

**APNEP Ecological Flows Action Team**

10:00 am - 1:00 pm  
October 30, 2018  
Green Square Building – Unite Conference Room 1107  
217 W. Jones St., Raleigh, NC 27603

<http://www.apnep.org/web/apnep/flows>

**DRAFT Meeting Notes**

[Meeting recording link](#) (Password: Cmcrc9MF)

***Meeting Goals: Review results of Phase I study and develop a strategy to complete Phase II***

**Attendees: Team Members:** Fred Tarver (NCDEQ/DWR), Mike O'Driscoll, ECU, Tom Cuffney, U.S. Geological Survey (retired), South Atlantic Water Science Center, Bob Christian (ECU); **Participants:** Ian McMillan, Nora Deamer, Paul Clark, Jenberu Feyyisa, Christina Davis (NCDEQ/DWR); **APNEP Staff:** Stacey Feken, Dean Carpenter, Heather Jennings, Bill Crowell, Jimmy Johnson & Trish Murphey (via WebEx)

**Review of Action Items**

- Team members to provide comments on the [draft ECU report](#) (data and supporting excel and GIS files are located on the Google drive folder).
  - Mike will explore looking at the FIMAN network / adding to the report and welcomes input on things they may have missed in the data compilation.
- Bob and Mike agreed to serve as co-leads for the flows team with assistance from Tom. They will evaluate the original [Action Plan](#) and Phase I/II the team originally drafted to see if it needs updating, and discuss ideas for pilot studies.
- APNEP will share the spreadsheet and presentations on the [team webpage](#), and think more about a central location for sharing synthesized flows and related data for the region.
- The group agreed that more flow based ecology detail/studies are needed.
  - Nora will talk with DWR biologists to see how they can participate in pilot studies.
  - APNEP staff will coordinate with the Freshwater Habitats and Fish Passage and other teams and see what information they can provide.
  - Dean will talk to the Aquatic Fauna and Water Resources MATs about integrating with their efforts.

**Welcome and Introductions**

**Stacey Feken**

Stacey Feken, APNEP team lead, welcomed attendees and thanked those that traveled from the coast. This is the first meeting the team has had since May 2017, were waiting on the release of the draft report from Dr. O'Driscoll and his colleagues. Stacey informed the group that the meeting was being recorded, primarily for note keeping purposes and the purposes of creating an article or blog post.

## Role of Ecological Flows Team

Dr. Dean Carpenter

Dr. Dean Carpenter, APNEP Co-team lead, gave an overview he has been involved since its inception 3.5 years ago, serving as the original team leader. A link to the slides is available [here](#). He provided an overview of APNEP's Comprehensive Conservation and Management Plan (CCMP) published in 2012 and spans through 2022, our Ecosystem System Based Management Approach, which relies on an adaptive management approach, and an overview of our partnership structure. The Ecological Flows team is an Action Team focused on CCMP implementation, it overlaps with the Water Resources Monitoring and Assessment Team which is developing indicators that can be monitored to track changes in ecosystem health.

Dean gave an overview of the iterative adaptive management cycle and shared the goals and ecosystem outcomes the CCMP actions should lead to. This team is focused on Goal 3: Water Quantity and Quality, with Outcome 3a: Appropriate hydrologic regimes support ecological integrity, and Goal 2: Native Species, with Outcome 2b: The extent and quality of upland, freshwater, estuarine, and near-shore marine habitats fully support biodiversity and ecosystem function.

The CCMP actions the team is addressing are listed below. The actions cannot be done in parallel; we need to complete Action A3.3 which will feed into D3.2:

**Action A3.3:** Develop and refine ecological flow requirements for each major river. Many of the fish, aquatic plants, and other species that live within the estuarine system depend on flowing water to survive. Identifying these ecological flows will help ensure that these species and ecosystems are protected.

