

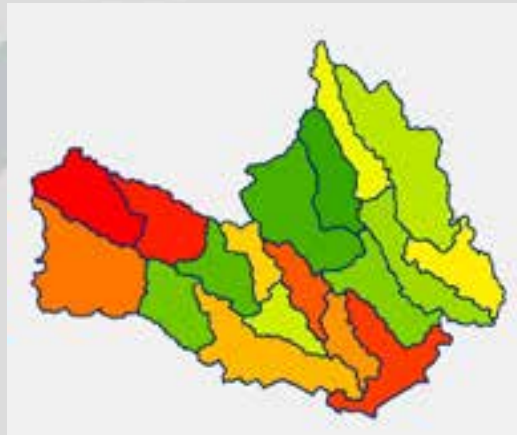


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Neuse 01 Regional Watershed Plan

Characterizing Stream Buffer Condition in GIS

2014 ESRI SERUG Conference
May 5th - 7th
Charlotte, NC





Presentation Outline

- n Background**
- n Methodology**
- n Results**
- n Questions**



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Background



Where is the Neuse River Basin?



North Carolina



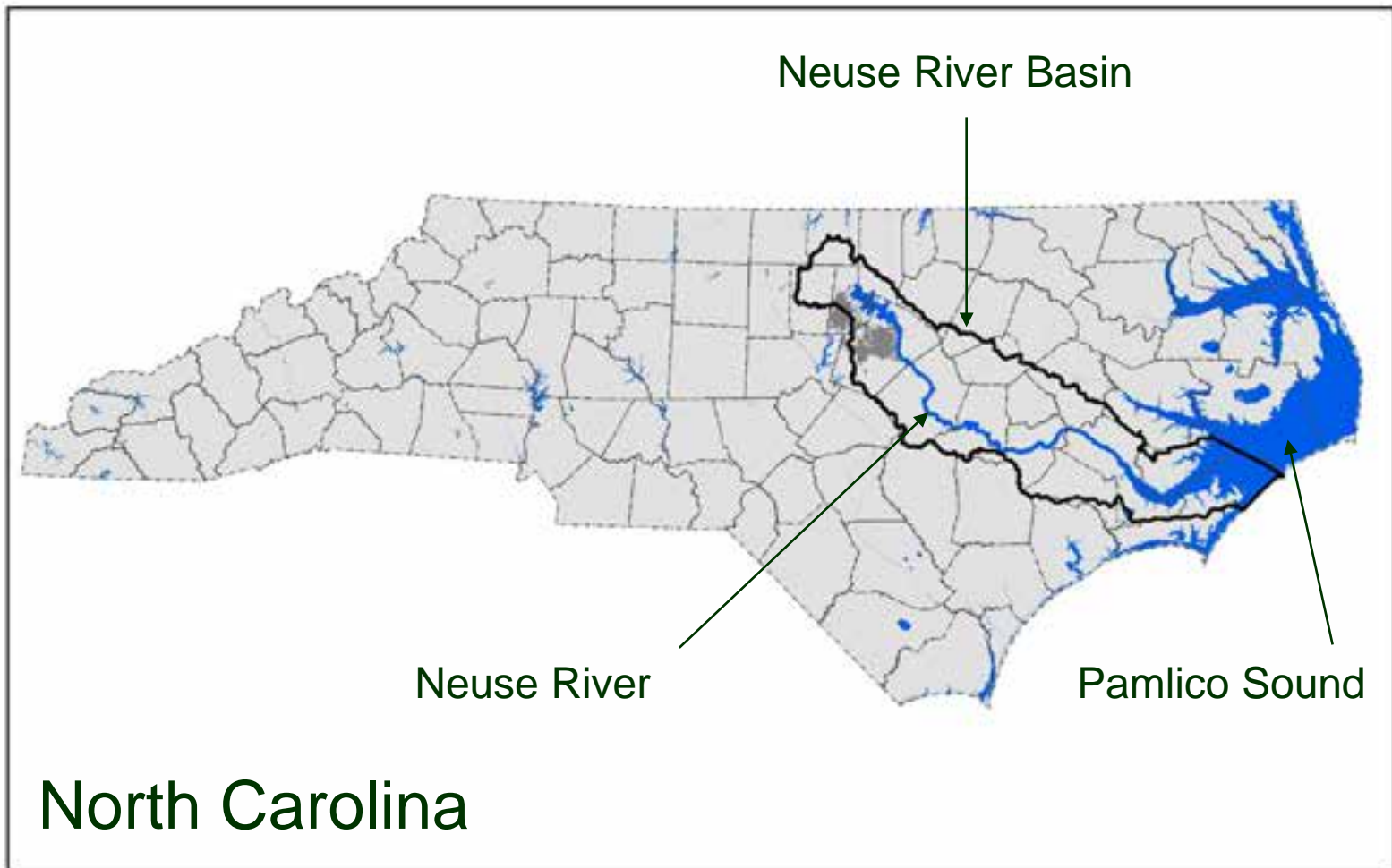
Where is the Neuse River Basin?



North Carolina



Where is the Neuse River Basin?



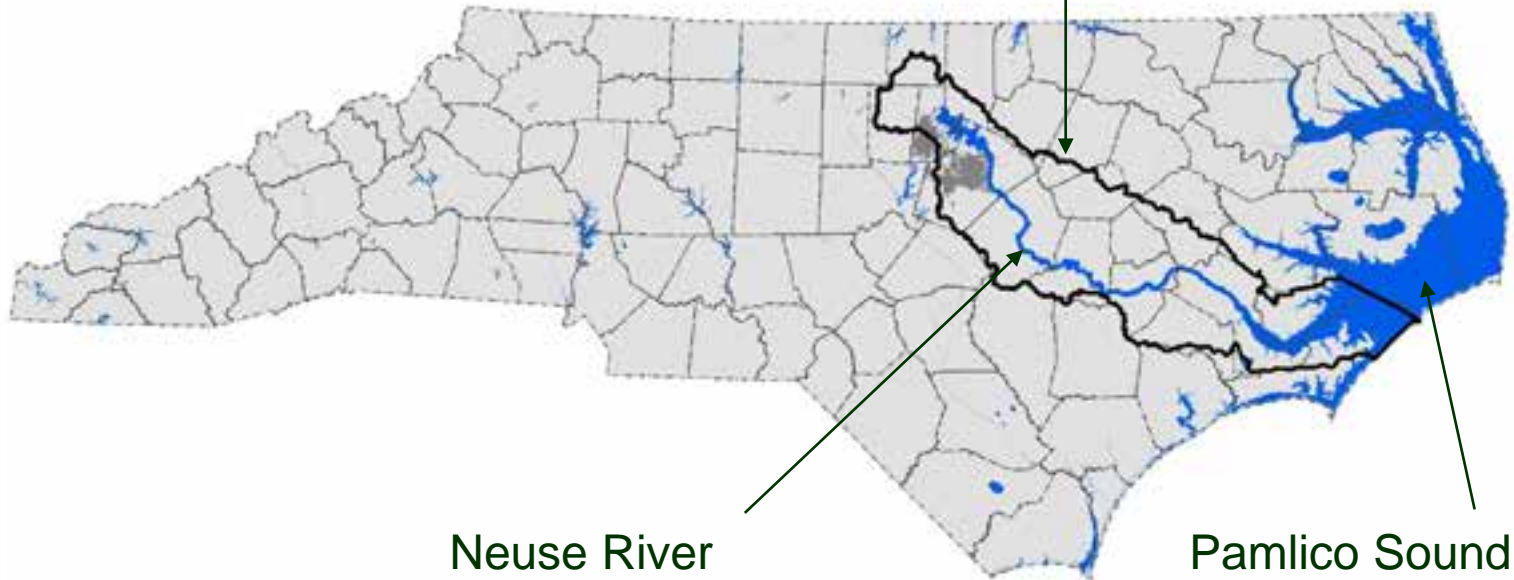


Where is the Neuse River Basin?

n ~ 275 miles in length

n ~ 6,200 sqmi drainage area

Neuse River Basin



Neuse River

Pamlico Sound

North Carolina



Neuse River Basin - Impacts

- n High nutrient levels entering river – Pamlico Sound
 - n Eutrophication
 - n Occurrences of hypoxia
 - n Outbreaks of Pfiesteria
 - n Fish kills





