Development of Bacterial TMDLs for Poquoson and Back Rivers in Virginia

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Public Meeting
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DEQ Virginia Department of Environmental Quality
William & Mary VIMS

Why We Are Here

1. To learn about water quality of the rivers
2. To discuss the Total Maximum Daily Load (TMDL) development
3. To gather comments and encourage public participation

Acknowledgements

Our sincere appreciation extends to…

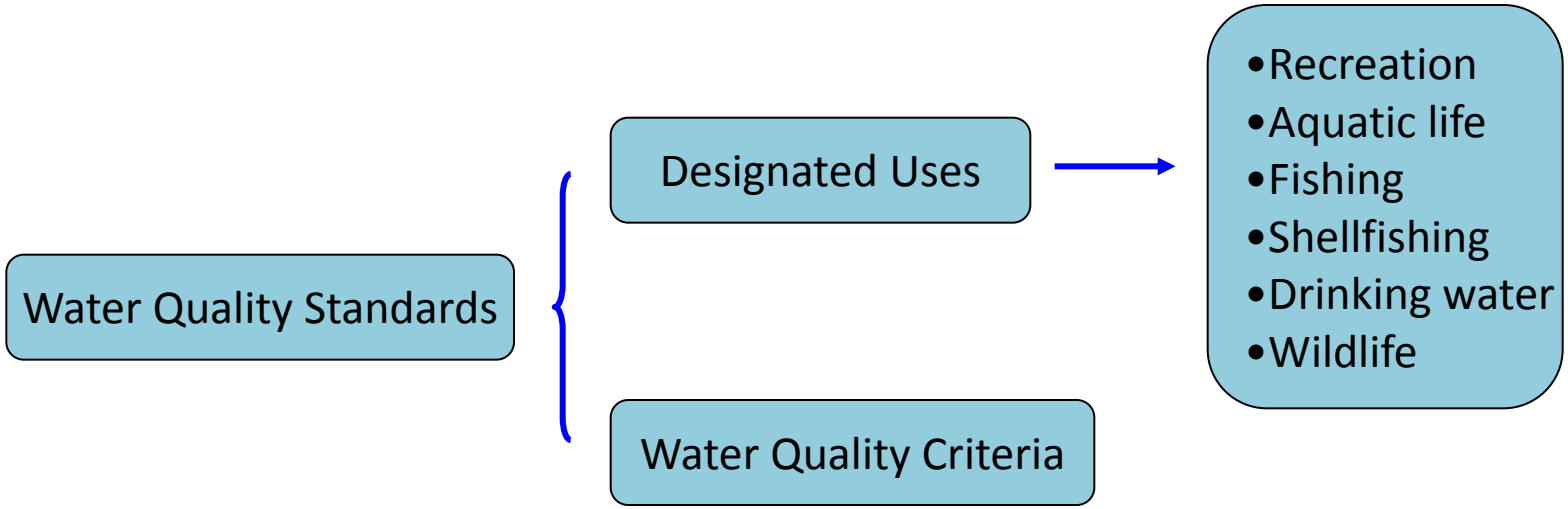
- Stakeholders contributing to the development of this TMDL by providing data, suggestions, and comments.
- Numerous individuals providing GIS data, monitoring data, public information, and answering our calls and emails
- Technical Advisory Committee members for suggestions, comments, and review of the TMDL development procedures

Outline

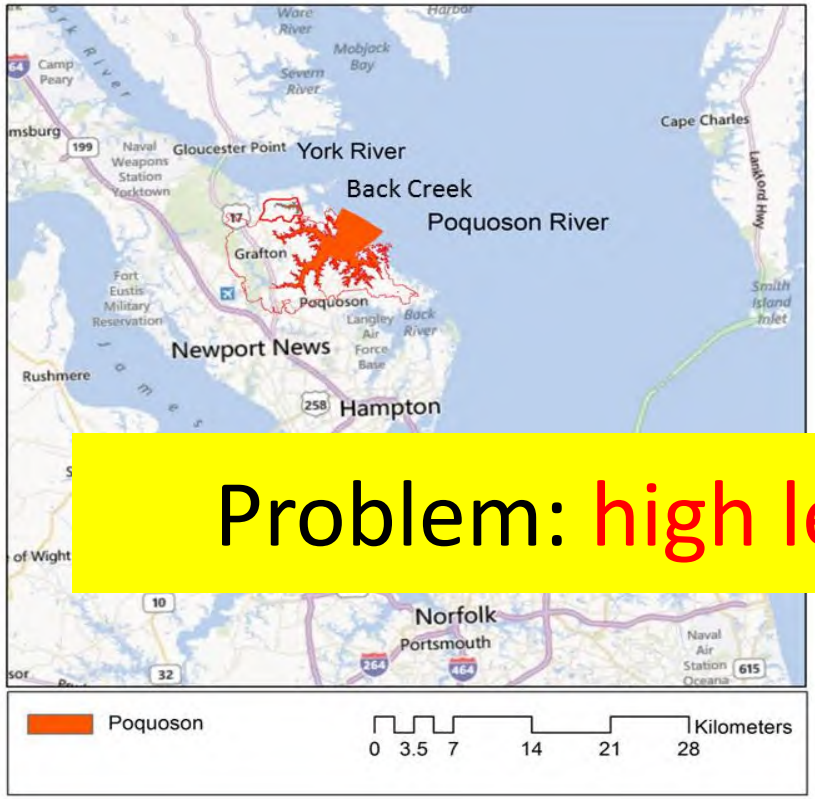
- The TMDL process
- Impaired waters and pollutants
- Procedures for pollutant source assessment
- Developed modeling approach
- TMDL results
- Comments

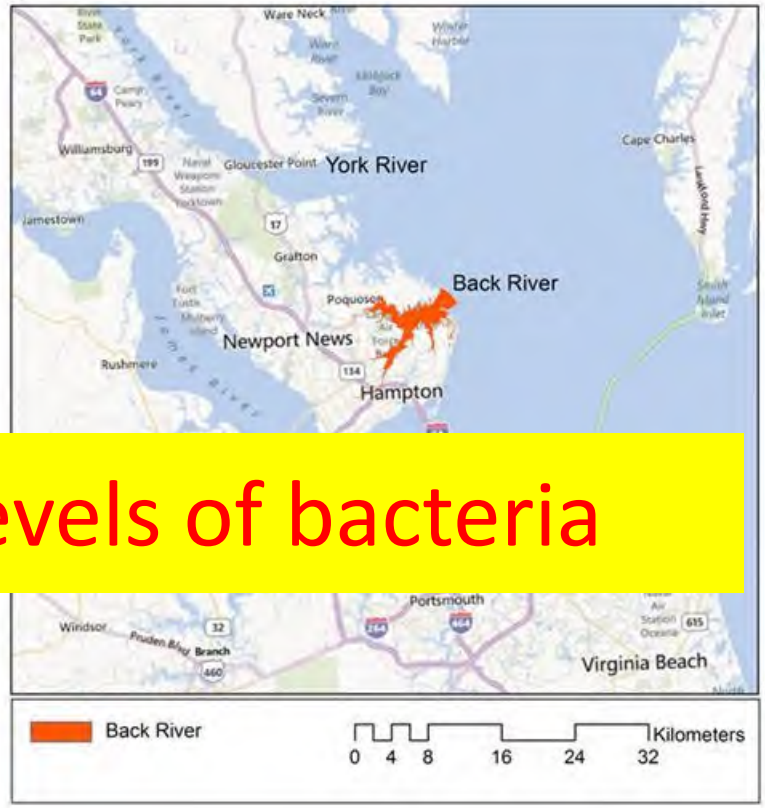
The TMDL Process

- DEQ routinely monitors the quality of waters across the state and publishes a list of impaired waters every 2 years
- Virginia is required by law to establish a TMDL for each pollutant causing an impairment
- A TMDL is the amount of a particular pollutant that a stream can receive and still meet Water Quality Standards



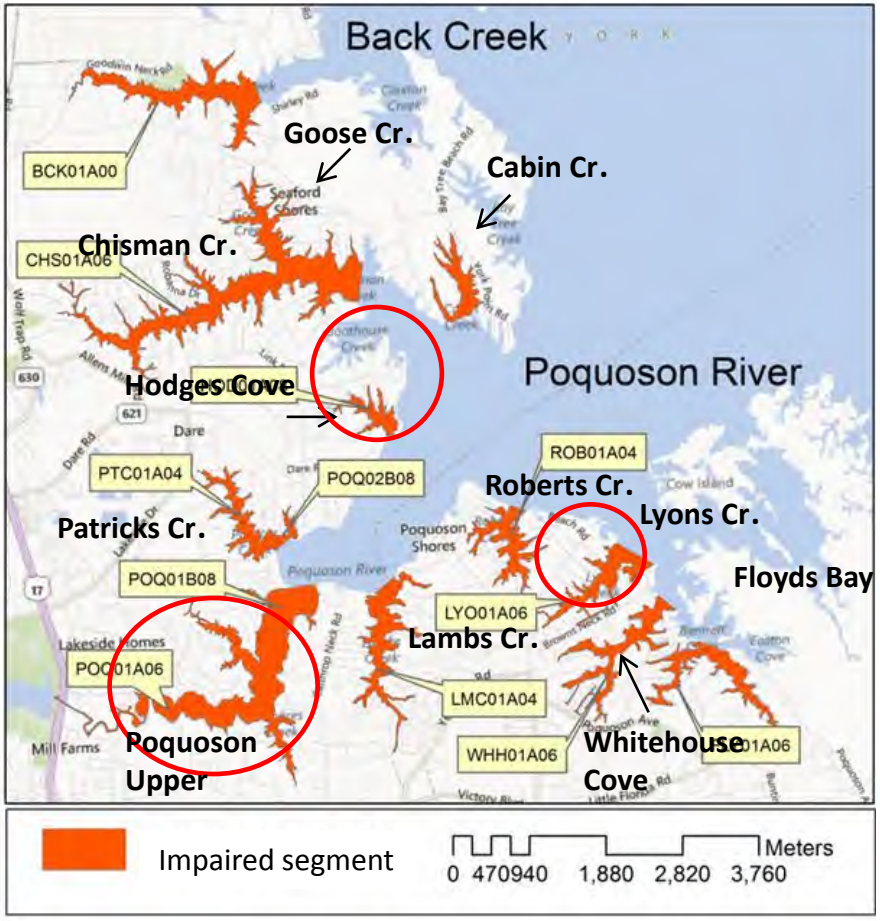
Location of Impaired Waters

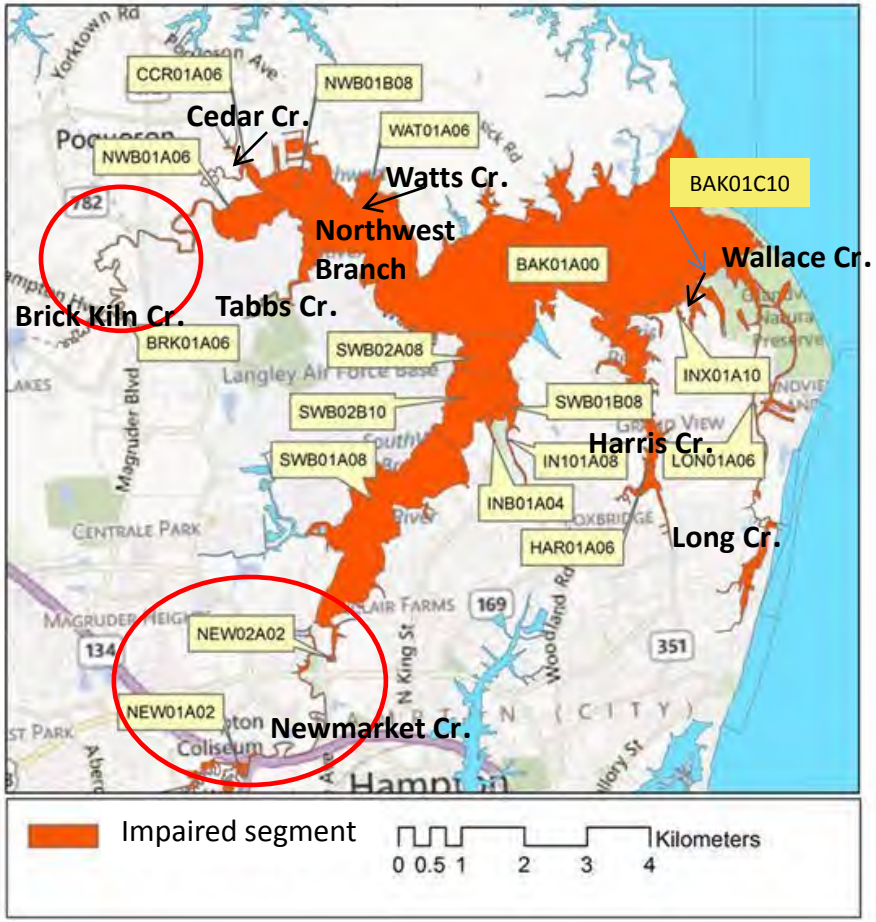




Problem: high levels of bacteria

Impaired Waters



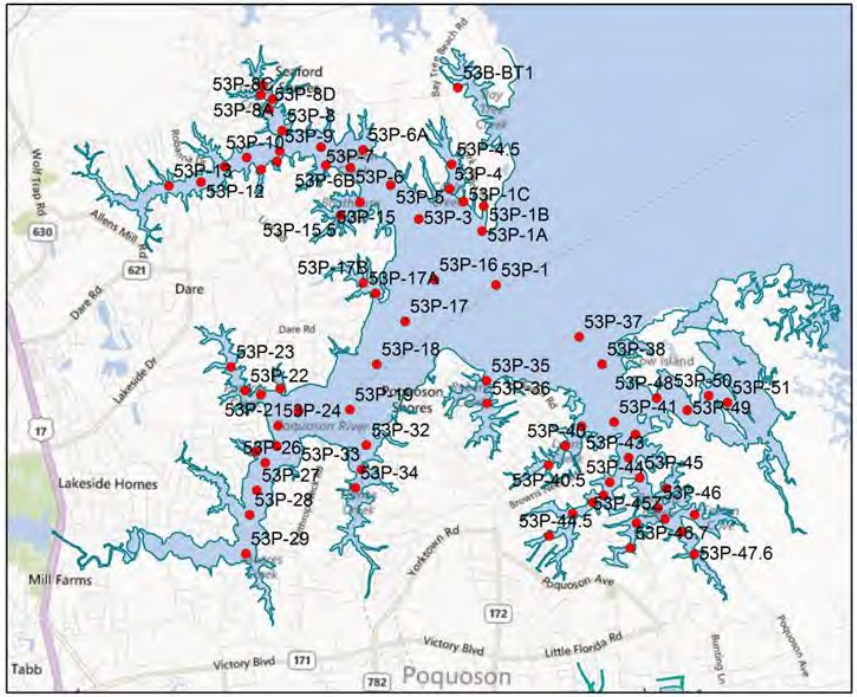


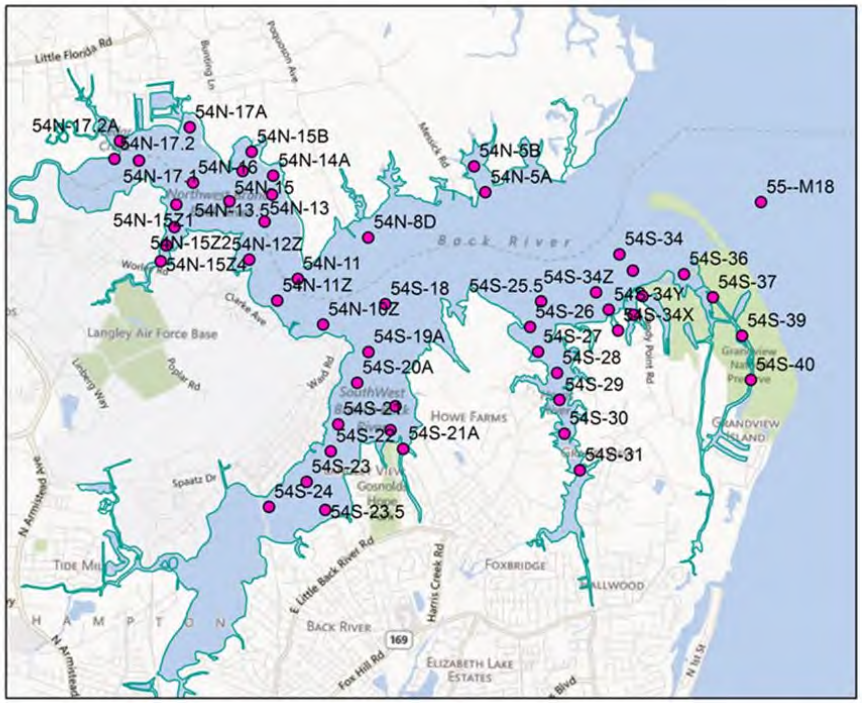
Enterococcus

Water Quality Criteria

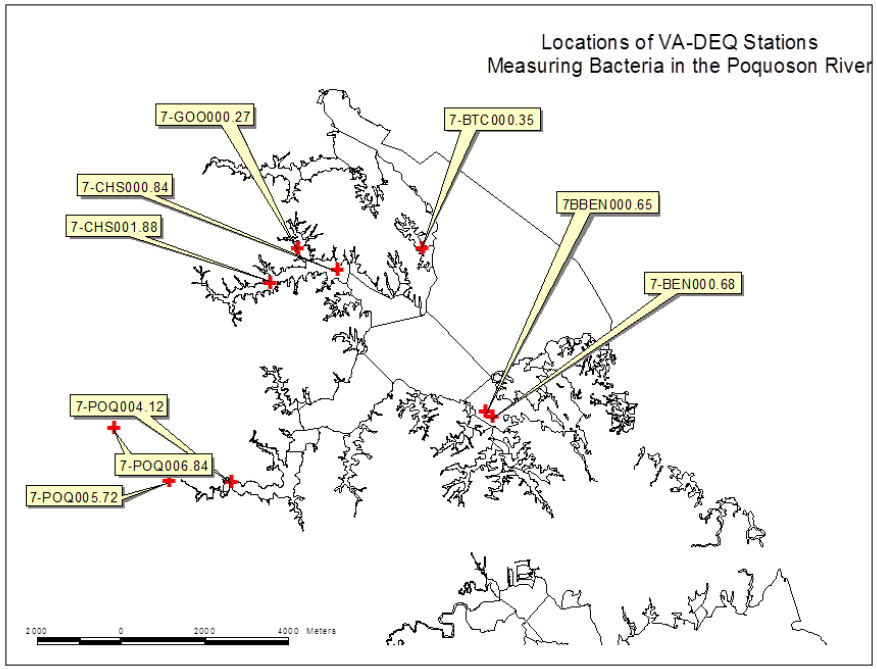
Water Type		Criteria
Class II (tidal water)	Fecal coliform	Geomean 14 counts/100ml 90th percentile: 49 counts/100ml
Class III (freshwater)	Enterococci (salt water)	Geomean 35 counts/100ml Single Sample Max. 104 counts/100ml