**Outputs:** Hydrologic models of each river basin within the APNEP region and associated ecological flow requirements to support better resource management decisions

**Results:** Management of river flows that support ecological integrity

**Action D3.2:** Facilitate the development and implementation of basinwide water management plans to ensure no less than minimum in-stream flows are maintained. APNEP will work to provide scientific information and engage regional stakeholders to develop and implement water management plans that fully account for both human and ecological demands.

**Outputs:** Management plans establishing minimum in-stream flows

**Results:** Science-based management of in-stream flows to support both human and ecological demands

This team will make recommendations to the Implementation Advisory Committee (IAC) which will help set the overall goals and priorities of all of the teams, and our Leadership Council which makes decisions on funding.

Dean talked about where we've been and where we're going, the team first met in 2015, developed an Action Plan in 2016, had an update on the Phase I Data Analysis in 2017, and this is our 4<sup>th</sup> workshop. He explained that the DEQ Ecological Flows Science Advisory Board (EFSAB) had done a great deal of work, then Bob Christian, an EFSAB member, took the initiative to approach the APNEP Science and Technical Advisory Committee about the gaps and lack of data and flow gauges and complexities in the coastal plain

and ask for help. There were some initial discussion and other members helped including Mike Piehler and Scott Ensign.

Dean hopes we can select a team lead during the meeting, which will be a point person that we can work with to develop strategies, this person can also be the representative on the IAC but it could be someone else. He hopes the team will meet more frequently, we typically say we will not meet more frequently than semi-annually, usually more along the lines of 8-10 months. These are not necessarily in person, we're trying to do more webinars to check in remotely and see what progress is being made.

### **Overview of Team Action Plan**

**Stacey Feken**

Stacey gave a brief overview of the team's [Action Plan](#) that the team collectively agreed to in 2016. The team identified data gaps in the APNEP geography and developed a list of tasks that were needed. At the time Drs. Eban Bean and Mike O'Driscoll indicated they had the capacity to assist and the team agreed that was the right path to move forward on. Dr. O'Driscoll will be talking about Phase I, she hopes we can discuss Phase II today after hearing his presentation, and noted that at least starting to flesh out the next steps for Phase II would be a good goal and outcome of this meeting.

### **[PHASE I: Existing Data for Evaluating Coastal Plain Ecological Flows](#) in the Albemarle-Pamlico Estuary Region**

**Dr. Mike O'Driscoll**

Dr. O'Driscoll mentioned that Cait Skeibel did a great deal of work on the project as the Research Assistant, but she moved on and several other students assisted in completing the report, all learned a great deal during the process. Coley Cordeiro helped facilitate. Bob Christian has the most history about the background and process. He explained their approach was to compile existing data. Mike explained why the study was needed: the statewide models did not cover the coastal plain. Bob helped push the need for a different approach due to the tidal influence and salinity differences in the coastal area. However, there are still data gaps: temporal water use data / low flows, understand what aquifer the water is coming from, river/groundwater interaction, pumping the surficial aquifer pulling water from the river. The focus of the study was on low flow data, ecological flows, the range of flows, and coastal-specific flow-biological effects.

Why is it important to study ecological flows / why is the study needed? Flow alterations affect fish and macroinvertebrates, groundwater inputs are declining, flows have been declining over the last decade or so, there have been a number of droughts, groundwater withdrawals. There is a relationship to population and economic growth and need to consider in future planning, climate change and land use change are also factors. Based on Session Law 2010-143, DEQ is required to develop basinwide hydrological models for each of NC's 17 river basins to predict the places, times, and frequencies at which ecological flows may be adversely affected in North Carolina (NC DEQ 2013). However, NC ecological flow efforts in the Piedmont didn't cover the majority of the Coastal Plain. These streams may differ based on low slope, tidal influence, and salinity. Coastal streams present particular challenges for ecological flow assessment due to the lack of streamflow data in tidal areas, flow reversals from wind and tides, spatiotemporal variability of salinity in coastal waters, and complex river-groundwater interactions.

