DRINKING WATER SOURCE PROTECTION PLAN

for the

CITY OF WESTERVILLE

November 2013

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Executive Summary

In recent years the City of Westerville has dedicated considerable time and resources to projects that help protect our source of drinking water—Alum Creek and its aquifer. Some of these projects do not have source water protection as their main goal but help accomplish that goal nonetheless. For example, the City's storm water regulations are intended primarily to prevent flooding while providing adequate drainage. However, they also protect aquatic life in Alum Creek and the water quality used for drinking water.

In addition, the City is fortunate to lie within the geographic focus area of a dedicated and hard-working watershed group—Friends of Alum Creek and Tributaries (FACT)—which has shepherded numerous watershed improvement efforts over the last 15 years with a coalition of community volunteers (see Figure 1). Many of its members are Westerville residents, and the Westerville water utility manager is a founding member and serves on the Board. In addition, the Water Utility manager is active on committees with the following organizations: Ohio Department of Agriculture, Ohio Water Resources Council public advisory committee, Ohio American Water Works Association and Mid Ohio Regional Planning Commission (MORPC) Greenways committee, all of which are efforts to protect the water resources of Ohio. As a result of all these efforts, the focus area for this source water protection plan has received significant attention and protection for over a decade.

It should also be noted that the Alum Creek watershed is surrounded by watersheds with active watershed groups, including The Rocky Fork Creek Watershed Protection Task Force, formed in 1991; Friends of Blacklick Creek, formed in 1998; Friends of Big Walnut Creek, formed in 2001; Friends of the Lower Olentangy Watershed and the Upper Big Walnut Creek Water Quality Partnership, formed in 1998. These groups have developed their own watershed action plans and their educational activities also reach folks living within the Alum Creek watershed.

The City's sources of drinking water are most vulnerable to contamination in the four-mile stretch between the Westerville and Alum Creek dams and the intakes near Main Street. Within this area, land use has changed rapidly from agricultural and residential to commercial and more intensively residential, with a greater population density and many more streets and parking lots. As a result, agricultural chemicals (pesticides and fertilizers) are becoming less of a concern while storm water runoff, carrying chlorides from road salt and oils from motor vehicles, is an increasing concern.

The Implementation Plan provided in pages 3-4 summarizes the source water protection activities that are ongoing, These activities are discussed in greater detail on pages16 to 21.

Figure 1. Friends of Alum Creek and Tributaries (FACT)
The Friends of Alum Creek and Tributaries is a watershed group that grew out of a 1998 Central Ohio initiative to create a 27-mile multi-use trail and greenway along Alum Creek. FACT organized as a nonprofit and obtained grants to hire a watershed coordinator and create a watershed action plan (WAP) for the lower Alum Creek watershed (see WAP summary in Appendix B).

The WAP provided suggestions for local government officials such as source water protection and riparian corridor overlay zoning ordinances, including conservation measures in subdivision regulations, and local regulations concerning management of storm water and household sewage treatment systems. It also provided a blueprint for activities that FACT members have undertaken over the years since the WAP was finalized in 2005.

According to a 2008 FACT newsletter, from 2001 through 2008 FACT held 82 service events with 1,460 volunteers. These included:

- **River clean-ups** that yielded 1,596 bags of trash (of which 237 were recycled and diverted from the landfill) and 1,172 oversized items, including 500 tires and 22 shopping carts;
- **Planting** 1,262 native trees and shrubs and 380 native herbaceous plants;
- **Removing** 1,660 invasive honeysuckle bushes and 17 bags of garlic mustard
- **Installing** 600 feet of trash exclusion fences along the streams

The group has also organized the removal of two low-head dams on Alum Creek (at Nelson Park and Academy Park). Because of this, two miles of Alum Creek that were not attaining aquatic life beneficial use standards have been upgraded. FACT has also participated in efforts to transform Otterbein Lake and the Boyer Nature Preserve (both in Westerville), and convinced permitting agencies to channel wetland mitigation to sites within the Alum Creek watershed instead of a mitigation bank in another watershed. Members have participated in countless educational events, including providing a booth at Fourth Fridays and Party at the Creek, which occur during the summer in Westerville.

Although the group has lacked funding for a watershed coordinator since 2009, it has a volunteer board, a comprehensive website, and an active membership of volunteers who attend monthly meetings. Semi-annual or annual meetings are held with its municipal partners. About twenty service events are held every year, including canoe floats and river clean-ups, removal of invasive plants, tree plantings, wetland enhancement, and installation of rain gardens and other storm water BMPs.

More information about FACT is available at www.friendsofalumcreek.org .

Implementation Plan

Activity	***Responsible Party***	***When Implemented***	***Comments***
SOURCE MANAGEMENT ACTIVITIES			
Reduce threat from spills on roads and parking lots and releases from construction sites			
Prevention: The City of Westerville has enacted and enforces Zoning Code restrictions on type of development, lot coverage, storm water control and water quality mitigation	Westerville Planning & Development Dept, with Water Division review	Ongoing - Initiated by city ordinance in 2005.	Source Water Protection Overlay District Ord, No. 05-02(A)
Drain labeling. Labeling storm water drains And gutter concrete stamp.	Service Dept. and volunteer groups. New development Planning & Development Dept.	On-going - Initiated in 1998	
Bioswales. Construct bioswales on water treatment plant property	Water Division	Starting in 2014	
Reduce agricultural impacts			
Conservation Measures. Support Soil and Water Conservation Districts and OSU Extension offices in encouraging producers within the protection area to implement conservation measures. Serve on the Ohio Dept of Agriculture Concentrated Animal Feeding Facilities Advisory Committee.	Landowners, Districts and Dept. of Agriculture	1980's	See pages 19-20
Reduce impacts from septic systems			
Central Sewer. All properties in City or annexed to City must connect to centralized sewer system	Planning & Development Dept.	Ongoing - Initiated in 1976. Ordinance No. 76-22	Health Dept and OEPA sampling data documents problem area and enforcement
Outreach to septic system owners. The city joins forces with township officials, the county health departments and other agencies to encourage owners of failing septic systems to upgrade or connect to central sewer.	County Health Depts and property owners	Ongoing -	
Reduce impacts from upstream wastewater treatment plants			
Rechannel effluent. The Delaware County WWTP's effluent is piped to enter Alum Creek downstream from Westerville's public drinking water intake. Lift station alarms	Delaware County	Complete - Part of plant design in early 2000's	

Activity	***Responsible Party***	***When Implemented***	***Comments***
PUBLIC EDUCATION			
Consumer Confidence Report. Include info on source water protection plan in CCR.	Westerville water utility manager	Annually	CCR is updated annually and made available on City web site
Plant tours Continue to schedule and offer tours upon request.	Westerville water utility manager	Ongoing – as scheduled or requested	Schools, Service groups, professional and community groups
Web Page Information about source water protection strategies is posted on the Water Plant's web page		Ongoing – initiated in 2004	www.westerville.org
Citizens Academy	City/Water Division	2013	Presentation and tour
Brochure Create brochure about Westerville's source water protection plan for distribution at appropriate venues	Team outreach members		
Local Outreach Events/Festivals The Water Division provides information booths on protecting Alum Creek at Fourth Fridays and Party at the Creek. Also participates in the annual Central Ohio Children's Water Fest held at the State Fair grounds.	Water Division staff, members of FACT	Annually, during the summer	
TV The local Otterbein University TV station airs interviews with the Water Utility Manager on source water protection and other topics.	WOCC	As available	Also available via web site on You Tube
Friends of Alum Creek and Tributaries (FACT)	FACT Outreach Coordinator	Initiated in 1998	See Figure 1, page 2
CONTINGENCY PLANNING			
Plans for Short and Long-term Water Shortages	Westerville water utility manager	Entered into City ordinance in 1989	Documented in plant's contingency plan, which is reviewed and updated annually
Update Emergency Contacts PWS staff will notify EMA, LEPC and Fire Depts of Westerville, Orange and Genoa Townships of any changes in contact staff on at least an annual basis.	Westerville water utility manager	As part of annual contingency plan review/update	

