NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM

Tributary Water Quality and Storm Water Monitoring, Old Woman Creek NERR

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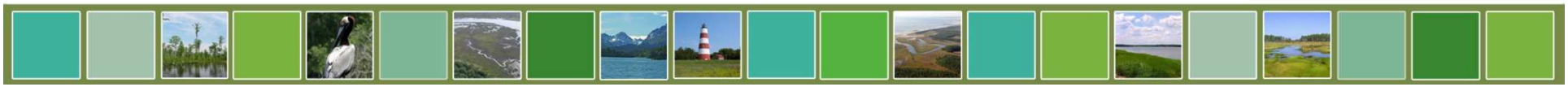
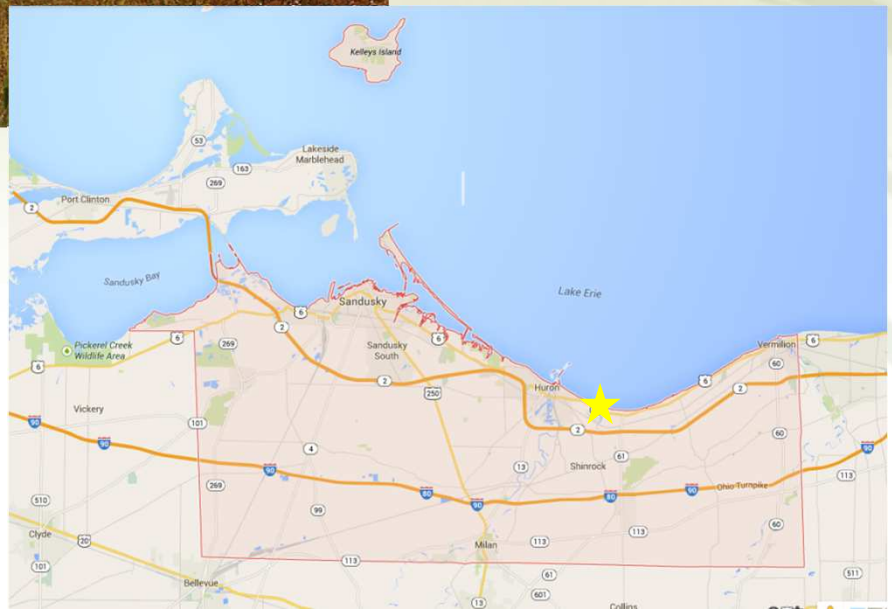


Old Woman Creek

ODNR DOW Wildlife Research Unit

ODNR State Nature Preserve



Old Woman Creek

National Estuarine Research Reserve

OWC as a model system

CLIMATE

Lake water level

Storm frequency and intensity

Temperature increase

LAND USE

Agricultural practices

Storm water runoff

MONITORING

Wetland ecosystem services

Watershed management

Water quality

HAB and hypoxia formation

Monitoring Programs

Tributary water quality monitoring programs

Old Woman Creek estuary

- NERRS System Wide Monitoring Program
- Heidelberg Tributary Loading Program

Erie County Watersheds

- Firelands Coastal Tributaries Volunteer Watershed Monitoring Program

Storm water monitoring programs

Low impact development stormwater control management systems

- Chagrin River Watershed Partners

Other Activities

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Other Activities

NERRS System Wide Monitoring Program (SWMP)

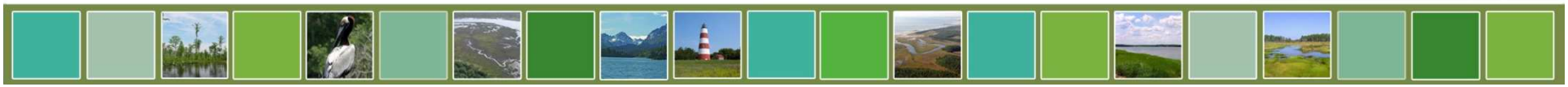
Meteorology, Water Quality

Goals

Identify, track short-term variability and long-term changes

- Water quality
- Biodiversity
- Land use and habitat

Contribute to effective coastal zone management



NERRS System Wide Monitoring Program (SWMP)

Meteorology

2002 – present

OWC Visitor Center

15-minute intervals

Parameters

- Air temperature
- Barometric pressure
- Humidity
- Wind direction and speed
- Precipitation
- Photosynthetically Active Radiation (PAR)

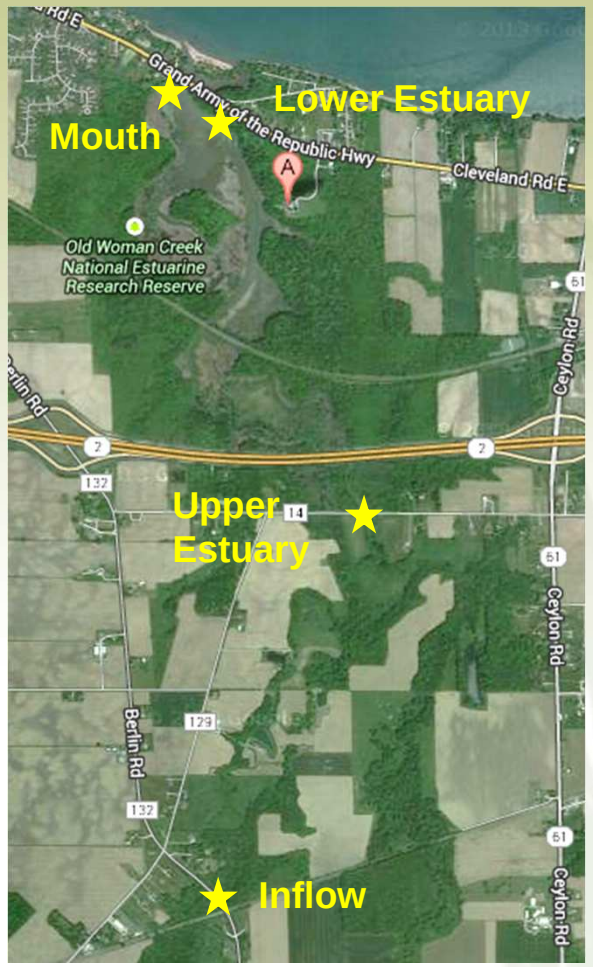
NERRS System Wide Monitoring Program (SWMP)

Water Quality

1996 – present; 1980 – present

March – December

4 locations throughout estuary



NERRS System Wide Monitoring Program (SWMP)

Water Quality

YSI 6600 and EXO2 sondes

15-minute intervals

Parameters

- Temperature
- Turbidity
- Conductivity
- Dissolved oxygen
- pH
- Water depth

NERRS System Wide Monitoring Program (SWMP)

