UNRBA MRSW Meeting

MRS Project Discussions

January 28, 2019

Discussion of Feedback from the Fall 2018 Stakeholder Meeting

Feedback Session

- Receive comments or input regarding the data sets described
- Understand stakeholder uses and needs from the modeling
  - What questions do they want to be able to answer?
  - What is the most useful format for the data?
  - How do they plan to use the data?

Decisions we make now affect what we can get out of the models later.

Top 8 Requests of Watershed Model in Order of Importance

- Understand which **land uses or activities** contribute to the highest nutrient loads
- Predict the effects of implementing various **Best Management Practices** on nutrient loading to the lake
- Estimate and compare **jurisdictional loads** (City, County, Utility)
- Understand **where nutrient loading is highest** (tributaries, jurisdictions, soil types)
- Understand the role **atmospheric deposition** plays in nutrient loads
- Identify **unmanageable and manageable sources** of nutrient loading
- Provide **input to the lake model**
- Understand the relationship between **nutrient concentrations and nutrient loads**

Next 9 Requests of Watershed Model in Order of Importance

- Understand the effect of **legacy nutrients** bound in sediment

- Simulate **nutrient concentrations and loading** at specific locations

- **Identify areas needing further exploration** because the loads are not well explained by the models

- Understand how **adjacent wetlands** affect water quality in Falls Lake

- Understand how **storm events** affect concentrations and loading

- Understand **terrestrial loading of total organic carbon**

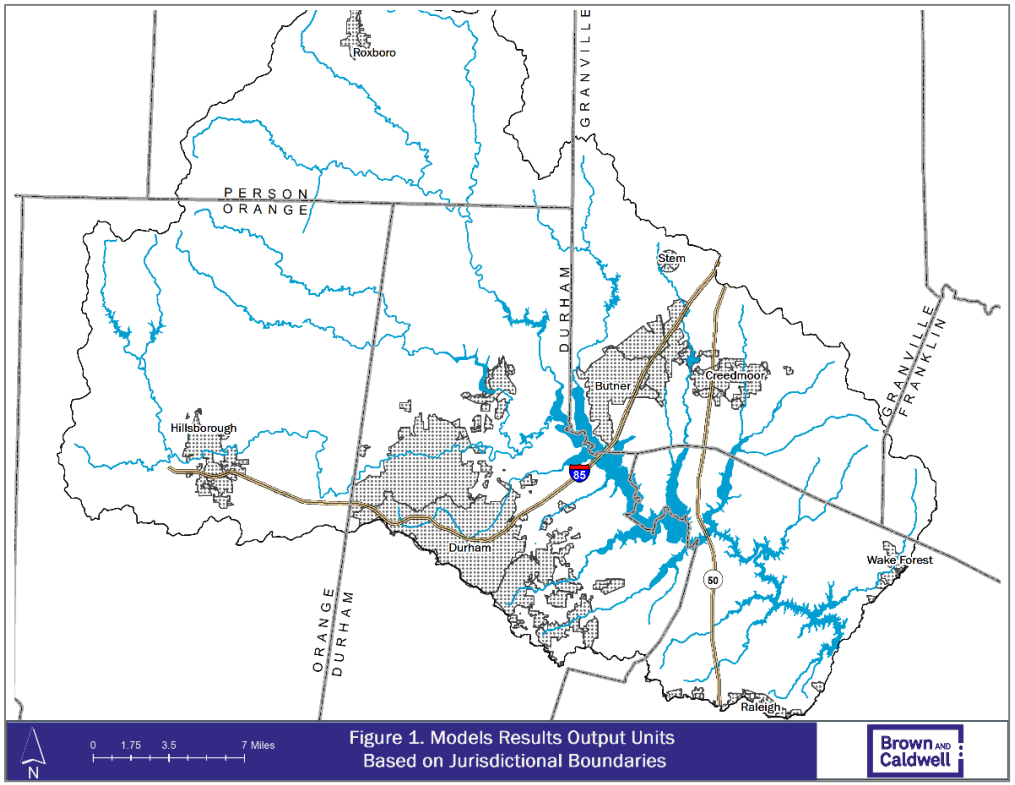
- Understand **ecological health baseline** for the watershed

- Understand how **onsite wastewater treatment systems** impact nutrient loading to Falls Lake

