Water Quality Monitoring Work Group
TEAMS Online Meeting
September 7, 2023 – Meeting Summary

Attendance

Jim Ammerman (Chair)—Long Island Sound Study (LISS)/NEIWPCC
Mary Becker-- Connecticut Department of Energy and Environmental Protection (CT DEEP)
Jordan Bishop—NEIWPCC
Anthony Caniano—Suffolk County
Michael Craghan-- Environmental Protection Agency (EPA)
Melissa Duvall—EPA
Richard Friesner—NEIWPCC
Michele Golden—New York State Department of Environmental Conservation (NYS DEC)
Ben Lawton—EPA ORISE
Peter Linderoth—Save The Sound (STS)
Kamazima Lwiza—Stony Brook University
Michelle Lapinel McAllister-- Coalition to Save Hempstead Harbor
Jon Morrison—USGS
Esther Nelson--EPA
Jim O'Donnell—UConn
Beau Ranheim—NY City Dept. of Environmental Protection (NYCDEP)
Samarra Scantlebury –NYSDEC
Nikki Spiller—Harbor Watch
Paul Stacey—Footprints in the Water
Kelly Streich—CT DEEP
Cayla Sullivan-- EPA, LIS Office
Nikki Tachiki--EPA
Jamie Vaudrey--UConn

Jim Ammerman quickly reviewed the meeting agenda, including talks from Peter Linderoth on QuickDrops, from Michael Craghan on estuarine remote sensing, a review of the 2023 summer monitoring season, and a discussion of the work group's work plan for the next year including budget priorities.

QuickDrops: Peter Linderoth, Save the Sound
Peter said that the release of the alpha version of QuickDrops was planned for the end of the month and today he is going to show a live demonstration of it. He started with a list of the partners involved including initial support from the Long Island Sound Funders Collaborative, and collaboration among Save the Sound, The Maritime Aquarium at Norwalk, Harbor Watch, Kisters, UCONN, and The COMMONS. The original project goal was to develop a standardized user-friendly data storage, visualization, and retrieval system for Long Island Sound community-generated data. They are currently developing the user training, including videos, refining the

WQX uplands, and finalizing the interface. He started with the login screen and showed the landing page with different maps and tables of stations. Every organizational user will have an account administrator as well as data contributors and users. The starting parameters in the database were based on surveys of LIS data generators and initially about 175 are being entered, though more can always be added if they are in the WQX library. Parameters also specify the relevant methods and units, and for nutrients also speciation. Stations can also be uploaded using templates or manually and are later assigned to projects. Organizational documents, such as QAPPs, SOPs, equipment manuals, etc., can also be uploaded.

At this point, after specifying the settings, users, parameters, stations, and documents, specific projects are detailed using the relevant entries made previously. The project must first address a series of questions, including completion of a "Methodology and Data Quality Statement", for which a template is provided, before uploading the project data. QuickDrops will take both discrete and continuous data, but the type needs to be specified. Uploaded data appears in a spreadsheet format and the field headers must either be the standard ones from the QuickDrops templates or as individually mapped by the users. Custom user headings can be saved and applied repeatedly. QuickDrops also adds three fields that are required by WQX to these headings and WQX will also convert the user-specified units to those required by WQX. The data can then be uploaded to QuickDrops and then synchronized to WQX, after it is verified by QuickDrops.

Several types of maps, data layers, and polygons can be applied to the uploaded data and individual stations or groups of stations including specific locations or watersheds can be searched for and selected for further examination using various filters. Data can be shown in a table, downloaded, or shown in scatter or box plots. Figures can then be saved in the user's dashboard and will automatically update as new data comes in. Continuous data can also be loaded into QuickDrops, which uses the same data compression that Excel uses. Such data can even be pushed to WQX as a zipped folder. Save the Sound will be offering extensive training in the use of QuickDrops and has been funded by the Long Island Regional Planning Council to do in person training on the north and south shores of Long Island as well as also creating instructional videos. Though not water quality parameters, information on Harmful Algal Blooms (HABs) and eelgrass extent may also be added.

Questions:

1. Jim Ammerman asked about how this QuickDrops system would talk to the USGS mapper being developed for Long Island Sound data. Peter answered that they have been talking to the USGS team working on the mapper and there is a full API (application programming interface) at the back end of QuickDrops which will allow station information from QuickDrops to be imported into the mapper. Peter also mentioned that table or figures made in QuickDrops can be embedded in web pages and shared with others.
2. Kamazima Lwiza asked if instrument data was included in the database. Peter replied that it would be included in the required QAPP, SOP, or the "Methodology and Data

Quality Statement, but was not specifically required by WQX. Kamazima also asked if two colleagues from separate organizations uploaded related data from the same location at the same time. Peter replied that QuickDrops was organization-based and would categorize the data by organization. Finally, Kamazima asked what the download formats were, just Excel or others as well. Peter noted that Excel was widely used but data could also be downloaded as CSV, JPEG, PDF, or PNG.