Water Quality

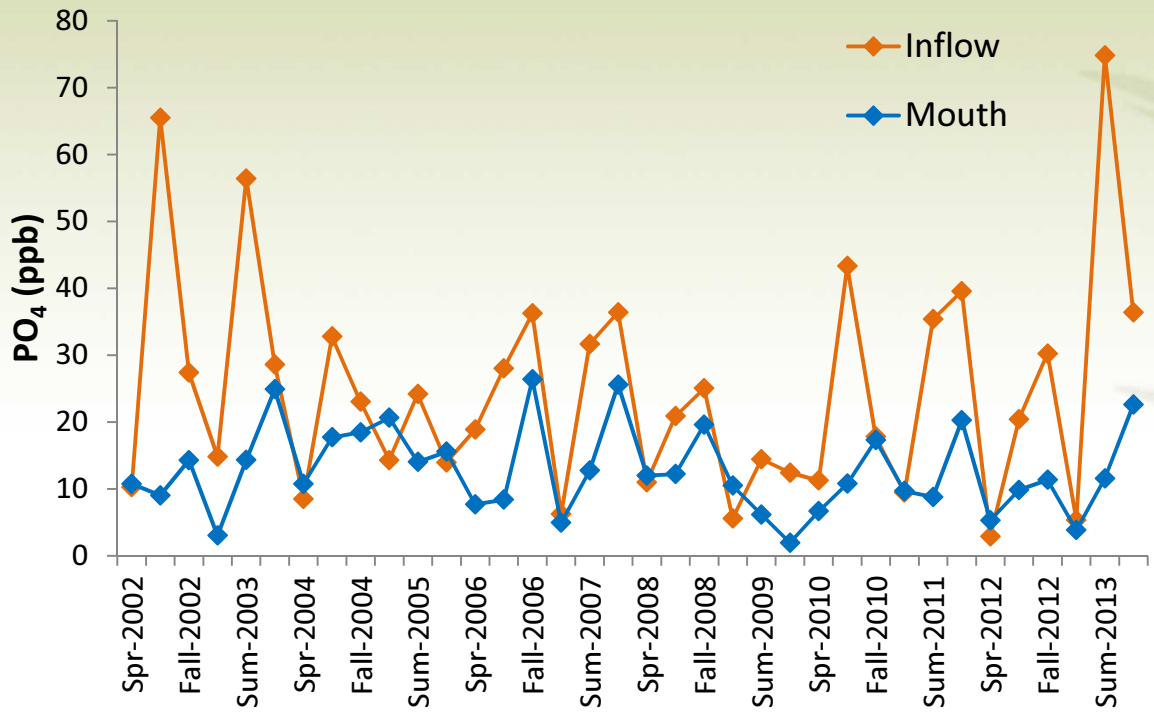
Monthly grab and diel surface water samples

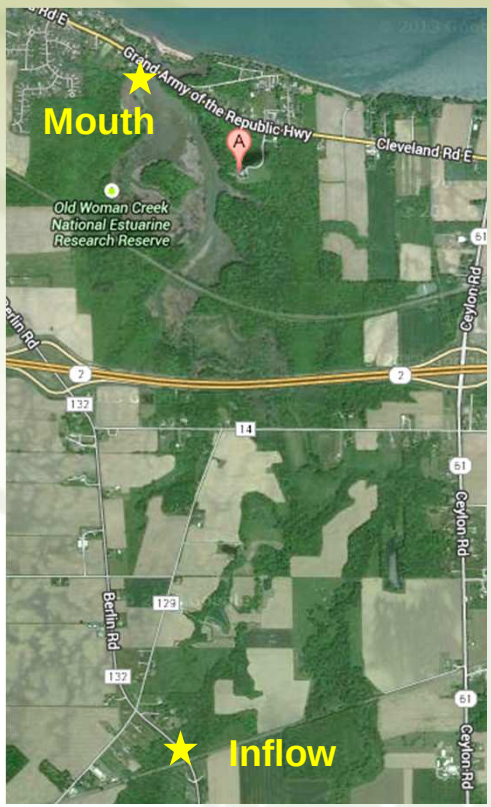
- Alkalinity
- Nutrients (TP, SRP, NO_3, NO_2, NH_3, SO_4^{2-})
- Ions (conductivity, chloride, silicate)
- Metals (Fe, Ca, Mg, Na, K)

NERRS System Wide Monitoring Program (SWMP)

Interannual variability (2002-2013)

