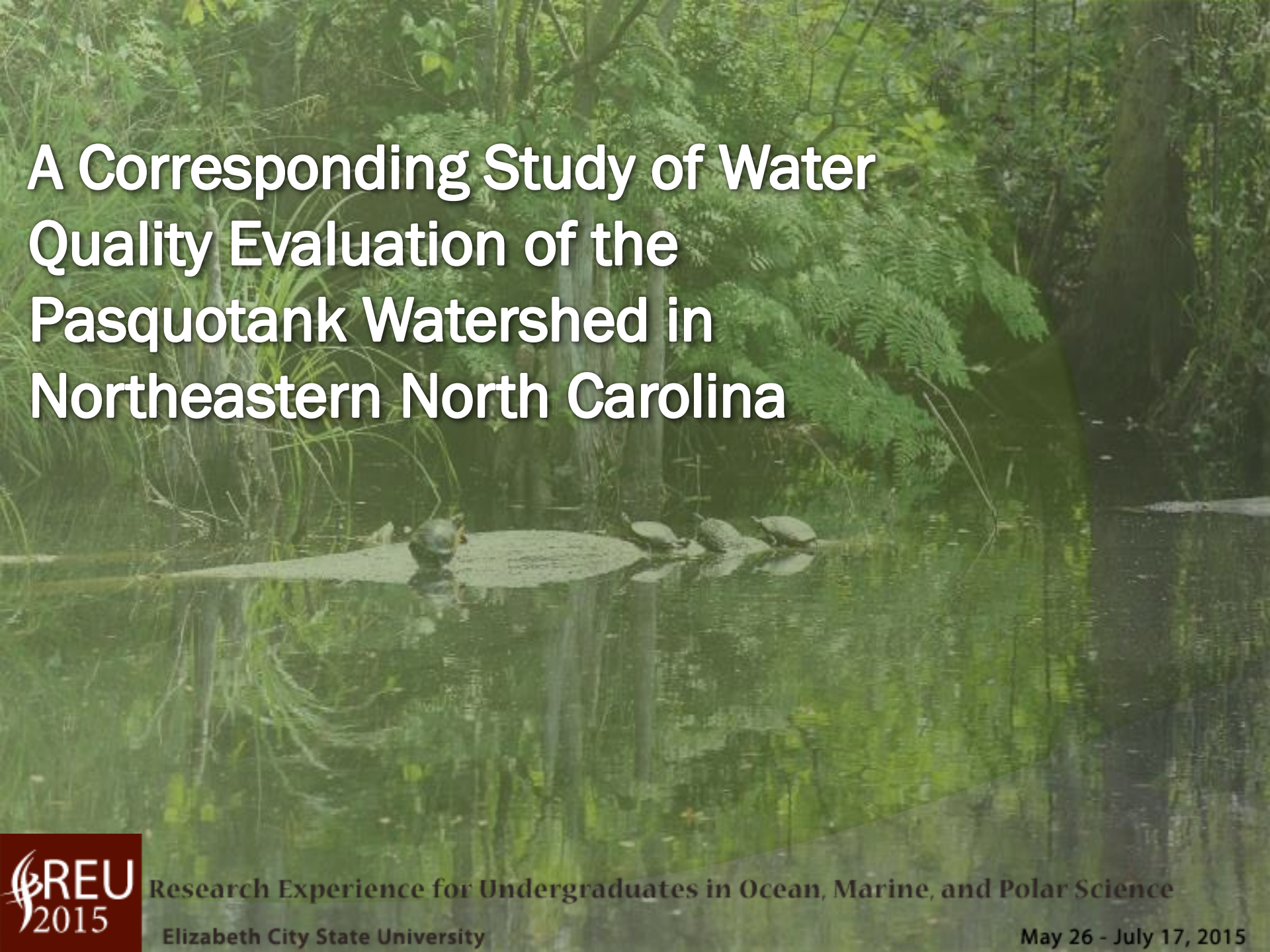
A Corresponding Study of Water Quality Evaluation of the Pasquotank Watershed in Northeastern North Carolina