- Understand how linear facilities such as **roads** impact loading

Desired Summary Units for Watershed Modeling in Order of Importance

- Spatial scale
  - Jurisdictional/utility level
  - Modeling unit level ✓
  - UNRBA monitoring station level ✓
  - Perennial stream level ✓
- Temporal scale ✓
  - Daily
  - Monthly
  - Seasonally
  - Annually
  - Weekly
  - Quarterly



Top 7 Requests of Lake Model in Order of Importance

- Understand how **watershed management** affects levels of nutrients, chlorophyll, and carbon in the lake
- Understand the relationship between **nutrient loading and lake water quality**
- Quantify all of the **in-lake sources** of nutrients and carbon
- Quantify all of the **external sources** of nutrients and carbon
- Understand how **seasonal loading and flow patterns** affect water quality in the lake
- Predict **differences in water quality** in different portions of the lake (e.g., upper lake vs lower lake, tributary arms vs. main stem)
- Understand the variability in water quality from **year-to-year**

These are either explicitly simulated, can be determined from post-processing model output in various ways, or can be evaluated using model scenarios.

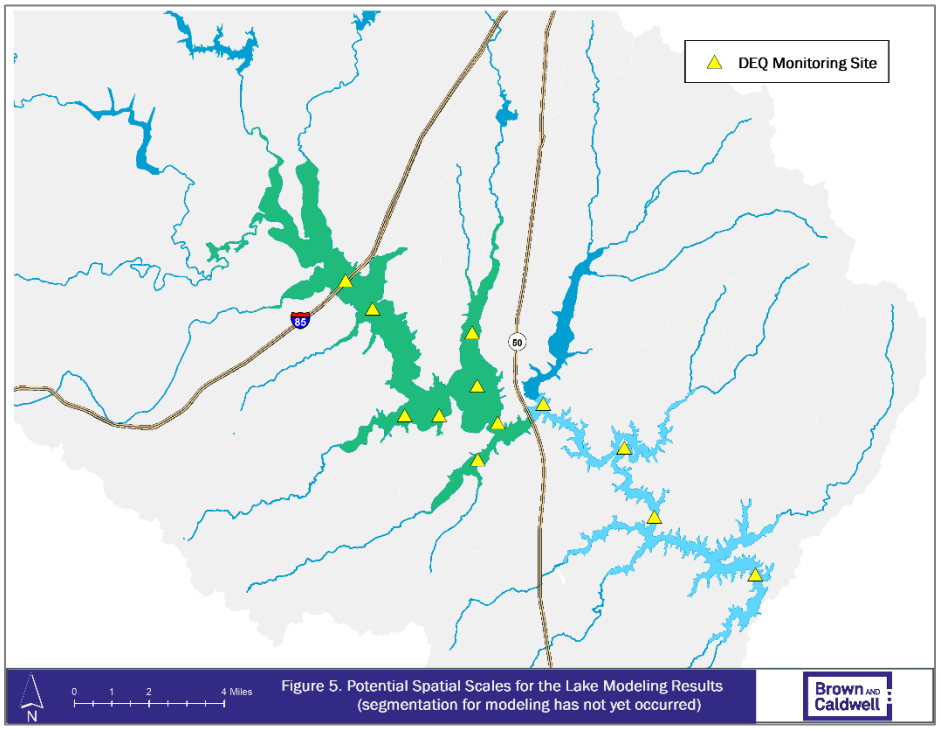
Next 7 Requests of Lake Model in Order of Importance

- Understand how **rainfall patterns, residence time, and causeways** affect water quality
- Predict water quality released to the **Neuse River** at the dam
- Understand how **lake management/operations** affect water quality
- Quantify the **reservoir of nutrients in the Falls Lake sediments** and understand how long it will take for those stores to deplete
- Evaluate a **range of weather conditions and long-term response to management**
- Ask “What if” questions such as Climate Change: what does **extreme weather/rain** do to lake health?
- Predict water quality at the **water supply intake**

These are either explicitly simulated, can be determined from post-processing model output in various ways, or can be evaluated using model scenarios.

