Nontidal Network Workgroup Monthly meeting

Wednesday, August 17th, 2022
1:00 PM – 2:00 PM

Join by Webinar:
https://umces.webex.com/umces/j.php?MTID=m7d15a76b1a528b8b484083cf913b45e7
Meeting Materials: Link

This meeting was recorded for internal use to assure the accuracy of meeting notes.

Actions:

- ✓ Next meeting – circle back on status of field audits. Check on status of network optimization and station prioritization, and any new funding updates.

AGENDA

1:00 PM **Welcome and Announcements** – *Mark Nardi (USGS)*

- Funding updates
- Please send station prioritization information if you have not already (which stations you would cut if you need to)

- Mark Nardi introduced Chris Mason to the group. Chris is with the USGS VA-WV Water Science Center and took over the loads and trends work from Doug Moyer and Mike Langland.
- Mark provided some funding updates. Mark had some conversations with Lee McDonnell regarding the USGS Nontidal Network agreement. The USGS Interagency Agreement (IA) will include 7 additional stations that will be collocated for continuous water quality monitoring installed this year at River Input Monitoring (RIM) stations. The IA will also include funding for the purchase of equipment for 5 additional small watershed monitoring locations; these locations will be determined by this team. Mark will keep the group posted on the final details.
- Mark reminded the group to send station prioritization information (if something bad happens which stations to keep and which to cut, and the rationale behind that).

1:15 PM **Nontidal Network Loads and Trends for WY2020** – *Chris Mason (USGS)*

- Chris Mason: I presented to this workgroup on the RIM 2020. RIM is presented every year but the full 123 station NTN analysis is developed and presented every other year. We have published those results and I will focus on the short-term trends for this latest release (2011-2020). This presentation focuses predominantly on total nitrogen (TN) and total phosphorous (TP), with some caveats as far as other scenarios we produce as far as long-term trends and other constituents we estimate.

- The short-term trends differs from the last update because we have new stations as we have new data coming in, they will be binned into a different category whether they're able to produce loads for a short term trend, whereas in 2018 they may have not had that ability based on duration of the time for which a time series of water quality data is available.
- The nontidal network contains 123 sites across NY, PA, DE, MD, VA and WV. All adhere to the same USGS water quality monitoring methods. We target a discrete monthly water quality sample and at least 8 storm samples a year. This is juxtaposed against continuous and daily discharge monitoring. Funding is mostly provided by EPA CBP, USGS, PA DEP, MD DNR and VA DEQ.
- Chris showed a map of the 2020 station status. As we bring in more data every two years for the nontidal network we'll be introducing new constituents for pre-existing stations and we'll also be bringing in new stations that haven't yet qualified for at least a load. The pink points on the map are load only sites which means they have at least 5 years of data. We don't yet have 10 year data. We use that 10 year delineator to provide a short term trend. Long term sites are more compared to the RIM sites (which I presented a few months ago). Those are 9 sites that represent 78% of the total watershed of the Chesapeake Bay. (The remaining watershed is below the fall line). We compute those RIM watershed trends every year. We do long term from 1985-present, and we do short term which is going to change every year we compute, analyze and publish those data. For the NTN we roughly make a cut off at 1990 for long term sites. We may change that in the future to provide more long term sites. Overall, there's a 1990 cut off. Every long term site will get a long term trend, a short term trend, and a load represented by every year from the start date of that historic record. Short term trend will get a short term trend relevant to the new publication (for this one 2011-2020) and an annual load going back to historical record. Load only sites will get a 5 year load and a 5 year yield.
- Chris gave a brief overview of methods. We get these estimations from the Weighted Regressions on Time, Discharge and Season (WRTDS) model we run which are means from the daily estimations. We then run a regression on time, discharge and season, then we adjust those loads to be flow normalized loads. Once we have a flow normalized load we recognize a trend and do a percent change from long term to short term. Then we can provide a probability of likelihood that we agree with the estimation of improving or degrading and how so. If it falls between 33 and 67% we say there's no discernable trends. We're not saying there is no trend; we're saying we are as likely to accept that trend as not likely to accept that trend. You'll see some of those no trend estimations show up in the following slides. With our monitoring efforts, we (USGS) believe that our (WRTDS) model produces the best estimations.
- These models and estimations are based on monitoring data. We have 5-15 minute flow discharge estimates we're taking in a continuous manner, we develop a daily mean, apply daily means across the annual record against those monthly and storm sample discrete samples. We're looking to see how our model water quality responses correspond with other results, and we're looking at the drivers of observed water quality changes – what are those? This is the what, but we do have other centers looking at the why (the drivers of what we're seeing).
- For total nitrogen, on the long term side since roughly 1985 (some stations have historic records starting in 1988 or 1989), overall 52% of the stations are improving since 1985. In the short term (2011-2020) data, 30% of the stations are improving. Of the RIM stations, 4 of 9 are improving. 3 of those 4 are the largest of the RIM stations (Susquehanna, Potomac and James). In the

Susquehanna about 35% are improving, and we see more improvement towards the lower watershed near the mouth of the Susquehanna. The majority of the Western shore compared to Eastern shore are improving (the Eastern shore is showing 4/5 degrading). In the Potomac, it's mixed across the basin from east-west, about same number improving as degrading. Most VA watershed stations show no trend.