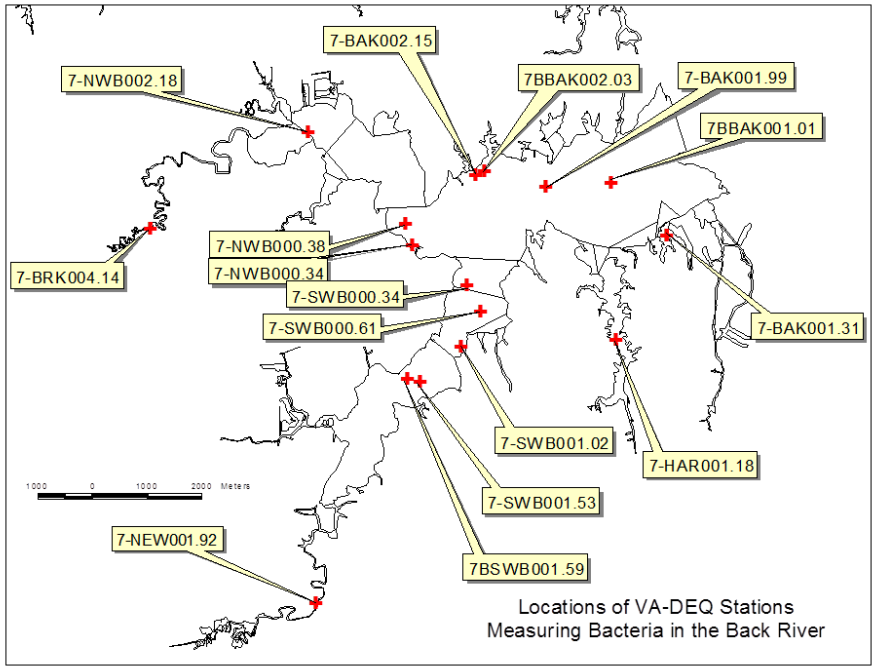
Observation Stations (VDH-DSS)



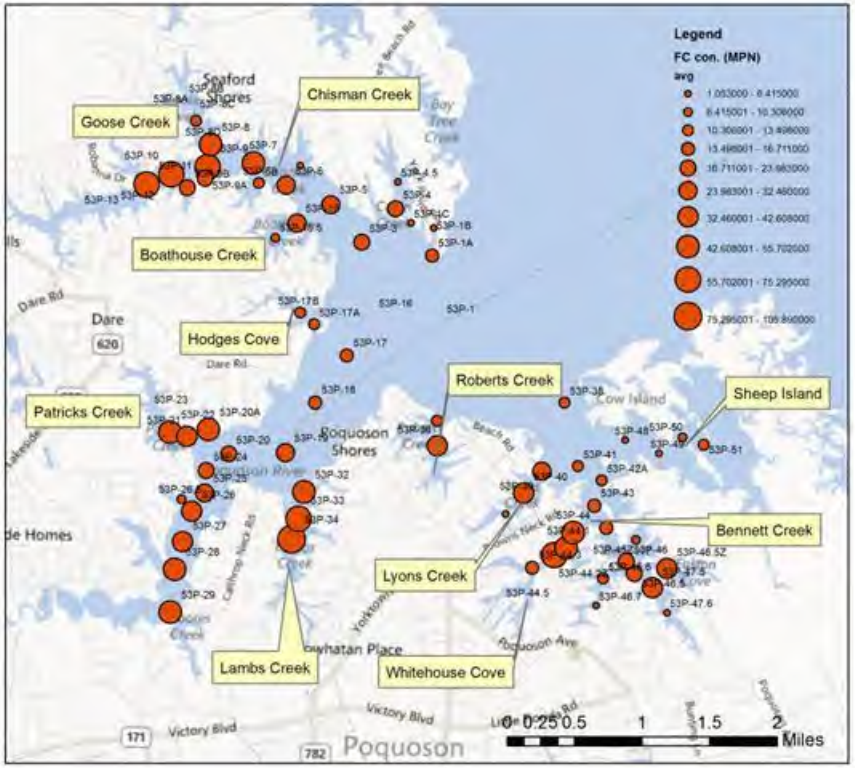


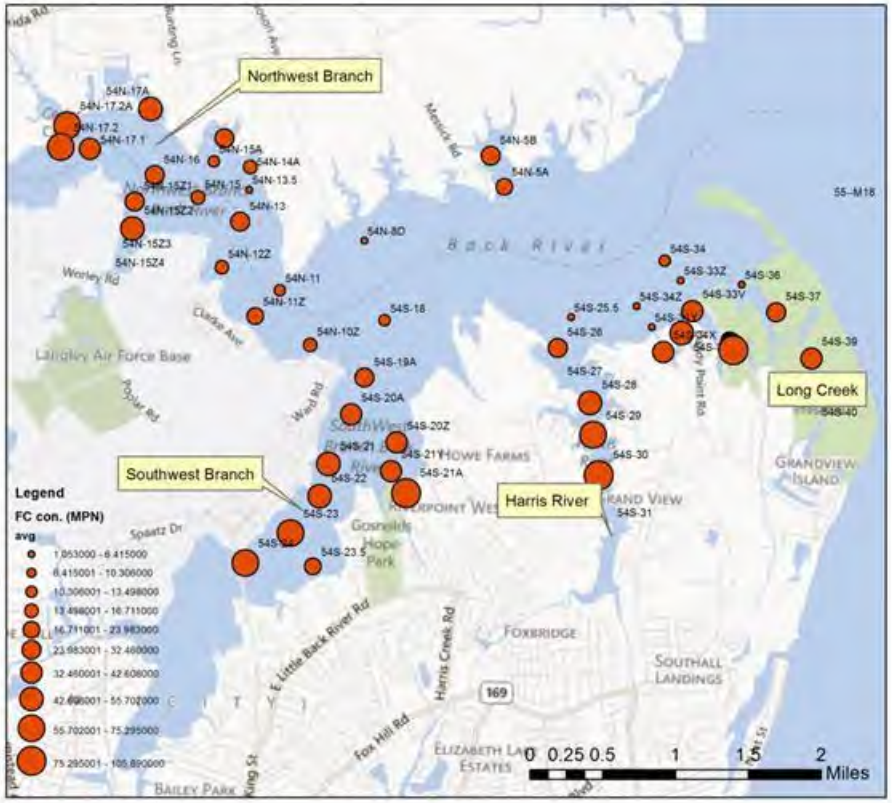
Observation Stations (DEQ)



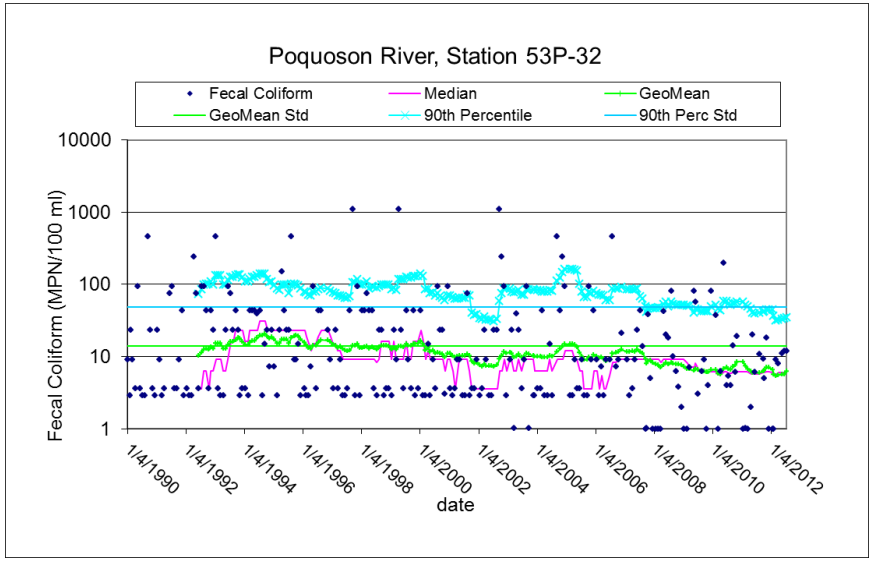


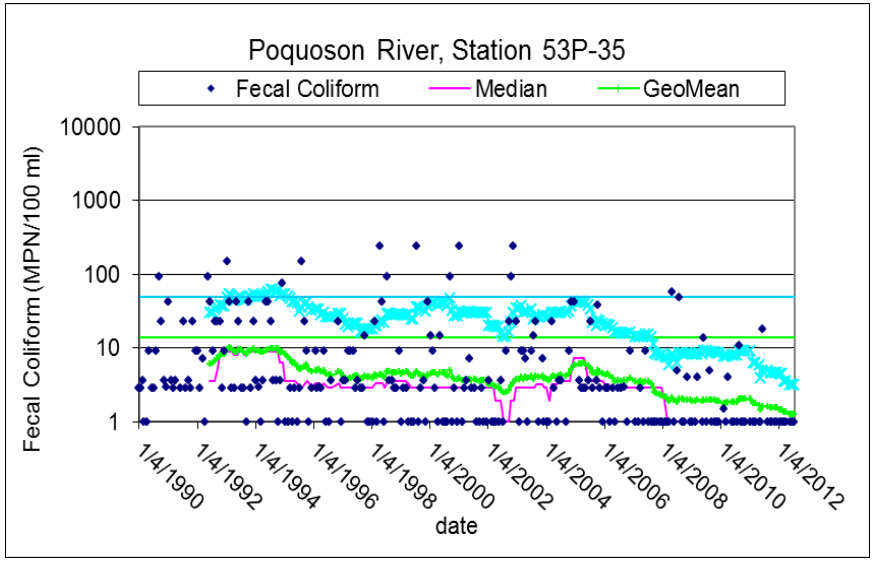
Distribution of Fecal Coliform

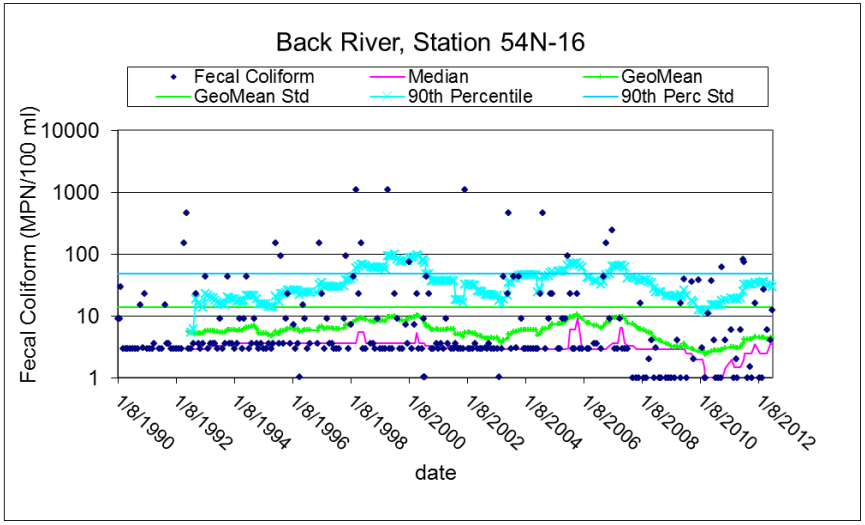


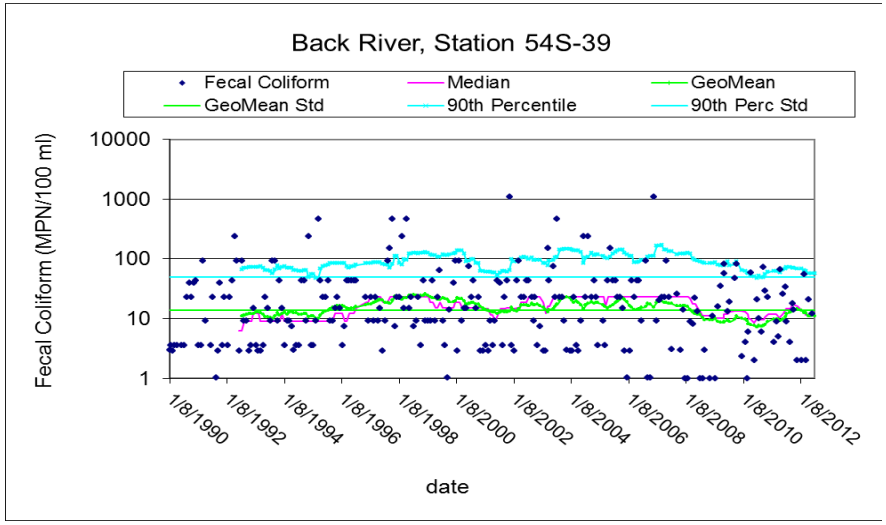


Example of Violation Assessment









Exceedance Percentages

- Poquoson (1990-2012)

