Cayuga Lake Modeling Project
in Support of a Phosphorus TMDL

Cayuga Watershed Network
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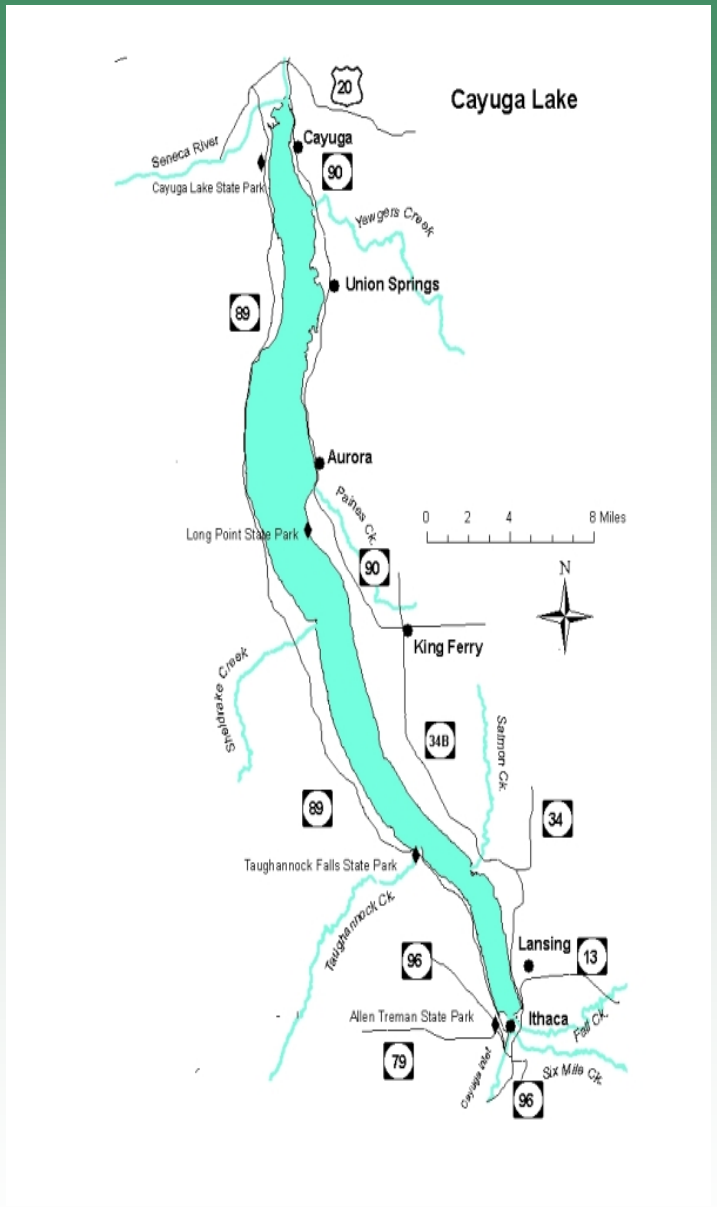
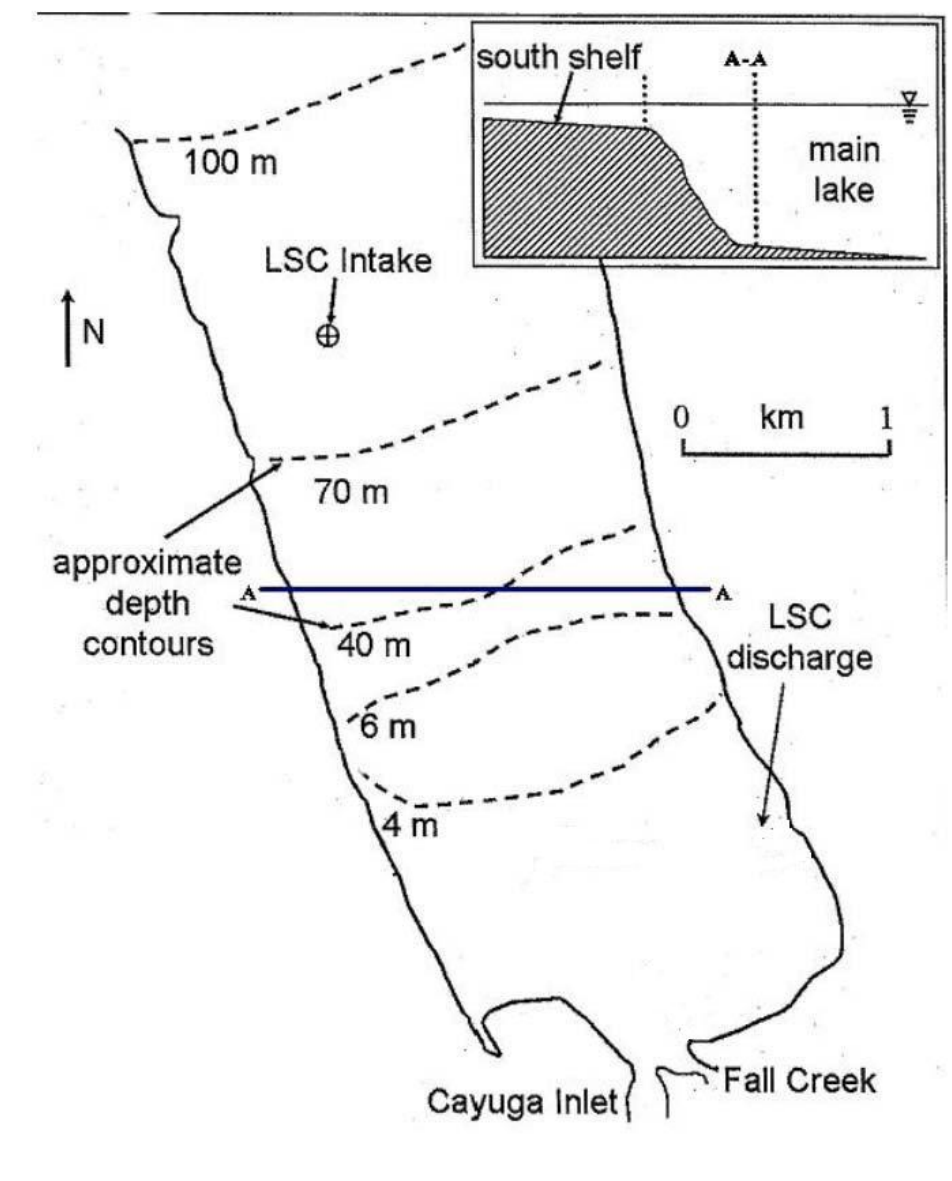
Total Maximum Daily Load

