Potomac Environmental Research and Education Center

College of Science

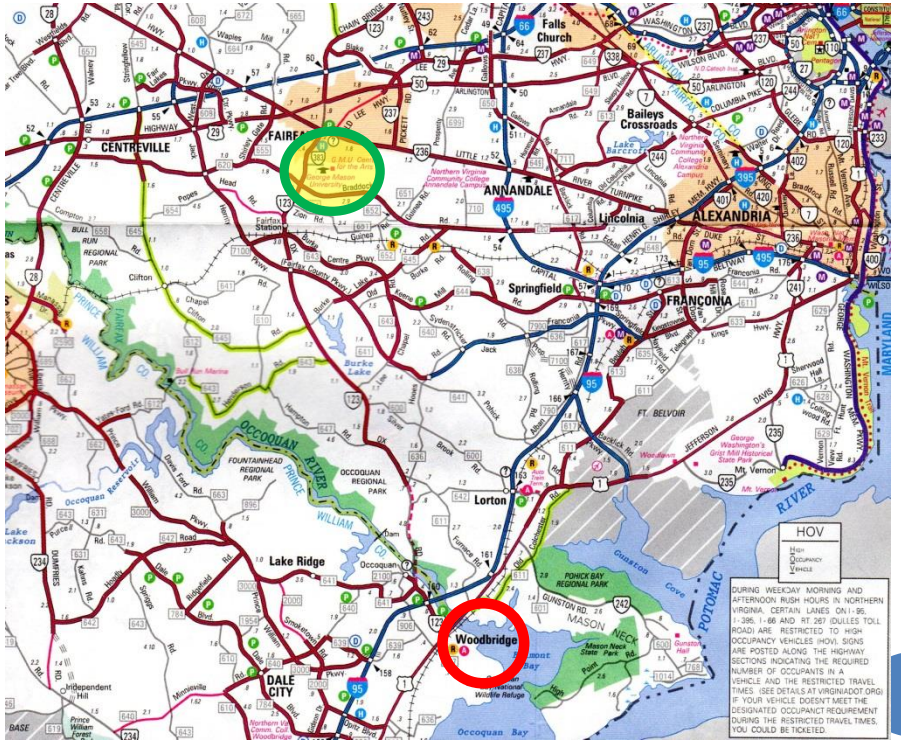
George Mason University

PEREC's Mission

- To utilize the tools of scientific research, restoration, education, and policy analysis to help society understand and sustain natural processes in ecosystems, watersheds, and landscapes.
- Our goals will be achieved through:
  - Research and Scholarship
  - Instruction: Academic and Contract
  - Outreach and Events

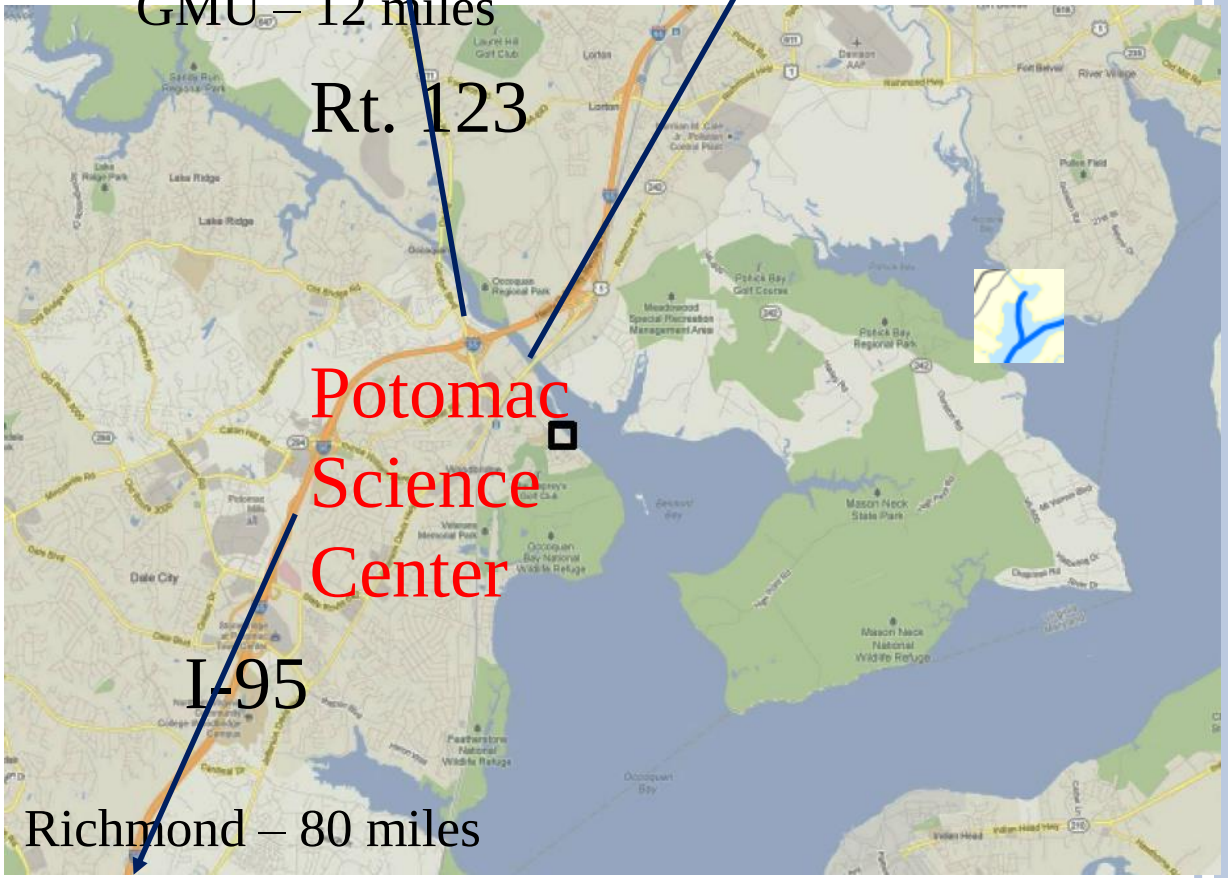
Potomac Environmental Research and Education Center