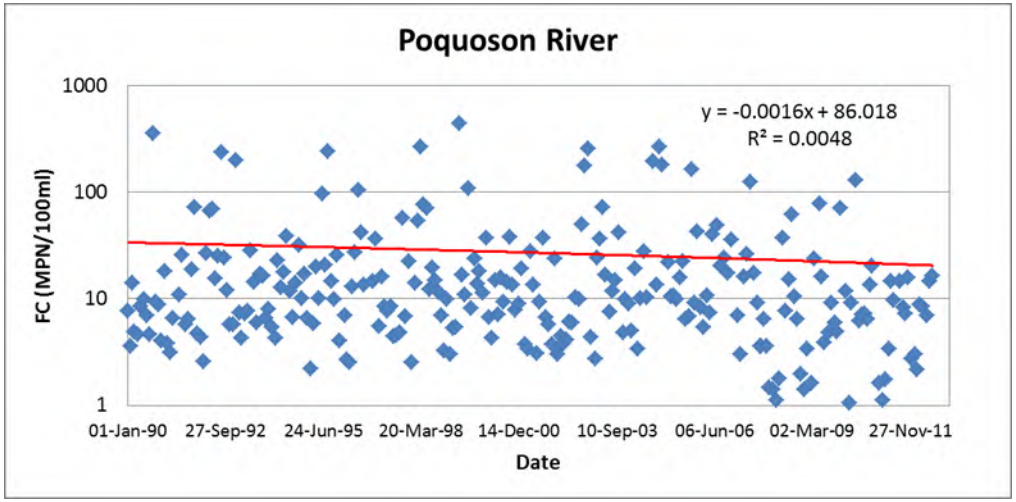
Station	Number of Samples	Geomean Criterion	Geomean Exceedance Percentage	90th Percentile Criterion	90th Percentile Exceedance Percentage
53P-22	259	14 MPN/100 ml	71.4%	49 MPN/100 ml	88.8%
53P-24	259	14 MPN/100 ml	1.2%	49 MPN/100 ml	14.7%
53P-25	259	14 MPN/100 ml	9.7%	49 MPN/100 ml	43.2%
53P-26	259	14 MPN/100 ml	7.7%	49 MPN/100 ml	44.8%
53P-26.5	259	14 MPN/100 ml	3.1%	49 MPN/100 ml	17.0%
53P-27	259	14 MPN/100 ml	3.1%	49 MPN/100 ml	76.8%
53P-28	259	14 MPN/100 ml	56.4%	49 MPN/100 ml	86.9%
53P-29	259	14 MPN/100 ml	80.3%	49 MPN/100 ml	88.8%
53P-32	259	14 MPN/100 ml	23.9%	49 MPN/100 ml	72.2%
53P-33	259	14 MPN/100 ml	68.0%	49 MPN/100 ml	88.8%
53P-34	259	14 MPN/100 ml	80.7%	49 MPN/100 ml	88.8%
53P-35	259	14 MPN/100 ml	0.0%	49 MPN/100 ml	7.3%
53P-36	259	14 MPN/100 ml	0.0%	49 MPN/100 ml	32.0%
53P-37	259	14 MPN/100 ml	0.0%	49 MPN/100 ml	0.0%
53P-38	259	14 MPN/100 ml	0.0%	49 MPN/100 ml	0.0%
53P-39	259	14 MPN/100 ml	0.8%	49 MPN/100 ml	15.4%
53P-40	259	14 MPN/100 ml	13.1%	49 MPN/100 ml	67.2%
53P-40.5	259	14 MPN/100 ml	5.4%	49 MPN/100 ml	54.1%
53P-41	259	14 MPN/100 ml	0.0%	49 MPN/100 ml	0.0%
53P-42A	259	14 MPN/100 ml	0.0%	49 MPN/100 ml	0.0%
53P-43	259	14 MPN/100 ml	0.0%	49 MPN/100 ml	10.4%
53P-44	259	14 MPN/100 ml	13.9%	49 MPN/100 ml	60.2%
53P-44.1	259	14 MPN/100 ml	37.1%	49 MPN/100 ml	71.4%
53P-44.2Z	259	14 MPN/100 ml	54.1%	49 MPN/100 ml	86.5%
53P-44.3	259	14 MPN/100 ml	5.4%	49 MPN/100 ml	29.7%
53P-45	259	14 MPN/100 ml	0.0%	49 MPN/100 ml	3.5%
53P-45Z	259	14 MPN/100 ml	0.0%	49 MPN/100 ml	2.7%
53P-46	259	14 MPN/100 ml	2.7%	49 MPN/100 ml	36.3%
53P-46.5	259	14 MPN/100 ml	0.0%	49 MPN/100 ml	13.1%
53P-46.5Z	259	14 MPN/100 ml	5.0%	49 MPN/100 ml	56.8%
53P-46.6	259	14 MPN/100 ml	0.0%	49 MPN/100 ml	13.9%
53P-46.7	259	14 MPN/100 ml	0.8%	49 MPN/100 ml	11.2%
53P-47.5	259	14 MPN/100 ml	5.8%	49 MPN/100 ml	53.7%
53P-47.6	259	14 MPN/100 ml	0.0%	49 MPN/100 ml	9.3%
53P-48	259	14 MPN/100 ml	0.0%	49 MPN/100 ml	0.0%
53P-49	259	14 MPN/100 ml	0.0%	49 MPN/100 ml	0.0%
53P-50	259	14 MPN/100 ml	0.0%	49 MPN/100 ml	0.0%
53P-51	259	14 MPN/100 ml	0.0%	49 MPN/100 ml	0.0%

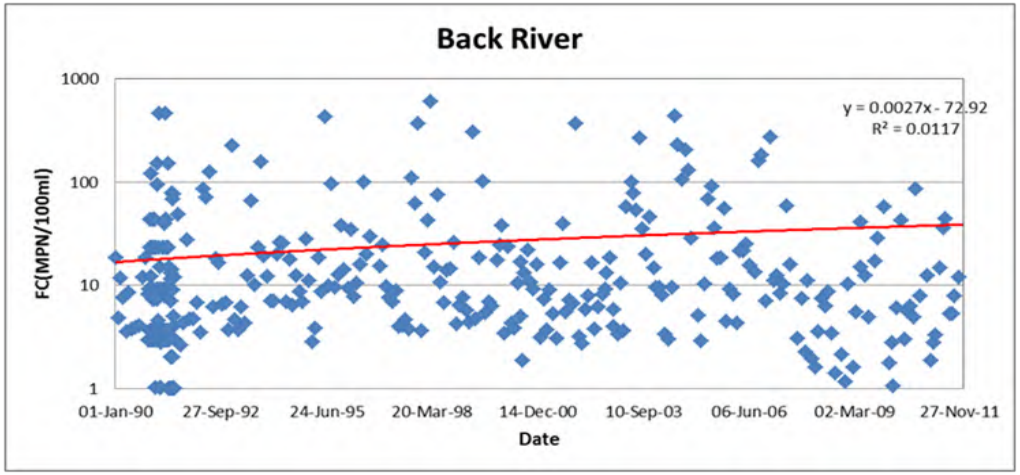
Exceedance Percentages

- Back River (1990-2012)

Station	Number of Samples	Geomean Criterion	Geomean Exceedance Percentage	90th Percentile Criterion	90th Percentile Exceedance Percentage
54N-5A	256	14 MPN/100 ml	0.0%	49 MPN/100 ml	7.4%
54N-5B	256	14 MPN/100 ml	8.6%	49 MPN/100 ml	48.4%
54N-8D	256	14 MPN/100 ml	0.0%	49 MPN/100 ml	0.0%
54N-10Z	256	14 MPN/100 ml	0.0%	49 MPN/100 ml	3.1%
54N-11	256	14 MPN/100 ml	0.0%	49 MPN/100 ml	0.0%
54N-11Z	256	14 MPN/100 ml	0.0%	49 MPN/100 ml	5.1%
54N-12Z	256	14 MPN/100 ml	0.0%	49 MPN/100 ml	3.5%
54N-13	256	14 MPN/100 ml	0.0%	49 MPN/100 ml	12.5%
54N-13.5	256	14 MPN/100 ml	0.0%	49 MPN/100 ml	0.0%
54N-14A	256	14 MPN/100 ml	0.0%	49 MPN/100 ml	10.9%
54N-15	256	14 MPN/100 ml	0.0%	49 MPN/100 ml	7.4%
54N-15A	256	14 MPN/100 ml	0.0%	49 MPN/100 ml	12.5%
54N-15B	256	14 MPN/100 ml	5.5%	49 MPN/100 ml	29.3%
54N-15Z1	256	14 MPN/100 ml	0.0%	49 MPN/100 ml	32.4%
54N-15Z2	256	14 MPN/100 ml	13.3%	49 MPN/100 ml	57.4%
54N-16	256	14 MPN/100 ml	0.0%	49 MPN/100 ml	18.8%
54N-17A	256	14 MPN/100 ml	20.3%	49 MPN/100 ml	78,1%
54N-17.1	256	14 MPN/100 ml	9.0%	49 MPN/100 ml	59.4%
54N-17.2	256	14 MPN/100 ml	41.4%	49 MPN/100 ml	80.9%
54N-17.2A	256	14 MPN/100 ml	34.8%	49 MPN/100 ml	73.0%
54S-18	256	14 MPN/100 ml	0.0%	49 MPN/100 ml	5.1%
54S-19A	256	14 MPN/100 ml	0.0%	49 MPN/100 ml	30.9%
54S-20A	256	14 MPN/100 ml	6.3%	49 MPN/100 ml	53.9%
54S-20Z	256	14 MPN/100 ml	6.3%	49 MPN/100 ml	53.9%
54S-21	256	14 MPN/100 ml	14.1%	49 MPN/100 ml	56.3%
54S-21A	256	14 MPN/100 ml	33.6%	49 MPN/100 ml	62.5%
54S-21Y	256	14 MPN/100 ml	6.3%	49 MPN/100 ml	40.6%
54S-22	256	14 MPN/100 ml	27.0%	49 MPN/100 ml	59.0%
54S-23	256	14 MPN/100 ml	44.9%	49 MPN/100 ml	67.2%
54S-23.5	256	14 MPN/100 ml	5.1%	49 MPN/100 ml	27.3%
54S-24	256	14 MPN/100 ml	56.3%	49 MPN/100 ml	73.8%
54S-25.5	256	14 MPN/100 ml	0.0%	49 MPN/100 ml	0.0%
54S-26	256	14 MPN/100 ml	3.5%	49 MPN/100 ml	33.6%
54S-28	256	14 MPN/100 ml	12.1%	49 MPN/100 ml	55.1%
54S-29	256	14 MPN/100 ml	19.5%	49 MPN/100 ml	69.1%

Long-term Trend of Fecal Coliform Concentration





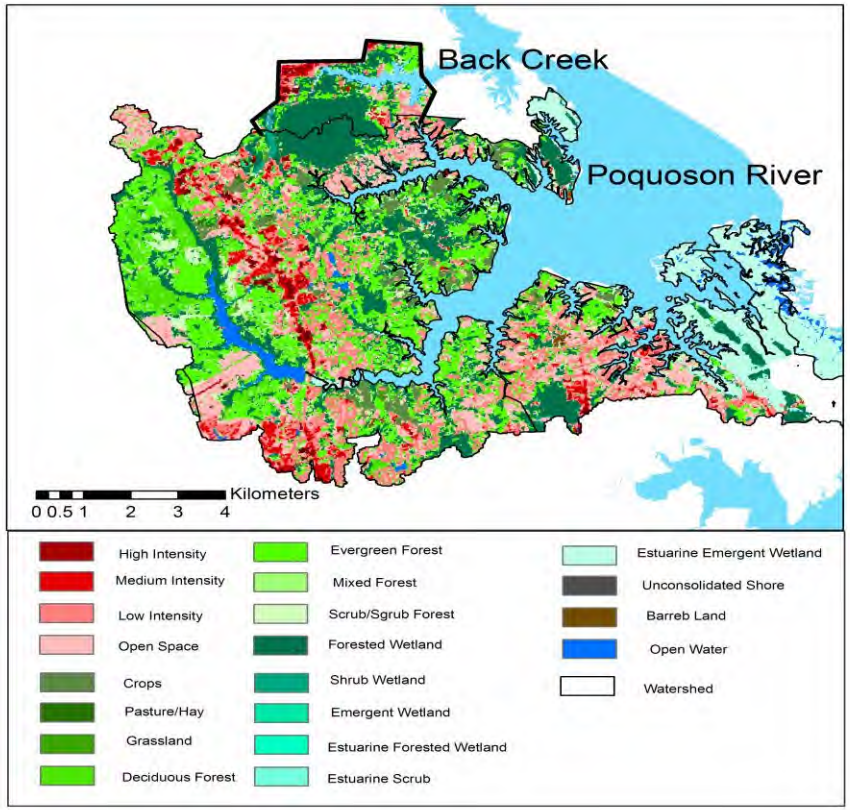
Procedures of Pollutant Source Assessment

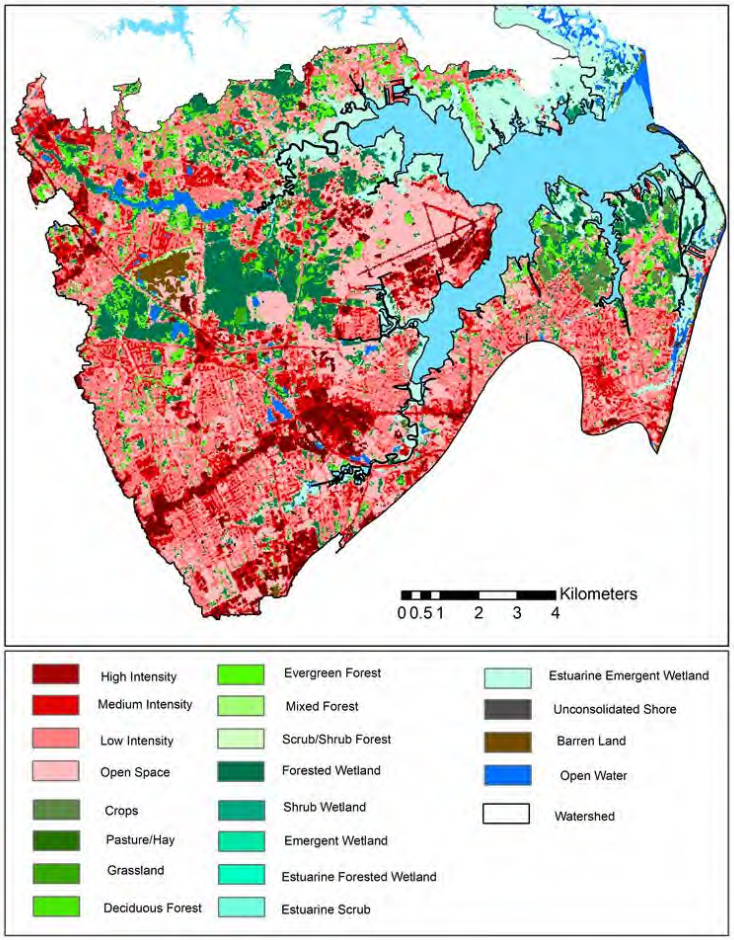
- Sources
  - Humans (septic systems, SSOs, marinas)
  - Pets
  - Livestock
  - Wildlife
- Approach
  - GIS (roads, buildings, sanitation boundaries, septic systems, etc.)
  - Land Use Data (NOAA's Coastal Change Analysis Program (C-CAP))
  - Wildlife survey data (animal density, animal habitat)
  - Shoreline survey data
  - Field survey
  - Public inputs
  - Public meeting
  - Interview
  - modeling

GIS and Land use data

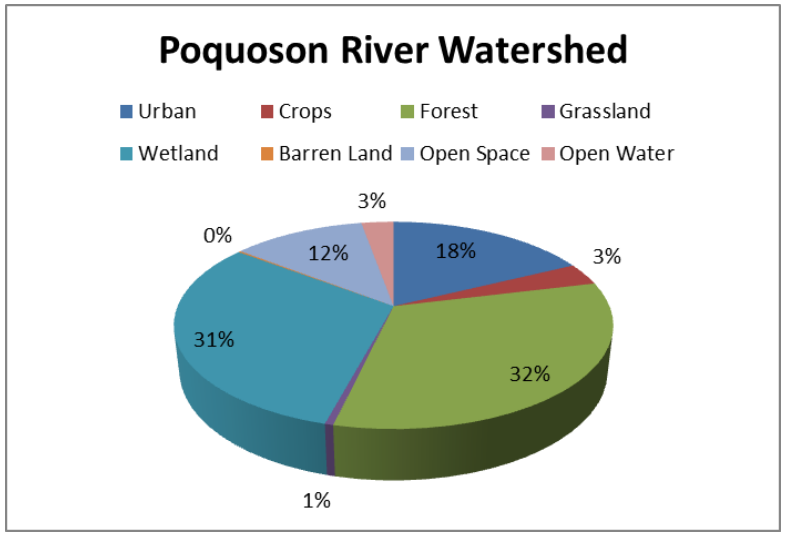
- NOAA's Coastal Change Analysis Program (C-CAP)
- DEM (digital elevation model)
- GIS data provided by York County, Cities of Poquoson, Hampton, and Newport News, NASA, and HRPDC etc.
- USGS stream data
- NOAA sounding data

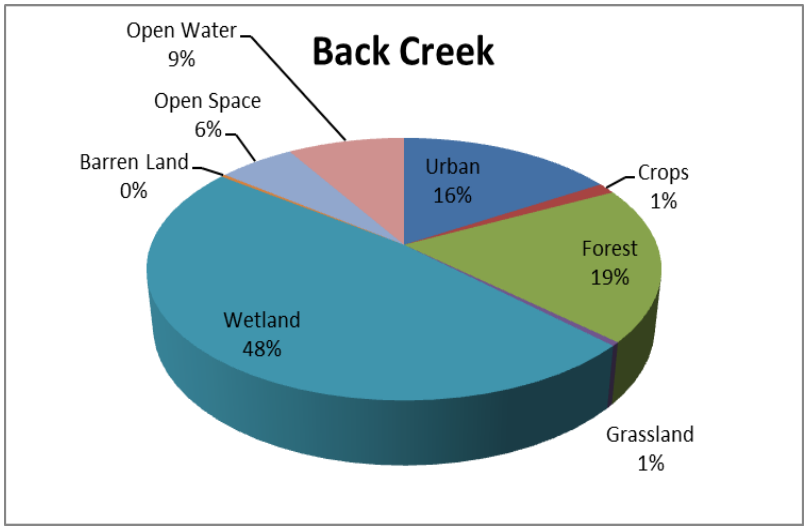
Landuse Data

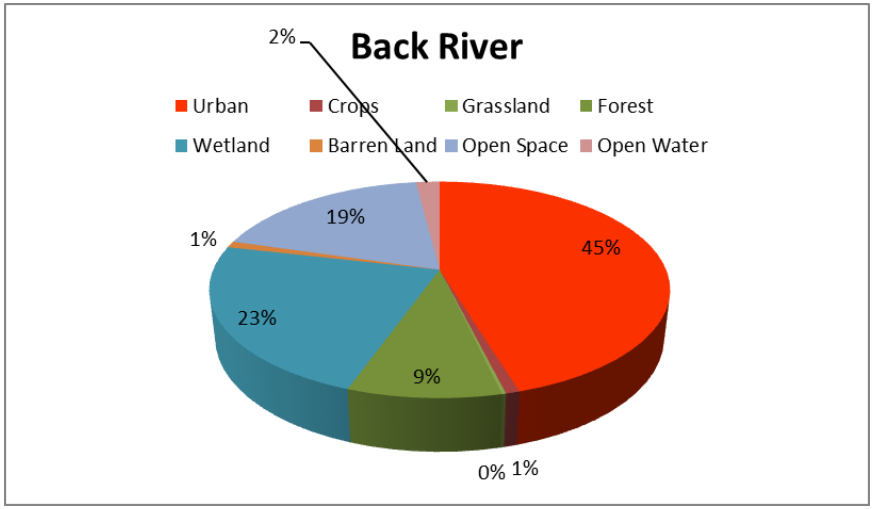




Landuse Distribution







Population and Pets

- Estimate population based on US Census Bureau data of 2011. Use percent of urban landuse to estimate population in Poquoson River and Back River watersheds for York County and City of Newport News.

