Non Point Source Nutrient Credits

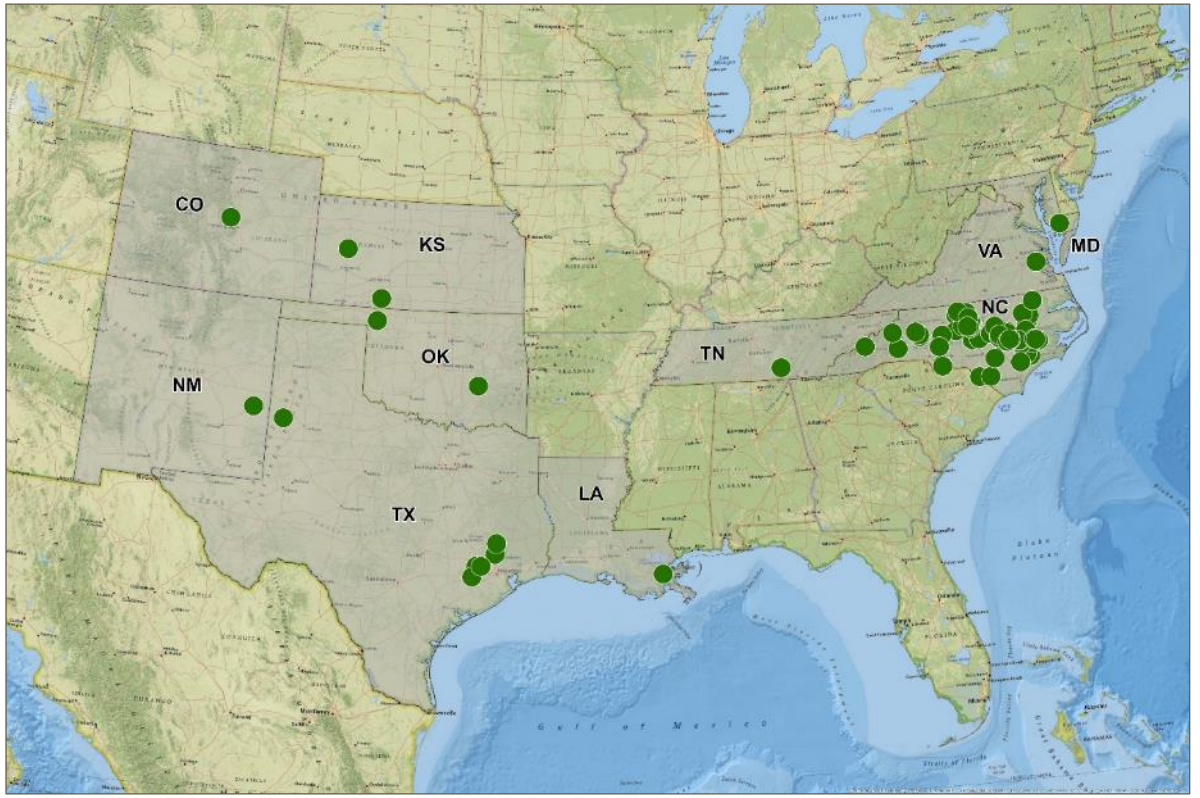
LNBA/NRCA Workshop July 2018

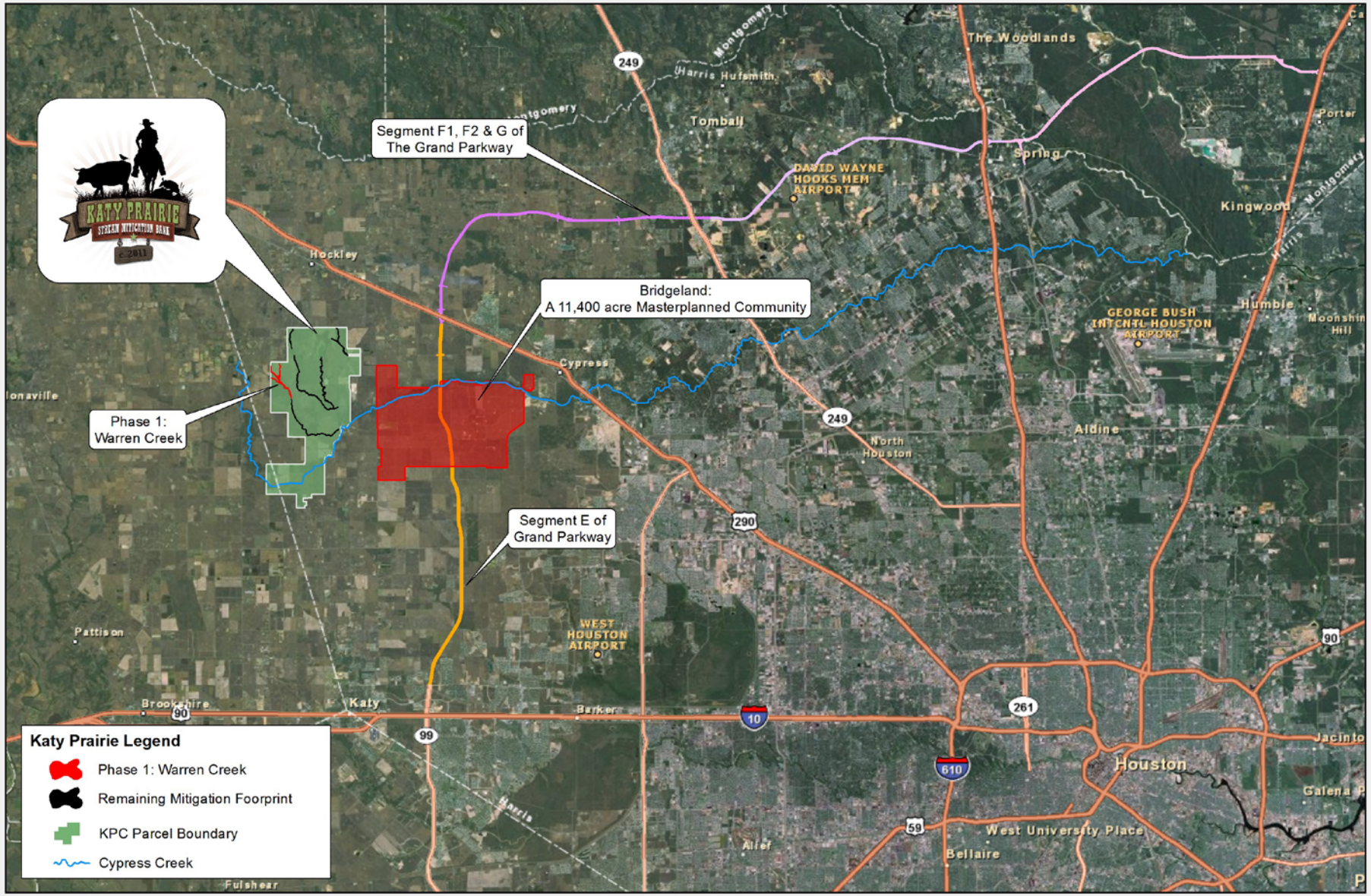
Barrett Jenkins

RESTORATION SYSTEMS | LLC

Restoration Systems

- North Carolina's first mitigation company
- 20th Anniversary, May 19, 2018
- Established 70+ mitigation sites
- 115,000+ acres of wetlands and prairies
- 75+ miles of creeks, streams, rivers and bayous.
- Planted more than 2,000,000 trees
- Three dam removals for mitigation





RESTORATION SYSTEMS, LLC
