TEAM KENTUCKY
ENERGY AND ENVIRONMENT CABINET

COMMONWEALTH OF KENTUCKY SOURCE WATER ASSESSMENT AND PROTECTION PROGRAM

SOURCE WATER PROTECTION PLANNING GUIDANCE

2025

Commonwealth of Kentucky
Source Water Assessment and Protection Program

Source Water Protection Planning Guidance

2025

TEAM KENTUCKY
ENERGY AND ENVIRONMENT CABINET

Table of Contents

CHAPTER 1

Background and Purpose

Chapter 1: Background and Purpose

Source water is a raw, untreated supply of water- typically surface water (streams, rivers, lakes and reservoirs) or groundwater (aquifers) - from which water is taken periodically or continuously by a public water system (PWS) for drinking water. In 1986 and 1996, amendments to the Safe Drinking Water Act (SDWA) required states to evaluate each source of water used by a PWS. As a result, the Kentucky Division of Water (Division) created the Wellhead Protection Program (WHPP) and Source Water Assessment and Protection Program (SWAPP), which produced reports delineating protection areas, inventories of potential contaminant sources, and associated susceptibility analyses for PWSs. The Division has recognized a need to update these assessments and focus on creating and implementing modernized protection plans, leading to the development of this Source Water Assessment and Protection Program guidance. The purpose of this guidance document is to describe the framework and criteria used by Division staff to determine the acceptability of Source Water Protection Plans for surface and groundwater for two primary audiences:

1. PWSs and their planning committees, who are preparing the plan; and
2. Division staff reviewers, to help them review plans consistently statewide. It provides information for communities that are at the early stages of developing a source water protection plan and systems that want to update or expand existing source water protection programs.

This document merges procedures and review criteria developed originally for Kentucky's WHPP (initiated in 1992), with those developed later for Kentucky's SWAPP (initiated in 1997). This guidance applies to drinking water utilities that meet the definition of a PWS which are responsible for meeting the requirements of U.S. Environmental Protection Agency (EPA) and state drinking water programs under the SDWA. A PWS provides water for human consumption through pipes or other constructed conveyances to at least 15 service connections or serves an average of at least 25 people for at least 60 days a year. A PWS may be publicly or privately owned. The EPA has defined three types of PWSs:

- Community Water System (CWS): A PWS that supplies water to the same population year-round.
- Non-Transient Non-Community Water System (NTNCWS): A PWS that regularly supplies water to at least 25 of the same people at least six months per year. Some examples are schools, factories, office buildings, and hospitals with their own water systems.
- Transient Non-Community Water System (TNCWS): A PWS that provides water in a place such as a gas station or campground where people do not remain for long periods.

What is Source Water Protection?

Source water protection is a proactive, front-line defense to safeguard, maintain, or improve the quality and/or quantity of drinking water sources and their contributing areas. Protecting drinking water at its source is one of the critical first steps in the utility process to treat and deliver high quality water to customers. Protecting source water provides economic, environmental, social, and public health value and has been shown to be a cost-effective and critical protective barrier that mitigates potential risks and actual impacts on drinking water sources (AWWA 2018, Gartner et al 2013, Price et al 2018). The goals, scope, actions and activities associated with source water protection can vary based on physical setting, source water quality and/or quantity, existing or potential contaminants, financial and technical resources, degree of community involvement, and many other factors. Source water protection can also focus on statewide, regional, or local policies and priorities.

Source water protection is conducted by local communities and their PWSs, as well as regional, state and/or federal government agencies, to protect drinking water sources from overuse and contamination. While effective source water protection programs often address existing issues or concerns, they should also evaluate and address future challenges and involve the public early and often throughout the planning and implementation process. Public involvement includes any group or individual interested in, affected by, or having an impact on source water protection activities. Public involvement can be diverse and vary based on local challenges faced in source water protection areas, and the

number of different stakeholders in the region.

Source Water Degradation

A number of human activities generate and introduce contaminants into the environment. Contaminants may include microorganisms (i.e., bacteria, parasites, and virus), sediments, nutrients, heavy metals, and endocrine-disrupting substances (i.e., pesticides, industrial and municipal effluents, agricultural runoff).

There are two categories of surface water and groundwater contamination: point source pollution and non-point source pollution. Point source pollution enters the environment at a specific place from an identifiable source. These permitted dischargers are most often regulated through state and/or federal programs. Some examples are:

- Industrial point discharges, as well as spills and leaks of industrial chemicals
- Municipal wastewater treatment plant effluents
- Landfill site leachate
- Wastes from existing and abandoned mining sites
- On-site wastewater treatment systems
- Leaking underground storage tanks

Nonpoint source (NPS) pollution originates from many diffuse sources, like land runoff, precipitation, atmospheric deposition, drainage, seepage, or hydrologic modification. Also called runoff pollution, NPS is caused by rainfall or snowmelt moving over and through the ground which carries natural and human-made pollutants and deposits them into receiving waterbodies, which are often source waters. NPS pollution can include:

- Excess fertilizers, herbicides, and insecticides from agricultural lands and residential areas
- Oil, grease, and toxic chemicals from urban runoff and energy production sites
- Sediment from improperly managed construction sites, crop and forest lands, and eroding streambanks
- Salt from irrigation practices and acid drainage from abandoned mines
- Bacteria and nutrients from livestock, pet wastes, and failing septic systems
- Atmospheric deposition and hydromodification

States report that NPS pollution is the leading remaining cause of water quality problems. The effects of NPS pollutants on specific waters vary and are often not fully assessed. The impact of NPS on the quality of untreated water depends on several factors, including the amount of pollutants carried by runoff (pollutant load) and the pathway the water takes when it flows through the source area. If water flows quickly over the surface of the land, most of the pollutants it carries will reach the waterbody. If the water flows more slowly or infiltrates the ground, more of the pollutants will be filtered out, either by adhering to plants and soil or by being absorbed through plants' root systems.

Source water protection requires an understanding of the interconnection between groundwater and surface water. Pollutants may move between surface water and groundwater, which means that both resources must be monitored and protected. Groundwater pollution, chemistry, and flow can directly influence surface water quality, while conversely surface water pollution can impact groundwater quality. For example, under some conditions in areas where water supply wells are in shallow aquifers adjacent to streams or lakes, pumping can reverse the direction of groundwater flow and induce aquifer infiltration through stream and lake bottoms. Thus, it is important that we look at the whole system, with all of its interconnections, to successfully protect drinking water sources.

The Safe Drinking Water Act: A Multi-Barrier Approach

The considerable threats to public drinking water require an integrated and comprehensive response. The multi-barrier

approach of the SDWA is designed to protect drinking water quality and quantity from both natural and human-made threats while eliminating or minimizing contaminant impacts. The following steps are an important part of the multiple barrier approach that places technical and managerial barriers that help prevent contamination at the sources, treatment, and tap to provide a safe supply of drinking for consumers. The barriers are:

- Risk prevention: Selecting and protecting the best source of water where possible or protection a current source of water;
- Risk management: Using effective treatment technologies, properly designed and constructed facilities, and employing treatment and certified operators to properly run systems components.
- Monitoring and compliance: Detecting and fixing program in the sources and/or distribution system
- Individual action: Providing customers with information on water quality and health effects so they are better informed about their water system.

By placing integrated barriers from the source to the consumer at the tap, water systems can help protect communities from the risk of contamination and waterborne disease. A successful multiple barrier approach includes barriers between potential threats and the consumer and programs and activities to make sure the barriers are in place and operational. While there is no federal mandate requiring comprehensive source water protection, source water protection strives to protect sources of drinking water by developing tools, leveraging funding and supporting voluntary partnerships/approaches that can prevent contamination of sources of drinking water.