- We have a new building opening in Spring 2017
- Chief Tenant of Potomac Science Center
- Located on the tidal Occoquan River in Woodbridge
- 15 miles from the Fairfax campus, about 25 minute drive down Rt. 123



Vicinity Map

- Many natural areas affording research opportunities in the immediate area
- National Wildlife Refuges: Mason Neck, Occoquan Bay, and Featherstone
- National Parks: Captain John Smith National Historic Trail, Potomac Heritage National Scenic Trail, Prince William Forest Park
- Regional Parks: Occoquan, Pohick Bay
- Meadowood BLM Special Use Area



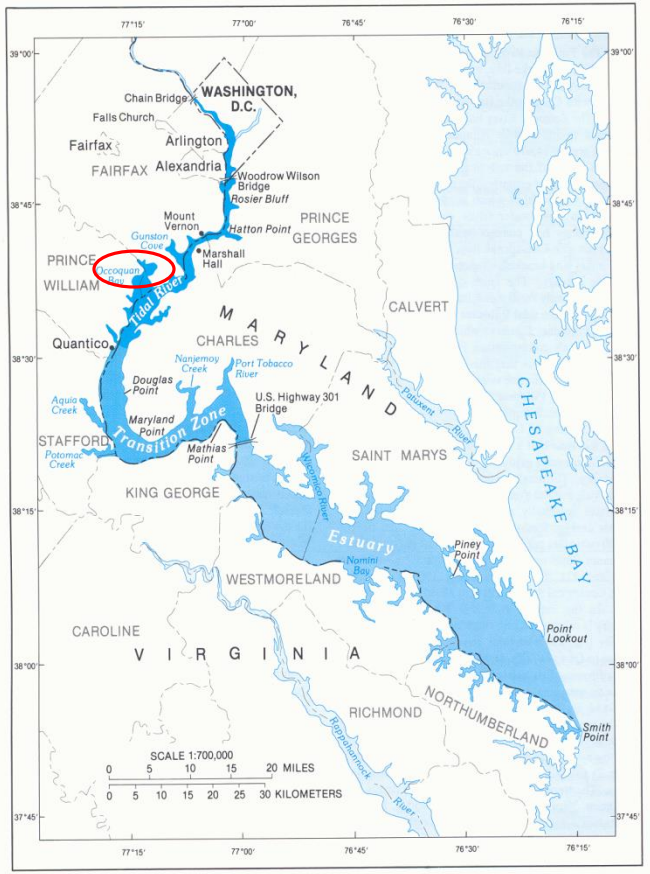


Figure 2. The tidal Potomac River and Estuary.

Tidal Potomac River: A Chesapeake Bay Subestuary

- The tidal Potomac River is the largest subestuary in the Chesapeake Bay system
- Salinity zones
  - Tidal Freshwater (“tidal river”),0.5 ppt salinity
  - Oligohaline (“transition zone” 0.5-6 ppt salinity)
  - Mesohaline (“estuary” 6-14 ppt salinity)
- Drainage area to tidal river at Chain Bridge: about 30,000 km^2
- So, large freshwater input that creates a large tidal freshwater zone of about 50 km in length


Parking Garage
GGS Offices
PEREC offices, labs
Multi-purpose room
Potomac Nat'l Heritage Scenic trail
1000ft² Exhibit Hall
Tidal Occoquan River


Occoquan River
NPS Potomac Nat'l Heritage Scenic trail
Flows to Potomac

Facilities at Potomac Science Center

- 8 PI Research wet labs
- 2 Teaching wet labs
- 12 Support rooms
  - Including autoclaves, growth chambers, biosafety cabinets
- Faculty and Grad Student Offices
- Large Multipurpose Event Room (100+)
- Lecture Room (40+)
- K12 Discovery Lab
- Exhibition Hall with walkout onto River Patio