Activity	***Responsible Party***	***When Implemented***	***Comments***
Spill Response	Westerville water utility manager	As needed	Documented in plant's contingency plan, which is reviewed and updated annually
SOURCE WATER MONITORING			
Raw Water Sampling at Intake PWS staff samples raw water at the intake every four hours, and ground water weekly when the wells are in use.	PWS staff	Ongoing	
University studies Otterbein University performs various water quality projects; current projects include monitoring for total dissolved solids to determine impacts from road salt as well as a project to determine interaction of ground water and surface water		As funding and research interests permit	

Drinking Water Source Protection Plan for the City of Westerville

Purpose

The goal of this document is to summarize strategies that are ongoing and/or will be pursued in the future to minimize the threats of contamination or water shortage to Westerville's sources of drinking water: Alum Creek and the Alum Creek Alluvial Aquifer. Although Westerville treats the water to meet or exceed federal and state drinking water standards, conventional treatment does not fully eradicate all potential contaminants, and beyond-conventional treatment is often very expensive. By completing this plan, the City of Westerville acknowledges that implementing measures to prevent spills and releases into Alum Creek and the Alum Creek Alluvial Aquifer can be a relatively economical way to help ensure the safety of the City's drinking water, while also improving water quality for other uses.

Why should a community have a source water protection plan? Water is a vital part of all facets of our communities. It is essential to agriculture, to washing, to cooling for industry and power stations, to moving wastewater away from populated areas and above all, to drinking. In addition to being a basic necessity of life, clean, affordable water can be an important economic driver. Many manufacturing plants use significant amounts of water and can even decide plant locations based on the availability of quality water. Clean water, provided at a reasonable cost, can attract new business and residents which help fuel economic growth and prosperity.

Communities invest a significant amount of money and time in their water treatment and distribution; *keeping the water source clean keeps costs as low as possible*. When contamination occurs, it can have a huge financial impact on communities and entire financial reserves can be wiped out. Contamination also disrupts lives and businesses, creating a negative economic effect for the local community. Most importantly, when drinking water is contaminated, the health of our families and fellow citizens is put at risk.

Because it only takes one major event to drastically change the quality of your water source, it is critical to plan ahead. Protection planning can prevent a future event entirely, minimize a potential threat, or simply prepare the community for when something does happen to the water supply. A source water protection plan can also be used when evaluating potential development opportunities that may affect drinking water supplies in the future.

- ✓ It helps the City provide the safest and highest quality drinking water to its customers at the lowest possible cost.

- ✓ It establishes activities to minimize the threats to the source of drinking water.

- ✓ It helps to plan for expansion, development, zoning, and emergency response issues.

- ✓ It can provide more opportunities for funding to improve infrastructure, purchase land in the protection area, and other improvements to the water system.

Background

Source Water Protection

Source water assessment and protection (SWAP) is a non-regulatory state program administered by the Ohio Environmental Protection Agency. The program started as the Wellhead Protection Program, which was part of the 1986 amendments to the federal Safe Drinking Water Act. These amendments required states to administer a source water protection program for their systems using ground water. In 1992 Ohio's Wellhead Protection Program was approved by the U.S. Environmental Protection Agency. The wellhead protection program provided guidance and technical assistance to public water systems, who were encouraged to complete assessments and protection plans using their own resources. Ohio EPA staff reviewed the assessments and formally endorsed them, when complete.

In 1996, the Safe Drinking Water Act was amended again. Section 1453 was added, providing states with the necessary federal funding to complete source water assessments for their public water systems. At that time, the program was extended to include surface water systems and was renamed "Source Water Protection." It was the intent of Congress that public water systems use the information in their source water assessment to develop a drinking water source protection plan. The background information presented here includes information from the Westerville source water assessment report completed by Ohio EPA in 2003 and the source water assessment report for the ground water source completed by Ohio EPA in 2011, but expands on it using data collected by Westerville's public water system staff.

This plan was drafted by Richard Lorenz, Westerville water utility manager, with assistance from Ohio EPA and in consultation with state and local officials. A source water protection team was formed to assist with implementation of strategies, especially the outreach efforts. This team consists of:

Richard Lorenz, Water Utility Manager
Daniel Langton, Water Plant Laboratory Technician
Jeremy Iles, Water Plant Operator
Jerry Holloway, resident and Friends of Alum Creek and Tributaries, Secretary
Christa Dickey, Community Affairs Administrator

Figure 2. The City of Westerville's Water Treatment Plant.
Photo source: http://www.westerville.org/index.aspx?page=216 (May 2013)

Public Water System Description

The City of Westerville operates a community public water system that serves a population of approximately 37,000 people in Westerville, Franklin County, Ohio (Figure 2). The average daily water demand is 3.975 million gallons per day (MGD) with a total water plant design capacity of 7.66 MGD. The primary source of water for the City's water treatment plant is surface water from Alum Creek.

The treatment process begins with the addition of a coagulant (ferric chloride) to clarify the water. The water is then softened with the addition of lime and caustic soda to remove the minerals calcium and magnesium. Carbon dioxide is then added for pH adjustment followed by disinfection with chlorine. After disinfection the water is filtered through rapid sand filtration units. The final steps of the treatment process involve the addition of phosphate for corrosion control, fluoride for the prevention of tooth decay, and on an as-needed basis, powdered activated carbon and potassium permanganate for taste and odor control.

The City also operates two wells located along Alum Creek, north of the water treatment plant. The wells supplement the surface water supply to improve the quality of water coming from the surface water intake into the water treatment plant. The two wells have a combined pumping capacity of approximately 2.4 MGD.

Description of Source Water Area

Alum Creek is a 58-mile tributary to Big Walnut Creek that originates in Morrow County, and flows south through Delaware and Franklin Counties, emptying into Big Walnut Creek at the confluence with Blacklick Creek, where all three creeks merge (Figure 3), between Obetz and Groveport. Big Walnut Creek then continues southwesterly another five miles to the Scioto River, which flows due south to the Ohio River.

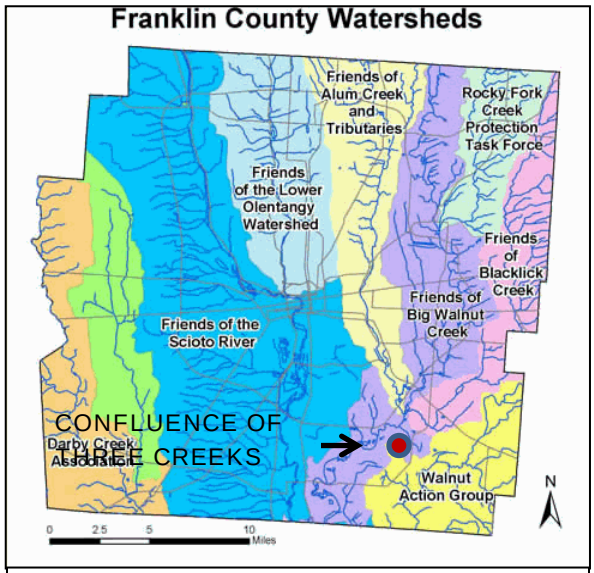

Figure 3. Franklin County Watersheds and Watershed Groups
Base map source: http://www.friendsofalumcreek.org/sitev2/aboutFACT.html (May 2013)

The source water area for Westerville's intake comprises only that portion of the Alum Creek watershed that drains into the river upstream from the intake (Figure 4), combined with the ground water protection area for the wells, which is largely enclosed within the watershed-based area. The area of focus for Westerville's source water protection activities will be only the southernmost portion of the source water area, as discussed further under "Area of Focus" (page 14).

Within the source water area the predominant land use is agriculture, at 68.2% of the total area. The percentage cover for other land uses includes: 25% deciduous/ evergreen forest, 3.1% open water, 1.2% residential, 0.9% wetlands, 0.7% commercial/ industrial/ transportation, 0.7% urban/recreational grasses, and the rest small percentages of quarries/strip mines/ gravel pits, transitional, and mixed forest.