3. In response to a question from Jon Morrison, Peter confirmed that a download could be in CSV, and noted that using the API one could pull more specific data. Jon also asked about the QA/QC process for continuous data. Peter replied that it was up to the data collectors, but that QuickDrops did reject data outside of normal ranges.
4. Testing by others beyond the initial core group will start on September 21.

Estuary Temperature Climatologies: Michael Craghan, EPA Office of Water, EPA Headquarters Office

Michael worked with Mark Tedesco and Nikki Tachiki to get this project started and worked closely with NOAA CoastWatch to make it happen. CoastWatch is a valuable tool that will also have additional uses going forward. Water temperate has widespread effects, impacting water quality, fish and wildlife, chemical and physical properties, and human uses. Temperature climatology establishes what is typical—both over a year and for every month, identifies trends, and is place-based, it integrates all available satellite data for each US estuary. The estuary temperature time-series are based on the NASA Multi-scale Ultra-high Resolution (MUR) Sea Surface Temperature using data from 2007-2021 for 83 different estuaries. The sea surface temperature (SST) data is developed from observations by a variety of sensors on several different satellites. The data set has a resolution of 0.01 degrees which results in grid cells of about 1 km. The data set was selected for its spatial and temporal coverage.

From the CoastWatch web site you click on the Data Portal Map Viewer and go to the Estuaries Toolkit. Twenty-five cells of 1 km^2 of clear open water (not contaminated by land) is the threshold for useful data, which includes about 2/3 of US estuaries, many others are just too small. Long Island Sound (LIS) is a large estuary of 3,314 km^2, which would yield 2500 to 3000 usable pixels, leading to 80,000 temperature observations per month to be averaged.

Michael then switched to a demonstration of the CoastWatch web page and pulled up a graph of annual LIS SST for 2007-2021. He then viewed diverse options such as the average temperature for specific months, showing annual temperature cycles, or adding or removing trend lines. He briefly demonstrated how to download data from the website and produced a table of annual data from Tampa Bay as an example. He is often asked whether data is available for LIS embayments, and though they do not meet the 25-pixel NOAA threshold, the underlying data is available. He chose a point in Hempstead Bay and produced a graph of the SST at that point from June 1 to September 1, 2018, which could also be downloaded if desired. Michael also demonstrated what could be done with the CoastWatch application in terms of examining temperature data from an embayment in more detail. From historical data he showed that the Northwest Atlantic Marine Heat Wave of 2012 showed up in Casco Bay, Maine. The Northeast

Pacific Heat Wave in 2015 (known as The Blob), also appeared in Tillamook Bay, in Oregon. The elevated temperatures in Gardiners Bay in Peconic Bay from 2019-2021 which led to the death of the bay scallops also appears in CoastWatch. Future upgrades will add Gulf of Mexico and West Coast estuaries as well as updating with 2022 data and automating the data acquisition process. NASA data reprocessing efforts may eventually extend the time series back to 2002 and perhaps to the 1980s.

Questions:

1. Peter Linderoth asked what was the most up to date data in the tool and how often updates occur. Michael replied that currently it is updated through the end of 2021, and that 2022 and 2023 data would be entered together. The eventual goal is to automate monthly updates.
2. Jim O'Donnell said it was impressive but that he was skeptical of the information. He noted that on many days are not clear images of LIS, so the data is biased by being limited to clear days. Without evaluating the bias can you really say that there are temperature trends and not just trends in the number of clear days. In addition, there is spatial smoothing as well as temporal averaging. Michael replied that there are a lot of different instruments measuring the temperature repeatedly but that he was not an expert in the technology. Jim replied that many sensors just measured the temperature of the cloud tops. Michael noted that there had been a lot of testing in Chesapeake Bay and some limited ground truthing in LIS.
3. Ben Lawton asked about the embayment data, whether the few pixels in embayments existed. Michael replied that the pixels did not exist as embayments in the tool but were available and would have to be assembled by the user.
4. Kamazima Lwiza asked if there was any effort to bring other related data, like chlorophyll *a,* or water clarity. Michael said that one of the problems was that every estuary has different optics and requires its own calibration so that it is unlikely that there will be a lot of additional parameters available in this tool.

