Five Years Later: Active Watershed Management Demonstrates Consistent Reduction in Pollution

> Jessica Glowczewski Charles Lacy City of Akron

•35 MGD average
•Conventional Filtration Plant
•Provides water to about 300,000 people
•Located in Kent, Ohio, about 12 miles from first tap in distribution system
•Source water comes from Lake Rockwell

SUPPLY

- -

Upper Cuyahoga River Watershed



Lake Rockwell Reservoir

- Impounds Upper Cuyahoga River
- 680 acres surface area
- > 207 square mile watershed
- Cost for treatment plant and Reservoir: \$815,000 in 1913





Long Term Enhanced

Surface Water Treatment

Rule (ESWTR)

- Over a two week period 403,000 of 1.6 million residents in Milwaukee are diagnosed with Cryptosporidiosis. At least 104 of those infected died.
- Howard Ave WTP Crpyto suspected source was runoff from cattle pastures combined with an unusual spring thaw event created the waterborne epidemic.



Boil water, mayor says

Safety of drinking supply probed in wake of mystery epidemic





The source is WATERSHED based!

No duh!

Cryptosporidium parvum and Drinking Water



What is Cryptosporidium and how can you prevent it from spreading?

Long Term Enhanced **Surface Water Treatment** Rule (ESWTR) 1998: Interim Surface Water **Treatment Rule** 2002: LT1 ESWTR 2006: LT2 ESWTR testing-round one 2015: LT2 ESWTR testing-round two

Sampling Date	Crypto (oocysts/l)	Giardia (cysts/L)	E. Coli (#/100 ml)	Turbidity (NTU)
10/11/2006	0.000	0	20	6.08
11/7/2006	1.000	0.1	52	5.65
12/12/2006	0.000	no data	70	9.06
1/9/2007	0.000	0	300	21.2
2/13/2007	0.000	0	8	4.24
3/13/2007	0.000	0.1	4 (est.)	8.21
4/10/2007	0.000	0	0	5.78
5/8/2007	0.000	0	<2 (est)	4.11
6/12/2007	0.000	0	<2	2.59
7/10/2007	0.000	0.1	4 (est.)	5.71
8/7/2007	0.889	no data	8 (est.)	3.76
9/11/2007	0.000	<0.091	8.5	4.37
10/9/2007	0.000	<0.091	3.1	2.51
11/26/2007	0.000	<0.091	118.7	4.96
12/11/2007	0.000	0.571	130.1	9.26
1/8/2008	0.093	0.651	9.8	5.40
2/12/08	0.095	0.762	145.5	5.06
3/11/2008	0.000	0.476	26.6	7.83
4/10/2008	0.000	0.476	1	5.46
5/13/2008	0.000	<0.095	<1.0	3.81
6/10/2008	0.000	<.091	63.1	3.34
7/8/2008	0.000	<0.089	1	6.69
8/12/2008	0.000	<0.089	7.5	10.70
9/9/2008	0.000	<0.089	4.1	4.10

2006-2008 Akron LT2ESWTR testinground one

LT2 sampling round 1/bin assignment

Toolbox Options for Additional Treatment:

- 1) Watershed Control Plan (0.5 log credit)
- 2) Alternative Source/Intake Management (nd)
- 3) Pre-sedimentation Basin with coagulation (0.5 log credit)
- 4) Two-stage lime softening (0.5 log credit)
- 5) Bank Filtration (0.5 log credit to 1.0 log credit)
- 6) Combined Filter Performance (0.5 log credit)

7) Individual Filter Performance (0.5 log credit)

- 8) Demonstration of Performance (nd)
- 9) Bag or Filter Cartridges (Individual Filters)
- 10) Bag or Filter Cartridges (In Series)
- 11) Membrane Filtration (nd)
- 12) Second Stage Filtration (0.5 log credit)
- 13) Slow Sand Filters (2.5 log credit)
- 14) Chlorine Dioxide (based on CT table)
- 15) Ozone (based on CT table)
- 16) UV(Based on CT table)

- First round of LT2 testing: Akron=Bin 2
- Averaged 0.89 cysts over testing period



Watershed Control Program (WCP): -Five year program (2013-2017) -Only endorsed WCP in Ohio

Step 1: Watershed Survey

Land use within the UCRW (TMDL 2004)

Category	Area	Acres
Open water	3.6%	4,865
Wetlands	9.8%	12991
Low intensity residential	1.7%	2,210
High intensity residential	0.1%	144
Commercial/industrial	0.5%	597
Sand and Gravel	0.6%	751
Forested	46%	61,114
Pasture/hay	26.6%	35,235
Row crops	11.0%	14,689



Step 2: Identify Sources





Step 3: Prioritize Watershed



- A1 Critical Management Zone
- A2 Primary Management Zone
- A3 Secondary Management Zon
- B Stewardship Zone

Step 4: Set Goals



What is your primary focus? <u>Start simple!</u>

 Things to consider when planning goals: staff, budget, scope, data.

