Notes for CWMTF Planning Grant Meeting of February 5th, 2020
Chowan County Agricultural Building
Edenton, NC

Attending:

1. **Bob Baker -** Chowan-Edenton Environmental Group
2. **Stephen Bevington -** Restoration Program Manager - Division of Land and Water Stewardship, CWMTF - NC Dept. of Natural and Cultural Resources
3. **Nita Coleman -** Green Saves Green
4. **Roger Coleman -** Edenton Town Council
5. **Nora Deamer -** River Basin Planner, Division of Water Resources – Planning Section - NC Department of Environmental Quality
6. **Fenton Eure -** ARC&D Council
7. **Elizabeth Fensin -** Algal Ecologist -Water Sciences Section - Division of Water
8. **Erin Fleckenstein -** Coastal Scientist and Regional Manager - NC Coastal Federation
9. **Michael Flynn -** NC Coastal Federation
10. **Nathan Hall –** Assistant Professor - UNC-CH Institute of Marine Sciences
11. **Jeri Hansen -** Finance Officer, Albemarle Commission
12. **Dwane Hinson -** Regional Water Management Specialist & Pasquotank Soil and Water
13. **Heather Jennings -** Program Manager - Albemarle-Pamlico National Estuary Partnership - Department of Environmental Quality
14. **Jimmy Johnson -** Coastal Habitats Coordinator - Albemarle-Pamlico National Estuary
15. **Rodney Johnson -** ARCD Council Member - Pasquotank County
16. **Colleen Karl -** Chowan-Edenton Environmental Group
17. **Anne-Marie Knighton -** Edenton Town Manager
18. **Brian Lannon -** Soil & Water Technician, CFM - Camden County
19. **Matthew Lowe -** Soil and Water Technician - Gates SWCD
20. **Celeste W. Maus -** Administrative Conservationist - Chowan Soil and Water
21. **Justin E. Mercer -** Eastern Field Representative - Clean Water Management Trust Fund - Division of Land and Water Stewardship - NC Dept. of Natural and Cultural Resources
22. **Eric Pare -** Regional Coordinator – Eastern - NC Soil and Water Conservation
23. **Hans W. Paerl -** Kenan Professor of Marine and Environmental Sciences - UNC-CH Institute of Marine Sciences
24. **Jill Paxson -** Environmental Senior Specialist - Water Sciences Section - Division of Water Resources - N.C. Department of Environmental Quality
25. **Eric M. Parker -** Hertford SWCD Technician
26. **Jacob Peele -** Soil and Water Technician - Chowan & Perquimans Soil and Water Conservation District
27. **Mark Powell -** ARCD Consultant
28. **Gloria Putnum -** Coastal Resources and Communities Specialist North Carolina Sea Grant - North Carolina State University
29. **Michelle Raquet -** River Basin Planner, Division of Water Resources – Planning Section - NC Department of Environmental Quality
30. **Lawrence R Sandeen, PE -** Synergistic Environmental Solutions, Inc.
31. **Brian P. Saunders –** NRCS - Resource Conservationist
32. **Forest Shepard -** River Basin Planner, Division of Water Resources – Planning Section - NC Department of Environmental Quality
33. **Hunter Synan -** Graduate Student, UNCW - Dept. of Earth and Ocean Sciences

Welcome and Introductions, Mark Powell, ARCD Council

Moderator, Mark Powell, ARCD

Update on Chowan River Basin Plan – Nora Deamer and Michelle Raquet, NCDWR

- Working on an update of the Plan
  - Will include both water quality and water quantity.
  - No Hydrodynamic model for the basin, using local municipality Local Water Supply Plans to understand water supply needs throughout the basin.
  - Ambient Data to be used is from 1981 to 2018.
  - Lakes Monitoring Data from 2015.
  - Biological Monitoring Data from 2010 and 2015.
  - Public Review should start in April 2020 (30 day comment period).
- Monitoring Update
  - Trigger for increased effort in Chowan is the resurgence of algal blooms in the Chowan, with an increased proportion being cyanobacteria
  - Multiple stations in the Chowan basin.
  - Focus of conversation will be on the Colerain station.
  - The phytoplankton community is changing, resulting in higher chlorophyll and cyanobacteria levels.
  - Exceedances of the 40 ug/l standard for Chl-*a* is increasing after declining from the 1980's.
  - Chl-*a* increases as we move to downstream monitoring stations
    - Loading from VA is low.
    - Loadings from Tribs – Potecasi Creek and Meherrin are low
    - Main stem Chowan is relatively high.
  - Ammonia Levels are generally low.
  - NOx
    - Is high from the Blackwater – winter discharges from paper manufacturing may be creating spikes.
    - generally increasing somewhat in the rest of the sample sites.
  - Organic Nitrogen (TKN)
    - ON is generally increasing.
    - Colerain station seems to be moving above the rest.
    - Potecasi is increasing as well and has higher concentrations than other monitoring stations.
  - Phosphorus
    - Periodic spikes in Blackwater are mirrored in the Chowan, though levels are decreasing generally.
  - Reviewed trends for forms of Nitrogen in select streams, a general increase in TKN has been observed and a reduction in NOx.

