

UNRBA Path Forward Committee Meeting

MRS Project Status Updates

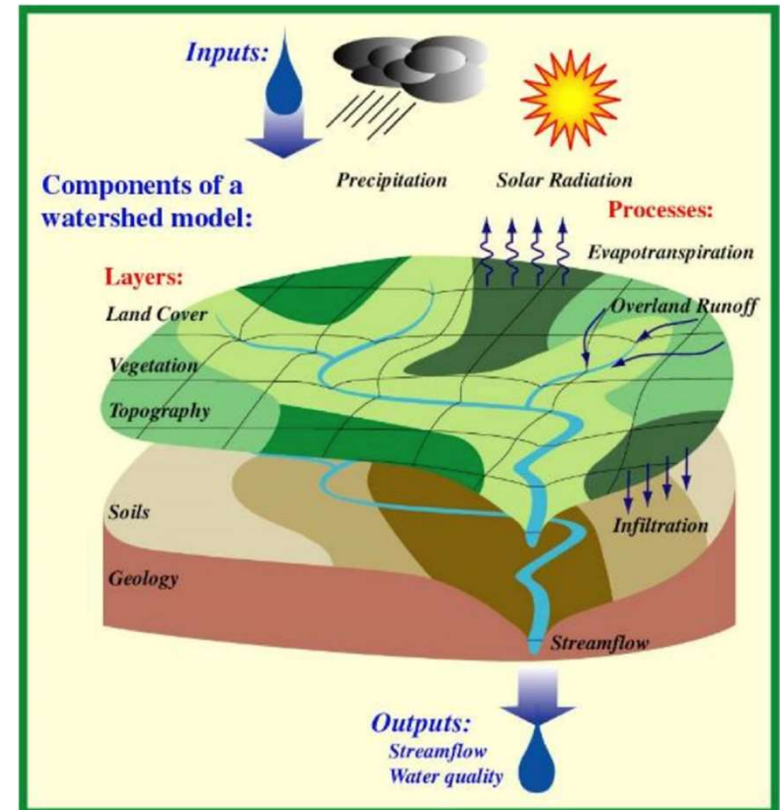
November 28, 2018



Summary of Feedback from the Fall 2018 Stakeholder Meeting

Technical Presentations

- History of the UNRBA
- Re-examination efforts
- Description of the modeling units
 - Watershed
 - Lake
- Subset of model inputs/
data requirements
 - Meteorology data
 - USGS water data
 - Impoundments
 - Withdrawals
 - Releases
 - Wastewater treatment facilities



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

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

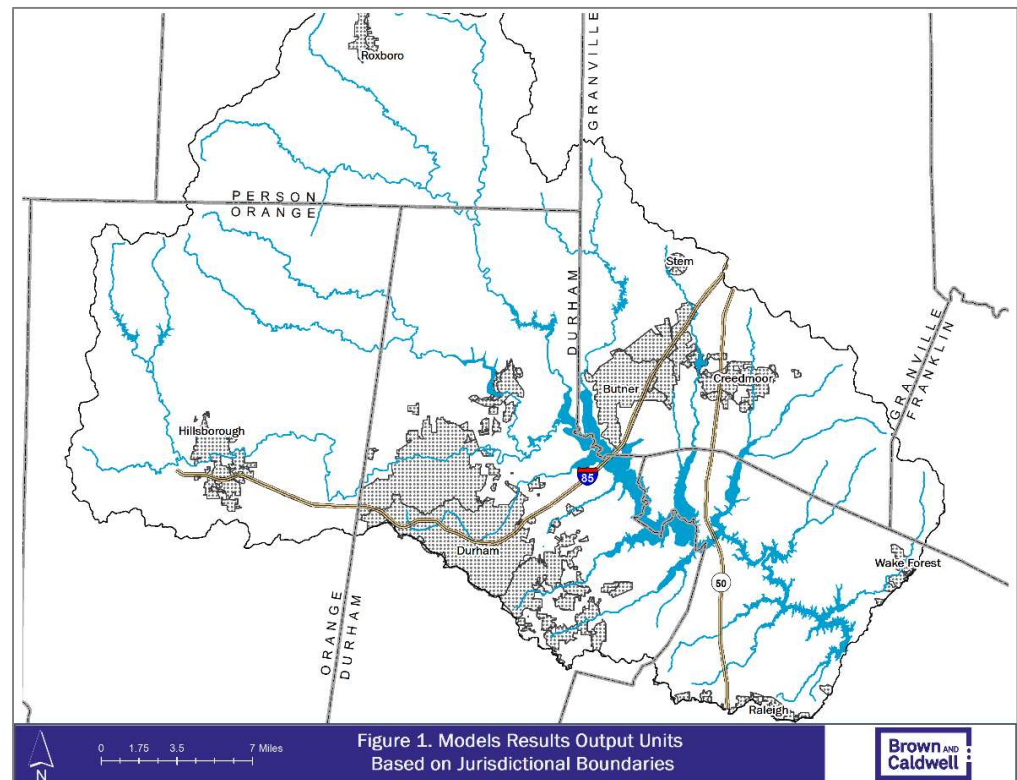
- Understand which land uses or activities contribute to the highest nutrient loads
- Predict the effects of implementing various **Best Management Practices** on nutrient loading to the lake
- Estimate and compare **jurisdictional loads** (City, County, Utility)
- Understand **where nutrient loading 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