Dissolved reactive phosphorus

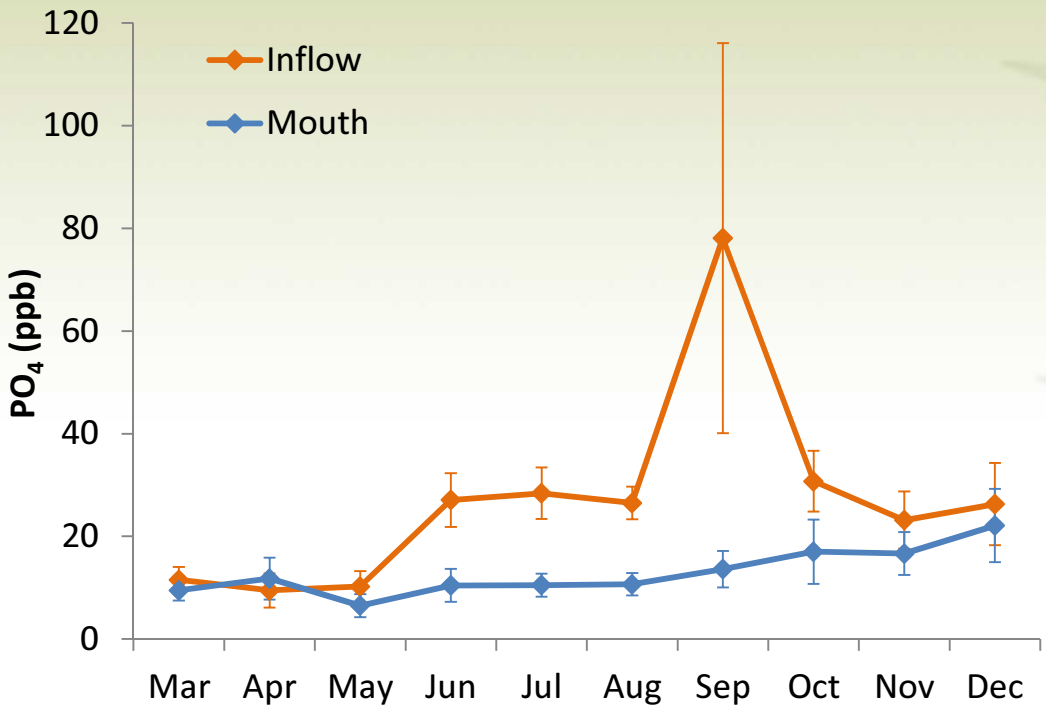


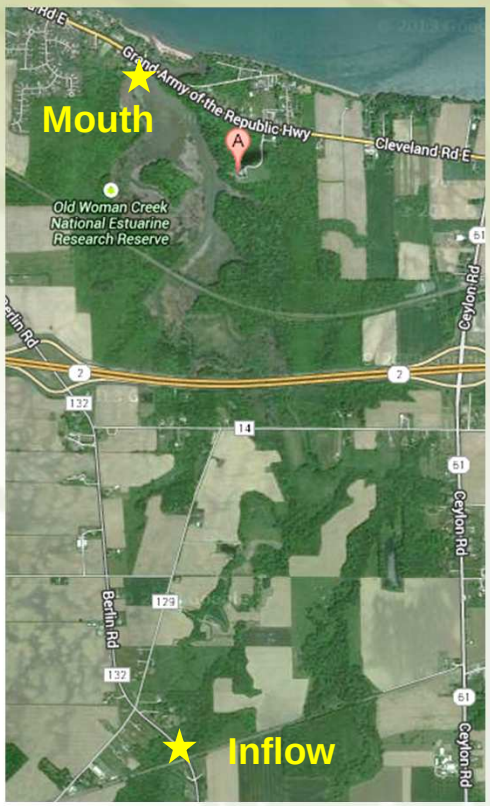


NERRS System Wide Monitoring Program (SWMP)

Monthly and seasonal variability (2002-2013)

Dissolved reactive phosphorus

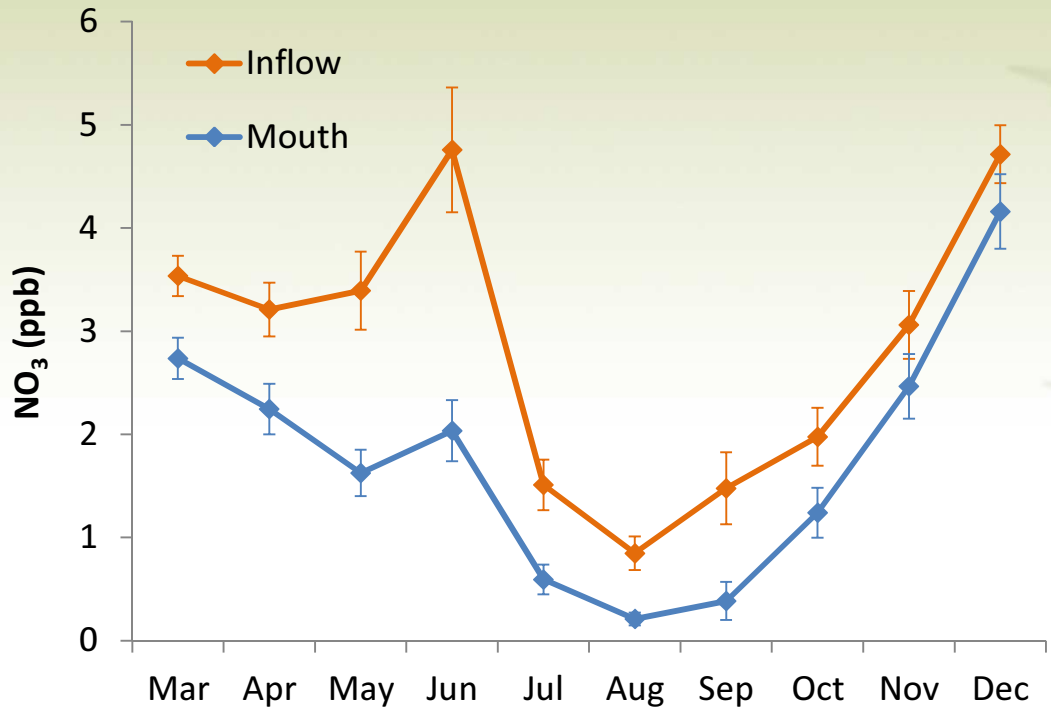


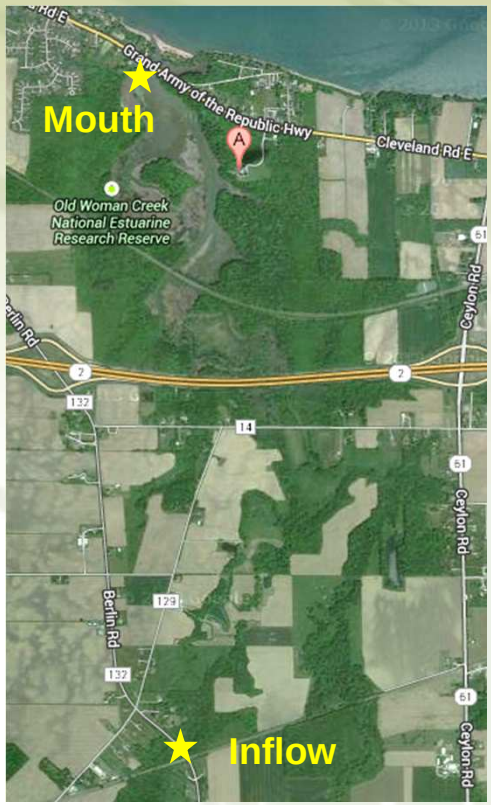


NERRS System Wide Monitoring Program (SWMP)

Monthly and seasonal variability (2002-2013)

Nitrate





NERRS System Wide Monitoring Program (SWMP)

Data Access

http://cdmo.baruch.sc.edu

NERRS System Wide Monitoring Program (SWMP)

Data Access

Station code = OWC

Site codes

- BR: Inflow (Berlin Road)
- DR: Upper estuary (Darrow Road)
- OL: Lower estuary
- WM: Outflow
- OW: Met station

Data Export System

The DES was developed to provide the majority of users with quick and easy access to SWMP data. The DES utilizes a map-based interface and offers single station exports, yearly authenticated file downloads (these may include non-standard nutrient parameters), charting, and a current conditions display for real-time stations.

To launch the Data Export System, click here.

Advanced Query System

The AQS was developed to specifically address the data delivery needs of those end-users looking for large amounts of data exported in a format that can be easily imported and manipulated for data analysis. The AQS offers three different query options allowing for mass downloads of annual files, customized queries for specific parameters and multiple stations in the same file, and an option to merge water quality, meteorological and nutrient datasets.

To launch the Advanced Query System, click here.