1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
PHONE : 919.755.9490
FAX : 919.755.9492

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SCALE:1 inch = 25,000 ft

DATE: July - 2012

PROJECT: KPC

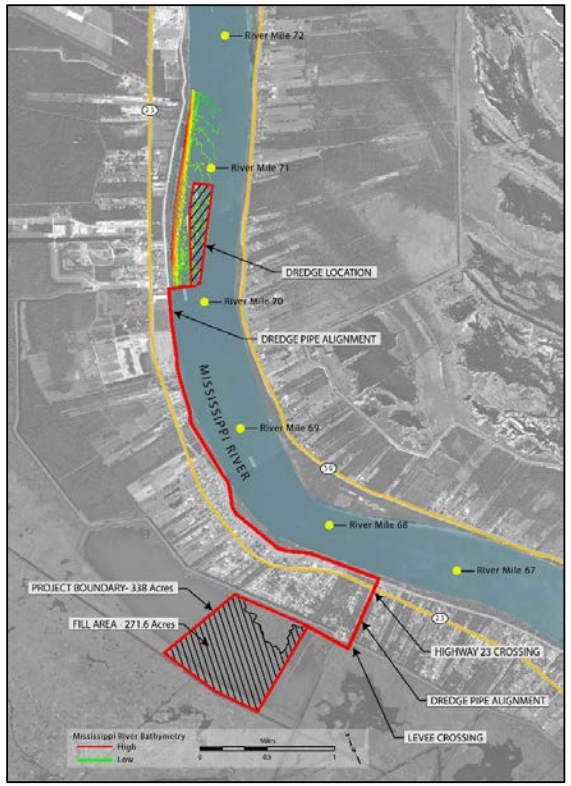
Katy Prairie Stream Mitigation Umbrella Bank
Serving the Greater Western Houston Area

Figure shows the Katy Prairie Stream Mitigation Umbrella Bank, indicating Phase 1 - Warren Creek and the remaining project phases. Indicates development pressure and the location of Segments E, F1, F2, & G of The Grand Parkway.