The 1986 amendments to the SDWA required states to establish wellhead protection programs. Because of the complexities of geology, resources, and technical limitations of many smaller groundwater-based systems, states were given a great deal of flexibility in delineating WHPAs, ranging from arbitrary fixed-radius circles around wells to sophisticated mathematical modeling of groundwater contributing areas. Although the delineated WHPAs can vary greatly in terms of accuracy and consistency, the overall success of the WHPP led to the inclusion of additional source water protection for surface water sources 10 years later. The 1996 SDWA Amendments required Kentucky among other states to delineate source water protection areas for all the remaining water drinking water systems, identify potential contamination sites and sources, analyze susceptibility of the public water supply to contamination, develop recommendations for protections and distribute the results of the assessment to water users and other interested entities. However, the SDWA did not require regular updates or revisions to the delineation and assessment of source water protection areas for surface waters. Although the SDWA does not mandate source water protection, some states have adopted rules requiring certain water systems to develop and implement plans, while they are voluntary in other states.

The program was designed to inform communities about the location of their drinking water resources and about threats to their water's quality and quantity to encourage and assist local protection activities. The call for source water assessments acknowledged the increasing challenges and costs facing PWSs, and the value of promoting source protection as part of a multiple barrier approach. While not mandated, public water suppliers and local communities are now expected to voluntarily develop management measures to protect their drinking water sources. Based on data from their source water assessment process, many communities are now focusing on watershed management issues, including land use planning, public education and outreach, land management, and conservation. Although some resources are provided to the states and organizations to run programs, no resources have been authorized or appropriated for implementing protection strategies and there have been no programmatic mandates. Thus, any planning and implementation is locally and/or PWS driven and often creatively funded.

Regulatory Framework for Source Water Protection in Kentucky

The Water Supply Section (WSS) of the Division administers and implements the source water protection program in accordance with federal and state requirements under Kentucky Revised Statute 151.636 and Kentucky Administrative Regulation 401 KAR 4:220. Many source water programs in the United States strive to develop tools and assistance that

support voluntary partnerships and approaches to protect sources of public drinking water. However, regulations are also a valuable tool in the toolkit and some states have promulgated regulations outlining source water protection requirements. In Kentucky, groundwater-based systems (well and spring sources) are required to review and update their plan every five years for submittal and approval from the Division. Surface water-based systems are not required to update their source water protection plans but are encouraged to do so voluntarily.

For a majority of existing surface water source PWSs, the basic source water assessments including delineations, contaminant source inventories, and susceptibility analysis requirements were completed in 2003. While a few systems have completed an update, as of 2022 the majority need to be reviewed and updated. For both groundwater and surface systems, if the location of wells, wellfield(s), springs, or surface water intakes change then specific elements of plans need to be revised. If new PWSs come into operation and service, then a new plan must be developed and drafted. This guidance, in addition to plan templates, contamination source inventory and a susceptibility determination spreadsheets, checklists, and brochure templates have been developed for creating or updating a plan.

Roles and Responsibilities

Source water protection is a planning process conducted by local water systems, as well as community, regional, state or federal government agencies, to protect drinking water sources from overuse and contamination. Many communities choose to form a committee or planning team comprised of interested partners at the various levels to coordinate update and management and implementation goals. There are opportunities, where programs and partners exist, for integrating source protection efforts. Careful planning, leadership, and partnerships are essential.

Local Level Planning

The primary responsibility lies at the local level because source water protection must be tailored to the needs of the water system and the communities that they serve. The key to the most successful source water protection is building collaboration and partnerships and support within communities. It is important to establish good working relationships between community organizations, conservation districts, business and landowners, planning board members, utilities, and regulatory agencies, all of whom can provide expertise, resources, and local knowledge that contribute to the feasibility and effectiveness of a plan. Developing a strong local group can help leverage additional resources and investment from federal, state, and private sources, as well as interest from key decision makers and partners.

Each PWS must solicit, recruit, identify and coordinate their planning team. Planning teams often include individuals and organizations with responsibility for water quality and land use planning at the local level and persons with expertise in water resources. Local planning teams are best represented by 5 to 7 members but will vary, both in size and responsibilities, depending on the water system and the population served. As a wide variety of skills can be useful in developing and implementing a plan, planning team members and organizations should be considered based on their potential contribution or role. The selected members may serve for the entire planning process; or they may be brought in for a short time, for a specific purpose. There are many ways that individuals can contribute at various stages of the planning process such as information and resource gathering, education and outreach, and administrative tasks. As the community clarifies their own needs and goals, consider the following for potential planning team members:

- PWS producers and providers (city/county manager, water system manager or superintendent, other public works employees).
- Local government (planning department or board, elected officials, county office of emergency management, fire department, budget and/or finance office, economic development office or commission, public information officer)
- Economic interests (developers, realtors, bankers, chamber of commerce, agricultural representatives, industry representatives)
- Community groups (residential water users, private well and septic system users in the protection area,

landowner groups, river basin associations, service/volunteer organizations, civic, ethnic or religious leaders)

- Expert advisors (water quality expert, legal counsel, health/environmental department, state agencies, medical representatives)
- Other (media, representatives from neighboring municipalities, council of government, purchasing small community water systems)

Once a planning team has been established the required duties include water source delineation, inventory of potential contaminants and susceptibility analysis, development and implementation of management strategies, and planning for the future. Each of these steps should include community involvement and public outreach and education.

Regional Level Planning

Regional agencies can provide additional support and knowledge within their areas of responsibility regarding land use and management. Agencies or organizations to consider contacting to support your water supply protection program include:

- County Office of Emergency Management
- Area Development District, Water Management Councils
- Kentucky Rural Water Association
- Neighboring municipalities
- County health department
- Volunteer councils
- U.S. Department of Agriculture (USDA)Cooperative Extension System Office
- Colleges and universities
- Conservation Districts
- County and state regional road/highway departments

Kentucky's Area Development Districts (ADDs), Area Water Management Councils (Councils) were also charged with the coordination and develop a long-range water supply plans for each district across the state. The Councils were created as a forum for local utilities and local officials to discuss and identify drinking water and wastewater needs and prioritize all projects for their region for any available funding. Each ADD employs a full-time water service coordinator whose primary responsibility was to coordinate the activities of the regional water management planning council and to serve as a liaison between local utilities, local elected officials, and state and federal funding agencies. Water service coordinators and other staff in each ADD can provide assistance.

The Kentucky Rural Water Association (KRWA) Source Water Protection Program is built around small water utilities, local businesses, agriculture, government, and other groups working together to develop and implement strategies to protect their drinking water sources. It is a voluntary, grassroots planning effort that builds local responsibility and creates more sustainable communities. This unique program is vital in creating community buy-in to protect their sources of water. KRWA employs a Source Water Protection Specialist made possible through funding from the USDA Farm Service that provides technical assistance with plan development and submittal. KRWA also provides training and technical assistance that covers every aspect of operating, managing, and financing water and wastewater utilities.

State and Federal Level Planning

State government provides data, technical assistance, guidance and participation, incentives for protection, and review and approval of plans that meet criteria. The state is also responsible for integrating water supply protection with other source water protection programs such as, groundwater and watershed-based plans. The state program strives to make source water protection a high priority and create policies and programs that support and encourage local efforts. At the federal level, the EPA administers the SDWA, which includes provisions for protecting drinking water supply sources.

The EPA provides works with states, tribes, local utilities, and many other stakeholders and provides technical, educational and financial assistance for source water protection.

The United States Geological Survey (USGS), Water Resources Programs and Ohio-Kentucky-Indiana Water Science Center and also provide geological, hydrological and environmental data, and technical assistance in support of source water protection. USDA Service Center Farm Service Agency (FSA), Natural Resources Conservation Service (NRCS), and Rural Development (RD) can also provide assistance and funding.

CHAPTER 2

Elements of Source Water Protection Planning

Chapter 2: Elements of Source Water Protection Planning

The following six program elements (Figure 1) provide a framework for developing and implementing a source protection plan (EPA: Assess, Plan and Protect Source Water). They can guide city planners, government officials, and water systems through a process that begins with developing a comprehensive understanding of land use threats to drinking water and leads to protection strategies.