Earlier work was done in 2013 by the [NC Ecological Flows Science Advisory Board](#) and Coastal Ecological Flows Working Group. The report made recommendations for estimated flow to maintain ecological integrity, instead of flow data used stage data (Scott Ensign). Separation from Piedmont and coastal plain (refer to graphic). Tidal systems are data-limited so used a staged habitat approach. Eban Bean GIS Map

reference: 1 meter cut-off for tidal effect. Have looked at the USGS (U.S. Geological Survey) data since then, APNEP region has more low-slope streams, so they grouped things based on this approach. Mike noted that he was a hydrologist and received help with the ecological aspects from colleagues.

They conducted a literature review of Ecological Flow Studies in NC and Southeastern U.S. • Included a literature review and annotated bibliography, highlights include: • *Pearsall et al (2017)* summarized four articles related to developing ecological flows in NC. They found: • Fish guild diversity and macroinvertebrate richness showed negative responses to flow reductions. • Space-for-time approach appears valid for establishing flow-biology relationships. • Flow-biology relationships showed seasonality with greater sensitivity to reduced streamflow during lower flow seasons. • Numerous studies found that anthropogenic flow alteration associated with negative effects on stream biota. • Much of the previous ecological flow work performed in other states included cooperative efforts with the USGS, The Nature Conservancy (TNC), and US Army Corps of Engineers, working alongside state agencies.

He shared efforts from other states including a Virginia report by Tetra Tech.

Data needs include understanding reference conditions, these are typically not organized for flows, need to compile in one place as reference, limited evapotranspiration data (actual vs. potential can make a huge difference in a water budget), understand the magnitude and timing of flow alterations and ecological effects (Department of Health and Human Services should be included as a data source, synthesizing the data into one place is a big need. For this study, they created a spreadsheet and synthesized the data and sources evaluated, Excel file available for download from the meeting materials section [here](#).

Bob Christian asked if they looked at FIMAN (Flood Inundation Mapping and Alert Network) gages and Mike said they would need to review and could add that information.

Some of the findings included:

The USGS network has 19 stations with 30-year records for stage and flow, but there are gaps in the coastal plain. 7Q10 (7-consecutive-day low-flow average with a probability of occurring 1-in-10 years) calculations can be used with the long-term station data.

A Duke student, Isabel Hillamin did a low-flow analysis in 2018. Lower order streams- more likely to dry up (watershed area < 250 mi<sup>2</sup>) Higher order streams- like Tar and Neuse have more gages, most of the low-order streams lack gages (limited capability to understand which lower order streams are drying up more frequently). Smaller watersheds may be affected by lower magnitude withdrawals, especially in summer. They looked at 7Q10 but need a longer term data set. Use of a baseflow index may help to predict 7Q10 for ungaged streams or streams with shorter discharge records. They developed maps of flow alterations including public water supply withdrawals, NPDES (National Pollutant Discharge Elimination System) permit discharges, and obstructions such as dams.

What are limitations based on--the data availability? (Data Gaps) • Streamflow- low order and tidal coastal streams – less monitoring stations < 3 m above sea level (tidal/wind) • Groundwater- more info on ground water inputs to streams (magnitude, spatiotemporal variability, source aquifer). • Salinity - most data in estuaries, for future monitoring of saltwater intrusion need more info in inland watersheds. • Evapotranspiration (ET) - Only one Ameriflux site in region (Plymouth, NC) where actual ET data is collected. • Ecological response-In Ecological Responses to Stream Flow Regional Database (*McNamany*

*et al. 2013*) - 114 studies for the Coastal Plain only 9 (4 on unregulated and 5 on regulated rivers) were conducted in NC (Appendix III). • Water use - There were a variety of gaps in water-use data that would prevent the construction of accurate water budgets in the region. However, approximate water budgets may be possible.