Desired Summary Units for Lake Modeling in Order of Importance

- Spatial scale
  - Lake arms and incremental segments
  - Many locations to demonstrate how much water quality varies across the lake and how designated uses are maintained
  - Upper and lower lake (divided at Hwy 50)
  - Each DWR monitoring station
  - For the whole lake
- Temporal scale
  - Monthly
  - Daily
  - Seasonally
  - Annually
  - Weekly
  - Quarterly



Further Discussion of Stakeholder Feedback

Issues Requiring Further Discussion

- Predict the effects of implementing various **Best Management Practices** on nutrient loading to the lake
- Estimate and compare **jurisdictional loads** (City, County, Utility)
- Understand the effect of **legacy nutrients** bound in sediment
- Understand **ecological health baseline** for the watershed
- Spatial scale: **jurisdictional**/utility level

Jurisdictional Loading Estimates and Reporting

- Most frequently requested spatial scale and third most requested information item from the watershed model
- Previous discussions about dividing the watershed modeling catchments at the jurisdictional boundary to allow for direct accounting
- Best source for jurisdictional boundaries is NCDOT
- Modelers recommend using the most recent year available to develop both models
  - 2017 is currently available
  - 2018 will be available at end of March
- Give the best accounting for today's ownership of loads

Catchment Delineations Nearly Complete

- UNRBA monitoring stations including storm event, jurisdictional, and lake loading (compare to observations)
- USGS flow and water level gages (compare to observations)
- Impoundments (required for WARMF)
- Carolina Slate Belt/Triassic Basin/Raleigh Belt (respond to stakeholders)
- Revised WARMF catchments from City of Durham (provide consistency across models)
- Add jurisdictional boundaries
- Ignore “slivers”

Discussion:
Jurisdictional Boundaries and Catchment Delineations

Legacy Sediments

- Inherently accounted for in model development and calibration
  - Monitoring data (suspended sediment and nutrient concentrations) includes contributions from legacy sediments (land surfaces, stream channels, and inlake sediments)
  - Models will account for different soil types in the watershed as well as inlake sediment nutrient releases and will be calibrated to data
- Modeling scenarios may be used to test changes
  - Decreasing sediment nutrient concentrations with time
  - Impacts from reductions in watershed nutrient loading
  - Depletion of inlake nutrient stores in sediments
- Refer to literature to inform modeling assumptions and scenarios (e.g., Wegman)

Discussion:
Legacy Sediments

Ecological Health Baseline

- Use Forest Service monitoring study to ensure the model is accurately representing forests in Carolina Slate Belt and Triassic Basins (monitoring period does not overlap with model years)
- Requested Duke Forest data from Collaboratory
- Develop model scenario that is all forested and wetlands
- Evaluate nutrient loading to Falls Lake and lake water quality for this scenario
- Put scenario results into context when discussing with stakeholders and managing expectations