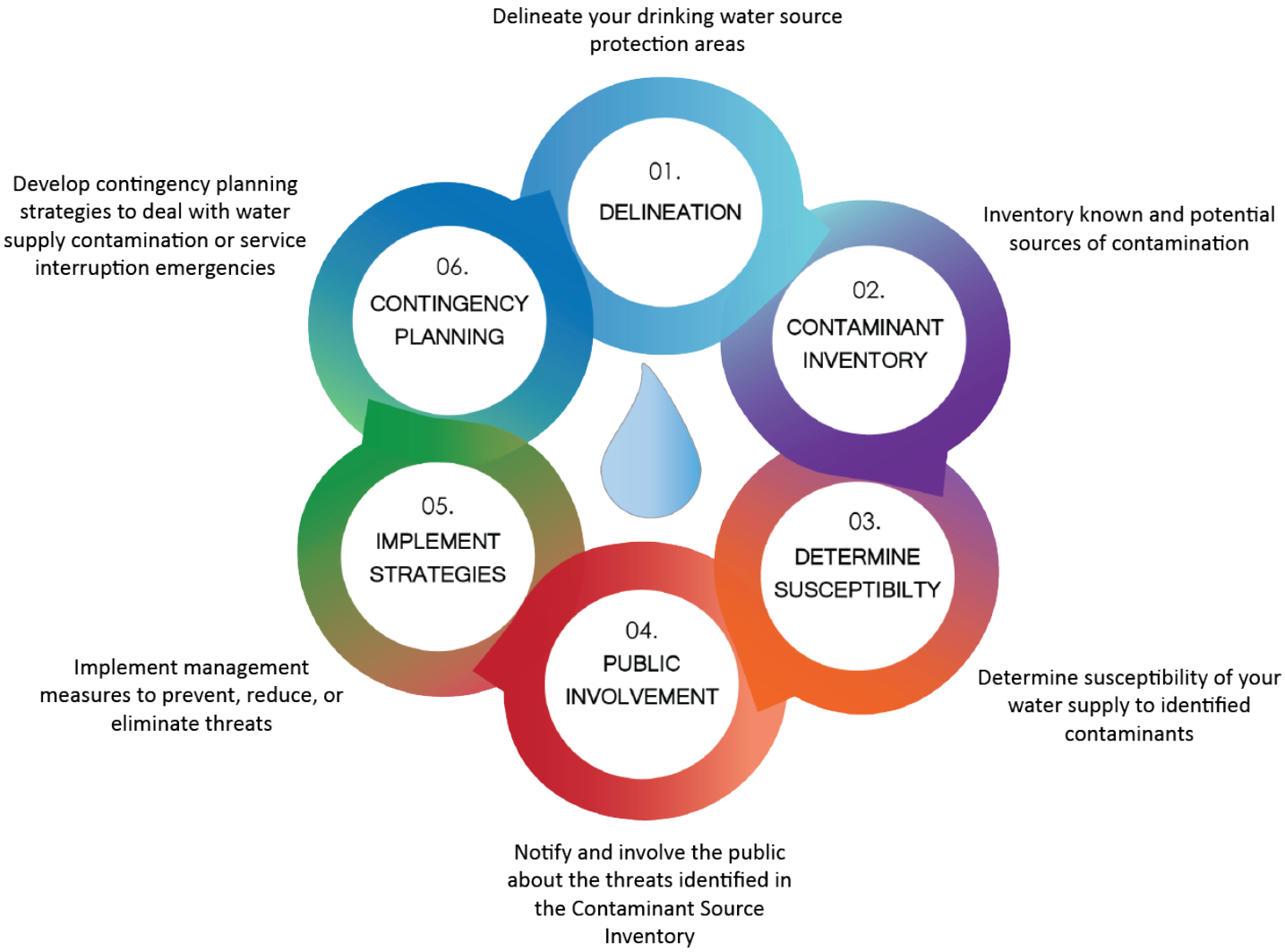


Figure 1. The six basic steps in source water assessment and planning.

The following guidance provides in-depth instructions for each of these steps. Some of these steps are identical regardless of the water source or PWS type. However, for some steps there are differences between PWSs using groundwater and surface water, and community and non-community water systems. These differences will be discussed as necessary under each of the appropriate steps.

STEP 1 – Delineate the Source Water Protection Area (SWPA).

Purpose: *Delineating the SWPA shows the area to be protected and prescribes the boundaries of the area from which drinking water supplies are drawn. This step also designates the area within which contaminant source inventories are*

conducted, identifying substances or activities that may pose potential risks to the drinking water supplies within that area. Delineations may be performed using a variety of accepted methods (e.g., calculated fixed radius; computer modeling, etc.), and are most protective when they include all sources of water and potential contaminants and activities affecting them within the prescribed area.

A source water protection plan includes a map of the area contributing water to the water source of the PWS. Mapping, or delineating, the source water protection area for assessment and protection is the first step in completing a source water assessment. This delineated area is often called a source water protection area or zone and designates the area within which a water system will conduct a potential contaminant source inventory (Step 2). By mapping the boundaries, drinking water systems will be able to identify where spilled or discharged contaminants could enter the water source. The size of the protection area may vary based on a variety of hydrogeological, environmental, regulatory, and management factors. Methods for delineating groundwater sources can differ widely from those for delineating surface water sources. Whether a surface or groundwater source, it is important to regularly evaluate and redefine protection areas and zones to account for land use changes, water monitoring data, and new information. Water systems can request technical assistance and/or data to complete delineations from KSWAPP.

Source water protection areas are also segmented to identify relative zones of concern. Zone boundaries are based on the time it takes for water or contaminants, expressed in Time of Travel (TOT), to reach well(s) or intake structure(s). The purpose of these zones is to define portions of the protection area where activities have a higher risk of contaminating the source water and where conditions and land surface activities should be more closely evaluated. More information on source water delineation is covered in Chapter 2.

To view Kentucky's delineated source water protection areas visit the Source Water Protection Viewer.

STEP 2 – Inventory known and potential Sources of Contamination (SOCs).

Purpose: *The contaminant source inventory lists all documented and potential contaminant sources or activities of concern that may be potential threats to drinking water supplies. The source inventory indicates the level of concern assigned to each potential risk by ranking, rating, or prioritizing management measures to reduce or eliminate them. In this way, the most serious concerns are assigned priority, and limited resources can be applied to these first.*

A contaminant source inventory (CSI) consists of a list and characterization of current and potential sources of contamination and associated contaminants of concern (COCs) identified within the protection area. Any facility or activity that stores, uses, or produces contaminants of concern, which could find their way into a source of drinking water, is a potential source of contamination. Figure 2 displays a generic contamination source inventory map. Examples of potential contaminant sources include:

- Waste landfills, garbage dumps, and lagoons;
- Contaminated sites (such as Brownfields sites or Superfund sites);
- Chemical storage facilities (such as oil and gas storage facilities or underground storage tanks);
- Industrial and municipal wastewater outfalls (such as those addressed by the National Pollutant Discharge Elimination System (NPDES) permit program);
- Mining operations;
- Agriculture and other types of NPS pollution;
- Residential or commercial septic systems;
- Stormwater runoff from streets and lawns and other impervious surfaces;
- Industrial facilities that use or store chemicals (such as tanneries, automotive body shops, dry cleaners, and others reported to the Toxic Release Inventory (TRI) program);
- Underground injection wells;
- Roads and hazardous materials transportation routes.