REU 2015

Research Experience for Undergraduates in Ocean, Marine, and Polar Science

Elizabeth City State University

May 26 - July 17, 2015

2015 Water Quality Research Team

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Abstract

The Pasquotank River Watershed covers over 450 square miles and is located in the Coastal Plain of northeastern North Carolina. It flows from the Great Dismal Swamp at the Virginia/North Carolina border into the Albemarle Sound. The watershed is part of the Albemarle-Pamlico Estuarine System, the second largest system in the United States after the Chesapeake Bay Estuary and provides a transition between spawning grounds and the waters of the Albemarle Sound. Forested swamp wetlands border much of the waterways. Increased agricultural and urban development has greatly affected water quality during recent years.

The 2015 Research Experience for Undergraduates Pasquotank River Watershed Team completed various tests along the tributaries and the river itself, adding to the previously gathered data from 2011, 2013, and 2014. The test points were derived during the 2011 Summer Watershed Team research project with four points added during the 2014 summer project. Results were compared with previous readings for analysis. Streams tested were the Newbegun Creek, Knobbs Creek, Areneuse Creek, Mill Dam Creek, and Sawyers Creek. These streams, along with the river, cover a large area of the watershed and provide a wide variety of shore development from swampland and farmland to industrial development.

Abstract

In-house tests on this year's samples continued to include pH, salinity, total dissolved solids, and conductivity. Air/water temperature, dissolved oxygen, wind speed/direction, and turbidity/clarity measurements were taken in the field. The results from these readings were placed into an online database where they are correlated to the location of the sample using Google Maps®.

Analysis tools were developed in order to compare the data from all years for any variations or similarities. Excel spreadsheets were developed to look more closely at individual points and tests for each point. Past projects have used a general analysis of the entire stream to determine water quality. Steps were also made to research the development of an online graphing tool for analyzing the data at individual points over several years. Test results collected were added to a database developed during the 2014-2015 academic year at Elizabeth City State University. This database was connected to a data visualization page utilizing Google Maps®.

Abstract

The results show that there were variations for the individual water quality scores, but the overall water quality score for all the tested water sources remained at a comparable level from previous years. Mill Dam Creek rose above the previous three scores of 48 (2011), 47 (2013), and 49 (2014) and achieved a medium water quality score of 57. Areneuse Creek improved in water quality with a medium water quality score of 60. Sawyers Creek became the lowest scoring waterway tested at 35. Knobbs Creek decreased from previous years with a water quality score of 42. For a fourth consecutive testing year, Newbegun Creek fell within the medium water quality range with a score of 65. Pasquotank River rose from the previous testing year's score of 35 but still remained within the bad water quality range with a score of 45. The Lower Pasquotank remained the highest scoring tributary for a second consecutive year with a score of 85.

Methodology

- Field Testing
- Lab Testing
- Data Visualization
- Water Quality Index

Test Equipment

- Mercury Thermometer
- MW600 Dissolved Oxygen Meter
- Garmin GPSMAP 60CSx (GPS)
- Secchi disk
- Skymate Wind Meter
- Tracer Pocket Tester
- Aquarium Testing Unit

Software Applications

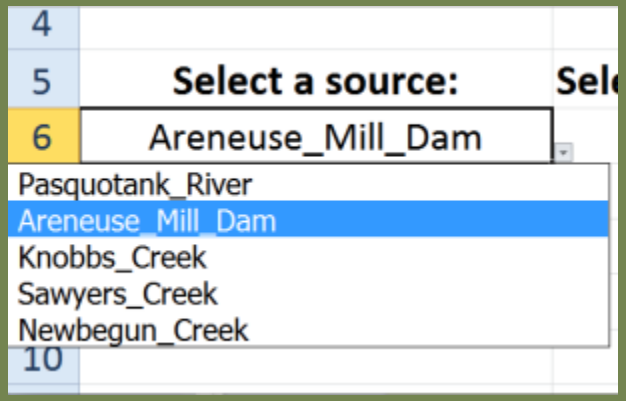
- Google Drive
- Dreamweaver
- Microsoft Excel
- Google Maps

