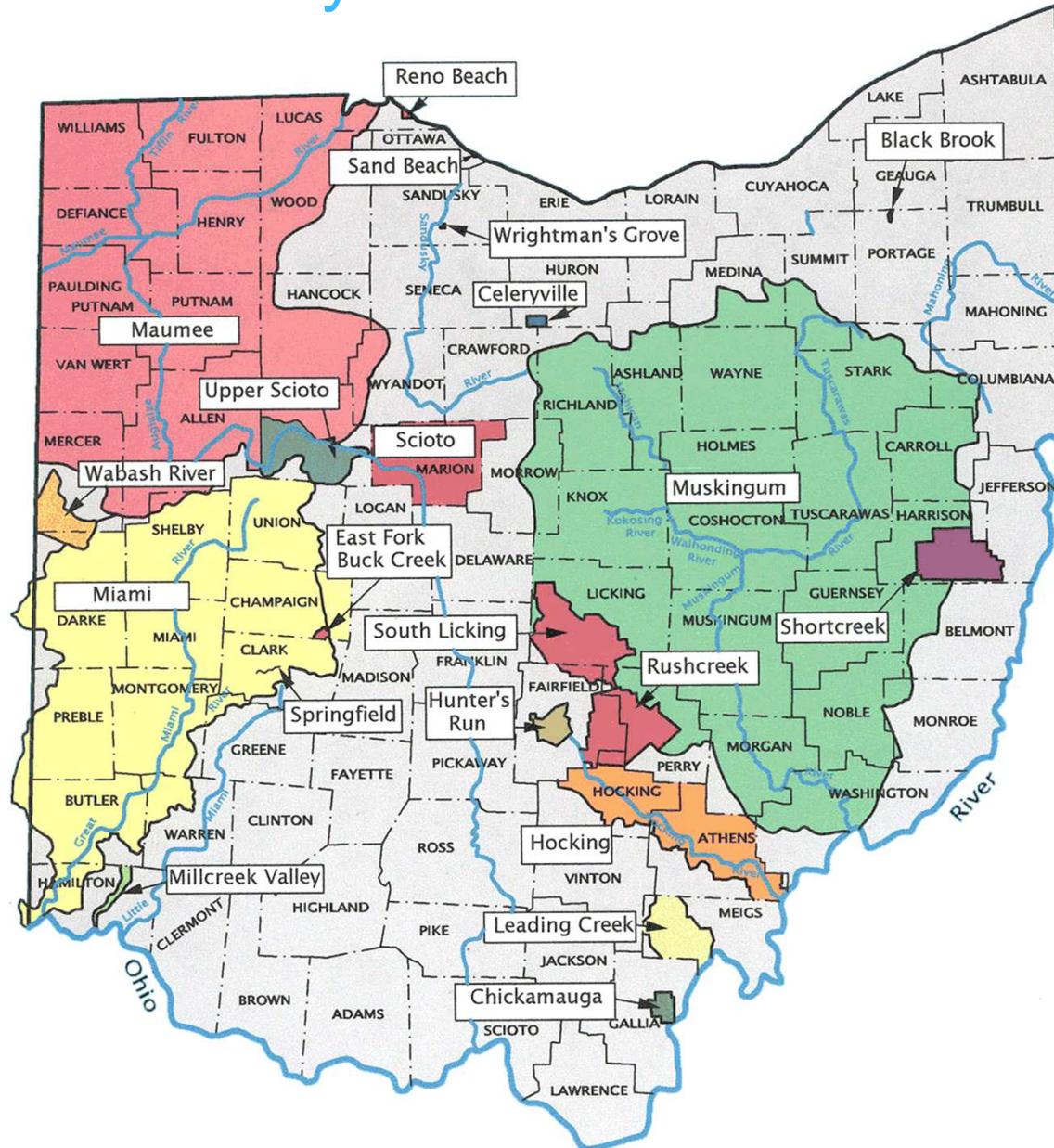




**MUSKINGUM
WATERSHED
CONSERVANCY DISTRICT**

1933-2015

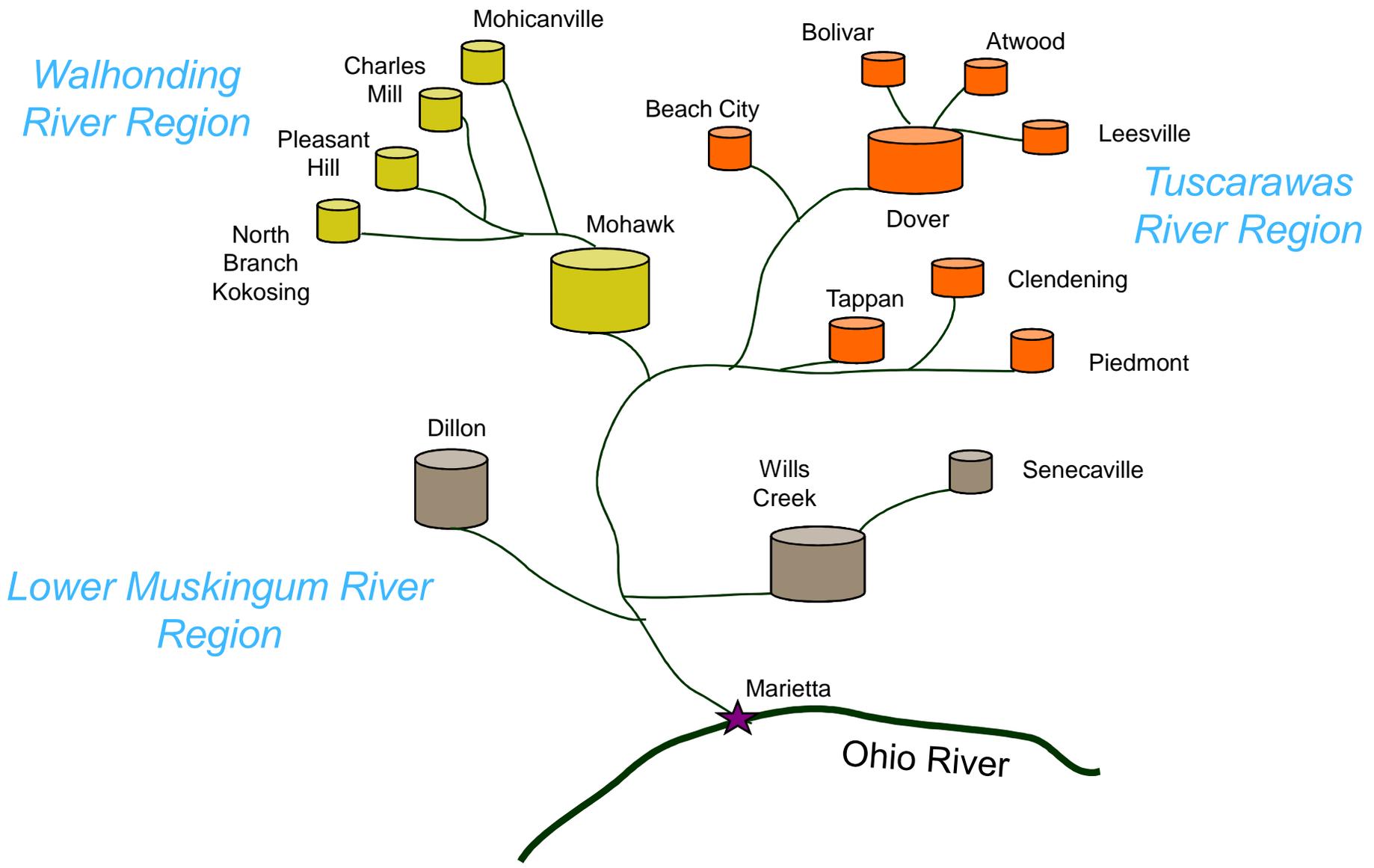
Ohio's Conservancy Districts



The Muskingum River Watershed covers about 20% of the state, over 8,000 square miles



The Muskingum River Basin Reservoir System



Facts About MWCD

- Created in 1933, in accordance with ORC, Chapter 6101
- Largest conservancy district in Ohio, covers 1/5 of state and all or portions of 18 counties
- Manages 54,000 acres for public use
 - * 16,000 acres of water surface at 10 lakes
 - * 38,000 acres of land
- Partnership with U.S. Army Corps of Engineers (USACE)
 - * USACE owns and operates dams
 - * MWCD manages reservoirs behind dams
- Partnerships on virtually every level of government for projects, programs, etc. – long-term and short-term
- **To date, system has prevented more than \$10 billion in potential property damage and saved countless lives, while providing a water resource for public uses**

MWCD Grant Programs, In-Kind and Joint Funding projects that support Water Quality Monitoring



- 1. 1986 – Present USACE Sampling Program with the Huntington District**