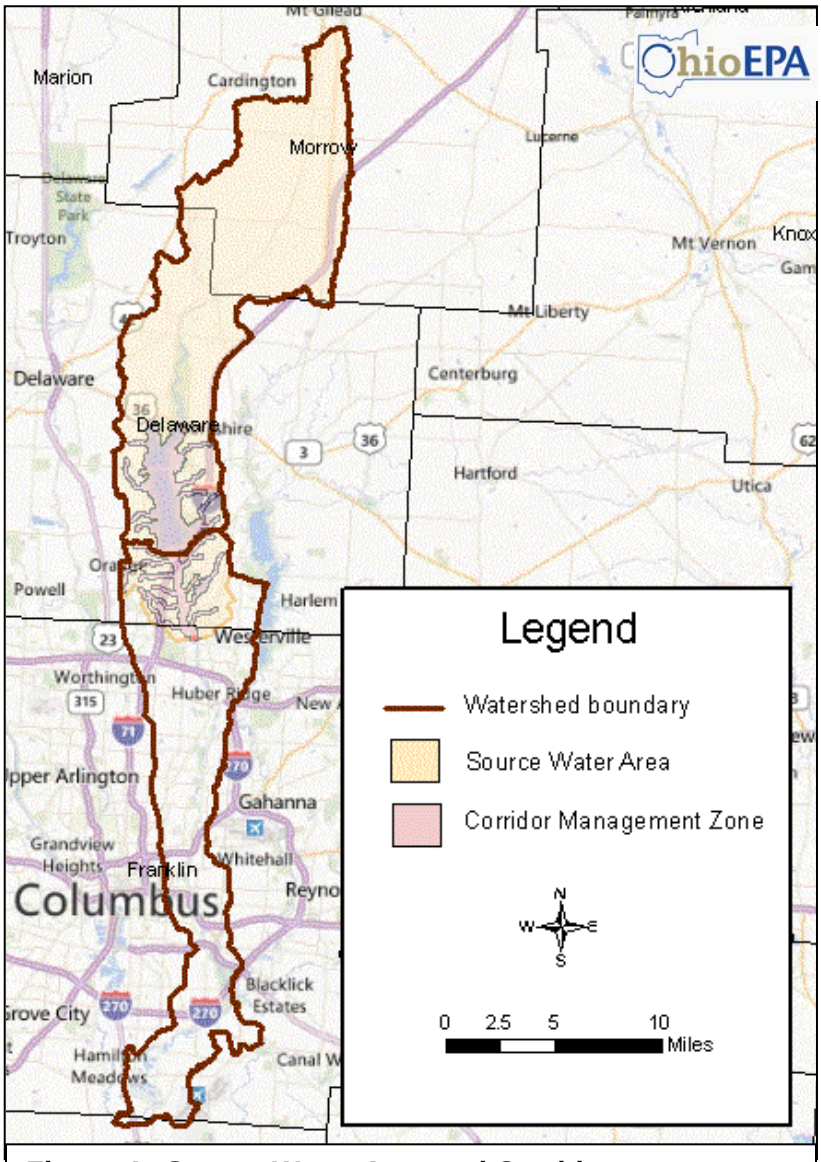

Figure 4. Source Water Area and Corridor Management Zone for Westerville's Public Drinking Water Intake

Land use types with extensive impervious surfaces (commercial/ industrial/transportation and residential) are expanding rapidly within the southern part of the source water area. Such surfaces may rapidly introduce surface runoff into Alum Creek and its tributaries through storm drains and sewers, ditches, old field tile systems, and adjacent parking lots or similar paved surfaces. Areas of concentrated impervious surface within or contiguous to the protection area upstream of the dam include: Ashley, Cardington, Fulton, Kilbourne and Marengo. Notable areas of concentrated impervious surface south of the dam include areas of Westerville East and West of Alum Creek proper and the rapidly developing Polaris complex north of the Franklin/ Delaware county line.

Figure 5. Alum Creek Reservoir and Dam, Looking Northwest.
Photo Source: http://commons.wikimedia.org/wiki/File: USACE Alum Creek Dam and Lake. jpg (May, 2013)

In 1974, the Army Corps of Engineers completed the Alum Creek Reservoir near the middle portion of the creek length to provide water supply, recreation and flood control (Figure 5). Held back by a 93-foot-high dam, the reservoir is 10.5 miles long, covers 3,387 acres on average and can store up to 134,815 acre-feet of water. It is a popular recreational spot for Central Ohioans, with resources for boating, fishing, and swimming. Delaware County (Delco) and the City of Columbus have intakes on Alum Creek Reservoir at the dam, and thus share with the City of Westerville the Alum Creek source water area above the dam. The Army Corps maintains water flows in Alum Creek at no less than five cubic feet per second, with dam releases usually scheduled in October or November.

A much smaller City-operated reservoir known as the Westerville Reservoir is located on a tributary of Alum Creek (known as "Indian Run") about two miles northeast of the plant along Worthington Road. Constructed in 1960, it stores an average of about 685 acre-feet of water and supplies approximately 25% of the daily surface water supply.

Ground Water. Westerville's wells withdraw water from the sand and gravel deposits of the Alum Creek Alluvial and Columbus Complex aquifer systems. The alluvial aquifer is covered by 15 to 20 feet of low-permeability material which provides some protection from contamination. The

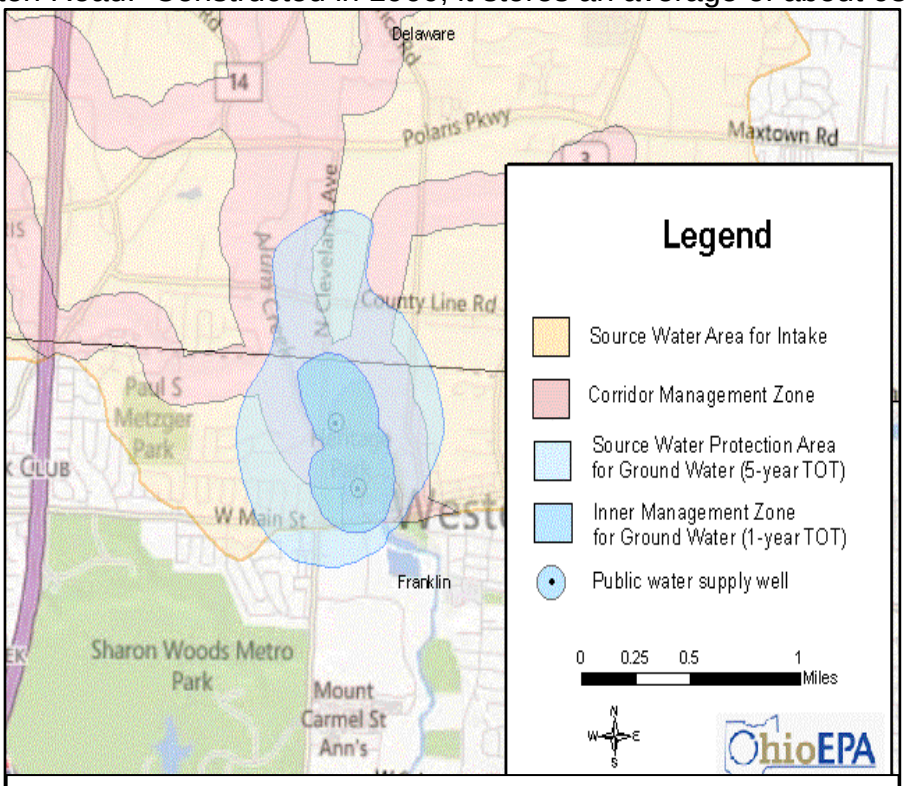

Figure 6. Source Water Protection Area for Westerville's Public Water System Wells

depth to water in this aquifer is estimated to be 5 to 12 feet below the ground surface based on data from the well drillers' logs. A semi-confined, 20-30 foot thick, sand and gravel aquifer lying below this upper aquifer is utilized as the City's ground water source with well screens set 50-80 feet below the surface.