Mike showed a series of slides of data gaps in water use, evaluating groundwater influence and low-flow conditions. There is evidence from USGS data that baseflow is declining. ALL Coastal Plain stream gage sites that were evaluated showed recent declines in 7Q10 baseflow. The low flows are getting lower, particularly in summer. There is a heavy reliance on groundwater in the Coastal Plain. There are challenges in evaluating water-use data due to lack of historic electronic records, differences in reporting estimates, etc. A growing number of states are recognizing these challenges and the need to standardize monitoring and use reporting. **Based on the number of agencies collecting water use (and wastewater discharge data), it would be worthwhile to bring together water use and water flux experts from USGS, NC DEQ, NC Dept. of Agriculture and Consumer Services, NC Climate Office, NC Dept. of Health and Human Services, water utilities, and other stakeholders with the goal of improving water accounting in the region.** • An interagency plan is needed to address the challenges, costs, and other issues associated with coordinating a more comprehensive water use and wastewater return-flow database for the Albemarle-Pamlico Drainage Basin. He recommended pulling all of the data into one publicly available database.

The ongoing [USGS Coastal Carolinas Water Availability Study](#) may also help overall efforts and serve as a model for the APNEP region.

**Potential Future Work** • a pilot study to determine if accurate water budgets can be constructed with pre-existing data at the watershed scale. • an interagency plan is needed to address the challenges, costs, and other issues associated with coordinating a more comprehensive water use and wastewater return-flow database for the Albemarle-Pamlico Drainage Basin. • watershed-based ecological flows research focused on potential changes to flows, salinity, and ecological responses • flow analysis on the long-term discharge records along unregulated river reaches in the Albemarle-Pamlico drainage basin--flow metrics can be compared with diversity indices for fish or macroinvertebrates where available. • numerous states in the southeast have data and experience developing ecological flow criteria--many suggest that adaptive management with stakeholder involvement is an important component of ecological flow management. • programs where federal, state, and local agencies work in cooperation with stakeholders to achieve ecological flow management objectives may be the most likely to succeed. In most states, the water or environmental agency in the state takes the lead, in this case that would be the NC DEQ. • moving forward, APNEP and DEQ could collaboratively develop a process to define ecological flow goals and criteria for the drainage basin. Based on Session Law 2010-143, future work on ecological flows in the Albemarle-Pamlico drainage basin should aim to complement the mandated efforts by NC DEQ.

**Potential Research Questions** • What are the most accurate and least accurate water flux and use estimates and how can gaps in water-use data be filled? • What are the relative influences of meteorological forcing vs water withdrawals on low flows? • Are current low flows protective of ecological integrity? What threshold of water use would adversely affect streamflow and/or ecological integrity? • How will climate change, withdrawals, and land-use change affect low flows in the future? • What are the general stressor-response relationships between flow alteration and ecological health? • Based on pre-existing data, can the stressor-response relationships be adequately evaluated and if not, what types of data are needed in the future? • What are barriers to understanding the dominant influences on

ecological flows at the watershed scale? • How do river-groundwater interactions vary across the basin and over time, and how do these influence low flows?

### **Discussion of Phase I Report & Recommendations**

### **Action Team**

Fred Tarver commented about the illustrations shown, he noted that the EFSAB didn't really follow through with the social side of the ELOHA (Ecological Limits of Hydrologic Alteration) process and getting buy-in from other stakeholders. There are different management goals vs ecological / fish / habitat goals.

Ian McMillan asked about water accounting in other states and mentioned that the EMC (Environmental Management Commission) wanted to utilize capacity use areas assigned to the whole state vs. water withdrawal permit programs. For 20 years they have been trying to work with stakeholders in the farming community. There are challenges with data gathering.

Tom Cuffney talked about the challenges with salinity and flow and that some data are based on insects and macroinvertebrates vs. crustaceans, how you set the assessment data. The border areas where salinity and communities change is a big data gap.

