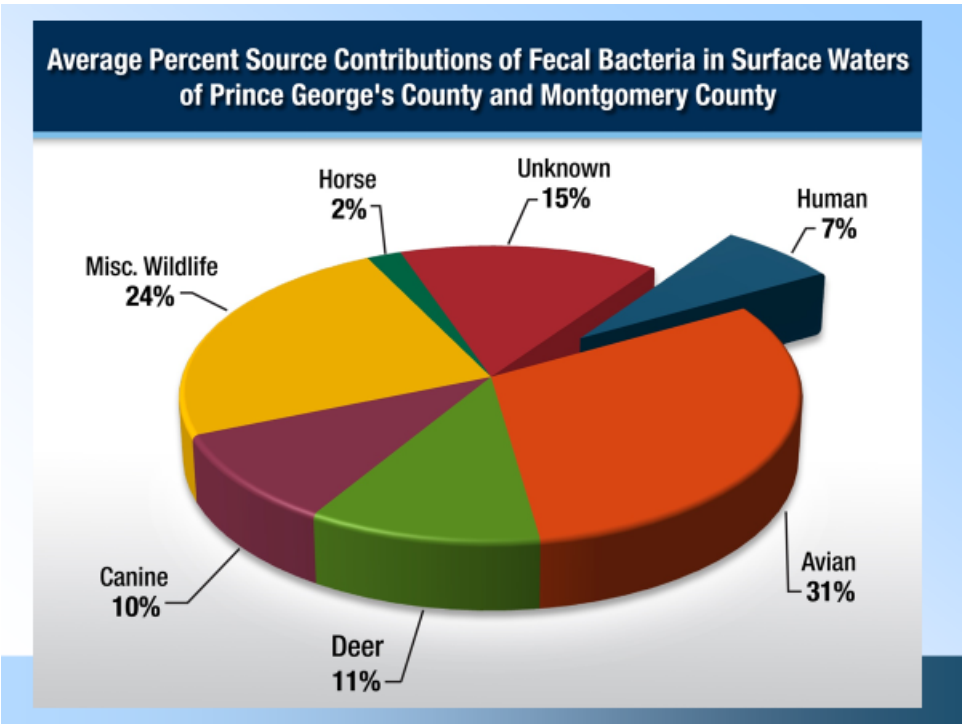
OPTION 5:

CONDUCT A REGION-WIDE ANALYSIS OF THE SOURCES OF BACTERIA IN AREA WATERS, USING THE LATEST MICROBIAL SOURCE TRACKING TECHNOLOGY

COG could explore opportunities for redirecting the monitoring efforts to instead address bacterial issues in local waters.

COG's FALL 2015 WATER QUALITY WORKSHOP
Using Monitoring Results in Local TMDL Development or Revision
https://www.mwcog.org/events/2015/11/16/using-monitoring-results-in-local-tmdl-development-or-revision/

As speakers at a November 2015 COG workshop discussed, many of the bacteria TMDLs that were established on local waters in the early 2000s by EPA and state regulatory agencies used source identification methods and models that are now outdated and whose assumptions have proved to be incorrect. Newer microbial source tracking techniques that use faster and more accurate genetic analysis techniques are generally showing lower levels of human and controllable animal (canine) sources of fecal bacteria in area waterways than those earlier studies.



Slide #6 from "Microbial Source Tracking Data," a presentation by Michael Powell of EA Engineering, Martin Chandler of WSSC, and Charles Hagedorn of Virginia Tech University at COG's Nov. 16, 2015, workshop, "Using Monitoring Results in Local TMDL Development or Revision."

Most COG members currently have bacteria TMDLs for local waters that they must address via implementation or action plans in their stormwater management programs. The region's wastewater utilities also address bacteria contamination through a variety of programs to minimize leaks and spills and, in WSSC's case, have used microbial source tracking techniques to monitor area streams.

Currently there is neither a uniform nor comprehensive approach to microbial source tracking and the methods being used are not completely settled. Most microbial source tracking techniques have been pioneered by university labs and their use has been both experimental and relatively costly. Various local entities have experimented with these techniques, such as WSSC, Arlington County and Frederick County, using various university-based laboratories or, in Arlington's case, the in-house laboratory for the Hampton Roads Sanitation District.

However, innovations in genetic analysis are bringing microbial source tracking into the world of commercial laboratories and making them more cost effective. A region-wide effort sponsored by COG could further enhance methods development and provide a sufficient volume of samples to drive the development of commercial or public sector laboratory capacity to do this work. The data it produced would provide both MS4 and wastewater permittees with better information to measure the success of reduction efforts, and to challenge, if need be, the premises of previous bacterial TMDL and to better shape the contents of future TMDLs.