The source water protection area for ground water wells is developed from computer models that calculate a five-year time-of-travel (TOT) area based on the distance a water particle could theoretically travel through the aquifer in five years, in accordance with pumping rates and what is known about aquifer properties. Enclosed within this area is an "inner management zone", which represents the one-year time-of-travel area (Figure 6). Communities are urged to focus ground water protection efforts on this area, because it is so close to the wells.

Source Water Quality

Based on biological and water quality studies conducted by Ohio EPA, Alum Creek's water quality is generally good in the Westerville area, supporting a relatively healthy and diverse community of fish and macroinvertebrates. The stretch of the mainstem within the I-270 outerbelt has historically been the most impacted for aquatic life use due to low-head dams, channelization, and urban pollution (Figure 7). However, this has improved since 2000 and is downstream from the Westerville intake in any case.

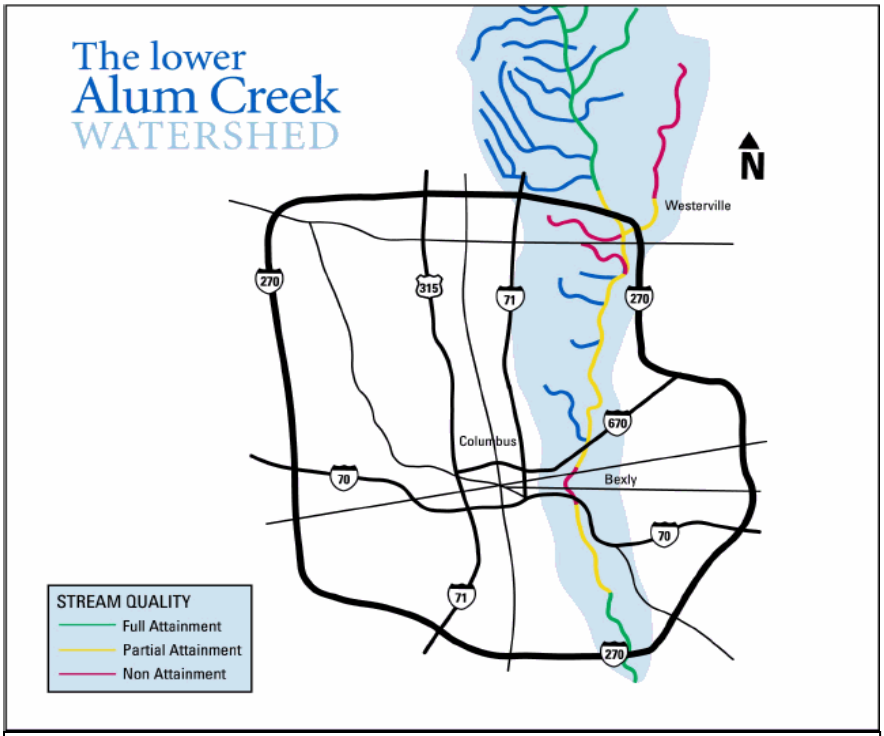

Figure 7. 2003 aquatic life use attainment status for the lower Alum Creek mainstem. Source: OEPA, 2003. Map created by OSU Extension, Columbus Ohio. (*Source: Alum Creek WAP, 2005, page III-64*)

For the purposes of drinking water, agricultural chemicals have historically been the biggest water treatment concerns. Also, the Ohio EPA studies indicated *E. coli* bacteria levels were high at a number of sampling sites, including two below the dam but upstream from the intake. Related concerns are elevated levels of disinfection byproducts (DBPs) in treated water, which are formed from the reaction of chlorine—used in the treatment process--with organic compounds in the source water, carried on silt and algae. To

address DBPs and microbiological contamination (primarily *Cryptosporidium*), the City is planning to install secondary filters of granular activated carbon (GAC).

Land use in the southernmost portion of the source water area has changed notably over the last couple decades; former farmland has been transformed into commercial and residential tracts with many more roads and parking lots. As a result, high chlorides from road salt have become a greater concern recently, particularly in the winter. There are no health-based regulatory limits on the amount of chloride in drinking water, but the general population can taste chloride at concentrations of 250 mg/l or so, and most find the taste objectionable. In 2010, Westerville's water treatment plant personnel conducted quarterly sampling for chlorides and found a maximum of 313 mg/l. In 2011 the maximum concentration detected in treated water was 110 mg/l. Therefore, a high priority for this source water protection plan is strategies to minimize runoff from roads and parking lots treated with de-icing chemicals from entering the source water.

The City is also required to sample the treated water before releasing it to the distribution system. A summary of regulated constituents detected from 1999 to 2013 is shown below in Table 1. The test results are also summarized on an annual basis in the City's Consumer Confidence Report, which is distributed to water customers and is available on the City's website at: http://www.westerville.org/index.aspx?page=702

Table 1. Water Quality Monitoring Summary of Treated Water
City of Westerville Public Water System
Ohio EPA Public Water System Compliance Monitoring Database (January, 1999 – March, 2013)

NOTES: Primary Maximum Contaminant Limits (MCLs) are health-based standards. Some constituents only have Secondary MCLs, which refer to taste, odor or appearance (staining of fixtures or clothing), not related to health. Action Levels apply to lead, copper, and some radioactive contaminants, which typically originate in individual homes.

Contaminant (units)[a]	Levels Found	Primary MCL	Secondary MCL	Action Level	MCL Violation?[b]	Typical Sources Related to Human Activities[c]
Barium (mg/l)	0.0094 - 0.0229	2	*	*	NO	Runoff from mining and metal production wastes
Chloride (mg/l)	37 - 128	*	250	*	NO	Runoff from road salt or salt storage areas
Copper (mg/l)	0.0071 – 0.195	*	*	1.3	*	Corrosion of household plumbing systems.
Fluoride (mg/l)	0.77 – 1.28	4	2	*	NO	Additive promoting strong teeth. Discharge from fertilizer plants and aluminum factories
Lead (µg/l)	5.1 – 11.3	*	*	15	*	Corrosion of household plumbing systems
Nitrate (mg/l)	0.13–2.97	10	*	*	NO	Runoff from fertilizer use, leaching from septic systems
Orthophosphate (mg/l)	0.08–0.23	*	*	*	NO	Fertilizer runoff, detergents
Phosphate (mg/l)	0.42–1.1	*	*	*	NO	Fertilizer runoff, detergents
Phosphorus (mg/l)	0.16–0.36	*	*	*	*	Runoff from fertilizer use; Leaching from septic tanks, sewage; Discharge of industrial waste

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Contaminant (units)[a]	Levels Found	Primary MCL	Secondary MCL	Action Level	MCL Violation?[b]	Typical Sources Related to Human Activities[c]
Sulfate (mg/l)	47.9-148	*	250	*	NO	Discharge from mining and industry, detergents in sewage, decomposition of organic matter
Radioactive Constituents						
Beta/photo emitters (pCi/L)	6.5	*	*	50	NO	Discharge from production of luminous dials,smoke detectors, hospital wastes, nuclear power plants
Synthetic Organic Contaminants including Herbicides and Pesticides						
Atrazine (µg/l)	0.33–1.82	3	*	*	NO	Herbicide runoff
Simazine (µg/l)	0.158–.93	4	*	*	NO	Herbicide runoff
Disinfection By-Products (DBP's)						
TTHMs [Total Trihalomethanes] (µg/l)	19.8-123	80	*	*	NO	By-product of drinking water chlorination
Bromodichloromethane (µg/l)	6.6–25.8	Primary MCL = 80 µg/l for the SUM of these four constituents, which are products of chlorinating the drinking water				
Chloroform (µg/l)	9.3–94.4					
Bromoform (µg/l)	0.5–2.83					
Dibromochloromethane (µg/l)	1.6–13.2					
HAA5s [Total Haloacetic Acids] (µg/l)	3.9-62	80	*	*	NO	By-product of drinking water chlorination
Dibromoacetic Acid (µg/l)	1.0-5.2	Primary MCL = 80 µg/l for the SUM of these five haloacetic acids, which are products of chlorinating the drinking water.				
Dichloroacetic Acid (µg/l)	5.4-40					
Trichloroacetic Acid (µg/l)	2.8-43					
Monobromoacetic Acid (µg/l)	1.2-9.2					
Monochloroacetic Acid (µg/l)	1.2-25.7					

[a] Units: mg/l = milligrams per liter (parts per million); µg/l = micrograms per liter (parts per billion); pCi = picoCuries per liter.
[b] A sampling result that exceeds the MCL value does not necessarily indicate a violation by the public water system. MCL violations for many contaminants are based on a running annual average instead of a single exceedance.
[c] All inorganic and radioactive constituents listed here are also naturally-occurring in the environment at some level.
* = Not applicable.