- Estimate pets based on licenses issued by Cities of Poquoson and Hampton
- Compute pets per acre of urban landuse for Poquoson (1.1 /ac of urban)
- Use this rate to compute pets in York County
- The rate calculated for Hampton is low (0.6 per ac)
- Use Poquoson rate for York County and City of Newport News in Back River

Poquoson River Watershed

		City of Poquoson	York County	Total
Poquoson River	Population (2011)	7,331	24,470	31,801
	Households	2,758	9,113	11,871
	Dogs	907*	2924	3832
Back Creek	Population (2011)		1650	1650
	Households		660	660
	Dogs		204	204

Back River Watershed

	City of Poquoson	York County	City of Hampton	City of Newport News	Total
Population (2011)	4,766	9,451	136,836	37,844	188,898
Households	1,862	3,906	60,118	15,944	81,829
Dogs	593	1,872	6,972	4,404	13,841

*Using typical number yields 2,500 dogs for Poquoson

Wildlife

- Estimate (non bird and duck) based on density per habitat area
- High density of deer was used to estimate deer population

Wildlife Type	Population Density	Habitat Requirements
Deer	**0.094** animals/acre	Entire watershed, except open water and urban development
Raccoon	0.078 animals/acre	Forest and Wetland within 600 feet of streams and ponds
Raccoon	0.016 animals/acre	Upland Forest
Muskrat	50/mile	Streams and Rivers
Nutria	18.5/mile	Streams and Rivers
Duck/birds	1.53 animals/acre*	Entire Watershed

Bacteria Production

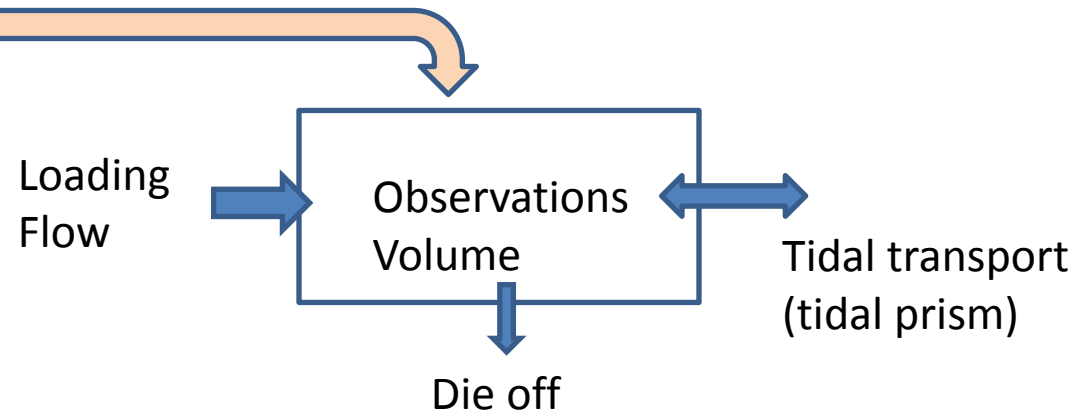
Name	FC (counts/animal/day)
Ducks	2,430,000,000
Geese	49,000,000,000
Deer	500,000,000
Raccoons	125,000,000
Muskrat*	250,000,000
Nutria	250,000,000
Dog (Fraction available for runoff 23%)	4,086,000,000

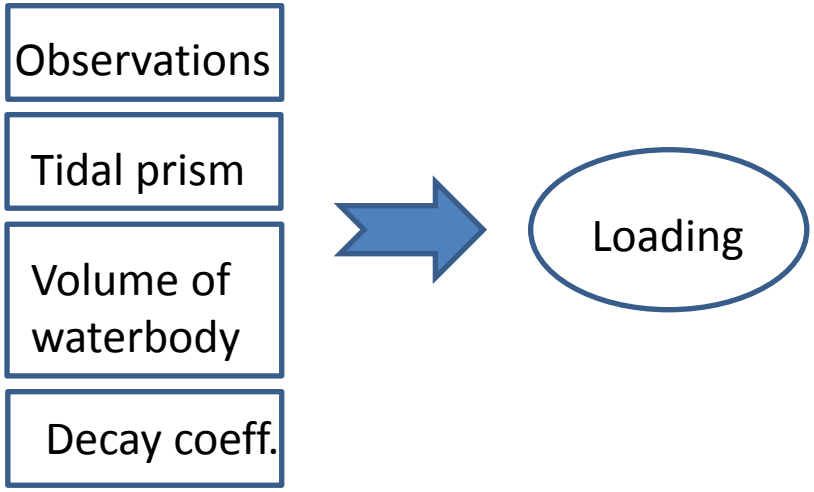
Example of Wildlife Habitat

Habitat within 600 feet of streams.

Wildlife: Birds/Ducks

Inverse Estimate of Loading Using Observation Data





Estimate Density and FC Loading

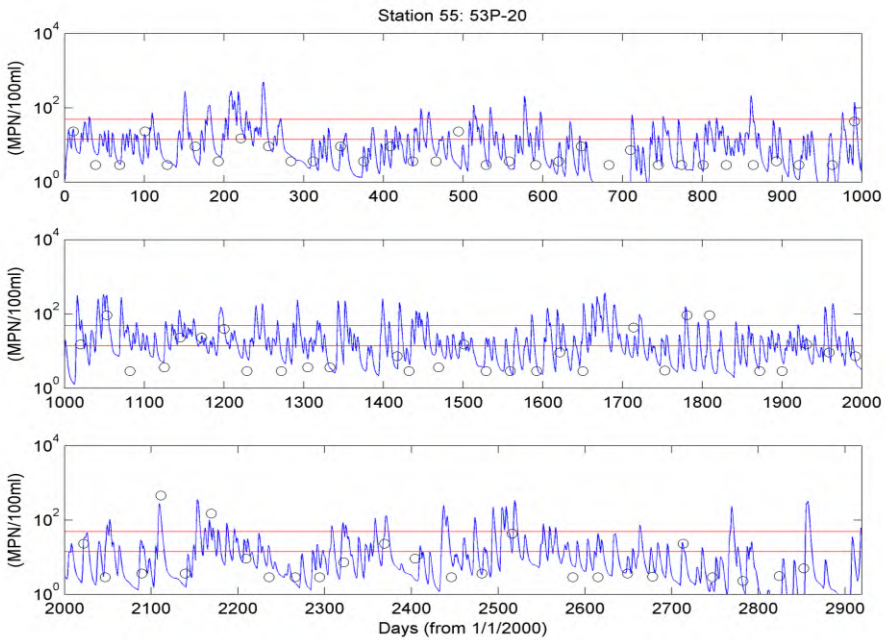
	Area (ac)	Birds Density (per ac) (Use MD number)	FC Production (per day)	Estimate FC (base on MD density)	Inverse Model (FC per day)	Inverse Model (counts/ac)
Floyds Bay 1(89)	273.55	1.85	2.43E+09	1.23E+12	8.12E+10	2.97E+08
Floyds Bay 2	944.02	1.85	2.43E+09	4.24E+12	4.11E+11	4.35E+08
Lioyd	758.47	1.85	2.43E+09	3.41E+12	7.16E+11	9.43E+08
Average						**5.59E+08**
		Inverse Estimate Density (#/ac)	**FC Production (per day)**			**Loading on Watershed (counts/ac)**
		0.77	2.43E+09			**1.86E+09**
		Density for other watershed				**Apply loading to model (counts/ac)**
Assume 25% density for other watershed		0.19				**4.65E+08**

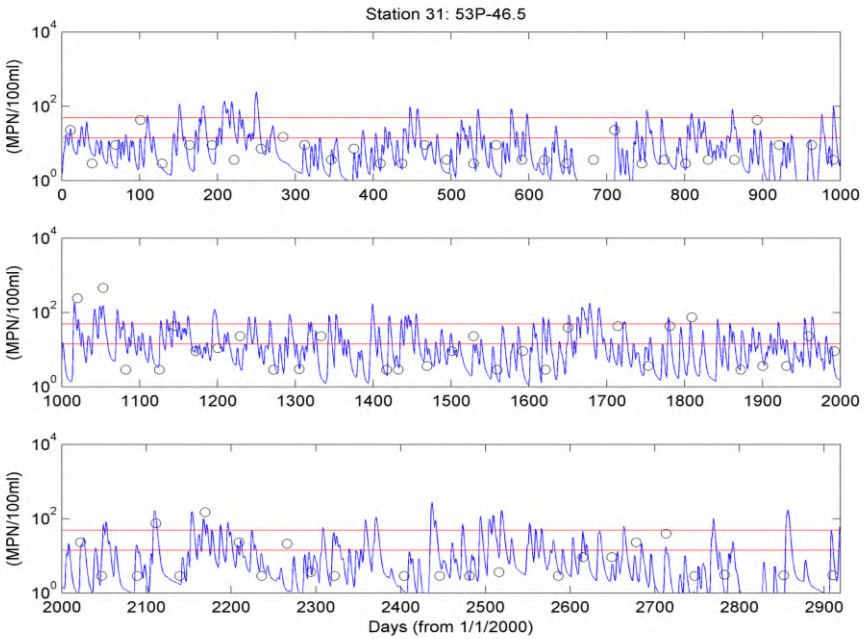
Assume 30% runoff

Pets (Poquoson)	**1500**		**Density (Counts/ac)**	**FC production**	**run off**	**Apply loading to model (counts/ac)**
	Urban + Open area (ac) =	2353.8	0.64	4.09E+09	23%	**5.99E+08**

Model Validation

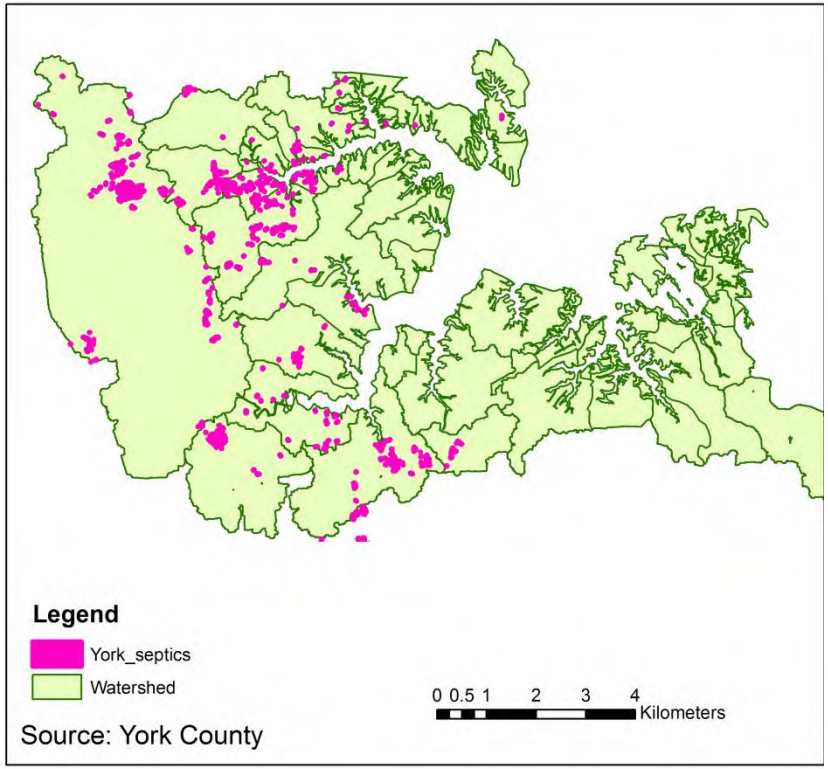
- Using estimated loading rates for input to model, good predictions are achieved

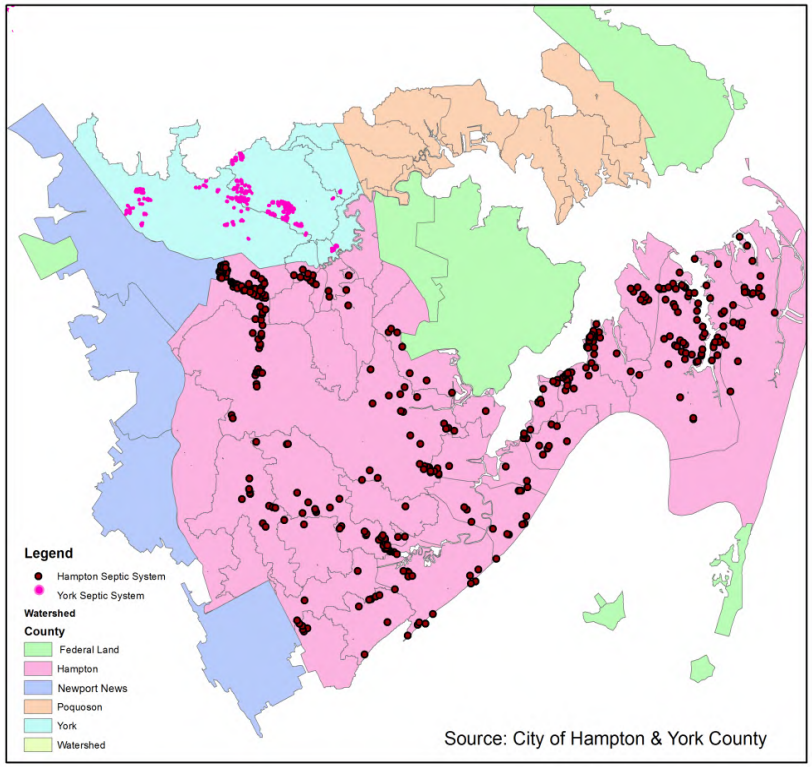




Septic System

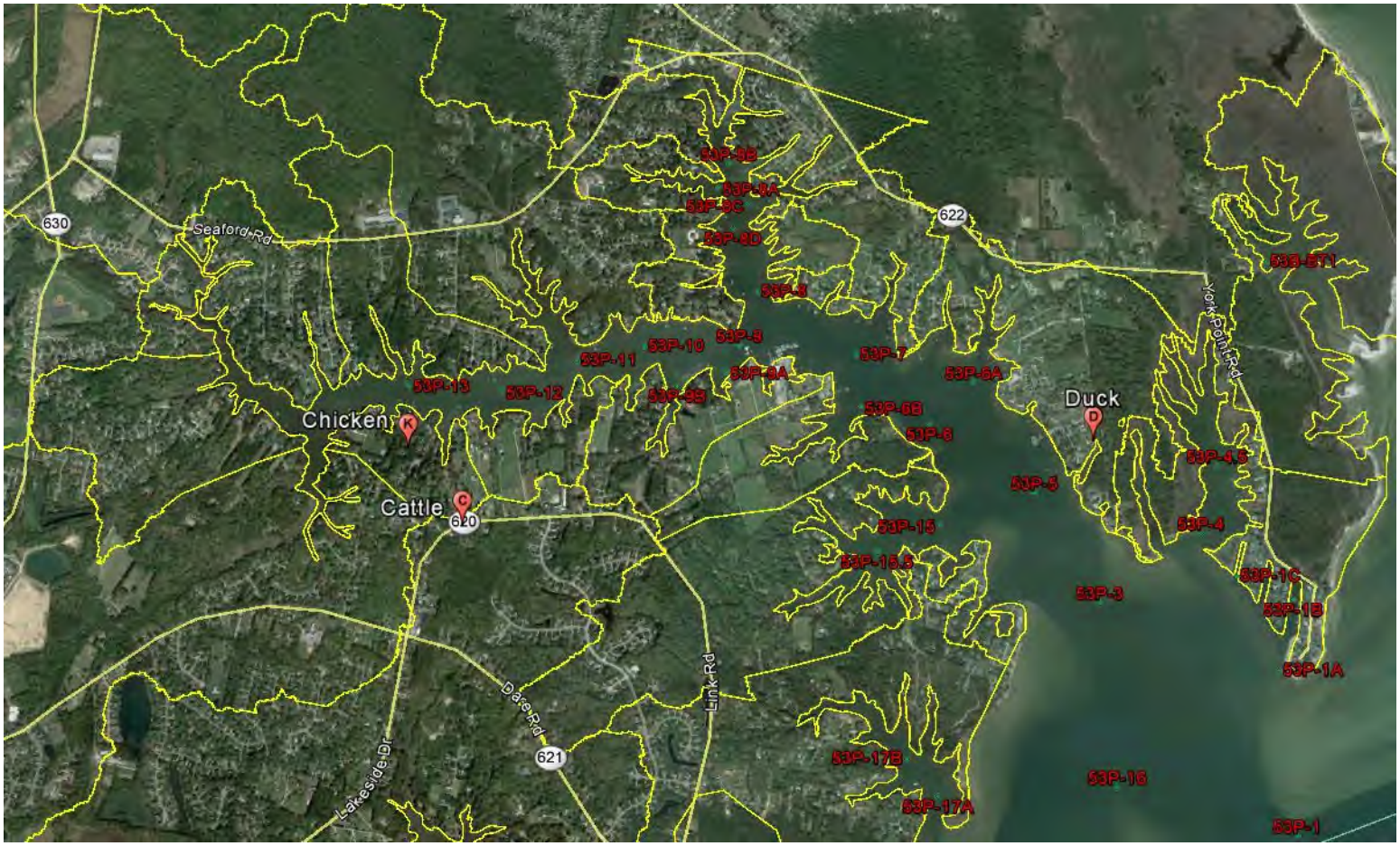
- Estimation based on GIS layer and household or buildings
- Failure rate 12%