AERIAL PHOTOGRAPHY
(c) Esri, DeLorme, NAVTEQ, TomTom, USGS, & Intermap

COORDINATE SYSTEM: NAD 1983 SP TX C FEET

0 1.25 2.5 5 7.5 10
Miles



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Jesuit Bend Mitigation Bank
Fresh to Intermittent Marsh
Plaquemines Parish, Louisiana
January 19, 2015 - Post Construction

NC Mitigation

- RS has 42 DMS stream, wetland and buffer restoration projects in addition to several private mitigation banks.
- 2008 Mitigation Rule required stream mitigation nationally
- Only stream mitigation method used today is “Natural Channel Design”

Milburnie Dam Removal as Stream Mitigation

RS began work on dam removal 10 years ago

RESTORATION SYSTEMS | LLC

20th Anniversary

NEUSE RIVER

MILBURNIE DAM REMOVAL

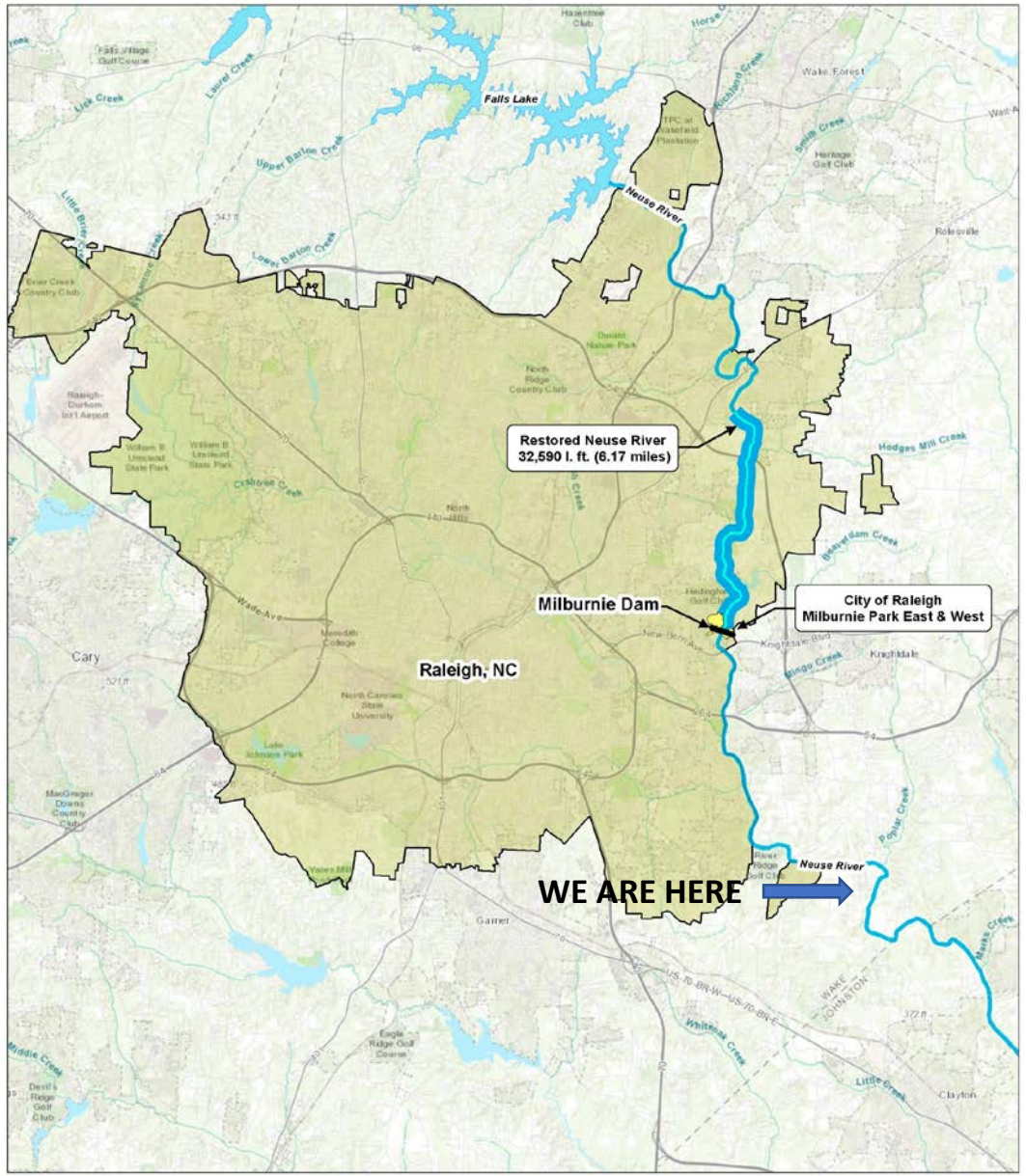
RESTORATION

Restored Neuse River
32,590 l. ft. (6.17 miles)