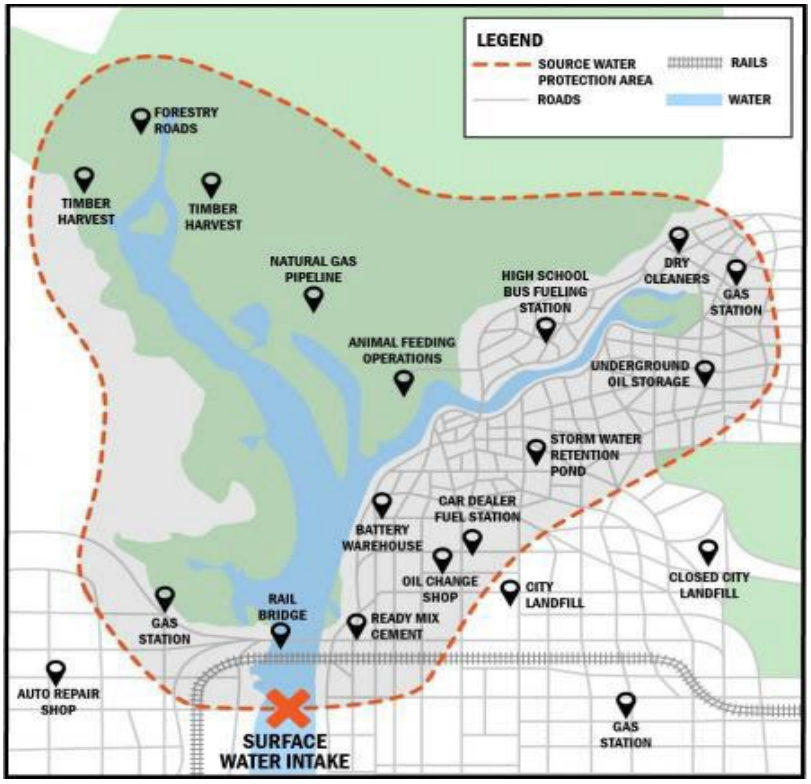


Figure 2. Example of mapped contaminant source inventory.

A contaminant source list may look like this:

Potential Contaminant/Activity	**Threat or Risk**	**Level of Concern**
Agricultural crop spraying	Excess amounts of material or improper application methods	Low to moderate, depending on proximity to source waters
Industrial waste disposal wells (e.g., Class V Injection Wells)	Introduction of chemicals directly into or above USDWs	Moderate to high, depending on surrounding hydrogeology
Storm water runoff; car washes; service stations	Introduction of contaminants into ground or surface water	Low to moderate, depending on type surrounding facilities (e.g., parking lots) and proximity to source waters.
Bridges (rail and roadways)	Introduction of contaminants directly over intake	High, within source water protection area and directly over surface water intake

Maps of contaminant source inventories (Fig.2) are to be included in all source water protection plans (groundwater and surface water) and should be designed so that water managers can easily locate and identify the sources of contamination in the areas of concern. This is important for purposes of emergency management, protection planning, and fully informing the public. More information on CSIs is in Chapter 3.

STEP 3 – Determine the susceptibility of the PWS to contaminant sources or activities within the SWPA.

Purpose: *Determining susceptibility of the PWS to inventoried threats relates the nature and severity of the threat to the likelihood of source waters serving that system becoming contaminated.*

Once potential sources of source water contamination are identified, susceptibility of the PWS to these contaminants should be determined. Drinking water systems use a range of criteria to rank source water threats and determine susceptibility to contamination, including:

- The likelihood that contaminants will be released from a source and contaminate the source water;
- The vulnerability of the PWS and probability that it would be impacted by source water contamination; and
- The potential consequences of source water contamination experienced by the PWS (such as increased water treatment costs and regulatory compliance) or its customers (such as illness).

Mitigating factors considered when determining susceptibility include potency or toxicity of the contaminant, volume of discharge or release, distance from wells or intakes, and the likelihood of entry of the contaminant into the source waters.

A susceptibility determination for an individual PWS may look like this:

Potential Contaminant/Activity	Level of Concern	Risk Reducing Factors	Susceptibility Rating
Leaking Underground Storage Tanks	High	Remove or Repair Tanks	High
Concentrated Animal Feeding Operations	Moderate	New/Upgraded Facility and Equipment	Low
Road Salt Storage Shed	Moderate	Diked facility with berms	Moderate

More information on susceptibility analysis and determinations is covered in Chapter 4.

STEP 4 – Notify and involve the public about threats identified in the contaminant source inventory and what they mean to their PWSs.

Purpose: *To ensure that the public has information necessary to control and modify their own actions to prevent contamination and to participate effectively in community activities to protect drinking water.*

The long-term success of a source water protection program requires the coordination and participation of the local community and support of key decision makers. It is important to involve the public throughout the process. Holding workshops or meetings to solicit input from community members aids in building public interest and participation. A collaborative planning process, where a broad spectrum of community members share concerns, contribute ideas and expertise, and define mutual goals, can help foster a sense of ownership in the program and commitment to carrying out the actions necessary to protect the source(s). Public involvement in protection planning is covered in more detail in Chapter 5.

STEP 5 – Implement management measures to prevent, reduce, or eliminate risks to your drinking water supply.

Purpose: *Using the information gathered from the assessments allows specific management measures to be developed and implemented for source water protection. By examining the results of the contaminant source inventory and the susceptibility determination for each PWS, these measures can be tailored to address each threat or array of risks specific to the PWS.*

It is increasingly clear to many at the federal, state, and local levels that management measures are necessary to reduce

pollutant loads to source waters. Communities can use the information gathered from the source water assessment process to develop management measures for protection and/or enhancement of source waters. Some examples of source water protection measures include:

- Riparian zone restoration to reduce runoff pollution;
- Stream bank stabilization to reduce sedimentation;
- Land protection or procurement through easements or deed restrictions;
- Best management practices for agricultural and forestry activities or stormwater control;
- Local ordinances to limit certain activities in source water protection areas;
- Developing water shortage and/or emergency response plans; and
- Educating local industry, businesses, and citizens on pollution prevention and source water protection.

More information on protection measures is covered in Chapter 6.

STEP 6 – Develop contingency planning strategies to deal with water supply contamination or service interruption emergencies.

Purpose: *In the event of short- or long-term water drinking water supply disruption as a result of natural causes (e.g., drought or floods) or accidental (e.g., contaminant spill or leak), water supply alternative strategies that coordinate all available efforts to restore water supplies are an indispensable part of any source water protection program.*

- Describe the most likely scenarios that could threaten the water supply;
- Public notification procedures in the event of a water system emergency;
- Outline emergency plans to procure alternative water supplies for short or long-term drinking water supplies; and
- Coordinate the efforts of water supply managers with those of local emergency response, state and federal assistance, and any other pertinent contacts.

More information on contingency planning and emergency response is located in Chapter 7.

CHAPTER 3

Protection Zone Delineation

Chapter 3: Protection Zone Delineation

Delineation for Groundwater Sources

An aquifer is one or more layers of rock or sediment that is capable of storing and transmitting useful quantities of water. An aquifer may be confined between two impermeable rock or sediment layers, or it may be unconfined with no barrier to water flow between the aquifer and the ground surface. There are three major types of aquifers present in Kentucky: granular, fractured rock, and karst. Each aquifer type occurs in its own unique geologic setting, which imparts basic characteristics of water availability, quantity, and quality. Groundwater occurrence is determined by the rock units, or geologic setting, of a given region. The geologic setting and geologic history give rise to landforms, or physiographic character, of an area, which also plays a role in groundwater distribution. Kentucky is divided into six major Physiographic Regions: Bluegrass, Knobs, Eastern Coal Field, Western Coal Field, Mississippian Plateau and Jackson Purchase (Lobeck, 1930). For the purposes of aquifer classification, alluvial deposits in the Ohio River Valley are considered as a seventh physiographic region. This is due to its depositional history, high groundwater production, and the wide and varied usage of the aquifer. Each of these regions has unique rock units and landforms that drive groundwater occurrence and yield. For a full discussion of Kentucky's Physiographic Regions please refer to McDowell (2001). Figure 3 displays these physiographic regions and how they relate to the predominant aquifer types in Kentucky.

