Monitoring Partnership meeting and pre-meeting of scientists 2/11/2014

A lively e-mail discussion ensued after the January 15th Technical Advisory Committee meeting surrounding questions raised by the numerous presentations given at that meeting. The participants in this e-mail discussion met before the regularly scheduled Monitoring Partnership meeting to move the conversation forward. The following summary covers both the pre-Partnership meeting and the regular Partnership meeting.

Attendees: Robert Howarth, Linda P. Wagenet, Liz Moran, Sharon Anderson, Brian Eden, Jim McGarry, Robert L. Johnson, Dan Karig, Jose Lozano, Jim Adams, Lee Ann Hill, John Halfman, Rich DePaolo, Steve Penningroth, Roxanna Johnston.

*Note: A set of comments/questions were sent to the TAC on January 22nd, 2014. They are included at the end of this document (Appendix D) for the TAC's convenience.

Measuring Phosphorus (P):

- Consistency is important
- Any indicator must have clearly defined sampling parameters to assure the indicator isn't improperly applied:
    - When and how often to sample
    - Where to sample
    - How to sample/analyze

Parameter	**+/-**
BAP	+ All bioavailable P - Theoretical, not measurable
TP	+ Historical record, consistency - Not correlated with algal density - Not performing as an indicator of trophic state - Confounded by storm inputs - Confounded by internal mixing and wave action and transition zones (from streams) - Inappropriate for near-shore or shallow areas
TDP	+ Measurable + More inclusive of bioavailable P than SRP - No certified method – not problematic from DEC's perspective. Could be added to ELAP's list.
SRP	+ Correlated with algal density - May be highly variable if certain sources (WWTP, CAFO's, some row crops, and failing septics) are present in the watershed, especially during runoff events. - Hard to measure accurately at low concentrations (easily contaminated or compromised) - Not inclusive of all bioavailable P - Methods variable - Possibly confounded by heavy sediment loads, method relies on presumption that filtering provides an accurate picture of in situ water column SRP concentrations.
Chl	+ More direct measure of algae density than TP - Most labs only measure chlorophyll a which all algae have. Many other types exist.

	Algae have 2 or more types of chlorophyll that vary by species. Species presence and abundance changes through time. - Confounded by seasonal changes - Confounded by macrophytes
Sechi	+ Direct measure of public concern + Measurable by trained and untrained - Not limited to algae

Request: Ask UFI to investigate availability of phosphorus bound to lake sediment and provide information on both the likelihood and magnitude of potential release of bioavailable phosphorus. *If the likelihood and magnitude of possible releases are small, total dissolved phosphorus (TDP) is proposed as a reasonable surrogate for bioavailable phosphorus (BAP) and a superior indicator of trophic state than total phosphorus (TP).*

*Note: Steve Penningroth from Community Science Institute sent expanded and in some instances opposing comments for many of the summaries above. As consensus could not be reached on many points, his comments are included separately for consideration, see Appendix A.

Streams Sediment:

- Not all phosphorus is equally available. The source of phosphorus must be determined to develop meaningful management approaches.
- Existing research shows that phosphorus in upper Six Mile Creek originates from overland sources while phosphorus in lower Six Mile Creek originates from tributaries. *Will the watershed model being developed be able to partition sources from reaches and tributaries of the various streams feeding the lake?*

Phosphorus from streambanks is predominantly glacial and less available	Phosphorus from farms and lawns, fertilizer and manure, is highly available.

Question: Is agricultural land (including abandoned and fallow land) 2x higher in phosphorus than *undisturbed* land? *We recognize that no land is truly undisturbed*
Question: What sediments are currently being tested for phosphorus availability? What land uses are represented? Under what weather conditions were the samples collected?
Request: T*he chamber test to determine the availability of phosphorus should be performed on streambank sediments (main channel and upper tributaries) and a variety of overland flow sources for inclusion in the watershed portion of the model.*
Request: *The phosphorus loading pie chart (streams, WWTP's, LSC) should be updated as part of the monitoring/modeling effort. Existing USGS flow and sediment data, CSI sediment and nutrient data and IAWWTF flow and nutrient data should be included in developing the updated budget.*

Is the lake healthy? YES.

Is there a limnological problem in the lake. NO

The TMDL regulatory process and limnology are not the same.	The regulatory process can include other factors such as: public interest or support, recreation, economic importance, need for expanding wasteload allocations and court orders. (EPA TMDL Course)

- Individual samples from the southern end of the lake exceed the TP guidance value in the summer. However, the TP guidance value is based on a season long average, not individual samples. LSC monitoring data indicate that the guidance value has not been exceeded since 2008 (Appendix B). There are no algae blooms of note in the lake.

Question: How can the Inlet be considered non-TMDL-able if those inputs may result in a TMDL for the south end of the Lake? Why not address the problem at the source?

Question: Is clarity the real public concern? If so, then sediment should be the major focus of the monitoring/modeling effort.

If sediment loading was stopped, wouldn't the phosphorus loading stop*? YES

*'stop' being a relative term in both cases

Streams Sediment:

Do we have a sediment transport problem? If so, impacts must be considered on more than the southern end of the lake. The Inlet and local reservoirs have similar loading issues.

- Taughannock Creek seems to have anthropogenic sources
- Fall and Salmon Creeks also have anthropogenic sources
- Six Mile Creek and the Inlet do not have appreciable anthropogenic sources

Question: What is DEC's approach to areas where sediment loading is from a natural (glacier) or legacy (100yrs+ past agricultural practices) source?

- Sediment delivery on the rising limb is not the same as sediment delivery on the falling limb. It is very hard for volunteers to mobilize in time to sample the rising limb of storm events. Even automated sampling equipment captures the falling limb disproportionately to the actual loading. Accurate assessments are not easily made for sediment and the associated phosphorus loading.
- Sediment loading should be apportioned across the watershed and tied to relevant information such as land use and geology.
- Disparate estimates of sediment (and phosphorus) loading exist for Virgil, Fall, and Six Mile Creeks and the Inlet. *The monitoring/modeling effort should attempt to rectify these numbers*.
- It is our understanding that the watershed model being used only addresses sheet erosion, or poorly captures channel erosion. Walking the stream channels may be the only way to accurately capture channel erosion. *If that is the case, the MP requests that students and/or volunteer monitoring individuals be asked to survey streambanks as this is a significant source of both sediment and phosphorus.*

Question: The current modeling efforts have 1 degree of freedom (years). How will correlations be assessed (for strength or confidence), how will hypotheses be tested? Including LSC data would result in 11 degrees of freedom and greatly improve the ability to find significant relationships.