Real Time Data Application

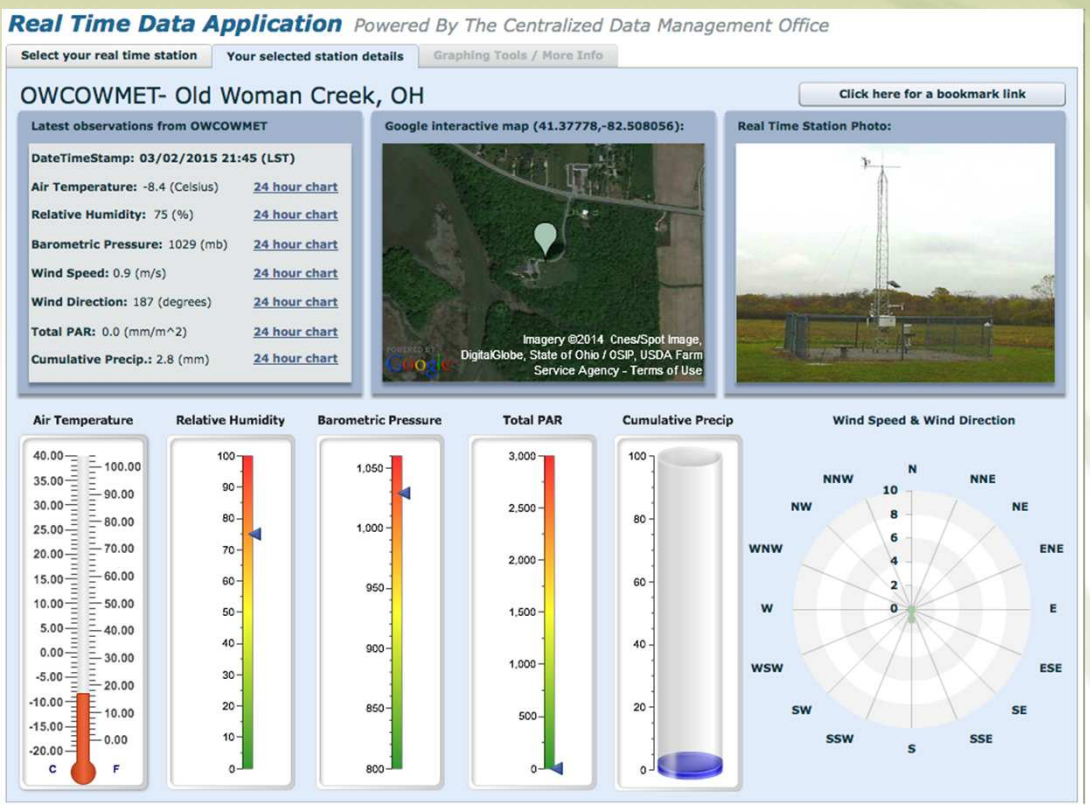
The Real Time Application allows users to view near real time data, real time gauges, and 24 hour graphs with multiple parameters. You may use a bookmarked link to directly access the station of interest, or browse and select your station. The display will update automatically with the latest information as it comes in.

To launch the Real Time Data Application, click here.

NERRS System Wide Monitoring Program (SWMP)

Data Access

(Near) Real Time Data



Monitoring Programs

Tributary water quality monitoring programs

Old Woman Creek estuary

- NERRS System Wide Monitoring Program
- Heidelberg Tributary Loading Program

Erie County Watersheds

- Firelands Coastal Tributaries Volunteer Watershed Monitoring Program

Storm water monitoring programs

Low impact development stormwater control management systems

- Chagrin River Watershed Partners

Other Activities

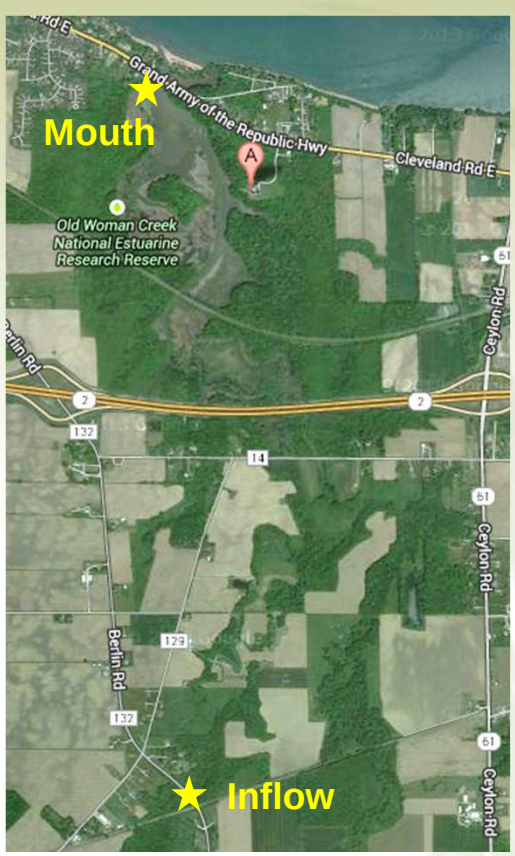
Heidelberg Tributaries Loading Program

OWC sediment and nutrient retention and loading

3-year study

Daily inflow and outflow

Replicate late 1980s study



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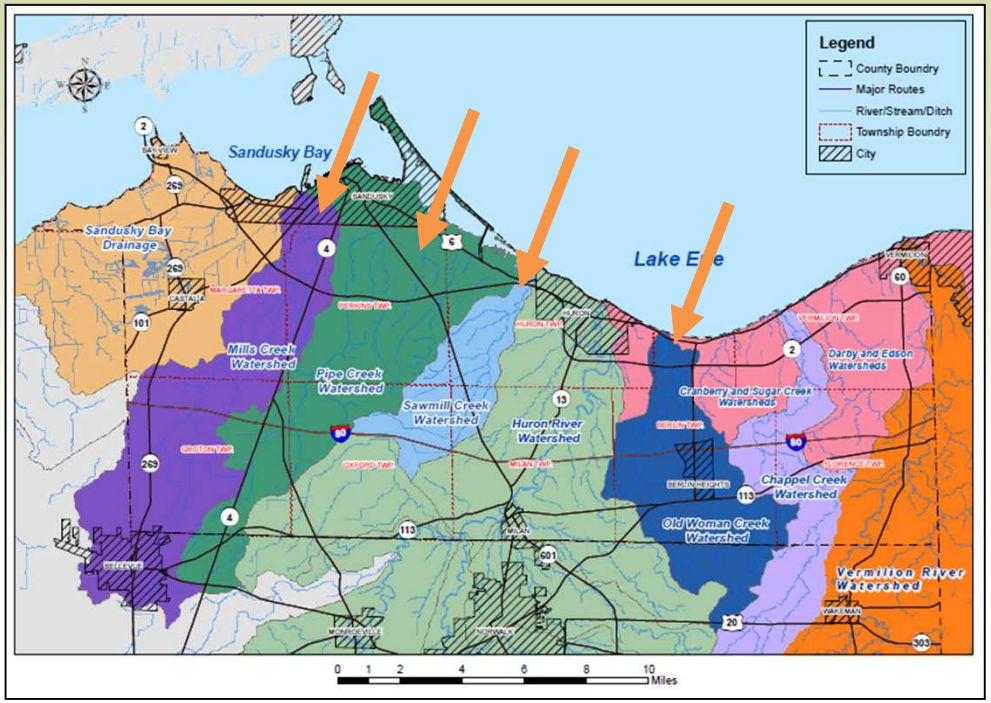
Other Activities