Raleigh, NC

Milburnie Falls
rst. 2017

https://milburniedam.com



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DATE: 11 - 2017
SCALE: 1 in = 14,583 ft
SITE: Mb Dam

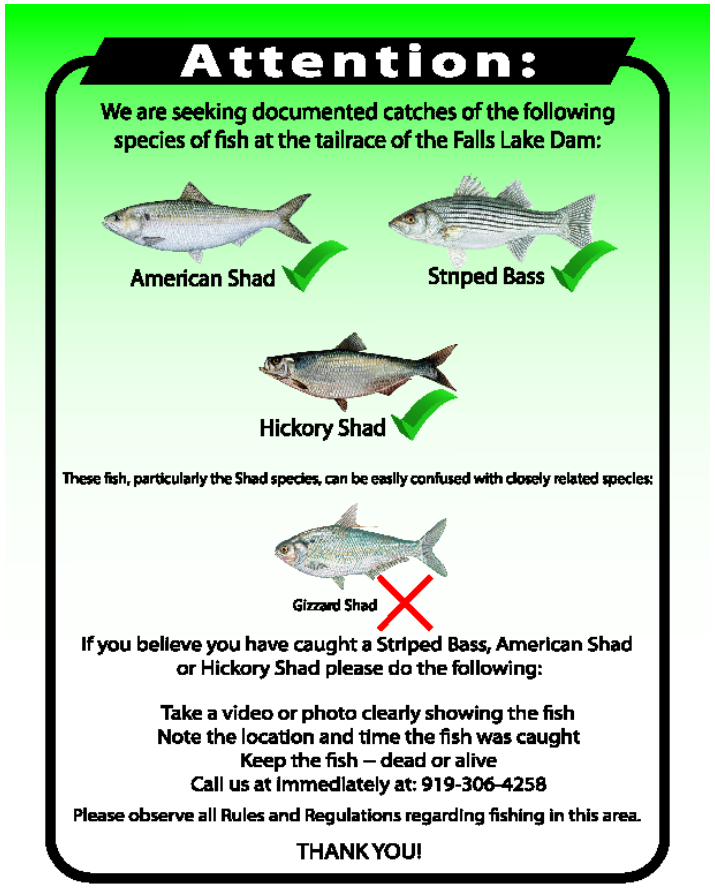
Restored Neuse River in City of Raleigh

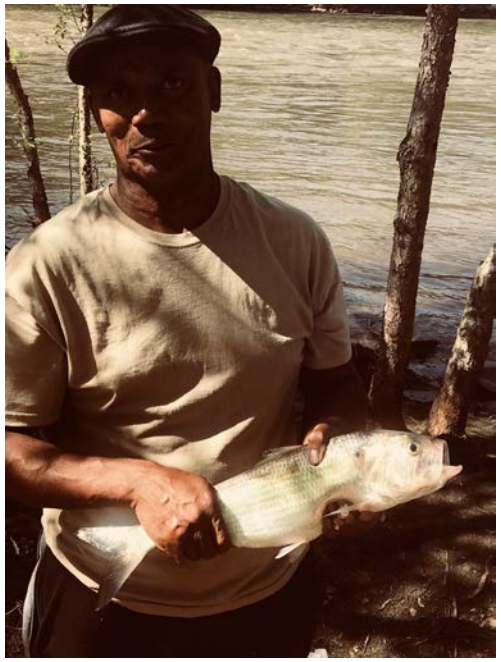
Coordinate System: NAD_1983_SP_NC_FIPS_3200_Ft.