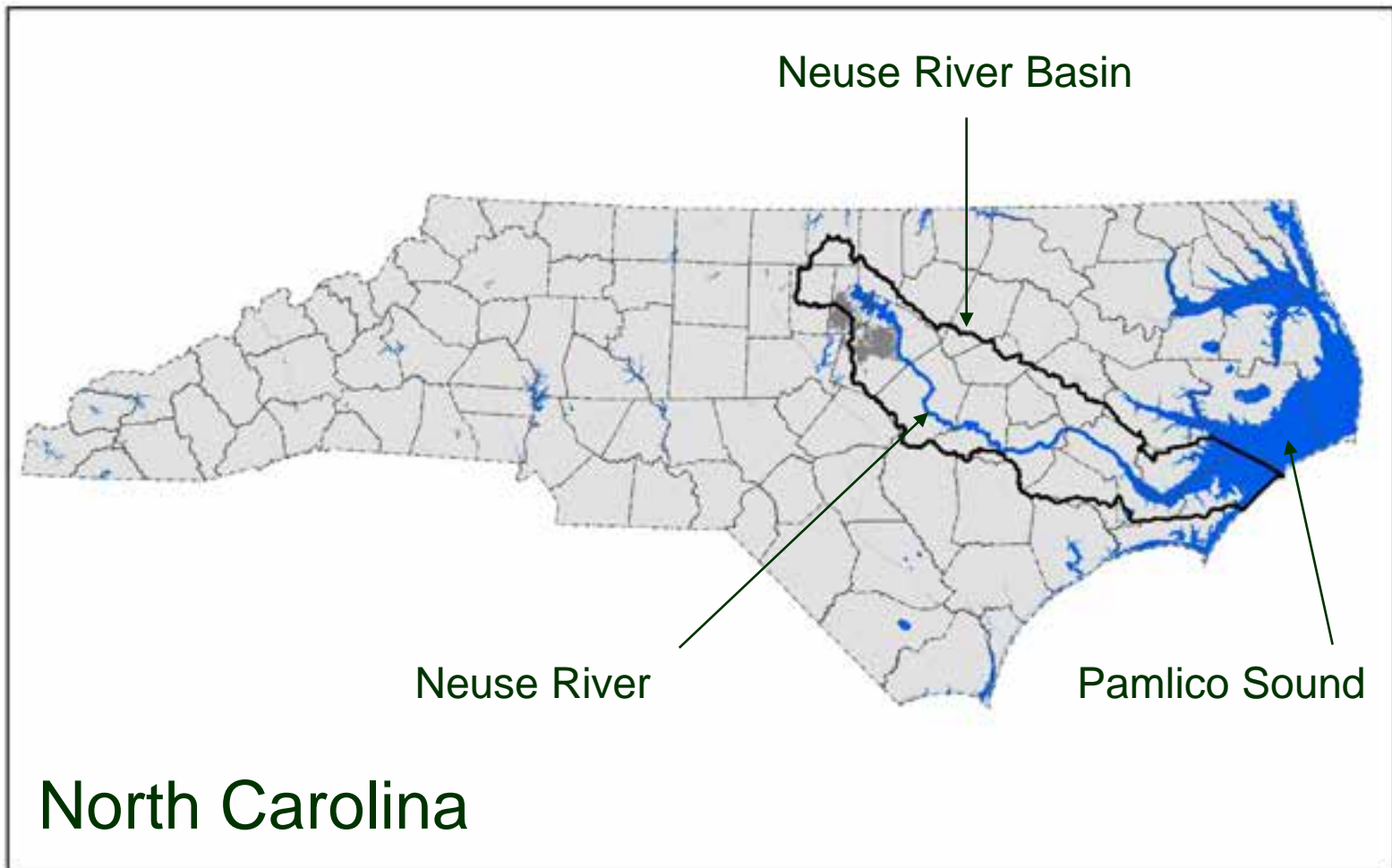
Neuse River Basin - Impacts

- n River/tributaries designated as nutrient sensitive waters
- n Nutrient management strategy established to reduce loads
- n Significant need for stream/wetland mitigation from rapid population growth and widespread development





Where is the Neuse River RWP study area?





Where is the Neuse River RWP study area?

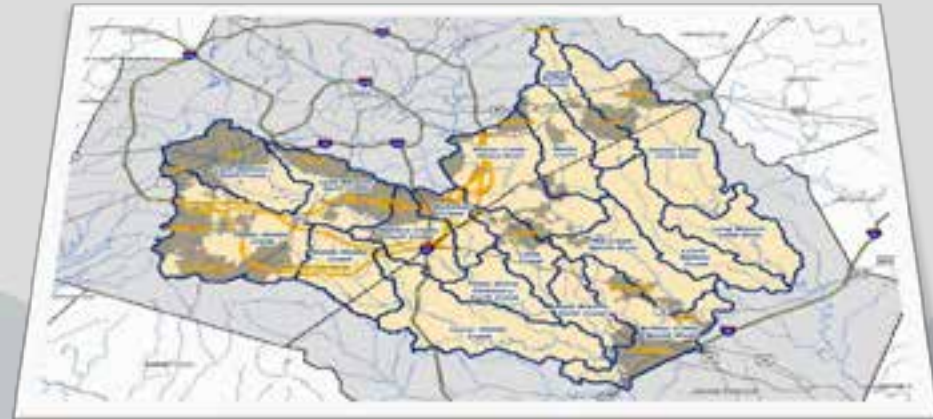




Neuse River RWP – Purpose

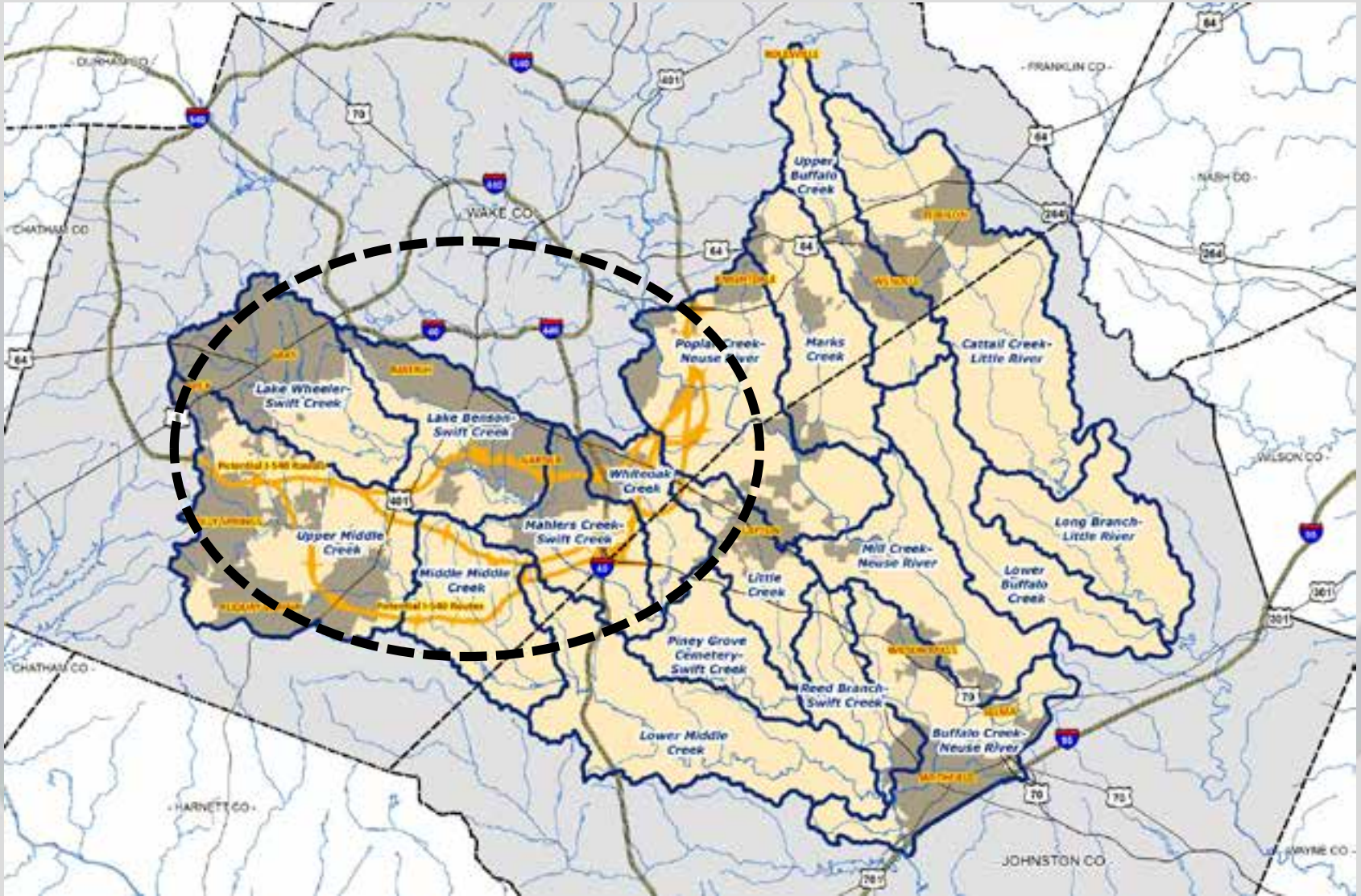
- n To identify and prioritize potential mitigation projects to offset ecological impacts
 - n Stream/wetland restoration
 - n Buffer restoration
 - n Nutrient offset
 - n BMPs
 - n Habitat preservation

- n Proposed I-540 Corridor is a major driver for mitigation related to development