Identification of Local Source Water Concerns

Area of Focus

While the entire source water area contributes to Westerville's water supply, it is impractical to focus on such a large area. Ohio EPA's Source Water Protection Program generally encourages communities to focus their efforts on the Corridor Management Zone. However, in Westerville's case, the area that appears to pose the greatest concern is the southern portion of the source water area, i.e., the fast-developing area between Lewis Center Road and Polaris South, where acres of parking lots and roadways are replacing agricultural fields and woodlands (Figure 8). This area incorporates a portion of the source water protection area for the ground water wells (see Figure 6). The constituent of greatest concern from this area is chloride from road salt, but volatile and semi-volatile organic constituents from fuel spills and leaks are also a concern.

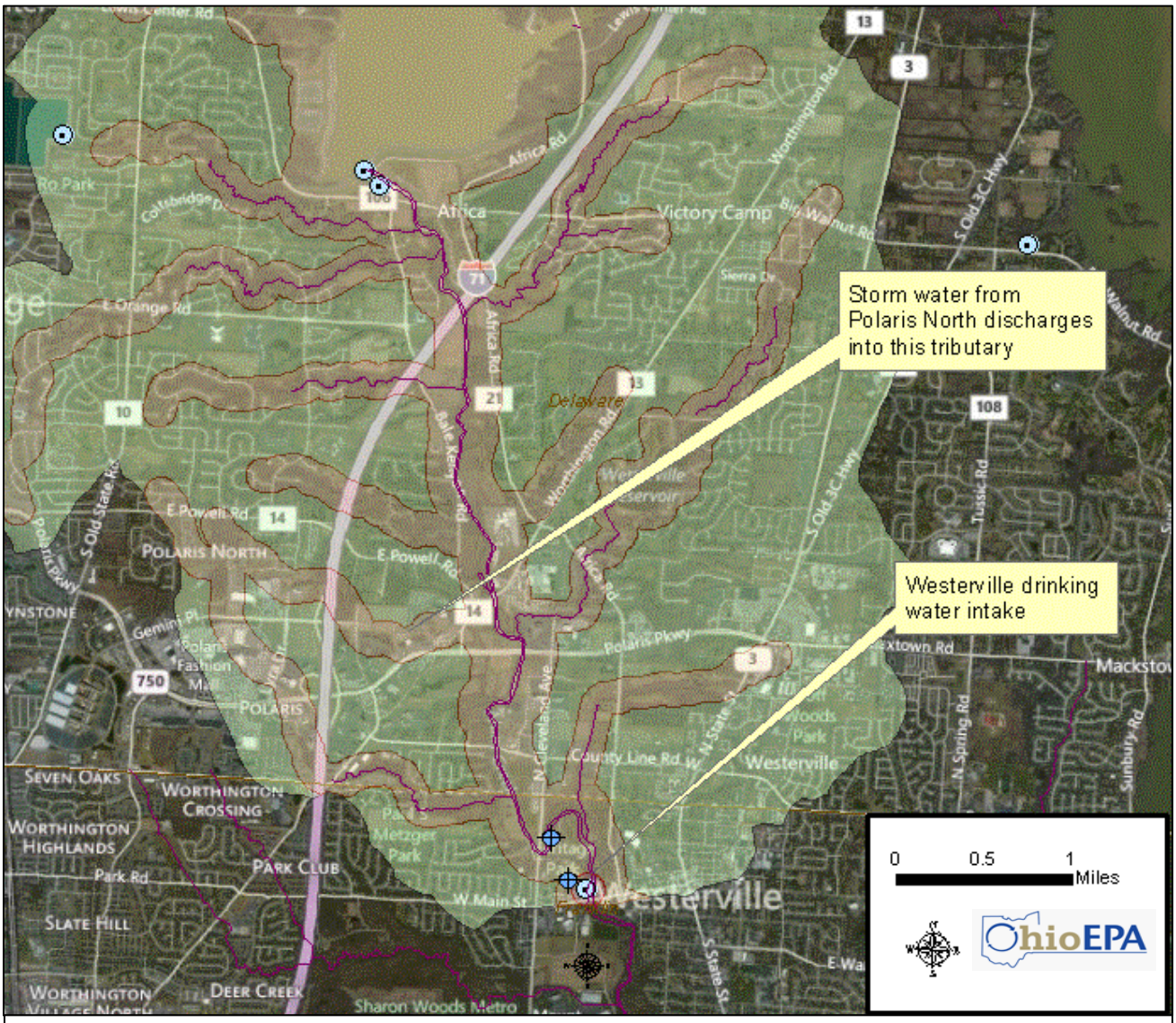


Figure 8. Area of Focus for Source Water Protection Strategies, City of Westerville

Potential Contaminant Sources

The area surrounding Alum Creek Reservoir—which comprises much of the Corridor Management Zone--is largely wooded and undeveloped, so the main concerns in this portion would be **fertilizers and pesticides** from more distant agricultural fields and residential areas, carried to the reservoir by various tributaries. Fuel spills directly into the reservoir from **gasoline-powered boats** or from **State Route 36**—a four-lane highway that crosses the reservoir in an east-west direction--are also a concern, but a serious spill likely could be contained by the dam long enough for cleanup efforts to be implemented. In general, contaminants released into the reservoir may break down and/or dilute to below-detection levels before reaching the creek below the dam, because currents in the reservoir are relatively sluggish.

Below the dam, the main potential contaminant source is **runoff from paved surfaces**, as discussed above. North of Polaris Parkway, storm water discharges into a tributary that empties into Alum Creek above the public water system intake, so this area is of primary concern. South of Polaris Parkway, storm water generally discharges below the intake, and thus poses less of a threat to the drinking water. Also influencing this area is Interstate 71.

Because high turbidity levels tend to result in elevated DBPs, sources of turbidity are a concern. These include **agricultural fields** (especially those that are tilled) and **construction sites** where storm water rules are not being followed, whether through negligence or simply because the site is too small to be subject to storm water rules

Other potential contaminants below the dam include **landscaping chemicals** from a nursery and residential areas, and **septage** from malfunctioning septic systems that may exist at older homes. (The high levels of bacteria found at sampling sites between the dam and the drinking water intake in 1996 suggest that septage or manure was entering Alum Creek during that period.) The South Delaware County **wastewater treatment plant** is rated to discharge up to 10 million gallons per day (MGD) of treated wastewater that is piped to a discharge below the intake. This plant could be a concern if there was a plant failure or a bypass (where untreated wastewater is released to the stream). A database inventory conducted in 2003 found 20 active and inactive **oil and gas wells** within the source water area, but the locations and status of these have not been verified; presumably most of them are located in the upper watershed.

Prioritization of Potential Contaminant Sources

Runoff from paved surfaces that drain to tributaries discharging into Alum Creek below the dam but above the drinking water intake is the highest priority contaminant in Westerville's source water protection area. This priority is supported by a 1994 incident, where materials from a partially paved parking lot in the Polaris area washed into the Creek, forcing the drinking water plant to shut down for four days and purchase water from Columbus. Above all, the City is concerned about chloride from road salt, because it is very difficult and expensive to remove from source water. Also, very small amounts of volatile and semi-volatile organics from fuel leaks or spills can trigger the need for expensive treatment. Due to the impact on levels of DBPs, **sources of turbidity** are a high priority as well.