- TMDL work with sediment on the Susquehanna River should be reviewed as the project moves forward. Update – the sediment TMDL is problematic there too – though it could be looked at. There is some sense that UFI (as they stated on January 15th) is probably doing 97% of the work necessary to develop a sediment TMDL.

Request: Ask UFI to review the Susquehanna TMDL and see what is needed beyond the current monitoring/modeling effort to develop a sediment TMDL.

Macrophytes:

- Aquatic plants and macroalgae are a main concern of lake users and the general public. Furthermore, "aquatic plants and heavy algae" and "growth of algae, weeds and slimes" have all been cited by the DEC as rationale for a determination of use impairment and a phosphorus problem. *Therefore, aquatic plants and macroalgae should be included in the monitoring/modeling effort.*
- Some macrophyte species likely compete with phytoplankton and filamentous algae for phosphorus in the littoral zone and also likely inhibit some algal growth by allelopathy.
    - Ceratophyllum, a native vascular plant and Nitellopsis, a non-native macroalgae, both have no true roots and obtain the majority of their phosphorus from the water column. Both also likely inhibit phytoplankton growth by allelopathy.
    - Recent surveys completed through the Hydrilla eradication effort indicate that both species appear to be expanding in range and abundance. They will likely be important in future phosphorus cycling in the littoral zone.
- Robert Johnson, local aquatic plant expert, summarizes his 40 years of data on Southern Cayuga Lake: "I suggest there is not a problem of excessive growth of filamentous algae, rooted macrophytes or slimes. The littoral zone of the southern shelf of Cayuga Lake is a healthy freshwater ecosystem providing all the attributes we strive to promote in a NYS mesotrophic lake littoral zone." *His work should be included in the monitoring/modeling effort, model validation and development of any subsequent TMDL.*

Data Sources:

- All historical data should be thoroughly reviewed before the model for Cayuga Lake is done, used for model validation and used for any subsequent TMDL development.
- The UFI monitoring program has only a pair of sampling points located in the area of Cayuga Lake targeted for a phosphorus TMDL. The IAWWTF monitoring program has 40 sampling sites and 10 years of data.

Request: *The IAWWTF is requesting that their 2000-2013 lake monitoring data be reviewed by the TAC before the modeling work is completed.* A summary of the data is attached, see Appendix C.

- It is understood that all data collected and used during the monitoring/modeling effort will be posted on e-commons.

Request: The Partnership asks that pre-existing data sets, mostly those provided by local stakeholders, be posted now. If an organizational structure for posting is lacking, the Tompkins County Water Resources Council's Education Committee may be able to help.

Determination of an Impairment based on phosphorus:

Question: How is the narrative criteria for phosphorus not being met?

- The guidance value for TP has been met since 2008, as referenced earlier.

Question: How was the guidance value developed? Should it be re-visited based on the changing nature of pollutant sources/loads?

Answer: DEC has a fact sheet on the guidance value. It was developed by DEC for recreational use of lakes. It is not for protection of streams, fisheries or drinking water. It is based on the perception of lake users. DEC collected information from lake users to determine break points (some measurable value) where respondents felt uses were impaired. (There is science tying TP to eutrophic, mesotrophic and oligotrophic conditions in lakes. That science was not part of the guidance value development process.)

DEC and other states are being tasked by EPA to develop numeric values for nutrients. It will be difficult to tie one number to all lake conditions. Site specific criteria can be developed if they work better than the state values, but they usually have to be stricter than the state value. An exception occurred on the south end of Lake Champlain in VT where sediment confounded all traditional indicators of trophic state. In that case, a value of 30 ug/l TP was used. EPA concurs that site specific endpoints could be developed for Cayuga Lake but it will take more work.

- Mixing zones (streams to lake, near-shore to lake, and in-lake) should be recognized and addressed separately in monitoring/modeling process. The guidance value is silent on application in littoral zones.

Request: The monitoring/modeling effort should provide information to DEC on mixing zones and littoral zones.

Request: DEC should develop clear criteria regarding how the guidance value is applied in these transitional areas.

- Legacy p and residence time issues should be included in monitoring/modeling process.
- The Monitoring Partnership supports an adaptive management approach – if a problem is determined to exist.

APPENDIX A

Comments provided by Steve Penningroth, Director of Community Science Institute, 2/21/2014:

Hi Roxy and all,

Following are suggestions regarding the list of MP meeting comments. I hope you don't mind my offering gratuitous clarifications where there seems to be some confusion, especially about phosphorus measurements. I've formulated four questions for the TAC at the end of this epistle.

Section on measuring P

1. SRP comments: I disagree with virtually all of them and would like to offer some clarifications:
a) SRP is not all that hard to measure.
b) I am not aware of any evidence that SRP measurements are confounded by sediment loads. Sediment concentration is not mentioned as a problem in either the EPA or Standard Methods protocol for SRP.
c) SRP, i.e., orthophosphate, is, by definition, bioavailable phosphorus. More complex forms of organic phosphorus, e.g., proteins, nucleic acids, ATP, ADP, need to be broken down to orthophosphate in the environment before they can be taken up by algae and other plants.
d) SRP is not highly variable, at least not in CSI's 10+ years of measuring it in Cayuga Lake tributary streams. In fact, SRP is highly consistent, with similar results recorded under similar flow conditions at any given location throughout the southern Cayuga Lake watershed. I realize this is a pretty broad generalization but I think it is borne out by the data on the CSI website. CSI staff is in the process of calculating SRP loads from the tribs. Such calculations are feasible because SRP measurements have been consistent over the years.

TDP comments and clarifications:
a) It's important to define what TDP is. To measure TDP, a sample is passed through a 0.45 um filter. If you were measuring SRP, you would measure the orthophosphate in the filtered sample. When you're measuring TDP, you take the filtered sample and digest it with acid, ammonium persulfate and heat, and then you measure the orthophosphate. Thus, TDP is equal to the sum of orthophosphate plus more complex forms of inorganic and organic phosphorus, e.g., proteins, nucleic acids, ATP, ADP, that are converted to orthophosphate by digestion in the test tube. -- The statement that TDP equals bioavailable phosphorus assumes that any complex organic forms of phosphorus in stream and lake water will be converted to orthophosphate by natural processes, like digestion in the test tube only slower. I believe that this assumption is correct.