Proposed I-540 Corridor





Neuse River RWP Phases

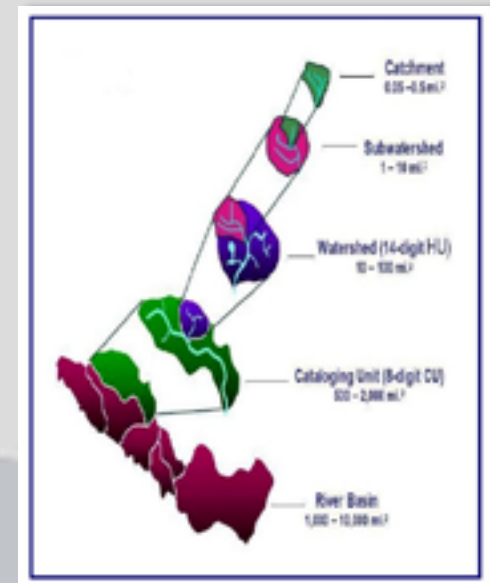
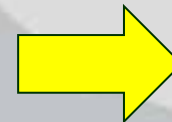
- n **Phase I: Characterization of Current Watershed Conditions**
- n Phase II: Detailed Watershed Assessment
- n Phase III: Development of Watershed Management Plan and Project Atlas
- n Phase IV: Implementation of Watershed Management Plan and Project Atlas





Phase I - Characterization of Current Watershed Conditions

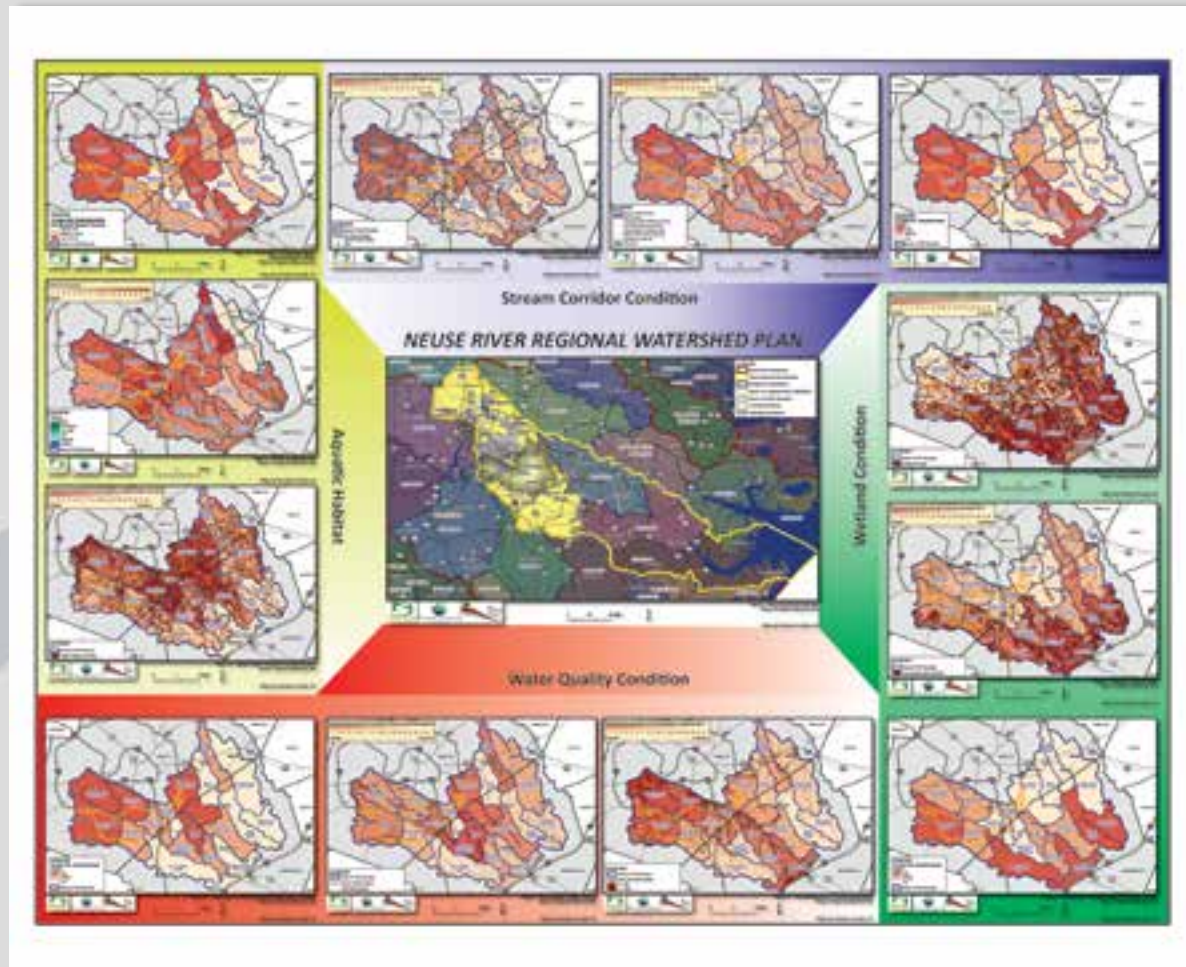
- n Remote sensing using GIS
- n Preliminary evaluation of watershed conditions
- n Preliminary identification of functional stressors/assets
- n Perform functional assessment of 18 subwatersheds
- n Identify subwatersheds for more detailed study





Prioritization of Subwatersheds

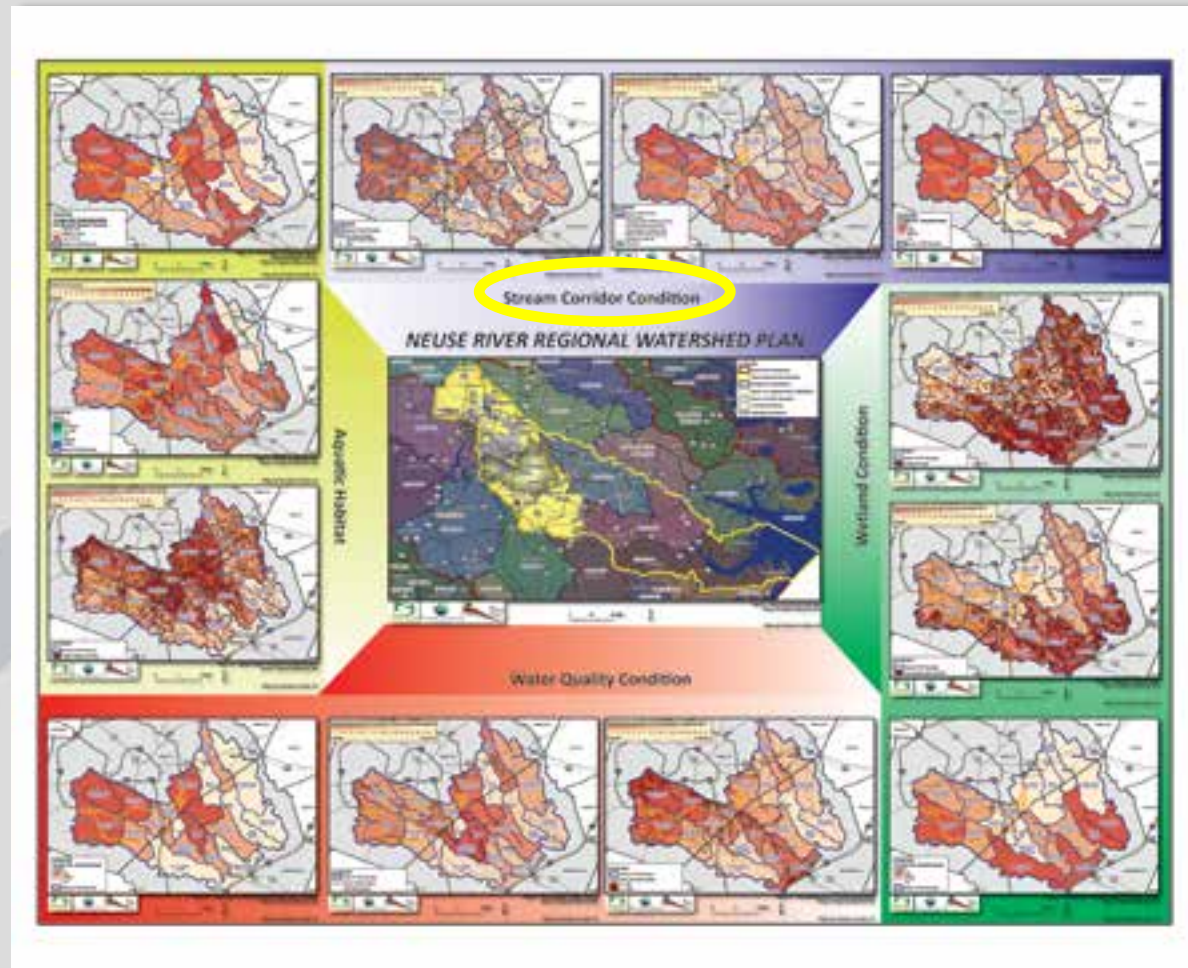
- n Four functional categories
 - n Stream corridor condition
 - n Wetland condition
 - n Water quality
 - n Presence of important habitats





Prioritization of Subwatersheds

- n Four functional categories
 - n **Stream corridor condition**
 - n Wetland condition
 - n Water quality
 - n Presence of important habitats





Stream Corridor Condition - Stream Buffers

- n Functions of Vegetated Buffers
 - n Reduce pollutant loading by filtering stormwater runoff
 - n Stabilize stream banks
 - n Provide shade to reduce water temperatures
 - n Provide habitat structure