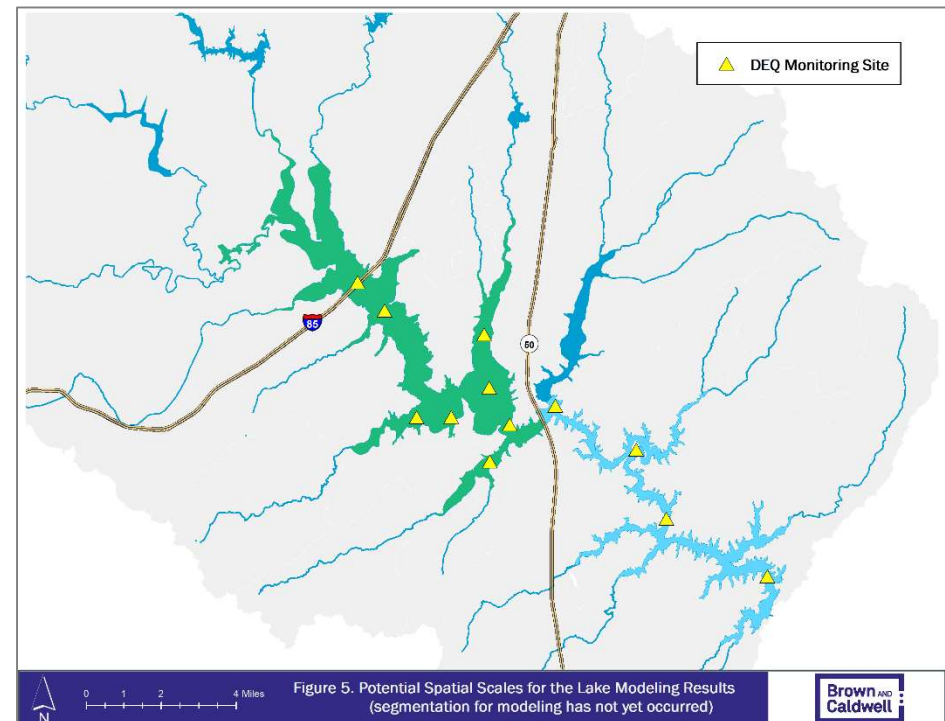
- Understand how watershed management affects levels of nutrients, chlorophyll, and carbon in the lake
- Understand the relationship between nutrient loading and lake water quality
- Quantify all of the in-lake sources of nutrients and carbon
- Quantify all of the external sources of nutrients and carbon
- 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