Facilities at Potomac Science Center

- Currently scheduled to move in August 2017
- Labs operational within days of move-in
- First university classes scheduled for Fall 2017
- First professional training class: Algal Identification, August 24/25, 2017

Facilities at Potomac Science Center

PEREC FACULTY

- R. Chris Jones – water quality, plankton, SAV (ESP)
- Kim De Mutsert – fish ecology (ESP)
- Dann Sklarew – aquatic ecology & sustainability (ESP)
- Greg Foster – aquatic organic chemistry (CHEM)
- Tom Huff – organic micropollutants

- Amy Fowler – benthic ecology (ESP)
- Randy McBride – coastal geomorphology (AOES)
- Cindy Smith – K12 outreach and sustainability (ESP)

R. Christian Jones, PhD

Director, PEREC

Water Quality and Nutrients

Plankton and Benthos

Long Term Study of Gunston Cove

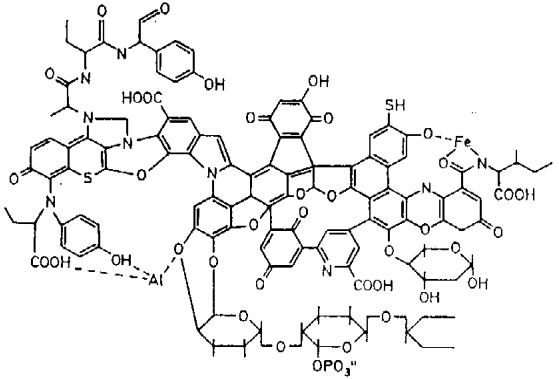
Greg Foster

Senior Faculty Fellow

Environmental Chemistry

Organic Micropollutants

- Organic matter flocculation at the ETM (estuarine turbidity maximum) examines sediment
- Fingerprinting and source apportionment of PAHs (where did pollutants come from)
- Wastewater Treatment Plant emissions of pharma chemicals
- Bioaccumulation of endocrine disrupting chemicals in fish – examines tissues



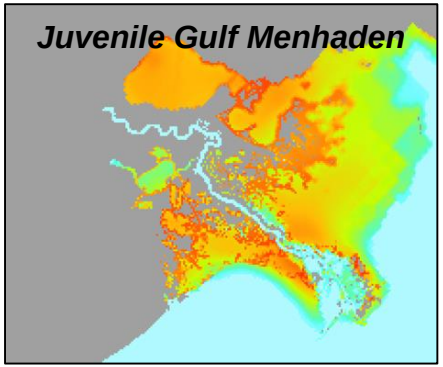
Kim DeMutsert

Associate Director

Fish Ecology

Ecosystem Modeling

Gulf of Mexico fish ecology



Dann Sklarew

Associate Director

Watershed Stewardship

Sustainability Science and Education

- Brook trout sustainability index
- Public participation and governance in water resources management
- Sustainability project on college campuses

Randy McBride

Faculty Fellow

Coastal Geology, Geomophology, and Processes

Examines sediment cores to understand deposition over time

Looks at processes of sea island inlet formation and closure

Amy Fowler

Faculty Fellow

Invertebrate Ecology

Invasive species

- Black gill disease in shrimp
- Individual-based model of blue crab fishery
- Developing a benthic IBI in the Potomac River

Cindy Smith

Faculty Fellow and K12 Director

K12 Schools Programs

Sustainability Education

- Meaningful Watershed Educational Experiences
  - 6000 6th Graders/yr in PW Co Public Schools
  - 5000 7th Graders/yr in Fairfax Co Public Schools
  - 20-30 Grad & Undergrad students/yr serving as Field Interpreters