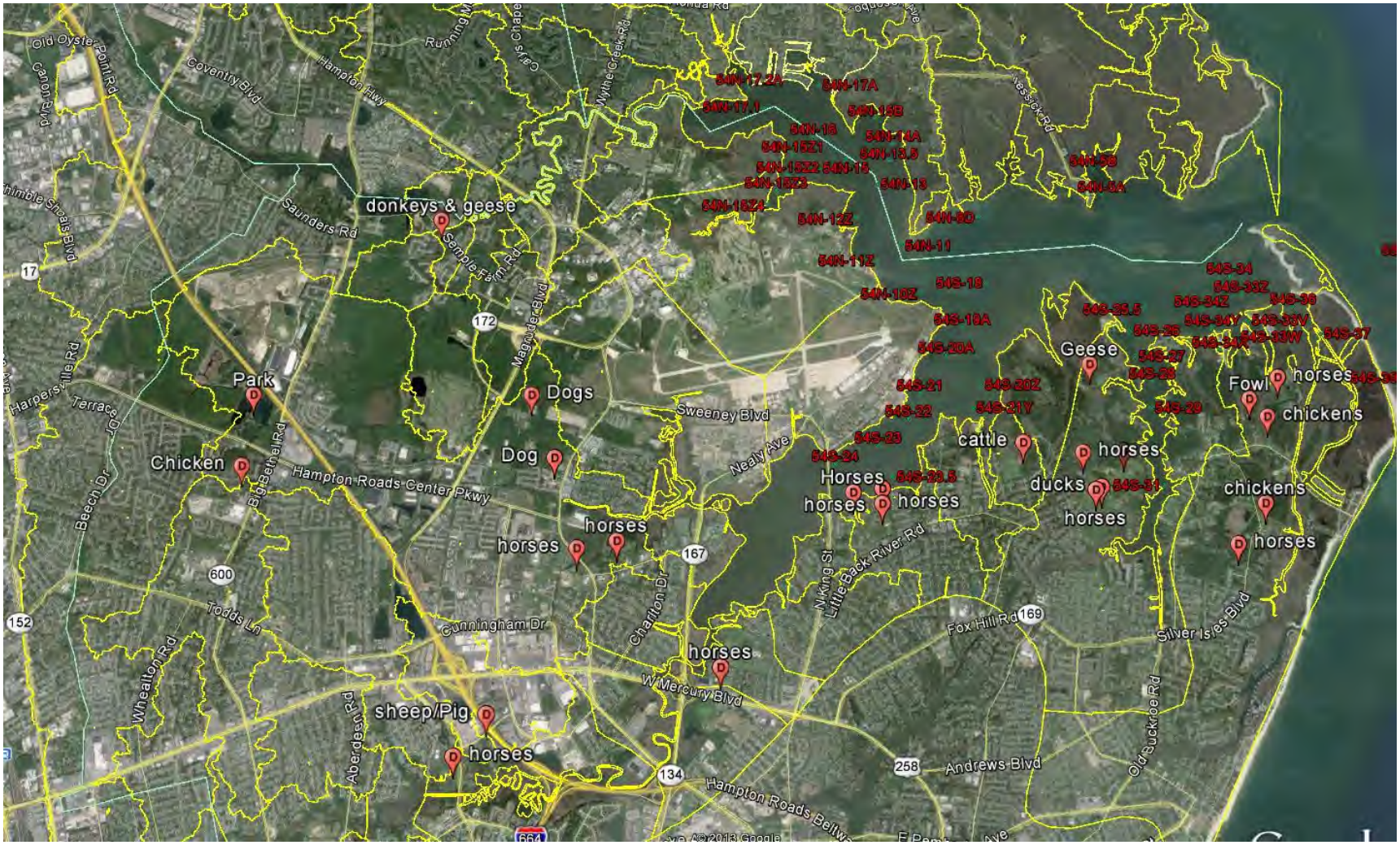


Livestock

- Use shoreline survey data (VDH-DSS)
- Estimate loading using EPA tool



Back River Watershed



SSOs

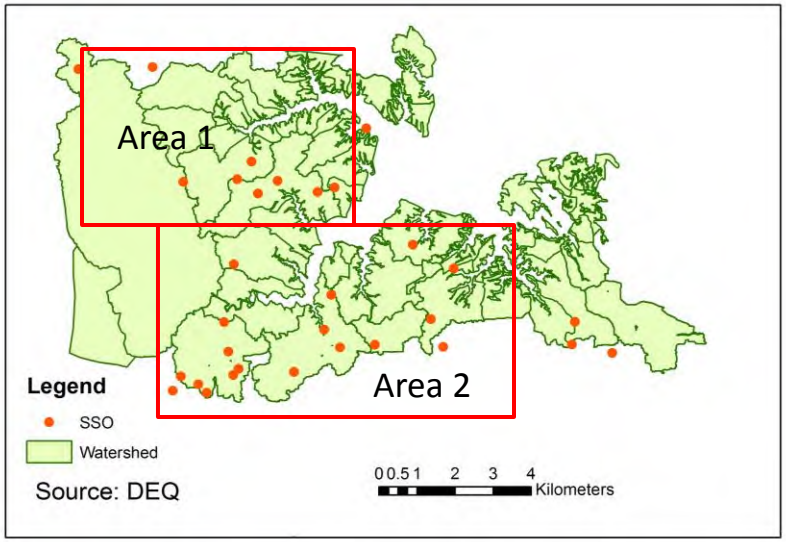
- Estimate base on observation with the consideration of spatial variation
- Compute 95 percentile loading 25% raw sewage and 75% non-raw sewage
- Using average value as loading estimation

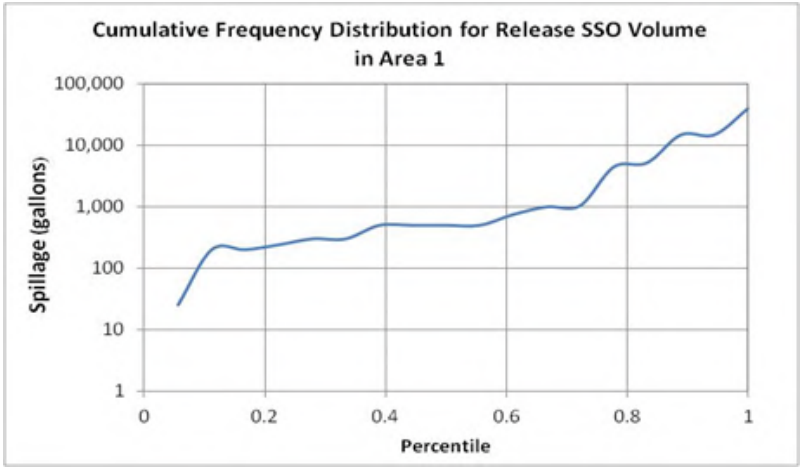
Poquoson River	Number of Spills	95% Volume (Gallons)	Raw Sewage Concentration (MPN/100ml)	Non-Raw Sewage Concentration (MPN/100ml)	m^3	Fecal Coliform (Counts/Day)
1	18	18,750	2,700,000	500,000	70.98	7.453E+11
2	4	185	2,700,000	500,000	0.70	7.353E+09

Back River	Number of spills	95% Volume (Gallons)	Raw Sewage (MNP/100mL)	Non-raw Sewage (MPN/100mL)	m^3	Fecal Coliform (Counts/Day)
1	93	154,362	2,700,000	500,000	584.32	6.135×10^{12}
2	11	30,315	2,700,000	500,000	114.75	1.21×10^{12}
3	14	17,390	2,700,000	500,000	65.83	6.91×10^{11}

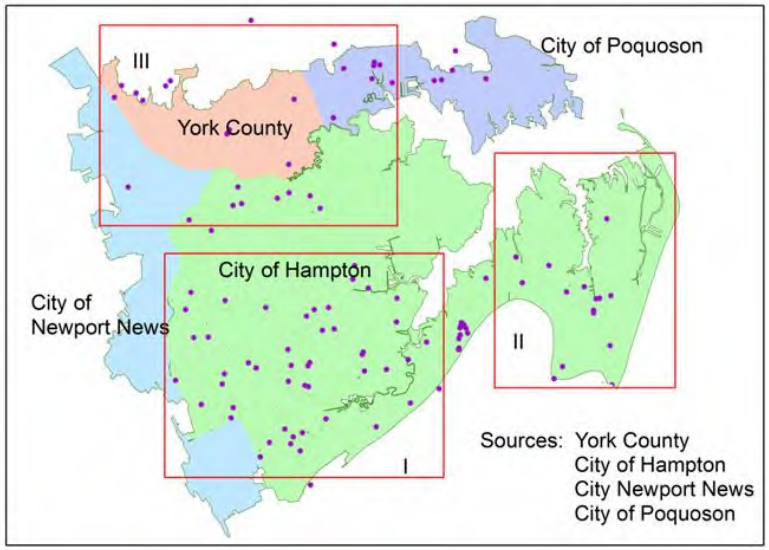
SSOs

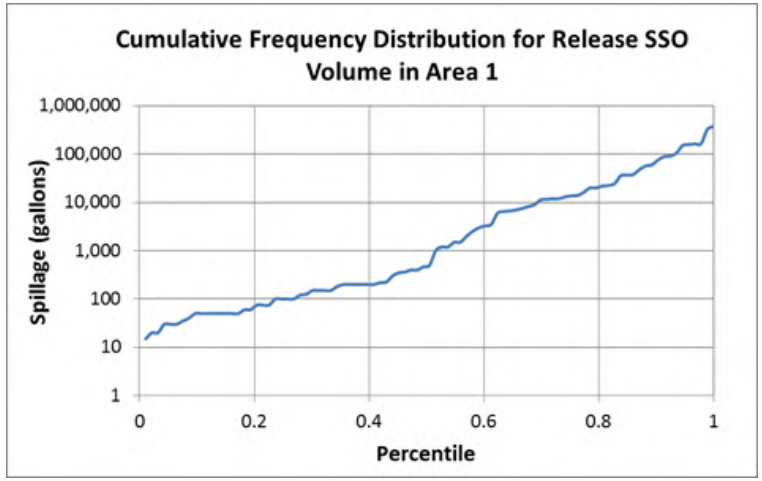
Poquoson River





Back River





Marina

- Based on shoreline survey data (VDH-DSS)
- Use number of slips
- Assume 3 persons per slip and 10% discharge to river
- Daily loading is 2.00E+09 per day per person

Total Loading Estimation

Poquoson River

Source	Animal	Number	Counts/Day	% of Total
Wildlife	Deer	1673	8.367E+11	5.6%
	Ducks/Birds	13708	8.328E+12	55.6%
	Muskrat	456	1.141E+11	0.8%
	Nutria	1045	2.612E+11	1.7%
	Raccoon	867	1.084E+11	0.7%
	Total Wildlife	17751	9.648E+12	64.4%
Pets	Dogs	3784	3.560E+12	23.8%
Septic		1023 (tanks)	8.788E+09	0.1%
SSOs			7.453E+11	5.0%
Livestock			7.866E+11	5.3%
Marinas		579 (slips)	2.316E+11	1.5%
Totals			1.498E+13	100.0 %

Back River

Name	Number	Loading (Counts/Day)	Percent
Deer	3,788	1.89E+12	4.3
Dog	16,064	1.51E+13	34.6
Ducks/Birds	31,031	1.89E+13	43.2
Muskrats	1,013	2.53E+11	0.6
Nutria	2,321	5.80E+11	1.3
Raccoons	1,123	1.40E+11	0.3
SSOs		2.68E+12	6.1
Septic	613	5.27E+09	0.0
Marinas	306	1.84E+11	0.4
Livestock		3.92E+12	9.0
Totals		4.36E+13	100.0

Questions & Comments for Source Assessment?

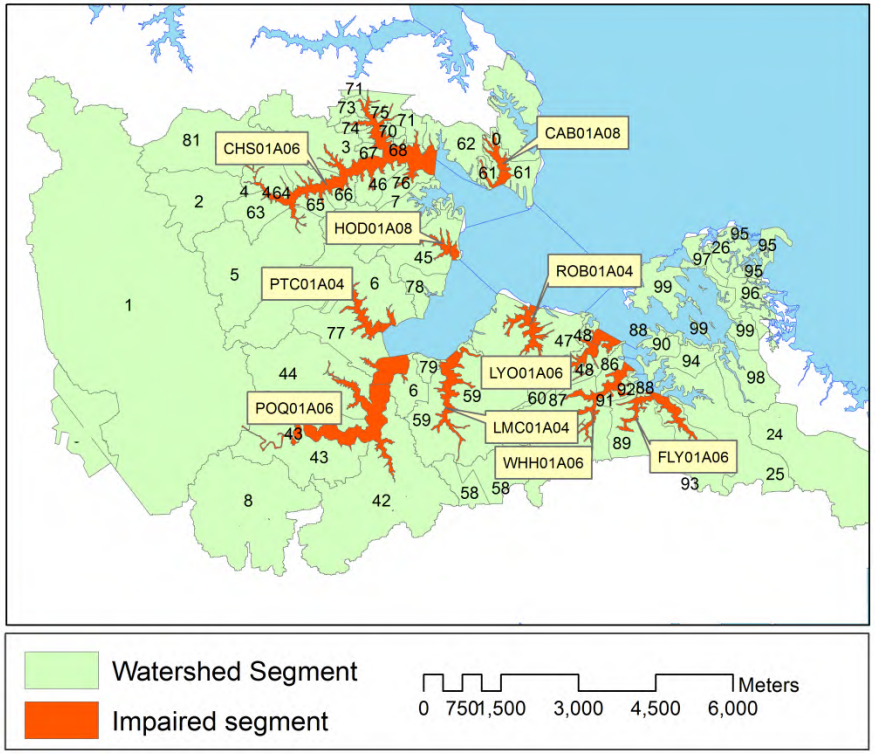
TMDL Development

- Perform source analysis
- Use linked watershed and in-stream modeling approach
- Develop watershed model
- Simulate daily bacteria loadings from watershed
- Conduct watershed model calibration
- Discharge loads to in-stream model
- Use in-stream water quality model for simulating bacteria transport and fate
- Calibrate bacteria transport model
- Compute allowable loads and determine load reduction

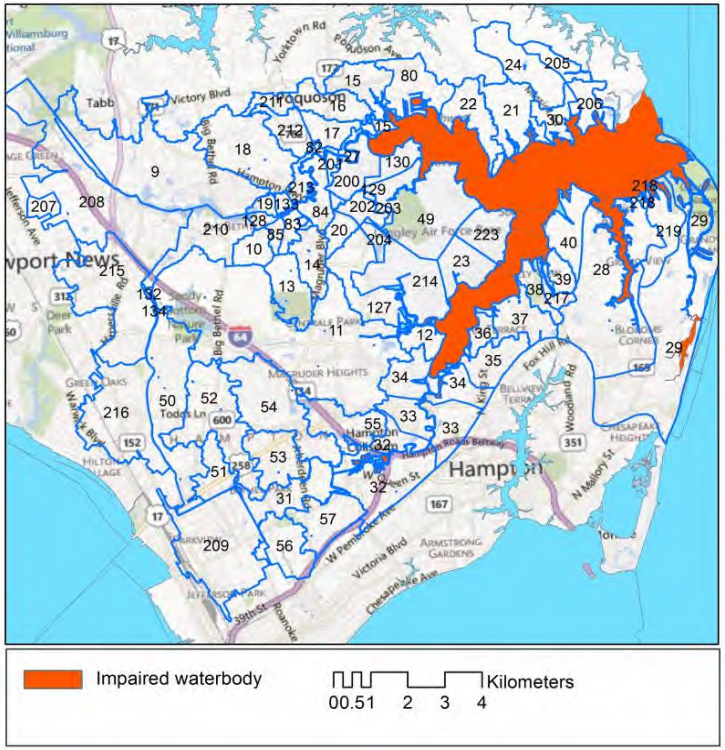
Model Simulation

- Nonpoint source model (Loading Simulation Program C++ (LSPC)
  - Hourly precipitation
  - Simulate loading and transport for different landuses
  - Loading discharge to 3D model
  - Landuses include
    - Urban pervious and impervious, wetland, forest, agricultural, past land (grass),barren, and
- Three-dimensional model (EFDC)
  - Simulate tide, surface elevation, salinity, and bacterial transport
  - Model simulation:2000 to 2007
- Both models are supported by US EPA