Firelands Coastal Tributaries (FCT) Program

Volunteer Stream Monitoring Program



Goals

Community-driven planning and stewardship

Reduce non-point source pollution

Current Scope

2008 – present

4 watersheds, 23 sites

25 volunteers

Firelands Coastal Tributaries (FCT) Program

Water Quality

Monthly

On site measurements

- pH
- DO
- turbidity

Surface water samples

- Alkalinity
- Nutrients (TP, SRP, NO_3, NO_2, NH_3, SO_4^{2-})
- Ions (conductivity, chloride, silicate)
- Metals (Fe, Ca, Mg, Na, K)

Firelands Coastal Tributaries (FCT) Program

Watershed Report Cards

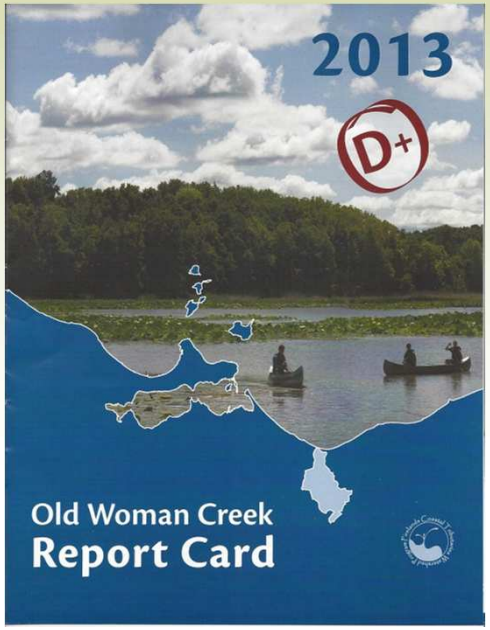
Goals

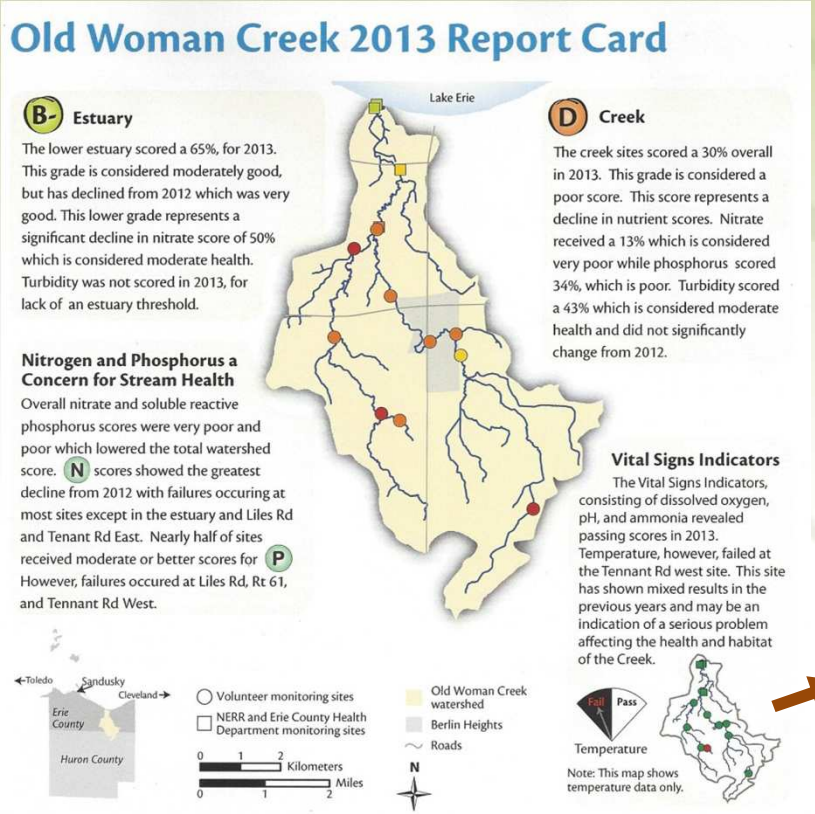
- Improve community awareness and understanding
- Promote stewardship

University of Maryland
Integration and Application Network

Firelands Coastal Tributaries (FCT) Program

Watershed Report Cards





Old Woman Creek 2013 Report Card

B- Estuary

The lower estuary scored a 65%, for 2013. This grade is considered moderately good, but has declined from 2012 which was very good. This lower grade represents a significant decline in nitrate score of 50% which is considered moderate health. Turbidity was not scored in 2013, for lack of an estuary threshold.

Nitrogen and Phosphorus a Concern for Stream Health

Overall nitrate and soluble reactive phosphorus scores were very poor and poor which lowered the total watershed score. N scores showed the greatest decline from 2012 with failures occuring at most sites except in the estuary and Liles Rd and Tenant Rd East. Nearly half of sites received moderate or better scores for P However, failures occured at Liles Rd, Rt 61, and Tennant Rd West.

Lake Erie

D Creek

The creek sites scored a 30% overall in 2013. This grade is considered a poor score. This score represents a decline in nutrient scores. Nitrate received a 13% which is considered very poor while phosphorus scored 34%, which is poor. Turbidity scored a 43% which is considered moderate health and did not significantly change from 2012.