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

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



Preliminary Discussions Regarding Trading Framework

Regulatory Framework

- The Falls Lake Nutrient Management Strategy defines the role of the Watershed Oversight Committee (WOC) with respect to nutrient trading in 15A NCAC 02B .0280 (7)(b)(viii)
 - Quantify nutrient credits for practices associated with trading
 - Establish criteria and a process for the exchange of credits
 - Obtain approval from the Division for the trading program
 - Approve and separately track eligible trades (ensure no double counting)

Preliminary Discussions re Trading

- DWR and the Division of Soil and Water met in August to discuss a technical approach for credit sharing
- Concept was discussed at the November WOC meeting
- The UNRBA is privy to the early discussions
 - Interest expressed by members in trading
 - Work on the livestock exclusion practice
 - Approval contingent on development of a trading program
 - Technical basis is approved
- Discussions are conceptual; more work is needed to work through details and negotiate an agreement

Challenges with Trading

- Ag and non-ag entities use different accounting methods under the Falls Strategy
 - Edge of field nutrient losses versus loads to the stream
 - Collective versus organization-specific accounting
- Local governments lack
 - Trusting relationships with farmers
 - Technical expertise regarding farming and best management practices
 - NRCS Technical Standards
 - Operation and maintenance requirements
 - Challenges and operational decisions

Preliminary Concepts for Framework

- Develop an MOA/MOU between Division of Soil and Water and the UNRBA (and its members)
 - UNRBA could collect and provide funds to the Division
 - The Division could implement projects and administer funds
- DWR would allow for the MOA/U as part of the Existing Development Model Program (2019); would not include specifics
- Neither DWR nor the WOC would be signatories to the MOA/U, but they would agree with the concept
- Start with practices that have loss and load terms
 - Livestock exclusion (with nutrient management and limits to post-implementation stocking rates)
 - Developed buffers (less than 50% ag parcel and the buffer cannot be adjacent to cultivated land)

Preliminary Concepts, Continued

- State Ag agencies would like to see agreement on a credit sharing established upfront
 - Division of Soil and Water would retain ag credits
 - Ag percent reduction would be applied to loss estimates
 - UNRBA/member percent reduction applied to ED loads
- Local governments would provide full costs to cover capital, technical services, O&M, repairs, etc.
- Local soil and water districts would provide relationships with farmers, assistance with project negotiations, technical services, inspections and enforcement
- Tracking credits for UNRBA members
 - Either establish bubble permit for ED load reductions, or
 - Allow members to track funding to specific county districts, or
 - Establish the MOA concepts and allow members to operate within the framework including funding mechanisms, contracts, sharing, etc.

Technical Issues to Consider

- Amount of credit sharing
- Where projects are installed and who gets credits
- Who are the signatories and participants
- Contract terms and renewal periods
- Other stakeholder interests
- Cost analysis for implementation
- Nitrogen and phosphorus accounting

Questions and Discussion

**Highlights from November
Annual Conference of the NC
American Water Works
Association & NC Water
Environment Federation**