- 2. 2009 – Present OLMS Citizen Lake Awareness and Monitoring (CLAM) since 2009 on 9 of the 10 lakes**
- 3. 2010 – Present USGS NOWCAST 3 beaches at MWCD inland lakes. Predictive modeling of *E. coli* bacterial levels.**
- 4. 2013 – Present Ohio University Wills Creek – White Eyes AMD Study to support Ohio Department of Natural Resource Division of Mineral Resources Management through OU**
- 5. 2014 - Present Carroll and Harrison County Soil and Water Conservation District Joint funding for a Water Watershed Specialist Position**
- 6. 2015 - USGS Water Quality Baseline Project for MWCD Reservoirs**
- 7. 2015 – USGS stream gages and continuous monitoring stations**
- 8. 2015 - Muskingum River Gage at McConnelsville (Heidelberg)**

Slide 6

SD4

Make sure this is Water Quality

Skyler Dewey, 3/2/2015



1. USACE Huntington District - Water Quality Monitoring – with MWCD

USACE Huntington District Water Quality Team manages the program. (USACE Geotechnical and Water Resources Engineering Branch)

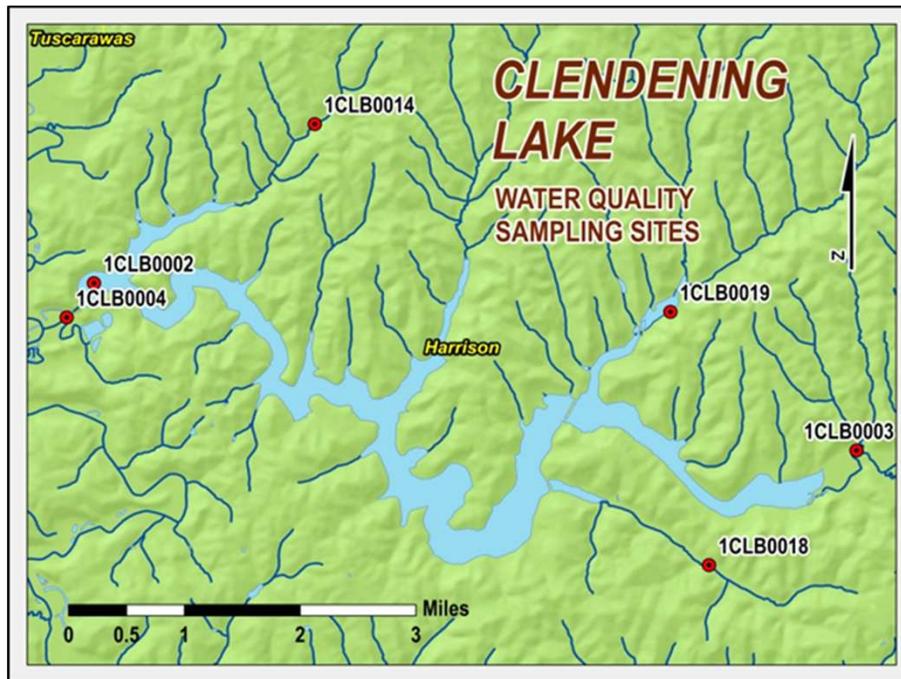
- A fixed-site sampling program with the flexibility to add or discontinue sites as needed. All of the MWCD lakes are on a rotation.