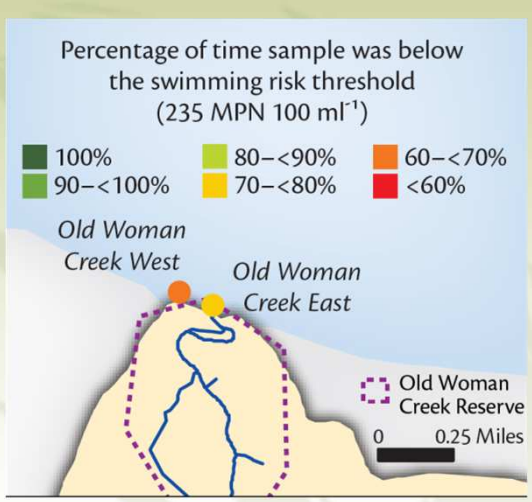
Vital Signs Indicators

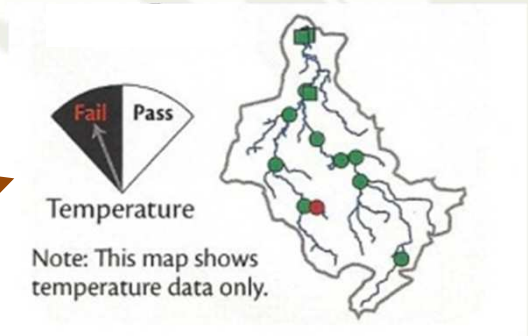
The Vital Signs Indicators, consisting of dissolved oxygen, pH, and ammonia revealed passing scores in 2013. Temperature, however, failed at the Tennant Rd west site. This site has shown mixed results in the previous years and may be an indication of a serious problem affecting the health and habitat of the Creek.

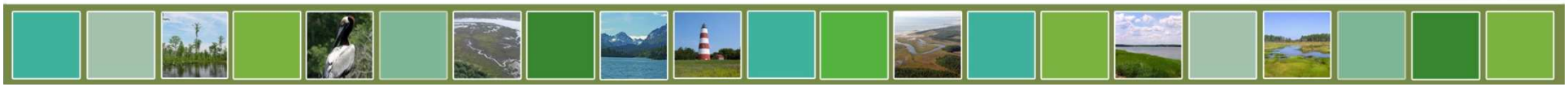
Fail Pass
Temperature
Note: This map shows temperature data only.

Toledo
Sandusky
Cleveland
Erie County
Huron County

Volunteer monitoring sites
NERR and Erie County Health Department monitoring sites
Old Woman Creek watershed
Berlin Heights
Roads
0 1 2 Kilometers
0 1 2 Miles
N







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Other Activities

Storm Water Monitoring

Low impact development storm water control systems

Goals

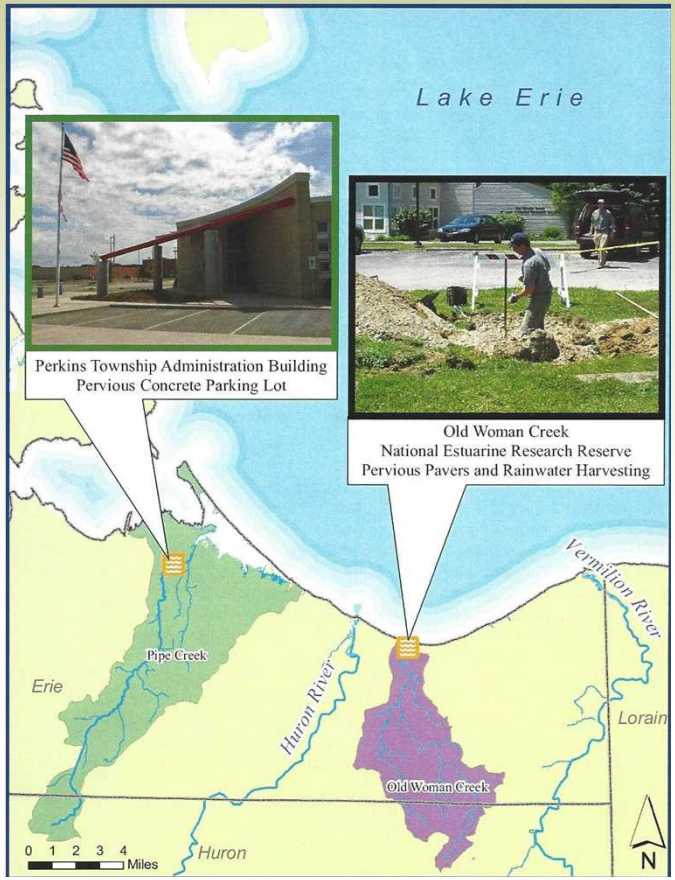
- Evaluate feasibility and performance: flow, water quality
- Inform crediting programs

Control Systems

- Pervious concrete and pavers
- Bioretention cells
- Future: dry detention basins, filter strips, grassed swales, constructed storm water wetlands