- For total phosphorus, since roughly 1985, 67% of the stations show improvement. Across the network we have 70 stations reporting a short term trend for phosphorous, and we have 89 stations reporting a short term trend for nitrogen. We are seeing a little more improvement for phosphorous. On the short term 44% of the stations are improving. 4/5 RIM stations are improving, but not the Potomac (Pamunkey replaces Potomac in improvement). In the Susquehanna, 42% of stations are improving. We see more improvement in the upper and lower watershed for phosphorous. There is more of a split with Western and Eastern shore, but the Eastern shore shows more degraded. 50% of Potomac stations are improving and 54% of Virginia watershed stations are improving.
- With the data release and the story map, we provide intermediary constituents along with all these results. We provide nitrate-nitrite, orthophosphate and suspended sediment. In the short term data, nitrate degraded at 69% of the stations, while orthophosphate improved at 66% of the stations, and suspended sediment only improved at 18% of the stations. The suspended sediment and total phosphorous stations are both at 70 of the stations.
- For Susquehanna basin short term trends: the map shows nitrogen yield by catchment and total phosphorous. We see a high level of per acre loading at the lower basin near the mouth of the Susquehanna, but we also see some improvements in these sites that are in high yielding areas. The Susquehanna RIM station (Susquehanna at Conowingo) is showing that on the long term we're extremely likely to accept there is a 23.6% reduction (which is an improvement), and on the short term we're likely to accept a 3.24% reduction. For the NTN stations, Chris highlighted best improving and most degrading. The Conestoga and the Swatara show most improvement. Pine Creek in the mid to Western side of the basement shows the most degradation. We see the same spatial pattern for nitrogen; improvements in the Eastern portion and more degradation in the Western portion. Overall, there are more degrading than improving stations, and the median degradation is 9%, while median improvement is 4.5%.
- For total phosphorous, there are a few less stations. The Conowingo RIM station is showing an improvement short and long term. We're likely to accept the long term and extremely likely to accept the short term improvement. We see more improvement and no trends at the bottom of the mouth, but we also see a flip in that the mid to Western areas of the basin are either showing improvement or no trend. Pine Creek again shows up as most degrading station, and RIM station Conowingo is the most improving. There are 11 improving and 3 degrading for phosphorous loads.
- For the Eastern and Western Shore: there is one RIM site on the Western Shore, Patuxent River near Bowie, and one RIM site on the Eastern Shore, the Choptank. For nitrogen, the Patuxent is extremely likely to be improving on the long and short term, while the Choptank is extremely likely to be degrading on the long and short term. As far as the rest of the network, the Patuxent is the most improving. Marshy Hope in DE is the most degrading. If you combine the two basins, it's a pretty even split of improving, degrading and no trend. It is a smaller median degradation and improvement. Improvement of 4.4% and median degradation of 7%