2. BAP comments and clarifications:
a) I agree it is probably not possible to measure biologically available phosphorus. However, I think it can be approximated. BAP consists of TDP plus any inorganic and organic phosphorus that may be loosely sequestered in the environment -- for example, in sediment -- and that may be released if environmental conditions are right. If it is assumed that the pools of loosely sequestered phosphorus are relatively small compared to TDP, then TDP should give a reasonable approximation of BAP. -- I'm not aware of any hard evidence that loosely sequestered phosphorus pools are large. The biggest pool of

sequestered phosphorus in our system of interest is Cayuga Lake sediment. Circumstantial evidence suggests that phosphorus in lake sediment is tightly sequestered based on the observation that phosphorus:sediment ratios in lake sediment are comparable to phosphorus:sediment ratios in sediment transported to the lake by the tributary streams, i.e., the ratio is roughly one part P per thousand parts sediment by weight both in lake sediment and in suspended solids in tributary streams. This similarity implies -- but does not prove -- that sediment-bound phosphorus is sequestered tightly and does not contribute to the pool of bioavailable phosphate. Therefore, TDP is probably a fairly good approximation of BAP. I suggest TDP be considered as a surrogate for BAP unless and until concrete evidence shows that a significant fraction of sediment-bound phosphorus is released into the water column. Hopefully the CLMP bioavailability experiments will give some idea of how tightly sequestered sediment-bound phosphorus really is. Correct me if I'm wrong, but as far as I understand, the bioavailability experiments will indicate whether sediment-bound phosphorus is bioavailable or not. They will not give the actual concentration of bioavailable phosphorus.

3. Chlorophyll comments:
a) Chlorophyll is not all that difficult to measure. It can be measured using a fluorometer or a spectrophotometer. Measuring it with a spectrophotometer requires collection of a larger water sample, about 1 L.

<u>My questions to the TAC</u>:

1. Is it possible to use the CLMP model to perform accurate estimates of sediment loads from tributaries to the 303(d) south end of Cayuga Lake? If so, what, if any, are the technical reasons for not developing sediment TMDLs alongside phosphorus TMDLs, given that sediment and phosphorus are linked in the Cayuga Lake system?

2. How exactly will historical/ongoing monitoring data from other sources, including CSI, IAWWTF and FLI, be used to calibrate and/or validate the CLMP tributary loading model?

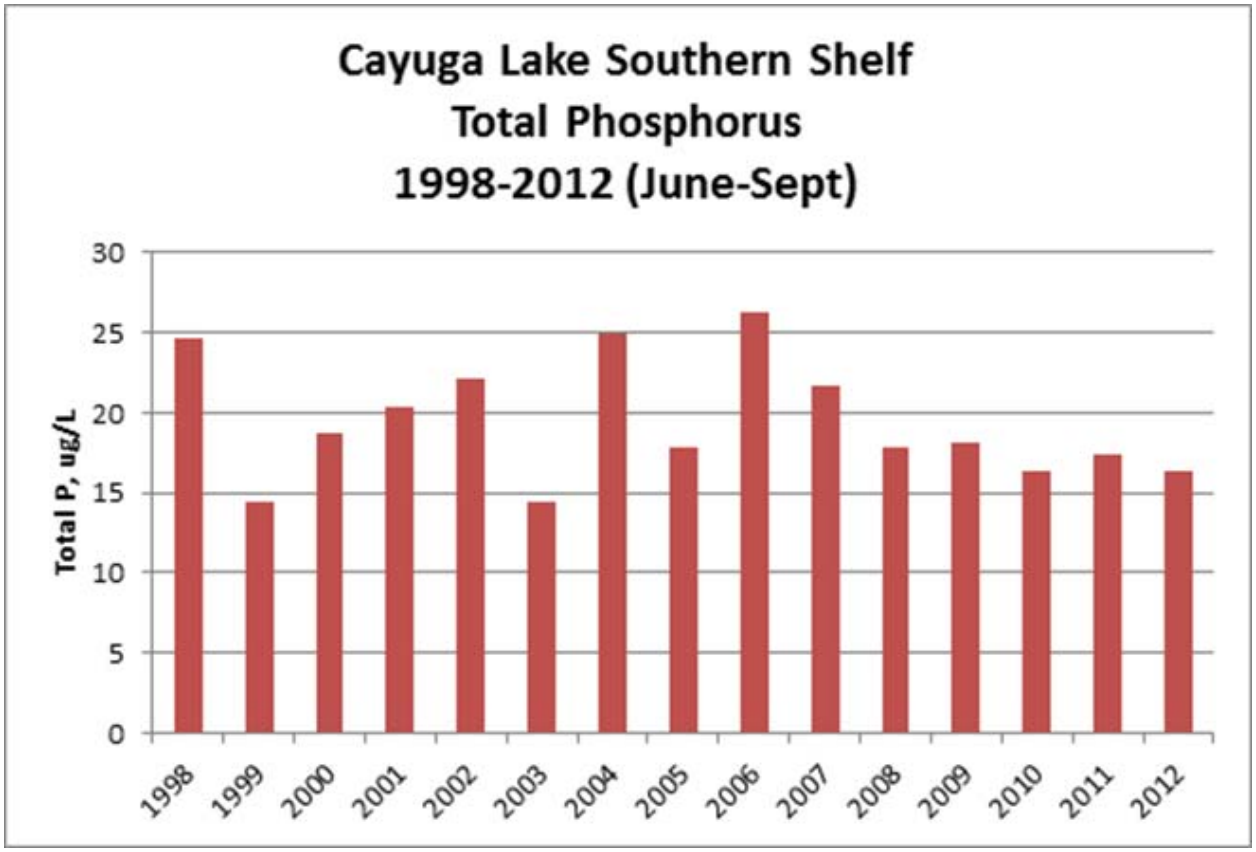
3. If there is a significant discrepancy between a load estimate based on the CLMP model and a load estimate based on data collected by CSI, IAWWTF and/or FLI, how will the discrepancy be resolved?