Model Segmentation

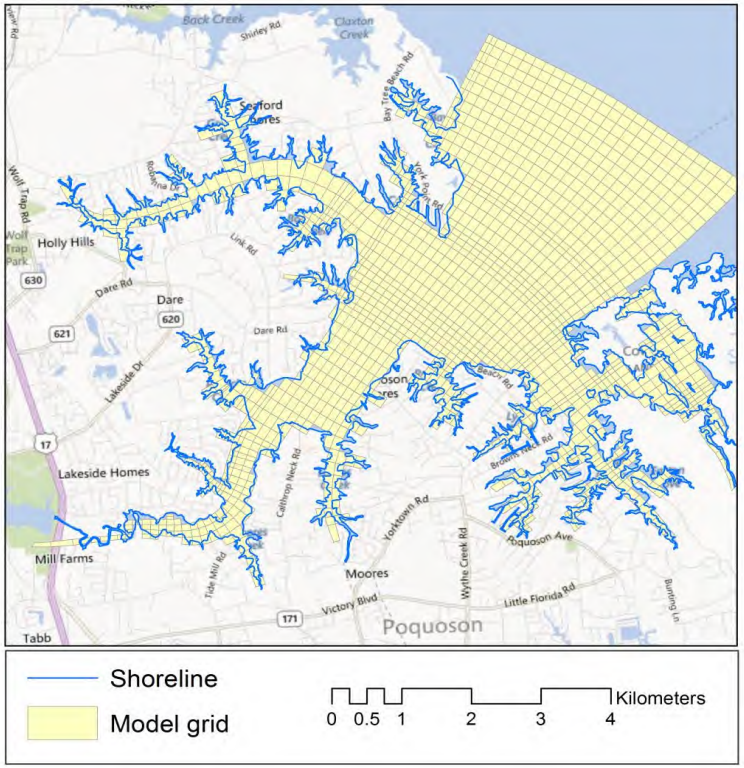


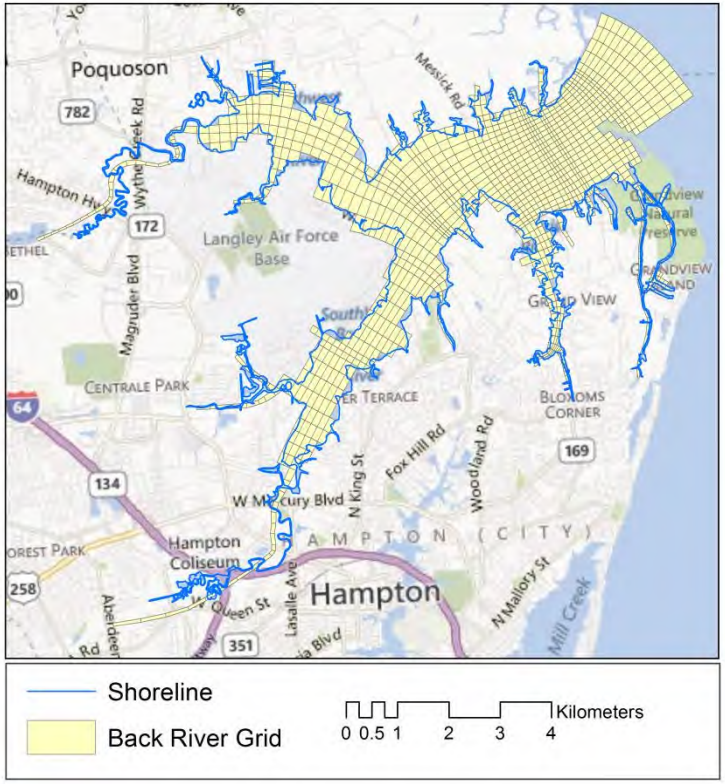
56 subwatersheds



45 subwatersheds with subarea of federal land etc

Three Dimensional Model



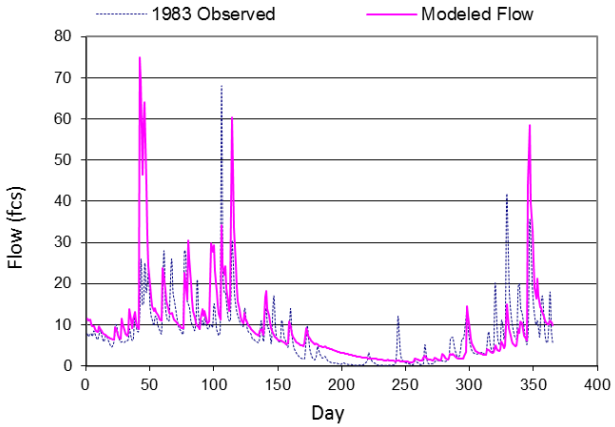


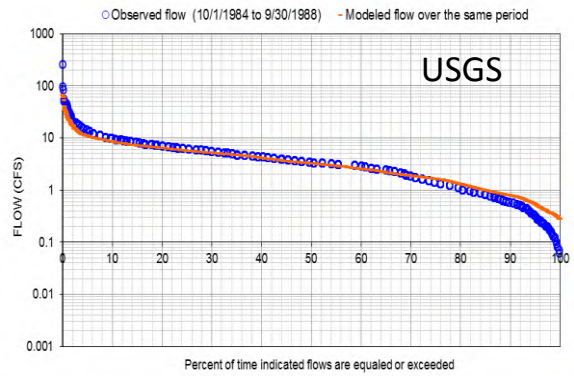
1593 grids and 3 vertical layers

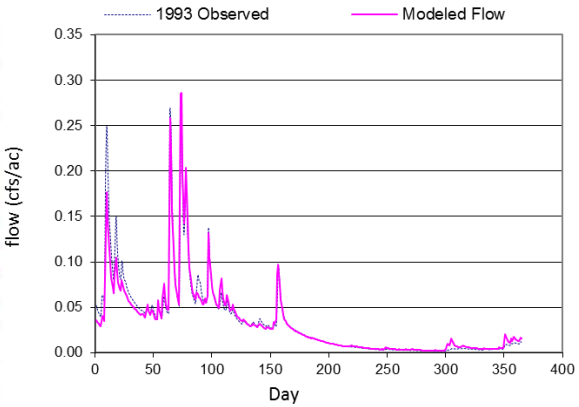
1264 grids and 3 vertical layers

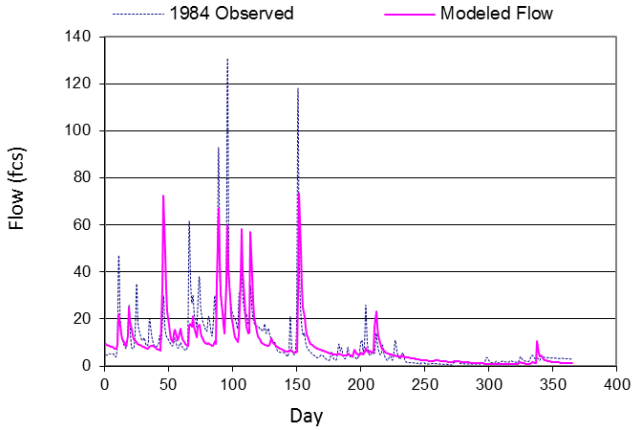
Watershed Model Calibration

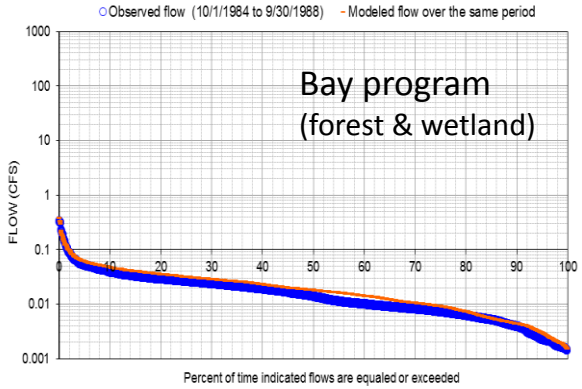
- Compare model results to nearby USGS station
  (USGS 01670000 BEAVERDAM SWAMP NEAR ARK, VA, 80-88)
- Compare to Bay Program watershed model results