Stream Buffer Condition – No Buffer





Stream Buffer Condition – No Buffer





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Methodology

Stream Buffer Condition Analysis



Don't fear the raster world:

“I'm just a caveman...your world
frightens and confuses me”





Software

- n ESRI ArcMap 10.1
- n Spatial Analyst





GIS Datasets

- n Vector

- n National Hydrography Dataset (NHD) 24K layer from USGS

- n Raster

- n National Land Cover Database 2006 (NLCD)



Stream Buffer Classifications

- n Characterize stream buffers using the following classifications based on a 50 foot buffer width:
 - n **No buffer** à no buffer either side
 - n **Minimal buffer** à < 50 feet both sides
 - n **Adequate buffer** à > 50 feet on one side
 - n **Good buffer** à > 50 feet both sides
 - n **Exceptional buffer** à > 200 feet both sides



Stream Buffer Classifications

- n Characterize stream buffers using the following classifications based on a 50 foot buffer width:
 - n **No buffer** à no buffer either side
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GOAL à ATTRIBUTED NHD VECTOR LAYER

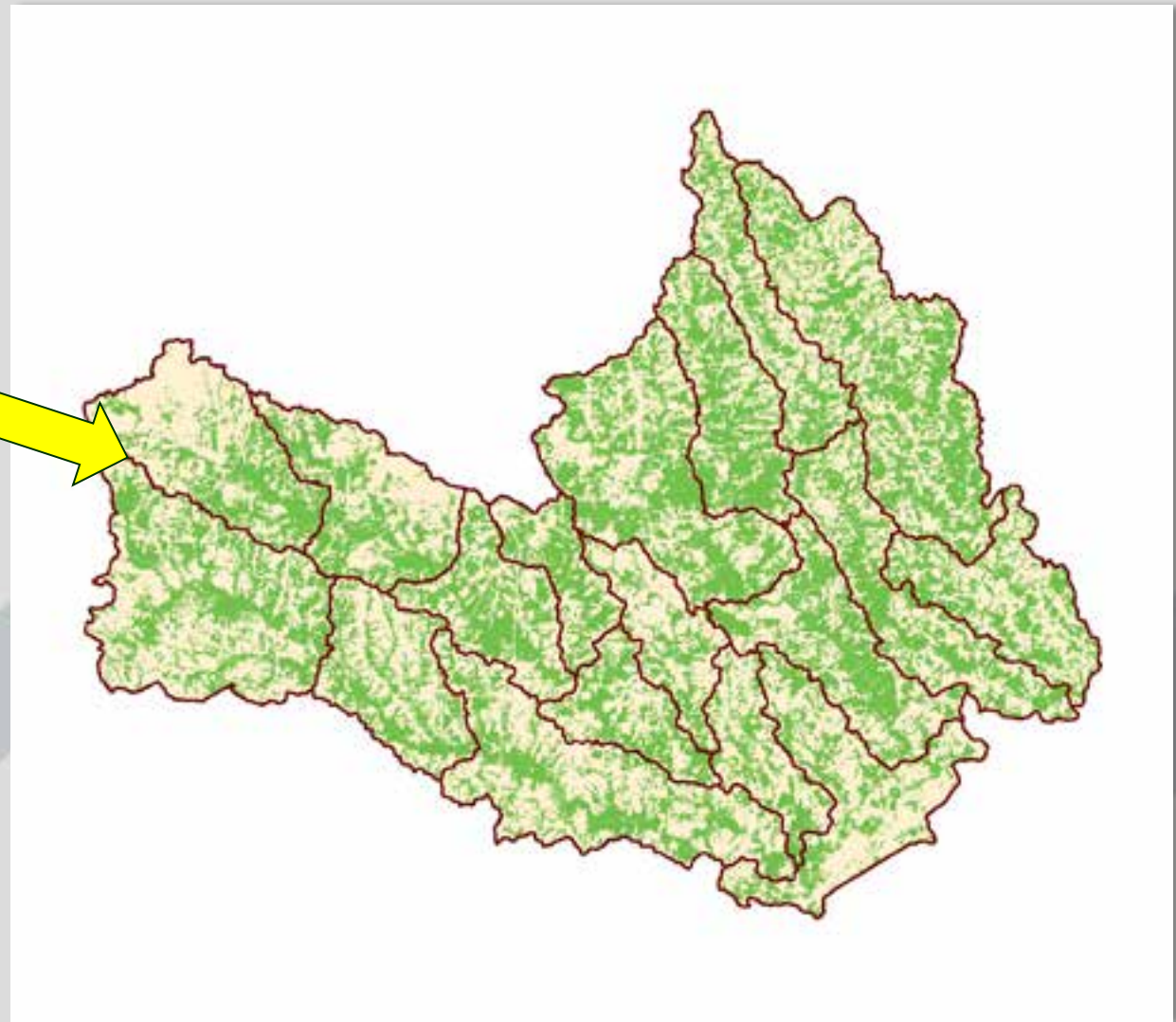
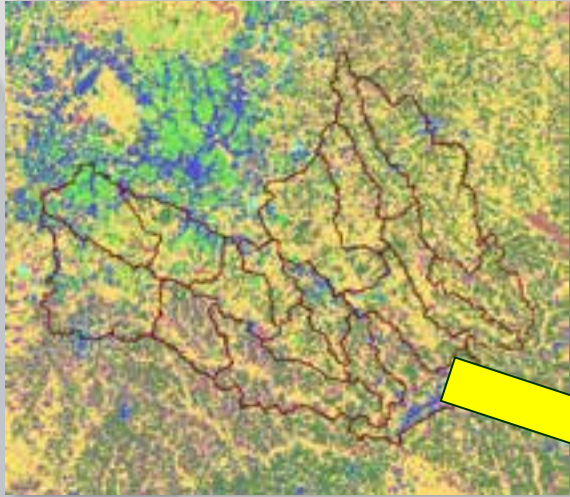


Reclass 2006 NCLD (Buffer/No Buffer)

- n Intact buffer classes (assigned value of 1)
 - n Undeveloped, primarily forested land cover classes associated with well established buffers
- n Denuded buffer classes (assigned value of 0)
 - n Low to high density developed lands
 - n Open space
 - n Pastureland
 - n Agricultural land



Reclass 2006 NCLD (Buffer/No Buffer)



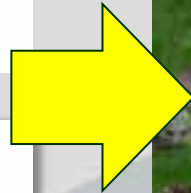
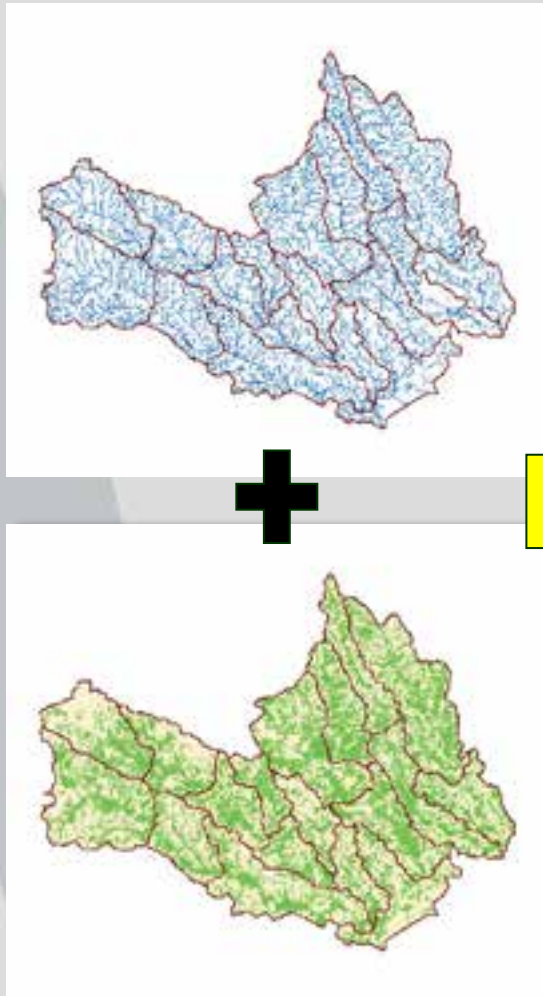


Unioned Merged NHD to Buffer Raster

- n Created shorter stream segments from which to calculate and report buffer width
 - n Attributed with unique ID to which buffer classifications will be joined
- n Buffer width values measured along these shorter stream segments were more consistently uniform

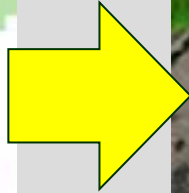


Union Merged NHD to Buffer Raster



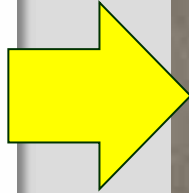
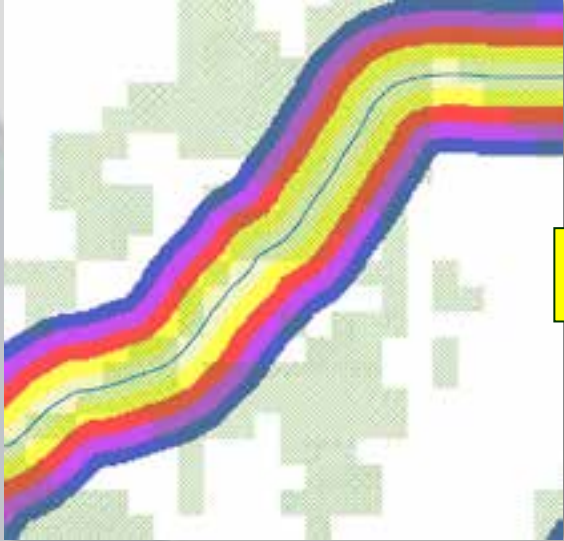