Goals: Biological?

YX

NL ML

NOTICE: OHIO EPA AUTHORIZED CLASS B BIOSOLIDS TRESPASSING IS PROHIBITED VILLAGE OF MANTUA 1-330-274-8776

N. M. M. M. INTA

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Goals: Industria ?

Goals: Residential?





Step 5: Program Commitment

Staff, equipment, transportation, data collection **BUDGET**

Step 5.1: Priority Feasibility



Akron's Commitments for the Watershed Control Program

 Source Water Area Monitoring
 Sampling: Stream, Reservoir and Canoe
 Wildlife Control

- Watershed BMPs
- Education and Collaboration



Step 6: Measurables How do you measure prevention?



S.ource W.ater A.rea M.onitoring Sites



Industrial

Stream, Reservoir, and Canoe Sampling

Monthly, quarterly and biannually









OHIO

DIVISION OF

BY AGREEMENT WITH CITY OF AKRON WATER SUPPLY DIVISION



Measurables: Financial Watershed Control Program cost over 5 years: \$2,906,523 5 Year Program total grant funding: \$1,908,109 5 Year total: \$4,814,632

• Grants:

- Ohio Environmental Education
 Fund
- o 319 NPSIS Mini-Grant
- o OWDA R&D
- Ohio 319 (h) Eckert Ditch
- WRRSP OEPA, Eckert Ditch
- Ohio SeaGrant



Evolution of the program

<u>Subtitle A</u>: Idealism VS Reality (What were we thinking?!) <u>Subtitle B</u>: Constantly shifting targets and expanding expectations <u>SWAM Sites</u>: Agreed to monitor swam sites quarterly to annually depending on location, also to monitor agricultural use.

<u>Sampling</u>: Agreed to 19 monthly sampling sites and once annually river canoe sampling for: temp, pH, DO, NO₂, NO₃, Total P, and turbidity

<u>Wildlife Control</u>: Committed to allow public hunting on certain watershed properties

<u>Watershed BMPs</u>: Committed to property management specific to WCP goals (acquisition, restoration, forestry, reservoir mgmt, property mgmt., etc.)

Education and Collaboration:

Committed to some educational materials and presentations, as well as developing partnerships with stakeholders

Original WCP Commitments



SWAM Sites: Add bio-solid application sites to regular monitoring. Higher expectations on Agricultural monitoring Sampling: Added NH₄, bacteria sampling, and additional sampling locations Wildlife Control: ODNR agreement for hunting/collaboration Watershed BMPs: Develop an approved SWAPP, Purchase and restore properties. Forestry management program with focus on water quality **Education and Collaboration:**

Nearly 500 Akron students tour each year. Website created for additional outreach. Developed a watershed signage program

WCP updates over 5 years:





4 #16: Tare Creek at Burton-Windsor Road Dav

#17: Cuyahoga River at East Branch Outlet

#18: Tare Creek at Durkee Road

#19: Wilkum Creek at Middlefield

Parameters Tested

Original Parameters

- Nitrate/Nitrite Ion Chromatography
- Total Phosphorus (Peroxydisulfate Digestion Method)
- TSS by Gravimetric Method
- Dissolved Oxygen by LDO
- pH by Probe

Parameters Changed/Added

- E. coli MMO/MUG Quanti-Tray
- Total Ammonia ISE and colorimetric with colorimeter/spectrophotomet er. Settled on ISE Now
- Nitrate and Orthophosphate by portable colorimeter verified by IC or Bench testing

Stream Sampling: Sample Processing Times

Field Testing

• DR900 tests per sample:

- Nitrate: 6 minutes
- Nitrite: 20 minutes
- Orthophosphate: 2.5 minutes (reactive

Orion Star Meter

Dissolved Oxygen, pH, Temperature

Laboratory Testing

- Bacteria Testing:
 - 24 hours to process and read
 - Suspended Solids per sample:
 - $\circ~~2$ $^{1\!/_{2}}$ hours to process and weigh

