

**Modeling and Regulatory Support
Year 2 Kickoff Meeting
Wednesday, October 25, 2017
9:30 AM – 12:30 PM
Butner Town Hall Multi-Purpose Room**

Agenda

- 9:30** Welcome and Introductions
- 9:50** Overview of UNRBA Modeling and Regulatory Support Project
- 10:10** Data Acquisition for the Watershed Modeling component of the Project
- 10:55** Break Out Groups to Discuss Concerns and Ideas for Providing the Data
- 11:50** Rapid Report Outs
- 12:20** Next Steps in Modeling and Regulatory Support
- 12:30** Adjourn



Overview UNRBA Modeling and Regulatory Support, Year 2

Forrest Westall - UNRBA



Modeling and Regulatory Support
Year 2 Kick-Off Meeting
October 25, 2017



Municipalities

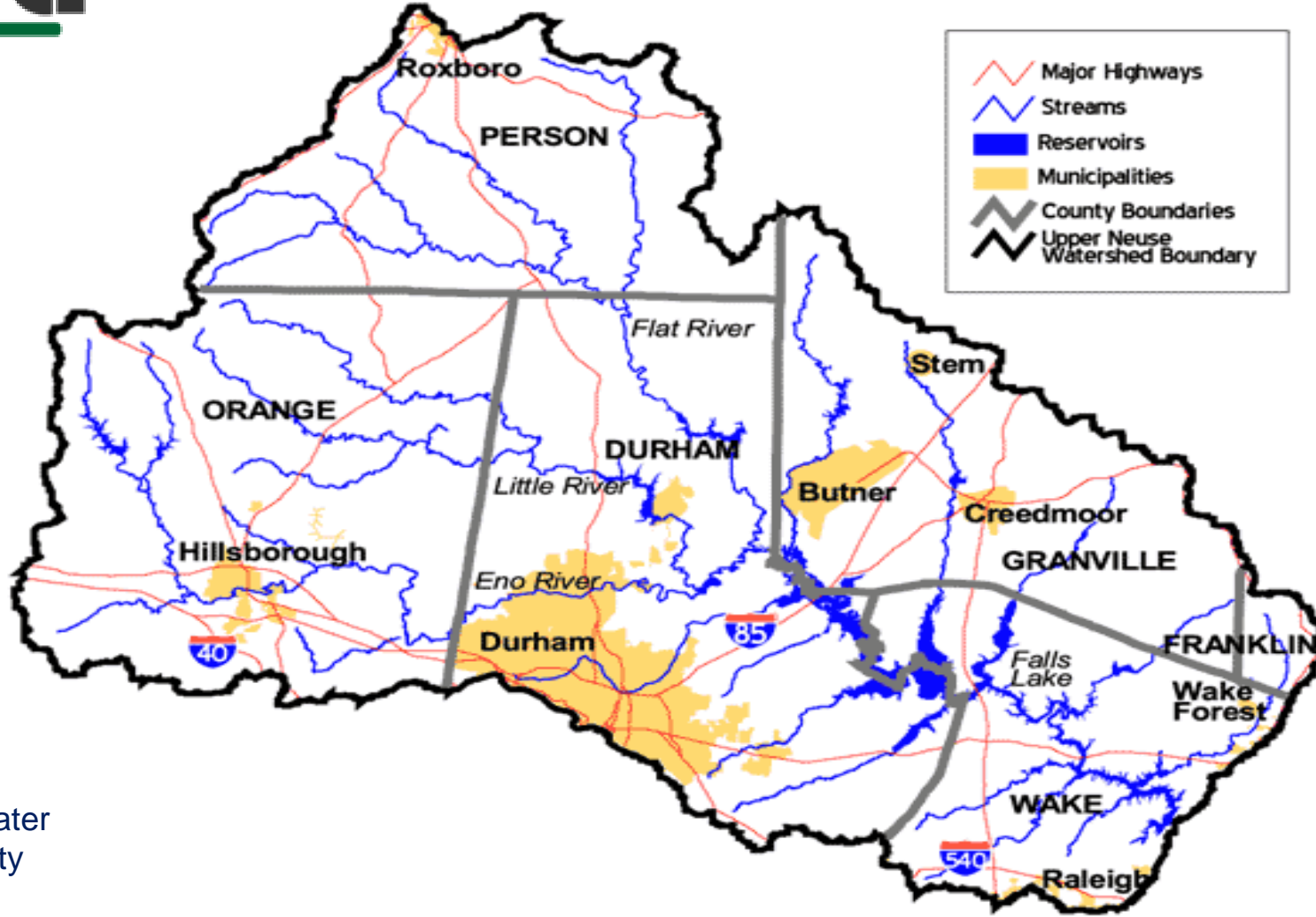
- Butner
- Creedmoor
- Durham
- Hillsborough
- Raleigh
- Stem
- Wake Forest

Counties

- Durham
- Franklin
- Granville
- Orange
- Person
- Wake

South Granville Water and Sewer Authority (SGWASA)

Soil and Water Conservation Districts (Ex Officio)



Project Background



Falls Lake Challenges and Realities

- > Primary source of water for one jurisdiction
- > Water quality concerns – chlorophyll *a* impairment
- > Legislative action required nutrient management
- > Falls Lake adopted rules
 - Very restrictive nutrient requirements
 - Stage I requirements for nutrient reductions are expensive
 - Extremely costly Stage II requirements
 - Rules allow for reexamination
- > Consensus Principles

Falls Lake at I-85 in October 2007
Source: City of Durham



Falls Lake at I-85 in November 2007
Source: Southeast Regional Climate Center



Rule Language Regarding Reexamination

- > “**Recognizing the uncertainty** associated with model-based load reduction targets...a person may at any time during implementation of the Falls nutrient strategy develop and submit for Commission approval **supplemental nutrient response modeling**” requiring
 - Division review and approval of any **monitoring study plan** and **description of the modeling framework**
 - A minimum of **three years** of lake water quality data
 - Supplemental modeling is conducted in accordance with the **quality assurance requirements** of the Division

UNRBA PLAN FOR THE REEXAMINATION

Coordination with agencies and stakeholders

2010

Falls Lake Strategy is passed

Consensus Principles adopted

2011

UNRBA decides to initiate a reexamination of Stage II

2012-2013

UNRBA contracted work to develop a strategy for the Reexamination process

2013-2014

Develop monitoring plan to support Reexamination and obtain DWR approval

2014-2018/19

Collect monitoring data for at least 4 years

2018-2021

Revise watershed and lake models; evaluate nutrient management strategies

2022-2023

Develop the UNRBA Reexamination package



Overview of the UNRBA Strategy for Reexamination

- > Use a measured, science-based approach to
 - Review monitoring and modeling conducted by DWR
 - Evaluate data gaps and uncertainties
 - Develop a strategy for the reexamination
 - Monitoring
 - Modeling
 - Management alternatives
 - Implement an adaptive monitoring program to support
 - Revised watershed and lake response models
 - Load allocations to sources and jurisdictions
 - Regulatory options as needed



UNRBA Reexamination Planning and Development Website

<https://www.unrba.org/reexamination>

- > Organized in reverse order
- > Technical memoranda from the planning phase are towards the bottom of the page
- > Task 1 – Described the plan for the reexamination
- > Task 2 – Summarized the watershed and lake data available at the time
- > Task 3 – Discussed available methods and models for determining loads from the watershed
- > Task 4 – Recommended monitoring and modeling studies to support the reexamination

Status of the UNRBA Monitoring Program



Routine Monitoring (Monthly)

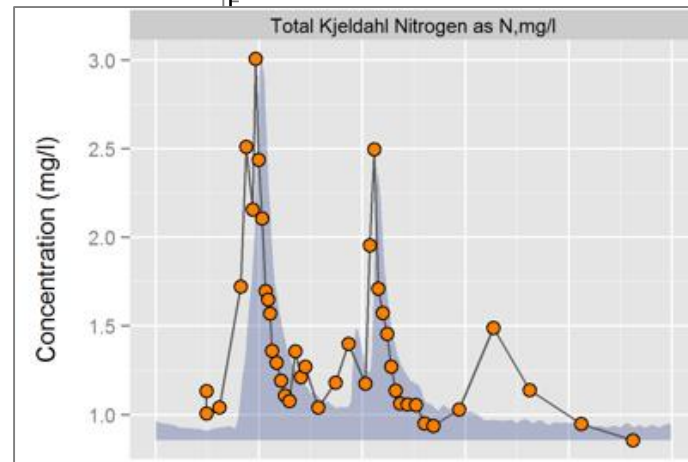
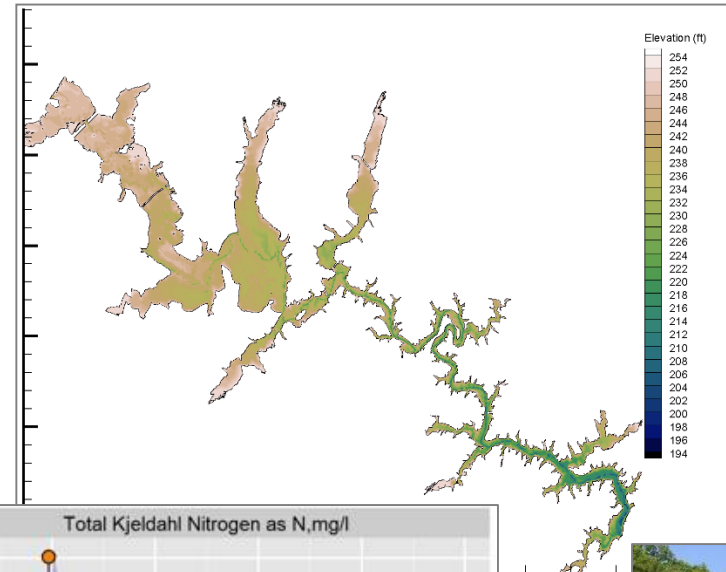
- > Began in August 2014
- > Stations
 - 18 lake loading
 - 20 jurisdictional
 - 12 inlake (supplemental data)
- > Parameters
 - Field parameters
 - Nutrients
 - Carbon
 - Chlorophyll *a*
- > Over 25,000 additional data points as of July





Special Studies

- > High flow grab sampling
- > Storm event sampling
- > Light extinction data
- > Lake sediment quality
- > Lake bathymetry
- > Lake constriction point study
 - Velocity
 - Water Quality





UNRBA Monitoring Program Website

<https://www.unrba.org/monitoring-program>

- > DWR-Approved documents as required by the Falls Lake Rules
 - UNRBA Monitoring Plan
 - UNRBA Monitoring Quality Assurance Project Plan
 - UNRBA Description of the Modeling Framework
- > Interim and annual reports that summarize the data collected and provide preliminary analyses
- > Link to the UNRBA Monitoring Database and User Documentation
- > Study Plans for the Special Studies
- > Additional analyses
 - Flow estimation methods
 - Model performance and sensitivity

Status of the UNRBA Modeling and Regulatory Support Project



Work Completed During Year 1

- > Stakeholder meetings in September 2016 and March 2017
- > Selection of watershed and lake models for the reexamination
 - Development of criteria
 - Model ranking and evaluation
 - Model selection by the Modeling and Regulatory Support Workgroup
- > Conceptual modeling plan to describe how the models work together
- > Development of the multi-year work plan
- > Memorandum are available at <https://www.unrba.org/reexamination>