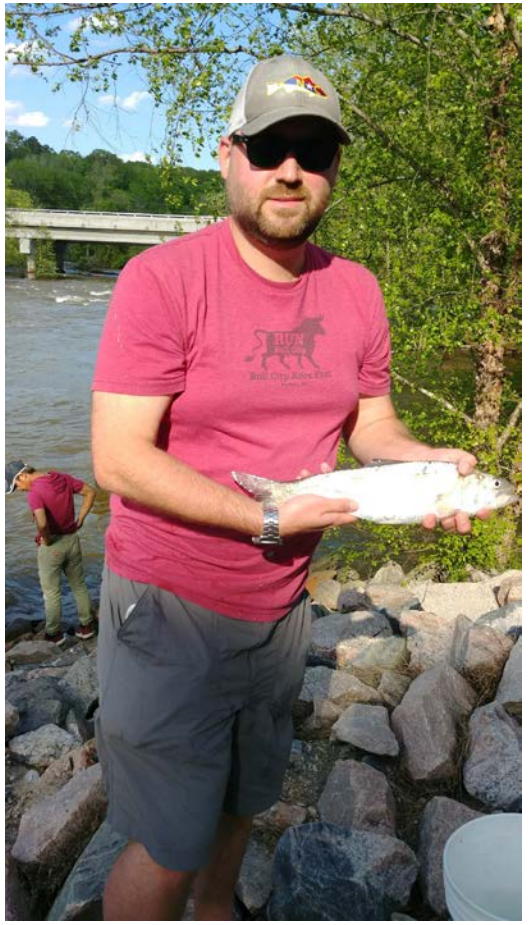
0 7,500 15,000 30,000 45,000

Feet

Fish Story







Accession Number: 13554 — 02 May 2018

RECORD of ACCESSION
North Carolina Musaum of Natural Sciences
11 West Jones Street, Raleigh, NC 27601-1029
919-707-8868
gabriela.hogue@naturalsciences.org

Donated by: Barrett Jenkins
Restoration Systems LLC
1101 Haynes Street, Suite 211
Raleigh, NC 27604
USA

Accepted by: Gabriela M. Hogue
Form Completed Date: 02 May 2018
Date Received: 01 May 2018
Location: Research Lab
Disposition: Research
Type of Accession: Gift

Materials Received: American Shad
Number of Specimens: 2
Where Obtained: NC; Wake County, Neuse River, Falls Lake Dam
Date Coll: 01 May 2018
Collector(s): Kevin Thomas (fisherman)

AGREEMENT: I, the undersigned, hereby donate the above listed object(s) to the North Carolina State Museum of Natural Sciences as a gift to be used, allocated or disposed of in the best interests of the museum and its programs as determined by officials of the institution. I understand that with this agreement the said object(s) become(s) sole property of the North Carolina State Museum of Natural Sciences, and that I have no further claim to its (their) ownership, usage or disposition.

Signed: Barrett M Jenkins Date: May 2, 2018

PLEASE SIGN AND RETURN ONE COPY

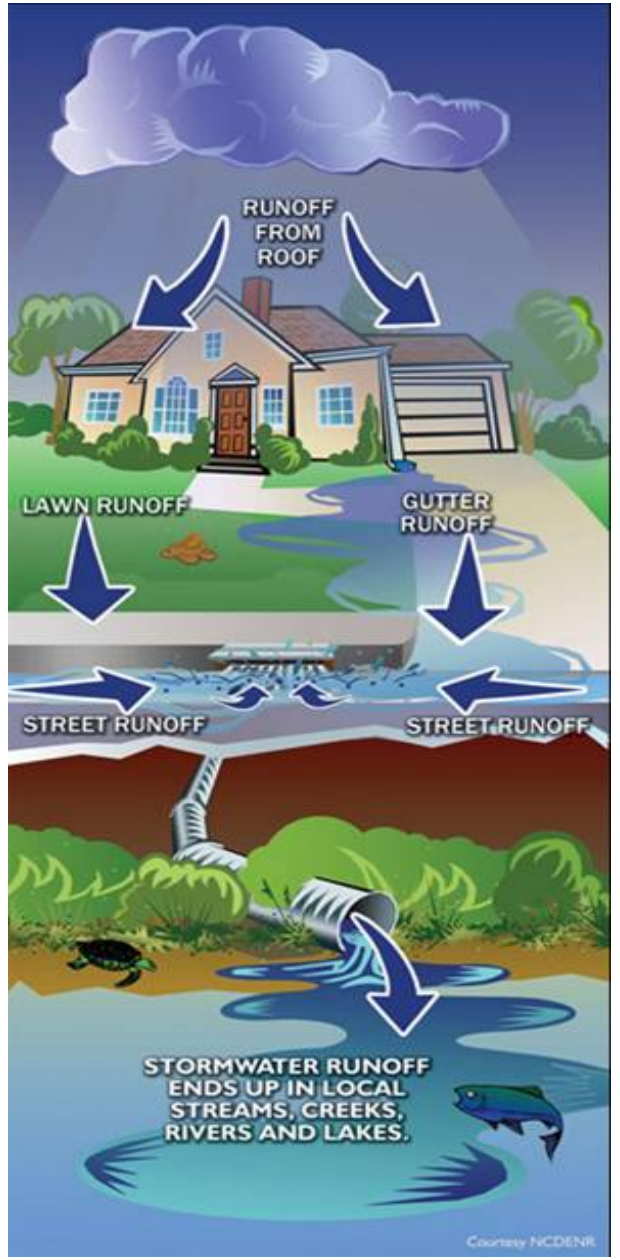
Nutrient Offset Credits

- Also known as water quality credits and/or nutrient mitigation
- In NC we have sold over 350,000 lbs of N offset credit
- 500+ transactions
- City of Raleigh, City of Durham, Town of Cary, Town of Garner, Town of Smithfield & Johnston County are the primary municipalities, but more are coming online

20 years ago….in the Neuse River Basin in NC….