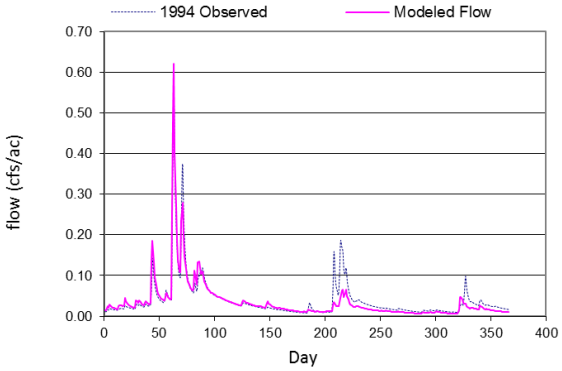






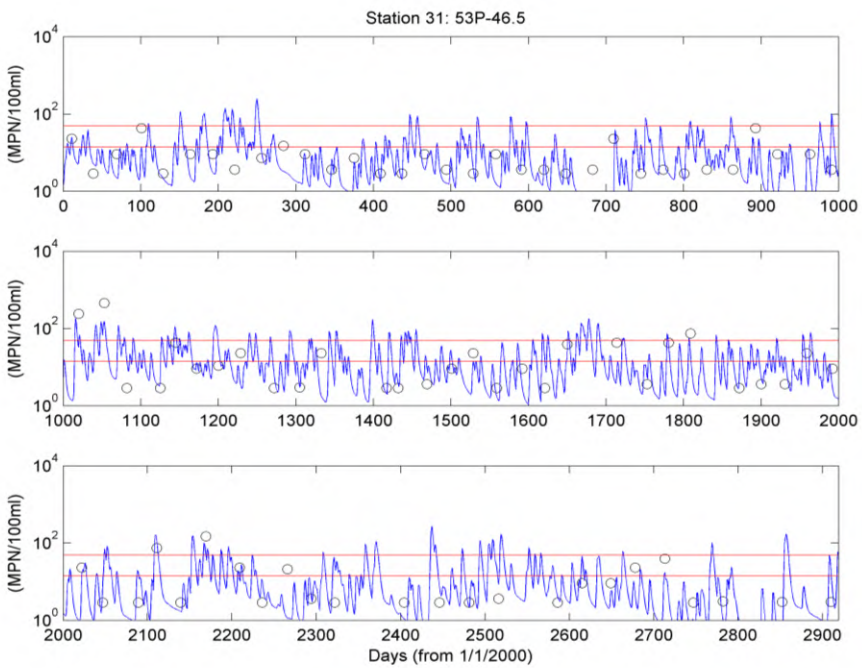


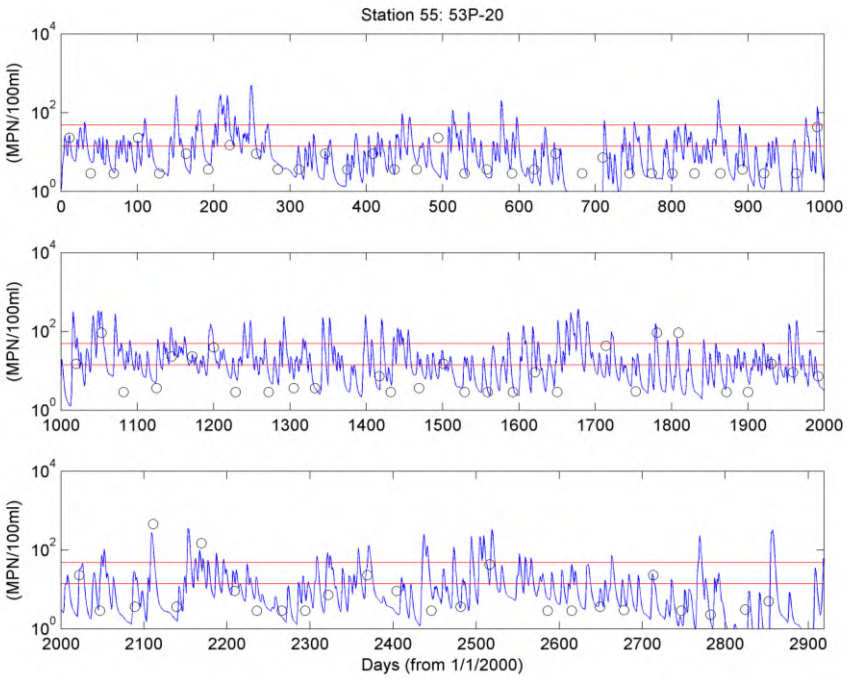




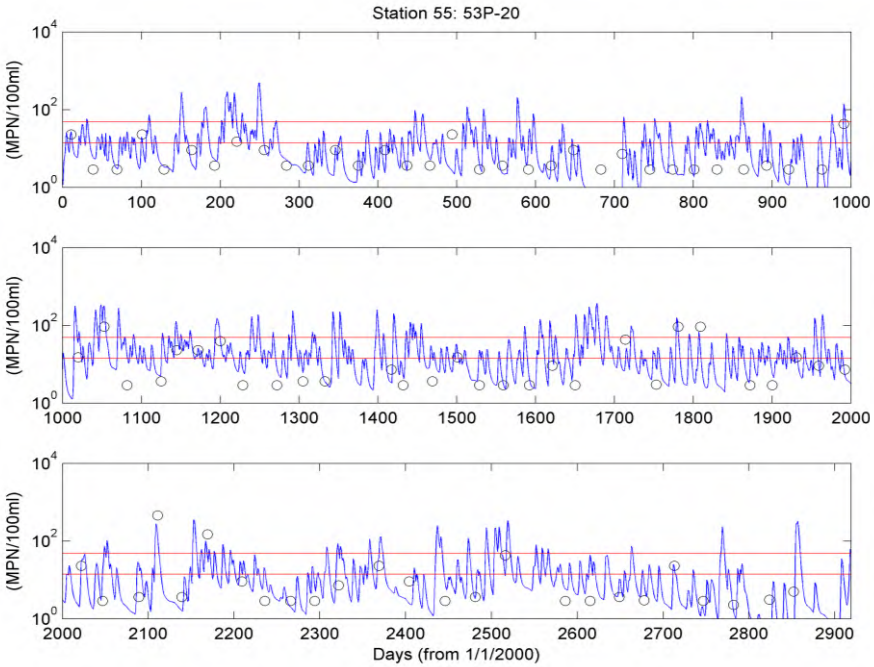
Model Simulation Results

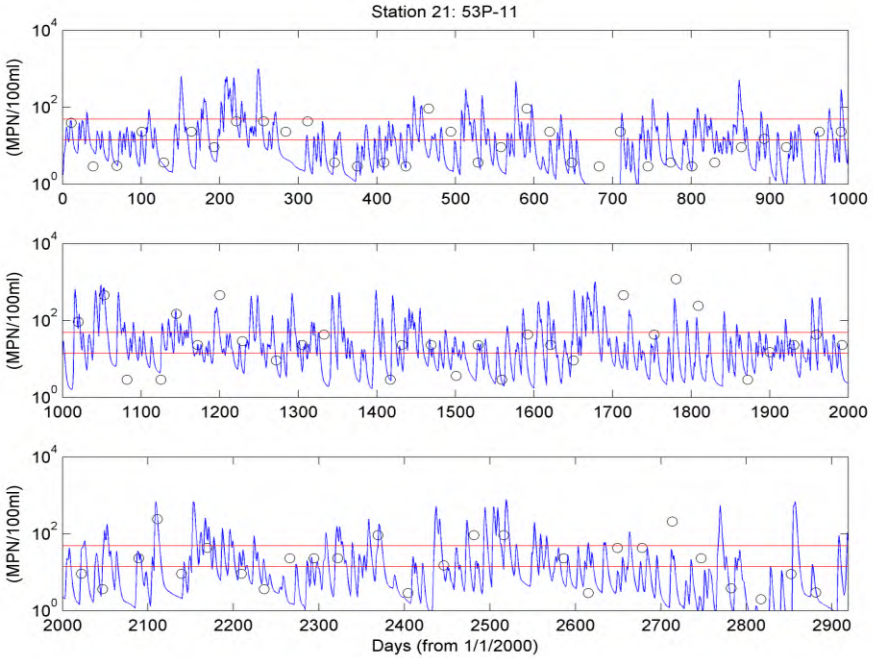
Poquoson River



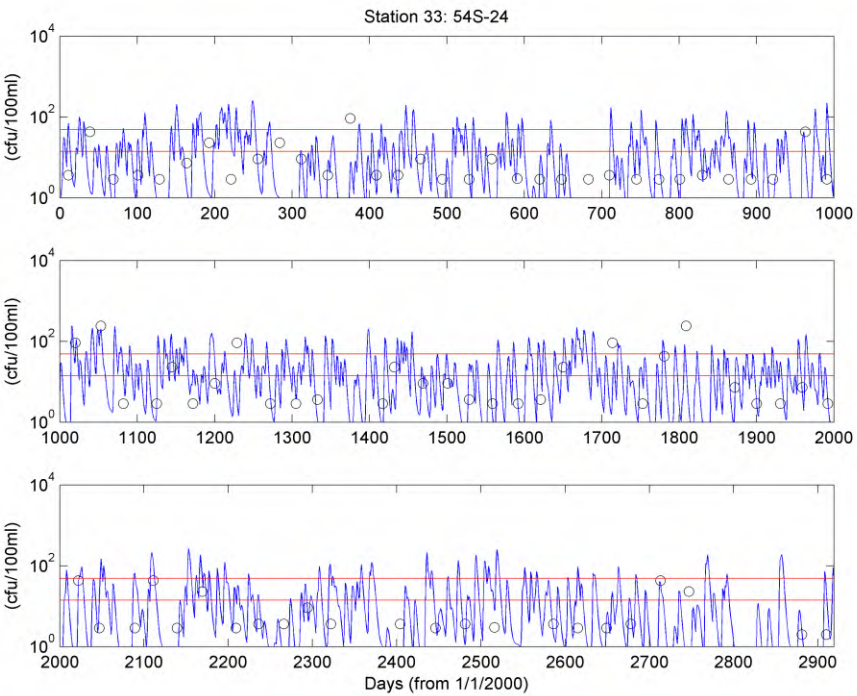


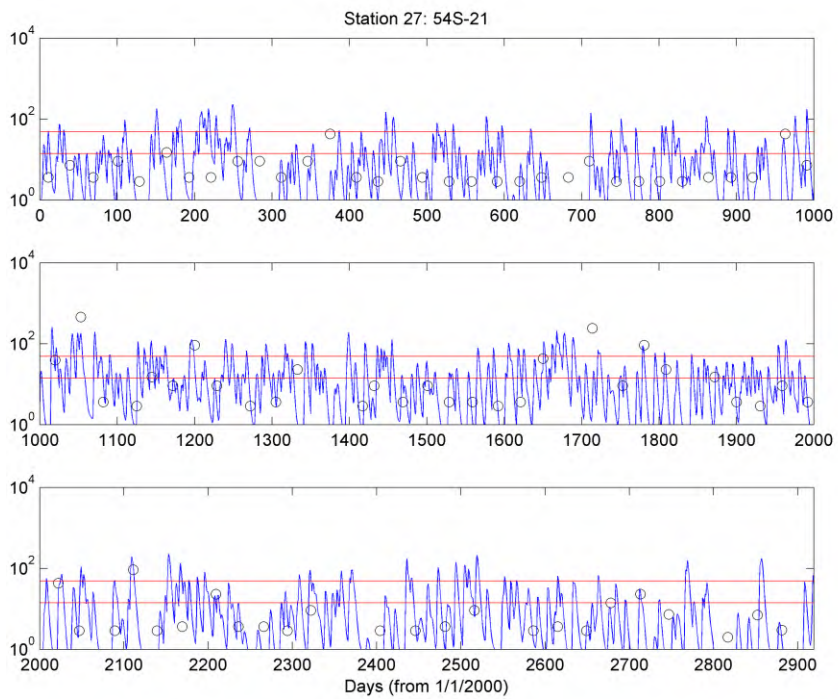
Poquoson River



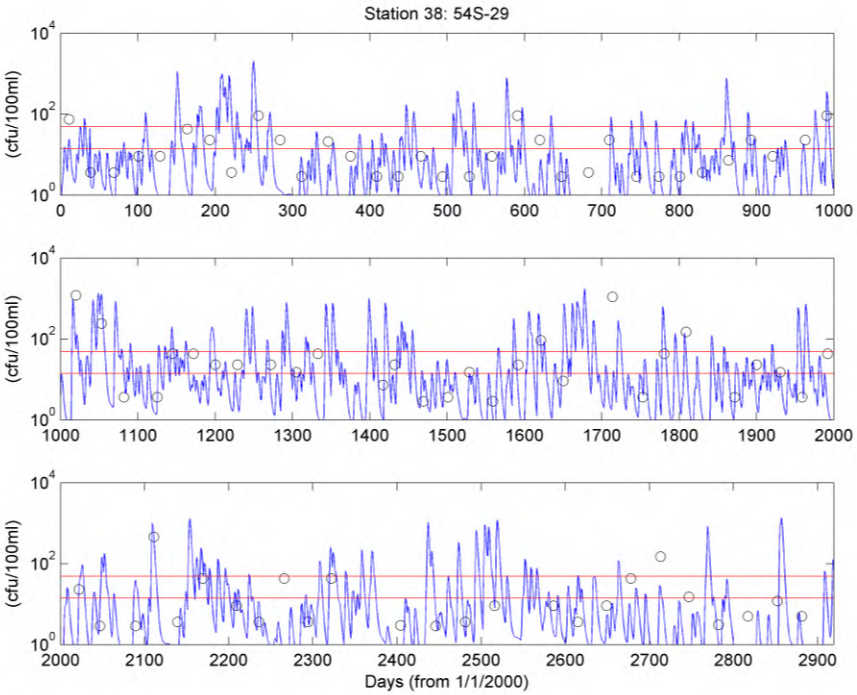


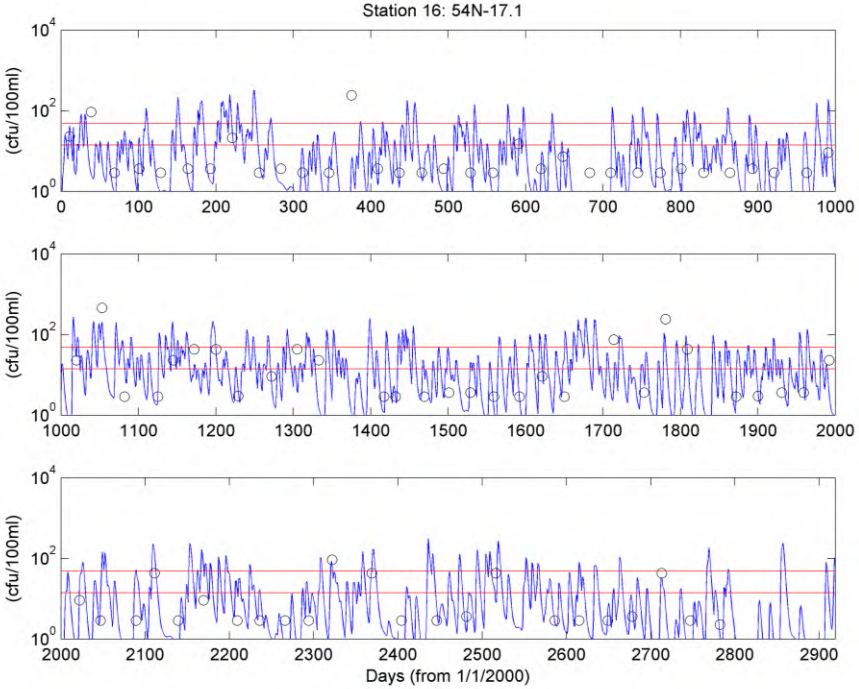
Back River


Station 33: 54S-24
(cfu/100ml)
Days (from 1/1/2000)


Station 27: 54S-21
Days (from 1/1/2000)

Back River


Station 38: 54S-29
(cfu/100ml)
Days (from 1/1/2000)


Station 16: 54N-17.1
(cfu/100ml)
Days (from 1/1/2000)

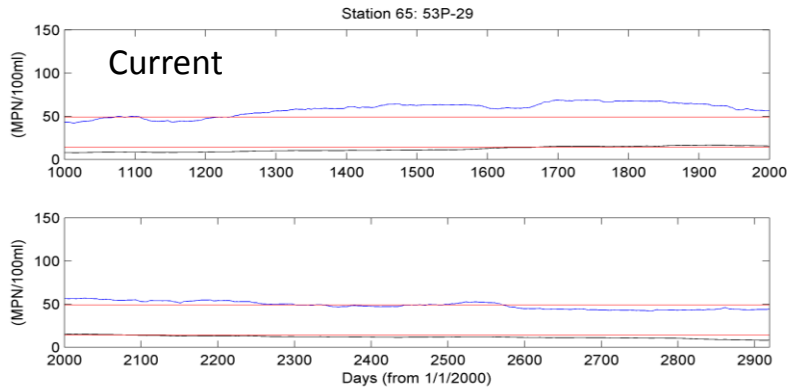
TMDL Development

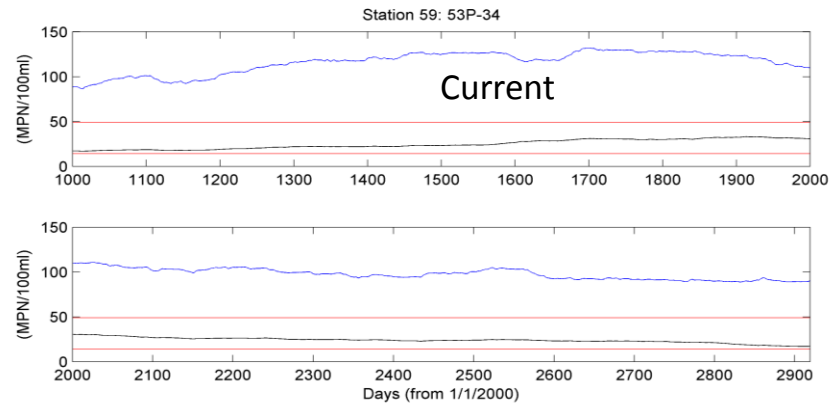
- Endpoint
  - Shellfish harvesting area (fecal coliform)
    - Geometric mean of 14 MPN/100mL
    - 90th percentile of 49 MPN/100mL
    - Use 30-month assessment period
    - 90th percentile is more stringent, and thus used as endpoint
  - Recreation (non-shellfish) area (enterococci)
    - Monthly geometric mean of 43 cfu/100 ml
    - Less than 10% of samples to exceed 104 cfu/100ml
  - Both shellfish and recreation area
    - Use most stringent criteria

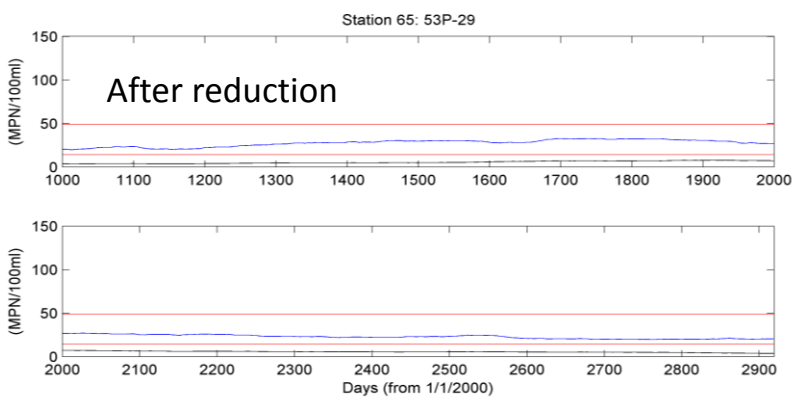
Model Simulation

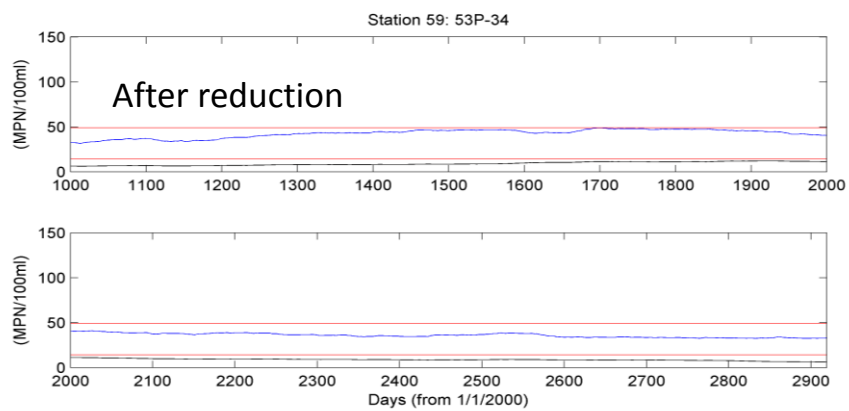
- Conduct model simulations
- For shellfish area
  - Compute 30-month geometric mean and 90th percentile for shellfish harvesting area
  - Ensure that 90th percentile and geometric mean criteria are met
- For recreational area
  - Convert fecal coliform to enterococci
  - Compute monthly geometric mean

Example of Results

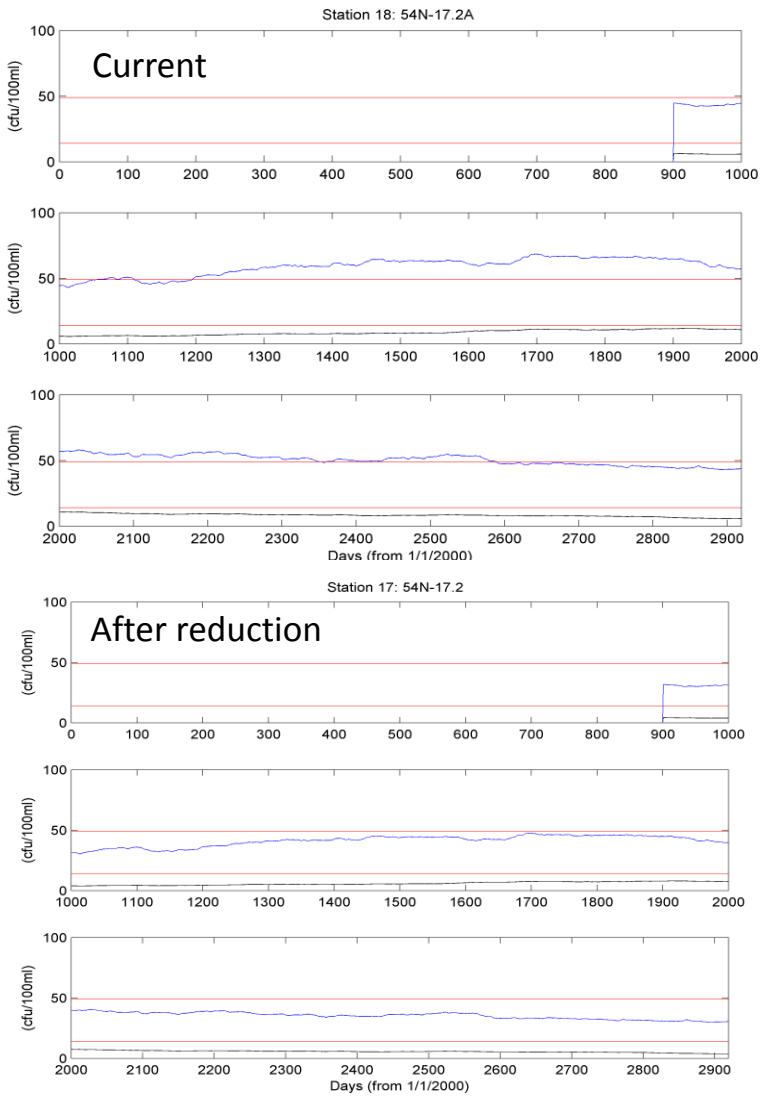




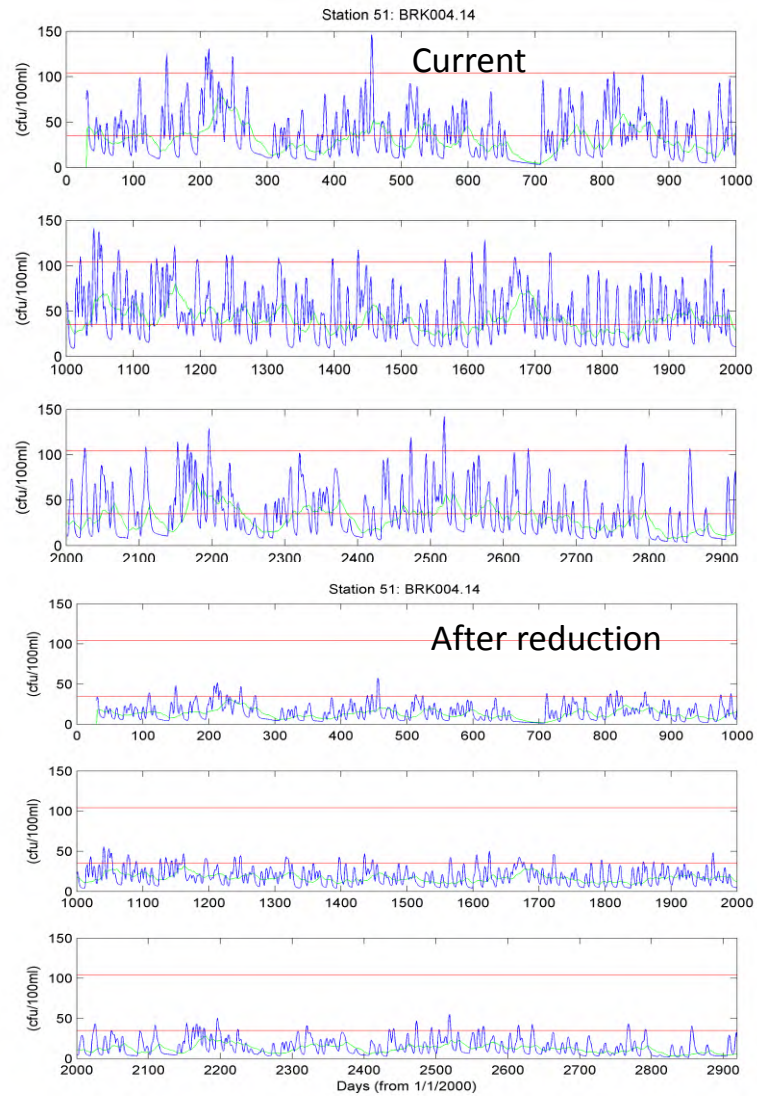




Back River



Shellfish area



Recreational area

Estimation of 90th Percentile Loading Based on Long-term Model Simulations

- Following USEPA guideline to convert long-term mean loading to 90th percentile maximum daily load
  - **The maximum daily load is a value that will be exceeded with a pre-defined probability:** In this option, a "reasonable" upper bound percentile is selected for the maximum daily load based upon a characterization of the variability of daily loads. For example, selection of the 90th percentile value would result in a maximum daily load that would be exceeded 10% of the time.