In 1986 MWCD began an informal partnership to assist with their sampling program

- 1986 – 2012 MWCD provided field personnel to do the majority of the sampling required within the Muskingum River Watershed
- 2013 – present MWCD provides field personnel to assist with sampling.
- USACE maintains and documents all the data collected from the sampling program

This program has been the foundation of all other WQS programs at MWCD

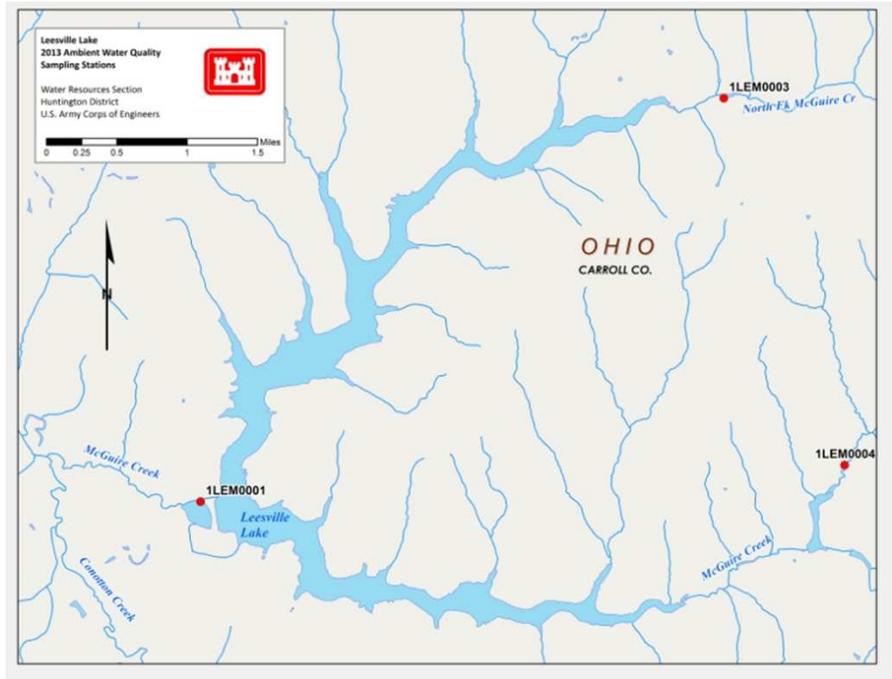
2013 Clendening Lake Intensive Survey Sites



Intensive Sampling

- 5 year rotation – physical parameters and water chemistry samples are collected
 - Up to 8 visits/year
 - Outflow
 - Multiple inflows
 - Profile at Dam
 - Lake Profiles
 - Sediment analysis

2013 Leesville Lake Ambient Survey Sites



Ambient Sampling

- 2 year rotation - physical parameters and water chemistry samples are collected
 - One time Grab Sample
 - Outflow
 - Main Inflow(s)

2. OLMS/CLAM

Citizen Lake Awareness and Monitoring - Training Citizen Scientists since 1991 OLMS was founded and incorporated in 1986

MWCD had funding available in 2009 began
program on 9 of the 10 lakes

Level 2 data

- Transparency
- Water temperature
- Water color
- Quality and lake use



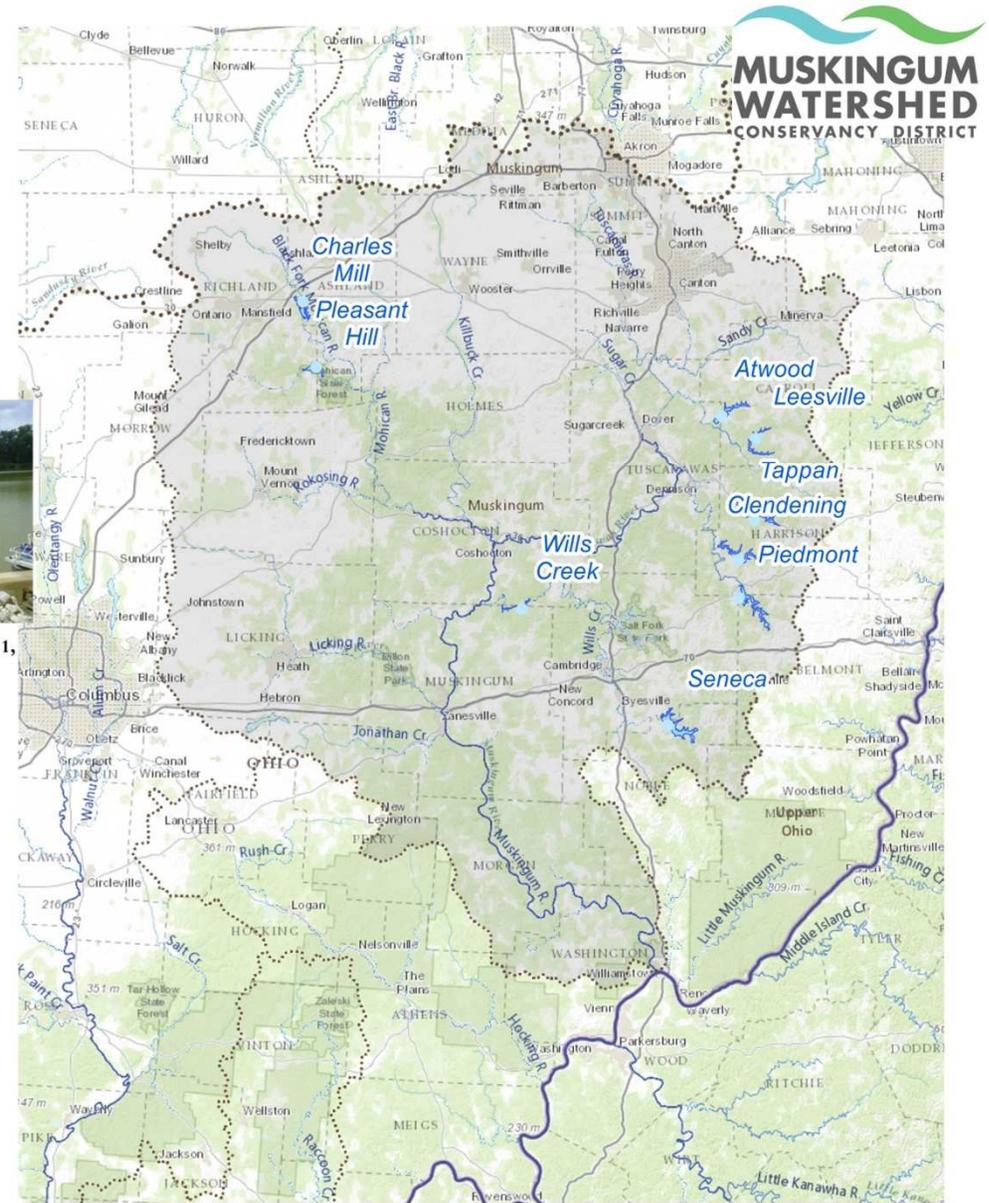
Maureen Coleman, June 2011,
Charles Mill Reservoir

Level 3 data

- Temp. / DO profiles
- Total nutrients
- Total suspended solids
- Chlorophyll *a* (added for all 9 lakes in 2014)

2011 cyanobacteria monitoring added

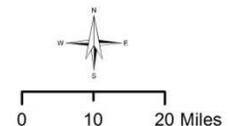
- A composite sample is collected by Lake Keepers using modified Ohio EPA methods twice a month.
- The samples are sent to BSA Environmental Services, Inc.
 - Microcystin
 - Cylindrospermopsin.
 - Cyanobacteria cell count
 - Phytoplankton identification