Stormwater regulations allowed for In Lieu Fee payments of $11/lb of N to be made to EEP/DMS to provide offsite nutrient reductions if a portion of the reductions could not be met onsite

Wastewater regulations developed a cap and trade system, the Neuse River Compliance Association (NRCA) to maximize their reduction efforts



10 years ago… In the Neuse River Basin in NC…

- EEP had a monopoly, but they weren't reinvesting fast enough
- The ILF at $11/lb N was not enough for them to implement projects
- RTI was commissioned to study the cost of implementing nutrient offset projects
- They concluded the new rate should be $28/lb N
- Policies were changed to allow other entities to create nutrient offset credit banks, limiting government liability, introducing competition, and improving timeliness

NC Division of Water Quality - Methodology and Calculations for determining Nutrient Reductions associated with Riparian Buffer Establishment

Nitrogen Water Quality Benefits for Riparian Buffer Restoration

1). Benefit of Land Use Change
2). Benefit of Nutrient Removal from Nonpoint Source Runoff
3). Benefit of Nutrient Removal from Periodic Overbank Flood

Nitrogen General Assumptions:

1. Life expectancy of Riparian Buffer is assumed to be 30 years. (Life expectancy for stormwater detention pond is 20 - 30 yrs)
2. Restored Riparian Buffer is assumed to be natural.

Effectiveness of Riparian Buffer	Annual Effectiveness (kg/ha/yr)	Annual Effectiveness (lb/ac/yr)	Effectiveness in 30 yrs (lb/ac)
Benefit (1)	11.08	9.89	296.6
Benefit (2)	70.09	62.54	1876.1
Benefit (3)	3.75	3.35	100.4
Total	84.92	75.77	2273.0

Nitrogen Benefit Descriptions and Assumptions:

1) Benefit is due to change land use.
Assume existing land use export coefficient is a composite export coefficient with a value of 12.98 kg/ha (agriculture and urban).
Wetland export coefficient is 1.9 kg/ha.
The annual nutrient output is decreased by 11.08 kg/ha annually by land use changing.
2) Benefit is due to nitrogen removal from nonpoint source runoff.
Nutrient contribution/buffer treatment area ratio is approximately 10.8 (based on studies examined by Gannon 1997).
In flow loading is calculated by nutrient contribution area x composite export coefficient.
In flow loading is 10.8 ha x 12.98 kg/ha = 140 kg/ha/yr.
Nutrient removal due to this benefit is calculated by in flow loading x removal efficiency
*Gannon, Richard. 1997. Effectiveness of Wetland Riparian Areas for Treatment of Agricultural Pollution Sources: A Literature Review. (Draft)
The nitrogen removal efficiency is 50% based on various literature.
* Kadlec, Robert H. and Robert L. Knight. 1996. Treatment Wetland
* Moshiri, Gerald A.1993. Constructed Wetlands for Water Quality Improvement. Lewis Publi.
* Mitsch, William J. 1994. Global Wetlands: Old world and New. Elsevier
3) Benefit is due to nitrogen removal from overbank flooding
Nitrogen concentration is assumed to be 2.5 mg/L. Assume overboard is 1 ft. Flood frequency is assumed to be once every year.
Nutrient removal due to this benefit is estimated by in flow concentration x area (1 ha) x overboard height x removal efficiency.

Formula for Calculating Nitrogen Offset Reductions on Riparian Buffer Restoration Sites:

*Size (Acres) * 75.77(lbs/Acre/Year) * 30 Years = Total Pounds of Nitorgen Removed from Riparian Buffer Project*