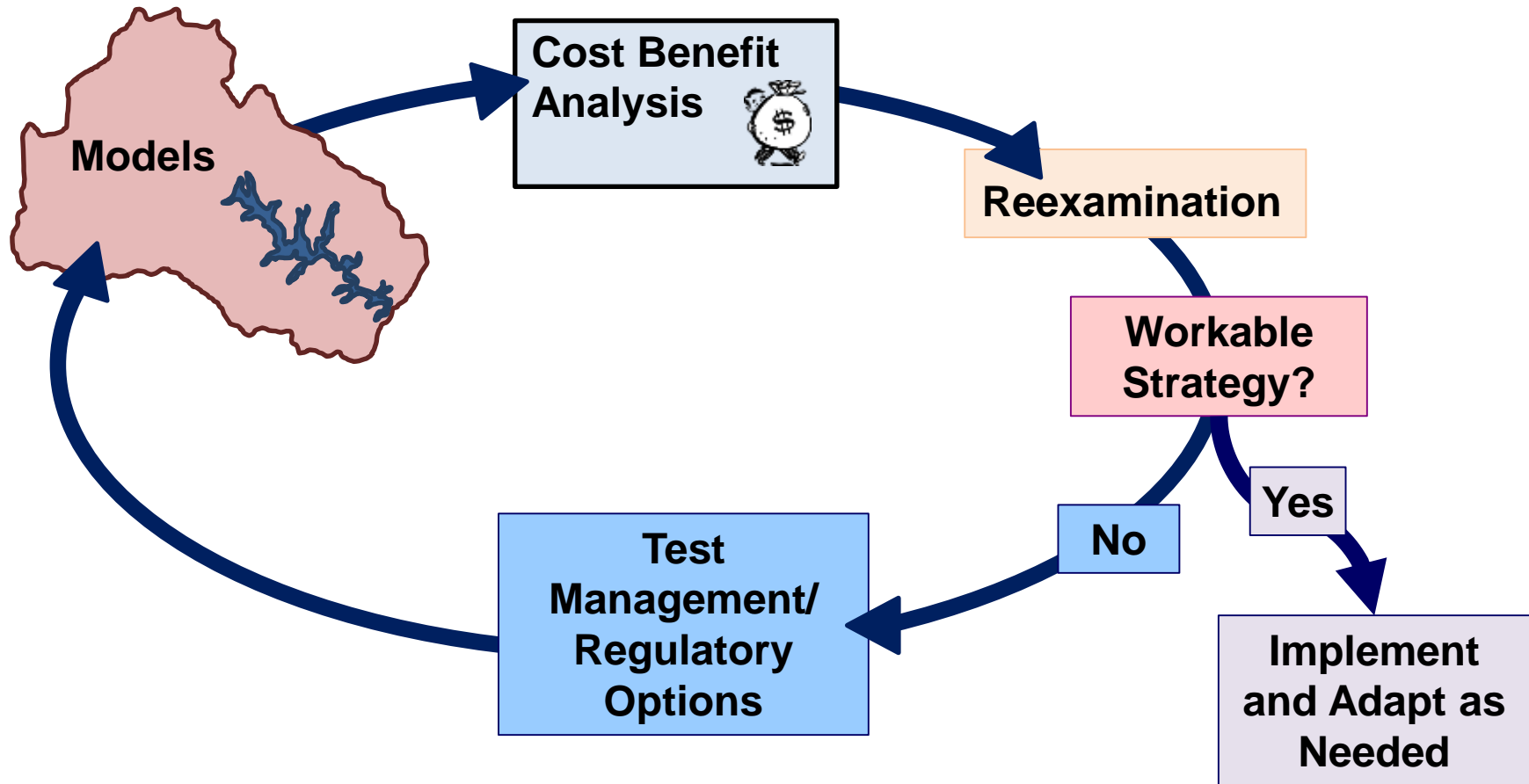


Models Selected for the Reexamination

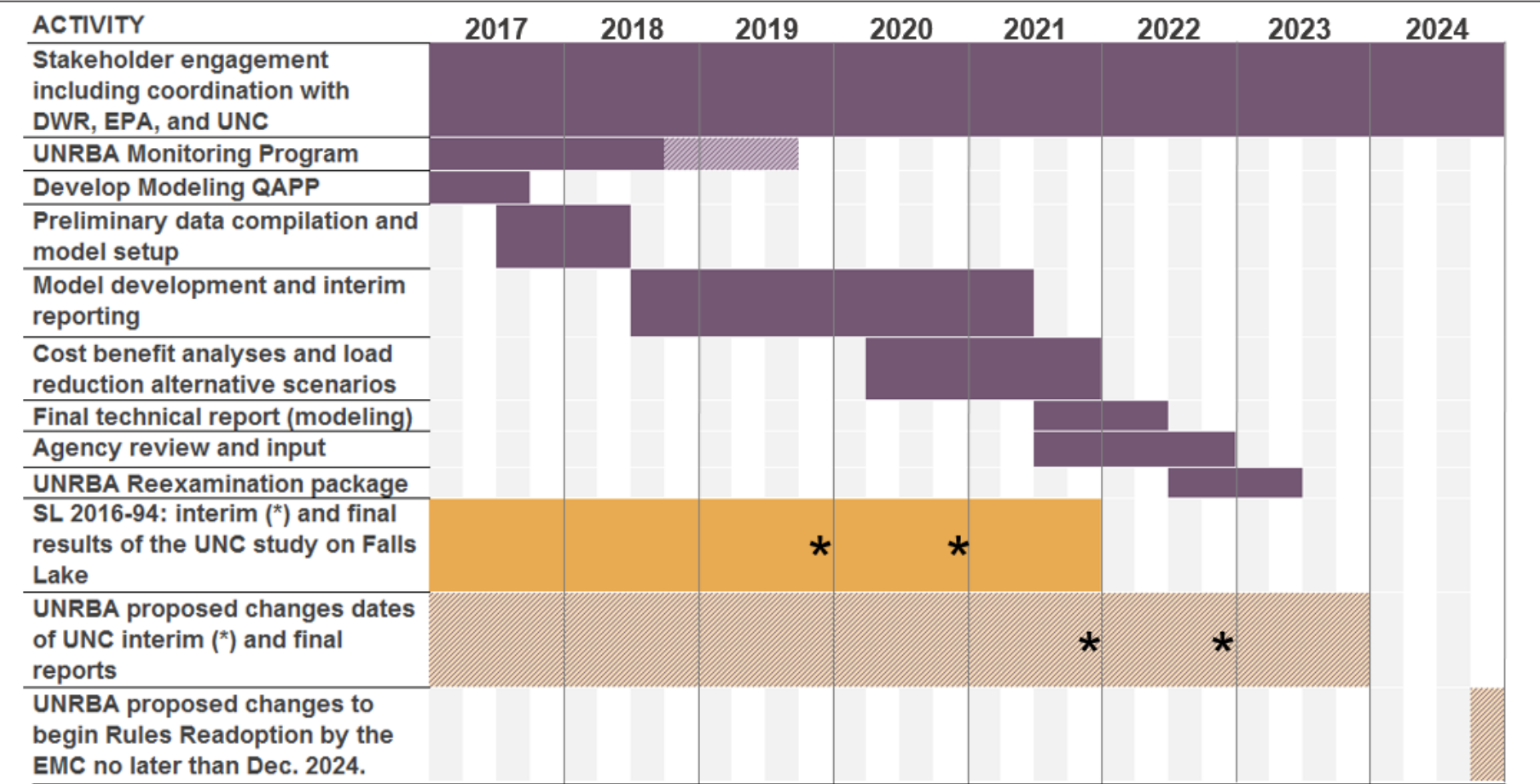
- > Watershed Analysis Risk Management Framework (WARMF)
 - Watershed model
 - Lake model – 1 dimensional with lake segments
- > Environmental Fluid Dynamics Code (EFDC)
 - Lake model – 3 dimensional, hydrodynamic, grid based
- > Statistical Modeling
 - Lake model – empirical model developed for lake segments



Framework for the Reexamination



Schedule for the Reexamination



■ UNRBA Activities
 ■ UNC Activities Required by SL 2016-94
 * Interim Reports
 ■ Changes proposed by the UNRBA regarding UNC and EMC Activities

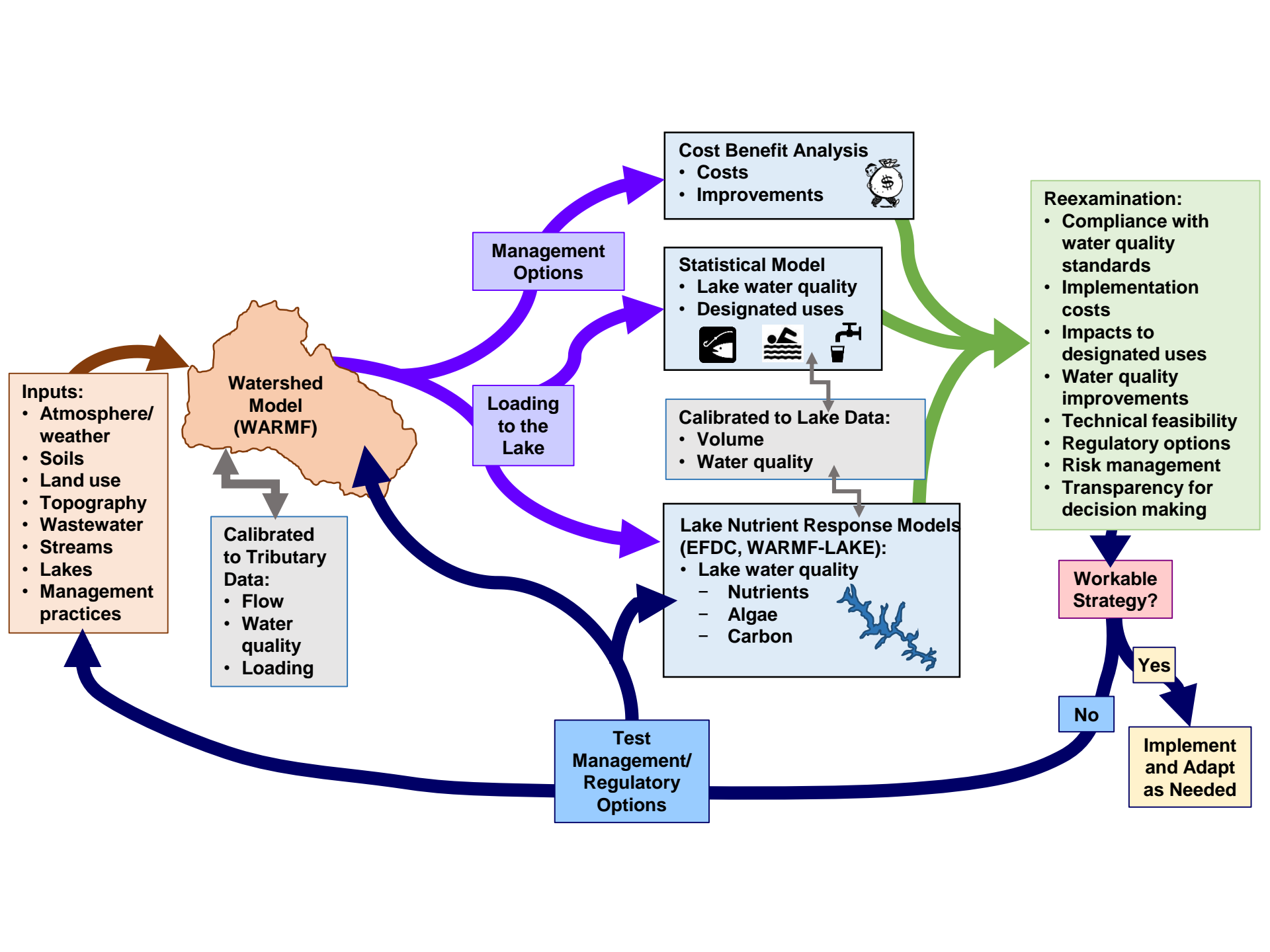




Goals for Year 2

- > Stakeholder meetings in October 2017 and spring 2018
- > Finalize Modeling Quality Assurance Project Plan
- > Preliminary model development
 - EFDC lake model grid
 - WARMF watershed model subwatersheds and stream network
 - Evaluation of lake water quality data to inform segmentation for the statistical modeling
- > Compilation of public and private data to support modeling
 - Work with stakeholders to obtain available data sets
 - Today's stakeholder meeting focuses on watershed data
 - Next presentation today will describe the data needed for WARMF







A Brief History of the UNRBA

- > Formed in 1996 due to concerns about the future water quality of Falls Lake
- > Following the adoption of Falls Lake Nutrient Management Strategy and the Falls Lake Rules in 2010, the organization shifted focus
- > Updated goals and objectives
 - Assist member jurisdictions with Strategy implementation
 - Reexamine the Stage II Rules



Primary UNRBA Driving Forces

- > Protect lake water quality for the purpose of water supply
- > Stage II feasibility
 - Costs greater than \$1 billion
 - Requirements are not technically feasible
- > Reexamination
 - Enhanced monitoring program - \$800,000 per year
 - Remodeling/updated data analysis – recalculate nutrient targets & loads
- > Nutrient credits development project
 - Expansion of BMP Toolbox
- > Development of alternative regulatory options



Nutrient Reduction Requirements

- > Stage I (2011- 2021)
 - Achieve standards in lower lake by 2021
 - Initial reductions watershed wide
 - Reduce loading by 20% for TN and 40% for TP
 - New development requirements implemented in 2012

- > Stage II (2021 – 2036)
 - Achieve standards in entire lake by 2041
 - Additional reduction in upper watershed
 - Reduce loading by 40% for TN and 77% for TP
 - Continue new development requirements



Major Components of the Rules as Developed Through the Consensus Principles

- > Adaptive Management
- > Provision for Reexamination of the Strategy/Rules



The Path Forward: Increasing the Effectiveness of the UNRBA in the Era of the Falls Lake Rules

Collaboration in the Era of the Falls Lake Rules

Providing a public forum to review and discuss innovative approaches to restore, protect & maintain water quality