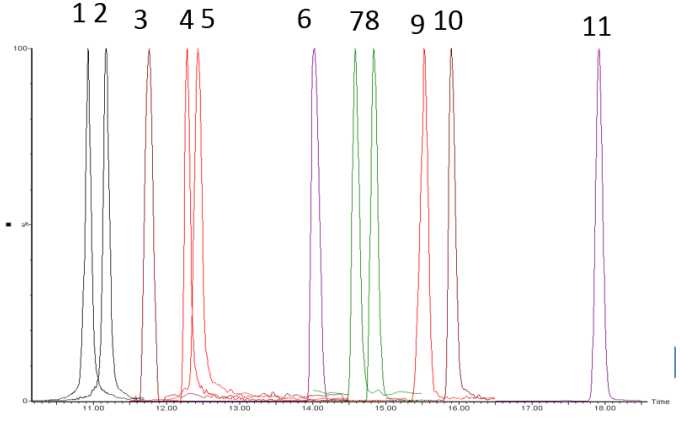
Tom Huff

Faculty Fellow

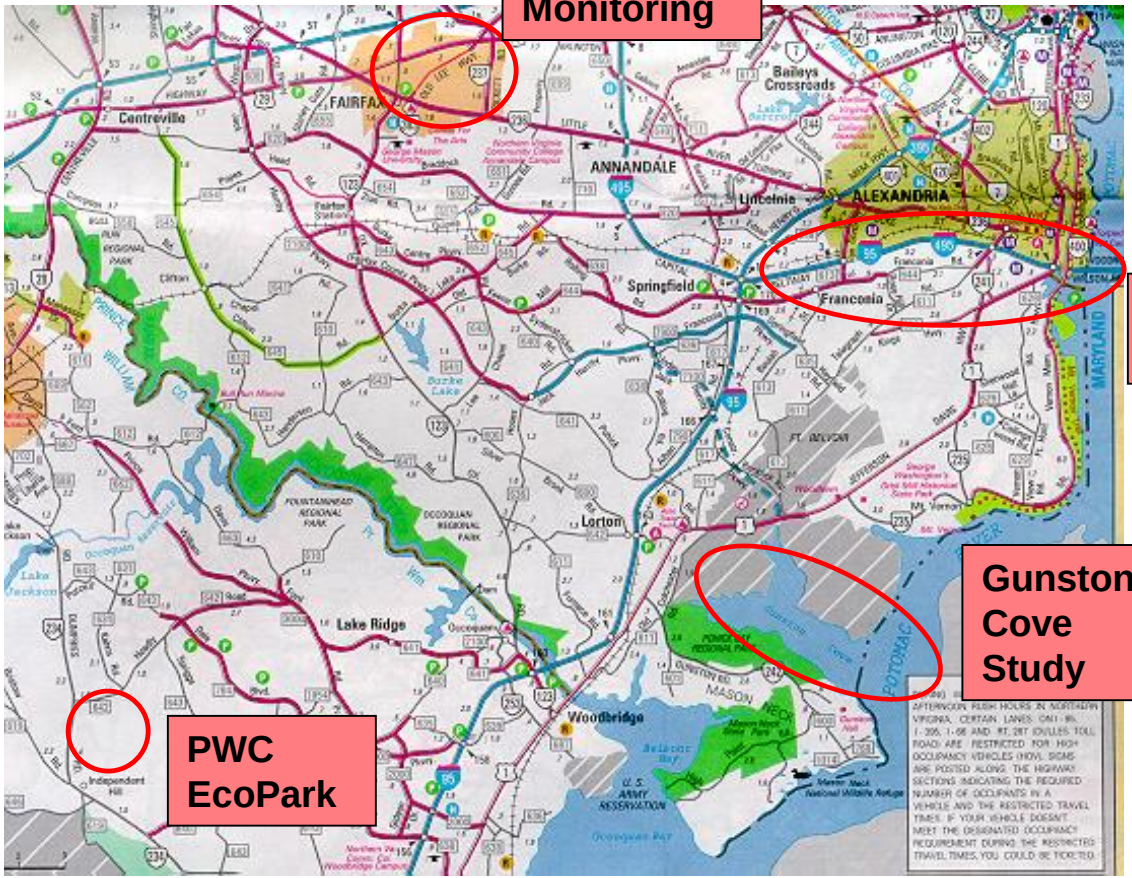
Instrumental Analysis

Organic and Inorganic Micropollutants

- Pesticides and herbicides in the Occoquan River Basin
- Mass spectrometric analysis of endocrine disrupting chemicals, pharmaceuticals and personal care products
- Hunting Creek micropollutant study – Alexandria Renew Enterprises Grant
- Development of liquid chromatography – tandem mass spectrometry methods for analysis of micropollutants in environmental samples