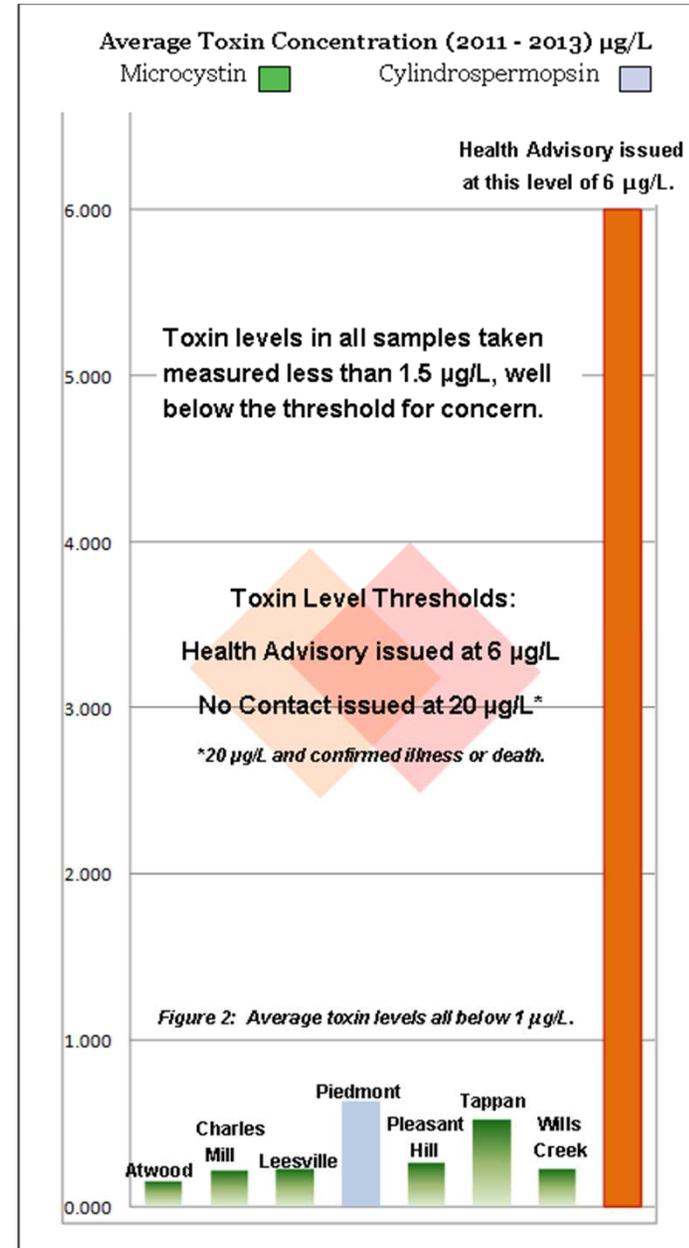
OLMS/CLAM

Water Quality Monitoring Project

- CLAM Lake Keeper



- Algae blooms are present but Toxin levels remained below 1 until 2014
- Microcystin Results
 - Tappan had 3 samples above 1. Highest reading was 5.125 still below threshold of 6.
 - Signs following OEPA format are prepared.



3. USGS NOWCAST

MWCD intern collects bacteria samples 4 days a week in the summer at Atwood, Tappan and Seneca Lake beaches.

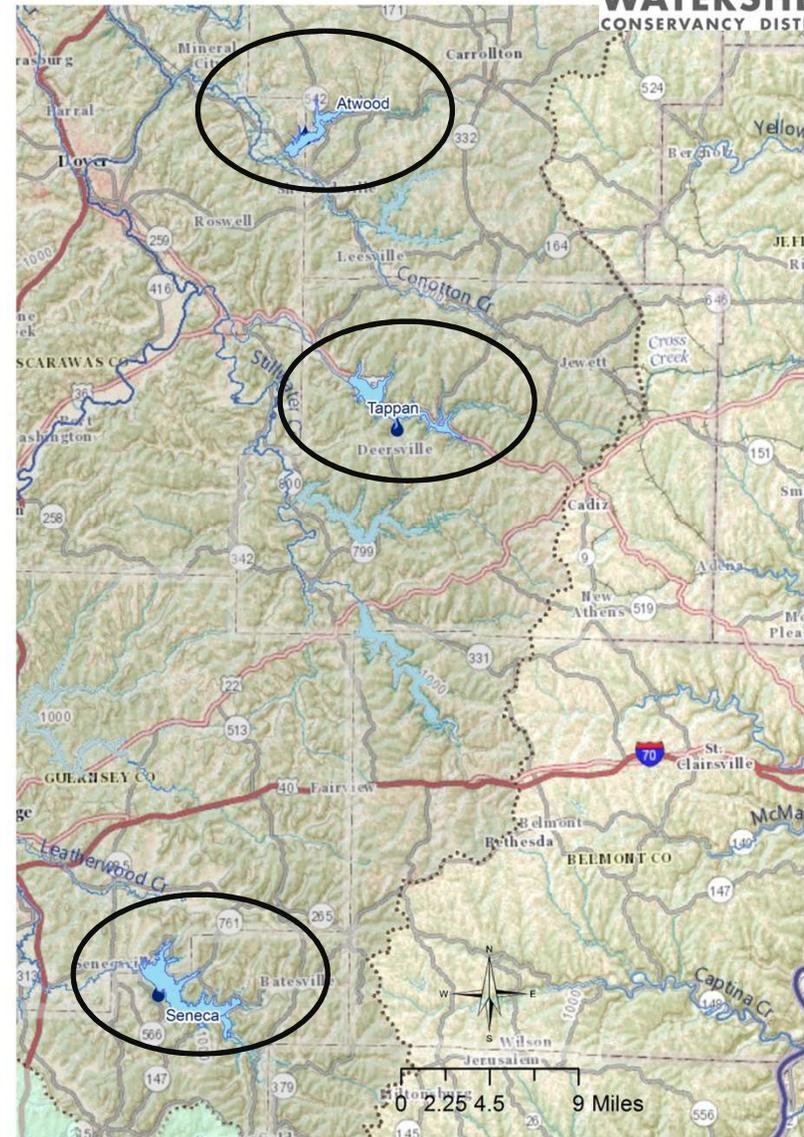
USGS provides

- Training
- Equipment
- Data Analysis for developing the predictive model

The standard Colilert tray method for analyzing E. coli takes 24hrs to analyze. MWCD has partnered with the USGS to create and test predictive models with their NowCast modeling system, to accurately predict E. coli concentrations within a couple minutes.