Mike noted that they know there is more literature that addresses ecological flows, but when doing word and title and even key word searches "ecological flow" is not always mentioned, or you may have a species-specific report that addresses flows but it may not have been the sole focus of the paper, so it would be worth finding more reports that address ecological flows for specific species or species assemblages. Stacey suggested that APNEP help by reaching out to the partners on relevant teams that can help, such as the Freshwater Habitat and Fish Passage Team.

Ian mentioned Larry Eaton's work and Fred mentioned there were monitoring stations that include salinity in Albemarle Sounds and noted the [report](#) from Michelle Moorman when she was with USGS.

Bob asked about citizen science monitoring and whether the Riverkeepers had data. Could Sound Rivers and others be helpful? Dean and Bill noted that APNEP may have some data from their former [citizen science program](#), DMF and Sound Rivers may have data.

Jenbura asked about the decline in baseflow and whether modeling looked at changes due to ET/Rain/Temperature over time. What level of groundwater flow causes those changes? Would it be valuable to look at those relationships? Could be but tricky. Coastal Plain seeing consistent changes, could be due to broader climate influences that are affecting the whole state.

Bob asked about the focus on summer low flows and that seasonal conditions need to be evaluated. Tom said it was complicated, may not want to just look at low-flow data, need to look at high flows and access to the floodplain.

Mike talked about the Trent River in the outer Coastal Plain/edge of what is representative of the APNEP region. Tom said philosophically the gages are not where they need to be; need to be more representative of the region.

Dean mentioned that stakeholder engagement and support for monitoring was challenging, also with the MATs (Monitoring and Assessment Teams). Bill mentioned that support for monitoring needs to come from the agricultural community/municipalities to get support from General Assembly.

Bob asked about major rivers goals, which ones, how major, how far into the order and back do we need to go. Dean noted that was where we needed input from the team and that it was an iterative process. Fred said we could take the mainstream Roanoke off the list for data gaps, it has been addressed. Mike mentioned a citizen science project, could have public help with lower order streams which are typically ignored, just take picture, track changes, is it there or not? Could even get a high school group to assist. Dean wondered if DEQ ambient monitoring staff could take pictures when they are out there.

Ian mentioned based on his experience in permitting, there is a great deal of data out there, it's just some of it may not be accessible, some of it is proprietary data from consultants.

Dean asked about the status of the 2010 modeling, Fred said they have the OASIS model but there are still gaps. Based on local water supply plans, gages, etc.; not high resolution.

Fred asked if there was a desire to better understand the agricultural uses, there are no gages or active irrigation metering, reports are voluntary. May be an underestimate of use because there is no check.

Christina Davis noted that the discrepancies between the USGS and agricultural data were baffling. She noted that USGS may use golf course data; said that USGS 5-year estimates there are discrepancies. Mike said it would be good to get folks together to share notes. Small uses may not be accounted for.

**Downstream dynamics affecting upstream conditions of water level:  
Examples from Bertie County**

**Bob Christian**

Dr. Bob Christian, ECU, gave a [presentation](#) of work his is doing with Dr. Stan Riggs they are doing through NC Land of Water (NC LOW) on the Cashie River in Bertie County with the Town of Windsor. He noted that these are just preliminary results and this is ongoing work, and that he is a semi-retired ecologist doing hydrologic work. He's happy to share data and ideas.