4. If, as historical data seem to indicate, 80-90% of phosphorus entering the south end of Cayuga Lake comes from the tributaries while roughly 10-20% comes from the three point sources: IAWWTF, CHWWTF and LSC, will TMDLs be imposed on local governments in tributary watersheds, as they have been on local governments in the Chesapeake Bay watershed? If so, will TMDLs be tailored on the basis of estimated phosphorus contributions from each tributary watershed, or will the same degree of reduction be mandated for all local governments -- say, a 25% reduction -- regardless of how much phosphorus may be contributed from a local government's jurisdiction?

Hope these questions and comments are of some use.

Cheers, Steve

APPENDIX B



Lake Source Cooling monitoring data indicate that the guidance value has not been exceeded since 2008

APPENDIX C

Summary of Phosphorus monitoring results from the Ithaca Area Waste Water Treatment Facility:

Cayuga Lake South
Phosphorus TMDL and the proposed 2014 303(d) list of impaired waters
Jose Lozano and Lee Ann Hill, Ithaca Area Wastewater Treatment Facility.
02.22.2014

Introduction
The proposed 2014 303(d) List of Impaired Waters lists the south end of Cayuga Lake for phosphorus impairment.

The 2012 303(d) List of Impaired Waters states that "an effective TMDL requires a sound understanding of the sources of pollutant loadings to the lake in order to develop appropriate allocations" (*Final New York State 2012 Section 303(d) List of Impaired Wasters Requiring a TMDL/Other Strategy,* NYSDEC, 2013). The 2012 303(d) list also states that a TMDL for the southern end of Cayuga Lake would require "additional loadings data, particularly during wet-weather events when it is thought much of the annual loads occur" (NYSDEC, 2013). In addition to the new data that will be provided by the Cayuga Lake model, local agencies have compiled additional phosphorus loading and distribution data.

Total Phosphorus Loading
There are three point sources of phosphorus to the south end of Cayuga Lake. These include the Cayuga Heights Wastewater Treatment Facility (CHWWTF), the Ithaca Area Wastewater Treatment Facility (IAWWTF), and Cornell's Lake Source Cooling Facility (LSC). Nonpoint sources of phosphorus include Fall Creek and Cayuga Inlet, the two major tributaries at the south end of Cayuga Lake.
IAWWTF collected water quality data and water samples on a monthly basis from April to October throughout the southern region of Cayuga Lake, including Fall Creek and Cayuga Inlet (N42.4583, 76.5058W and 42.4679°N, 76.5142°W, respectively, and 40 other additional sites on the south end). The water samples were analyzed for total phosphorus (TP) and total dissolved phosphorus (TDP) by the IAWWTF Laboratory (ELAP ID 1086). The data collected from 2007-2013 was used to estimate the phosphorus loading of the south end of Cayuga Lake. The Fall Creek phosphorus loading was calculated using the United States Geological Survey (USGS) flow data and the phosphorus (total and total dissolved) data from the IAWWTF monitoring program.

The Cayuga Inlet phosphorus loading was calculated using the crosssectional area of the Inlet, corrected by the USGS gage height, and the current velocity, measured with an Acoustic Doppler Current Profiler, ADCP. The ADCP deployment at Cayuga Inlet was continuous during the 2007-2013 boating seasons.

Point source phosphorus loading was calculated using the SPDES reports data on flow and total phosphorus concentrations from IAWWTF, CHWWTP, and LSC. The total phosphorus loading from point and non-point sources at the south end of Cayuga Lake is depicted in Figure 1.

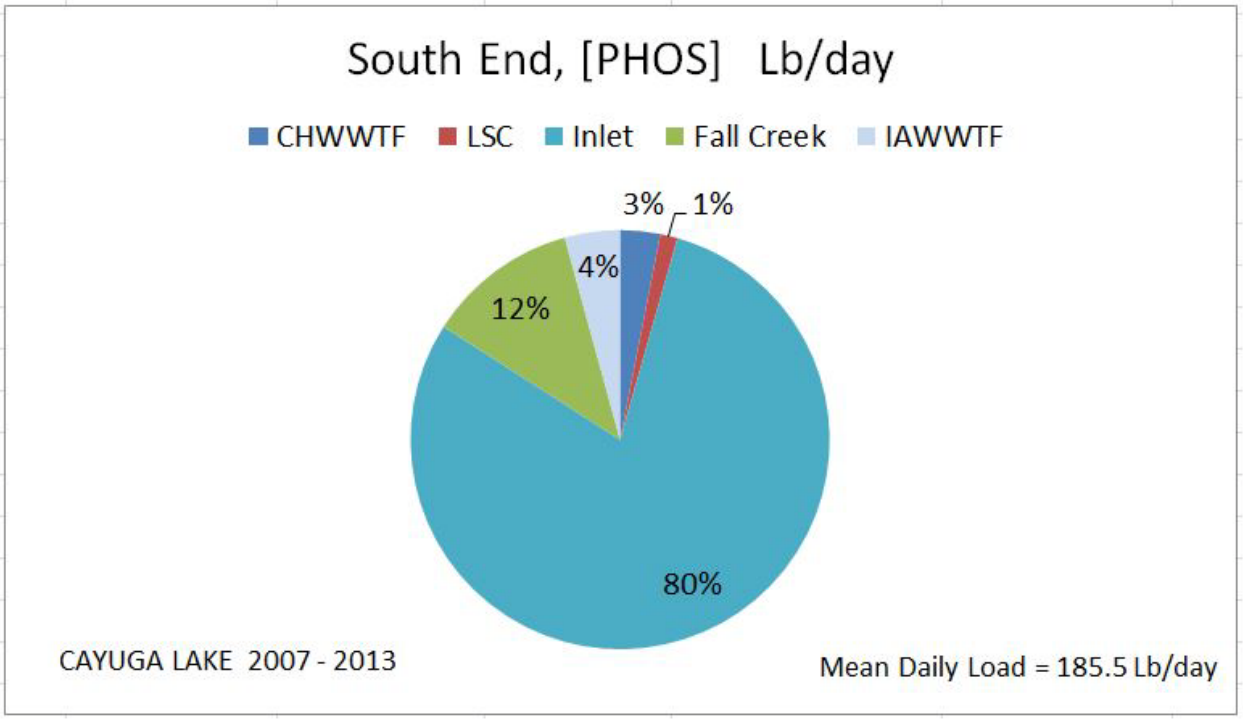


Figure 1. Phosphorus, total, average loading during 2007-2013 boating season. The flow of the Inlet was measured with an Acoustic Doppler Current Profiler and the Fall Creek flow was obtained from the USGS Fall Creek data. The point sources loading data was obtained from SPDES reports.