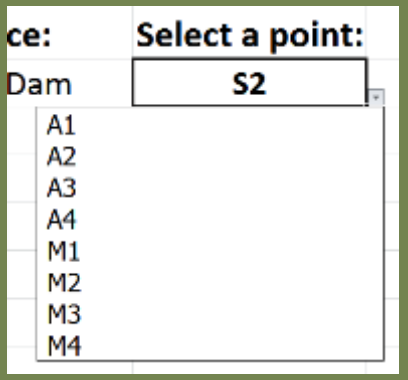
Analysis Tools

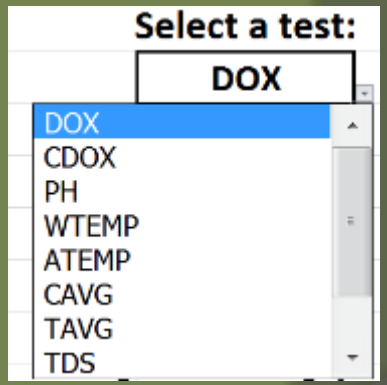
- Excel File
- Water Quality Evaluation

Excel

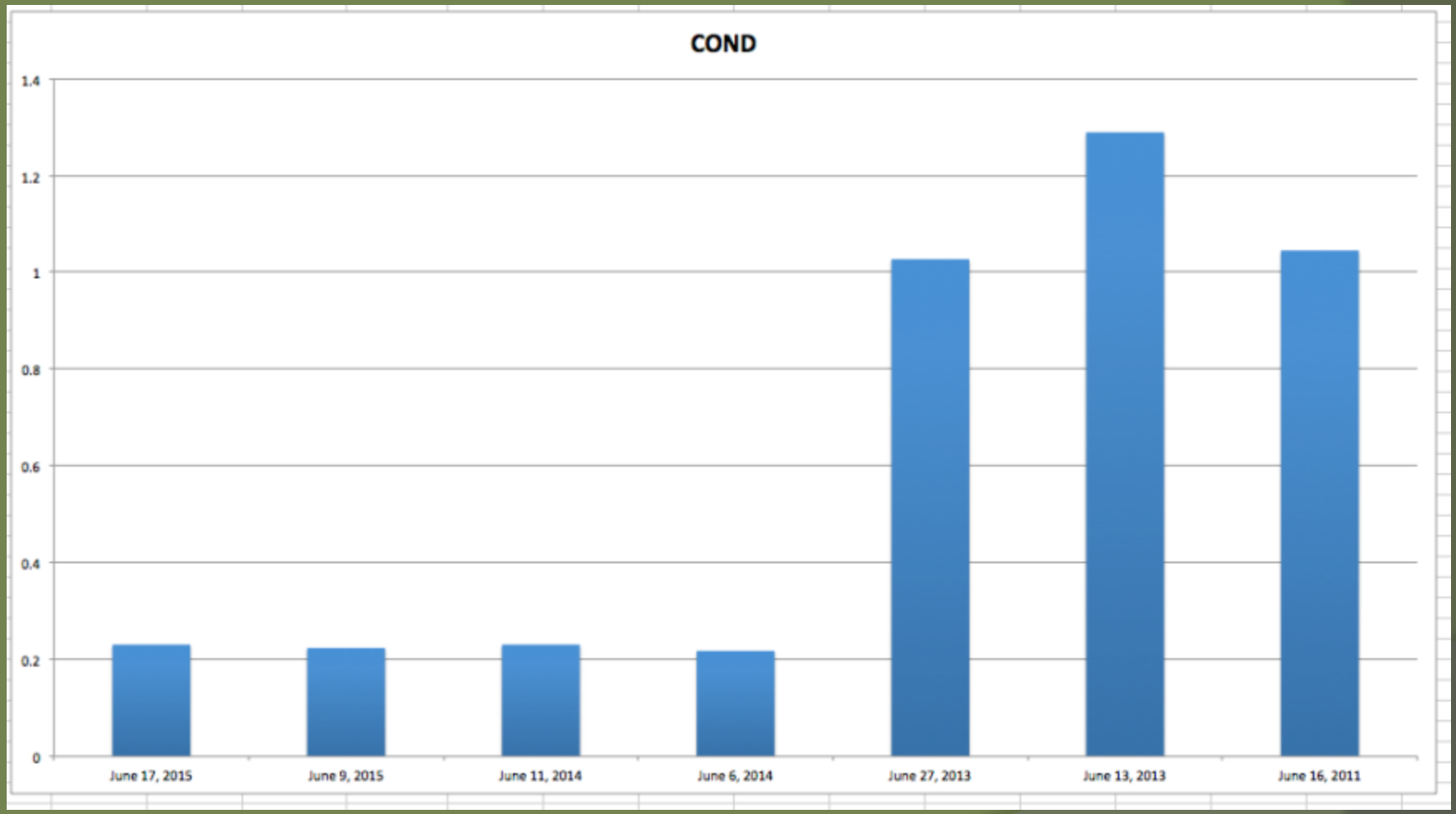
- Source
- Point
- Test







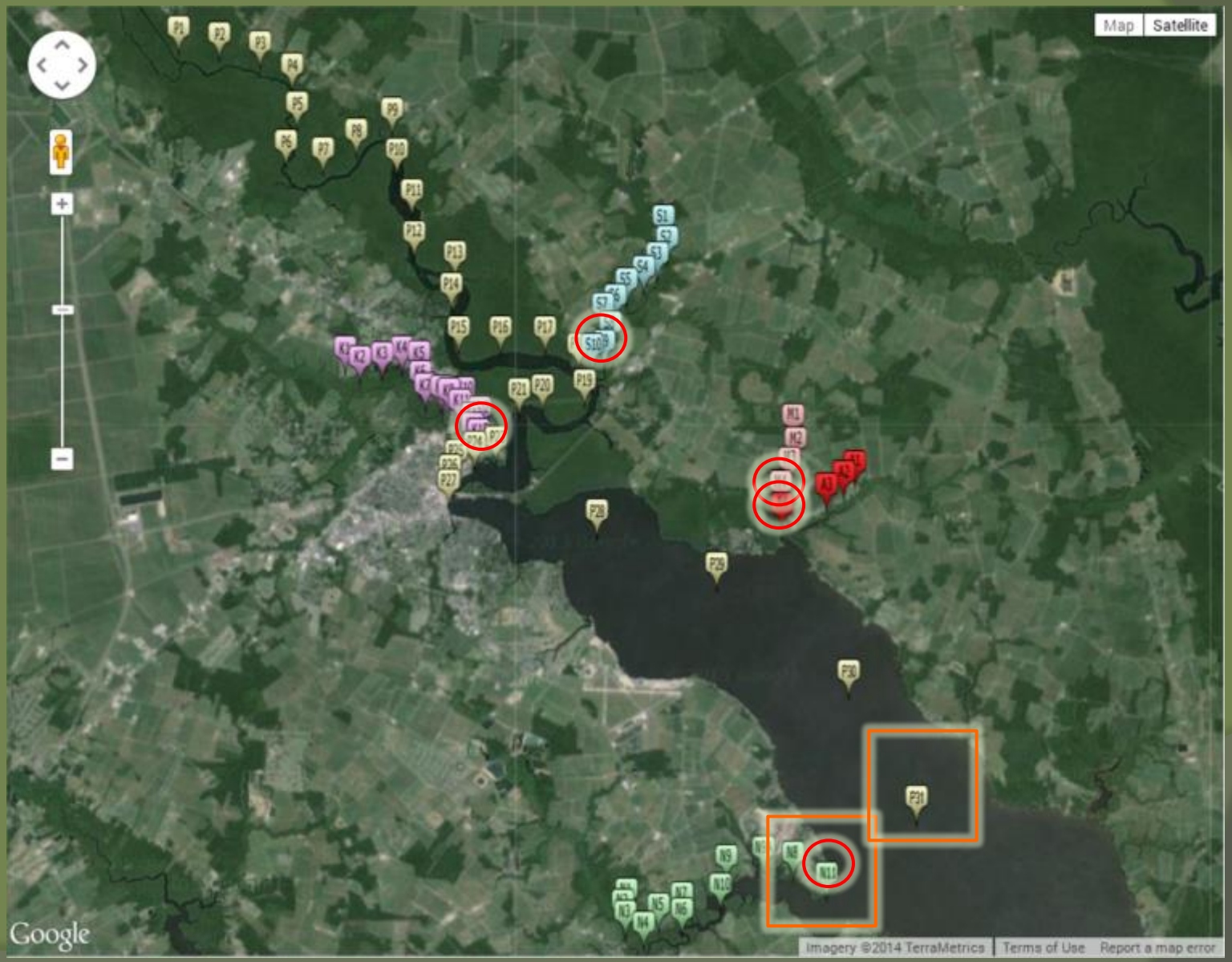
Excel


COND
1.4
1.2