Ion Chromatography:

- Prep: 10 min per sample
- Run time: 25 min per sample

Total Phosphorus 4 hours of digestion/qc



Practical Considerations of Testing Methods

- Did Not Want glass Ampules In Vehicle
- Nitrite on colorimeter took 20 minutes.
- Turbidity and color concerns for colorimetric tests?
- Low phosphorus numbers on IC due to filtering of particulates.
- High chloride levels colorimeter a Nitrate test interference.
- The General ranges of the analytes in the watershed important in testing method choices.
- Determination of values to be ADL's or evalutated as "troublesome" results.
- Don't be afraid to modify methods to get more convenient and more accurate results.

Equipment Improvements

Field Testing

Hach SL1000 Portable Parallel Analyzer

PO

•Replaced both Orion DO/pH/Temperature meter and DR900 9425200 Colorimeter.

•Probes for pH/DO/Temp and uses chemkeys for Orthophosphate and NH3

•Eliminated having to provide storage for reacted colorimeter waste in vehicle.

•NH3 test provides in field ammonia numbers and will reduce number of ammonia samples run on bench.
•Promises more consistent results.
•Does NH3 and PO4 Simultaneously.

•Currently tracked very well vs. bench results.

Equipment Improvements Cont. In Lab Testing

Metrohm 930 Compact Flex Ion Chromatograph

•Replaced legacy Dionex unit

•With inline sample filtration saves time setting up samples.

•More reliable software.

•Combination led to sampling all Nitrate/Nitrite in lab normally same day

as sampling.

•More consistent numbers for those parameters.



Equipment Improvements Cont. Miscellaneous

New Quanti-tray Sealer /Viewing Cabinet





Success Story 1: Rothenbuhler Cheese



Example Rothenbuhler Cheese



Problem Identified

Average E. Coli per Year



Total Phosphorus Comparison



Nitrate Comparison





2016 Phosphorus Comparison Cuyahoga River vs Eckert Ditch



Success Story 2:Eckert Ditch Sampling . work



Eckert Ditch

- Goals:
- Identify pollution sources and potential sampling sites
- Reduce nutrient pollution coming into Lake Rockwell reservoir
- Reduce and/or eliminate bacteria loading



Eckert Ditch Sample sites

Eckert Ditch 1 Cottonwood Creek

Rockwell #2

Eckert Ditch 3

Eckert Ditch 5

Eckert Ditch 4

Goothier Creek

Old Canal Creek

Average Phosphorus



Avg E. coli Main Stem (col/100 mL)



Average Phosphorus & Nitrate at Red Fox



Average Suspended Solids



Round 1 LT2, 2006-2008

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2/13/2007			4.24
3/13/2007	otal C	rypto:	8.21
4/10/2007			5.78
5/8/2007	0.89	cvsts	4.11
6/12/2007			2.59
7/10/2007	0.000	4 (est.)	5.71
8/7/2007	0.889	8 (est.)	3.76
2/11/2007	0.000	8.5	4.37
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5/13/2008	0.000	<1.0	3.81
6/10/2008	0.000	63.1	3.34
7/8/2008	0.000	1	6.69
3/12/2008	0.000	7.5	10.70
9/9/2008	0.000	4.1	4.10

Round 2 LT2 2015-2017

Sampling Date	Crypto (oocysts/I)	E. coli	Turbidity (NTU)
2/10/2015	0.000	16.1	2.73
3/10/2015	0.000	45.3	3.64
4/6/2015	0.000	0	5.39
5/13/2015	0.000	2	1.26
6/8/2015	0.000	4.2	2.85
7/7/2015	Total (rvnta.	4.75
8/10/2015			4.12
9/8/2015	$\cap \cap \cap$	ovete	4.46
10/14/2015	0.00	Cysis	9.56
11/9/2015	0.000	0	6.17
12/7/2015	0.000	2	2.15
1/13/2016	0.000	50.4	6.33
2/8/2016	0.000	56	11.9
3/7/2016	0.000	4.2	7.88
4/11/2016	0.000	2	6.6
5/12/2016	0.000	1	3.46
6/6/2016	0.000	1	1.24
7/11/2016	0.000	0	4.46
8/9/2016	0.000	4.2	6.41
9/14/2016	0.000	15	6.72
10/11/2016	0.000	1	13.4
11/7/2016	0.000	4.2	6.85
12/14/2016	0.000	13.7	3.21
1/11/2017	0.000		

Thanks!