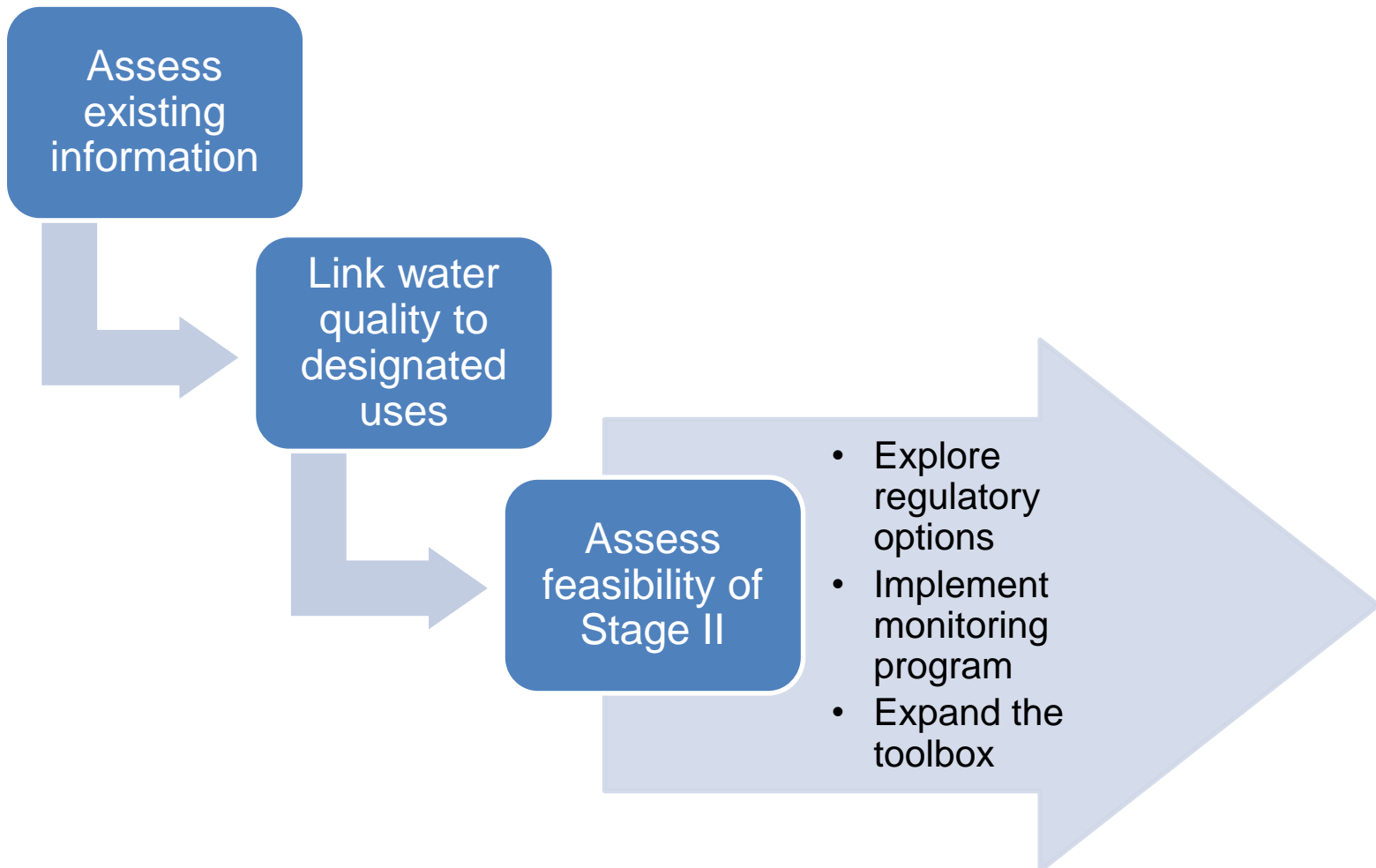
A robust and innovative trading program with a transparent and accessible system for recording and maintaining nutrient offsets and credits. [*Consensus Principles #11, Session Law 2010-115*]

Technical assistance for all jurisdictions. Service needs will vary based on the jurisdiction size and existing programs.

A re-examination of the nutrient management strategy that answers key questions about the impacts of reductions and the feasibility of Stage II. [*Consensus Principles #9, 15A NCAC 02B.0275(5)*]



UNRBA Re-examination Strategy for Stage II





Reexamination Effort Status

- > Monitoring began August 2014
- > Special studies are underway
- > Interim report released November 13, 2015
- > Annual monitoring report issued May 18, 2016
- > RFQ for modeling and data analysis released April 8, 2016
- > Modeling and Regulatory Support (MRS) Kick-Off Meeting, September 28, 2016
- > Year 2 MRS Kick-Off Meeting, October 25, 2017



Falls Lake Monitoring and Modeling

- > Past efforts
 - DWR
 - UNRBA
- > Current work
 - Monitoring
 - Planning for modeling
- > Future activities
 - Continued monitoring
 - Modeling

UNRBA Monitoring and Modeling to Support Reexamination



Special Studies

- > Legislative mandate required that DWR collect monitoring data, develop and calibrate watershed and lake models, and draft rules within 3 years
- > Most of the chlorophyll *a* data from 2005 had to be rejected due to laboratory analysis issues
- > Given time constraints, DWR proposed that the Nutrient Management Strategy would be based largely on 2006 data
- > Technical Advisory Committee had concerns with 2006 as the baseline year, but no alternative available
- > Overall the monitoring period (2005 through 2007) occurred in a severe drought when lake levels were often extremely low



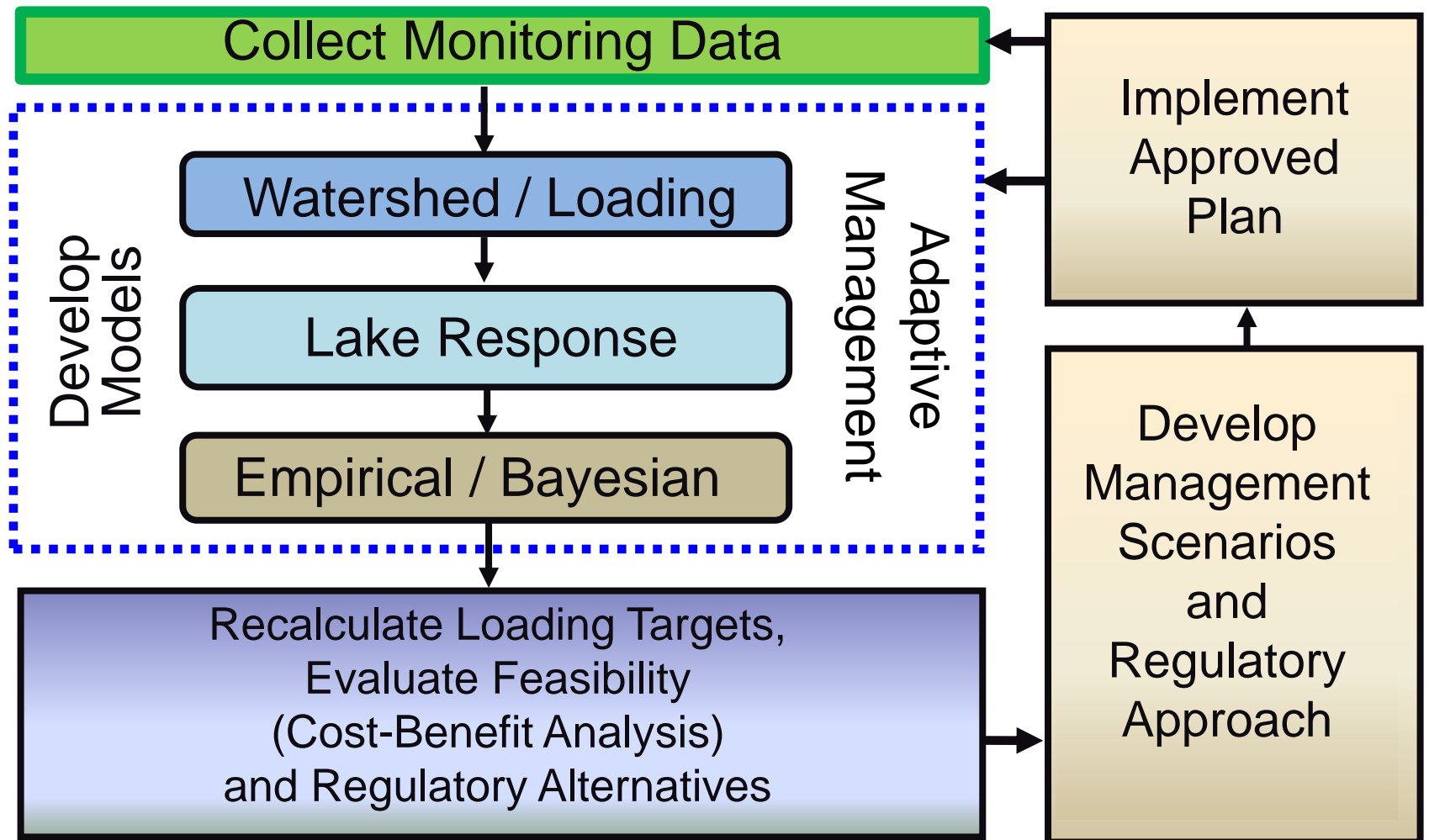
UNRBA Modeling Approach

- > Use multiple models to corroborate results
- > Test and optimize management strategies
- > Make future predictions
- > Link Watershed and Lake models
- > Test “What ifs”





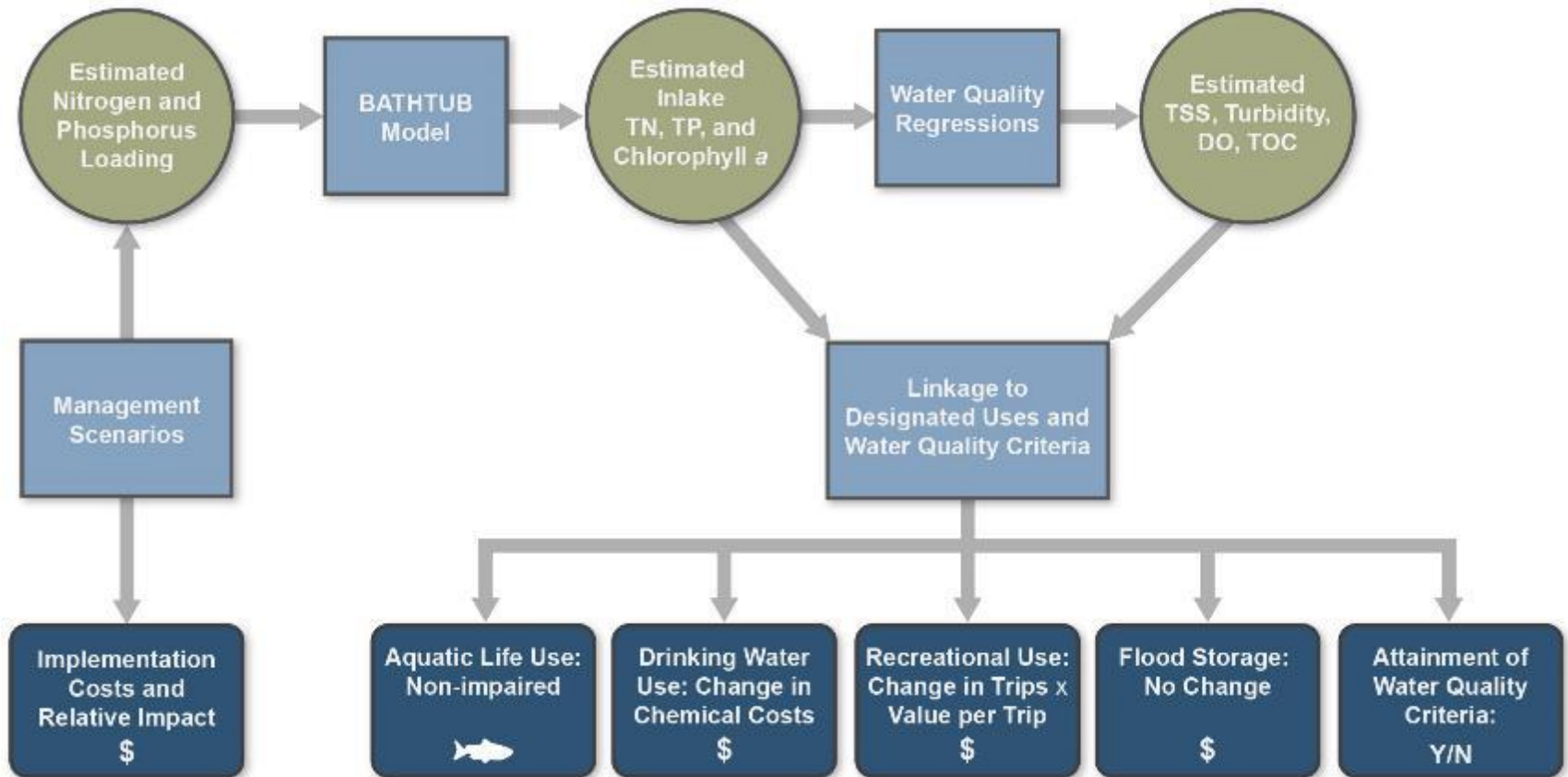
Linking the Components of the Reexamination