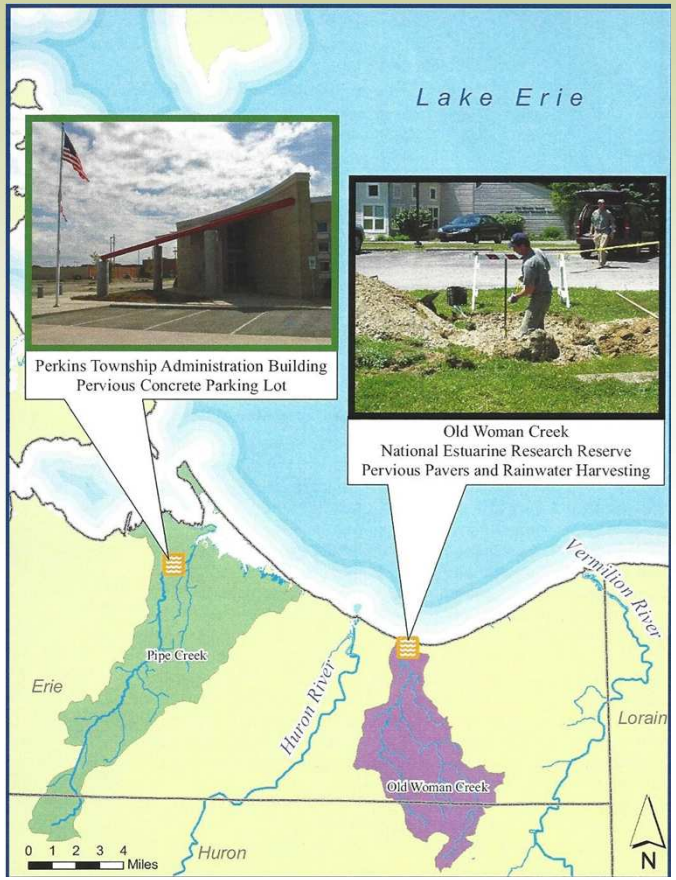
Storm Water Monitoring

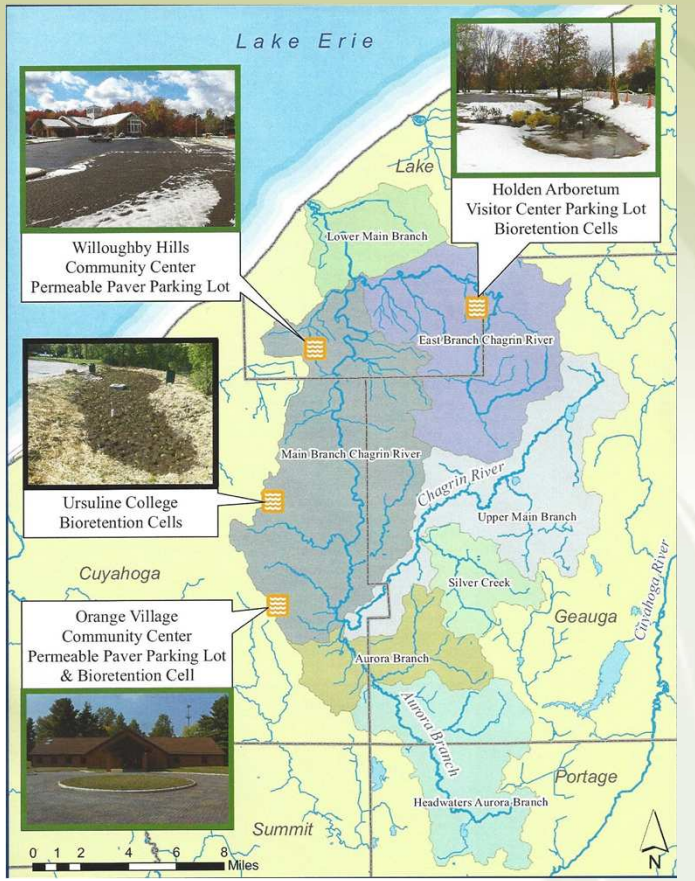
Low impact development storm water control systems



Storm Water Monitoring

Low impact development storm water control systems





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Other Activities

Other Activities

Edge of field and BMP monitoring

Erie Soil and Water Conservation District

Voluntary farmer participation

Sentinel Site development

Climate-induced impacts on estuary function and habitat

Potable drinking water testing

Erie County Health Department

NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM

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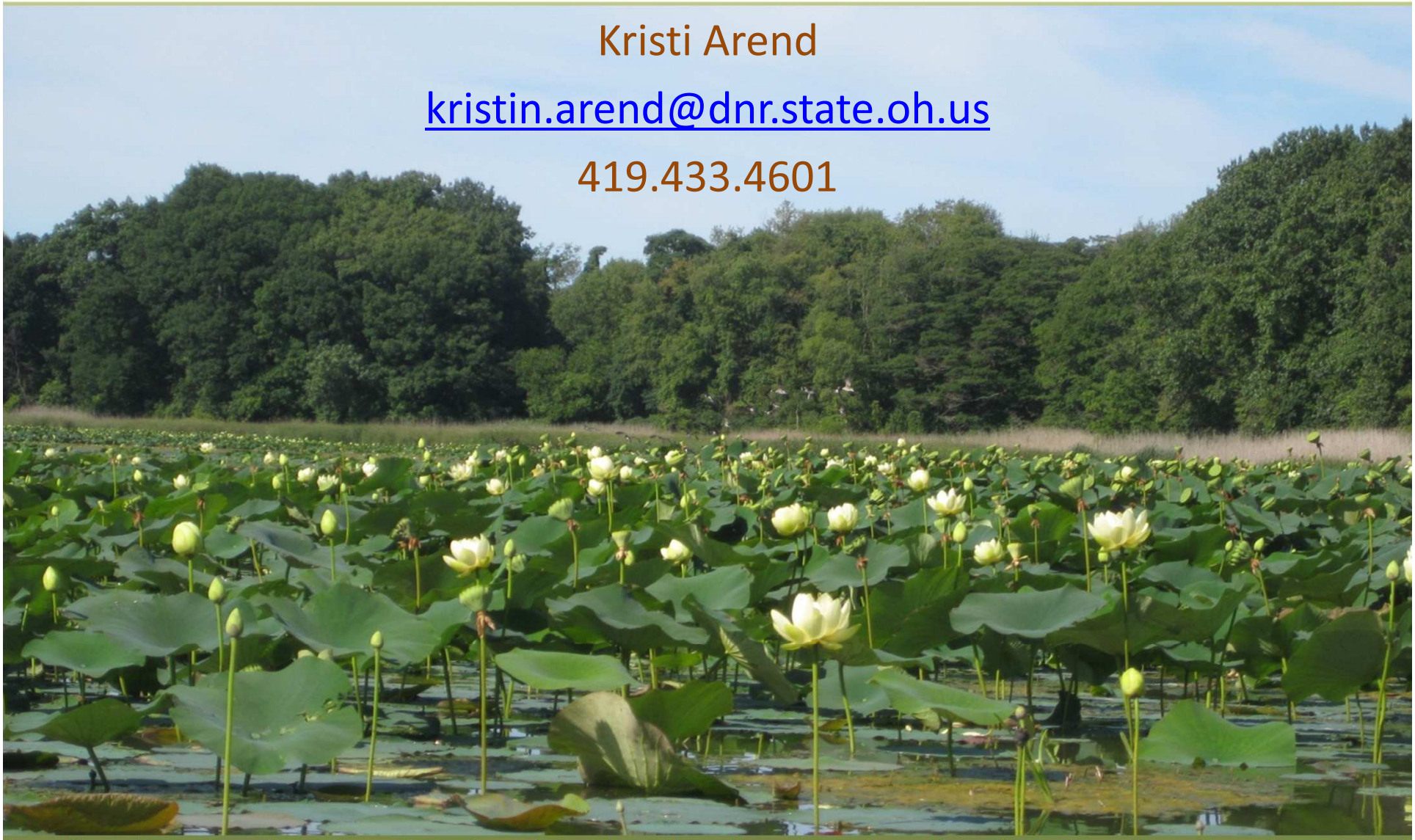


Firelands Coastal Tributaries (FCT) Program

Watershed Report Cards

Score parameters

- Local – national standards
- Pass/Fail or ranked

Indicator	Threshold	Source	Scoring
Dissolved oxygen	5 mg/L	OH EPA; aquatic life, warmwater use	P/F
pH	6.5-9.0 pH	OH EPA; aquatic life, warmwater use	P/F
Turbidity	3-10 NTU	US EPA; ambient water quality criteria by sub-ecoregion; benthic IBI reference	0 → 5

Firelands Coastal Tributaries (FCT) Program

Watershed Report Cards

Indices

- Watershed Health
  - SRP, NO_3, turbidity

A 80–100%: All water quality indicators meet desired levels. Quality of water in these locations tends to be very good, most often leading to preferred habitat conditions for aquatic life.

B 60–80%: Most water quality indicators meet desired levels. Quality of water in these locations tends to be good, often leading to acceptable habitat conditions for aquatic life.