- TMDLs are Load Allocation Plans
  used to set discharge limits
  for a specific pollutant
  into a specific waterbody.
- TMDLs are typical for more complex and multiple discharger situations.



Cayuga Lake

- Northern End
  Class B(T)
- Main Lake, Mid-North
  Class A(T)
- Main Lake, Mid-South
  Class AA(T)
- Southern End
  Class A



Complexities

- One Lake, Multiple Segs
- Multiple Discharges
  - Ithaca Area WWTP
  - Cayuga Hgts WWTP
  - Cornell LSC
- Tributary Loads
- In-Lake Recycling
- Lake Dynamics
- Changing Lake WQ
- Narrative Phos Standard
- Other ?
  - Invasives
  - Climate Change

Section 303(d) Listing for Cayuga Lake South End

- Phosphorus
- Silt/Sediment
- Pathogens

The Focus of the TMDL is on

Impairments due to Phosphorus

Phosphorus Criteria

- Narrative Standard

  "None in amounts that will result in the growths of algae, weeds and slimes that will impair the waters for their best usages"
- Numeric Interpretation

  20 ug/l Total Phosphorus

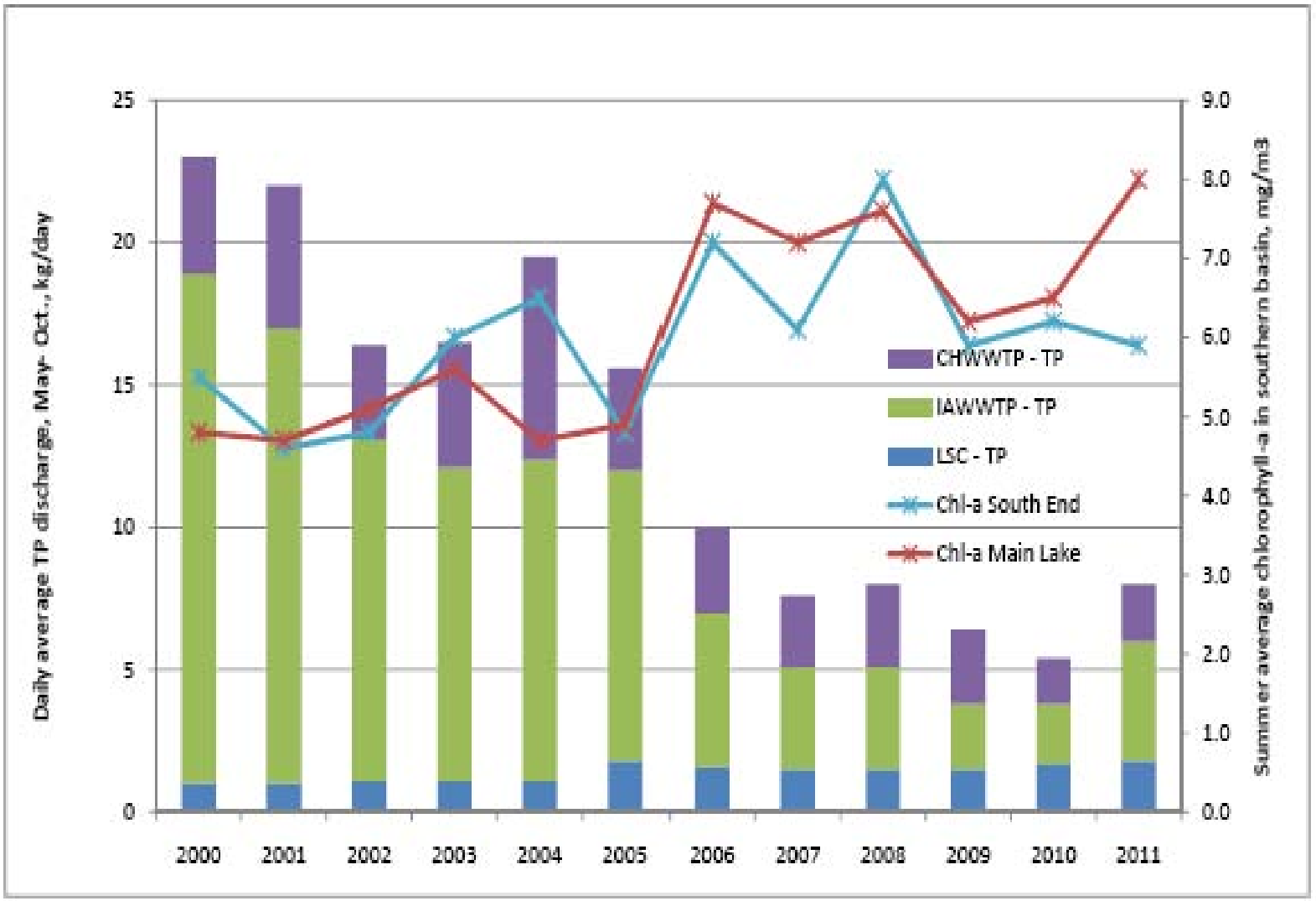
  - based on Aesthetics for Recreation
- Future Revised Numeric Nutrient Criteria

How Could LSC Affect Cayuga Lake Water Quality?

- Transfer of High Phosphorus Water From Deep Lake to Shallow Shelf
- Amount of Phosphorus in Discharge has increased
- Maximum Use During Warmest Months

Why LSC Might Not Affect Cayuga Lake Water Quality?

- Water quality impacts in the Lake predate the Cornell LSC discharge
- Cornell LSC Phosphorus increase is affected by increasing lake concentrations
- Significant reductions of phosphorus from WWTPs to date have not resulted in improved water quality


Daily average TP discharge, May- Oct., kg/day
Summer average chlorophyll-a in southern basin, mg/m3
25
20
15
10
5
0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
CHWWTP - TP
IAWWTP - TP
LSC - TP
Chl-a South End
Chl-a Main Lake

Goal of Cayuga Lake Water Quality Modeling Project

The Goal:

A model to provide better understanding of Cayuga Lake water quality under varying conditions in order to develop an effective TMDL Plan.