- For phosphorous we see the same response for the RIM stations compared to nitrogen. Patuxent is extremely likely to be improving on the long and short term, while the Choptank is extremely likely to be degrading on the long and short term. We also see the same response with the Patuxent being the most improving and Marshy Hope being the most degrading. Combining both basins, there is 48% median degradation. That matches the Potomac.
- For the Potomac: There is one RIM station, Potomac River at Chain Bridge. For nitrogen, there is extremely likely long term and likely short term reduction. There is an improving section at the MD-PA border, a cluster of degrading stations near WV, a mixed bag near mouth of Potomac, and some improvement at north fork and south fork Shenandoah which feeds directly into the Potomac. There are more improving than degrading stations, and 14% median degradation and 5.5% median improvement.
- For phosphorous, there is extremely likely improvement for the RIM station. For short term, we see no trend. That's something that speaks to the model and how you get these probability scores. If you want to look at the scores and likelihood estimates I encourage you to download corresponding tables with the data release. The MD-PA border shows no trend and degradation more than improvement, while WV has more improvement than with total nitrogen. Same response with Shenandoahs and a mixed response at the mouth. There is more improving to degrading, 11 to 6. The median degradation is 48% and ties for the largest in the watershed with the Eastern and Western shores.
- For Virginia: There are 5 RIM stations. For total nitrogen for the long term, it's more improvement, and degradation in the short term. There is a mix across the basin from west to east. Little River near Doswell, VA, which is slightly north of Richmond, shows the most improvement, and Calfpasture River in the western portion of the basin shows the most degradation. Overall, it's mixed with improvement, degradation, and no trend. There's more no trend stations in total nitrogen than improving or degrading. For total phosphorous, we see slightly more degradation in the long term, and a mixed bag with the short term. It's 2:2:1 improving:degrading:no trend across the VA basin for short term phosphorous. There are less stations that report total phosphorous in VA compared to total nitrogen. The Rivanna, which is a tributary of the James River, is showing the most improvement, and the Appomattox River is showing the most degrading. The Appomattox has been under some scrutiny and interest. It is showing degradation across all long and short term constituents. It's been written up in the Bay Journal and there are other agencies and interested parties looking into what may be facilitating that degradation, especially since the upstream site at Farm Hill is showing improvements in total nitrogen. Overall, with total phosphorous, we're getting more improvement than degradation, with 8% median improvement and 9% median degradation.
- Sharing results: we provide daily, monthly and annual loads and concentrations in the data release. Each station needs at least 5 years of station data for a load, and as of 2020, all the NTN stations have loads. If you have at least 5 years of loads, you also get a 5 year yield. If you have a trend (which requires at least 10 years of data), you get a 10 year yield. If you have 10 years of data, you get a short term trend, and if you have historic data that existed before 1990, you get a long term trend.
- The results are shared via a data release (links available at the end of Chris's presentation). Also available is the input data and the R and egret versions from WRTDS if you want to compute these on your own. There is also a story map. You can select a single site or basin and it will give

you available data and summary statistics. You can use the lasso tool to select a group of stations.

- Another data sharing method is the CBRIM page, which has also been updated. This houses the most recent, and the most recent past data release information and summary. 2020 and 2018 is there. If you want to link onto any of the table queries you can still access CBRIM. All the updated maps and links are available at this website.
- The Chesapeake Watershed Data Dashboard is another resource. It is in the process of being updated.
- EPA computers had some issues opening the links. However, if you click on "advanced" and proceed anyway, you will be able to open the link and won't have problems clicking on that link in the future.
- Kaylyn Gootman (EPA) asked who made the video and Chris said it was Casey Fontz out of the West Virginia Water Science Center.
- Mike Mallonee: I have been emailing the datasets to James Colgin. Did he forward the water year 2021 data to you or should I send it directly to you?
- Chris: It should go to James. He gets the initial data set.
- Doug Moyer gave an overview of how the data gets to Chris. All the agencies in the NTN WG collect the samples. Then there's a transmission of data to the Data Upload and Evaluation Tool (DUET) process and stored in the database at the Bay Program. Mike runs scripts and quality assurance (QA) on them. The scripts he pulls will take the raw data and send it to James Colgin at the PA Water Science Center. James has a series of scripts which have a couple functions. The process brings in state and USGS station IDs, and figures out which stations belong together (have the same physical location). This ensures that instead of having 150 time series for data, it's merged to have 123 timeseries for each of the constituents. Then there's another script that says how do we compute TP and TN concentrations. Depending on the time of the record and station or the lab that's analyzed, different constituents are used to sum up to determine the total concentration of TN and TP. There's an analysis to get to TP and TN and it varies over time. That script has a decision tree that says if we're at this time frame and have these constituents use this as a priority, else this round of constituents etc. James also has some QA on that as well. Those raw datasets are pulled together. Stations are joined to get the right station numbers. Constituents are merged to get to TN, TP, nitrate, suspended sediment and orthophosphorous. James's last step is to merge the WRTDS files that Chris Mason uses as inputs to WRTDS process. 2021 data should all be going to James and James is storing it in his database at PA water science center. The scripts will not be run until we have the 2022 data sets. Where everyone can help is at the data collector level, make sure you QA that data when they come back from the lab before you send it off to Mike. That helps us because you're the owner of those data and can say whether they are high quality data or if there are issues. The sooner we can do it once we have 2022 data in that will allow James to go through his process, which takes 4-5 weeks to get through all the timeseries and get the files clean and ready for Chris. Then once Chris gets the data, it's a minimum of 5 months until we're able to publish those results. So the sooner the data is transmitted the sooner you can get those results.
- Alex Soroka (USGS): DUET is now called C4.