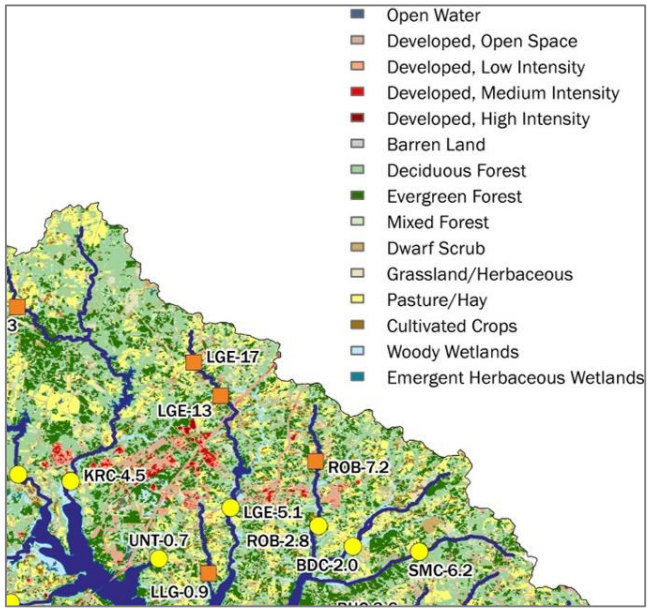
Discussion:
Ecological Health Baseline

Simulate Best Management Practices

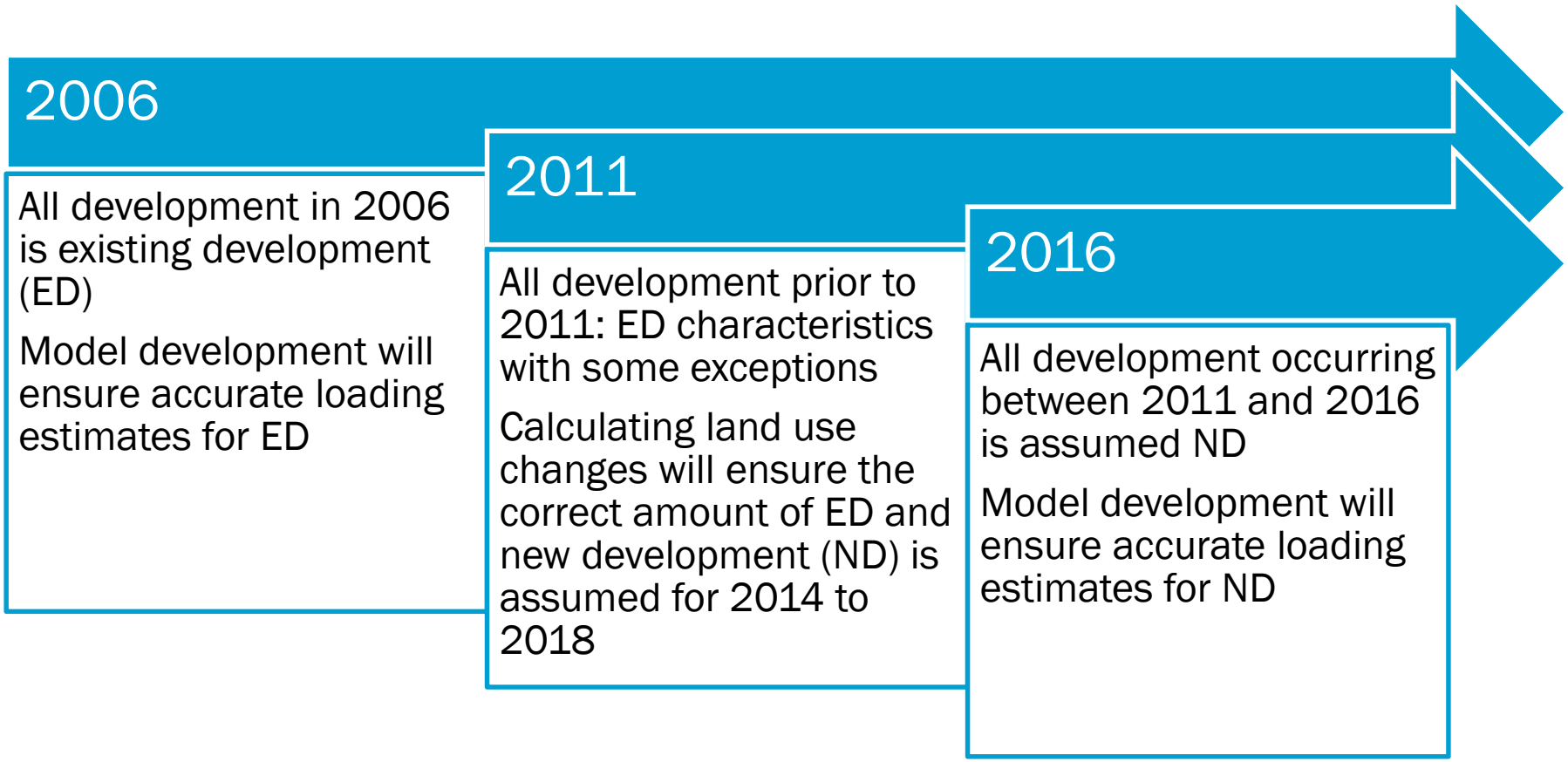
- Simulating each individual BMP is challenging
  - Location and date of installation (staggered implementation)
  - Design goals (volume, water quality, other)
  - O&M activities
- Simulating BMP scenarios or regional-scale BMPs is more efficient
- Accounting for differences in existing development and new development can account for BMPs indirectly and allow flexibility for building implementation scenarios

Simulating Existing and New Development

- USGS National Land Cover Data (NLCD)
  - Landsat satellite-based landcover database
  - 30-meter resolution grid
  - Anticipated 2019 release will include
    - 2016 new data (midpoint of the 2014 to 2018 model period)
    - 2006 re-processed data (midpoint of the 2005 to 2007 model period; baseline year for existing rules)
    - 2011 re-processed data (transition to new development requirements for most jurisdictions)