Development and Implementation of Nutrient Reduction Practices by the UNRBA

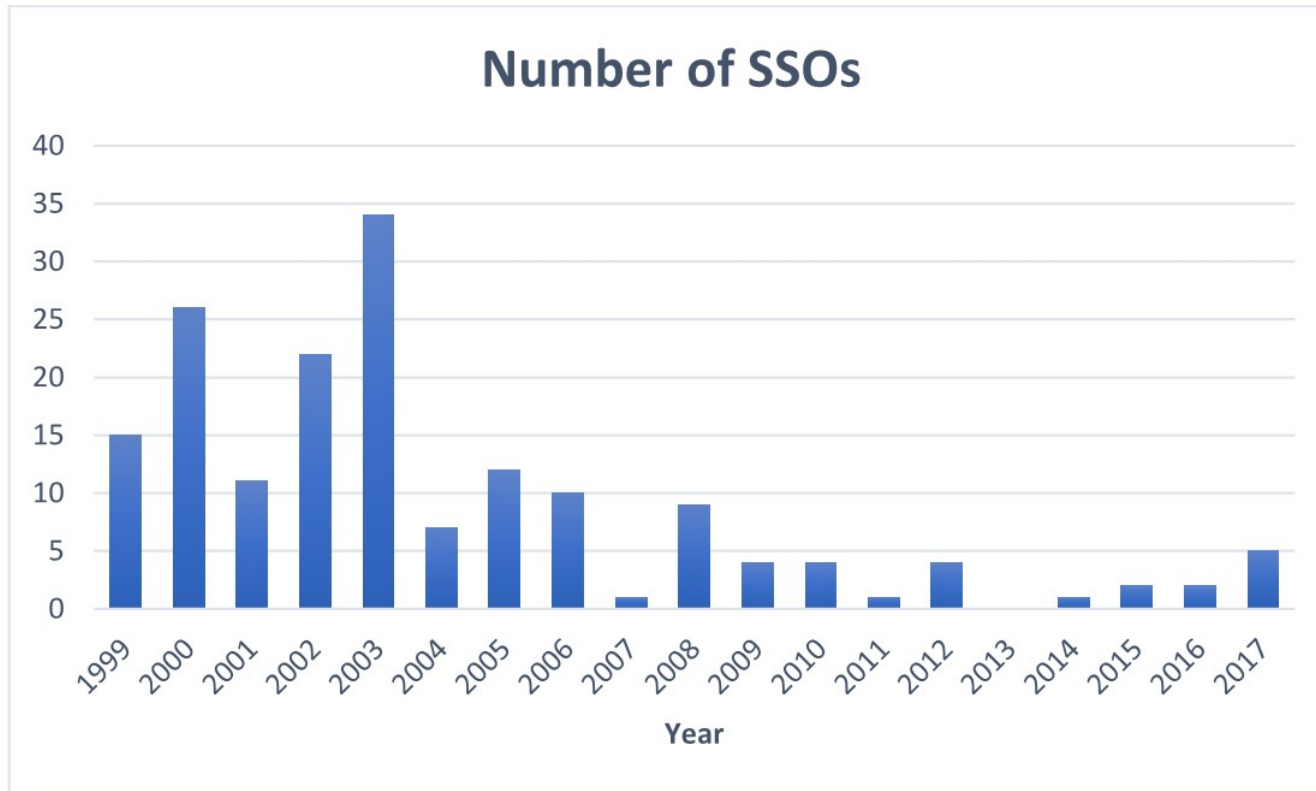
- Provided a background of the Falls Lake Nutrient Management Strategy
- Described challenges associated with meeting the stringent load reductions
- Summarized the UNRBA Nutrient Credit Project
- Provided links to new practices
 - UNRBA website
 - NC Stormwater Crediting Manual
- Described examples of practices implemented in the watershed

Year 2017 Projects Implemented for New Development

Community	Wet Pond	Bioretention	Dry Pond	Filterra	Stormfilter	Under-ground Detention	Stormwater Wetland	Level Spreader Filter Strip	Infiltration Trench	Swales	Stormwater Sand Filter	Cisterns
Butner	2	1										
City of Durham	4	4	2	1		2	1				5	
Granville County	1		1									
Hillsborough	3	4		3	2	4						
Orange County							2					
Person County			1					1				
Raleigh		1							1			
Wake County	7	2	12				7	7		2		2
Wake Forest		2										
Total (68)	17	14	16	4	2	6	10	8	1	2	5	2

Reducing Sanitary Sewer Overflows

- Town of Hillsborough aging infrastructure project
 - Significantly reduced the number of SSOs



Soil Improvement

- Town of Hillsborough pilot project at the town cemetery
 - Project cost = \$1500
 - Included tillage, compost amendment, seeding and stabilization
 - Nitrogen credit – 0.05 lbs/yr
 - Phosphorus credit – 0.01 lbs/yr



Bioretention Cell

- Town of Hillsborough retrofit project at Cates Creek Park
 - Retrofit designed to divert parking lot runoff into an existing bioretention cell
 - Project cost = \$41,754
 - Nitrogen credit – 1.8 lbs/yr
 - Phosphorus credit – 0.33 lbs/yr