Review of the Summer 2023 Monitoring Season

Unified Water Study (UWS): Peter Linderoth, Save the Sound

Project Oceanology (Project O) successfully joined the UWS this summer, bringing it to 47 embayments. The are monitoring Mumford Cove and the Poquonnock River, both near Groton, CT. Mumford Cove is of historical interest because of the recovery of eelgrass following outfall removal. In 2024, two additional embayments from the Fishers Island Seagrass Management Coalition will join the UWS. Jim Ammerman asked about any significant observations or trends and Peter replied that the Westchester coast has some late summer blooms and reports of possible cyanobacteria floating on the surface especially in locations near freshwater tributaries. The UWS has also retired all their Eureka multiparameter instruments and replaced them with YSI ProDSS and EXO1 sensors which have performed well, except for a couple of turbidity sensors. Paul Stacey asked about Mumford Cove and the resiliency of the eelgrass beds which appeared after removal of the sewage outfall. Jamie Vaudrey added that they had

been going out to Mumford Cover with EPA Region 1 to verify the use of satellite data for mapping eelgrass. Last year there was a significant decline in eelgrass in Mumford Cove, but it has increased this year showing the variability found in many coves. The sewage outfall was relocated from Mumford Cove to the Thames River in 1987. Water quality improvement started in Mumford Cove almost immediately after the outfall removal, but it took fifteen years for eelgrass to come back naturally. Mumford cove is also part of the new CT National Estuarine Research Reserve so they will be monitoring eelgrass and hope to make it a long-term monitoring station.

LIS Hypoxia: Katie O'Brien-Clayton, CT DEEP
Jim Ammerman said that CT DEEP data showed the largest area of hypoxia in LIS was 350 km^2, or 135 mi^2, which would be the largest since 2021 and 2016. Katie (working on samples at the dock) agreed and said it was not surprising given that the weather this summer was hot and wet. She also mentioned that the Dempsey was out of action with hydraulic steering problems. Jim followed up with a question about the status of the Dempsey's replacement and Katie responded that the bids received were too high and now they had to move forward with an RFP, agreeing that it was a long-term process.

Long Island Sound Integrated Coastal Observing System (LISICOS): Jim O'Donnell, UConn
Jim O'Donnell showed the near bottom dissolved oxygen (DO) concentration from June to today at the Execution Rocks buoy on the UCONN ERDDAP server. In was below 3 mg/l from early July to late August and was zero in late July. It has bounced around recently but is currently declining which is unusual. He also showed similar rapid increases and decreases in DO in the bottom waters for the Western Sound Buoy. The ARTG buoy is currently not telemetering data, but the data is stored and will be available later. Jim also mentioned that he just received notification of funding for next year which will enable hiring more support to increase access to older LISICOS data and improve buoy telemetry. Current buoy data is available on the UCONN ERDDAP server which he briefly demonstrated, and data from a recent glider deployment in the western Sound will be available soon.

Questions:

1. Paul Stacey noted that we have not made significant nitrogen reductions in LIS in the last decade and this year's hypoxia area was higher than normal. Was there something about the climate or the weather that caused this larger area or is something else going on? Jim O'Donnell made two points: 1. We don't have good nitrogen loading data, as reporting is slow, and 2. Since the area of hypoxia is now smaller, it is also more difficult to measure accurately. Therefore, it is difficult to pinpoint changes in loading, weather, or other natural variability as the cause. Paul responded that he now considers nitrogen loading as part of natural variability which is unaffected by our management. Jim responded that in his report to CT DEEP he found that there were five years of anomalously large hypoxic areas that he could not explain while he believed that the

hypoxic area in most other years could be explained by the nitrogen loading. Paul replied that in his opinion it was natural variation and was not likely to significantly improve.

Upper Connecticut River Monitoring Project: Jon Morrison, USGS
Jon said that this was the first year that they collected data from the entire Connecticut River watershed, including Massachusetts, New Hampshire, and Vermont. Their sampling crew was out on the upper Connecticut River in early July when there was significant rainfall and flooding. He showed a photo of their sampling site at North Walpole, New Hampshire, which included a raft of debris, as well as a series of filled sampled bottles showing the heavy sediment load at that location. They got water samples all the way down the river by using their heavy sampler because of the high water levels and velocities.