Quantitative Evaluation of Changing Nutrient Sources to the Chowan River, Nathan Hall and Hans Paerl, UNCIMS, Colleen Karl, CEEG

- Blooms are symptomatic of an increase in trophic status throughout Albemarle Sound – fastest rate is in the easternmost station of the sound.
    - Total P is flat, nitrogen is increasing.
    - Five experiments in 2019 from the lower Chowan River have shown N was the primary limiting nutrient.
    - Flow can be estimated based on ratios of surface area for ungauged streams to that of gauged streams; thus detailed hydrodynamic model may not be needed.
    - Small increases in average nitrogen concentrations are evident over the last 10 to 15 years.
    - Small Streams have shown an increase in total N loading, while the Chowan seems to be decreasing slightly.
- Four sources that were studied
    - Increased loading from the Tributaries
        - Tributary streams are reactors not pipes – algal blooms are created or seeded in the tributaries and small streams.
        - Flow can be estimated based on surface area.
        - Small increases in average nitrogen concentrations are evident over the last 10 to 15 years.
        - Small Streams have shown an increase in total N loading, while the Chowan seems to be decreasing slightly.
        - Study had no data to assess 16% of the flow (unmonitored tributaries) into the sound, but small streams like including the unmonitored streams could represent over 40% of the total N load.
    - Swamp Forest Harvest
        - Swamp forest are significant nutrient banks.
        - Questions that aided evaluation:
            - What is the increase of N and P loadings due to swamp forest harvest on a loading/acre basis?
            - What is the acreage harvested?
            - How long will the impact last?
        - Significant impact of loadings from swamp forest harvest areas appears to attenuate in about 1 year.
        - Loadings from swamp forest harvest areas estimated to be less than 4% of total loadings, though local effects could be significant.
    - Atmospheric Deposition of N
        - Looked at 3 sites in the region.
        - NOx is going down and ammonia is going up.
        - Total loadings are small.
    - N Loading due to N Fixation by cyanobacteria.
        - There is an increase in the fraction of biomass that are N fixers.
        - The increase since 2000 is roughly 100 fold.

    - Samples were collected in summer 2019 and immediately evaluated for N fixation rates. N fixation was determined to be roughly 1% of the total tributary loadings.
    - It is possible that N fixation is highly localized and not captured by the samples. The uncertainty in the loading 1% loading estimate is very high.
- Summary: Unassessed Coastal Streams are a potential huge contributor, with N fixation being a possible significant factor.
- The transfer of nitrogen through the Albemarle Sound is roughly 100 times the nitrogen accumulation in the sound.
- Wetlands that rim the Albemarle Sound undergo seasonal burst of nitrification that convert ammonia nitrogen to nitrate that can then be removed from the sound by denitrification.
- Without water levels dropping seasonally, the periodic nitrification of NH3 may not be occurring in wetland soils, and sea level rise may be preventing the drop in water levels.
- Decreasing wind speeds may favor algal bloom formation due to less oxygenation of the estuary. Changes in wind speeds for the area should be investigated.
- Septic system can be impacted by higher water levels, prevent nitrification of ammonia, and subsequent denitrification.
- There has been a general increase (2014-2018) in total N in the sound, with an increase in total N as you move from the western sound to the eastern sound, which is the reverse of the 2001-2005 period. The makeup of total N is mostly organic nitrogen, a combination of dissolved organic nitrogen with unknown biological reactivity and particulate organic N which is likely dominated by phytoplankton biomass.

Results from Citizen Science Water Quality Monitoring on the Chowan River, Little River, Pasquotank River, and Potecasi Creek Watershed, Mark Powell, ARCD

- Concern is the resurgence of algal blooms in the 2015-2018 after 30 years of little algal activity.
- Most of the Chowan watershed is in Virginia, but Virginia does not appear to be a significant source of nutrients.
- Organic N is increasing across the NC sites.
- Water temperature is increasing in the Chowan.
- Monitoring focus in 2019 was on tributaries to the Chowan River, Little River and Pasquotank River.
- June-October sampling in the Chowan River and tributaries. Per UNCIMS lab 2019 analysis, Queen Anne Creek had highest total N, ammonium, particulate N, total P, and Chlorophyll *a*. Rocky Hock Creek had next highest values for most parameters. Arrowhead Beach and Colerain sample sites had the highest values for NOx.
- Potecasi data for organic nitrogen is an outlier when compared to other sites.
- UNCIMS Lab 2019 Potecasi site 2 highest for Nitrate and Nitrite, and total P.