1
0.8
0.6
0.4
0.2
0
June 17, 2015
June 9, 2015
June 11, 2014
June 6, 2014
June 27, 2013
June 13, 2013
June 16, 2011

Excel

- **IF**
  [**(logical_test,value_if_true,**value_if_false**)]**
- **INDEX**
  [(array, row_num, [column_num])]
- **MATCH**
  [**(lookup_value,lookup_array,**match_type**)]**
- **HLOOKUP**
  [**(lookup_value,table_array,row_index_num,**range_lookup**)]**

Variations


Map
Satellite
Google
Imagery ©2014 TerraMetrics
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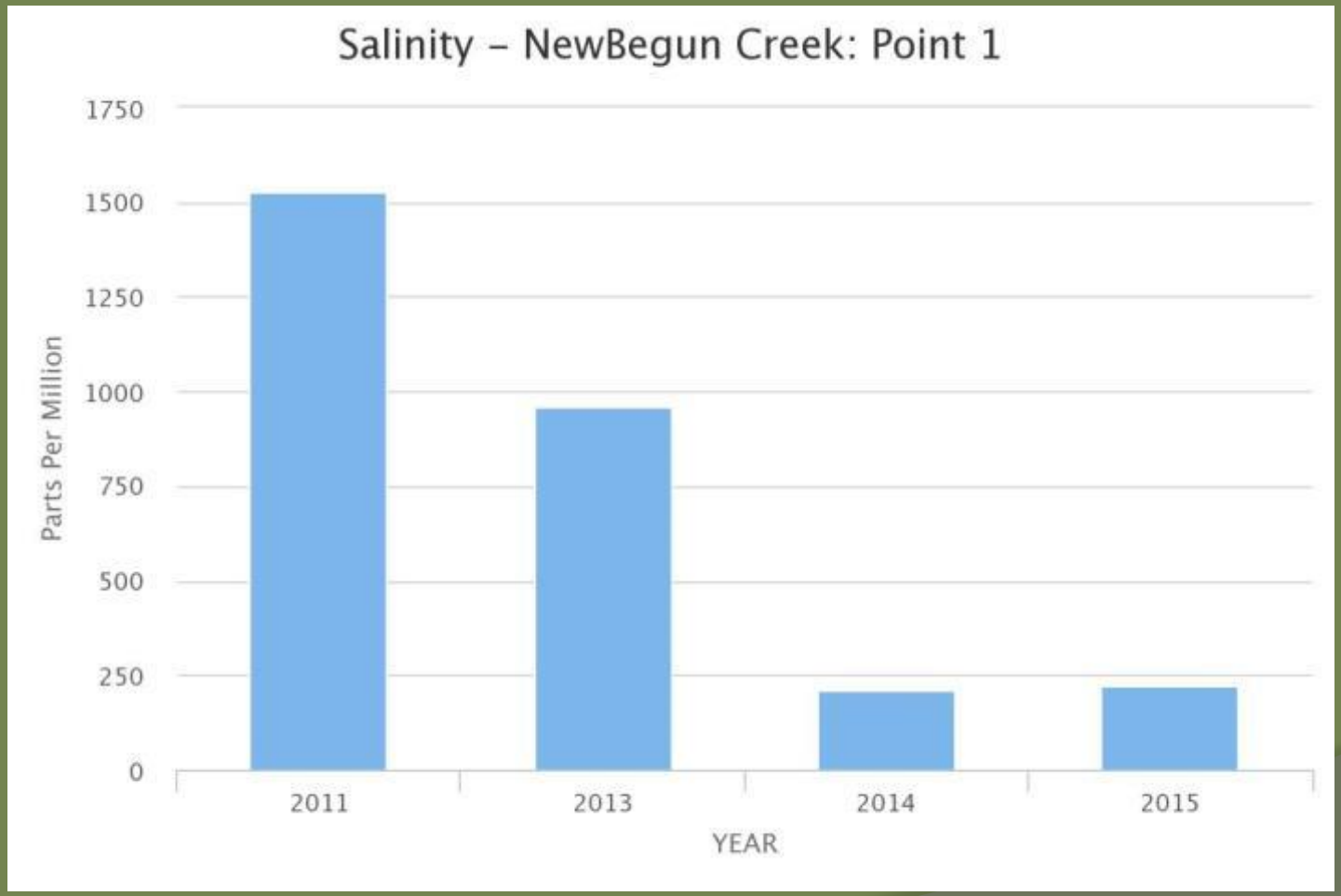
Report a map error