Protective Strategies

Protective strategies for Westerville's source water protection areas are detailed below in four categories: strategies targeted to specific types of activities or facilities; contingency planning; public education; and source water monitoring.

Specific Contaminant Source Strategies

For development and run-off from paved surfaces.

Over the last decade the area upstream of the Water Plant intake has been changing from agriculture and low density residential to office/commercial development. To limit the impacts of this development, within the corporate boundaries, Westerville has enacted and enforces Zoning Code restrictions. These restrictions address the type of development, lot coverage, storm water control and water quality mitigation requirements. Source water protection has been specifically addressed by the creation of a "Source Water Protection Overlay District" within the Planning and Zoning Code.

The Source Water Protection Overlay limits the use of hazardous chemicals, mining activities, new private wells, permanent dewatering installations, underground storage tanks and storage of road de-icing chemicals. The applicant for new development must address measures to be taken to protect both surface and ground water quality, quantity and aquifer recharge. (See summary of ordinance in Appendix A).

Most of the inner management zone and a large percentage of the source water protection zone for ground water is City-owned land that is used for park or water treatment purposes. To limit localized impacts, the policy for the water treatment complex is to not apply de-icing chemicals to its roadways. To mitigate impacts from the 2014 Water Plant facilities upgrade, the storm water design incorporates a bio swale system for water quality and quantity considerations. Bioswales temporarily retain run off water, allowingfor percolation into the ground and water quality improvements by natural processes. Also, during periods of heavy de-icing use, a greater percentage of ground water is pumped because ground water is much less likely to be impacted by surface-applied substances.

For agricultural fields.

The majority of the agricultural fields are now located north of the Alum Creek Reservoir. This large storage impoundment, on a relatively small creek, provides long detention times and dilution of any chemicals that may have been carried into the reservoir. Because the water is relatively still, turbidity brought in by tributaries also tends to settle out. Monitoring of the source water alerts us when low levels of herbicides are present.

The City endorsed, and FACT participated in, the development of the Big Walnut Watershed Plan, which promotes the following best management practices for managers of agricultural land within the watershed:

1. *Manure application*. Never apply manure to frozen grounds.

2. *Soil Tests*. Agriculture producers in the watershed should perform regular soil tests to properly gage the additions of nutrients necessary for proper crop response and yield expectations.

3. *Nutrient Management Plans*. Livestock producers should work with local Soil and Water Conservation District officials and complete a comprehensive nutrient management plan for their operation. These plans are good tools to help fully utilize all manure nutrients without adding excess amounts that can increase the potential for aquatic contamination.

4. *Stream Buffers*. Buffering the stream with native grasses or tree plantings can further prevent excess nutrients and sediments from ending up in the creek. Operators may be eligible for buffer-strip incentives from a variety of programs.

The City of Westerville has no jurisdiction over agricultural land outside the city boundaries, and must rely on agricultural outreach staff with the Franklin and Delaware County OSU Extension offices and Soil and Water Conservation Districts to work with any farmers who have not already adopted these best management practices. Farm Bill-funded programs are available to financially assist farmers who are willing to implement the conservation measures listed above, as well as many others, including fencing off livestock from streams, improved manure storage facilities, no-till farming, planting winter crops (to hold nitrogen in the soil), etc.

During periods of elevated herbicides or turbidity, the wells can be utilized to mitigate the influence on the finished drinking water. Activated carbon is also available to reduce the impact of herbicides.

For construction sites.
The City of Westerville engineering staff reviews development plans for compliance with State and local storm water regulations. City staff also monitor active sites for compliance (Figure 9).

For septic systems.
Westerville requires all properties in the City or annexed into the City to connect to the centralized sewer

Figure 9. A failed sediment fence beside a large plot of land undergoing development allows runoff of silt into a tributary to Alum Creek. Photo source: Alum Creek and Tributaries Watershed Action Plan, 2005.

system. The unincorporated township areas in or near the source water area have been surveyed by either the Franklin or Delaware County Health Departments to identify problem areas or properties. In response, City and township officials, Ohio EPA and the county health departments have met to discuss coordinated efforts to address areas of poor water quality. Owners have been requested to either improve their systems or consider annexation to the City for access to the centralized system.

For wastewater treatment plant(s).
In the early 2000's, the impact of a proposed 10 MGD Delaware County sewage treatment plant upstream of the water plant intake was successfully mitigated by the County agreeing to pipe their treated effluent discharge to a point downstream of our water plant intake. Any sewage bypasses or discharges are reported to the Water Plant.

For residential lawn chemicals.
Impacts from residential lawns are being addressed through public awareness and education. The City directly or indirectly through FACT and Franklin County Soil and Water District provides information on protecting water resources at community events with environmental themes (Fourth Fridays, Party at the Creek, Children's Water Fest, open houses and citizens workshops on rain barrels, composting and rain gardens).

Drinking Water Shortage/Emergency Response

A well designed contingency plan enables a utility to prepare for, respond to, and recover from crisis conditions without wasting time or money on futile or unnecessary efforts. The plan defines the duties, responsibilities, and functions of all water system personnel with respect to each specific emergency condition. The Westerville Water Department has developed procedures to address specific situations that can be expected to arise, and these are documented in the Plant Contingency Plan, which is updated annually. Copies are kept at the water treatment plant, Fire Department, City Manager's office and the Water Utility Manager's home.

The following are issues that are specific to source water protection. This information has been included in the water plant contingency plan.

Emergency Response – Contamination Above the Alum Creek Dam
Detection, monitoring and the response to a contamination event above the reservoir dam would involve numerous agencies and their resources. These agencies include: Del-Co Water System, City of Columbus Water System, U.S. Army Corps of Engineers, Ohio Department of Natural Resources, Ohio EPA and the City of Westerville. The first response would be to prevent the contamination from migrating downstream and reaching the intake using containment and clean-up measures. Prior to the contaminant reaching the intake the treated water reserves would be filled up. If the contaminant is not treatable, the plant would close its creek intake and switch to our ground water supply until the surface water supply contamination has been mitigated and the source tested.

Emergency Response – Contamination Below the Alum Creek Dam
A contamination event below the dam creates a much more immediate threat to our source water supply due to proximity and the time for response or mitigation. The responding agencies would be the Ohio EPA and the City. The first response would be to prevent the contamination from migrating downstream and reaching the intake using containment and clean-up measures. Prior to the contaminant reaching the intake the treated water reserves would be filled up. If the contaminant is not treatable, the plant would close its creek intake and switch to our ground water supply until the surface water supply contamination has been mitigated and the source tested. Flushing the creek from the reservoir supplies may speed the recovery of this source.

Drinking Water Shortage – Short- and Long-Term Loss of Source
Because the City of Westerville is surrounded by other large-capacity public water systems, the loss of its source of water would not be difficult to address logistically unless the loss were due to some catastrophe that also impacted all the surrounding public water systems. To deal with a short-term loss of source (for example, a few days to a few weeks), Westerville could open an existing connection with the City of Columbus, which currently obtains its water from three different sources: the Scioto River, Hoover Reservoir, and the Parsons Avenue wellfield. If the problem affected only Alum Creek below the dam, water could be piped directly from the reservoir to the water treatment plant. If the problem affected only the reservoir, the ground water could still be used, supplemented by purchased water. If the problem at the reservoir promised to be long-term, Westerville would most likely expand its wellfield.

If the problem affected only the ground water, the water supply would not be seriously compromised, because the reservoirs provide more than adequate supply. For this system ground water is used to enhance water quality more than quantity Long-term loss of ground water would most likely be addressed by considering other types of treatment to ensure high quality of the water provided.

Funding for Water Emergencies
The City has a fiscal policy of maintaining a minimum Water Fund balance to address emergencies. This designated fund balance has at least a two month reserve of operating capital, along with next year's debt and capital expenses. In addition to this minimum fund balance the Water Fund has a positive balance it can draw from.