Union Merged NHD to Buffer Raster



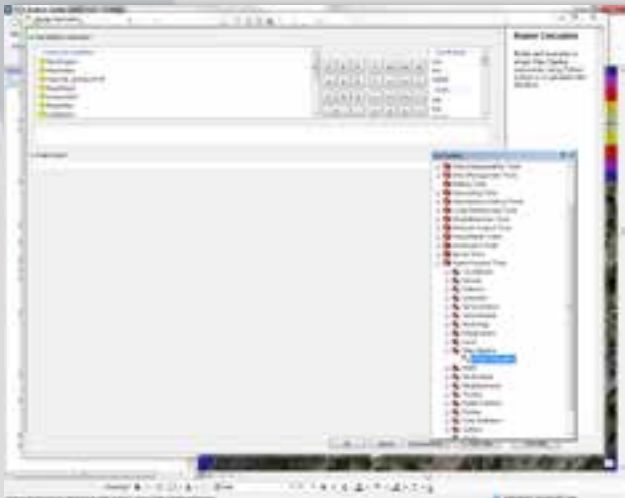
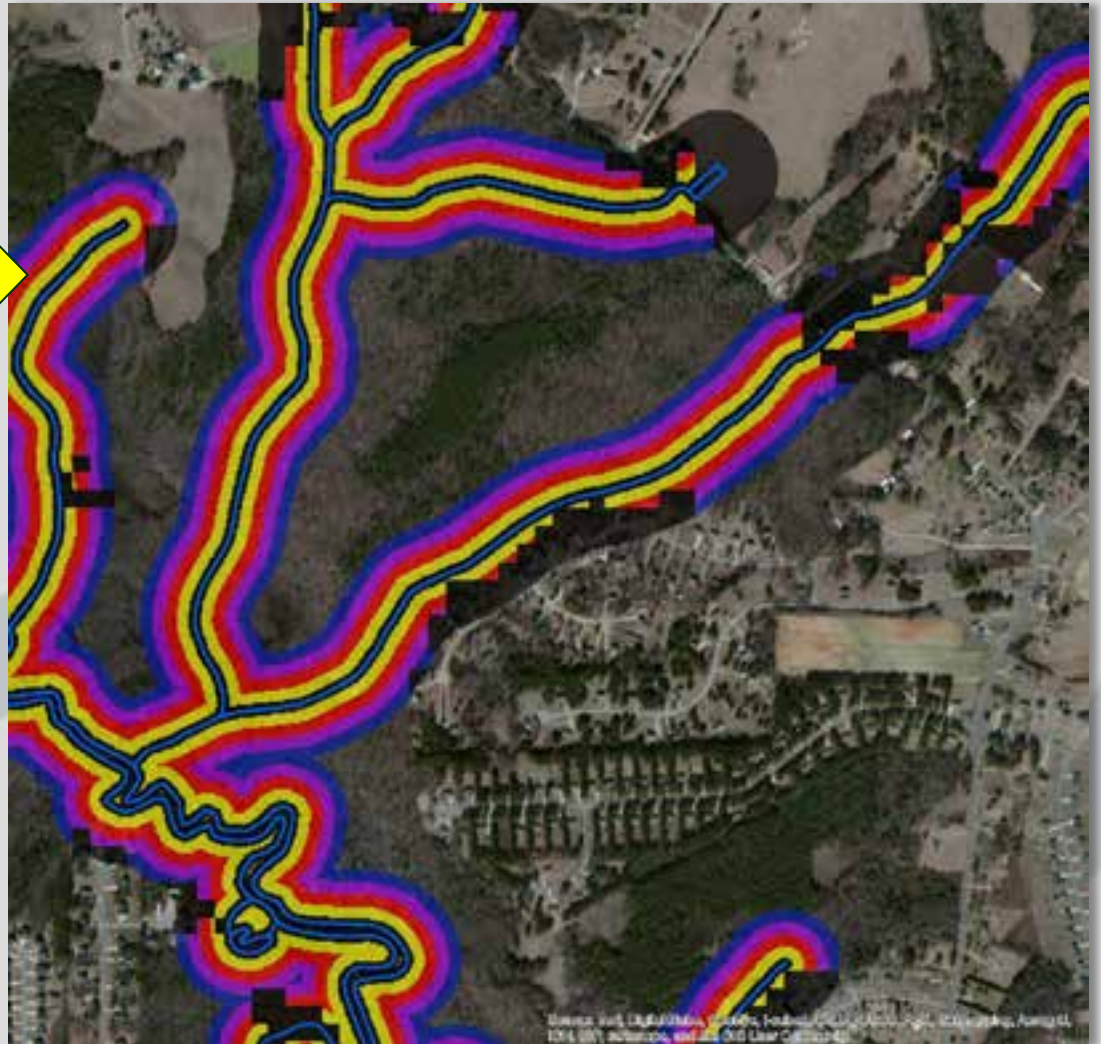
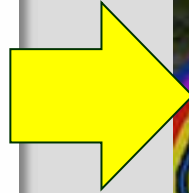
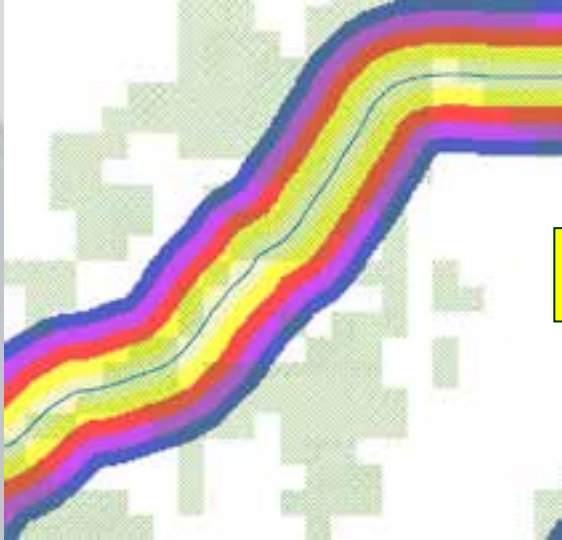


Measure Buffer Width – Euclidean Distance





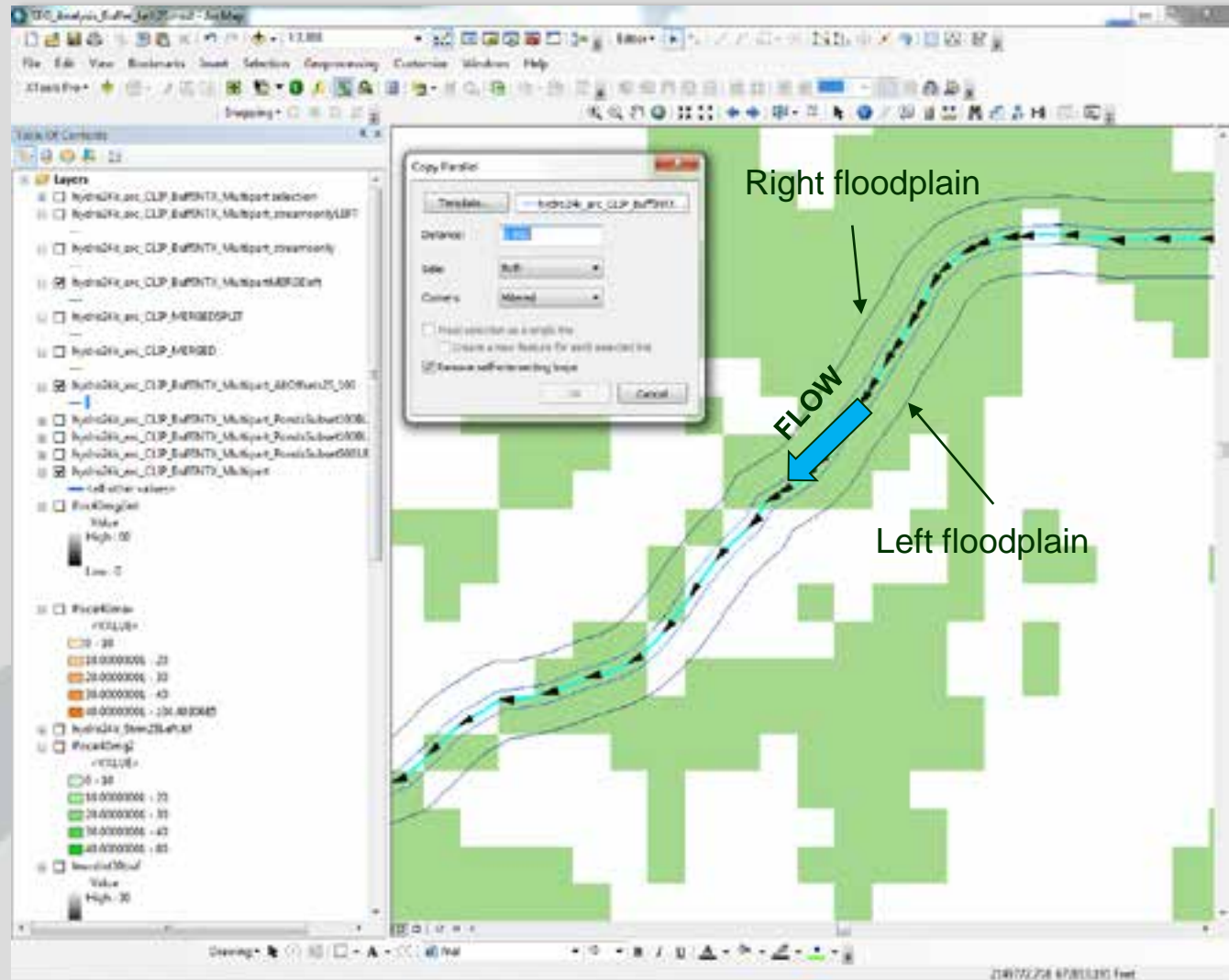
Measure Buffer Width – Raster Calculator (X)