Nutrient Off-Set
Service Area
Durham
Cary
Raleigh
Wilkins Nutrient Bank
Smithfield
Lane Nutrient Bank
Goldsboro
NEUSE
NATURAL RESOURCE
RESTORATION & CONSERVATION
♦ NC's 1st DWQ Approved Nitrogen Bank
♦ Friendly Service with a Quick Turnaround
♦ Meet or Beat State Pricing
♦ Special Discount Offered to NAHB Members
♦ Volume Discounts Available
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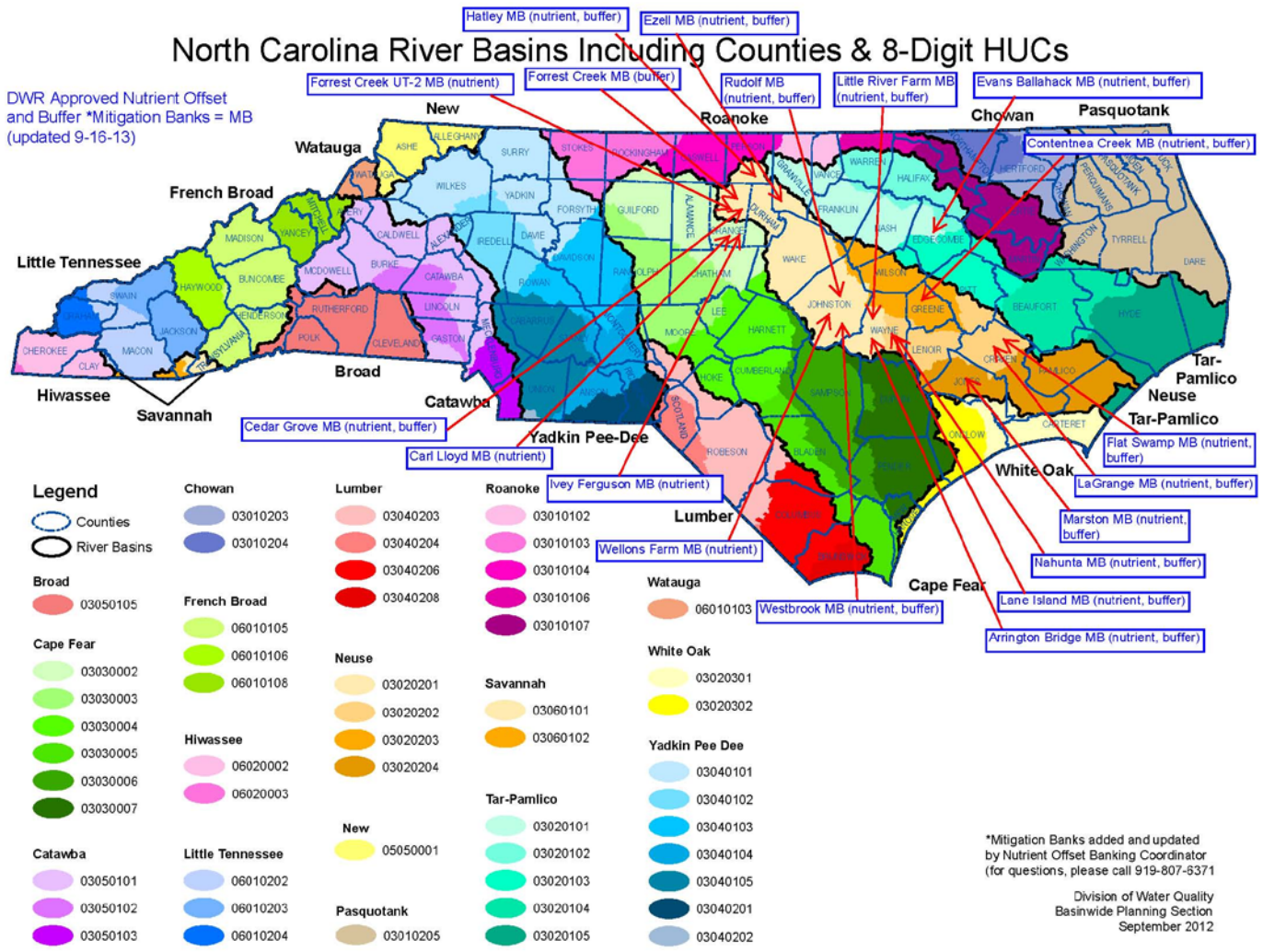
Nutrient Offset Banking in NC Today

- Over 30 Nutrient Offset Credit Mitigation Banks in NC today
- Nutrient Offset Mitigation Banks sell below the ILF price
- The ILF provides a back drop for service areas that do not have offset projects already in place