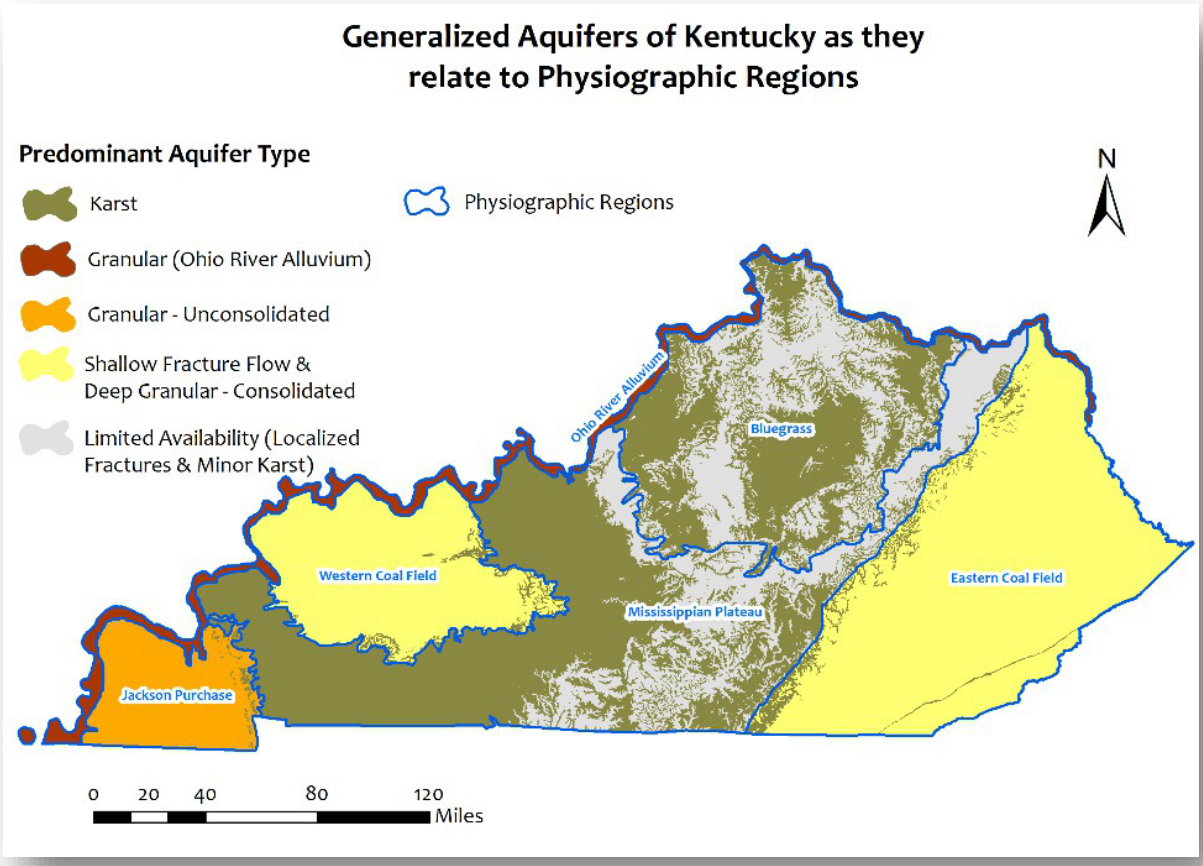


Figure 3. Generalized aquifers of Kentucky as they relate to physiographic regions

As aquifers may receive water via infiltration of surface and rainwater through the ground surface and overlying materials the contributing area, or recharge area, must be determined. Determining the recharge area for groundwater

supplies, and the appropriate wellhead protection areas (WHPAs), requires the collection and interpretation of geologic and hydrogeologic data specific to the aquifer from which groundwater is withdrawn.

In Kentucky, the EPA approved (1993) criteria for delineation of each of the three WHPAs are the following:

- Zone 1: Critical Zone. Based on 180-day travel time to the withdrawal point and encompasses the area directly adjacent to the groundwater source. Water wells require a minimum 400-foot fixed radius for this zone.
  - If the source is a karst spring or abandoned mine works, then the entire recharge area is delineated as WHPA Zone 1. This is due to rapid groundwater movement and the relative lack of natural filtration and reduction of contaminants. No other WHPA zones are delineated for karst springs or abandoned mine works.
- Zone 2: Zone of Responsibility. Based on 10-year travel time to the withdrawal point. Various mathematical and computer-based models are available to delineate Zone 2.
- Zone 3: Zone of Potential Impact. Extends to the hydrogeologic boundary that marks the outer limits of the aquifer recharge area. Knowledge and understanding of the site-specific geologic setting are necessary to delineate this area.

Various methods are used to delineate WHPAs. In order of increasing accuracy and complexity, common methods include:

- Arbitrary Radial Distance – The simplest method for delineating a wellhead protection area, this approach involves drawing a circle (or circles) with an arbitrary fixed radius around the well. The radius of the circle may be determined by an evaluation of local hydrogeological conditions, such as soil porosity or groundwater flow rate.
- Calculated Fixed Radius – This method defines a circular area around the well where the radius of the circle depends on the time it takes groundwater to travel from the edge of the circle to the well. Groundwater travel times are calculated using an algebraic equation with readily available data inputs (e.g., pumping rate, aquifer porosity). Utilities can use this approach to define concentric zones of concern based on Time-of-Travel (TOT) estimates (e.g., hours, 6-month, 10-year TOT zones).
- Analytical Methods – With this method, WHPAs are delineated by using equations to define groundwater flow and/or contaminant flow and transport to the well. A system analytical model can often provide a close approximation of TOT boundaries.
- Hydrogeologic Mapping – This approach uses geological and/or geophysical data to map delineation area(s). This method requires a high level of professional expertise and access to geologic data and technical reports, but is suitable in areas with more complicated hydrogeological conditions (e.g., Karst, fractured rock).
- Groundwater Flow and Transport Models – This approach uses computer models to determine groundwater and/or contaminant flow and transport. EPA WhAEM and USGS MODFLOW are examples of computer models.

Some of these methods are more scientifically complex and accurate than others. The appropriate option (or combination of options) will depend on a range of site-specific conditions, including access to technical resources, availability of data (e.g., hydrogeologic data), cost, and the desired level of effort. Certain sources may require a more accurate delineation method (Karst regions or high-risk potential contaminant sources). Figure 4 displays a generic wellhead protection area delineation with associated zones.

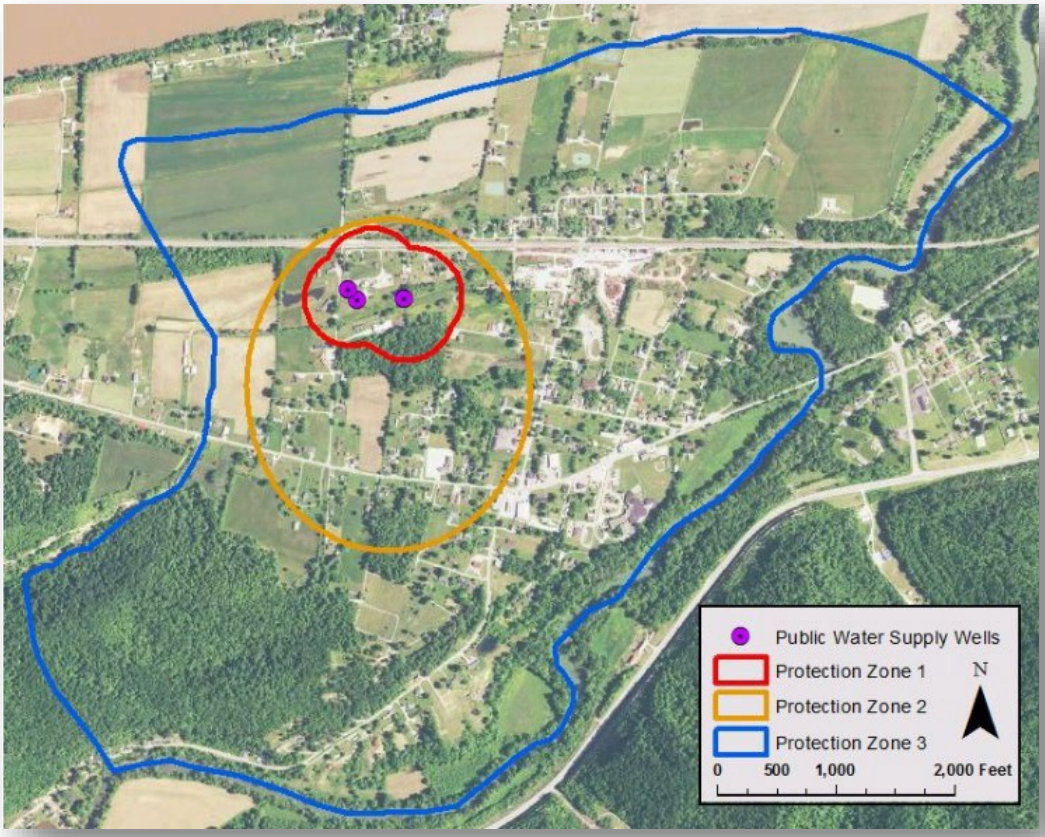


Figure 4. Example of mapped wellhead delineation areas.