UNRBA Modeling Approach—Designated Use

> Link water quality in the lake to designated uses

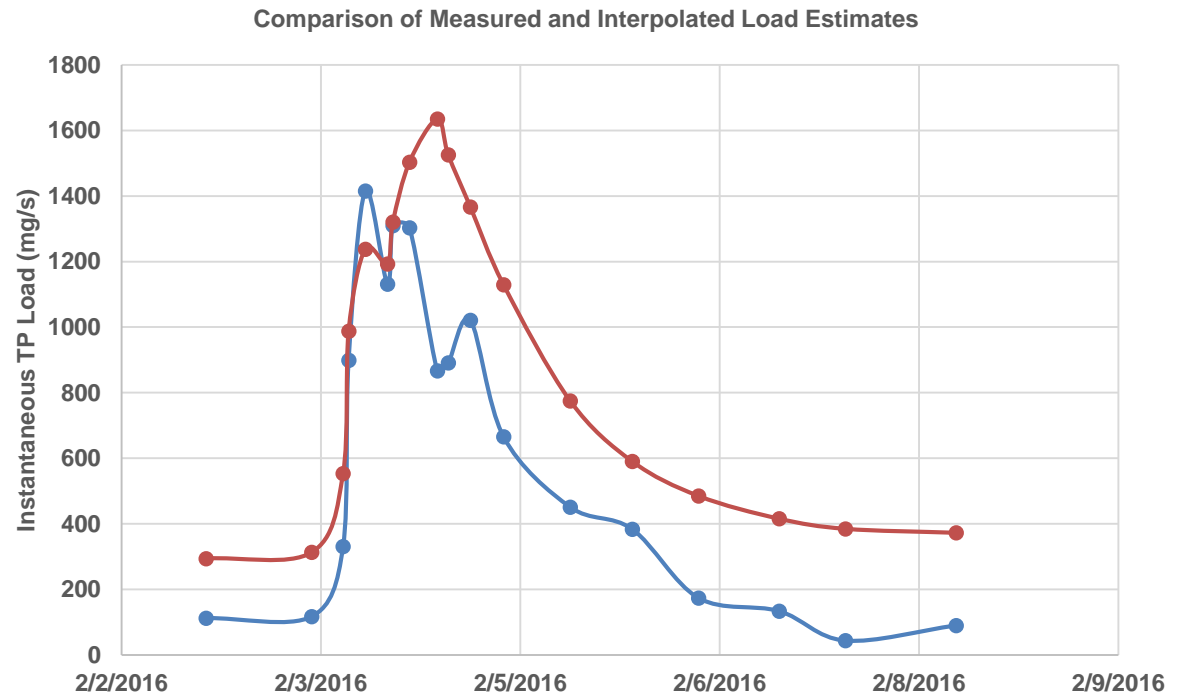




“What is entering the lake”?

(chlorophyll a, nitrogen, phosphorus, organic carbon)

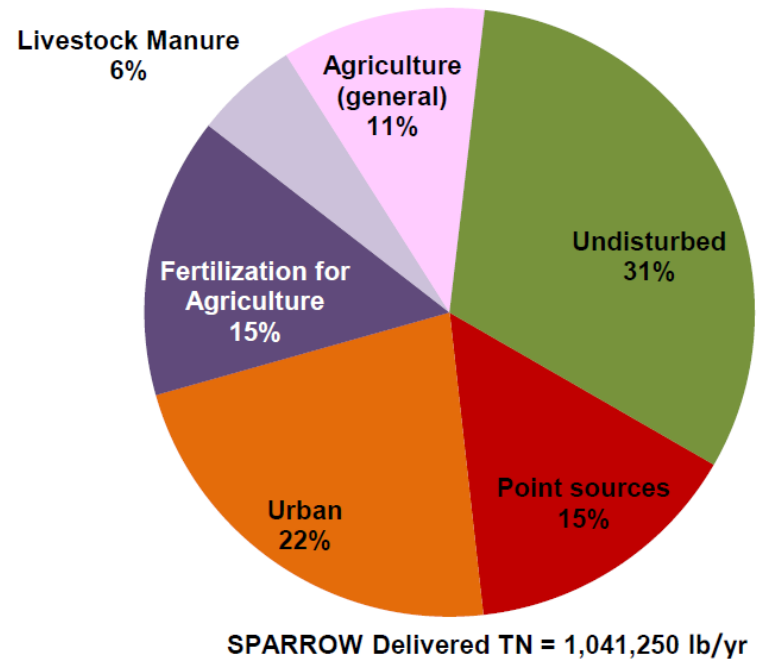
- > Comparison of load estimation techniques to develop most accurate tributary input files for the lake response model





“What is entering the lake”?
(chlorophyll a, nitrogen, phosphorus)

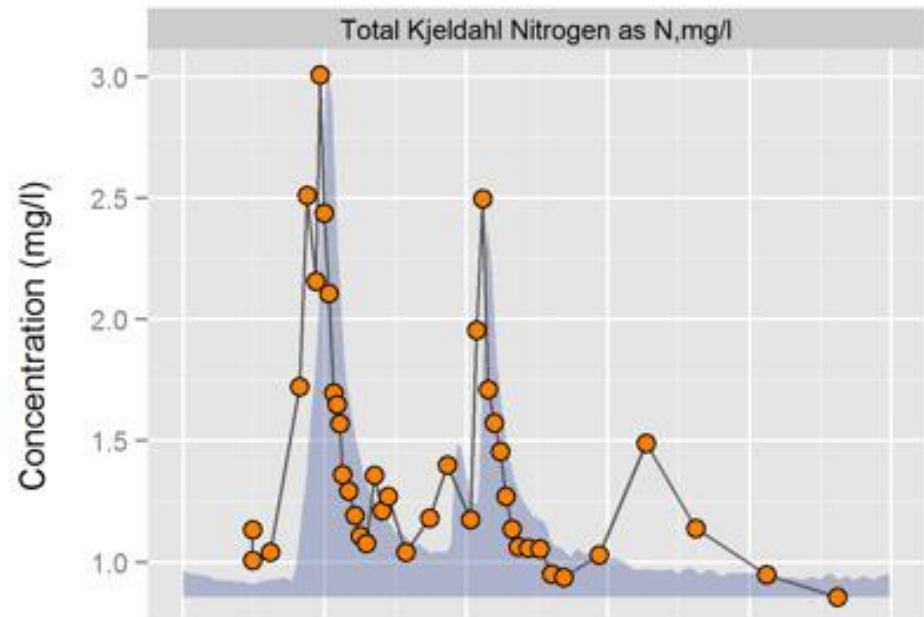
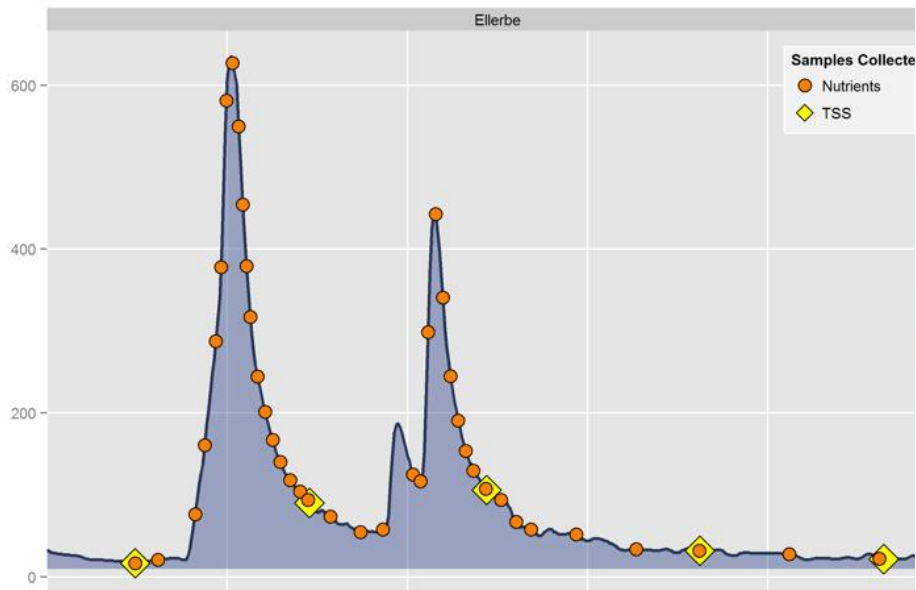
- > Future development of a watershed model will help identify sources of nutrient and carbon loading





“What is entering the lake”? (chlorophyll a, nitrogen, phosphorus)

- > Storm event sampling occurred during four storms on two tributaries to obtain “measured” loads entering the lake
- > Auto samplers collect approximately 20 samples per storm to be paired with USGS 15-min flow data





Issues with Original Modeling Period

- > Legislative mandate required that DWR collect monitoring data, develop and calibrate watershed and lake models, and draft rules within 3 years
- > Most of the chlorophyll *a* data from 2005 had to be rejected due to laboratory analysis issues
- > Given time constraints, DWR proposed that the Nutrient Management Strategy would be based largely on 2006 data
- > Technical Advisory Committee had concerns with 2006 as the baseline year, but no alternative available
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Pictures of Falls Lake at I-85 Taken in 2007



Photo courtesy of City of Durham (October)

Photo courtesy of Southeast Regional
Climate Center (November)



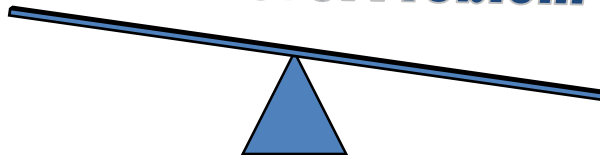


Summary of Falls Reexamination

- a measured, stepwise, reexamination process

- > Local governments want to improve water quality
- > Local governments' burden is over \$1,000,000,000
- > Local governments want the best science
- > Achieve improved water quality by applying economic, scientifically supportable and reasonable actions

***Working to Balance Action
With Level Of Problem***



UNRBA Modeling and Regulatory Support

Year 2 Kickoff Meeting

WARMF Data Presentation

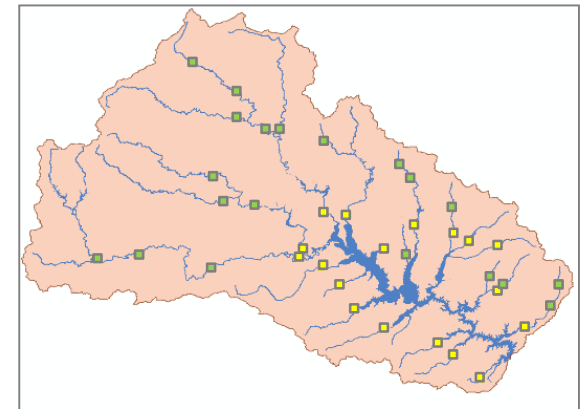
October 25, 2017



Watershed Modeling Overview

Existing Falls Lake Watershed Model

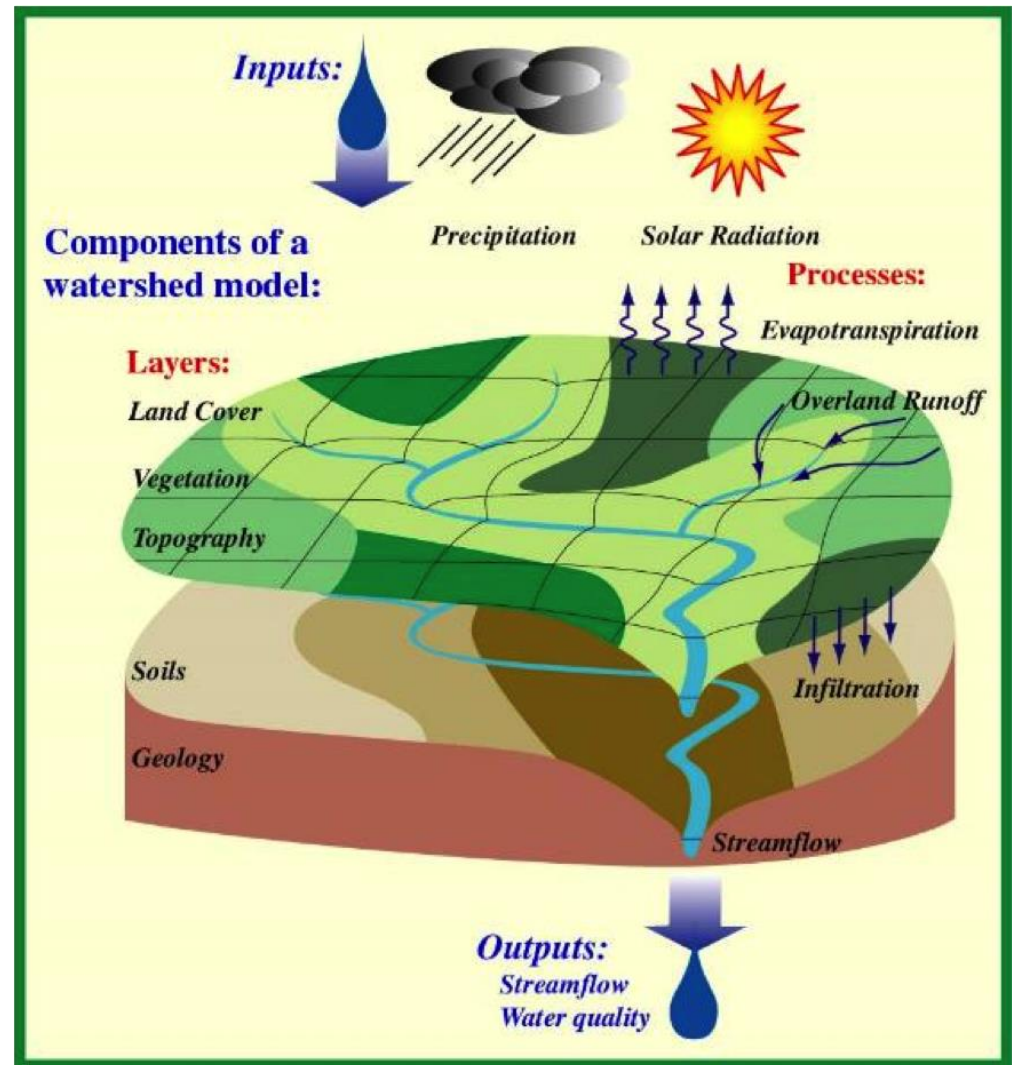
- In 2009, DWR developed a watershed model using WARMF
- Additional data have been collected
 - Routine water quality monitoring at 38 stations since August 2014
 - Storm event and high flow sampling
- Need data and information to build the watershed model
- The UNRBA has begun its process to acquire local data