Estimation of 90th Percentile Loading Based on Long-term Model Simulations

$$TMDL = LTA \cdot \exp(Z_p \sigma_y - 0.5\sigma_y^2)$$

Where Zp is p^{th} percentage point of the standard normal distribution. For the 90th percentile, Zp = 1.28 (for the 95th percentile, Zp =1.645). LTA is long-term mean daily loading and σ_y is computed as:

$$\sigma_y = \sqrt{\ln(CV^2 + 1)}$$

where the CV is coefficient of variation of the untransformed data, which equals the standard deviation divided by the mean.

USEPA 2007

Results (Poquoson River)

List ID	Name	Current Load (Counts/Day)	Allowable Load (Counts/Day)	Reduction (%)
VAT-C07E_LMC01A04	Lambs Creek - Poquoson River	1.67E+12	5.84E+11	65.0
VAT-C07E_PTC01A04	Patricks Creek - Poquoson River	1.00E+11	4.52E+10	55.0
VAT-C07E_ROB01A04	Roberts Creek - Upper	7.31E+10	5.33E+10	27.0
VAT-C07E_WHH01A06	White House Cove - Bennet Cr. Area	6.10E+11	3.42E+11	43.9
VAT-C07E_POQ01A06	Poquoson River - Upper [TMDL-CD]	1.30E+12	7.84E+11	39.5
VAT-C07E_CHS01A06	Chisman Creek-Upper & Goose Cr	1.30E+12	6.09E+11	53.3
VAT-C07E_HOD01A08	Hodges Creek - Upper	4.31E+11	1.73E+11	60.0
VAT-C07E_LYO01A06	Lyons Creek - Upper (DSS_06-IR)	1.11E+11	7.22E+10	35.0
VAT-C07E_FLY01A06	Floyds Bay	2.18E+11	1.38E+11	36.8
VAT-C07E_CAB01A08	Cabin Creek - Upper	2.29E+11	1.37E+11	40.0
VAT-C07E_POQ01B08	Poquoson Upper downstream POQ01A06	4.19E+10	1.38E+10	67.1
VAT-C07E_POQ02B08	Unnamed Cove @Crane	1.38E+10	6.20E+09	55.0
Sum		6.10E+12	2.96E+12	51.5

Results (Back River)

List ID	Name	Current Load (Counts/Day)	Allowable Load (Counts/Day)	Reduction (%)
VAT-C07E_LON01A06	Long & Grunland Creeks	5.39E+12	9.69E+11	82.0
VAT-C07E_INX01A10	Unnamed Inlet - Back R South Shore near Wallace Cr	7.53E+10	1.04E+10	86.2
VAT-C07E_HAR01A06	Harris River	8.65E+12	1.04E+12	88.0
VAT-C07E_IN101A08	DSS Inlet #1 - Unnamed Inle	1.09E+12	8.81E+10	91.9
VAT-C07E_WAT01A06	Watts Creek -	8.98E+10	6.47E+10	28.0
VAT-C07E_INB01A04	DSS Inlet #2 - Unnamed Inlet S. Shore of SW Br.	7.46E+10	7.46E+09	90.0
VAT-C07E_NEW01A02	Newmarket Creek - Upper	2.32E+12	1.25E+12	46.2
VAT-C07E_NEW02A02	Newmarket Creek – Lower	2.63E+12	1.39E+12	47.3
VAT-C07E_SWB01A08	SW Br Back River - Incl Tides Mill Cr	3.77E+12	2.10E+12	44.2
VAT-C07E_SWB02B10	SW Br Back R - DSS OPEN	4.99E+12	2.24E+12	55.1
VAT-C07E_SWB02A08	Southwest Br. Back River - Mouth	5.36E+12	2.53E+12	52.7
VAT-C07E_SWB01B08	SW Br Back River - Outside DSS Inlet #1 & #2	1.16E+12	9.55E+10	91.8
VAT-C07E_BRK01A06	Brick Kiln Creek	1.63E+12	4.76E+11	70.7
VAT-C07E_CCR01A06	Cedar & Topping Creeks	2.34E+11	1.29E+11	44.9
VAT-C07E_NWB01A06	Northwest	1.71E+12	5.53E+11	67.7
VAT-C07E_NWB01B08	Northwest Br. Back River - Upper	2.12E+12	7.98E+11	62.4
VAT-C07E_BAK01A00	Mainstem Back River	2.34E+13	5.89E+12	74.9

TMDL and Load Allocation

- There are no permits to discharge fecal coliform in Poquoson River and Back River
- There are MS4 permits held within both watersheds. Waste loads (WL) are allocated to MS4 based on percent of urban landuse within MS4 area
- Consider future development, 1% of TMDL is allocated to future growth (FA)
- The rest of loading is allocated to nonpoint source (LA)

TMDLs

Impairment	WLA	LA	MOS	TMDL
Poquoson River	**6.65E+11**	**2.29E+12**	Implicit	**2.96E+12**
MS4 Poquoson (VAR040024)	*2.87E+11*			
VDOT (VAR040044)				
MS4 York (VAR040028)	*3.48E+11*			
VDOT (VAR040044)				
Future Load	*2.96E+10*			
Back Creek	**9.46E+10**	**2.87E+11**	Implicit	**3.82E+11**
MS4 York (VAR040028)	*9.08E+10*			
VDOT (VAR040044)				
Future Load	*3.81E+09*			

*Each of the municipality MS4 loads has been aggregated with a portion of the adjacent VDOT MS4 load due to the continuity of the system.

Source Allocation and Reduction

Waterbody Name	Category	Current Load (Counts/Day)	Percentage	Allowable Load (Counts/Day)	Reduction Needed (%)
Poquoson River	Wildlife	3.90E+12	63.91	2.96E+12	24.0
	Pets	1.44E+12	23.58	0.00E+00	100.0
	Livestock	3.18E+11	5.21	0.00E+00	100.0
	Septic	3.55E+09	0.06	0.00E+00	100.0
	SSO	3.01E+11	4.94	0.00E+00	100.0
	Marina	1.40E+11	2.30	0.00E+00	100.0
	Total	6.10E+12	100.0	2.96E+12	51.4
Back Creek	Wildlife	5.84E+11	79.44	3.81E+11	34.7
	Pets	1.50E+11	20.47	0.00E+00	100.0
	Livestock	5.90E+08	<1	0.00E+00	100.0
	Septic	1.34E+08	<0	0.00E+00	100.0
	SSO	0	0	0	
	Marina	0	0	0	
	Total	**7.35E+11**	**100**	**3.81E+11**	**48.2**

TMDLs

Impairment	WLA	LA	MOS	TMDL
Back River	**2.76E+12**	**3.13E+12**	implicit	**5.89E+12**
MS4 Newport News (VA0088633)	*3.11E+11*			
VDOT (VAR040044)				
DOE-TJ Accelerator Facility (VAR040079)				
MS4 Hampton (VA0088641)	*2.16E+12*			
VDOT (VAR040044)				
TNCC (VAR040087)				
Langley Air Force Base				
MS4 Poquoson (VAR040024)	*8.45E+10*			
VDOT (VAR040044)				
MS4 York (VAR040028)	*1.21E+11*			
VDOT (VAR040044)				
MS4 NASA Langley Research	*2.99E+10*			
Center (VAR040079)				
Future Load	*5.89E+10*			

*Each of the municipality MS4 loads has been aggregated with a portion of the adjacent VDOT MS4 load and other Phase II MS4 permit holders where noted, due to the continuity of the system.

Source Allocation and Reduction

Waterbody Name	Category	Current Load (Counts/Day)	Load Allocation (Counts/Day)	Reduction Needed (%)
	Livestock	2.10E+12	0.0	100.0%
Back River	Wildlife	1.16E+13	5.89E+12	49.5%
	Human (Septic, SSO, Marina)	1.54E+12	0.0	100.0%
	Pets	8.10E+12	0.0	100.0%
	Total	2.34E+13	5.89E+12	74.8%

Questions and Comments

(Comment period August 1- August 31, 2013)

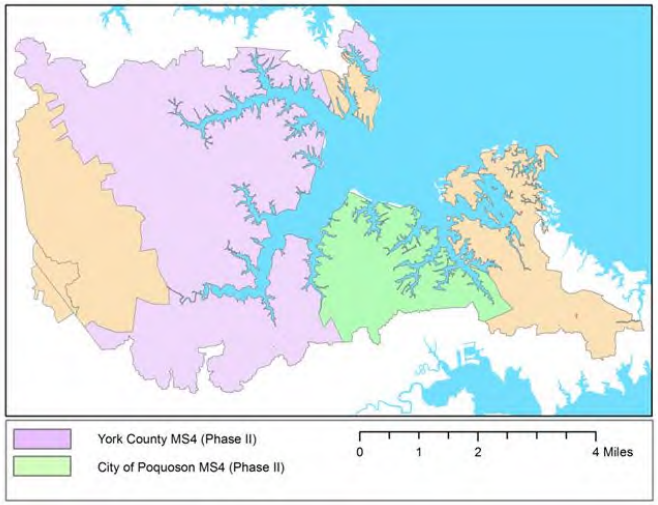
Thanks!

Comments send to:
Jennifer S. Howell (Jennifer.Howell@deq.virginia.gov)
Virginia Department of Environmental Quality
Tidewater Regional Office, 5636 Southern Blvd
Virginia Beach, VA 23462

MS4

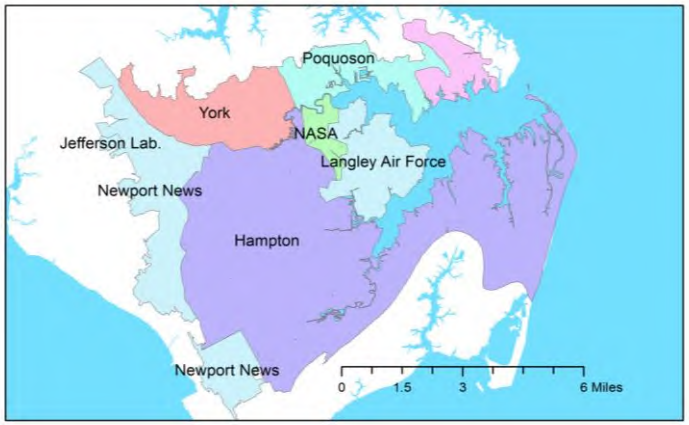
Poquoson River

MS4 Permit Holder	Phase	Permit Number	Jurisdiction	Acreage
York County	II	VAR040028	York County	11,098
City of Poquoson	II	VAR040024	City of Poquoson	2,692
VDOT*	II	VAR040044	York County/City of Poquoson	



Back River

MS4 Permit Holder	Phase	Permit Number	Jurisdiction	Acreage
Newport News	I	VA0088633	Newport News	5,962
Hampton	I	VA0088641	City of Hampton	22,186
York	II	VAR040028	York County	3,729
Poquoson	II	VAR040024	City of Poquoson	2,495
Thomas Nelson Community College	II	VAR040087	York County	91.3
NASA Langley Research Center	II	VAR040079	York County	729
VDOT*	II	VAR040044		
DOE Thomas Jefferson Accelerator Facility	II	VAR040079		116
Langley Air Force Base	II		DOD properties	2,917



*The Technical Advisory Committee (TAC) recommended that the aggregation of the VDOT MS4 WLA with watershed MS4 WLA was the best course of action

TMDL for Impaired Segment

List ID	TMDL	LA	WLA	MOS
VAT-C07E_LMC01A04	5.84E+11	4.44E+11	1.39E+11	Implicit
VAT-C07E_PTC01A04	4.52E+10	3.91E+10	6.15E+09	Implicit
VAT-C07E_ROB01A04	5.33E+10	4.45E+10	8.86E+09	Implicit
VAT-C07E_WHH01A06	3.42E+11	1.95E+11	1.47E+11	Implicit
VAT-C07E_POQ01A06	7.84E+11	6.21E+11	1.63E+11	Implicit
VAT-C07E_CHS01A06	6.09E+11	4.89E+11	1.20E+11	Implicit
VAT-C07E_HOD01A08	1.73E+11	1.68E+11	4.84E+09	Implicit
VAT-C07E_LYO01A06	7.22E+10	5.18E+10	2.04E+10	Implicit
VAT-C07E_FLY01A06	1.38E+11	1.19E+11	1.92E+10	Implicit
VAT-C07E_CAB01A08	1.37E+11	1.27E+11	1.05E+10	Implicit
VAT-C07E_POQ01B08	1.38E+10	1.27E+10	1.09E+09	Implicit
VAT-C07E_POQ02B08	6.20E+09	5.36E+09	8.44E+08	Implicit
Sum	2.96E+12	2.32E+12	6.41E+11	

Poquoson River Watershed

Waterbody Name	Impairment	TMDL	=	LA	+	WLA	+	FA	+	MOS
City of Poquoson MS4 (VAR040024)	Fecal coliform	1.00×10^{12}		7.02×10^{11}		2.90×10^{11}		1.00×10^{10}		Implicit
York County MS4 (VAR040028)	Fecal coliform	1.96×10^{12}		1.59×10^{12}		3.52×10^{11}		1.96×10^{10}		Implicit

Back River TMDL for Impaired Segment

List ID	TMDL	LA	WLA
VAT-C07E_LON01A06	9.69E+11	6.46E+11	3.23E+11
VAT-C07E_INX01A10	1.04E+10	8.20E+09	2.16E+09
VAT-C07E_HAR01A06	1.04E+12	5.97E+11	4.38E+11
VAT-C07E_IN101A08	8.81E+10	5.60E+10	3.21E+10
VAT-C07E_WAT01A06	6.47E+10	5.80E+10	6.65E+09
VAT-C07E_INB01A04	7.46E+09	4.47E+09	2.99E+09
VAT-C07E_NEW01A02	1.25E+12	4.20E+11	8.30E+11
VAT-C07E_NEW02A02	1.39E+12	4.71E+11	9.17E+11
VAT-C07E_SWB01A08	2.10E+12	8.32E+11	1.27E+12
VAT-C07E_SWB02B10	2.24E+12	8.86E+11	1.35E+12
VAT-C07E_SWB02A08	2.53E+12	1.05E+12	1.48E+12
VAT-C07E_SWB01B08	9.55E+10	5.93E+10	3.62E+10
VAT-C07E_BRK01A06	4.76E+11	3.13E+11	1.63E+11
VAT-C07E_CCR01A06	1.29E+11	9.26E+10	3.63E+10
VAT-C07E_NWB01A06	5.53E+11	3.66E+11	1.87E+11
VAT-C07E_NWB01B08	7.98E+11	5.56E+11	2.43E+11
VAT-C07E_BAK01A00	5.89E+12	3.13E+12	2.70E+12