Between 2007 and 2013, the tributaries were the greatest contributors of total phosphorus to the south end of Cayuga Lake, with Cayuga Inlet contributing 80% of the total phosphorus load. Point sources combined comprise only 8% of the total phosphorus loading to the south end of Cayuga Lake (Figure 1).

Total Phosphorus (TP) and Total Dissolved Phosphorus (TDP) Distribution

The 2007 -2013 data from the IAWWTF monitoring program was used to estimate the TP and TDP distribution at the south end of Cayuga Lake. The sampling protocols and the monitoring sites coordinates are described in Smith (2007). A copy of the original data has been submitted to DEC, and additional copies are available upon request to Josel@cityofithaca.org

The Cayuga Lake south end TP and TDP concentration distribution and probability maps were prepared using ArcGIS Geostatistical Analysis. The TP concentration distribution map was prepared using Inverse distance weighting using 1,698 samples (Figure 2). The probability maps

were prepared using simple Kriging with a primary threshold to exceed 20ug/L TP or TDP (Figure 3 & 6).

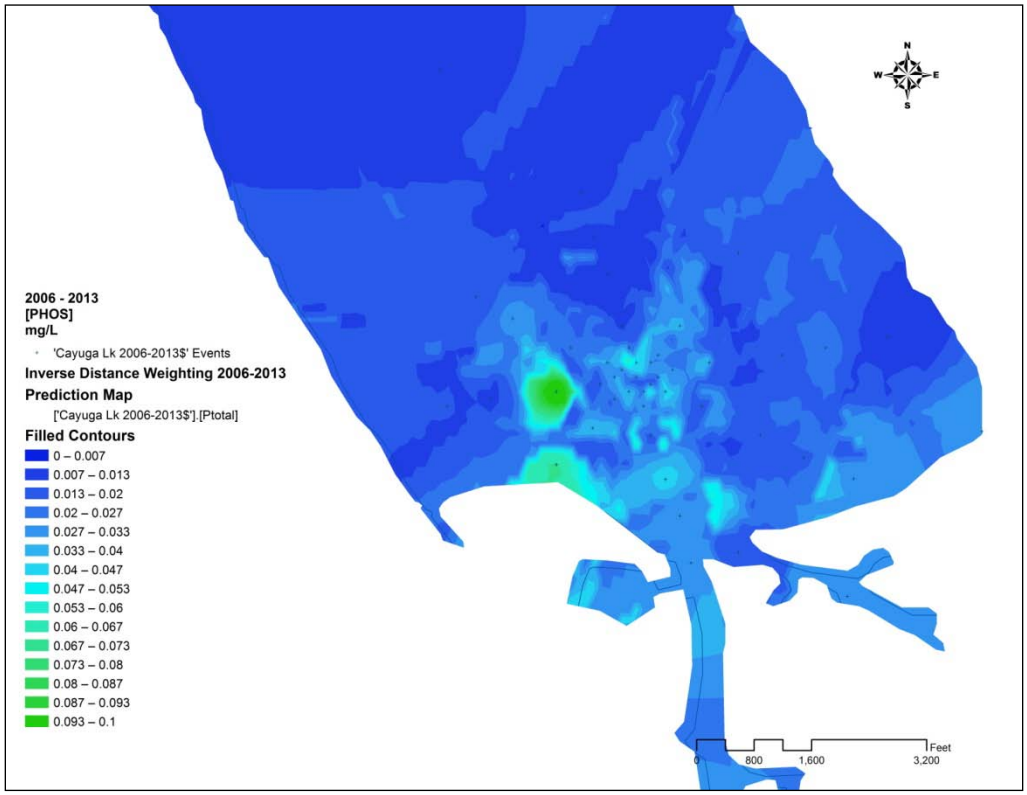


Figure 2. Cayuga Lake south end total phosphorus concentration distribution map 2006 – 2013. This filled contours map indicates TP concentrations in mg/L. Data from the IAWWTF Cayuga Lake monitoring program.