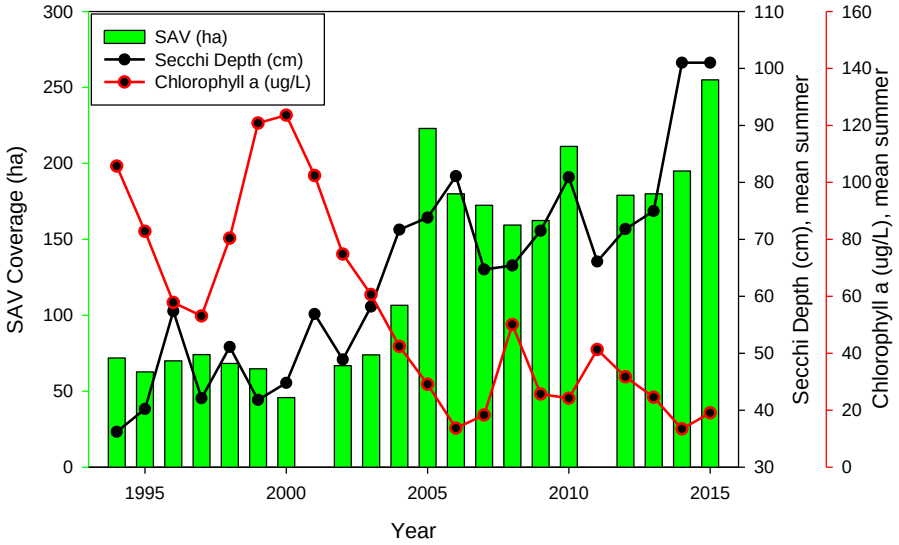


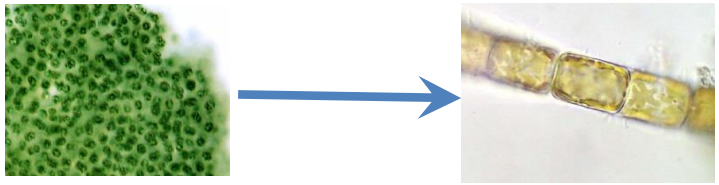
PEREC Research Sites



Major Research Projects

- Gunston Cove
  - Begun in 1984 to track effectiveness of remedial measures to control nutrient loading of the Potomac
  - Has documented long-term recovery of the Gunston Cove ecosystem including a shift in dominant phytoplankton taxa from cynaobacteria to diatoms
  - Total funding: >$2 million



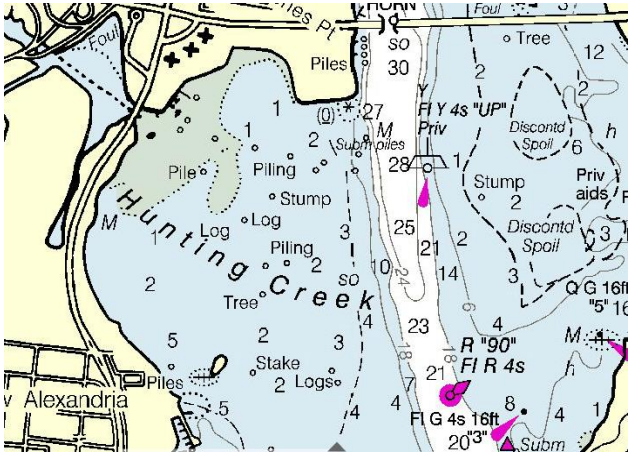


Major Research Projects

- Gunston Cove
  - Gunston Cove study has been a partnership with Fairfax County that has brought numerous national awards as a model of cooperation and adaptive management
- Fairfax County has produced a YouTube video that we have linked to at the PEREC web site
- https://youtu.be/W5AQixS_vvg
- https://cos.gmu.edu/perec/our-research/gunston-cove-study/

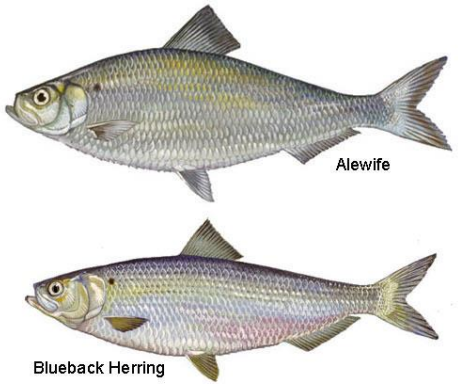
Major Research Projects

- Hunting Creek
  - Begun in 2003 again to track effectiveness of remedial measures to control nutrient loading of the Potomac
  - Modeled after Gunston Cove Study, but includes some additional components:
    - E. coli (combined sewer issues)
    - Organic micropollutant studies
    - Water quality mapping



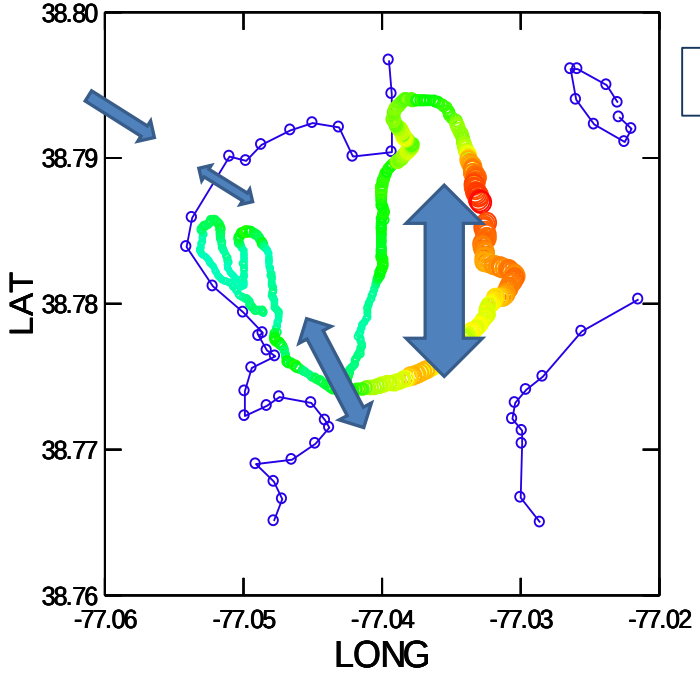
Hunting Creek - Fish Sampling

- Intensive sampling at Head of Tide site March – May to address anadromous fish spawning utilization
- To everyone's surprise, we have discovered river herring spawning in Cameron Run, a highly urbanized drainage