C 40–60%: There is a mix of good and poor levels of water quality indicators. Quality of water in these locations tends to be fair, leading to sufficient habitat conditions for aquatic life.

D 20–40%: Some or few water quality indicators meet desired levels. Quality of water in these locations tends to be poor, often leading to degraded habitat conditions for aquatic life.

F 0–20%: Very few or no water quality indicators meet desired levels. Quality of water in these locations tends to be very poor, most often leading to unacceptable habitat conditions for aquatic life.

Firelands Coastal Tributaries (FCT) Program

Watershed Report Cards

Indices

- Watershed Health
- Vital Signs
  - Water temp, DO, pH, NH_3

Firelands Coastal Tributaries (FCT) Program

Watershed Report Cards

Indices

- Watershed Health
  - SRP, NO_3, turbidity
- Vital Signs
  - DO, pH, NH_3
- Human health
  - Health Dept. beach bacterial counts

Percentage of time sample was below the swimming risk threshold (235 MPN 100 ml^{-1})

100%	80–<90%	60–<70%
90–<100%	70–<80%	<60%

Scoring

Determine quantitative thresholds or targets for each indicator

- Local – national standards
- Literature review
- Management goals

Determine scoring

- Pass (100%) / Fail (0%)
- Ranked intervals: Lowest (0) → highest (5)

Calculate indicator scores

- Per site-date
- Mean over time per site
- Mean across sites

Turbidity (NTUs)	Score
< 3	5
≤ 3 – < 4.75	4
≥ 4.75 – < 6.5	3
≥ 6.5 – < 8.25	2
≥ 8.25 - < 10	1
≥ 10	0

Indicator	Threshold	Source	Scoring
Dissolved oxygen	5 mg/L	OH EPA; aquatic life, warmwater use	P/F
pH	6.5-9.0 pH	OH EPA; aquatic life, warmwater use	P/F
Water temperature	Daily mean	OH EPA; general Lake Erie basin	P/F
Ammonia	Det. by pH, temp	OH EPA; aquatic life, warmwater use	P/F
Nitrate	$\leq$ 0.425 mg/L	OH EPA; association between nitrate and benthic IBI for OH river and streams	P/F
Soluble reactive phosphorus	$\leq$ ug/L	OH EPA; association between TP and benthic IBI for OH river and streams	P/F
Turbidity	3-10 NTU	US EPA; ambient water quality criteria bu sub-ecoregion; benthic IBI reference	0 → 5
Bacteria (*E. coli*)	235 orgs/100 mL	US EPA	P/F

Report

Identify key watershed drivers

Wet year with several storms

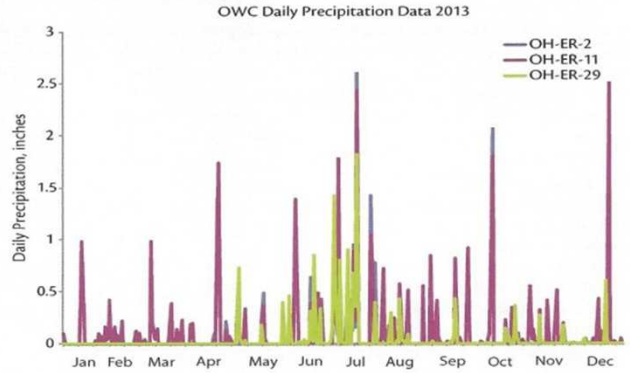
2013 was a very wet year. During the sampling period from April to November, records show the number of "wet days" for daily rain events was 10 days or greater for the majority of sampling months. The driest month in 2013 was May. In addition to the wet days, the total number of storms producing rainfall greater than 3/4 inch from April to November was 16. The months with the highest amount of both wet days and significant storm events were June and July with 5 major storms occurring in both months.

Because Old Woman Creek, like many watersheds, is a storm-driven system, water quality responds to storm activity for the year. 2012 was a drier year, resulting in slightly better water quality in samples analyzed. In 2013, there was decline in quality, which was similar to results of wetter years.

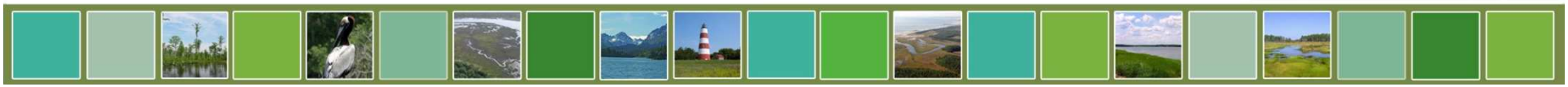
How does this affect the water quality of Old Woman Creek? Overall, Old Woman Creek scored a 37%, D+, which is considered in poor health. All site scores declined from 2012 to 2013 with the greatest overall decline occurring in the Creek sub-region, which scored in poor health. The best sites were in the Lower Estuary sub-region which scored moderate good health. This could be attributed to cleansing effects of the wetland or dilution of the polluted stream water with Lake Erie water.

Nitrate and soluble reactive phosphorus scores declined at most sites with only a few mid-watershed sites improving or showing no significant change . Nitrate exceeded the threshold at every site, with several sites in the Creek sub-region failing overall. This could be a result of increased storm activity. The turbidity score did not change significantly, with an overall moderately poor score of C-.

Overall nutrient reduction is greatly needed to improve the watershed especially if storm activity increases.



Daily rainfall totals from the COCORAHs stations within the Old Woman Creek Watershed.



Report

Provide stewardship actions

You can help!

N = nitrogen
P = phosphorus
= sediment

WHAT YOU CAN DO	WHO BENEFITS	WHAT'S REDUCED
Leave a natural area along a stream or ditch	Grass or wooded buffers help filter pollutants and reduce flood damage	N P
Remember to inspect and pump out your septic system every 3–5 years	A properly maintained septic system prevents costly repairs and untreated sewage discharge into our streams	N P
Help your community develop a plan that supports low impact development	Smart development fosters growth and protects the local resources and character of a community	N P
Follow the "4Rs" of fertilizer use: Right source, Right amount, Right place, Right time	The "4Rs" approach promotes the wise use of fertilizer by farmers, residents, and landscapers to reduce costly nutrient loss that pollutes our streams	N P
Plant cover crops	Cover crops build healthy soils that help hold back nutrients and water and increase crop yields	N P
Plant a rain garden or install a rain barrel	Rain gardens and rain barrels help reduce stormwater runoff and can cut down on landscaping costs	N P
Install a drainage management system	Managing field drainage reduces nutrient loss while saving water for when your crops need it the most	N P
Properly manage livestock & pet waste	Storing and disposing of animal waste properly reduces nutrients and prevents harmful bacteria from fouling beaches	N P