*UNRBA Watershed
Monitoring Stations*

How Watershed Models Work

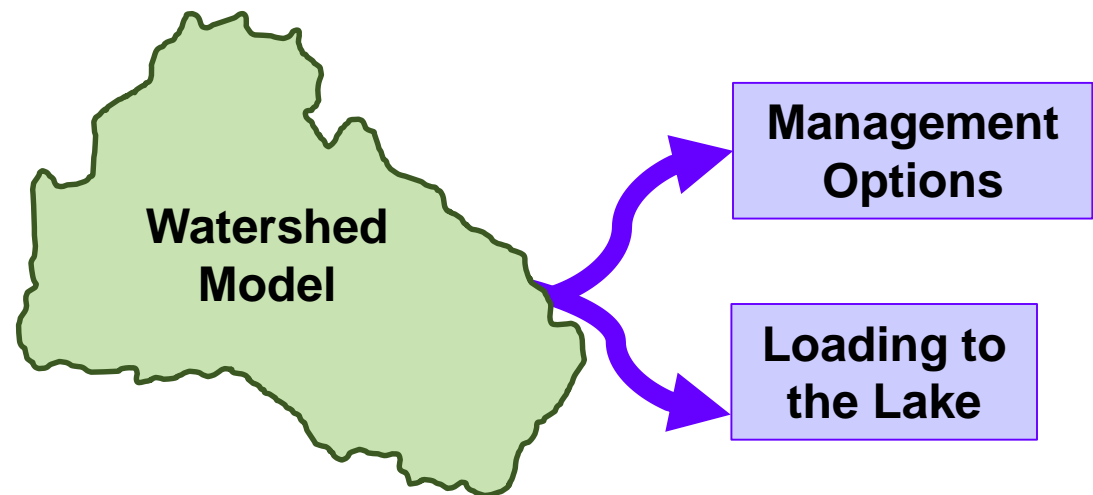
- Mathematical representation of watershed processes
- Inputs: Model forcing
- Catchment processes
- Stream/reservoir processes
- Model output



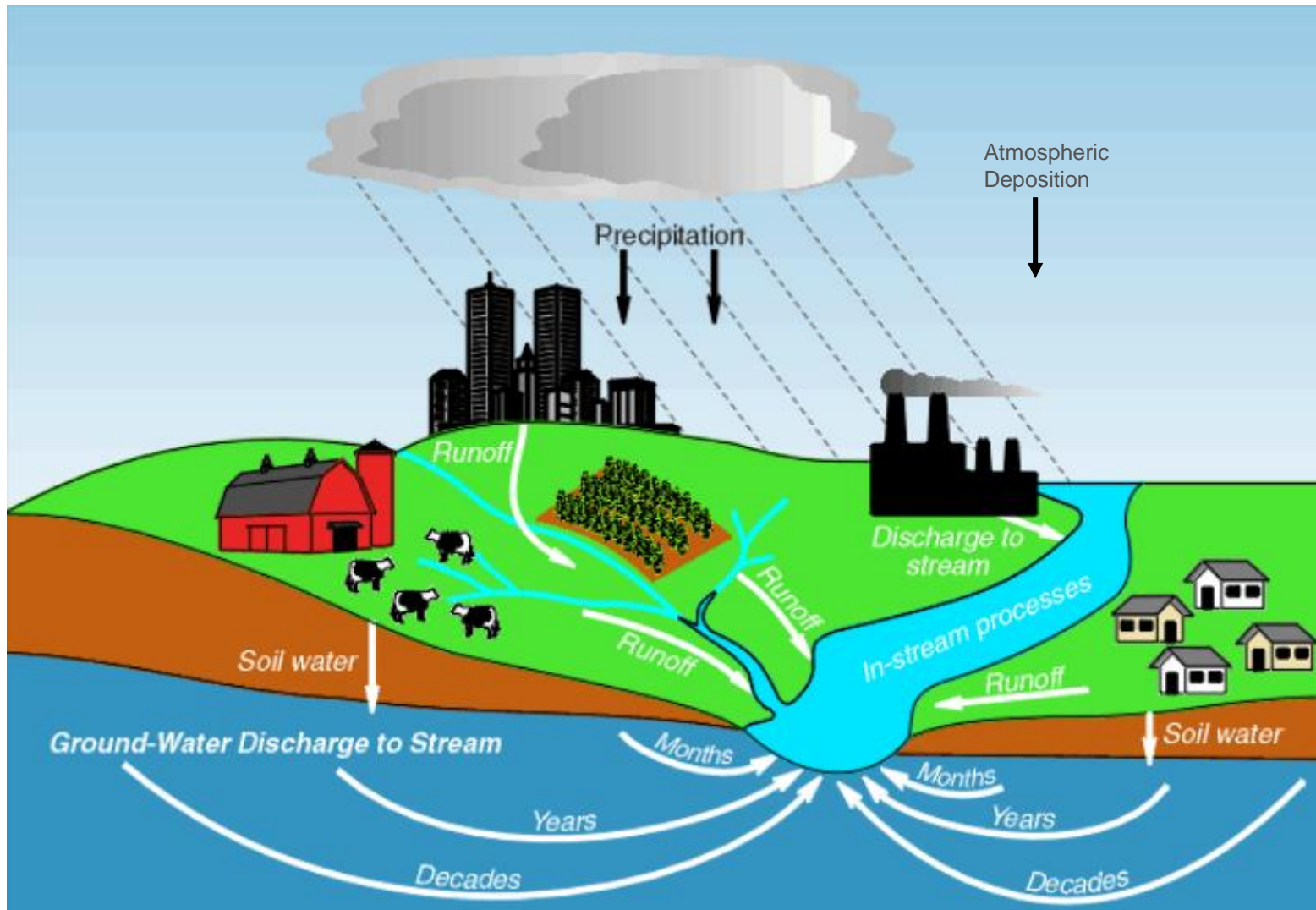
<https://scwrs.files.wordpress.com/2016/04/model-components.png>

Goals of Watershed Modeling

- Identify major sources contributing loads going to the lake
- Simulate loads to the lake to drive the lake water quality model
- Predict how management activities affect loading
- Provide information for the cost benefit analyses

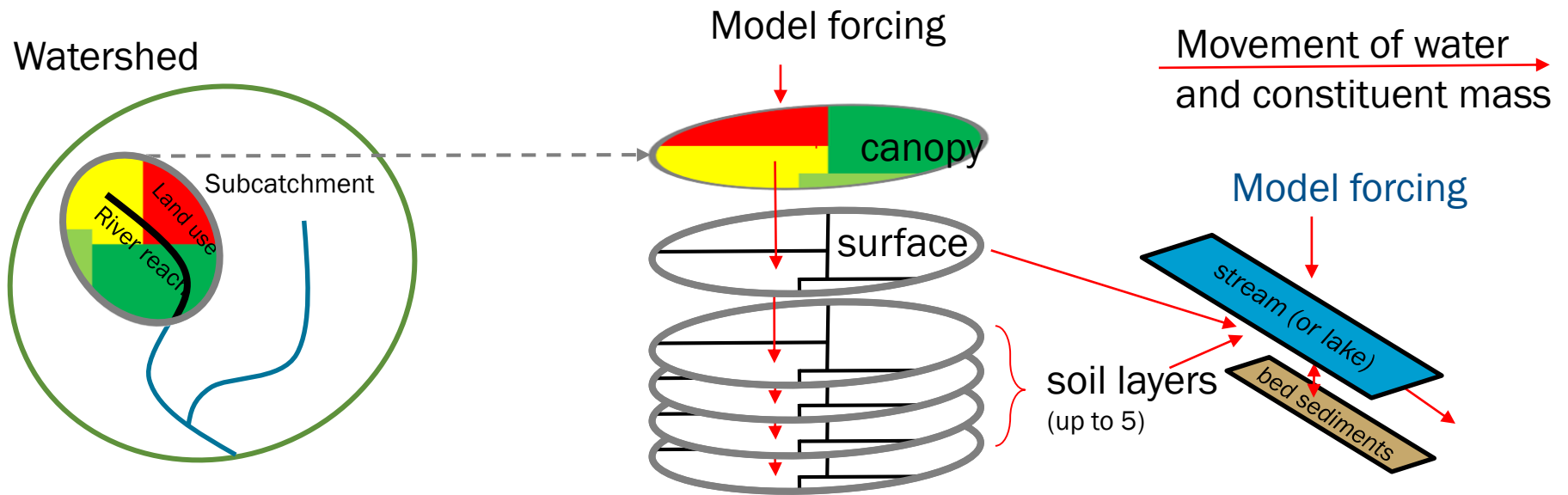


Sources of Loading



<https://pubs.usgs.gov/fs/fs15099/>

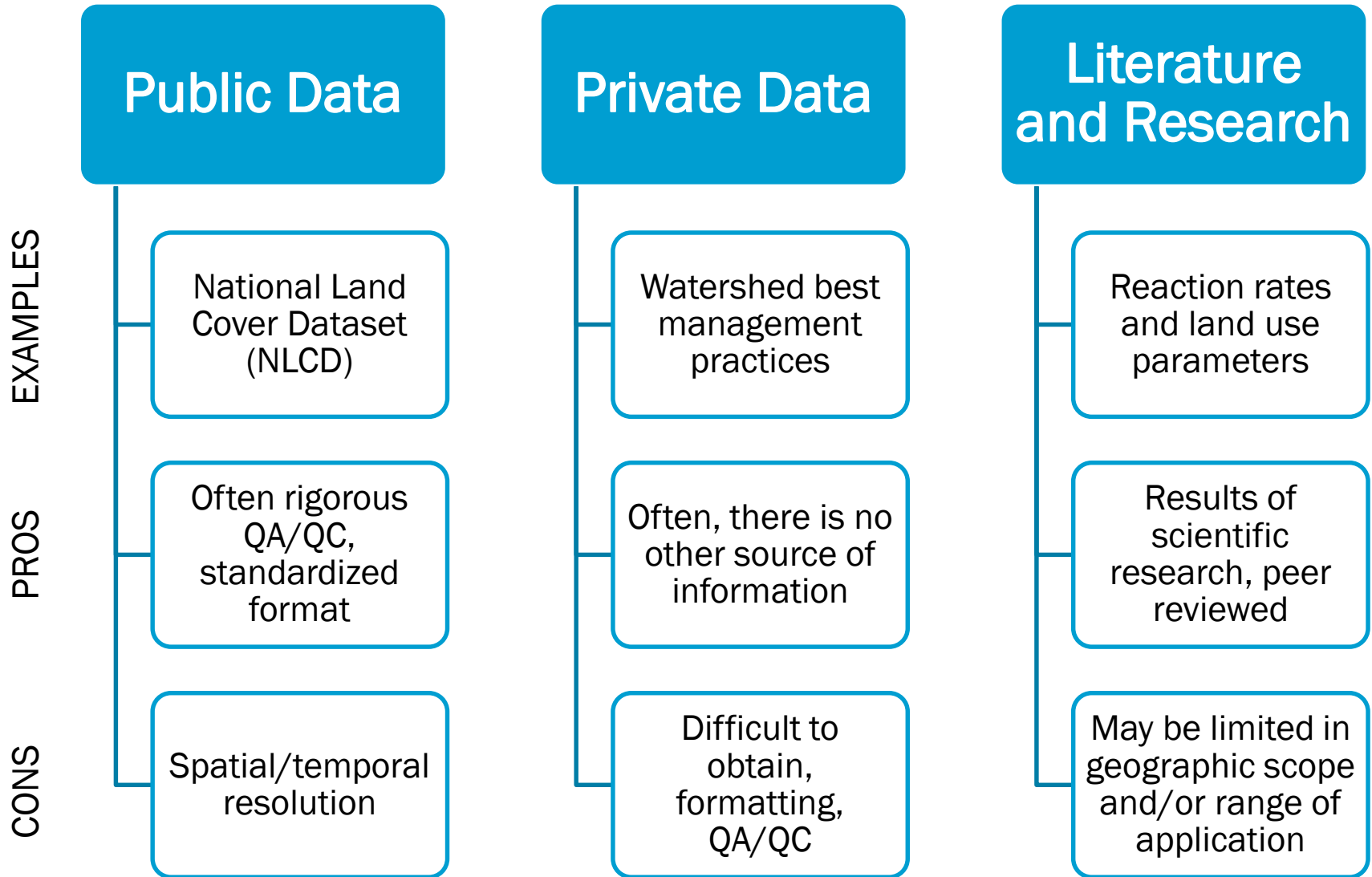
How WARMF Handles Loading Sources



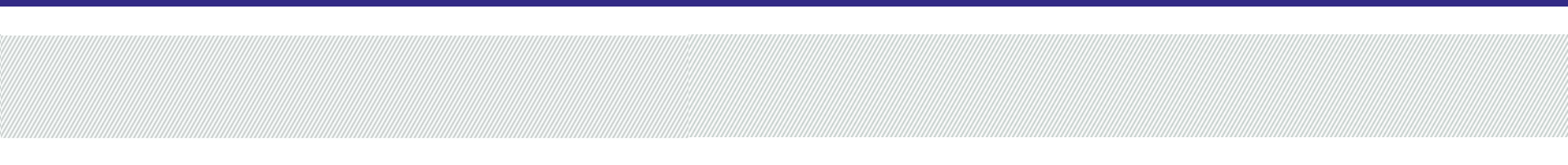
- For finer spatial resolution
→ delineate more subcatchments and/or rivers