Hunting Creek - Water Quality Mapping

- Data mapping on selected dates to address fine scale spatial variation (below Turbidity was measured at 15 second intervals moving slowly through the study area)

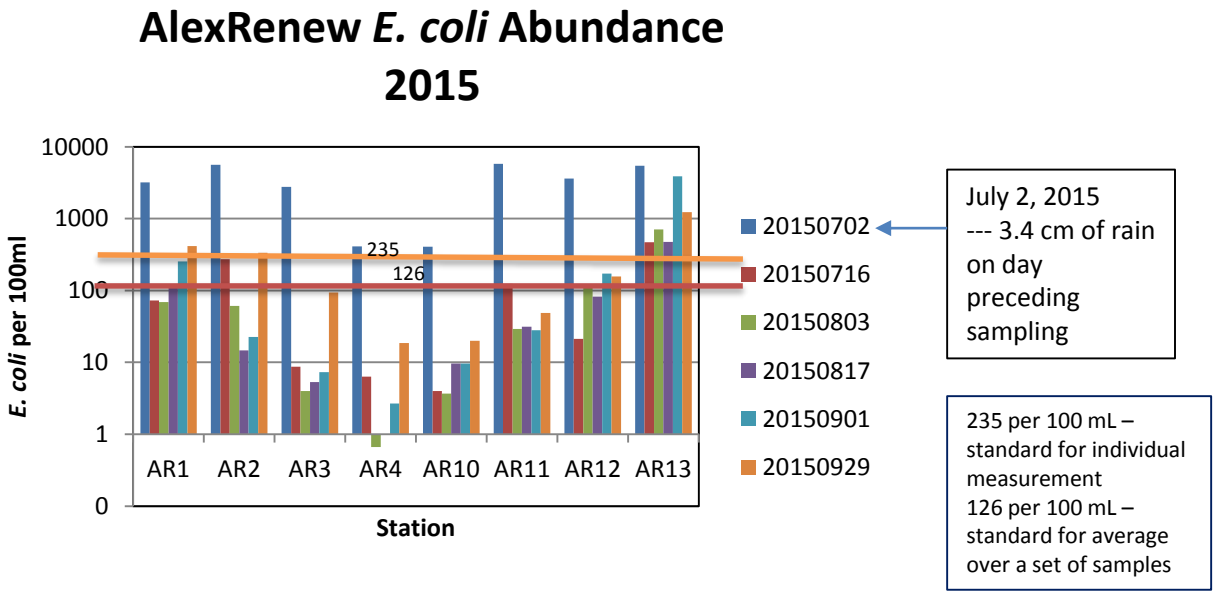


Water flows in blue

TURBID_	TURBID_
20	20
10	10
0	0
-10	-10

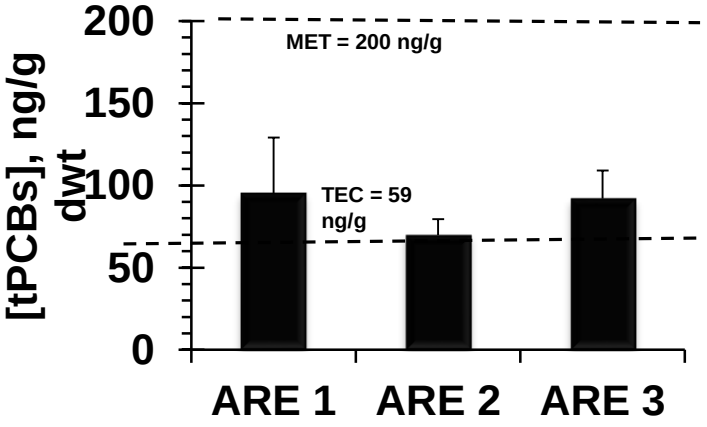
Hunting Creek – *E. coli* Studies

- *E. coli* results are depicted on log graph due to wide range of concentrations
- Note higher values on certain dates (ex. July 2) and at certain stations (AR 1, AR 11, AR 12, AR 13 – tributary sites) due to combined sewer overflows

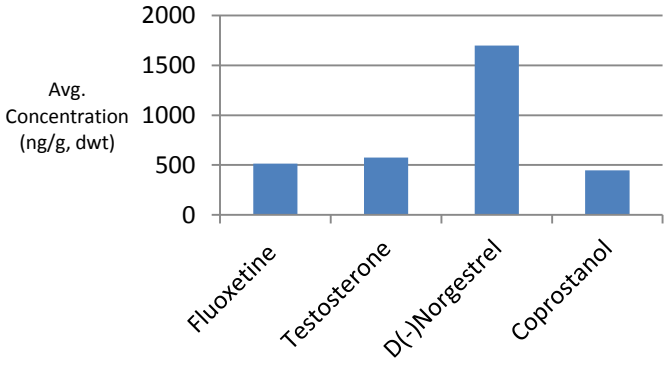


Hunting Creek - Micropollutant Data

- Micropollutant data require demanding sample prep and analysis protocols but yield prolific data
- Here are some of the ways that the data has been summarized
- In 2013 we focused on PCB's and in 2014 and 2015 on pharmaceuticals