The Reality:

Project expected to answer some of the questions…

but not expecting to answer them all.

Connection to the Cornell Lake Source Cooling Permit

…which includes a requirement outlining Cornell's commitment to fund a study of Cayuga Lake to assist NYSDEC with the development of the TMDL for the South End of the Lake.

The Cayuga Lake TMDL Process

- Collection of Data
- Development of Model
- Use of Model to Develop TMDL
- Stakeholder Input to TMDL
- DEC Proposes/EPA Approves TMDL
- TMDL Implementation

Other Actions Required by SPDES Permit

- Biological Monitoring Studies
- Outfall Redesign Study
- LSC Facility BMP Study

What Sampling is Being Done?

Lake Monitoring

- Entire Lake
- Phosphorus, Turbidity/Clarity, Chlorophyll

Watershed Monitoring

- Input from Tribs (Fall, 6-Mile/Inlet, Salmon)
- Focus on Storm/Snowmelt Events
- Phosphorus, Sediment

Wastewater Treatment Plant, LCS Discharges

Other? (Mussels, Paleolimnology)

What Has Been Learned So Far?

1, It Is Also Still Early

2, We Were Right, It's Complicated

- Much of Total P comes from Tribs
- Total P Not as important as Reactive P
- Reactive P from Lake Bottom is Significant
- How Does In-Lake Reactive P move in the Lake (Does It Feed the Shelf?)
- The Role of Sediment could be significant.

Technical Advisory Committee

Provide independent expertise/advice on scientific and technical aspects associated with lake water quality issues and the development of the TMDL for phosphorus in Cayuga Lake.

Can a TMDL Improve Water Quality?

Yes, provided…

- Good Understanding of the Dynamics
- Focus on the Right Cause, Pollutant
- Set the Right Target for Reduction
- Effective Implementation

(and Takes Time)

Is TMDL for Southern Shelf or Whole Lake?

Proposed TMDL is to Address Impairment in Southern Shelf (target), but…

- Sources to be Reduced could Occur Anywhere in the Watershed
- There is also Some Concern regarding Water Quality in Entire Lake
- The Aim of the Model is to Provide Tool to Find Most Efficient Reductions

What Are Potential Impacts to Activities in Cayuga County?

- Interest in Preventing Impacts Before they Meet Level of Impairment
- On-going Work with Local Agencies
- Most Measures Re Land Activities are Voluntary, Rather than Regulatory
- Expect would Continue as Voluntary
- Perhaps Enhanced Funding for Implementation

Will Rooted Vegetation (Macrophytes) Be Addressed?

- Focus is on Phosphorus, Chlorophyll and Algal Blooms
- Macrophytes Not the Focus
  - Harder to Define End-point
  - Sediment Load is Critical
- Some Ancillary Benefit?
- More Recent Concerns Re Invasives

Could the Designated Uses (Classification) Be Changed?

- First, Develop Model to Use in Development of a Strategy
- Second, Develop Most Effective Load Reduction Strategy (w/ Stakeholder Input)
- Third, Evaluate Costs to Implement TMDL Reductions
- Clean Water Act Allows for:
  - Reclass (DEC Does Not Typically Do)
  - UAA

Modeling Study/TMDL Schedule of Activities

2013 – Monitoring/Data Collection

2014/15 – Model Development

2015/16 – Model Evaluation

2016/17 – TMDL Development

May 2017 – Draft TMDL

Sep 2017 – Final TMDL

Project Outreach

- Occasional Public Meetings

  Scheduled around Key Project Milestones
- Tompkins Co WRC/Monitoring Partnership

  Regular (Monthly) Communication, Technical
- Technical Advisory Committee (TAC)

  Track/Comment on Monitoring/Model Progress

Project Outreach

Con't

Also:

Webpages and List Serves

- DEC Cayuga Lake Watershed Page
- Cornell Cayuga Lake Modeling Project
- Tompkins County Water Resources Council

- NYSDEC *“Making Waves”*

Questions?