Application of USGS NLCD Data



Simulating Existing and New Development

- Landuse categories will be replicated for existing development and new development
- ED model parameters will be established using the 2005 to 2007 model development and comparison to water quality observations
- ND model parameters will be established using the 2014 to 2018 model development and comparison to water quality observations
  - Altered ND parameters will inherently account for best management practices and structural control measures required under the ND rules

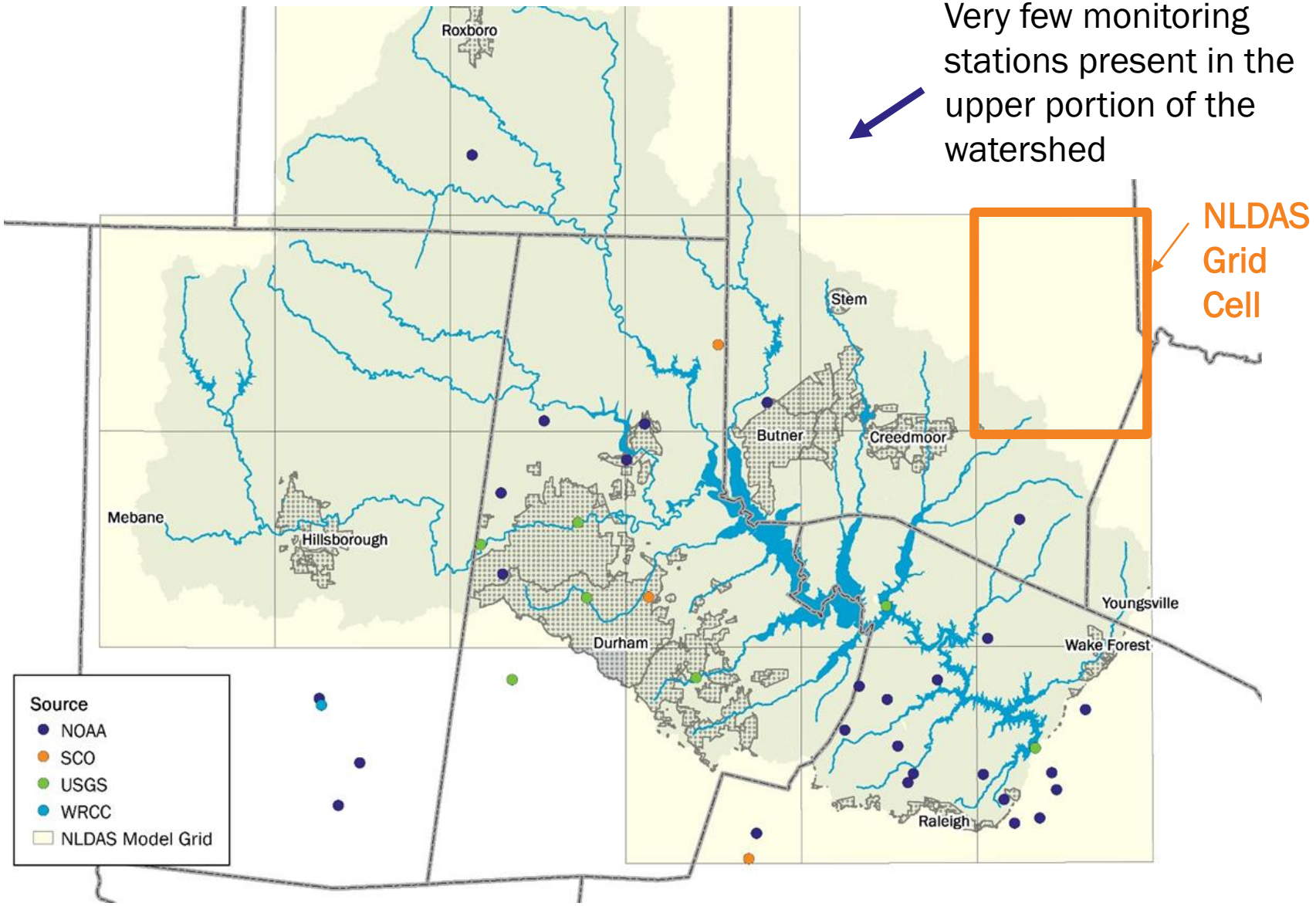
Discussion:
BMPs and Land Use Assumptions