The Roanoke River has been really high due to USACE releases, however the Cashie is low right now. There has been flooding in Windsor, which has increased over time, they are trying to understand the dynamics. Windsor is 100 miles from Oregon Inlet for context. NCSU is looking at hydrologic models in the watersheds above Windsor, looking at cost-benefit, but they did not look at downstream impacts. They are looking at water level stations/NC emergency management data / School Road (no tidal influence), King Street (tidal influence 05.-1 foot; Matthew 12 ft crest), Bowling Farm. Maps may be useful, for rivers we want to focus on with this team. Wind may be more influential than rain when it comes to coastal flooding. They also have low flow data and have developed a rapport with Bertie County. It may be a good location for a pilot study, the Scuppernong may be another area of interest. Ian noted that Linwood Peele (Water Supply Planning Branch Supervisor) of NCDWR is from there (Bertie County) so may also have connections. Mike mentioned that NOAA did a dry weather flooding study, wind / flood event study it would be interesting to compare the data. It's not even rain events, it's wind and tide. The NCSU study focused on rain events and storms. Mike mentioned that similar events happen in the Tar Basin.

PRELIMINARY SUMMARY Downstream processes affecting flow and water level do matter. They may be as or more important than upstream processes at times.

Fred explained that they have been having discussions within the basin planning group about incorporating ecological flows into the basin plans, and that he hoped there would be some useful information that comes out of the basin plans that can be used by the APNEP flows group and vice versa. He noted that the Ecological Flows Science Advisory board completed their work in 2013, they were supposed to provide assistance to DEQ in developing ecological flows for the whole state not just the APNEP basins. They presented recommendations to the Environmental Management Commission (EMC), who in their findings had some issues with the language, see extract below from the minutes of September 11, 2014 Meeting, which directed DENR (now DEQ) to work with the General Assembly on the definition of ecological flows. It placed things on hold, they did not approve the hydrologic models for the Tar, Neuse, and Cape Fear basins. It doesn't mean DWR can't use the models, they did use Cape Fear OASIS model in Pender County interbasin transfer (IBT) certification, in conjunction with a modified Tennant Method, but there are still issues with the language that haven't been resolved.

The Department of Environment and Natural Resources is authorized and directed to work with the General Assembly to specifically resolve the inconsistent and incompatible uses of the term "ecological flow" in General Statute section 143-355 (o)(3) and (4).

Until such time that such issue is resolved, the hydrologic models for the Tar River Basin, the Roanoke River Basin and the Cape Fear River-Neuse Basin are not approved.

Until such time that such issue is resolved, the Department is authorized to continue to use the Tar River Basin, the Roanoke River basin and the Cape Fear-Neuse River Basin hydrologic modes in planning decisions and, as required in order to comply with required statutes or rules, to make decisions on permit applications or other matters concerning water allocations; PROVIDED THAT any determination required by General Statute section 143-355 (o)(3)(b) 1, 2, and 3 shall be based on site specific data and shall not be based on any generally applicable standard or value, including but not limited to any generally applicable standard or value for ecological flow contained in or derived from the report entitled "Recommendations for Estimating Flows to Maintain Ecological Integrity in Streams and Rivers in North Carolina" dated November 2013.

If the Department wishes to establish generally applicable standards or values for determining "all needs", "all essential uses", or "ecological flow" for purposes of making the predictions required by General Statute section 143-355 (o)(3)(b), 1, 2 and 3, it shall do so by rulemaking proceedings in accordance with the applicable provisions of the North Carolina Administrative Act.

Fred talked about basin plan development, in the 1990's DWQ had a flow group. They developed flow requirements on the Dan River, they were essentially ecological flows, the process has evolved over time. They were incorporated into the 7Q10 flow in the NPDES permits, have evolved to more desktop methods such as the Tennant Method, and other states and other agencies have been evolving over time as well. In 2013, DWR/DEQ integrated quantity and quality divisions together, also looking at water quality standards, designated uses of a waterbody and impairments. They are still trying to figure out how to accomplish these goals together. 85% of the flow standard in the hydrologic models, if we can't use ecological flow, how do we deal with it? Nora explained they were interested in how they move forward under this constraint from the EMC.