- Each component (e.g. river, soil layer) is simulated as a CSTR
- Completely mixed within each time step
- Time steps from 24 hours down to 1 minute

Data Sources



Spatial Data for the Watershed Model



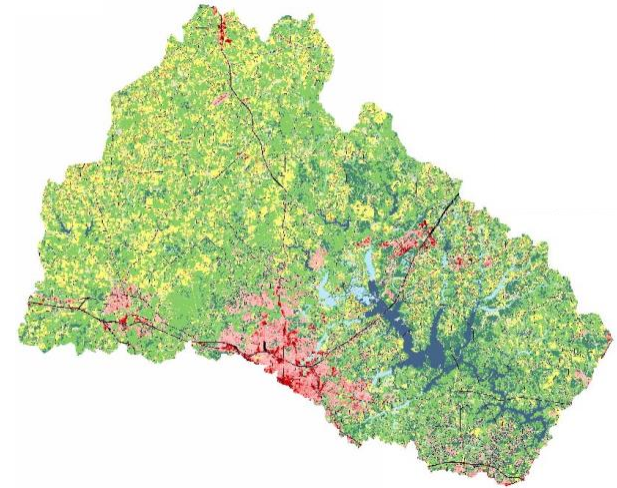
Topographic Data

- Examples:
 - Digital elevation models (DEM)
 - LIDAR
- Sources:
 - USGS
 - Local governments
 - State agencies
- Purpose:
 - Delineate the watershed and river network
 - Provide:
 - Catchment and stream slope
 - Catchment aspect

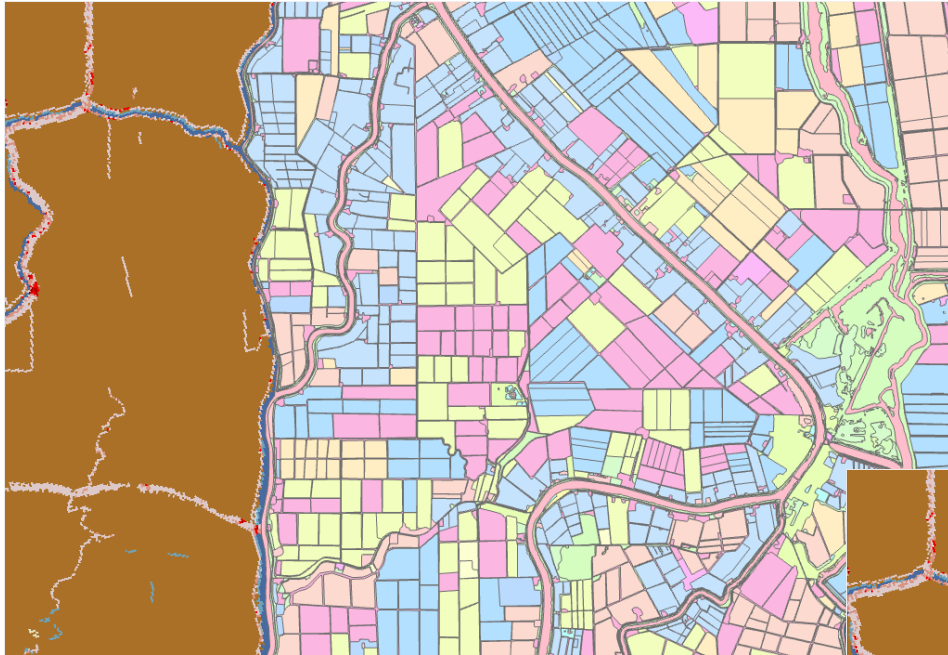


Land Use Data

- Sources: USGS, state agencies, local governments, researchers, agricultural representatives
- Purpose: Differentiate how land uses and land covers affect
 - Hydrologic response
 - Soil detachment
 - Vegetative processes
 - Management practices
- Note: Greater number of land uses may provide more detail, but information on the hydrologic response of each land use is required

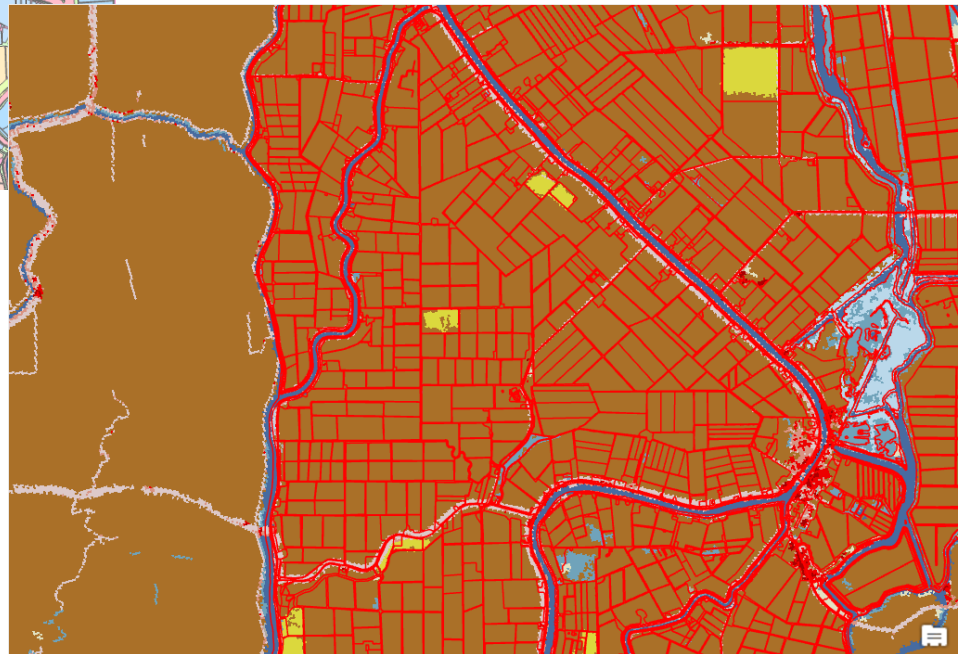


Land Use Data



Differences:

- Level of detail
- Specificity of land use classification
- Data type (grid vs polygon)



Choose carefully!!

Added complexity does not always lead to added accuracy...

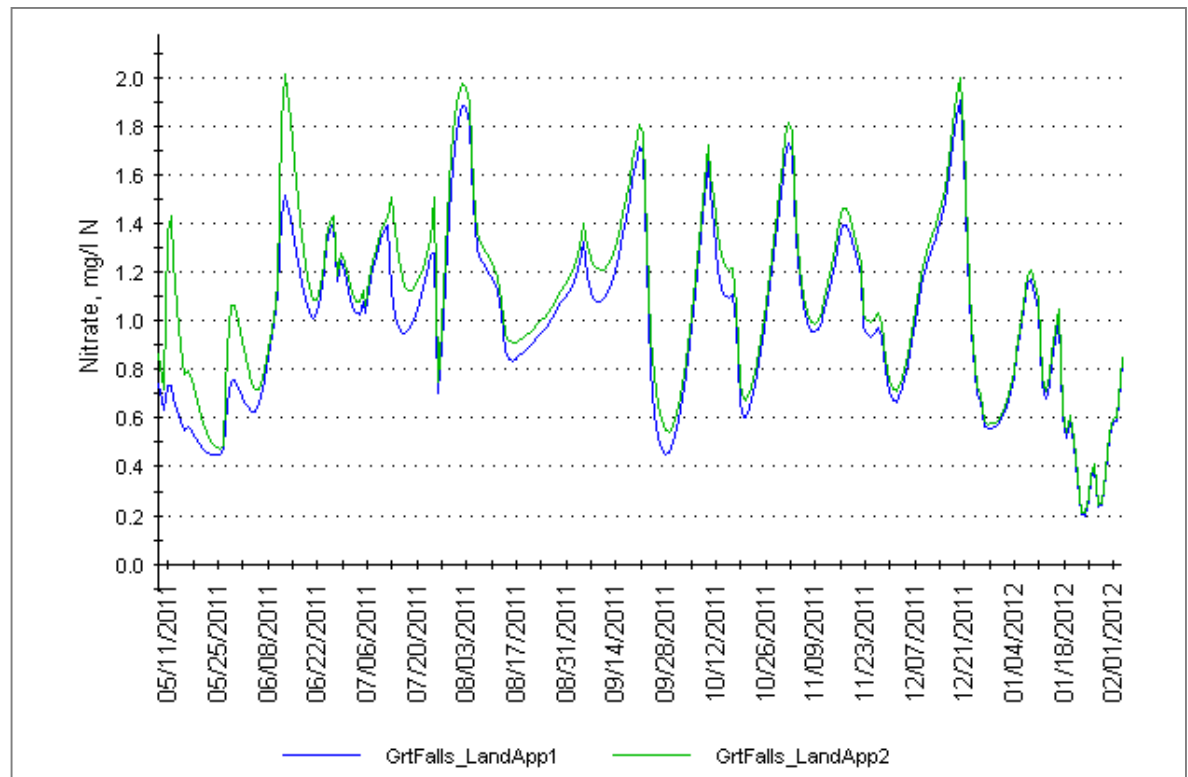
Land Application of Nutrients

- Examples: fertilizer, manure, and biosolids composition and application rates
- Source: USDA, state agencies, local governments, researchers, agricultural representatives, literature
- Purpose: Quantify the loads applied to each land use by month
- Values can vary spatially across the watershed, or can be uniform, based on available data
- WARMF also accounts for nutrient uptake by plants



Land Application of Nutrients

- Useful information that affects model simulations
 - Application rates (load/area/time)
 - Timing of application
 - composition
 - Timing of harvest



Water Withdrawal/Irrigation

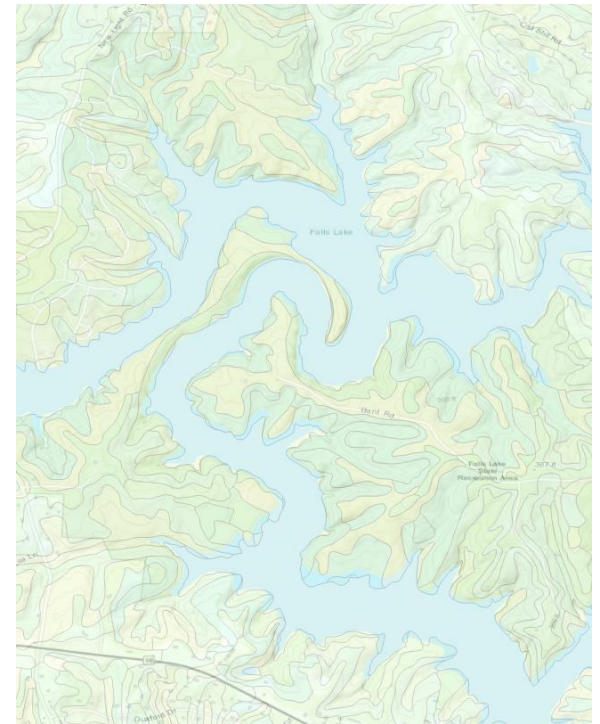
- Examples:
 - Water can be removed from a water source
 - Water can be applied to a land use as irrigation water
 - Interbasin transfers can also be simulated
- Sources: Local governments, utilities, agricultural representatives, hydrologic models



Source: City of Durham Teer Quarry

Soils

- Sources: NRCS, agricultural representatives, researchers, local governments
- Purpose: describe soil erosivity, soil fractions, **chemistry**, infiltration rates
- Key hydrology parameters:
 - Hydrologic soil group
 - Depth to bedrock
 - Drainage class
 - Hydric classification
- Most of this data is publicly available
- Additional soil chemistry data would be helpful



Soil mapping units in the Falls Lake watershed

Onsite Wastewater (Septic) Systems

- Source: Local governments, state agencies, census data/drinking water well correlations
- Information: Location, density, failure rates, complaints
- Alternative to local data: Assumptions, US Census (1990)

Minerals | Sediment | Phytoplankton | Periphyton | Food Web | Parameters
 Physical Data | Land Uses | Snow/Ice | Heat/Light | Canopy | Litter | Septic Sys.