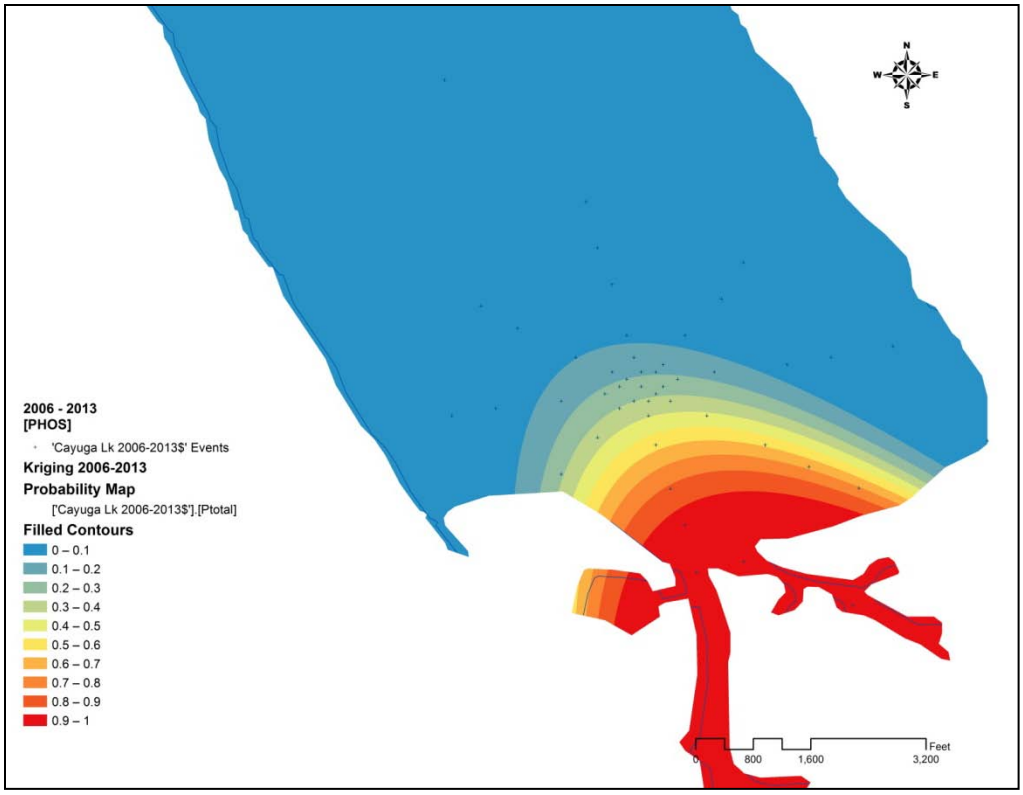
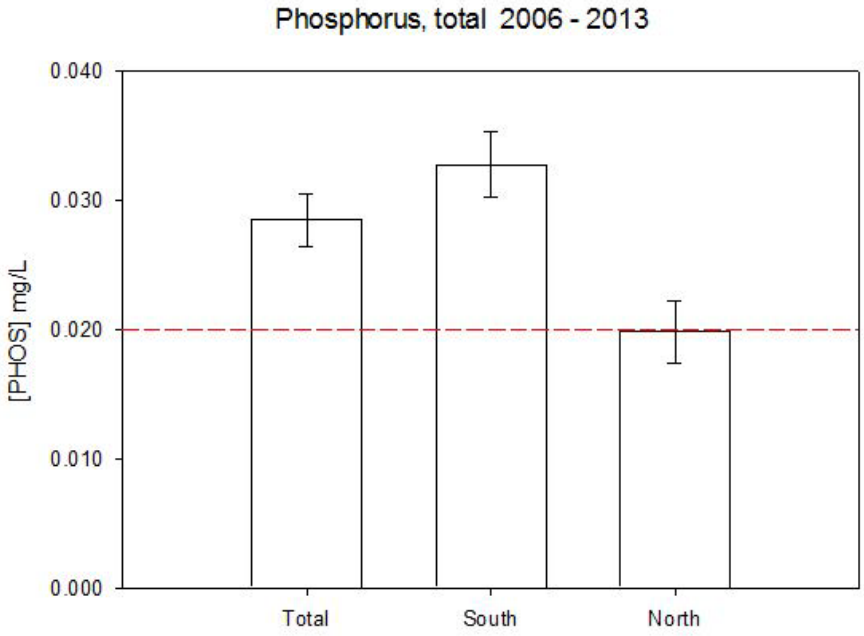


Figure 3. Total phosphorus probability distribution at the south end of Cayuga Lake. This map indicates the probability to exceed 20ug/L TP. 2006 – 2013 data from the IAWWTF Cayuga Lake monitoring program.

The higher probability that a given sample exceeds the guidance value (20ug/L) is strongly associated with the tributaries, and this probability declines as the samples are collected further north, and away from Cayuga Inlet and Fall Creek. TP concentration at the south end of Cayuga Lake is strongly influenced by the TP load from Fall Creek and Cayuga Inlet (Figure 3).

a



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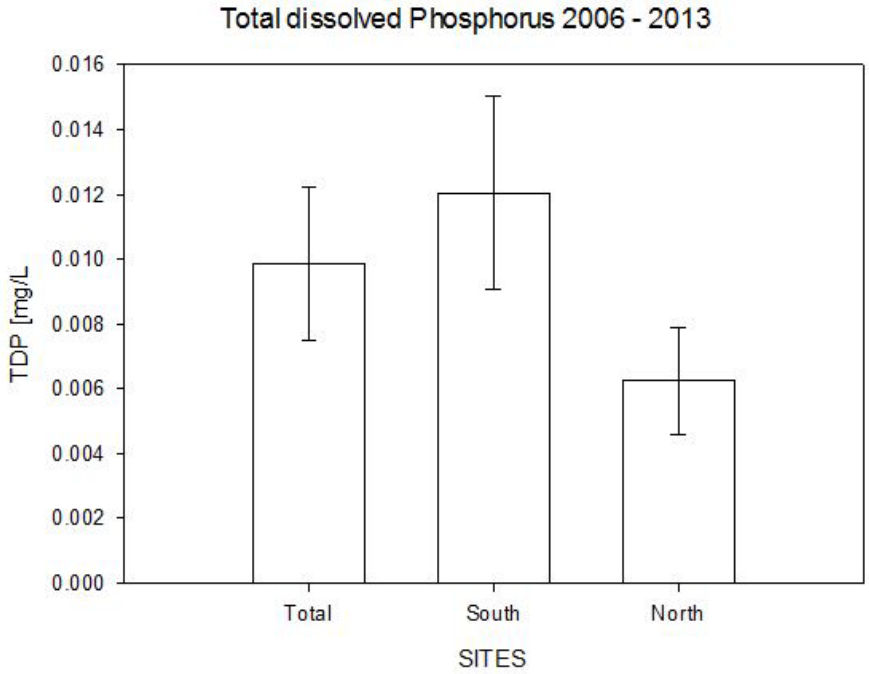

Figure 4. Total and Total Dissolved Phosphorus, TP and TDP respectively, concentrations for sites north and south of the IAWWTF Outfall (N42.4667, W76.5131). Sites north of the outfall have a TP at or near the EPA guidance value of 20.0ug/L. The TDP was below 20ug/L in all cases. 95% confidence intervals are indicated. 2006 – 2013 data from the IAWWTF Cayuga Lake monitoring program.

The comparison of TP concentration north and south of the IAWWTF Outfall is shown in Figure 4a. The 2006-2013 average TP concentration shows a significantly lower TP concentration for sites north of the IAWWTF Outfall (2a =0.05). The average TP concentration north of the outfall

site was 20ug/L during 2006-2013, indicating that this portion of the southern end has met the EPA guidance value of 20ug/L for over seven years

Figure 4b shows the average TDP concentration for the sites north and south of the IAWWTF Outfall, as well as the average TDP concentration for all 2006-2013 IAWWTF sampling sites. All sites had a lower than 20ug/L TDP, and the North sites had the lowest average TDP concentration, 0.006ug/L.