Land Conversion

- Town of Hillsborough project at Public Works Facility
 - Includes removal of two buildings and a parking lot and planting in native species
 - Estimated project cost = \$165,000
 - Nitrogen credit – 6.76 lbs/yr
 - Phosphorus credit – 0.82 lbs/yr



Durham County Soil and Water Conservation District Stream Restoration Projects

- Marbrey-Jackson Project
 - Estimated project cost = \$650,000
 - More than 3,000 linear feet of stream restoration
 - 8 acres of land conservation
 - Nitrogen reduction – 495 lbs/yr
 - Phosphorus reduction – 41 lbs/yr
- Walker Project
 - Estimated project cost = \$400,000
 - Includes more than 2,200 linear feet of stream restoration and 8 acres of land conservation
 - Nitrogen reduction – 270 lbs/yr
 - Phosphorus reduction – 22 lbs/yr



Photos courtesy of Durham County Soil and Water Conservation District

Durham County Soil and Water Conservation District Stormwater Projects

- Southern High School
 - Estimated project cost = \$525,000
 - Stormwater wetland
 - Wet detention reuse pond
 - Bioretention cell
 - 2.2 acres of land conservation
 - Nitrogen credit – 74 lbs/yr
 - Phosphorus credit – 9.5 lbs/yr



Photo courtesy of Durham County Soil and Water Conservation District

The North Carolina Association of Soil and Water Conservation Districts selected Durham Soil and Water Conservation District as the 2018 “Conservation Technical District of the Year.”

South Ellerbe Stormwater Wetland

- City of Durham retrofit project at former Duke Diet and Fitness Center near Downtown Durham
 - Project cost = ~\$8,000,000 (plus amenities)
 - Retrofit wetland designed to treat 485 acres of developed downtown area. 2.1 acres of impervious area including a building will be removed.
 - Nitrogen credit – ~500 lbs/yr
 - Phosphorus credit – ~80 lbs/yr