Development of Weather Inputs

Approach for Developing Weather Inputs

- Recommendation for precipitation
  - Submit request to NCDOT/State Climate Office to process radar data for quartered NLDAS grids (~2 miles by 2 miles)
  - Use the NEXRAD radar data to generate hourly precipitation estimates across the watershed
  - Compare NEXRAD data to locations with observations
  - Evaluate for bias and correct as needed
- Other parameters
  - Use the NLDAS remote sensing-based weather data files using the ~8 mile by 8 mile grids
  - Compare NLDAS data to locations with observations
  - Evaluate for bias and correct as needed

Locations of Weather Data Sources



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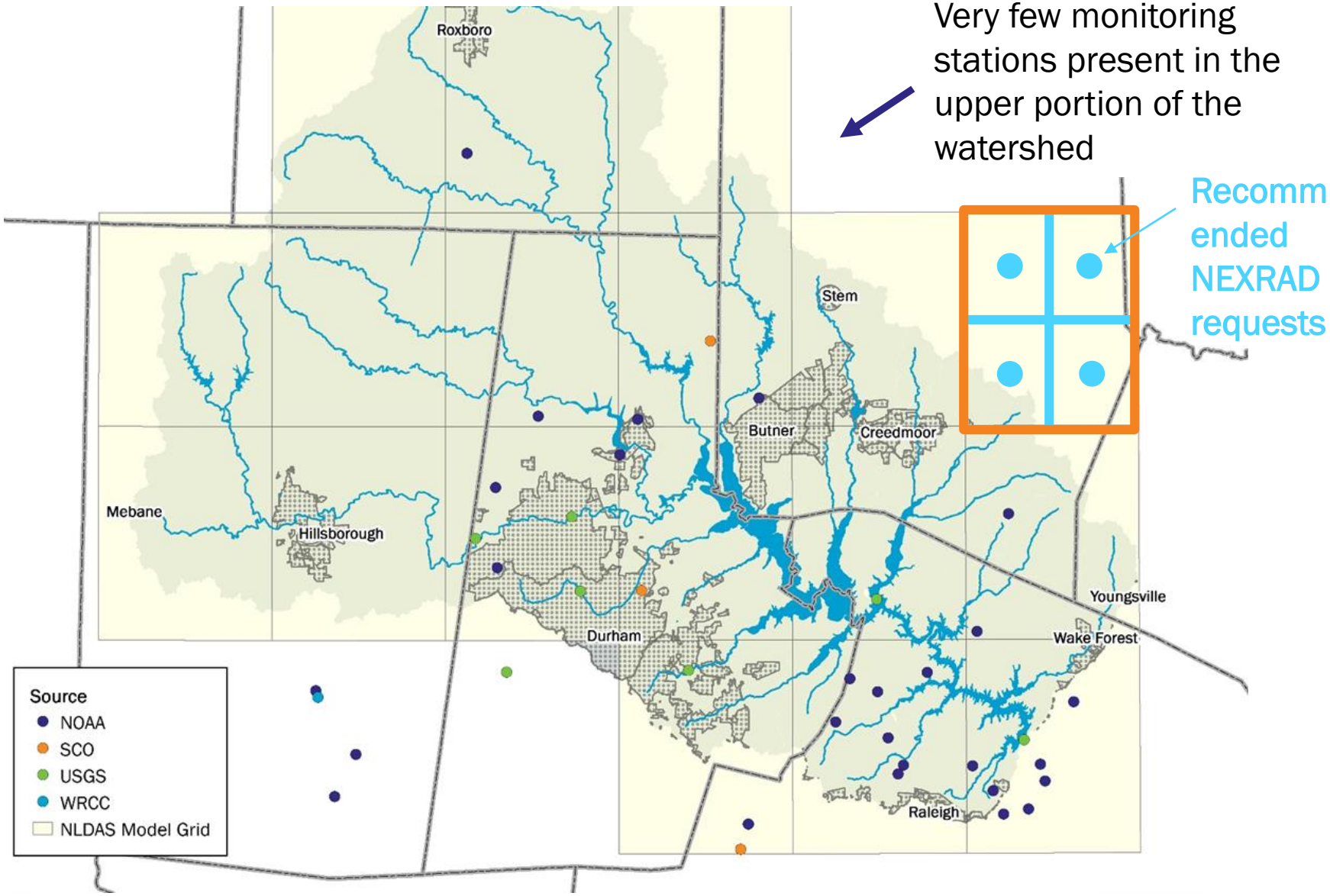