The Connecticut River flow peaked at Thompsonville, CT at just over 100,000 cubic feet per second on about July 12, and USGS was able to follow the peaks in flow and turbidity all the way down river to LIS. The turbidity caused brief discontinuities in their automated nitrate sensors downstream because it blocked the UV light, however, that data will be filled in with discrete sample measurements. It was a hot and wet summer with a lot of nonpoint source deliveries to the rivers which they have been actively monitoring. In addition, USGS monitors ten LIS embayments in Connecticut and New York, including new monitoring of the Farm River estuary in Connecticut. Dissolved oxygen (DO) monitoring has continued in Norwalk Harbor, with several periods of hypoxia/anoxia through the summer in both surface and bottom waters, though now in September it is beginning to recover.

Jon provided quick updates on other USGS projects including the USGS Long Island Sound Data Mapper. Meetings have been held with stakeholders and the initial round of data types, locations, and metadata have been compiled. An update and stakeholder briefing will be held on Friday, September 22nd. (Note: this meeting was a useful update on project progress.) The development of the dynamic SPARROW model is continuing to move forward. Data compilation and load modeling using WRTDS has been completed and model predictors have been evaluated and analyzed. Currently the project is working on how to couple SPARROW with the RBEROST part of the model. The nitrogen load analysis for the Connecticut fall line has been done and should be updated in the dashboard by early October.

New York City Monitoring: Beau Ranheim, New York City Department of Environmental Protection (NYCDEP)
Beau said that their regular monitoring in New York Harbor this summer was uneventful, the Harbor had few problems. Another monitoring effort requiring dry weather was more challenging. However, he spent much of his time doing other things like fixing problems. Their new boat already had engine problems which will need repair. He has also been short of three staff members for two years but hopes to be fully staffed by January, facilitating more regular data releases than in the recent past.

Questions:

1. Paul Stacey commented that the LISS had spent a lot of money on monitoring and that it was worth it to show the decline in hypoxic area because of the treatment plant upgrades. However, he wondered if the monitoring was useful going forward and asked Jon Morrison if he could see any non-sewage (presumably nonpoint source) nitrogen reductions in the USGS data. Jon said that information was difficult to tease out of the long-term model data but that they were now looking more closely at seasonal variations. Looking at the absolute load data it is important to know whether it was a wet or dry year since the nonpoint load increases significantly in a wet year like this past summer with frequent large rain events with substantial amounts of runoff. They are looking more closely at the point vs. nonpoint source loads. The other reason for monitoring investments is to be able to set nutrient criteria in both New York and Connecticut, which Paul said has never been done. Jon commented that the data documented a clear decline in point source loading and now they need to get a better understanding of nonpoint source loading.

Annual Work Group Work Plan and Potential Priorities for Next Year's Budget: Jim Ammerman, NEIWPCC

Jim reviewed the work plan, quickly covering the boilerplate slides at the beginning. Though he noted that he has substituted an organization list for a member list as the attendees vary. He mentioned that there has been a great increase in the amount of monitoring in recent years, from the Unified Water Study to the recent addition of acidification and pathogen monitoring, as well as the increased upstream monitoring by USGS described earlier. He emphasized that rather than increasing monitoring even more, the focus going forward should be on data management to make that data more available and accessible.

Priorities for the Coming Year

Data collected using EPA funds is currently required to be uploaded to WQX/WQP, though this database may not currently be useable for continuous data which can be uploaded to other secure and accessible databases, such as NOAA ERDDAP servers. Once QuickDrops, as discussed by Peter Linderoth earlier in this meeting, is fully deployed, it should help to facilitate uploading of data to WQX/WQP. Peter suggested that LISS-supported Futures Fund grants through NFWF, and research grants through Sea Grant, should specify that data be uploaded to WQX/WQP and suggest QuickDrops or other intermediate steps to facilitate it.

Another important responsibility of LISS data collectors is to provide their metadata to the new USGS LIS Data Clearinghouse, or data mapper, which is currently in development and will include metadata and location data from all LISS-supported data as well as other important LIS data. This data mapper is not just for water quality data, but also includes habitat and other LIS data, and the project leaders recently held a stakeholder meeting to update those interested, as discussed by Jon Morrison earlier in this meeting. LISS infrastructure funding is also

supporting improved LISICOS telemetry as well as the replacement ship for CT DEEP's R/V Dempsey. As discussed earlier in this meeting, both projects have been delayed, though the LISICOS telemetry should be improved by next summer. The new ship is likely to take longer.

The meeting of this work group in June 2022 focused on environmental justice (EJ) following this work group chair's earlier discussions with the EJ work group co-chairs in advance of the meeting. Detailed notes from that meeting, including numerous suggestions for EJ-related activities by this work group can be found in the meeting notes on the LISS website. However, little activity has occurred, at least that has been mentioned to this work group, so that should be considered a work group priority for the next year, though further discussion will be needed. Additionally, the new LISS Communications Plan calls for more frequent information exchanges between the work group and the communications team. That increased exchange has not yet begun and will probably not start until the communications team is fully staffed. An additional task for this work group in the coming year will be to support the development of the new 2025 CCMP and review the implementation actions for the five-year period of 2025-2029.