The TDP samples are prepared by 0.45um filtration before testing for phosphorus by the EPA Method 365.3. The phosphorus associated with particles larger than 0.45um is enough to reduce the phosphorus concentration on all samples below 20ug/L.

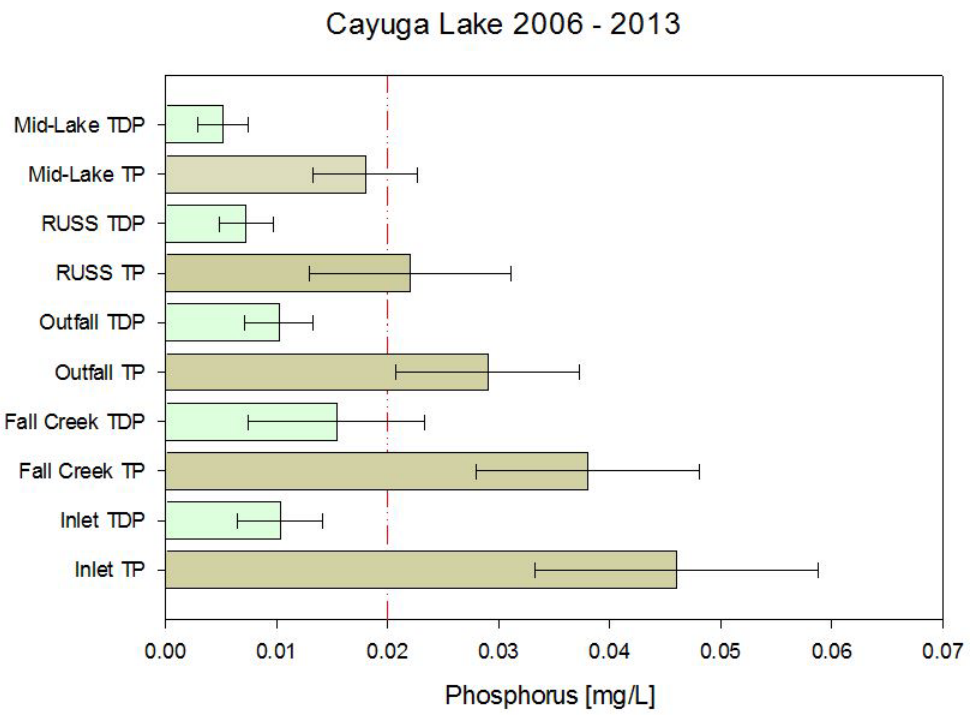

Figure 5. TP and TDP for selected sampling locations in Cayuga Lake. TDP samples were tested for total phosphorus after 0.45um filtration by EPA Method 365.3. The sampling locations are arranged from south, at the lower end of the graph, to north. The 95% Confidence Intervals are indicated. The 20ug/L guidance value for total phosphorus is also depicted in the graph (vertical broken line). Data from the IAWWTF Cayuga Lake monitoring program.

The samples collected closer to the tributaries at the south end of Cayuga Lake have a higher concentration of phosphorus, both total and soluble (Figure 5). A large fraction of the phosphorus is associated to particles larger than 45um. The same correlation is not only observed between north-south sampling locations, but also among discrete sampling sites. TP

and TDP concentrations decline as the samples are collected further from Cayuga Inlet and Fall Creek (Figure 5).

Since all the TDP samples, even those taken at Cayuga Inlet and Fall Creek, yield average concentrations lower than 20.0ug/L, the probability of having higher concentrations than this guidance value should be negligible (Figure 5).

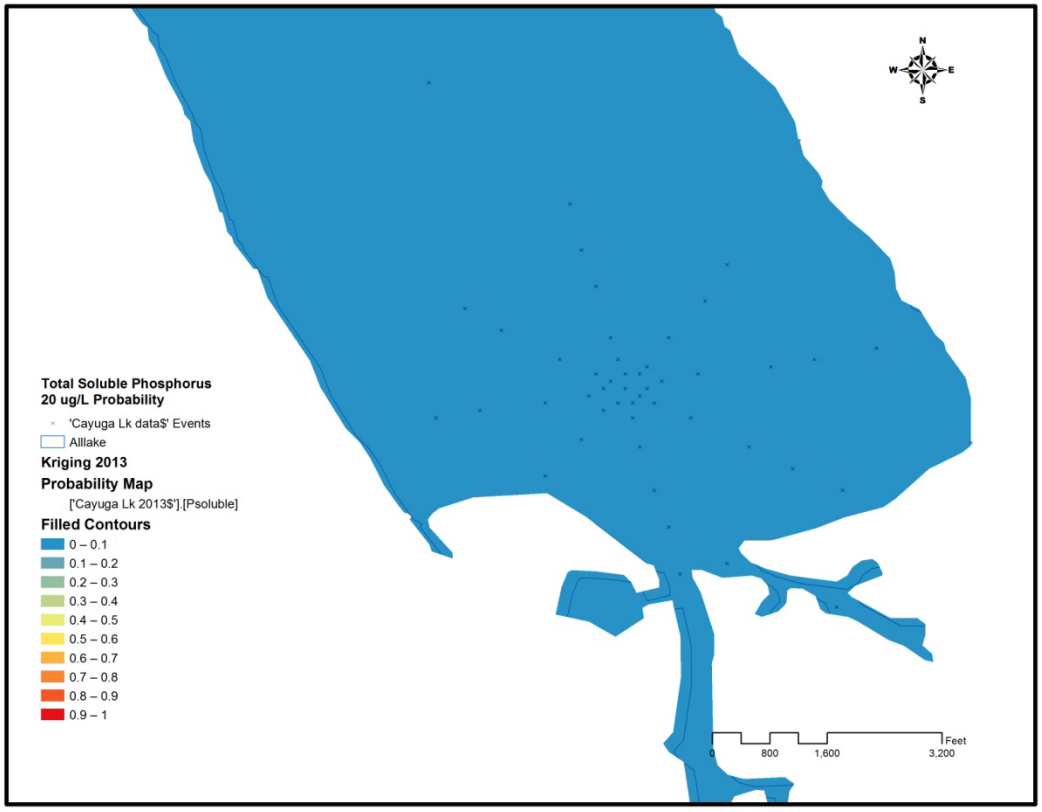

Figure 6. Total dissolved phosphorus (TDP) probability distribution map for the south end of Cayuga Lake. It was prepared using simple Kriging with a primary threshold to exceed 20 ug/L TP, using the TDP data from the IAWWTF sampling program during 2006-2013.