Delineation for Surface Water Sources

For surface water sources, water systems identify the land area upstream of an intake within the source watershed. The source water protection area boundary generally is described using a topographic map connecting the highest points of the watershed from which overland flow drains to the drinking water source. Water systems use various methods to delineate surface water-based SWPAs, such as:

- The entire watershed or hydrologic unit containing the intake;
- Stream Time-of-Travel (TOT) distances upstream of the intakes (i.e., containing stream length and watershed area);
- Arbitrary distances upstream or around the intake; and
- Buffer zones.

The criteria for delineation of surface water assessment and protection areas (SWAPP) were developed by the Division and approved by the EPA in 1997 (DOW 1997). These methods utilize watershed boundaries and fixed-distance buffers around the waterbody. Several GIS datasets and tools can be used to automate this process. The geographic extent of the protection zones varies based on the size of the contributing watershed, and requirements differ for reservoirs and rivers. Three protection zones have been prescribed based on proximity to the raw water intake. The general definitions for each protection zone are below, followed by waterbody-specific delineation requirements:

- **Zone 1**: **Critical Zone.** Closest to the intake, and therefore most susceptible to a contamination event. A spill may reach the water supply very quickly through a tributary or overland within 1 hour or less.

- **Lakes/Reservoirs**: From ¼ mile downstream of intake to 1 mile upstream of intake, extending ¼ mile landward from the shoreline at normal summer pool.
- **Rivers**: From ¼ mile downstream of intake to 5 miles upstream of intake, with buffer zones extending ¼ mile from each bank. This designation will include any tributary stream in this zone that is 3rd order or higher. This coincides with Kentucky's five-mile policy, which prohibits Kentucky Pollutant Discharge Elimination System (KPDES) discharges within five miles upstream of a water supply intake.

- **Zone 2: Zone of Responsibility.** Encompasses Zone 1 and includes the areas from 1 to 5 hours from the intake based on flow of 2 to 10 miles per hours. Contaminants in this zone represent a significant potential threat to the water source.
  - **Lakes/Reservoirs:** From ¼ mile downstream of intake to 5 miles upstream of intake, extending ½ mile landward from the shoreline.
  - **Rivers:** From ¼ mile downstream of intake to 10 miles upstream of intake, with buffer zones extending ½ mile from each bank. This designation will include any tributary stream in this zone that is 3rd order or higher.
- **Zone 3: Zone of Potential Impact.** *S*urrounds Zones 1 & 2 and extends to the upper portions of the contributing area. Contaminant would reach the intake within 2.5 hours to 12.5 hours from time of release.
  - **Lakes/Reservoirs:** From ¼ mile downstream of intake to 10 miles upstream of intake, extending to the watershed boundary of tributary streams, as defined by 12-digit hydrologic unit codes.
  - **Rivers:** From ¼ mile downstream of intake to 25 miles upstream of intake, extending to the watershed boundary of tributary streams, as defined by 12-digit hydrologic unit codes.

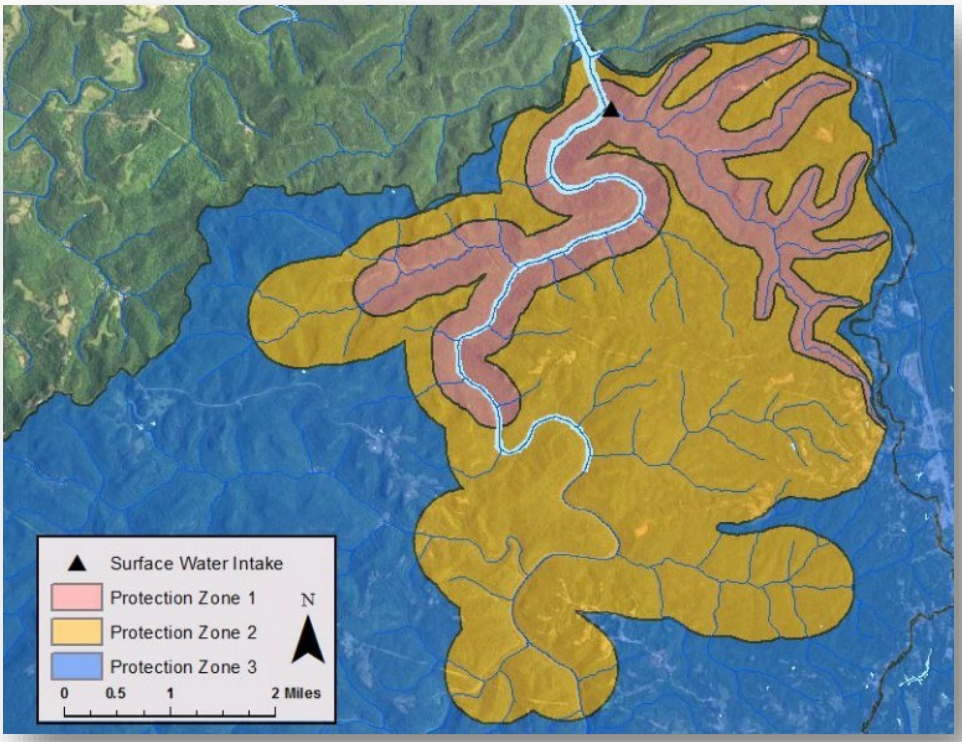


Figure 5. Example of mapped surface water protection areas.

If the watershed boundary of the source water is encountered some protection zones may be truncated. For example, if a watershed boundary is within 10 miles of the intake, then only two protection zones would be delineated. Similarly,

contributing areas for small reservoirs may be delineated completely as Zone 1 if the watershed upstream is less than 5 miles. Figure 5 displays a generic zone delineation within a source water protection area for a surface water intake.

Active source water delineations have been completed for all primary producers, but PWSs can request assistance when completing delineations for any revisions or new delineations. State agencies and federal agencies (e.g. USGS or EPA), universities, nongovernmental organizations, and private companies may all provide technical assistance and/or data and information to complete delineations. Existing delineations may be viewed on the Kentucky Source Water Protection Viewer. ArcGIS data regarding Division designated wellhead and source water protection areas may be downloaded from the Kentucky Geoportal (Keywork search: DOW Wellhead Protection Areas; or DOW SWAPP).

CHAPTER 4

Contaminant Source Inventories and Mapping

Chapter 4: Contaminant Source Inventories and Mapping

Contamination of drinking water supply sources may result in loss of the water supply, poor water quality, increased treatment costs, and potential health risks. A Contaminant Source Inventory (CSI) identifies and reports the location of all potential contaminant sources within defined protection areas around wells, springs, and surface water intakes. Implementing reasonable and effective management and contingency plans in regards to potential contamination is a critical goal of source water protection. A CSI consists of two (2) items:

1. Potential Contaminant Source List- A contaminant source inventory worksheet (Excel format) that lists and assigns identification numbers to all the potential contaminants within the source water protection area. The worksheet will also require values to be entered to calculate the numeric rating for each contaminant source and determine the overall susceptibility ranking for each system.
2. Contaminant Source Map- The inventory of contaminant sources with assigned identification numbers marked on a map within the source water protection area that correspond to the contaminant source worksheet.