Potential Priorities for the Budget Period 10/1/24-9/30/25

This work group may want to consider developing a five-year work plan, as was suggested in the memo that requested work plans as a potential way to proceed. Both the Environmental Justice and the Sustainable and Resilient Community work groups have done this, though both started from very limited activities. This work group, in contrast, includes many separate groups which are pursuing extensive monitoring efforts over long time periods that are increasing every year. Therefore, development of a five-year work plan to better coordinate LISS monitoring efforts would probably be a worthwhile though difficult challenge. Developing such a plan in parallel with the new CCMP may also be particularly timely.

Jim further discussed the use of Open Science methods, as has been championed by the data scientist Marcus Beck at the Tampa Bay Estuary Program. Several members of the work group were involved in the OpenScapes pilot as part of the EPA Hypoxia Forecast Project last spring. The work group could automate acquisition, extraction, and analysis of water quality data from public repositories using these methods, with the recently acquired acidification data as an initial model data set. In addition, a recent EPA technical staff hire, and a series of ORISE Fellows have improved our data analysis capabilities which should be continued going forward. The program will likely continue with ORISE Fellows, a new Fellow will start shortly, but should consider other avenues of additional data analysis support. The remainder of the draft work plan is a series of implementation actions, some of which have been completed and others that are ongoing.

Jim then asked for comments and ideas. Jamie Vaudrey said she was intrigued by the Open Science framework and had investigated it. She noted that it met the data requirements of several federal agencies and asked whether those in the work group had used some of the available data platforms. Jim Ammerman responded that several LISS staff and partners were

part of an Openscapes group last spring, as EPA ran a special pilot for EPA staff and collaborators in our Hypoxia Forecast Project. OpenScapes used GitHub as their central repository and mostly R as their programming language. Jim mentioned that Jamie had earlier sent him information about another open science platform called OSF (https://osf.io/) and said that Ben Lawton was familiar with many of these methods and should comment.

Paul Stacey said that he would be brief and that the annual work plan would have to work because little could be done about it at this point. In terms of the CCMP revision he said that the work group had lost touch with other work groups (including the habitat and watershed work groups) and was monitoring for its own sake and not really addressing what people need. He sees little results-based accountability that we can show for the money that the program has spent and says that we need to go back and look at the science needs. Jim Ammerman responded that watersheds and their connection to the Sound would be a major topic of the CCMP revision.

Jim O'Donnell said that he was strongly in favor of Open Science, but he was concerned that QuickDrops, which Peter Linderoth discussed, may not be compliant with emerging data sharing standards, WQX may work better. Machine to machine communication is the key to Open Science. Ben Lawton added that the LISS has data aggregation needs for which tools are now being developed including QuickDrops, ERDDAP, and NOAA sea surface temperature. The challenge is to bring it all together and have people have a consensus on what is available, where it is found, and how it can be easily accessed. Because of the limitations with WQX, these auxiliary tools are very useful, and the data clearinghouse should also be very useful as a directory of where to find everything. In the brief period of time as an ORISE Fellow, it is difficult to make all the changes necessary to make a solid Open Science infrastructure. Ben added that to be able to easily build on the work of another Fellow (or staffer) it will take long-term planning, such as mentioned in the potential five-year plan for the work group.

Jamie Vaudrey asked what we are really talking about, just data management using Open Science methods, but Open Science goes beyond data sharing. Are we as a community just willing to share our data or fully embrace Open Science in terms of project collaboration? Jim Ammerman added that we will not settle this here and mentioned that in the chat, Katie O'Brien-Clayton had advocated for more Open Science as well. Jim O'Donnell said that he did not mean to imply that Open Science is just data sharing, but it does underlie Open Science. Sharing products on GitHub is a promising idea, but most investigators work on funded projects and the teams that develop projects could be encouraged or even required to build in such sharing by the project sponsors. For example, HDR's contract for the new integrated systemwide model requires some components of Open Science, such as sharing model results with others and allowing them to evaluate those results. Building such requirements into RFPs would make sense. Jim Ammerman concluded by noting an example from OpenScapes where a NOAA group on the west coast automated their data acquisition using Open Science, reducing

the time required from months to days. He suggested that further discussion and long-range planning about implementing such methods was important and reminded anyone with comments on the work plan or other issues to contact him.