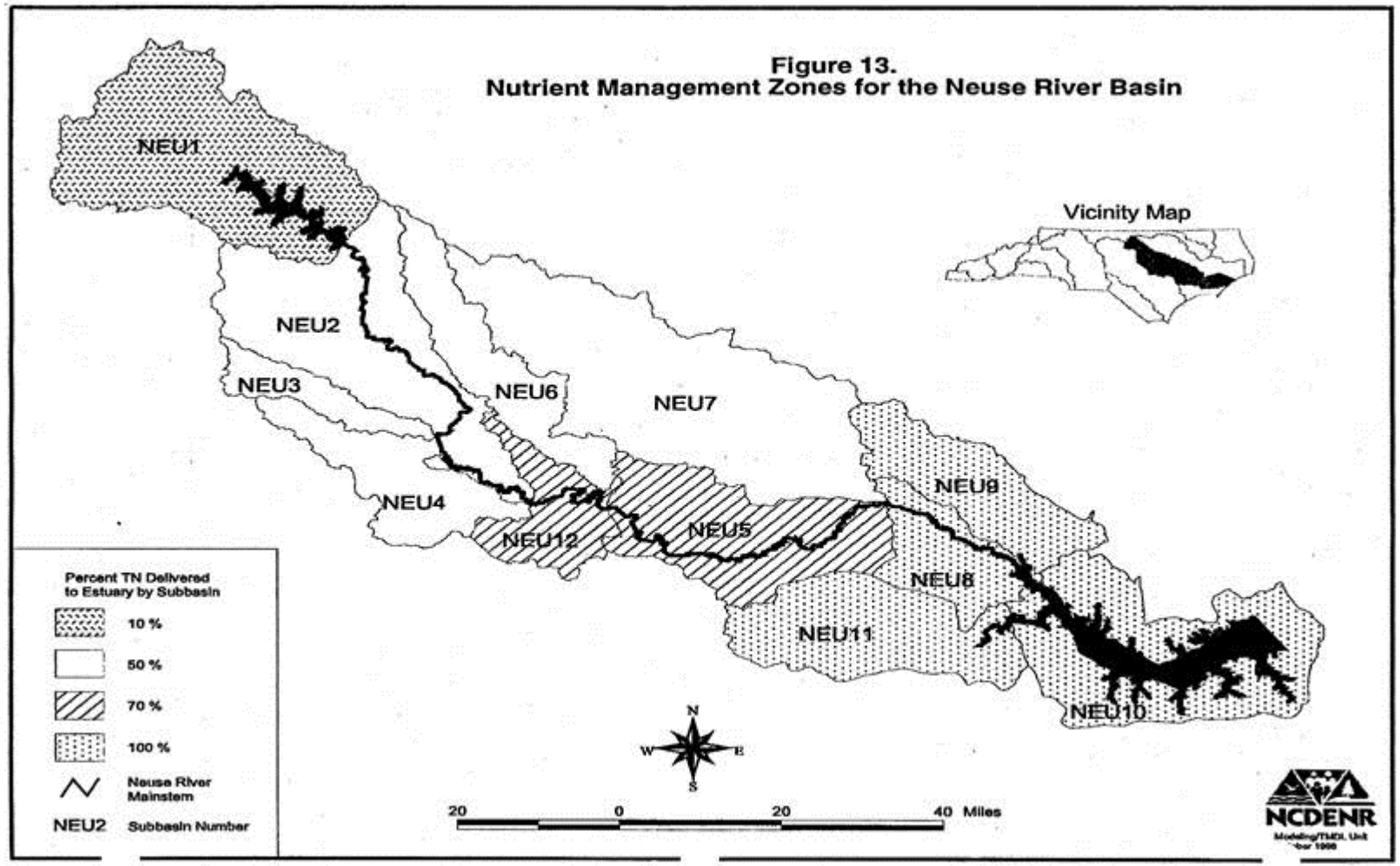
Nitrogen Offset ILF Rates Per Credit

Service Area	Nutrient	DMS Rate (per pound) (Through September 30, 2018)
Neuse basin 8-digit HUCs 03020202, 03020203 and 03020204	Nitrogen	$13.37
Neuse – 03020201 outside the Falls Lake watershed	Nitrogen	$21.86
Neuse - Falls Lake watershed	Nitrogen	$10.52
Tar-Pamlico basin	Nitrogen	$8.28
Jordan Lake watershed	Nitrogen	$132.00

NC nutrient offset mitigation banks and service areas



Transport factors for wastewater



Units of nutrient offset credit different in different markets

- NC – pounds of nitrogen with total estimated over 30 year period and released for sale over a 6 year period
- VA – pounds generated annually in perpetuity
- MD – Impervious acre equivalents with conversions to N and P
- DC – Stormwater retention credits, each represents one gallon of stormwater retention maintained for one year

Alternative cost effective offset methods

- Buffer restoration – Cost effective based on estimated removal efficiency
- Wetland restoration – USACE overlap
- Hog farm conversion – Soil and Water Hog Farm Buyout Program
- Oyster reef/marsh restoration – Virginia living shorelines and oyster harvest
- Dam removal/restoration