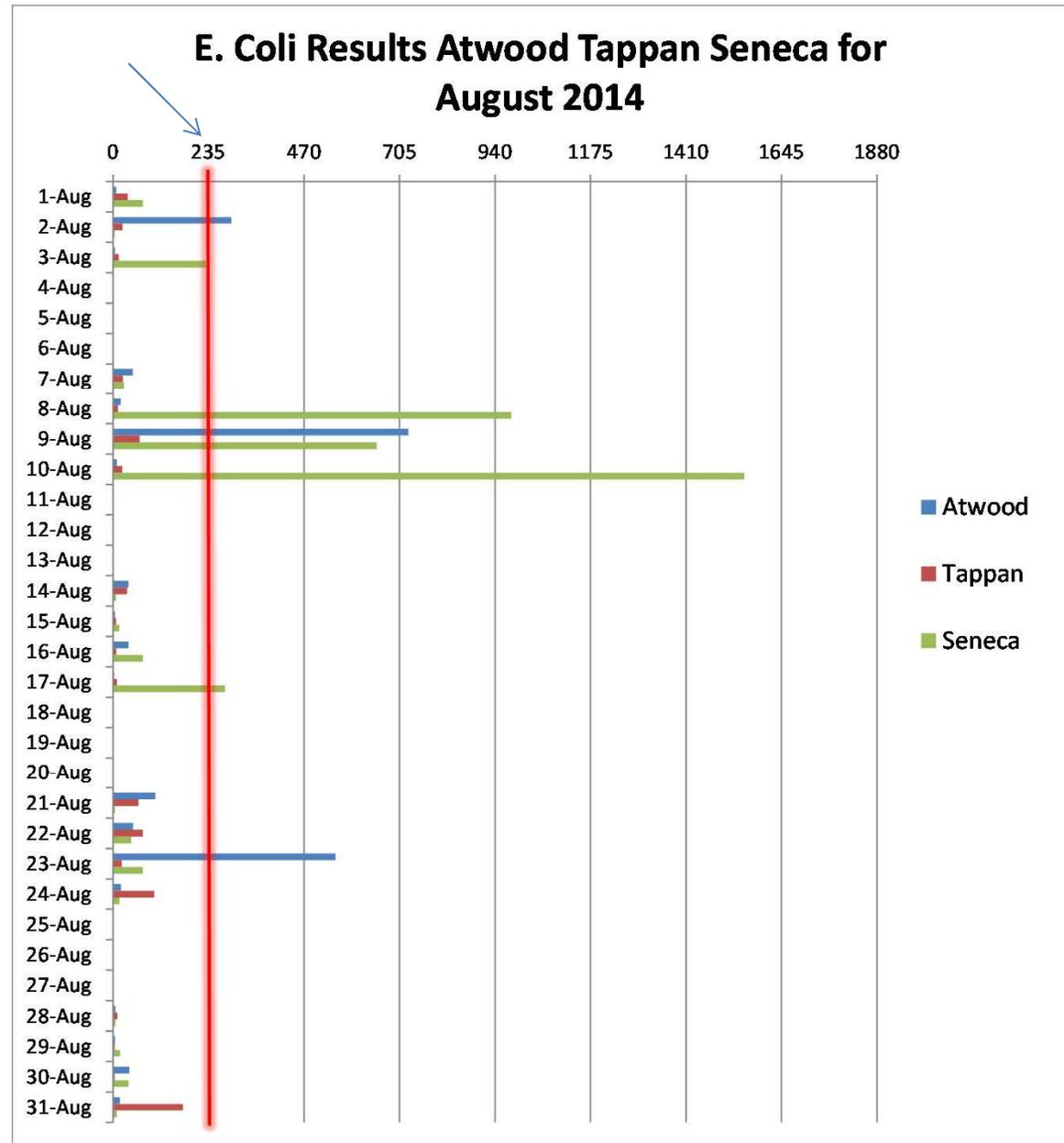
Modeling Results for 2014

Lakes	Full Season Model	Previous Day Model
Atwood	92%	78%
Tappan	83%	100%
Seneca	77%	78%



Overall exceedances are down since 2010.

- The Bacteria results have helped the District direct more projects to improve water quality at the beaches.
 - Atwood shoreline project at the beach was prioritized in hopes that will improve Atwood results



4. Ohio University and ODNR DMRM - Wills Creek and White Eyes AMD

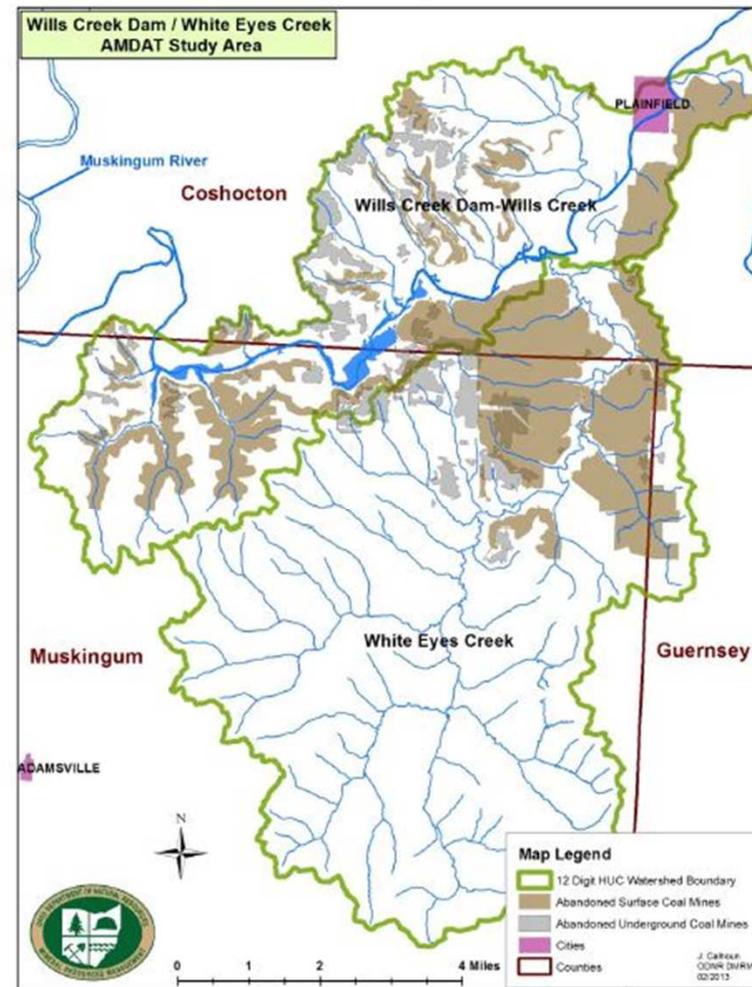
MWCD helped fund a collaboration between ODNR and Ohio University

- Characterize AMD in Wills Creek and White Eyes Creek watersheds to support DMRM and the MWCD in the development of an Acid Mine Drainage Abatement and Treatment Plan (AMDAT).