Online Data Visualization



Water Quality Evaluation

- Water Quality Index Calculator

Water Quality Index Calculator

Parameter	TEST RESULT	Units	Q-value	Weighting Factor	Weighting Factor	Subtotal
pH	7.45	pH units	92	0.12	0.12	11.01
Change in temp		degrees C	NM	0.11	NM	NM
DO	93.29	% saturation	96	0.18	0.18	17.31
BOD		mg/L	NM	0.12	NM	NM
Turbidity	27	NTU	55	0.09	0.09	4.96
Total Phosphorus		mg/L P	NM	0.11	NM	NM
Nitrate Nitrogen		mg/L NO3-N	NM	0.10	NM	NM
E. coli*		CFU/100 mL	NM	0.17	NM	NM
Fecal Coliforms*		CFU/100 mL	NM	0.17	NM	NM
Only use one microorganism, not fecal coliforms AND E. coli		NM = Not Measured		TOTALS:	0.39	33.28
				Water Quality Index =		85.33
				Water Quality Rating =		GOOD

Water Quality Index Scores

Water Source	2015 WQI	2014 WQI	2013 WQI	2011 WQI
Mill Dam Creek	57	49	47	48
Areneuse Creek	60	57	47	49
Sawyers Creek	35	51	50	54
Knobbs Creek	42	63	50	52
NewBegun Creek	65	59	66	50
Pasquotank River	45	35	44	64
Lower Pasquotank	85	86		

Water Quality Index Score Range

0 to 25 = Very Bad

25 to 50 = Bad

50 to 70 = Medium

70 to 90 = Good

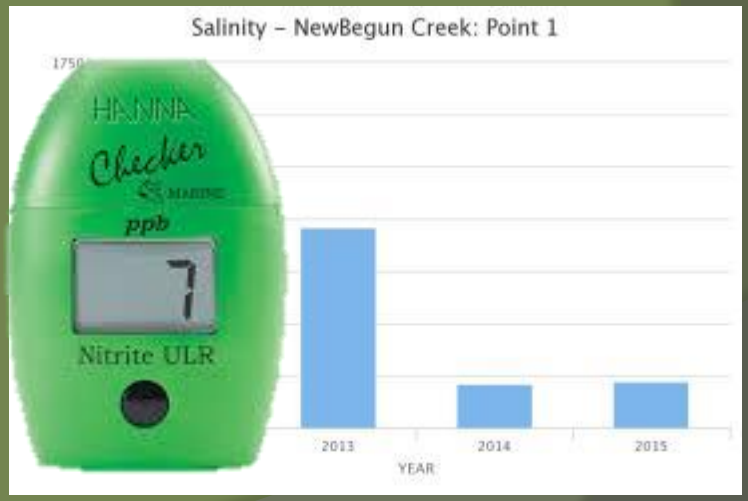
90+ = Excellent

Conclusion

- Water Quality Index
- Excel file

Future Works

- Control Company VWR Waterproof Thermometer
- Portable Turbidity Meter and Bentonite Check Meter
- Online Data Visualization
- Additional Tests
  - Nitrate
  - Change of Water Temperature