Flow (L/cap/day)

Septic System Discharge Quality (mg/L)

	Type 1	Type 2	Type 3
Ammonia	58	0	0
Aluminum	0	0	0
Calcium	0	0	0
Magnesium	0	0	0
Potassium	0	0	0
Sodium	0	0	0
Sulfate	0	0	0
Nitrate	0	0	0
Chloride	0	0	0
Phosphate	9.8	0	0
Org. Carbon	0	0	0

Physical Data | Meteorology | Land Uses | Land Application | Irrigation | Sediment | BMP's
 Point Sources | Pumping | Septic Sys. | Reactions | Soil Layers | Mining | CE-QUAL-W2

Discharge Layer

Population Served by Septics

Distribution of Septic Systems (total should = 100)

Treatment Type 1 (%)

Treatment Type 2 (%)

Treatment Type 3 (%)

Initial Biomass (g/cm2)

Biomass Thickness (cm)

Biozone Area (m2 / capita)

Biomass Respiration Coeff (cm3/d)

Biomass Mortality Coeff (cm3/d)

Animal Operations

- Examples: Horses, kennels, livestock operations
- Source: State agencies, agricultural representatives, USDA, local governments
- Information: location, type, number of animals, permits
- Practices: waste management, carcass disposal



Source: Scott Eaton, Kings Mountain NC

Best Management Practices

- Attenuate pollutant loads
- Examples:
 - Livestock exclusion
 - Buffer zones
 - Street sweeping
 - Detention ponds
- Sources of information:
 - Local governments
 - Agricultural representatives
 - Agencies
 - Large land owners

Soil Layers	Mining	CE-QUAL-W2	
ication	Irrigation	Sediment	BMP's
Buffer Zone			
Percent Buffered	<input type="text" value="25"/>		
Width (m)	<input type="text" value="5"/>		
Slope	<input type="text" value="0.01"/>		
Roughness	<input type="text" value="0.3"/>		
Street Sweeping			
Frequency	<input type="text" value="3"/>		
Efficiency (%)	<input type="text" value="90"/>		
Detention Ponds			
Impervious Routing (%)	<input type="text" value="20"/>		
Volume (m ³)	<input type="text" value="1000"/>		

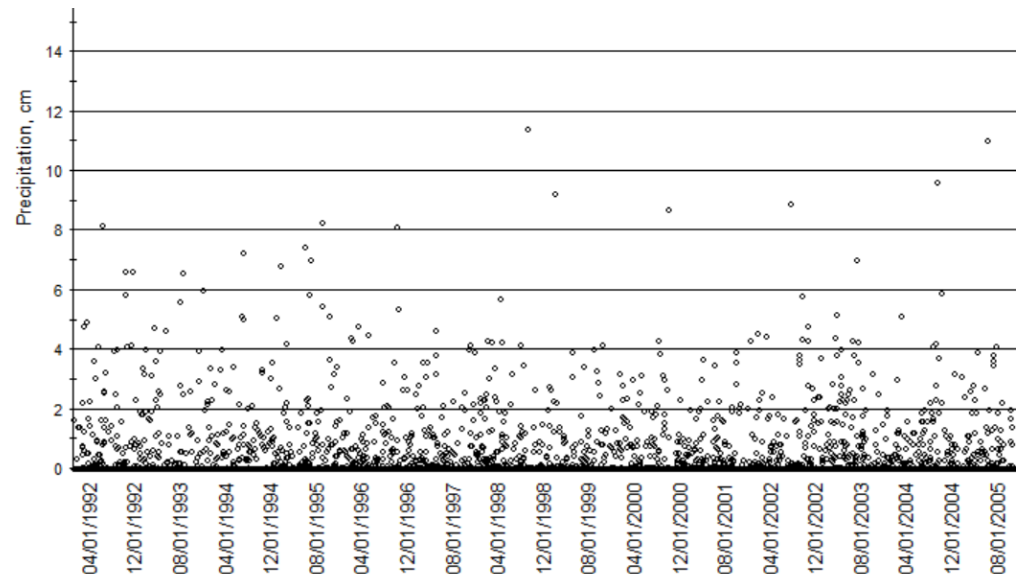
Time Series Data

Time Series Data

- Specifies inputs to the model that vary with time or provides data to compare model output
- Examples of data include meteorology, air quality, point sources, managed flow, hydrology, and observed water quality
- Data are entered into WARMF in spreadsheet format

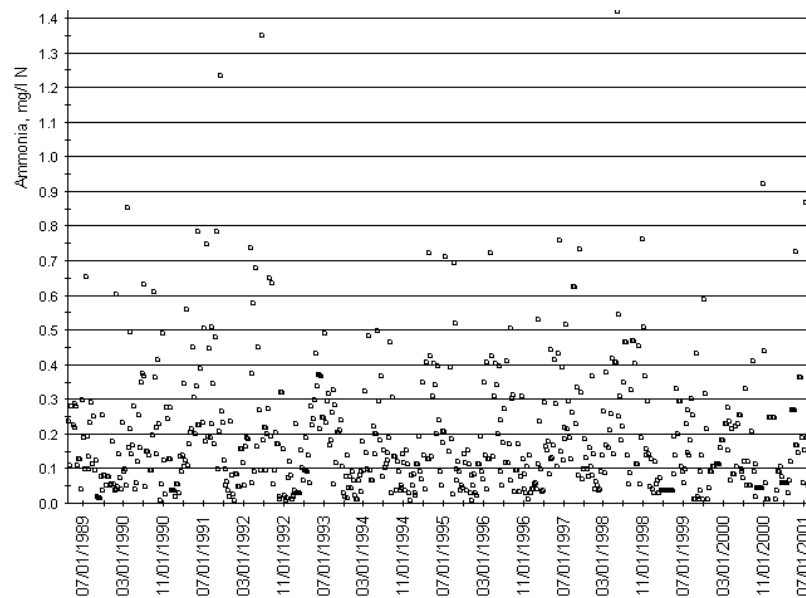
Sources of Meteorology Data

- NOAA National Climatic Data Center (NCDC)
- NOAA North American Land Data Assimilation System (NLDAS)
- NC Climate Retrieval and Observations Network of the Southeast (CRONOS) database
- USGS National Water Information System (NWIS)
- Local data



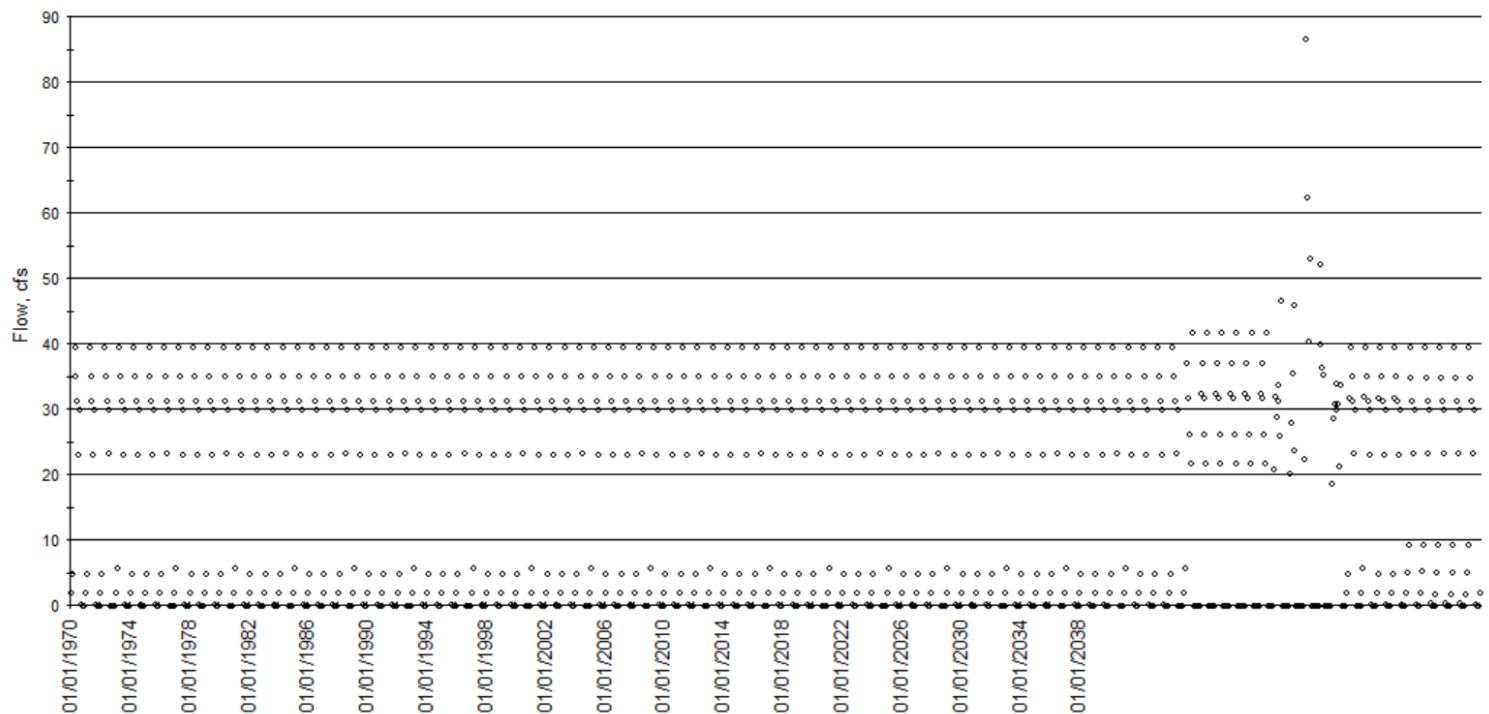
Sources of Air Quality Data

- National Atmospheric Deposition Program (NADP)
- Clean Air Status and Trends Network (CASTNET)
- Community Multi-Scale Air Quality (CMAQ) Modeling System for Air Quality Management
- City of Durham Atmospheric Deposition Monitoring Study
- Research



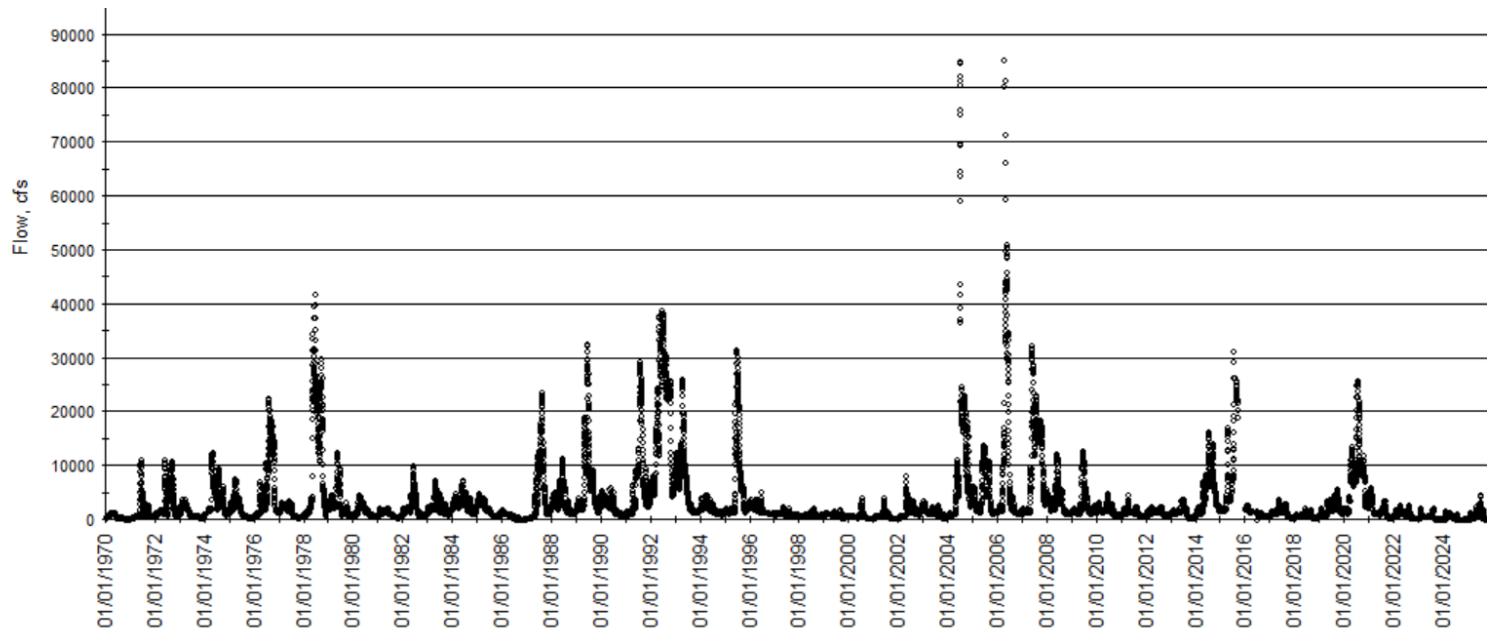
Sources of Point Source Data

- EPA Pollution Control System (PCS) Database
- DEQ Database
- Dischargers' Records