Planning for the Future

A. Current average water use = 3.729 million gallons per day (MGD) as of 2013
B. Current daily system design capacity = 7.66 MGD
C. Flow capacity of Alum Creek = 7 MGD

Westerville is currently using 49% of its rated capacity of 7.66 MGD. Water demand over the last five years shows a level to slightly negative trend. However, population has been increasing rapidly over the last four decades (Figure 7) and is predicted to be 42,000 in 2030--a 16% increase over the 2010 census population of 36,120. Projections indicate average water demand will be 4.35 MGD in 2030 with a peak of 7.4

MGD, which approaches the system's design capacity. A third well site, estimated to supply 1-1.5 MGD, is planned to be developed within the next 5 years.

Public Education and Outreach

Consumer Confidence Report.

Information on our source water vulnerability and contaminants is included in our annual consumer confidence report. Actions being taken by the City and its partners are included along with what individuals can do to protect their water supply.

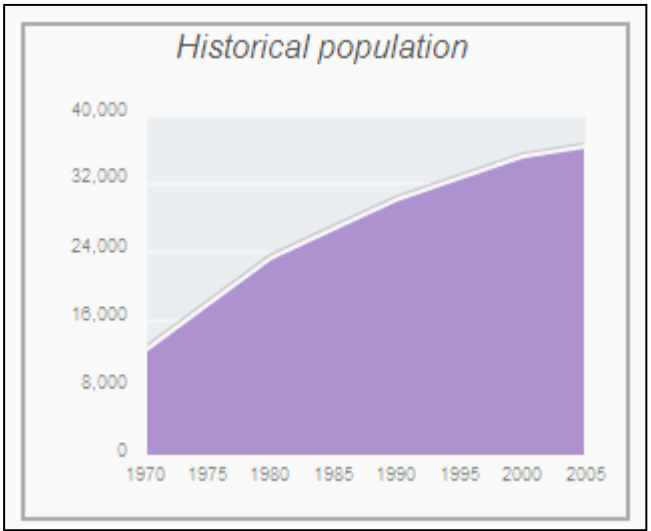


Figure 7. Historical population of Westerville, 1970-2005
Graph source: http://www.city-data.com/city/Westerville-Ohio.html (May, 2013)

Plant Tours.

The best outreach tool is to experience how drinking water is treated. The importance of protecting the source is highlighted as part of the tours. The City offers several opportunities through the year for water plant tours. Tours are offered in conjunction with community events, citizen academies, along with school, club and watershed group events.

Web Page.

A variety of information on current activities, water quality, treatment, conservation, plant tours, frequently asked questions and related links for more information is available on the Water Division's pages of the City web site, www.westerville.org.

Festivals.

The Water Division, along with the Friends of Alum Creek and Tributaries and other environmental groups participate in local annual festivals (Fourth Fridays and Party at the Creek) where we have booths focusing on the protection of Alum Creek. The Water Division also participates in the annual Central Ohio Children's Water Fest held at the State Fair grounds.

SWEET Team.

The Source Water Environmental Educational Team consists of staff with the Franklin County Soil and Water Conservation District (which is under contract with the City to provide educational programs), FACT, the consulting firm the MAD Scientist and Associates and City personnel. All participate in events in our City to promote water quality and awareness. The local Otterbein University TV station also on occasion airs interviews with the Water Utility Manager on source water protection and drinking water treatment in our community.

FACT.
The Friends of Alum Creek and Tributaries is a watershed protection group that promotes the protection, awareness and enjoyment of Alum Creek. The City is a sponsor/member and participates in FACT activities and governance. FACT activities along Alum Creek include litter clean-ups, native tree and shrub plantings, invasion plant removal, educational and social events, rain barrel, rain garden and composting workshops, wetland enhancements, and low head dam removals all to improve water quality. FACT also advocates for the protection of the Creek and surrounding habitat from development pressure and cultural impacts.

Storm Drain Stamping.
In 1998 the City of Westerville initiated a program to stamp storm drains throughout its jurisdiction with the message "No Dumping, Flows to Creek" (Figure 11). Such messages remind residents that these drains do not lead to the sanitary sewer (as many suppose) but to a nearby stream, so whatever is dumped into them will have an impact on the aquatic life and the stream's water quality.

Figure 11. A Westerville employee stamps the message: "No Dumping, Flows to Creek" into fresh concrete near a storm drain (Photo source: City of Westerville, 1998)

Water Quality Monitoring

Water treatment plant personnel monitor raw water quality at the intake visually and in the laboratory for nitrate, alkalinity, pH, turbidity, hardness, fluoride and temperature. Frequency of monitoring is typically every four hours. Ground water quality is monitored weekly from the production wells when they are in use. Ground water levels are monitored monthly. Monitoring of the finished water varies from continuously to every four hours. Staff also monitor the reservoirs for algal blooms or other potential concerns.

In addition, Otterbein University in partnership with the City performs some water resource monitoring projects. Research projects currently on-going include the monitoring of Alum Creek for total dissolved solids (an indicator of road salt), pH, temperature, weather and water level at our plant intake. This research is further defining the impact of road salt on the Creek and has been presented at an Ohio AWWA meeting. Otterbein University also has a project that monitors ground water levels and quality in relation to surface water level and quality to determine the local interaction between ground and surface waters.

Delaware and Franklin County Health Departments monitor local tributaries to document and act on failing septic tanks in our intake watershed.

Updating the Plan

A protection plan is not a static document. Over time many issues related to protection planning will change- existing potential contaminant sources will close, new education and outreach opportunities will become available, new partners in protecting the drinking water source will be identified. The protection plan needs to plan for these and other events.

The City of Westerville commits to reviewing the Drinking Water Source Protection Plan every five years, beginning with 2018, and when significant changes occur.

Updating the SWAP Assessment
Each review of this plan will include consideration of the following questions:

Water Treatment Plant Updates
- Has the water usage increased or decreased since the last review?
- Have any new treatment protocols been added?
- Has a reservoir or intake been added or removed, or have additional wells been installed?
- Have there been any significant changes in flow in Alum Creek?

Changes to the intake or the addition of wells will be reported to Ohio EPA's source water protection program so that the source water assessment can be adjusted (if necessary) to reflect new sources of drinking water.

Potential Contaminant Source Inventory
- Has the extent of the protection area changed?
- Have land uses in and around the protection area changed?
- Has management of businesses in the protection area changed?

If the answer to any of the above questions is yes, Westerville will update the inventory or conduct a new inventory. Westerville may contact Ohio EPA's Source Water Protection staff in the district office for guidance or assistance in conducting the inventory.

Evaluating the Effectiveness of the Protective Strategies
In order to evaluate if the protective strategies in this Source Water Protection Plan are achieving the desired outcomes, Westerville will consider the following types of questions and write any changes into the Protection Plan.

- Do we have reason to be concerned about how the drinking water source protection area may be used in the future?
- Should we consider trying to better protect it through local regulations?

Pollution Source Control Strategies

- Have we followed our own schedule of implementation/timeline for each of the pollution source control strategies?
- Are there new potential contaminant sources that need to be addressed with new pollution source control strategies?
- Have we implemented any new protective strategies that are not documented here?
- Did any of our strategies result in removal or elimination of a potential source?
- Did any of our strategies result in individuals modifying practices to decrease the risk of contaminating the drinking water source?
- Did our coordination with other groups (SWCDs, county EMAs, local health dept., local watershed group, etc.) contribute to the implementation of protective strategies?
- Have the partnerships developed during plan implementation been productive?