Bob asked about the [Tennant method: developed in western U.S. as a desktop method to be](#) used with western trout (Tennant, D.L. 1976. Fisheries 1(4):6-10). Qualitative categories established based on the percent of mean annual flow as flow requirement. Ecological flows are important for individual flows. Some dam safety permits have zero flow requirements. NPDES assimilative capacity based on 7Q10, but not revisited, potential impact not being addressed. With SEPA (N.C. (State) Environmental Policy Act) we could establish a ecological flow but with the bar set so high it is never evoked, so have a quasi-ecological review.

Bill noted that you could include as supplemental information in the basin plans. Nora agreed that they do have the leeway to do that. The DWR staff think there is more willingness with the current EMC to go above and beyond to protect the ecosystem, and thinks EMC would be more supportive if we had data to support true ecological flows, vs. the 85% broad target. The basin plans are also good at identifying research needs and questions that need to be answered. Ian agreed that the attitudes may be shifting, things they may not have been supported in the past could be now, and in terms of the recommendations being vetted, the EFSAB met for 3 years. Mitch Gillespie may be an advocate on the EMC for doing that. Bill agreed, he thinks he would be supportive of having real data to provide to the regulatory community.

Stacey asked if that was a good segue into talking about a potential pilot study, is there a way to hone in on a particular area, to provide the data and basis to move those conversations forward. Are we looking at species specific data or information at the community level or an assemblage of species in terms of information being more palatable?

Tom noted there is a fundamental problem, could do a model that provides a value, but what does that mean in terms of society's ability to accept the information? There are challenges with modeling, need to take an adaptive management approach, it's the only way to make recommendations and incorporate hard science into rulemaking. You need the interaction, back and forth, not sure how we achieve that.

Mike noted that with nutrient impairments, we're getting better at valuing how much it costs to clean up a waterbody, and valuing ecosystem services, quantify impact, worth putting extra effort into measuring. Can we quantify ecological impacts and tell that story?

Bob asked where this fits into the APNEP structure? Going back and forth between the science and the management, these stakeholders are not necessarily on the teams. Dean said ideally there is a transition that the technical folks on the teams make recommendations to the managers. However, what can we do with the data we have now? The data we have now may not be a regulatory value, but more of a reference value, but want the conversations to be grounded in science. If we don't have enough data for folks to feel comfortable moving forward, perhaps do a pilot. That's the idea behind the iterative nature of our process. In order to reduce uncertainty, need to invest more in doing more monitoring and studies, however afraid that that puts us even further down the road, but then it takes 5 years to collect that data, so what can we say with the data we have now, with recommendations that uncertainty may be high. However, if folks ask why we can't move forward now, can at least have the conversation, can't move forward because we don't even have gauges at the coast.

Bob asked his fellow EFSAB members, Fred, Tom, would they be comfortable with all the areas above the fall line, or ahead of tide, could we accept the ecological flows determined by the board? There is no way that APNEP can put in the time/effort/manpower that went into the 3-year EFSAB process. So for those streams, knowing the limitations, and asking has the science changed in the last 5 years since the report was released, what do they think?

Tom said we're getting more recent data out of the coastal Carolinas and other efforts, but from his perspective they were the scientists providing a tool, from an ecological perspective thinks would be in pretty good shape using the 85% target, however, if push comes to shove from a societal perspective, we need 80%, or say there is a big drought and we need to go to 75%, that type of back and forth and what if scenarios never occurred during the process. Concerned there were representatives that didn't speak up during the process but essentially killed it at the end, worked behind the scenes with advocacy groups.

Ian said his understanding was that the City of Raleigh and others were concerned that an entity such as American Rivers would sue and set precedent in case law.

Dean noted that APNEP may not have to work under the same restrictions set by the EMC.

Mike asked if there was an absolute minimum flow where you know you would have harm if there were droughts, etc., Fred and Tom said that was built into the process. He noted it was also important to look at cumulative and additive effects.

## **PHASE II: Data Analysis / Pilot Project: Team Discussion & Identification of Next Steps Action Team**

Dean went back to Mike's graphic; how can we continue to move forward? What guidance is needed for folks to move forward? Additional discussion is needed; how does the team want to move forward? Gather additional thoughts, think about next steps.