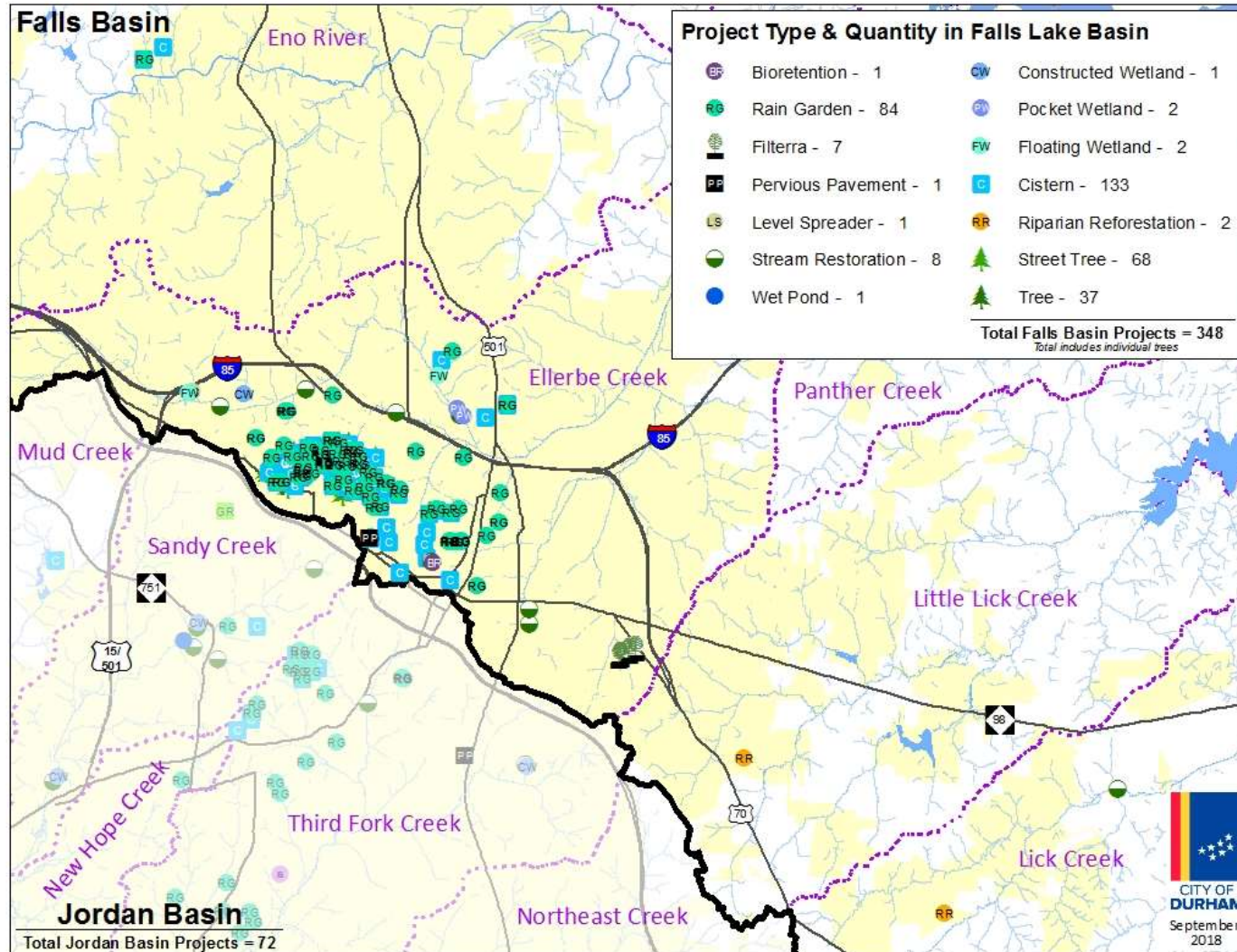


Rain Gardens and Cisterns

- City of Durham Small Scale Retrofits over 80 rain gardens and over 130 cisterns installed (ongoing program)
 - Estimated project cost = \$500 - \$1500 per device
 - Includes Nitrogen credit – < 1.0 lbs/yr per device
 - Phosphorus credit – < 1.0 lbs/yr per device



City of Durham Retrofits (348 Falls Projects) for Existing Development Compliance



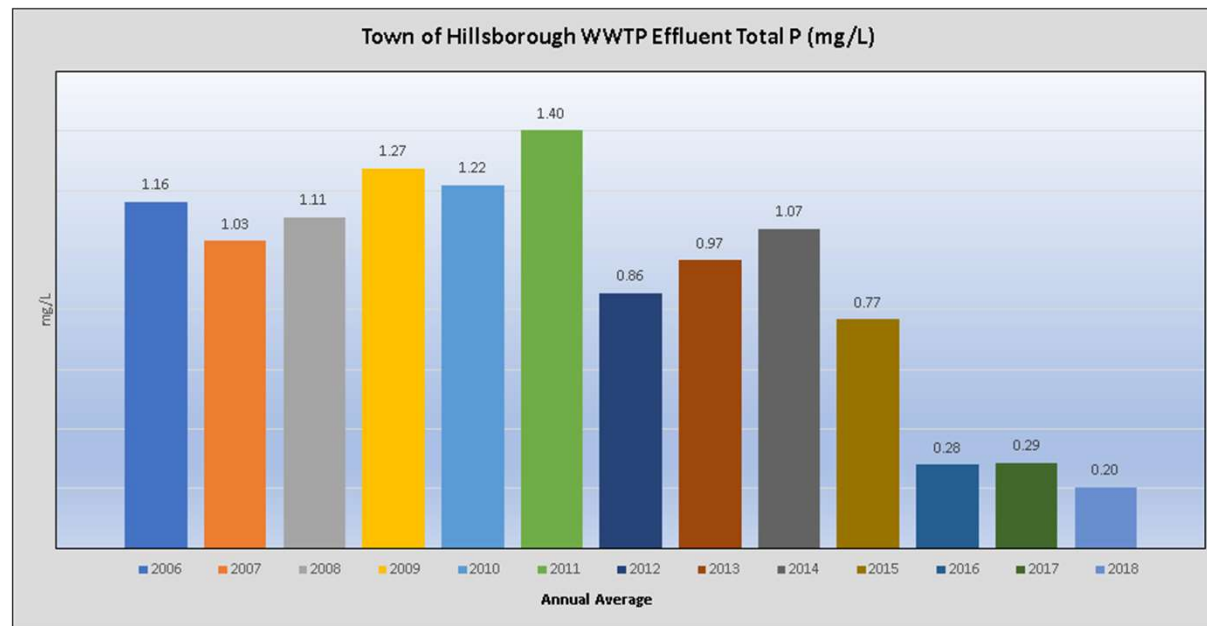
Algal Flowway (Algal Turf Scrubber)