4 samples/year on 17 tributaries

24 parameters

Calculate loading to prioritize problem areas and to design treatment options



Slide 13

SD7

Cut out the title and scope of work - Just have their Map

Skyler Dewey, 3/2/2015

All of the data can be downloaded at www.watersheddata.com
OU has also created a Story Map of the project

The screenshot shows a web browser displaying an ArcGIS Story Map. The browser's address bar shows the URL www.watersheddata.com/storyMap/index.html. The page header includes the text "Ohio Watershed Data" and "A study of abandoned coal mine impacts in Ohio streams" with the subtitle "Identifying sources of acid mine drainage in Wills Creek and White Eyes Creek". The Ohio State University logo is visible in the top right corner. A navigation menu contains links for Home, Surface Water, Groundwater, AMD Projects, Partner Watersheds, Contact, and StoryMap. The main content area features a topographic map of a region with several red numbered markers (1-9) indicating specific sites. A large, detailed photograph of a stream with a large, dark, reddish-brown discharge is shown in a pop-up window. Below this window, a text box reads: "Acid mine drainage discharge site WCL0095" and "Underground mine discharge draining directly into Wills Creek Reservoir adjacent to site WCL0095". At the bottom of the map, a series of seven small thumbnail images, numbered 1 through 7, provide a visual sequence of the study area.

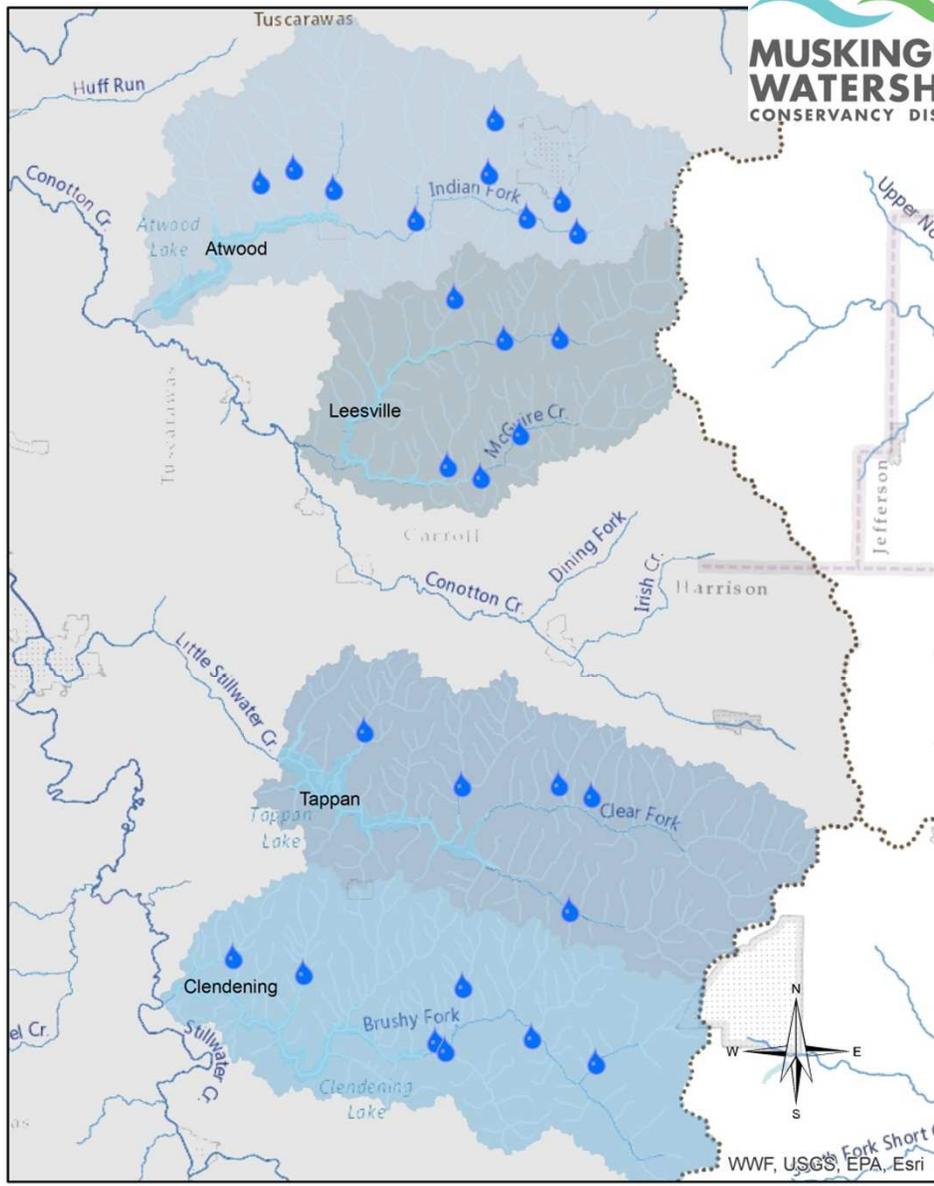
5. Watershed Specialist – Carroll/Harrison County SWCDs

In 2014 the MWCD helped fund a joint county watershed specialist position, for Carroll and Harrison County SWCD

Josh Britton will Focus on the watersheds of 4 MWCD reservoirs:

- Atwood
- Leesville
- Tappan
- Clendening

Intensive sampling will begin on 28 smaller tributaries in 2015



Carroll/Harrison County SWCD 2015 Sites

Atwood	Leesville	Tappan	Sample Points
Clendening	NHDFlowline		

Slide 15

SD9

maybe change map more contrast

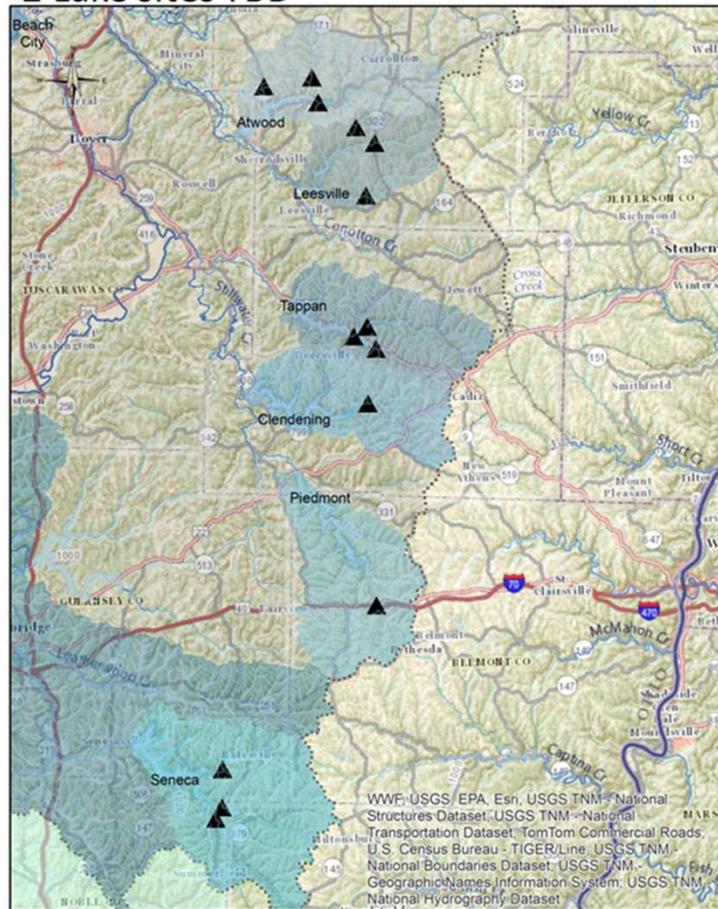
Skyler Dewey, 3/2/2015

6. USGS Water Quality Baseline Project for MWCD Reservoirs

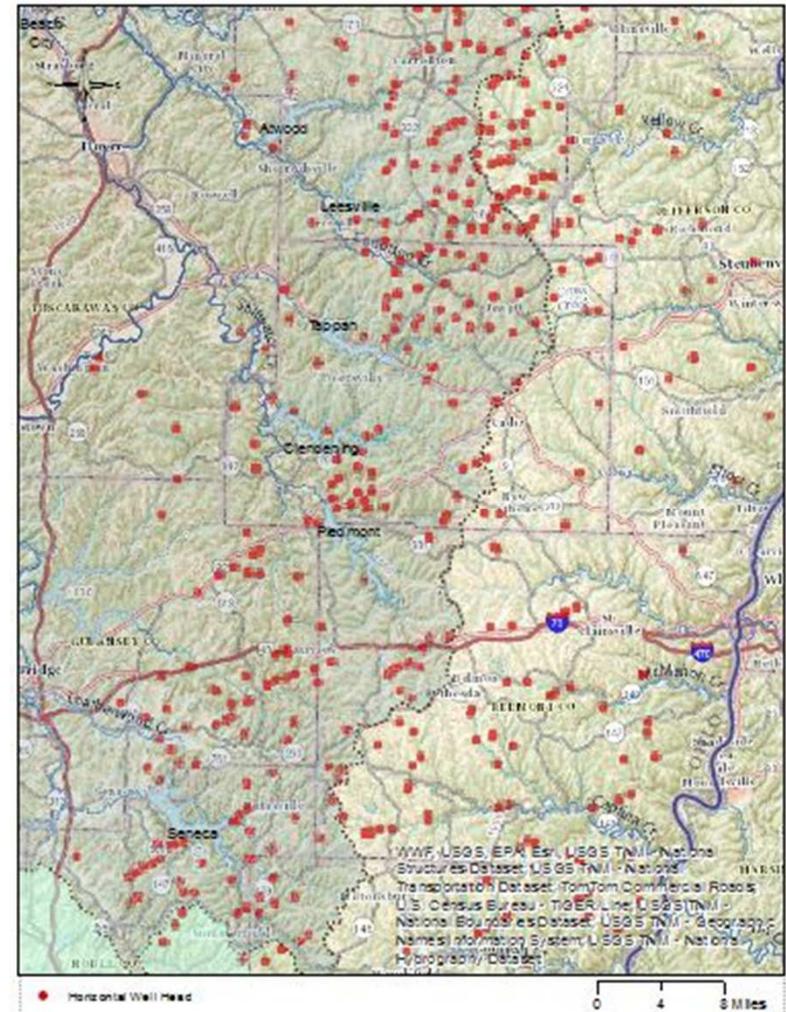
The MWCD has executed a joint funding agreement with the USGS to establish a baseline of the water quality at the 6 eastern reservoirs of the MWCD in the region of the Utica Shale oil and gas play.

- Three year study
- Thirty sampling sites, with some tributaries in areas of significant development and others in areas of minimal development
- Six times/year
- Sixty two parameters will be collected, including benzene, toluene, ethylbenzene and xylene (BTEX) as well as radium 226 and 228. All associated with the oil and gas industry
- Sampling will begin in 2015.

30 sites total including the 14 gage sites shown above on the map
 An additional 6 control sites (with no oil and gas activity), 6 sites down stream from dam, 4 lake sites



Permitted Horizontal Oil and Gas Wells



* Compiled using ODNR Division of Oil and Gas map service - the wells above are only permitted and will not necessarily be drilled