Copy Parallel - NHD Centerline

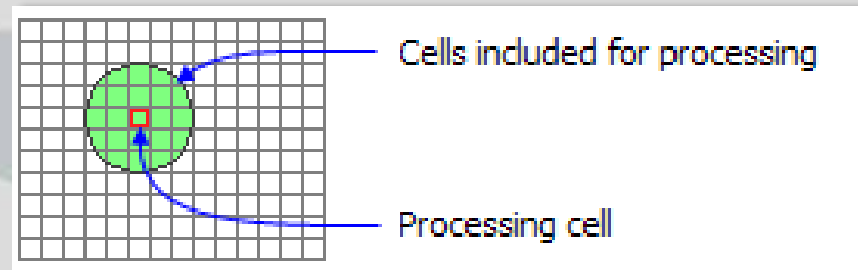
- n Enables measurement of buffer width along both floodplains independently
- n Left/Right copied parallel segments retain unique ID of centerline





Measure Buffer Width Range – Focal Statistics

- n Ran Focal Statistics on Euclidean distance buffer width raster
- n Measured buffer along left/right floodplains independently using a raster analysis mask per floodplain:
 - n Range
 - n Circle





Measure Buffer Width Range – Focal Statistics





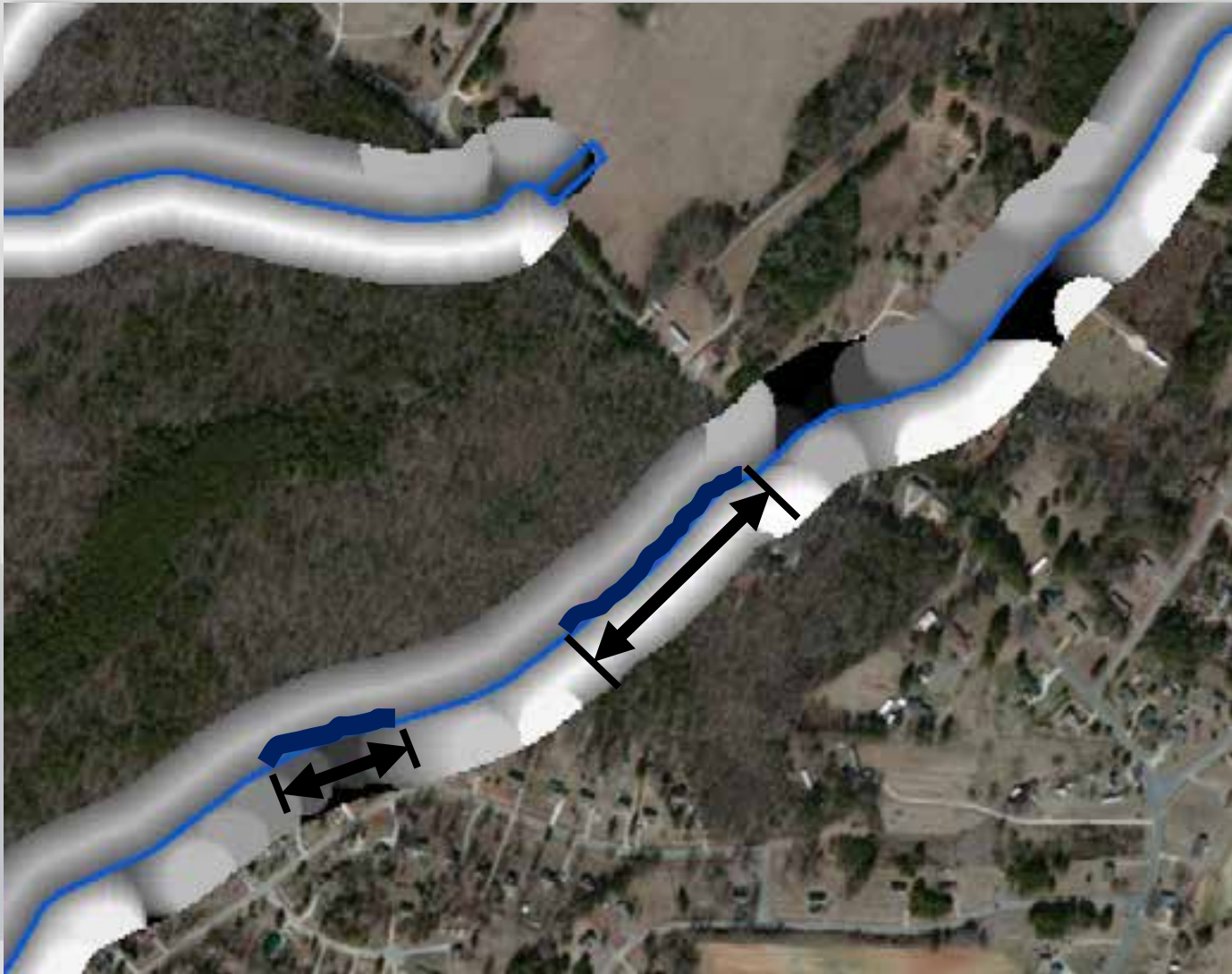
Zonal Tabular Statistics

- n For both left/right floodplain buffer width measurements
- n Used unique IDs of left/right floodplane polylines as zone (originally from the NHD layer)
- n Joined left/right floodplain zonal statistics tables to NHD centerline layer using these unique IDs





Zonal Tabular Statistics - Majority





Zonal Tabular Statistics

Rowid	VALUE*	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM	VARIETY	MAJORITY	MINORITY	MEDIAN
1	0	7	700	0	0	0	0	0	0	1	0	0	0
2	1	9	900	72	134	62	102.2222	19.81457	920	9	72	72	102
3	2	4	400	50	63	13	56	4.949748	204	4	50	50	53
4	3	15	1500	0	50	50	26.66667	72.11693	450	6	50	10	30
5	4	1	100	50	50	0	50	0	50	1	50	50	50
6	54	15	1500	10	90	80	43.46667	24.30227	652	12	10	14	42
7	55	7	700	31	70	39	45.00007	13.37494	348	7	31	36	42
8	56	15	1500	50	100	50	67.52174	13.43218	1053	12	50	58	64
9	59	24	2400	0	150	150	66.70834	51.96253	1937	23	0	10	72
10	60	58	5800	14	85	71	83.5	20.19238	3883	19	78	14	72
11	61	82	8200	0	100	100	34.37805	19.36667	2618	19	28	60	36
12	62	226	22600	0	84	84	17.24779	31.47271	3896	28	0	20	0
13	63	520	52000	0	141	141	7.955769	26.92911	4137	37	0	14	0
14	94	35	3500	84	100	16	91.94286	2.672001	3218	6	92	84	92
15	115	30	3000	85	117	32	113.1333	8.22084	3394	7	117	85	117
16	121	637	63700	0	206	206	27.27747	86.28194	14848	31	0	63	0
17	123	525	52500	0	127	127	1.139048	10.23727	596	8	0	53	0
18	125	450	45000	0	209	209	7.36	37.26204	3312	8	0	155	0
19	127	7	700	197	203	6	201	2	1407	4	202	197	202
20	128	2	200	141	141	0	141	0	282	1	141	141	141
21	129	11	1100	199	206	7	202.7273	2.799055	2230	4	208	203	202
22	130	45	4500	20	72	52	47.75555	16.16852	2149	12	41	20	41
23	131	217	21700	86	206	100	190.7235	25.14542	41387	30	200	98	200
24	132	28	2800	136	186	50	164.7143	13.67703	4612	15	180	136	165
25	133	212	21200	0	0	0	0	0	0	1	0	0	0
26	136	555	55500	0	0	0	0	0	0	1	0	0	0
27	137	1027	102700	0	202	202	3.059296	24.3284	3142	6	0	194	0
28	140	3	300	0	10	10	3.333333	4.714045	50	2	0	10	0
29	141	27	2700	90	180	90	152.5926	38.64296	4120	6	180	130	180
30	142	21	2100	70	70	0	70	0	5470	1	70	70	70
31	144	363	36300	0	50	50	0.2506887	3.384533	91	3	0	41	0
32	145	305	30500	0	0	0	0	0	0	1	0	0	0
33	150	8	800	141	160	19	153	6.5	1224	5	160	141	150
34	151	5	500	134	141	7	139	2.529622	695	3	140	134	140
35	154	3	300	0	10	10	6.666667	4.714045	20	2	10	0	10
36	155	13	1300	192	205	13	199.2308	4.097914	2590	6	196	192	199
37	156	36	3600	95	205	107	165.6309	30.62942	6683	13	197	98	197
38	161	15	1500	67	67	0	67	0	1005	1	67	67	67
39	162	12	1200	177	177	0	177	0	2124	1	177	177	177
40	163	24	2400	67	167	100	92.41666	30.07895	2216	10	80	72	80
41	184	21	2100	80	141	61	99.28571	19.94789	2085	9	80	84	98
42	185	25	2500	176	200	24	196.92	6.858105	4923	9	202	176	199
43	166	18	1800	64	64	0	64	0	1824	1	64	64	64