The Division electronically compiles CSIs within all existing protection areas based on the most recent source water protection plans. On request, the Division will send an existing CSI with plan update forms to begin the process of verifying existing contaminant sources, identifying any additional/new sources, and removing inactive sources based on desktop and physical review of the local area. The Division has developed standard CSI worksheets for both wellhead and surface water system (Tables 1 and 2) and a list of potential point and NPSs of contamination to use for CSI development and updates (Table 3). As time and resources allow the Division may provide technical, educational, and financial assistance for CSI development and updates.

CSI Process

Several methods can be used to complete the inventory procedure and may vary between PWSs. Activities which should be considered include the following:

1: Pre-Site Activities

- Assemble an inventory team consisting of stakeholders in the region with knowledge of relevant concerns regarding water quality. This may include state regulators, municipal governments, local nonprofits, watershed groups, landowners and businesses, and community members.
- Review the existing CSI (if applicable).
- Locate and review lists of contaminant sources compiled by federal, state, and local agencies.
- Research other existing sources of information:
    - Databases;
    - Literature and historical records searches;
    - Aerial imagery.
- Make copies of the current delineation map; preferably using recent aerial imagery as the base map. A larger or multi-section map may be needed for large protection areas.
- Make copies of the inventory forms.
- Define in-house steps to complete, update and maintain the CSI data.

2: Site Visit Activities

- Conduct Surveys:
    - Windshield (physically explore protection zone);
    - Personal interviews;

- Mail and phone;
- Door-to-door;
- Social media;
- On-site/field;
- Google Earth/aerial imagery review.

- List and assign identification numbers to each additional/new contaminant source inventory. Record the name, address or coordinates, and type of the potential contaminants.
- Mark each inventory item on the map and label with the assigned identification number.
- Provide educational materials to property owners about source water protection and how they can help (example: Proper Septic Maintenance brochure)

3: Post-Site Visit Activities

- Update the inventory based on site visit activities. Confirm that identification numbers correspond to the appropriate potential contaminant sources and are located correctly on the map.
- The drinking water supplier should review, modify, and update inventory methods and procedures in accordance with 401 KAR 4:220 Water supply planning requirements.

Locating Potential Sources of Contamination

Locations of potential sources of contamination can be determined using a variety of methods, including:

- KY Energy and Environment eSearch Reports;
- EPA's Drinking Water Mapping Application for Sourcewater (DWMAPS);
- EPA's Environmental Compliance and History Online Database (ECHO);
- Aerial photographs and land use maps;
- Sanitary surveys;
- Zoning maps and build-out analyses from municipal general plans;
- On-site field surveys;
- Interviews with facility managers and municipal officials; and
- Public meetings with local stakeholders and residents.

Local governments or organizations including community groups, watershed organizations, and conservation districts, may also provide valuable local information about local sources of potential contamination and/or land use not registered in state or federal databases. They may be willing to help conduct more detailed, site-specific investigations to augment desktop research, and can be indispensable resources for completing inventories.

Resources for Contaminant Source Identification

The Division, EPA, and other partners have generated a variety of web-based tools that can assist with building a contaminant source inventory. You can find

KENTUCKY SOURCE WATER PROTECTION VIEWER

In addition to federal resources, the Division maintains the Source Water Protection Viewer which can be used to find and view a specific PWS's source water protection zones.

Division staff can also be contacted to provide data from state regulatory databases for use in protection planning, as well as assistance with development of the contaminant source inventory and susceptibility analysis.

Available Division GIS Data
Airports/Heliports
Bridges and Culverts
Delineated SWPA and WHPAs
Hazardous Waste Generator
KPDES Permits
KY Division of Oil and Gas (Gas and Oil Wells)
Land Use: 2019 National Land Cover Dataset
Major Roadways
Permitted Mine Boundaries
Power Lines
Quarries/mineral operations
Railroads
Sewer Lines
Sinkholes
Solid Waste
Stockyards
Superfund Sites
Underground injection Control (EPA_UIC 2010)
Underground Storage Tanks

many of these tools on the Source Water Protection Program's Web Tools for SWP Planning website including links, descriptions and tutorials. Tools included are:

- Kentucky Water Health Portal
- Kentucky Source Water Protection Viewer
- Kentucky Integrated Report Hub Site
- Kentucky Harmful Algal Bloom Viewer
- EPA Drinking Water Mapping Application
- EPA Underground Storage Tank Finder
- Kentucky Watershed Explorer
- KGS Well and Spring Interactive Map
- Kentucky Flood Hazard Map
- Kentucky Drought Viewer
- Kentucky Geoportal

Considerations for Source Water Quality

The quality of source water used by a drinking water treatment plant has a direct impact on its operations. It is impacted by the local geology, topography, land use, and activities within and outside the watershed or aquifer. Contaminants to consider in a source water assessment include any physical, biological, chemical or radiological substance that may pose a threat to public health. Drinking water systems may prioritize identification of facilities or activities that store, produce, or use these contaminants and that have the potential to degrade source water quality.

Source water quality data taken from a variety of locations throughout the source watershed or delineated wellhead protection area can help utilities identify problem areas that may require additional scrutiny and help with prioritizing potential issues for remediation. Once baseline water quality conditions are understood, maintaining a source water monitoring program enables a drinking water utility to more effectively identify significant changes in water quality (e.g., from a spill or contaminant incident), monitor long-term threats to source water quality, and take actions to protect source water.

The National Primary Drinking Water Regulations are legally enforceable primary standards and treatment techniques for contaminants regulated under the SDWA with a Maximum Contaminant Level (MCL). In addition, unregulated contaminants and unregulated contaminants of emerging concern (CECs) need to be considered. In addition to pathogens, CECs include chemicals, metals, pharmaceuticals and personal care products (PPCPs), and cyanotoxins that may be found in surface water or groundwater. Many of these contaminants are not regulated by the SDWA. However, they are considered when developing the Contaminant Candidate List (CCL), a list of unregulated contaminants known or anticipated to occur in PWSs. CECs have a variety of sources including industrial discharge, wastewater discharge, runoff, and atmospheric deposition. While all contaminants can pose a challenge to drinking water utilities, the following contaminants present common and complex challenges:

- **Nutrients-** Nitrate is a necessary nutrient for plant and animal growth. However, elevated levels of nitrate and other nutrients may lead to harmful algal blooms (HABs) and other ecological degradation. High levels of nitrate are also harmful to human health. EPA has a national primary drinking water regulation for nitrate with a MCL of 10 mg/L (as nitrate N) for most PWSs. Sources of elevated nitrate in surface and groundwater includes fertilizer runoff, leaking septic tanks, damaged sewage lines, cross-connections, industrial discharges, and atmospheric deposition. Drinking water treatment for high levels of nitrate in source water can be complex and costly. In source waters where harmful algal blooms are present, drinking water utilities may also consider monitoring and treating for cyanotoxins due to toxicity issues.

- **Pathogens-** Pathogens are microorganisms that can cause illness. Pathogens in surface and groundwater may come from animal waste (including from wildlife, livestock, and pets), malfunctioning or poorly sited septic tanks, damaged sewage lines or cross-connections, and combined and sanitary sewer overflow events. Source waters are also susceptible to contamination by antibiotic-resistant bacteria from agricultural runoff, pharmaceutical industries and wastewater treatment plants (Meradji et al. 2025).
- **Suspended Sediment/Turbidity-** Suspended sediment and turbidity measure water clarity or the amount of solids in water. High turbidity can also be an indicator of high total organic carbon (TOC) which must be settled out or filtered during the drinking water treatment process. High turbidity events can exceed filter capacity at water treatment plants resulting in operational shut-downs. Additionally, TOC can react with certain disinfection chemicals and cause harmful disinfection by-products.