Fred said that he thinks site-specific studies, ground truth relationship between habitat and different stages would be good.

Tom noted pulling data together intense projects, can we agree a pilot study needed?

Mike noted other states investing a great deal in doing studies with consultants, TNC / USGS have capacity, but need matching funds, get something defensible if bring them in.

Mike suggested looking at subwatersheds that have better groundwater records that overlaps with long term flow records.

Stacey suggested looking at a spread across the APNEP geography, probably can't do each river basin, but could have a spatial spread of across the watersheds, the areas for further study suggested in the report may provide a basis. The group discussed the benefits of selecting multiple area in the APNEP geography to do a pilot study and evaluating data from several different river basins. Could look at USGS, water quality, and biological data. It would be good to utilize subwatersheds with long term data available. Sites suggested included Contentnea Creek in the Neuse Basin, Potecasi Creek in the Chowan Basin, Trent River in the Neuse Basin.

Stacey also noted that Albemarle Commission / Albemarle RC&D (Resource Conservation and Development Council, Inc.) is doing a study about the causes of algal blooms in the Chowan Basin and is focusing on Potecasi Creek, which was an area suggested in the ECU (East Carolina University) report for further study, to the extent that data may be relevant. Mike noted that for algal blooms residence times

matter, low flow, get blooms, salinity, traditional ecological flow studies, tend to keep them separate, but there are flow/WQ dynamics that are important, but it could quickly complicate things.

Nora mentioned biological data in the Trent River, could look at where we have data. Tom said USGS has been looking at WQ/biology in Contentnea Creek for 20 years, have several good potential sites; maybe take 3 examples.

Dean asked about team leads and Bob Christian, Mike O'Driscoll, and Tom Cuffney agreed to be co-leads. They will talk more and flesh out ideas for a strategy for pilot studies.

Stacey suggested re-evaluating Phase II from original team action plan, merge with Mike's recommendations in the approach, come up with revised path forward. Bob suggested he and Mike could start working on it, include Tom as needed.

APNEP will share the spreadsheet on the website and discuss creating a web clearinghouse. There is currently no central place to synthesize flows data. The pilot could be a first cut at developing a long-term data set. Look at flow/ecological relationship in more detail. How much low-flow withdrawals, doing water budgets in a smaller area.

Mike said it would be helpful to get more eyes on the data, things could have been missed, originally Coley was thinking about a centralized place to share data. There is a webpage (Web World of Water) that has a tremendous amount of information, and USGS is great about sharing information and real-time data, however, no one has everything together from a flows perspective. Could filter some of spreadsheet, put relevant ones on our webpage, water levels for instance; for GW, sometimes DEQ has more data. Dean suggested we create a Clearinghouse on web if folks are looking for water data in our geography.

Phase II is data analysis, so really looking at focus being data analysis. Mike agreed and said from an analysis perspective they did a first cut at a low-flow analysis, need to look at flow/ecology relationships in more detail, more low flow/water withdrawals, and seeing if we can tease out meteorological vs. anthropogenic impacts.

The group agreed that more flow based ecology detail/studies are needed. Nora talked about work the DEQ biologists are doing, such as monitoring after droughts, and noted their data might be helpful. Dean said he could coordinate with Aquatic Fauna and Water Resources MATs teams as well. Trish suggested looking at striped bass, she thinks that egg survival may be correlated with flows. Stacey said they could work with the Freshwater Habitats and Fish Passage and other teams and see what information they can provide. Jimmy is one of the leads on that team.

Stacey thanked everyone for coming and said they would share presentations and supporting information on the team page, and extended the invitation to the DWR planners to continue to participate, while Fred is the official DWR lead, these are complicated issues and we can help each other by sharing information so the more folks the better.

**Adjourn / Meeting recording ends ~3:42**