7. USGS Stream Gages and Continuous Monitoring Stations

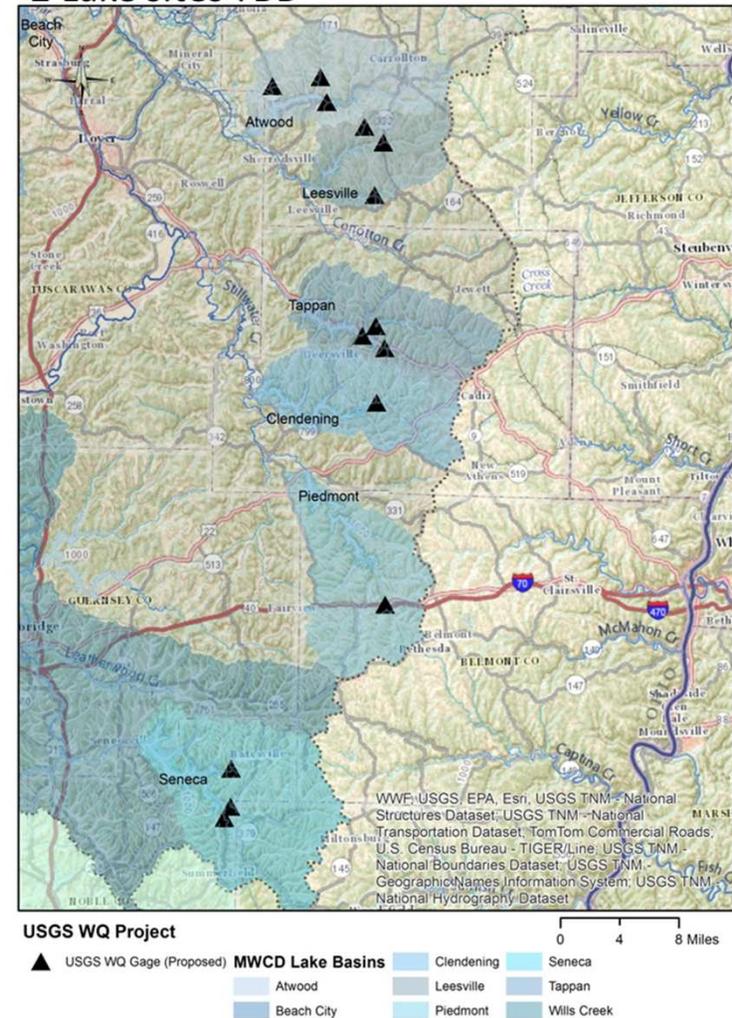
The MWCD has executed a joint funding agreement with the USGS to install stream gages, weather stations and 14 continuous monitoring stations at the 6 eastern reservoirs of the MWCD in the region of the Utica Shale oil and gas play.

Real time reporting will include

- Specific conductivity
- Temperature
- Stage data

Sampling will begin in 2015.

USGS Gages 14 on tributaries+
2 Lake sites TBD



8. 2015 - Muskingum River Gage at McConnellsville (Heidelberg)

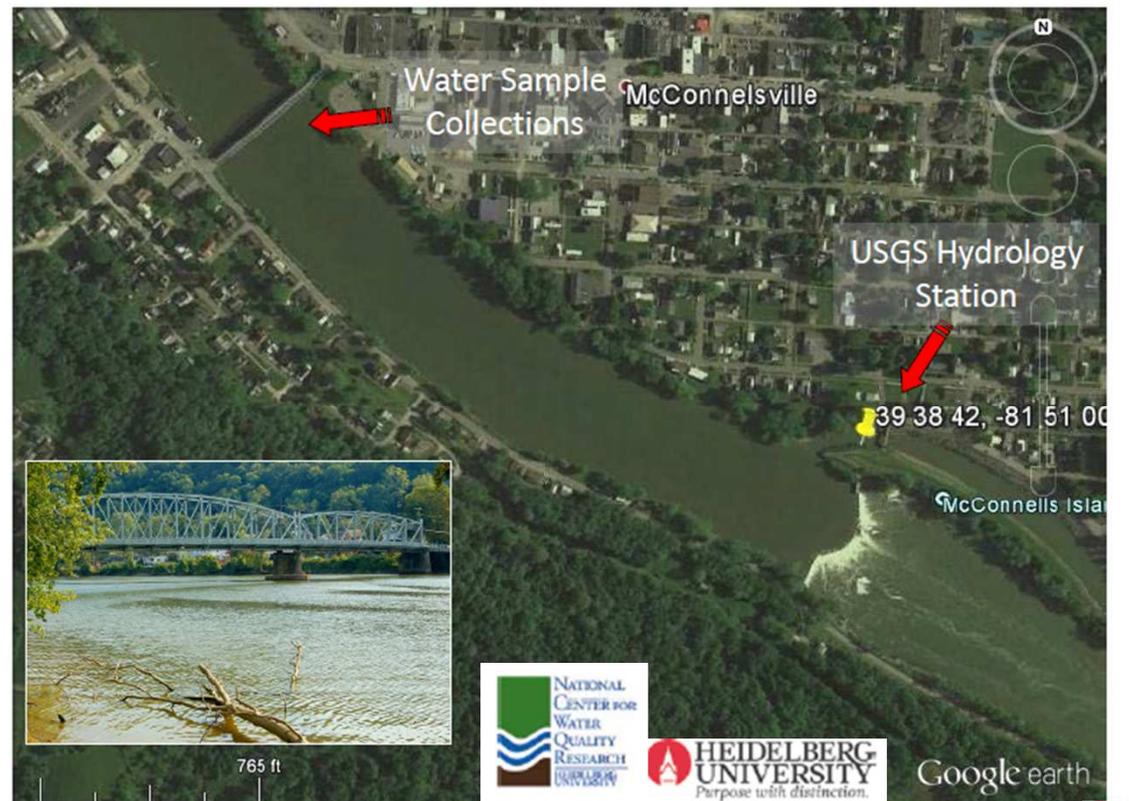
Water Quality of the Lower Muskingum River at McConnellsville Water Quality Gage

The National Center for Water Quality Research (NCWQR) of Heidelberg University has operated a water quality monitoring station on the Muskingum River at McConnellsville since 1996 as part of the statewide Heidelberg Tributary Loading Program (HTLP).

Averages 350 grab
samples/year

- measure concentrations of suspended solids, total phosphorus, dissolved reactive phosphorus, nitrate, nitrite, ammonia, total Kjeldahl nitrogen, sulfate, chloride, silica, and conductivity.

The analytical program Operates under the requirements of Level 3 Credible Data program of the Ohio EPA.



Additional Sampling

- ODNR Division of Wildlife – Manages MWCD lake fisheries. Collect water and fish tissue samples, stock fish, conduct surveys
- OEPA – TMDL studies in the watershed of the MWCD lakes
- Oil and Gas Producers – collecting samples within 1,500'-3,000' of well head, ground and surface water

Conservation Efforts

- Partner with Division of Soil and Water Resources and local SWCD offices to provide matching funds for
 - Cover Crops
 - Cattle Exclusion fences
 - Riparian Buffers
- MWCD Partners in Watershed Management Program (began in 2009) provides grant assistance for water quality projects, watershed education, and flood reduction projects
 - In 2015:
 - Support Huff Run and Mud Run Watershed Environmental education and public outreach
 - Kent State – purchase equipment for watershed education

Conservation Efforts



2015 PWM continued...

- Regional Sewer design near Piedmont and Clendenning
- Sewer Line project at Ohio FFA Camp Muskingum
- Nutrient Management Project with Muskingum SWCD
- Help with Killbuck Valley wetlands acquisition of 63 acres



QUESTIONS????