RANGE

MAJORITY





Buffer Width Classification Attribution

- n Field calculator
 - n Code fields for left/right floodplain according to Majority statistic buffer width category per floodplain:
 - n 0' buffer width = 0
 - n 1' – 49' buffer width = 1
 - n > 50' buffer width = 2
- 
 - n **No buffer** à no buffer either side
 - n **Minimal buffer** à < 50 feet both sides
 - n **Adequate buffer** à > 50 feet on one side
 - n **Good buffer** à > 50 feet both sides
 - n **Exceptional buffer** à > 200 feet both sides



Buffer Width Classification Attribution

n Sum left/right floodplain coded values:

n $0 (0 + 0) =$

n **no buffer on either side**

n $1 \text{ or } 2 (0 + 1 \text{ or } 1 + 1) =$

n **minimal buffer on both sides (<50 feet)**

n $2 \text{ or } 3 (2 + 1 \text{ or } 2 + 0) =$

n **adequate buffer on one side (>50 feet on one side)**

n $4 (2 + 2) =$

n **good buffer on both sides (>50 feet)**



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MAJOR_R50	MINOR_R50	MEDIAN_R50	MAJOR_L50	MINOR_L50	MEDIAN_L50	RMAJCODE50	LMAJCODE50	MAJCDSUM50	BUFWIDTH50
0	0	0	0	0	0	0	0	0	No Buffer (on either side)
0	10	10	0	10	0	0	0	0	No Buffer (on either side)
0	10	10	0	10	14	0	0	0	No Buffer (on either side)
0	0	0	0	10	0	0	0	0	No Buffer (on either side)
0	0	0	20	20	20	0	1	1	Minimal Buffer (<50 feet both sides)
10	14	10	20	14	20	1	1	2	Minimal Buffer (<50 feet both sides)
31	28	31	0	14	14	1	0	1	Minimal Buffer (>50 feet both sides)
0	10	0	0	10	0	0	0	0	No Buffer (on either side)
0	20	0	0	10	0	0	0	0	No Buffer (on either side)
0	0	0	0	0	0	0	0	0	No Buffer (on either side)
50	20	42	22	20	22	2	1	3	Adequate Buffer (>50 feet one side)
53	30	53	53	30	53	2	2	4	Adequate Buffer (>50 feet both sides)
0	44	0	0	10	0	0	0	0	No Buffer (on either side)
0	0	0	0	0	0	0	0	0	No Buffer (on either side)
0	0	0	0	0	0	0	0	0	No Buffer (on either side)
56	56	56	50	50	50	2	2	4	Adequate Buffer (>50 feet both sides)
53	44	53	53	41	53	2	2	4	Adequate Buffer (>50 feet both sides)
41	22	36	53	58	53	2	2	4	Adequate Buffer (>50 feet one side)
50	36	50	50	14	50	2	2	4	Adequate Buffer (>50 feet both sides)
0	0	0	0	0	0	0	0	0	No Buffer (on either side)
0	0	0	0	0	0	0	0	0	No Buffer (on either side)
0	0	0	0	0	0	0	0	0	No Buffer (on either side)
10	10	10	60	50	60	1	2	3	Adequate Buffer (>50 feet one side)
60	53	50	10	14	20	2	1	3	Adequate Buffer (>50 feet one side)
50	42	50	44	36	44	2	1	3	Adequate Buffer (>50 feet one side)
0	0	0	0	0	0	0	0	0	No Buffer (on either side)
0	0	0	0	0	0	0	0	0	No Buffer (on either side)
58	31	50	60	44	58	2	2	4	Adequate Buffer (>50 feet both sides)
50	53	50	0	20	20	2	0	2	Adequate Buffer (>50 feet one side)
10	10	10	42	31	42	1	1	2	Minimal Buffer (<50 feet both sides)
20	14	20	53	50	53	1	2	3	Adequate Buffer (>50 feet one side)
50	28	50	56	14	56	2	2	4	Adequate Buffer (>50 feet both sides)
50	42	50	44	28	41	2	1	3	Adequate Buffer (>50 feet one side)
58	53	58	50	30	20	2	2	4	Adequate Buffer (>50 feet both sides)
53	14	53	53	14	50	2	2	4	Adequate Buffer (>50 feet both sides)
50	22	50	20	14	30	2	1	3	Adequate Buffer (>50 feet one side)
50	28	50	50	28	50	2	2	4	Adequate Buffer (>50 feet both sides)
50	36	50	50	41	53	2	2	4	Adequate Buffer (>50 feet both sides)
0	0	0	0	0	0	0	0	0	No Buffer (on either side)
53	44	50	44	10	36	2	1	3	Adequate Buffer (>50 feet one side)
28	10	28	50	53	50	1	2	3	Adequate Buffer (>50 feet one side)
56	22	53	50	28	50	2	2	4	Adequate Buffer (>50 feet both sides)
50	31	50	53	22	53	2	2	4	Adequate Buffer (>50 feet both sides)
50	20	40	60	53	60	2	2	4	Adequate Buffer (>50 feet both sides)
53	36	53	53	40	53	2	2	4	Adequate Buffer (>50 feet both sides)

RMAJ

LMAJ

RIGHT

LEFT

SUM
CODE

BUFFER
CONDITION





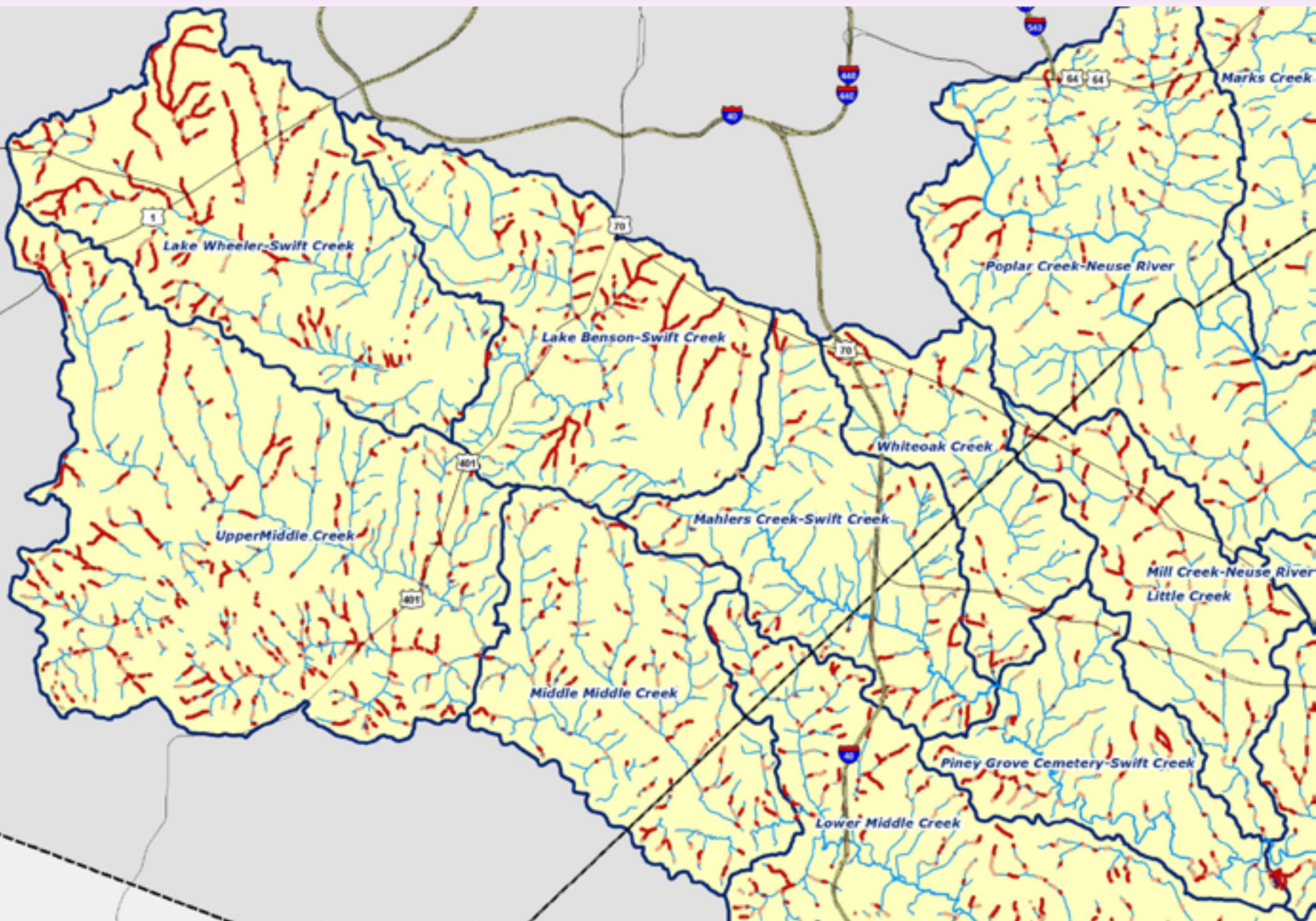
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Results