Education and Outreach

- Have we followed our own schedule of implementation/timeline for each of the educational strategies?
- Are there any new groups in the population that we need to target with education and outreach strategies?
- Have we implemented any new educational strategies that are not already documented here?
- Has education and outreach targeting any specific group resulted in actions that reduced or could potentially reduce the risk of contaminating the drinking water source (e.g., septic system owners conducting regular maintenance, farmers adopting best management practices)?
- Have we received additional funding to continue any particular education and outreach strategy?
- Have we received any accolades, awards or recognition from outside entities or organizations for our educational efforts?
- Have we had any unsolicited requests for SWAP-related education (such as requests for plant tours, requests for presenters/speakers at events, etc.)?
- Did our coordination with other groups (SWCDs, SWEET Team, local health dept., local watershed group, etc.) contribute to the successful development and dissemination of SWAP-related information?
- Did we have sufficient staff and resources to complete all the planned educational efforts?
- Have educational efforts been cost effective? Efficient? (Consider level of attendance, attentiveness and participation by audience, comments received, etc., vs. the cost to facilitate the event) Should the frequency of the outreach be increased, decreased, or remain the same?
- Have the partnerships developed during plan implementation been productive?
- Have any of the target groups contacted the public water system for additional information about something they saw or heard about through these activities?

Drinking Water Shortage/Emergency Response

- Are there any updates to the Drinking Water Shortage/Emergency Response Plan?
- Did our coordination with emergency responders at the local and county level result in better communication and handling of spill incidents that could impact our drinking water?

Raw Water Monitoring

- Have we followed our raw water monitoring plan (i.e., sampled at the specific frequency, analyzed for the appropriate parameters, etc.)?
- Have there been any significant changes to our water quality?
- Do we have sufficient water quality data or other reasons (e.g., the source was removed) to conclude that source water monitoring can be cut back or is no longer needed?
- Are there new water quality, potential contaminant source, or land use issues that would influence the need to expand our water quality monitoring network?
- Does our raw water monitoring plan need to be updated for any reason?

Revising the Plan

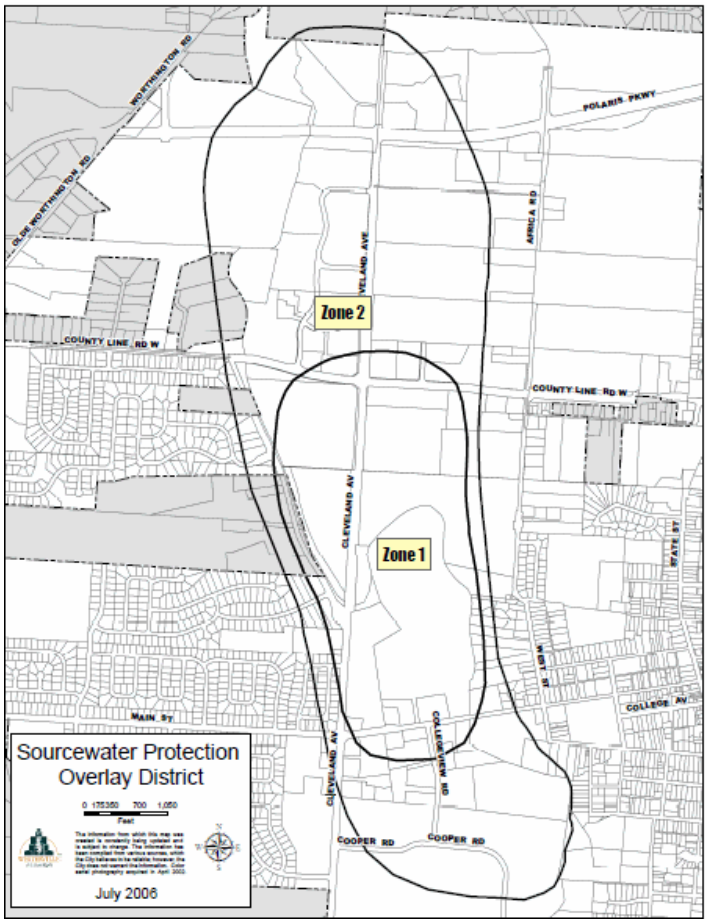
Upon review, if any revisions of the SWAP Assessment Report are needed, Westerville will contact Ohio EPA's Central District office for guidance. Also, if the local planning team makes any substantial changes to Westerville's Protection Plan, a copy will be forwarded to Ohio EPA for concurrence. The revision will be documented on the front cover by adding "Revised [date]" beneath the date at the bottom of the page.

APPENDIX A

The City of Westerville's Source Water Protection Ordinance

In March 2005 the City of Westerville passed Ordinance 05-02A, establishing a Source Water Protection Overlay District roughly following the boundaries of the source water protection area delineated for its ground water wells (see map below). It consists of two zones: Protection Zone 1, which is equivalent to the one-year time-of-travel area; and Protection Zone 2, which is the remaining area. The ordinance prohibits the following within both of these zones:

- Use of any Regulated Substance in violation of any local, state or Federal law, statute, ordinance, rule or regulation
- Use of any Regulated Substance not specifically exempted (however, 14 exemptions apply, providing for limited amounts under specified conditions of such items as: small-packaged chemicals for consumer use, laboratory chemicals; swimming pool chemicals; agricultural chemicals, etc.)
- Mining of industrial minerals and extraction of petroleum products
- Private water wells (with exemptions for recharging aesthetic ponds in Zone 2)
- Underground storage tanks
- Yard waste storage or composting greater than 250 square feet
- Storage of road deicing chemicals outside or inside salt piles exceeding 4000 pounds
- Structures requiring permanent ground water dewatering



The ordinance allows previously existing nonconforming uses, which must be registered with the Water Utility manager annually and which are subject to inspection upon request. Procedures are described for applying to develop a property within the zones. Such applications are reviewed and approved by the Zoning Officer or applicable reviewing Board. Violations are subject to penalties, and provision is made for appeals.

The ordinance encourages landowners within the Source Water Protection Overlay District to implement stormwater Best Management Practices and provides a list of 21 such practices. They include filter strips, wetlands, green roofs, alternative paving, containment ponds, etc.

The ordinance can be accessed online at: http://www.westerville.org/index.aspx?page=156

APPENDIX B

Lower Alum Creek Watershed Action Plan

The Lower Alum Creek Watershed Action Plan (WAP) was initiated by FACT in 2001, using grant money provided by Ohio EPA. The geographic focus of this plan was the lower half of Alum Creek, from the dam on Alum Creek Reservoir to the mouth, so it covers the area of focus for Westerville's source water protection efforts as well as much additional area. A Steering Committee was formed in 2002 to guide the WAP planning process, with representatives from FACT, local resource agencies, local governments, environmental groups and universities. The plan was finalized in 2005.

Four major impairment issues were identified:

- Land Use
- Stormwater and Construction
- Hydromodification (dams, levees, channelizations)
- Organic Enrichment and Pollutants (fertilizers, pathogens, toxics, etc.)

While the WAP addresses the overall health of the stream, with a focus on fish and macroinvertebrates, the remedies it proposes improve the water quality for drinking water purposes as well:

--to promote more protective **land use** along Alum Creek (for example, parkland rather than industry), the WAP urges representatives of municipalities, townships and counties to create source water protection and riparian corridor overlay zones, revise subdivision regulations, and develop setback requirements. (*Westerville passed a source water protection zone ordinance—Ordinance 05-02A—in March, 2005—see Appendix A*)

--to reduce **stormwater runoff**—and the sediment, pathogens, and toxic chemicals it carries—the WAP urges government officials to pass local ordinances for construction site runoff control, inspect their areas for violations, create a citizen network to help with visual monitoring, label drains, and promote stormwater BMPs like wetlands, rain gardens, rain barrels, etc. (*Westerville enforces city regulations for stormwater management and pursues stormwater BMPs; its drains are labeled.*)

--to reverse the impacts of **hydromodification**—which include excessive erosion that leads to high turbidity in Westerville's source water—the WAP proposed the removal of low-head dams and restoration of floodplains with tree plantings (*as of 2013, FACT has worked with partners to remove two of the five low-head dams on Alum Creek and has planted over 1500 trees and native plants.*)

--to reduce **nutrient enrichment**—which introduces nitrate and pesticides into source water—the WAP urges government officials to extend sanitary sewer lines to critical areas and tighten regulations and inspections of household sewage treatment systems.

The entire Lower Alum Creek WAP is available online at
http://www.friendsofalumcreek.org/sitev2/action_plan_05.php