- City of Durham potential retrofit project (pilot study completed)
 - Project cost = \$5.7 million to \$9.6 million
 - Retrofit designed to harvest algae to provide nutrient pollution removal. 10 - 25 MGD sizes.
 - Nitrogen credit: ~2800 - 7000 lbs/yr
 - Phosphorus credit: ~500 - 1200 lbs/yr



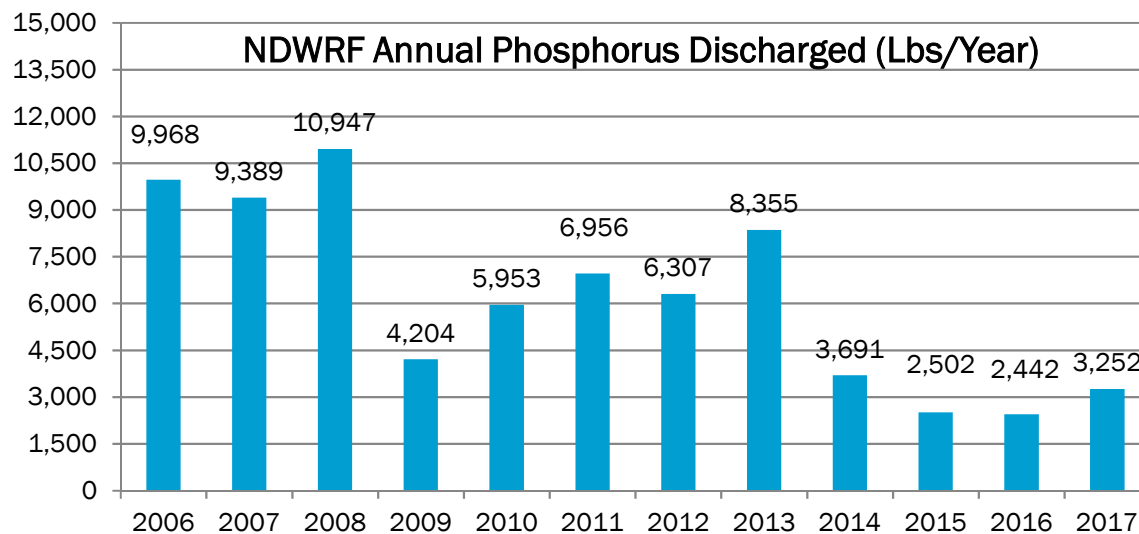
Improvements at Wastewater Treatment Facilities

- Town of Hillsborough - \$16 million in upgrades
 - Total nitrogen concentrations reduced from ~14 mg/L to ~ 2 mg/L
 - Total nitrogen loads reduced by 29,000 lb/yr
 - Total phosphorus concentrations reduced from 1.4 mg/L to 0.2 mg/L
 - Total phosphorus loads reduced from 2,900 lb/yr



Improvements at Wastewater Treatment Facilities

- South Granville Water and Sewer Authority
 - Total nitrogen concentrations reduced from ~6 mg/L to ~ 2.5 mg/L
 - Total phosphorus concentrations reduced from ~0.78 mg/L to ~ 0.3 mg/L
- North Durham Water Reclamation Facility (relative to 2006)
 - Total nitrogen loads reduced by 31,528 lb/yr
 - Total phosphorus loads reduced by 6,716 lb/yr