Sediment values
TEC = threshold effect standard
MET = minimum effect threshold



Sediment values of selected pharmaceuticals
Averaged over all samples

- **Citizen science outreach for river water quality monitoring**

Prince William County Public Schools
Providing A World-Class Education

Potomac Environmental Research and Education Center
George Mason University
perec.gmu.edu

National Park Service

National Wildlife Refuge System

National Oceanic and Atmospheric Administration
NOAA
U.S. Department of Commerce

Alice Ferguson Foundation
www.FergusonFoundation.org

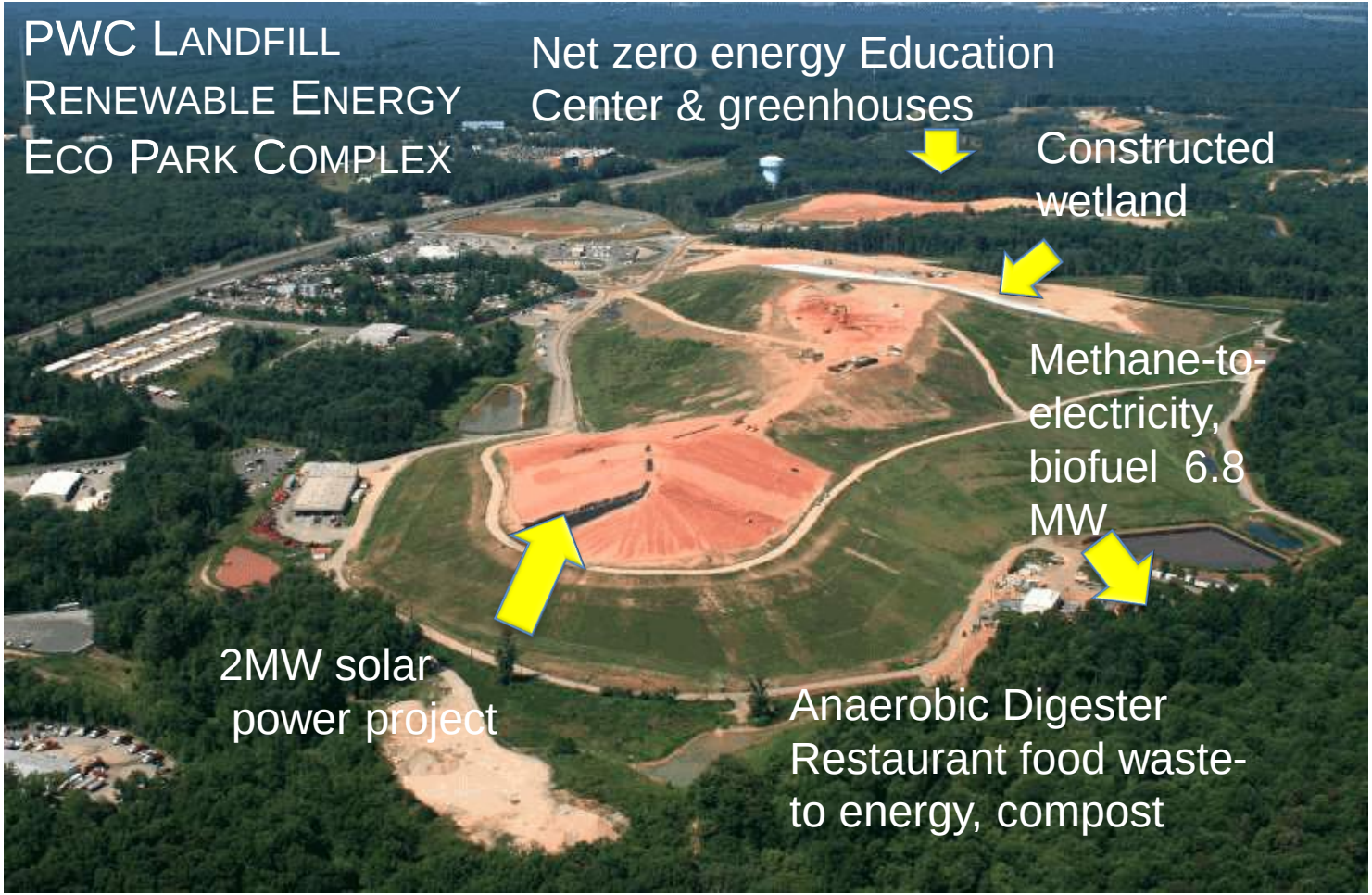
Meaningful Watershed Educational Experiences Prince Wm. Co. Public Schools