Stream Buffer Condition - Results



Stream Buffer Condition - Results



Stream Buffer Condition – Results (No Buffer)

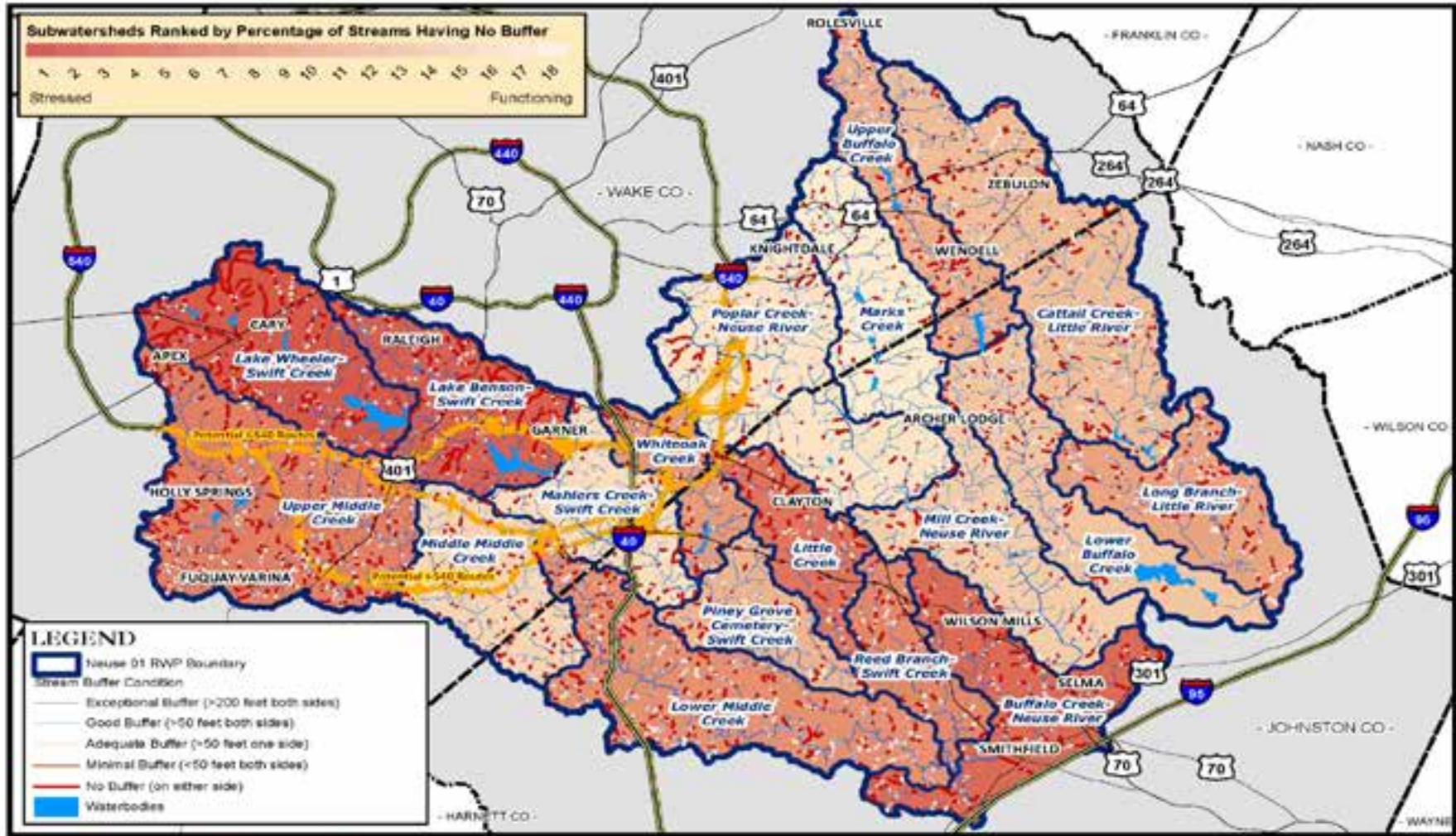


Figure 4 - Stream Buffer Condition Results
Neuse 01 Regional Watershed Plan



Stream Corridor Prioritization

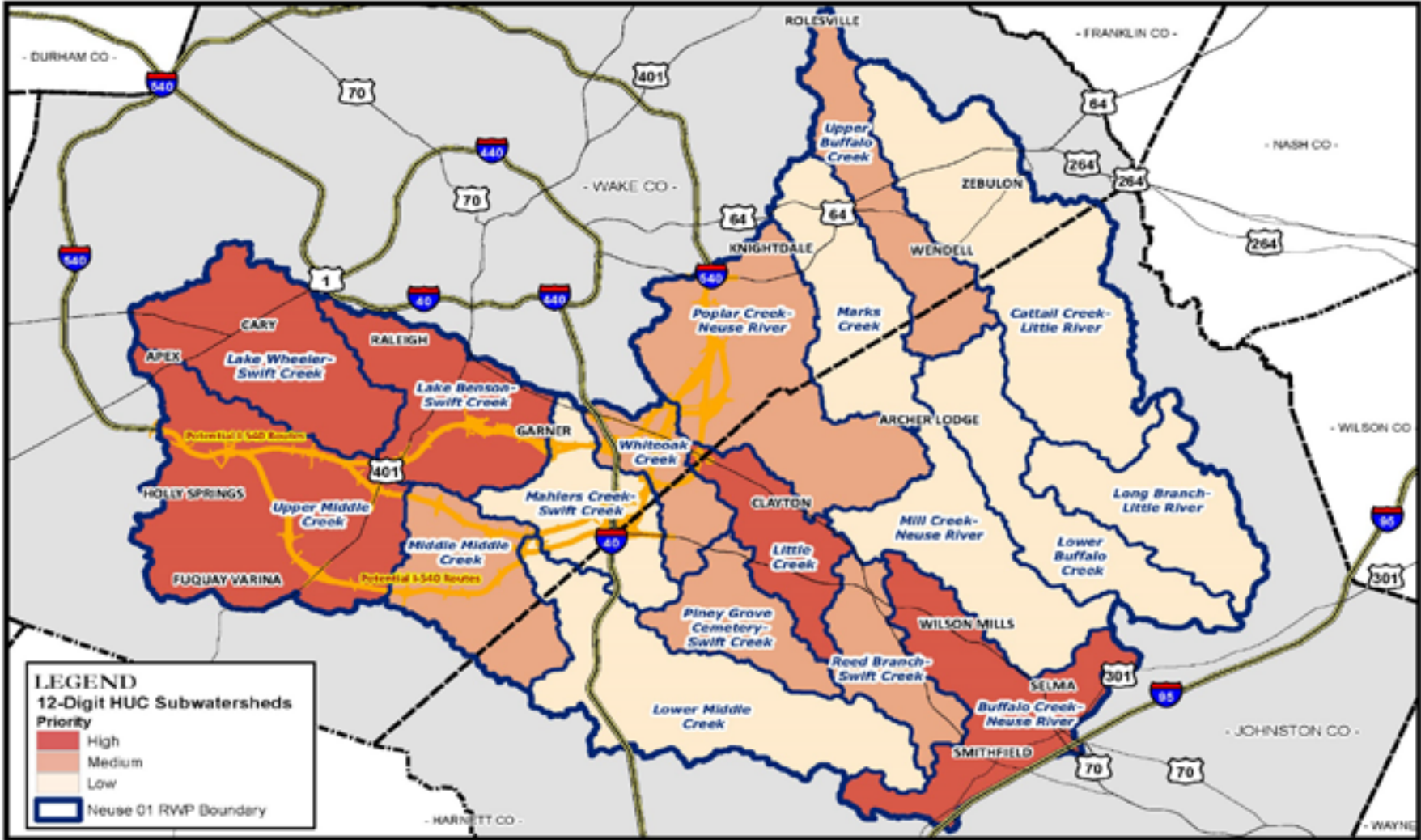
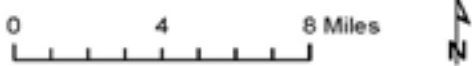


Figure 16 - Prioritization of Subwatersheds for Stream Corridor Condition
 Neuse 01 Regional Watershed Plan





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Questions?



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