Discussion:
Weather Inputs/NEXRAD Request

Discussion on Climate Change

Recent Presentation on Climate Change and Liability of Regulated Community

- Case study on Chesapeake Bay
- Climate resiliency is part of the Agreement
- Includes adopting climate change targets in revised targets for nitrogen, phosphorus, and sediment
- Account for sea level rise (SLR), temperature increases, and precipitation changes in models
- Increased nutrient load reduction targets (preliminary estimates) to offset decreases in dissolved oxygen relating from climate change
- Climate change modeling to be conducted in 2019

November 16, 2018
Elizabeth Andrews
Director, Virginia Coastal Policy Center
William & Mary Law School

Recent Presentation on Climate Change and Liability of Regulated Community

- Risks to local governments and utilities
  - Impacts on utility assets and operations caused by SLR
  - Flooding and risk of litigation
- Recommendations
  - Account for climate change in flood mapping
  - Assess vulnerabilities
  - Floodproof sites and improve design standards
  - Incorporate green infrastructure
  - Educate the public

November 16, 2018

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Director, Virginia Coastal Policy Center
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Follow-up UNRBA Discussions/Emails

- Changes in storm intensity relative to design size for BMPs/SCMs
- Resiliency of BMPs compared to land conservation
- Impacts to WWTP operations and SSOs
- Seasonal patterns of loading, flushing, and algal growth

Ongoing and Potential Analyses

- Analyses planned for 2019 Monitoring Program Annual Report
  - Nutrient and carbon loading associated with storms of varying sizes
  - Analysis of seasonal patterns and algal growth
- Considerations for current modeling
  - Test effects of large storms on loading and lake water quality
- Potential additional modeling
  - Evaluate climate change scenarios by revising meteorological files (e.g., more intense storms with longer low flow/drought periods or downscale regional models)
  - Test climate change scenarios using existing model configuration
  - Update watershed characterization (e.g., land use, wastewater) and run with climate change scenarios
- Considerations for revised strategy
  - Long-term management and effects on load reduction targets

Discussion:
Climate Change

Discussion of Re-examination MOA with DWR

Draft MOA with DWR

- Legal group has drafted a preliminary MOA that is under review
- Discussed at November Board and PFC Meetings
- Definitions and clarifications to discuss
  - Supplemental Modeling
  - Supplemental Modeling submission
  - Submission
  - Draft recommendations
  - Recommendations
  - Supplemental information
  - Combined set of recommendations
  - Final version of recommendations

Items to Discuss

- Agency review time (DWR/EPA) and
  - Assignment of an agency point of contact
  - Establishment of project milestones and technical meetings
- Upper versus lower – potential silos
- Expectations for DWR to provide comments throughout the process, not just formal submissions
  - As work products are developed and posted (tech memos)
  - After stakeholder meetings, PFC and BOD meetings
  - Following or during supplemental technical meetings with agencies
  - As issues or concerns arise
- Third party reviewers
  - Who will fund this?
  - Who will manage this?
  - When can we expect to roll this into the process?
- Education of the EMC
- Conflict resolution, agency level

Discussion: MOA

Chesapeake Bay Implementation – Lessons Learned

Components of the Chesapeake Bay Implementation Plan

- Adaptive management is “ongoing” with periodic checks
- Management activities are updated to reflect updated information
- Requires ongoing monitoring and evaluation with feed-back to the programmatic components of the management plan
- The program is managed by an organization that is made up of the regulated jurisdictions with limited agency oversight; culture of cooperative interaction and mutual decision making
- Significant flexibility in type of actions and control activities allowed

Components of the Chesapeake Bay Implementation Plan, Continued

- The effort is broken down into multiple phases. Our revised strategy may benefit from this approach:
  - Evaluate water quality following the current set of actions
  - Adjust the next phase of the effort
  - Improve effectiveness of next phase.
- The modeling and planning tools used are updated periodically to reflect new data collected
- Organized procedures for developing and approving BMPs and practices fall mainly under the purview of the organization, not the agency
- Organization benefits from providing tools for nutrient reduction

Discussion: Chesapeake Bay

Emerging Issues

Emerging Issues

- SAC updates
- Site specific criteria – preliminary evaluation based on data
- Loading estimates – preliminary evaluation based on data

Questions ?