6000 6th graders/yr

~60 MWEE days in 2 nat'l parks

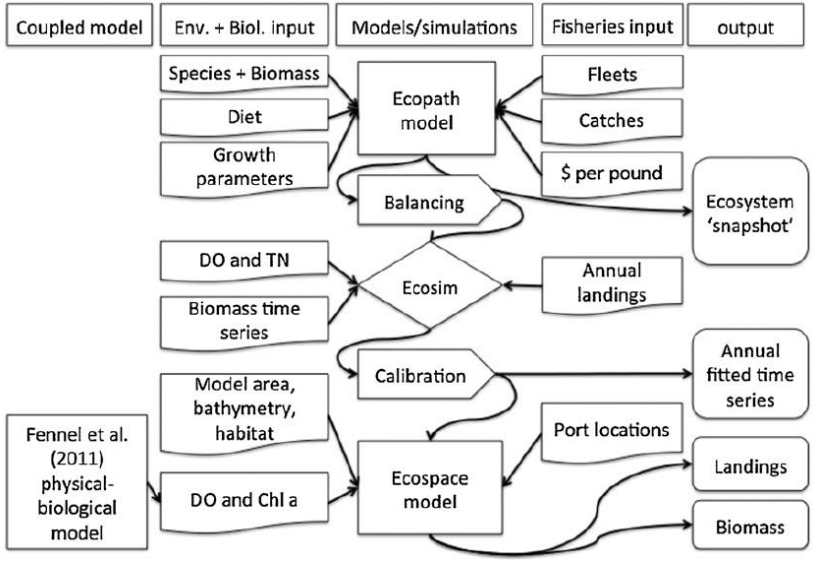





PWC Landfill Renewable Energy Eco Park Complex
Net zero energy Education Center & greenhouses
Constructed wetland
Methane-to-electricity, biofuel 6.8 MW
2MW solar power project
Anaerobic Digester Restaurant food waste-to energy, compost

Reach goes beyond the Potomac
Modeling of the Gulf of Mexico

- Kim DeMutsert just landed a $750K grant to use modeling skills to help understand how changing the amount and location of Missisippi River inflows will affect Gulf fisheries



Reach goes beyond the Potomac
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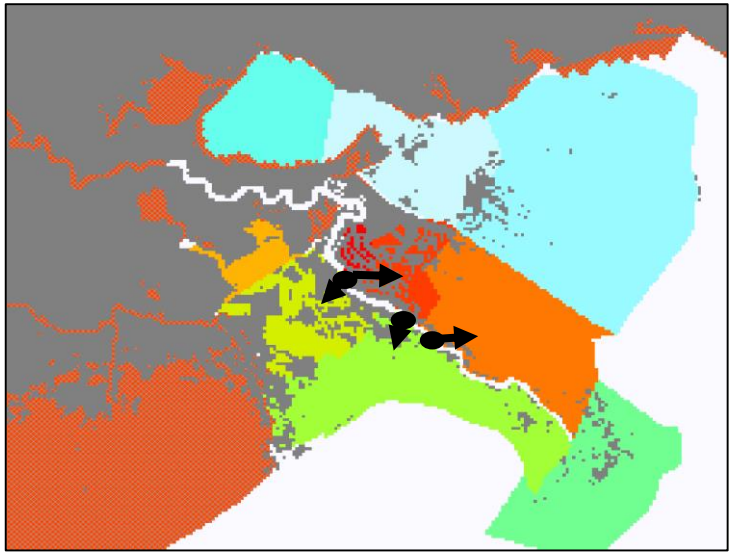
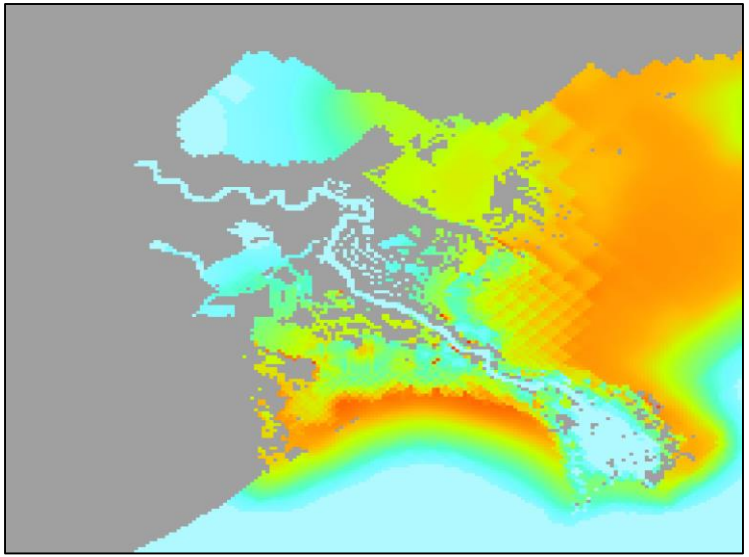


Diversions in tested operation plan



Example: brown shrimp biomass year 50

PEREC Moving to PSC
Looking forward to Great Things!