- Tammy Zimmerman (USGS): Appreciated the presentation, Chris. Question - one slide that showed Accotink, VA looked like it said there was 100% change in total phosphorous in the 2011-2020 time period, was that right?
- Chris : that's correct. It was percent change. Unfortunately it was degrading.
- Doug: We fixed a bug in WRTDS that was giving greater than 100% improvements but on the degrading side, especially when you're dealing with smaller concentrations you can get a high percent increase.
- Chris: when you see something like that it's interesting to dive into the yields.
- Mark: that's a good point. If it goes into a quarter of a milligram to two milligrams that's a big change but may not be that impactful.
- Matt Cashman: back on the process and data source side, there's a lot of water quality data accessible in the Chesapeake Bay Data Hub. Are those separate water quality data than used in this workflow process or are you pulling from a different database?
- Mike: I am pulling from the same Chesapeake Environmental Data Repository (CEDR) database that the data hub is drawing from. It's all one data source.
- Doug: Is it correct that on the data hub there may be more sites listed than in the NTN? Are there more stations represented on the hub than the 123 NTN stations?
- Mike: the data hub pulls from CEDR and CEDR contains both tidal and nontidal data sources.
- Doug: What's in CEDR is in the hub, but what's on the hub is not everything in CEDR.
- Mike: Any water quality data that is uploaded to DUET goes through all the QA checks is accepted and imported into CEDR and is available through the data hub.
- Matt: I've also pulled some water quality data for matching up to where macroinvertebrates were collected at the same time and where we have habitat data. A number of those are just at random monitoring locations; for macroinvertebrates that may not co-locate at a gauge. I just wanted to make sure it's that same data even if it's a different location.
- Mike: it's one source. The data hub allows you to pull strictly water quality data from the water quality programs, and CEDR also houses living resources data sets and there is water quality data collected at many sites for the NTN benthic project.
- Qian: there's a category called NTID – Nontidal out of network water quality monitoring project separate from the NTN. There are some stations there but don't know how many data points. Maybe there are more stations in here. I was interested in knowing whether there is any plan, is it worthwhile to have the code part of the archive you release? I noted you have input data from the latest output all well organized in data release. For someone who wants to make an analysis for other stations or other constituents (other than the big 5), do you think it's possible to have the code to be part of that as well so people can use same arguments when running the WRTDS or WRTDS-Kalman analysis and be consistent with what you do every year? When I heard the presentation, I noted that the long term trends is not really part of the presentation or part of the PDF summary and wondered why. Then I realized in last data release 1985-2018 there was no long term either. There were long term trends in 1985-2016 release. Why is long term not part of this communication product?
- D: It was by design that the summary focuses on short term changes because as we got into the Total Maximum Daily Loads (TMDL), the focus was on the recent changes. At the time there was not as much interest in changes from 1985 but what's happened recently, how can we line up with two year milestones, etc., so most recent 10 year had greatest relevance at the time. Not

that long term isn't important. You can get to the long term and we provide it through different communications tools to say what is the long and short term trend but when we highlight it and try to put everything on a map, the greatest amount of information is in the 10 year data. If you go to long term, for phosphorous we only have 18 of 123 sites you can show. That leaves people concerned with there not being a lot of information. You get more of the NTN network represented in the short term data.

- James Colgin (USGS) in the chat: I might have additional historical data (maybe additional sites) that is not in CEDR. I am only sent 1 year's worth of new data that is tacked on to historical data. We have considered doing a data release for the historical data.
- Matt in the chat: Qian, there is also an API to access data through the datahub. We can talk - I have scripts that can access the data
- Qian: for the annual RIM update every year, that will continue to have long and short term?
- Doug: yes, RIM update every year will have short and long term. As far as the code goes, much of our code is on the post processing and batch running of the script. A lot of the resources coming out through Bob Hirsch and others through the Egret package can allow that. We can talk case by case for code sharing.
- Mike: As far as the NTID project, that's Maryland Department of Natural Resource's (MD DNR) core trend project. Some of the stations overlap between NTID and NTN. NTID is a bucket sample as opposed to NTN sites being equal in sampling methods to USGS approved sampling method.
- Next time: circle back on field audits.

2:00 PM **Adjourn**

Participants:

Amy Goldfischer (CRC), Chris Mason (USGS), Doug Chambers (USGS), James Webber (USGS), Tammy Zimmerman (USGS), Roger Stewart (VA DEP), Nicholas Santoro (USGS), Breck Sullivan (USGS), Ken Hyer (USGS), Meighan Wisswell (VA DEQ), Mike Mallonee (ICPRB), Nicholas Murray (WV DEQ), Qian Zhang (UMCES), Tyler Shenk (SRBC), Alex Soroka (USGS), James Colgin (USGS), Mark Nardi (USGS), Matthew Cashman (USGS), Cindy Johnson (VADEQ), Kaylyn Gootman (EPA), Lucretia Brown (DC DOEE), Doug Moyer (USGS), John Jastram (USGS)