Land Conservation

- 9,330 acres of land have been conserved since 2006 with a total cost of \$78 million
- Cost effectiveness depends on the amount of credit which has been under negotiation since 2014
 - Nitrogen: \$6,000/lb-N to over \$800,000/lb-N
 - Phosphorus: \$36,000/lb-P to over \$400,000/lb-P



Example Durham County conservation site (Triangle Land Conservancy)

Range of Nitrogen Credits for Land Conservation

Nitrogen Credit (lb-N/ac/yr)	Total Credit for All 9,330 Acres Conserved (lb-N/yr)	Cost Effectiveness (\$/lb-N) assuming total costs of \$78 million	Cost Effectiveness (\$/lb-N) assuming cash investments of \$68.66 million
1.2	11,196	\$ 6,967	\$ 6,133
1	9,330	\$ 8,360	\$ 7,359
0.62	5,785	\$ 13,484	\$ 11,869
0.54	5,038	\$ 15,482	\$ 13,628
0.5	4,665	\$ 16,720	\$ 14,718
0.45	4,199	\$ 18,578	\$ 16,353
0.35	3,266	\$ 23,886	\$ 21,026
0.25	2,333	\$ 33,441	\$ 29,436
0.1	933	\$ 83,601	\$ 73,591
0.07	653	\$ 119,430	\$ 105,129
0.01	93	\$ 836,013	\$ 735,906

Range of Phosphorus Credits for Land Conservation

Phosphorus Credit (lb-P/ac/yr)	Total Credit for All 9,330 Acres Conserved (lb-P/yr)	Cost Effectiveness (\$/lb-P) assuming total costs of \$78 million	Cost Effectiveness (\$/lb-P) assuming cash investments of \$68.66 million
0.2	1,866	\$ 41,801	\$ 36,795
0.1	933	\$ 83,601	\$ 73,591
0.061	569	\$ 137,051	\$ 120,640
0.052	485	\$ 160,772	\$ 141,520
0.05	467	\$ 167,203	\$ 147,181
0.043	401	\$ 194,422	\$ 171,141
0.035	327	\$ 238,861	\$ 210,259
0.02	187	\$ 418,006	\$ 367,953
0	0	Not applicable	Not applicable

Comparison of Costs per Pound

Project	Project Cost	\$/lb-N/yr	\$/lb-P/yr
UNCWI Land Conservation	\$ 78,000,000	\$6K – 736K	\$37K – 368K
Land Conversion at Public Works	\$ 165,000	\$ 24,408	\$ 201,220
Cemetery Soil Improvement	\$ 1,500	\$ 30,000	\$ 150,000
Bioretention Retrofit	\$ 41,754	\$ 23,197	\$ 126,527
South Ellerbe Wetland	\$ 8,000,000	\$ 16,000	\$ 100,000
Highschool Stormwater	\$ 525,000	\$ 7,095	\$ 55,263
Walker Project	\$ 400,000	\$ 1,481	\$ 18,182
Marbrey-Jackson Project	\$ 650,000	\$ 1,313	\$ 15,854
Algal Floway	\$ 7,650,000	\$ 1,561	\$ 9,000
Hillsborough WWTP Upgrades	\$ 16,000,000	\$ 552	\$ 5,517
Rain Gardens/Cisterns	\$ 1,000	>\$1,000	>\$1,000

For comparison, gold cost \$1,233 per ounce,
or \$19,728 per pound based on 11/5/2018 data.

Summary of Activities in the Watershed

- New development regulations have been in effect since 2012
 - Limit increases in loading from new development
 - May decrease loading from some sites
- Significant reductions in loading from WWTP's have been realized
 - The three major facilities are meeting or exceeding the Stage 1 reduction requirements
- Agriculture has exceeded their Stage 1 requirements
- Several local governments are implementing practices to reduce loading from existing development
 - Conventional stormwater practices
 - New practices or design variants funded by the UNRBA
 - Innovative practices like the algal turf scrubber

Questions ?