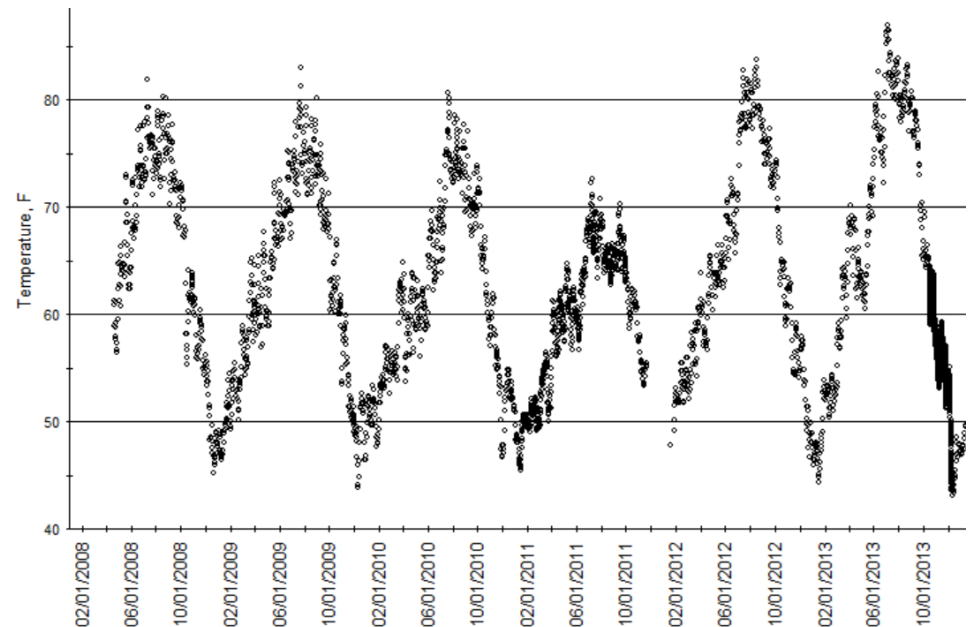
Sources of Hydrology and Managed Flow Data

- USGS gages
- US Army Corp of Engineers
- Operators of reservoir release structures



Sources of Water Quality Data

- UNRBA Monitoring Program and individual members
- Federal and state agencies (e.g., USGS, DEQ, EPA)
- Universities and researchers (e.g., Center for Applied Aquatic Ecology)
- Dischargers/utilities



UNRBA Data Acquisition to Support Modeling

October 2017

UNRBA Process for Acquiring Local Data

- Distributed Data Acquisition Form on 10/17/2017
 - Please return forms 11/8/2017
- UNRBA will provide instructions for data transmittal to organizations that indicate ownership of data
 - Please submit data by the end of 2017

Small Group Session

- What obstacles are you facing or do you anticipate regarding getting the requested data sets to the UNRBA in a timely manner?
- What advice can people at the table provide that will help the others overcome those obstacles?
- What help would you like from UNRBA or others, as follow-up to this meeting, to help you in getting the requested data sets to the UNRBA in a timely manner?
- What are the concerns about use of the data?
- Do you have any lessons learned from similar projects where these types of data were used?

DATA ACQUISITION FORM
FOR THE UPPER NEUSE RIVER BASIN ASSOCIATION (UNRBA)
FALLS LAKE AND WATERSHED MODELING PROJECT
DISTRIBUTED TO WATERSHED STAKEHOLDERS AND INTERESTED PARTIES
ON OCTOBER 17, 2017

The Upper Neuse River Basin Association (UNRBA) is conducting a reexamination of the Falls Lake Nutrient Management Strategy (the Strategy) following the requirements specified by rule¹. The requirements include collection of a minimum of three years of water quality data, development of a modeling framework, and revisions to the models used to develop the Strategy and estimate the load reduction targets. Each component of the reexamination requires approval by the Division of Water Resources (DWR). The UNRBA is currently in its fourth year of water quality data collection (<https://unrba.org/monitoring-program>) and has begun the modeling component of the reexamination (<https://unrba.org/reexamination>) including development of a Modeling Quality Assurance Project Plan (QAPP). The Modeling QAPP specifies the data to be used in the modeling effort and acknowledges the many entities that collect and manage data which may be used to describe conditions in the watershed.

This Data Acquisition Form is being distributed to stakeholders and interested parties in the Falls Lake Watershed including local governments, utilities, agricultural interests, state and federal agencies, and universities. The UNRBA is requesting that the Form be distributed by the recipients to the appropriate staff within their organizations for each type of data: land use, nutrient management, wastewater, etc. This information will be used by the UNRBA to manage the collection of the data and ensure that all available information is acquired.

The UNRBA is requesting completion and submittal of these forms by **November 8, 2017**. This form is being distributed as a Word document so that entities can complete and modify the form as needed to best fit their needs. Pages of the form that are not applicable may be marked as such. Please return electronic forms by email to the following addresses: forrest.westall@unrba.org, amatos@brwncald.com, and lhandsel@brwncald.com. [Instructions for uploading the requested data and metadata will be distributed soon.]

The UNRBA looks forward to working with all the stakeholders and interested parties on this important project. Accurate characterization of the watershed and sources of nutrient loading to the lake will be critical to the success of the project, and we welcome input and information from all sources. The next stakeholder meeting will be on October 25th at 9:30 am in the Butner Town Hall during which we will discuss the data needs of the watershed model. An agenda and meeting materials will be distributed prior.

¹ N.C. Rules Review Commission. 2010. Falls Nutrient Strategy Rules Approved by the RRC on December 16, 2010. Effective Date - January 15, 2011.

Land Use / Land Cover Data (2005, 2006, 2007; 2014, 2015, 2016, 2017, 2018)

Form completed by _____ (Name, Title, Organization, Contact Information)

Primary Contact	
Follow-up Contact	
Types of data	Land Use/Land Cover <input type="checkbox"/> Parcel <input type="checkbox"/> Impervious Cover <input type="checkbox"/> Satellite Imagery <input type="checkbox"/> Crop acreages/rotations <input type="checkbox"/> Ground truthing <input type="checkbox"/> Other <input type="checkbox"/>
Years data available	
Format	
Spatial extent	
Resolution	
Metadata provided (yes/no)	
Anticipated delivery date to UNRBA	
Notes or concerns about use of data; lessons learned from previous projects	
Other organizations that may provide duplicate data set/collaborators on data collection	

Nutrient Management (Agricultural Fertilization) (2005, 2006, 2007; 2014, 2015, 2016, 2017, 2018)

Form completed by _____ (Name, Title, Organization, Contact Information)

Primary Contact	
Follow-up Contact	
Types of data	Type <input type="checkbox"/> Application rates, timing, methods <input type="checkbox"/> Best practices <input type="checkbox"/> Crop nutrient budgets <input type="checkbox"/> Other <input type="checkbox"/>
Years data available	
Format	
Spatial extent	
Resolution	
Metadata provided (yes/no)	
Anticipated delivery date to UNRBA	
Notes or concerns about use of data; lessons learned from previous projects	
Other organizations that may provide duplicate data set/collaborators on data collection	

Nutrient Management (Urban Fertilization) (2005, 2006, 2007; 2014, 2015, 2016, 2017, 2018)

Form completed by _____ (Name, Title, Organization, Contact Information)

Primary Contact	
Follow-up Contact	
Types of data	Type <input type="checkbox"/> Application rates, timing, methods <input type="checkbox"/> Best practices <input type="checkbox"/> Plant nutrient budgets <input type="checkbox"/> Other <input type="checkbox"/>
Years data available	
Format	
Spatial extent	
Resolution	
Metadata provided (yes/no)	
Anticipated delivery date to UNRBA	
Notes or concerns about use of data; lessons learned from previous projects	
Other organizations that may provide duplicate data set/collaborators on data collection	

Urban Best Management Practice/Structural Control Measure Data (2000 to present)

Form completed by _____ (Name, Title, Organization, Contact Information)

Primary Contact	
Follow-up Contact	
Types of data	Spatial database <input type="checkbox"/> Volume/water quality credits <input type="checkbox"/> Programmatic information <input type="checkbox"/> BMP Monitoring Data <input type="checkbox"/> Other <input type="checkbox"/>
Years data available	
Format	
Spatial extent	
Resolution	
Metadata provided (yes/no)	
Anticipated delivery date to UNRBA	
Notes or concerns about use of data; lessons learned from previous projects	
Other organizations that may provide duplicate data set/collaborators on data collection	

Agricultural Best Management Practice and Nutrient Reduction Practices Data (2000 to present)

Form completed by _____ (Name, Title, Organization, Contact Information)

Primary Contact	
Follow-up Contact	
Types of data	Spatial database <input type="checkbox"/> Volume/water quality calculations <input type="checkbox"/> Programmatic information <input type="checkbox"/> Cost sharing information <input type="checkbox"/> Monitoring Data <input type="checkbox"/> Other <input type="checkbox"/>
Years data available	
Format	
Spatial extent	
Resolution	
Metadata provided (yes/no)	
Anticipated delivery date to UNRBA	
Notes or concerns about use of data; lessons learned from previous projects	
Other organizations that may provide duplicate data set/collaborators on data collection	

Onsite Wastewater Disposal Data (2000 to present)

Form completed by _____ (Name, Title, Organization, Contact Information)

Primary Contact	
Follow-up Contact	
Types of data	Inventories <input type="checkbox"/> Failure Rate Studies <input type="checkbox"/> Complaints <input type="checkbox"/> Monitoring Studies <input type="checkbox"/> Other <input type="checkbox"/>
Years data available	
Format	
Spatial extent	
Resolution	
Metadata provided (yes/no)	
Anticipated delivery date to UNRBA	
Notes or concerns about use of data; lessons learned from previous projects	
Other organizations that may provide duplicate data set/collaborators on data collection	

Wastewater/Biosolids Data (2005, 2006, 2007; 2014, 2015, 2016, 2017, 2018)

Form completed by _____ (Name, Title, Organization, Contact Information)

Primary Contact	
Follow-up Contact	
Types of data	Discharge Monitoring Data <input type="checkbox"/> Sanitary Sewer Overflows <input type="checkbox"/> Complaints <input type="checkbox"/> Land application rates and timing <input type="checkbox"/> Other <input type="checkbox"/>
Years data available	
Format	
Spatial extent	
Resolution	
Metadata provided (yes/no)	
Anticipated delivery date to UNRBA	
Notes or concerns about use of data; lessons learned from previous projects	
Other organizations that may provide duplicate data set/collaborators on data collection	

Animal Operation Data (Feeding Operations, Horse Farms, Kennels, etc.) (2005, 2006, 2007; 2014, 2015, 2016, 2017, 2018)

Form completed by _____ (Name, Title, Organization, Contact Information)

Primary Contact	
Follow-up Contact	
Types of data	Location and Animal Type <input type="checkbox"/> Maximum Permitted and Actual Animals <input type="checkbox"/> Operational info. <input type="checkbox"/> Waste and carcass disposal methods <input type="checkbox"/> Other <input type="checkbox"/>
Years data available	
Format	
Spatial extent	
Resolution	
Metadata provided (yes/no)	
Anticipated delivery date to UNRBA	
Notes or concerns about use of data; lessons learned from previous projects	
Other organizations that may provide duplicate data set/collaborators on data collection	

Impoundment Data (All available data for stage-discharge, volume, or bathymetric surveys; 2005, 2006, 2007, 2014, 2015, 2016, 2017, 2018 for water quality data and withdrawal rates)

Form completed by _____ (Name, Title, Organization, Contact Information)

Primary Contact	
Follow-up Contact	
Types of data	Stage-Discharge, Volume <input type="checkbox"/> Water Quality Data <input type="checkbox"/> Withdrawal Rates <input type="checkbox"/> Bathymetric surveys <input type="checkbox"/> Other <input type="checkbox"/>
Years data available	
Format	
Spatial extent	
Resolution	
Metadata provided (yes/no)	
Anticipated delivery date to UNRBA	
Notes or concerns about use of data; lessons learned from previous projects	
Other organizations that may provide duplicate data set/collaborators on data collection	

Soils Data (All available information)

Form completed by _____ (Name, Title, Organization, Contact Information)

Primary Contact	
Follow-up Contact	
Types of data	Chemistry <input type="checkbox"/> Partitioning <input type="checkbox"/> Erosivity <input type="checkbox"/> Field capacity/saturation moisture <input type="checkbox"/> Other <input type="checkbox"/>
Years data available	
Format	
Spatial extent	
Resolution	
Metadata provided (yes/no)	
Anticipated delivery date to UNRBA	
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