Figure 6 illustrates the probability distribution of obtaining a sample with a TDP concentration higher than 20.0ug/L at the south end of Cayuga Lake. This further indicates that a significant fraction of the phosphorus load to Cayuga Lake is allochthonous, and associated with sediments from the tributaries.

Reclassification of Cayuga Inlet as an Impaired Waterbody

According to the New York State Consolidated Assessment and Listing Methodology Section 305 (b) Assessment Methodology, May 2009, and the *EPA Guidance for 2004 Assessment, Listing, and Reporting Requirements Pursuant to Sections 303(d) and 305(b) of the Clean Water*

Act (July 21, 2003), different waterbody types are not combined into single waterbody segments. That is, lakes (including reservoirs and ponds) are not combined with river reaches to form one segment. Similarly, estuary waters, ocean coastline and Great Lakes shoreline are distinct waterbody types that must be tracked as separate Assessment Unities.

Given that the Cayuga Inlet contributes a large and significant portion of total phosphorus loading to the south end of Cayuga Lake, the impairment of Cayuga Inlet should be reclassified as an Impaired Segment, from its current status as Minor Impacts. Priority must be given to the restoration of Cayuga Inlet, under the Water Quality Improvements program.

Recommendations

The phosphorus impairment at the south end of Cayuga Lake is primarily caused by nonpoint sources as pollution; as such, water quality improvements should be controlled by nonpoint source best management practices (BMP), rather than point source controls (i.e. a TMDL).

The Cayuga Lake, Southern End [*(0705-0040) Ont 66-12-P296 (portion 4) Impaired Seg.*] should be considered as impacted by the Cayuga Inlet, lower and minor tribs. *[(0705-0041) Ont 66-12-P296-75]*, including its delta, a sediment depositional zone. The southern end of Cayuga Lake Phosphorus impairment should be classified as the result of "non-TMDL-able cause" (not of point source origin).

The data and assessment used by NYSDEC to identify impairments and place the southern end of Cayuga Lake on the§303(d)(1)(A) list should be carefully examined. Evaluation of data used should be based on the EPA guidance protocol, which states that at a 99% confidence level a one percent false positive and a one percent false negative decision error should be the starting point for setting decision error rates (EPA QA/G-4, 2004) Further, this EPA guidance protocol recommends that if the decision maker increases the decision error rate from one percent, that entity or person "should document the reasoning behind setting the decision error rate and what the potential impacts may be on cost, resource expenditure, human health and ecological conditions" (EPA QA/G-4, 2004).

The current regulations in effect at 40 CFR §130.7(b)(5) state that "all existing and readily available water quality related data and information" must be used in the listing determination (AMSA, 2000). The following questions regarding the following data should be addressed by the DEC for the 2014 proposed 303(d) listing:

a) What specific data did the state rely on? Were all sources of data taken into account?

b) Was the data of sufficient quality that it can be relied on?

c) Was there a sufficient quantity of data so as to be statistically significant?

d) Was the data temporally representative or is it too restricted to be of use?

e) Does the spatial extent of the impairment match the actual data points demonstrating impairment?

f) What assumptions were made regarding the interpretation and analysis of the data? (pollutant loadings, flow, water chemistry, etc.)

g) Does the data show, to a sufficient level of quantification and accuracy that point sources cause or contribute to the impairment?

h) Was the data appropriately applied for evaluating compliance with water quality standards (e.g., what is the probability of a false positive result?)

References

American Metropolitan Sewerage Assocation (AMSA). *Evaluating TMDLs. Protecting the Rights of POTWs*, 2000.

EPA Guidance for 2004 Assessment, Listing, and Reporting Requirements Pursuant to Sections 303(d) and 305(b) of the Clean Water Act (July 21, 2003)

EPA QA/G-4, 2004

New York State Consolidated Assessment and Listing Methodology Section 305 (b) Assessment Methodology, May 2009.

New York State Department of Environmental Conservation (NYSDEC). *Final New York State 2012 Section 303(d) List of Impaired Wasters Requiring a TMDL/Other Strategy*, 2013.

Smith, L. & J. Lozano (2007) Less Phosphorus Entering Cayuga Lake. Autumn Cayuga Lake Watershed Network News.

APPENDIX D

Monitoring Partnership comments/questions submitted to the TAC January 22nd, 2014:

Combined from Partnership member comments and e-mail discussion:

1) monitoring/modeling (MM) should address high levels of SRP in the hypolimnion

2) MM should address sources of P in the tribs; is it innate or is it picked up in transit. If it is picked up, what are the sources and can they be reduced?

3) MM should address sources of P in the lake; while fairly well established that tribs and sediment are the sources in the southern end of the lake, what is the long term availability of P bound to the sediment, is there a release of legacy P occuring as seen in Europe and elsewhere?

4) MM should address potential 'legacy P' and project reasonable time frames for release of historical inputs in tributary floodplains (Ag, fertilizer, detergents) and the lake (from tributary sources and wastewater treatment plants).

5) MM should address oxygen and pH conditions that could release previously unavailable P to the water column.

6) Please review the relative inputs of sediment from Six Mile Creek versus Cayuga Inlet. Local qualitative observations and physical data indicate that Six Mile Creek remains a much higher source of turbidity than the Inlet long after a storm event. UFI's median values for TP and Tn also show Six Mile Creek to be highest. Is the max value from the Inlet skewing the data?

7) MM should address management strategies in mixing zones (tribs to the lake) and depositional zones and whether or not strategies differ there than in the main lake.

8) At what point in the process are cost estimates of management options developed? For example, if tributary sediment loading is deemed the best way to reduce P on the southern shelf of the lake, who or what model develops cost estimates for that control?

Other comments/questions:

1) Triplicate data is highly variable. What does this mean for QA of the data?

2) TDP and SRP results were inconsistent with CSI findings - UFI and CSI have already agreed to review procedures and data to resolve this issue.

3) Why were only 2 samples collected from the IAWWTF?

4) Why wasn't SiO2 measured in Fall Creek?

5) Why wasn't DOC measured at CL-4?