Acknowledgements

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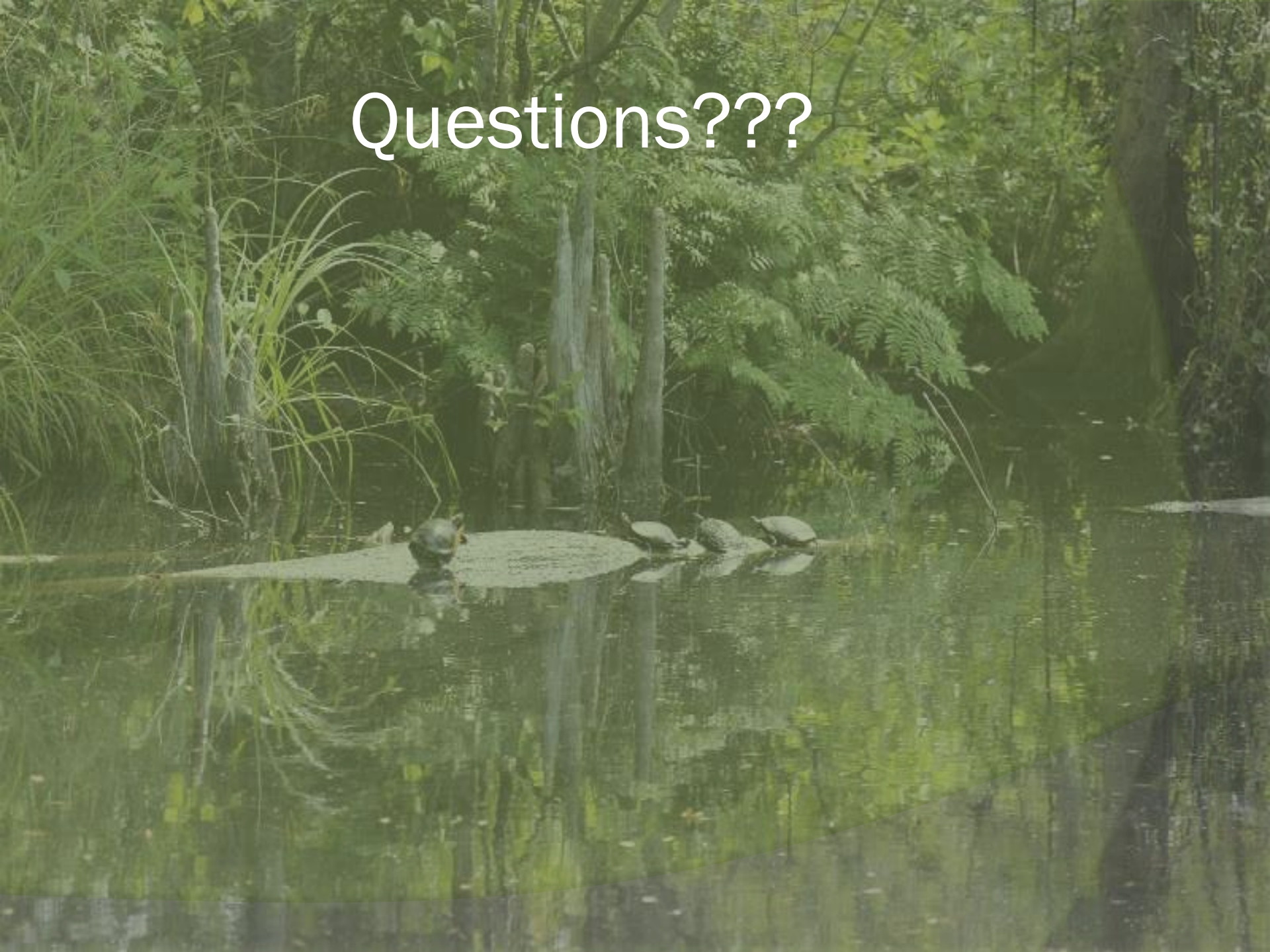
Questions???