- NCDA Lab 2019 Potecasi sites 1,3 highest for TKN.
- NCDA Lab 2019 Potecasi sites 3,5,4 highest for Organic N.
- NCDA Lab 2019 Potecasi Organic N trends with DEQ historical data through 2015.
- NCDA Lab 2019 Little River and tributaries, and Pasquotank River tributaries
    - All sites had high average Total P with Newbegun, Symonds and Knobbs creeks the highest. *Legacy P* may be playing a role as these areas have supported potato and cabbage production for many years going back to the 1970's.
    - Little River sites 1 and 3 (upper watershed), and Charles Creek had highest average TKN and organic N.
- Comparison of UNCIMS and NCDA Labs 2019
    - UNCIMS Total P generally lower than NCDA total P.
    - UNCIMS and NCDA similar trends in Nitrate and Nitrite in Chowan River.
    - NCDA results for Little River TKN, NH4-N, N03-N, organic N, and total P are reasonably close to DEQ 2000-2018 averages at Woodville.
    - NCDA Little River organic N and total P supported by DEQ historic trends.
- Regional high-rainfall storm events may flush nutrients farther into the main rivers and sounds. Relatively dry season may have been the reason that there was not a large bloom in Edenton Bay and adjacent sound in 2019.
- Summer SW winds concentrate nutrients and blooms on the east side of the Chowan River and north shorelines of the Albemarle Sound.
- Low-flow conditions may concentrate nutrients closer to shorelines and sources, with septic tanks possibly playing a larger role.
- The application of the monitoring data to the HU-12 watersheds will allow the examination of specific geographic areas for sources.

Remote Sensing Approaches for Monitoring Harmful Algal Blooms, Hunter Dillon Synan, UNCW

- Remote Sensing Overview
    - Satellite Imagery
        - Ocean Color
        - Chlorophyll Monitoring
    - Spectral Bands
    - Specific Algorithms
    - Spectrum
        - All Plankton
        - Cyanobacteria
    - Can determine by spectra clean water from water with algae
- Project Methods
    - Apply satellite algorithms to small scale imagery
        - 3 Meter Resolution
        - 4 bands – RGB +near infrared
    - Drones
    - Calibrated with images of known algae concentrations

  - Working to measure accuracy of technologies
- Various sensors for the drones are available
- Preliminary Results
  - Reviewed Satellite evaluation 6/27/2017 Arrowhead Beach Bloom
    - Showed levels of up to 77ug/l for total Cl-a and 56 ug/l for cyanobacteria
    - Reviewed 2019 drone evaluation of blooms in Greenfield Lake (Wilmington, NC)
- Future Products
  - WebMap Application interfacing with ESRI Application
    - Archive of all data analysis
    - User friendly interface
    - Publicly available
  - Mobile App
    - PhycoScan app WebMap
      - GPS enabled
    - NC Bloom Map
    - NOA Chlorophyll Prediction
- Summary
  - Applying existing satellite algorithms to new imagery
    - Adjusting if error is large
  - Still collecting & processing imagery
    - Water-only drone imagery
  - Results made into a WebMap application
  - Mobile App still in process

Open discussion of next steps

- Nora Deamer comments on DWR tasks
  - Looking to determine appropriate nutrient standards (N and P or possibly Chl-*a*) standards for Albemarle Sound and for Rivers per a request from EPA.
  - Looking to determine data gaps (flow and monitoring stations) that need to be addressed. May need to expand the program for a year to collect additional data.
  - 2020 is the year for biological assessment of the sound, and will not include fin-fish.
  - Basin Plan will not be paper, but will be electronic and updated with new information as it becomes available.
- Key Questions and suggestion actions
  - What are the nutrient thresholds that are of concern in the watersheds?
  - What are the sources of nutrients to the estuary?
  - What are appropriate actions to mitigate nutrient issues?
  - Should we pull together a large project plan that can address the total algal bloom problem?
  - Can we involve VA and the Norfolk area in the effort to study and address algal bloom issues in the Albemarle Sound and its tributaries?

- Should we contact Greg Murphy and link him with VA legislators?
- Nita Coleman stated that she had avenues to reach our senators.
- Need to get local press involved and reporting on the project.
- Need to get state and local political support for solving this issue before we can get federal level support.
- What is the tradeoff between making the algal problem more visible in the press to galvanize long term improvements vs trying to protect property values and minimizing tourism impacts over the short term?
- It appears that small watersheds (e.g.: creeks) are likely a major sources/triggers of algal blooms and we should consider attack the problem at the micro-watershed level.
- There was a resolution (#35) in the VA house to address water quality issues in the Albemarle Sound Estuary. Do we know the scope and drivers for this resolution?
- There is a need to understand the specific application of data collected to ensure that data precision and cost are balanced to best meet the needs of the effort – data to trackdown sources can be of lower precision, while data to inform status and trends needs to have higher precision.
- The 2018-2019 citizen science monitoring program selected the NCDA lab due to low cost per sample analyzed, and because the lab could provide TKN and Total P, which could be compared to DEQ data. The program also sent some samples to the UNCIMS lab for comparison.
- Citizens in Perquimans County are forming the Perquimans County Waterway Watch to accomplish sampling and stewardship activities in the county.
- Cam McNutt is a contact person for possible thoughts and actions on storing the data.
- Mark Powell stated that the planning effort from the very beginning discouraged people from pointing fingers at a single source of the blooms, for example agriculture. The partnership has always stated that everyone is a part of the problem, and that everyone will be part of the solution.
- Dwane Hinson suggested that ARCD take the lead on developing a concise document with recommended actions and associated costs.