The threat to public health from emerging contaminants presents the most compelling reason to protect drinking water sources. Emerging contaminants are contaminants that either are new to the environment (new diseases or chemicals) or have only recently been identified as potential health threats (for example, microplastics). With new contaminants comes new challenges to develop treatment methods that are often costly and may have limited effectiveness. These contaminants eventually reach our water sources via septic systems, storm and sewer overflows, and runoff from lawns and farms. Although advances in treatment technologies allow most suppliers to meet current drinking water standards, the challenges of known and emerging contaminants make treatment ever more complex and expensive. New water quality regulations are often the final impetus for treatment upgrades. However, suppliers with protected source waters are less likely to be forced to invest in major upgrades because their pollution concentrations are more likely to remain below maximum allowed levels. Some of the treatment challenges faced by systems withdrawing from sources include:

- The emergence of new contaminants that suppliers may not be prepared to test or treat
- Spikes in contaminant loads due to storms and flooding that make treatment more challenging
- Constantly changing standards and regulations regarding new contaminants, which are present in the water long before they are identified as threats to public health
- Increased treatment and capital costs due to higher pollutant loads and changing water quality standards
- Increased incidence of disinfection byproduct formation that occur when organic materials interact with treatment chemicals like chlorine, producing chemical compounds like trihalomethanes (THMs), haloacetic acids (HAAs), chlorite, and bromate (Unrine 2024).

When selecting sources, systems should examine:

- The quantity of the raw water (does it have the ability of the supply to meet current and future demands?)
- The quality of the raw water (does it contain pathogens, chemicals, radionuclides, nitrates, or high turbidity?)
- Risk of contamination (e.g., potential for encroachment and development in and around the water source?)

Existing systems can and should take steps to protect their water sources, including:

- Identifying the most likely scenarios that could threaten the water supply
- Identifying sources of contamination in watersheds and recharge areas
- Supporting community monitoring to identify potential illicit discharges in the source protection area
- Developing and implementing source water management strategies

By properly selecting and protecting its water source, a system can reduce its need for and reliance on treatment and increase the reliability of water quality and quantity. The financial incentives for systems to prevent risks are significant (ARF 2013, USEPA 2012, Postel et al 2005). It is almost always more cost-effective for a water system to protect its source water from contamination than to remove or inactivate contamination during treatment.

Submittal Requirements for CSIs

The CSI including the worksheet and map must be submitted in an electronic format to the Division with each new plan or plan update. This is also recommended for surface water protection plans, but not currently required. The Division will review the changes, provide written approval, and update the Division's ArcGIS CSI Database to reflect any changes.

Once submitted to Division with a new or updated plan, the CSI will be reviewed and added to the ArcGIS database. This database will not be made public but will serve as the basis for future updates and facilitate planning efforts. While PWSs should maintain their own copies of their CSI's, copies of the data in Excel and GIS format will be available on request.

Table 1. Surface water protection plan contaminant source inventory and susceptibility worksheet.

SWAPP Contaminant Source Inventory and Susceptibility Analysis for

[System Name/PWS ID#]

CSI Map ID #	Site ID	Contaminant Source Type	CS Type Code	Name	Address	Lat	Lon	Quantity	Zone	Proximity Value	Contaminant Value	Likelihood of Release	Numeric Rating	Susceptibility Ranking	Contaminant Notes
1										X2	X3				
2										X2	X3				
3										X2	X3				
4										X2	X3				
5										X2	X3				
6										X2	X3				
7										X2	X3				
8										X2	X3				
9										X2	X3				
10										X2	X3				
11										X2	X3				
12										X2	X3				
13										X2	X3				
14										X2	X3				
15										X2	X3				
											Totals:	**High**	**Med**	**Low**	

Table 2. Wellhead protection plan contaminant source inventory and susceptibility worksheet.

WHPP Contaminant Source Inventory and Susceptibility Analysis

[System Name/PWS ID#]

CSI Map ID #	Site ID	Contaminant Source Type	CS Type Code	Name	Address	Lat	Lon	Quantity	Zone	Proximity Value	Contaminant Value	Hydrologic Sensitivity	Numeric Rating	Susceptibility Ranking	Contaminant Notes
1										X2	X3				
2										X2	X3				
3										X2	X3				
4										X2	X3				
5										X2	X3				
6										X2	X3				
7										X2	X3				
8										X2	X3				
9										X2	X3				
10										X2	X3				
11										X2	X3				
12										X2	X3				
13										X2	X3				
14										X2	X3				
15										X2	X3				
											Totals:	**High**	**Med**	**Low**	

The following section gives more information on what information to use in the Contaminant Source Inventory (Table 4), Contaminant Source Types (Table 5), guidelines for selecting effective Site Identifiers (Table 6), how to estimate Contaminant Value for the Susceptibility Analysis (Table 7), and guidance on the types of contaminants found in certain sources of contamination (Table 8).

Table 3. SWAPP/WHPP Worksheet: What goes where and why.

CSI Map ID #	Assigned CSI Inventory # that is displayed on the CSI map
Site ID	Site ID will vary based on the information source. See below for general guidance.
Contaminant Source Type	Reference contaminant source types listed in table A-1, Appendix A.
Name	The name of the operator/owner/ or business name.
Address	Physical address of the contaminant source; may be omitted if latitude and longitude (decimal degrees) are provided
Quantity	If there are multiples of the same contaminant type within a particular zone, they may be listed on one line with quantity specified. For example, a neighborhood of 80 septic systems could be included on one line of the inventory table with Quantity = 80.
Zone	Source Water Protection Zone number 1, 2, or 3
Proximity Value	Proximity of the contaminant to the drinking water source. Values are higher closer to the source (Zone 1 =3, Zone 2=2, Zone 3=1).
Contaminant Value	The contaminant value is based upon the toxicity and mobility characteristics of the contaminants usually associated with a particular land use. A site may have a number of various potential contaminants. Default to the highest value when there are multiple options.
Likelihood of Release Value	Regulatory compliance history and the implementation of best management practices (BMP) at potential contaminant sources may indicate the likelihood of release of a contaminant from a particular facility. A facility that is in compliance with regulatory programs and implements best management practices, such as those in a groundwater protection plans, agriculture water quality plans, storm water BMP plans, and hazardous waste contingency plans may be considered less likely to release a contaminant that can reach the water source. (1-3, low to high)

Hydrologic Sensitivity	The physical, chemical, geological, hydrological, and biological characteristics of the area over which, or through which, the contaminants move to the aquifer have various capabilities to detain or attenuate contaminant releases. The concept of "natural barriers" or "natural protection" is more applicable to groundwater sources than surface water sources. Natural barriers (aquicludes) to vertical migration of water and contaminants may overlie groundwater sources (aquifers). These types of aquifers are called confined aquifers. Other aquifers are sufficiently deep that the soil and rock strata between the surface and the aquifer serve to prevent migration of contaminants to the aquifer. Still other aquifers are very shallow, or are under the direct influence of surface water, and are much more susceptible to contamination than a confined aquifer. More information can be found here: https://kgs.uky.edu/kgsweb/download/wrs/sensitivity.pdf, https://www.uky.edu/KGS/gis/sensitivity.htm, https://opengisdata.ky.gov/datasets/kygeonet::ky-groundwater-sensitivity-regions/about **Hydrologic sensitivity is not used in the calculation for surface water. (1-5, low to high)**
Numeric Rating	Groundwater o Numeric Rating = (Proximity Value x 2)+(Contaminant Value x 3) + (Hydrologic Sensitivity Value) Surface Water o Numeric Rating = (Proximity Value x 2)+(Contaminant Value x 3) + (Likelihood of Release Value)
Susceptibility Ranking	Numeric Rating translated to Susceptibility Ranking: *Less than 10 = Low; 10-15 = Medium; Greater than 15 = High
Contaminant Notes	Any relevant information about the contaminants of concern at this site, or information about status of the source that might influence the Likeliness of Release or Contaminant value. You may also want to include specifics about the contaminant type (i.e., Large Capacity Septic System, LUSTs, plugged and abandoned well). May be left blank if no relevant information is needed/available.

Table 4. This guidance shows relative contaminant value risk to human health based on the types of contaminants associated with the noted sites, land uses and/or activities. Note, this list is not intended to be comprehensive, and professional judgement may be applied to make the contaminant value determination.

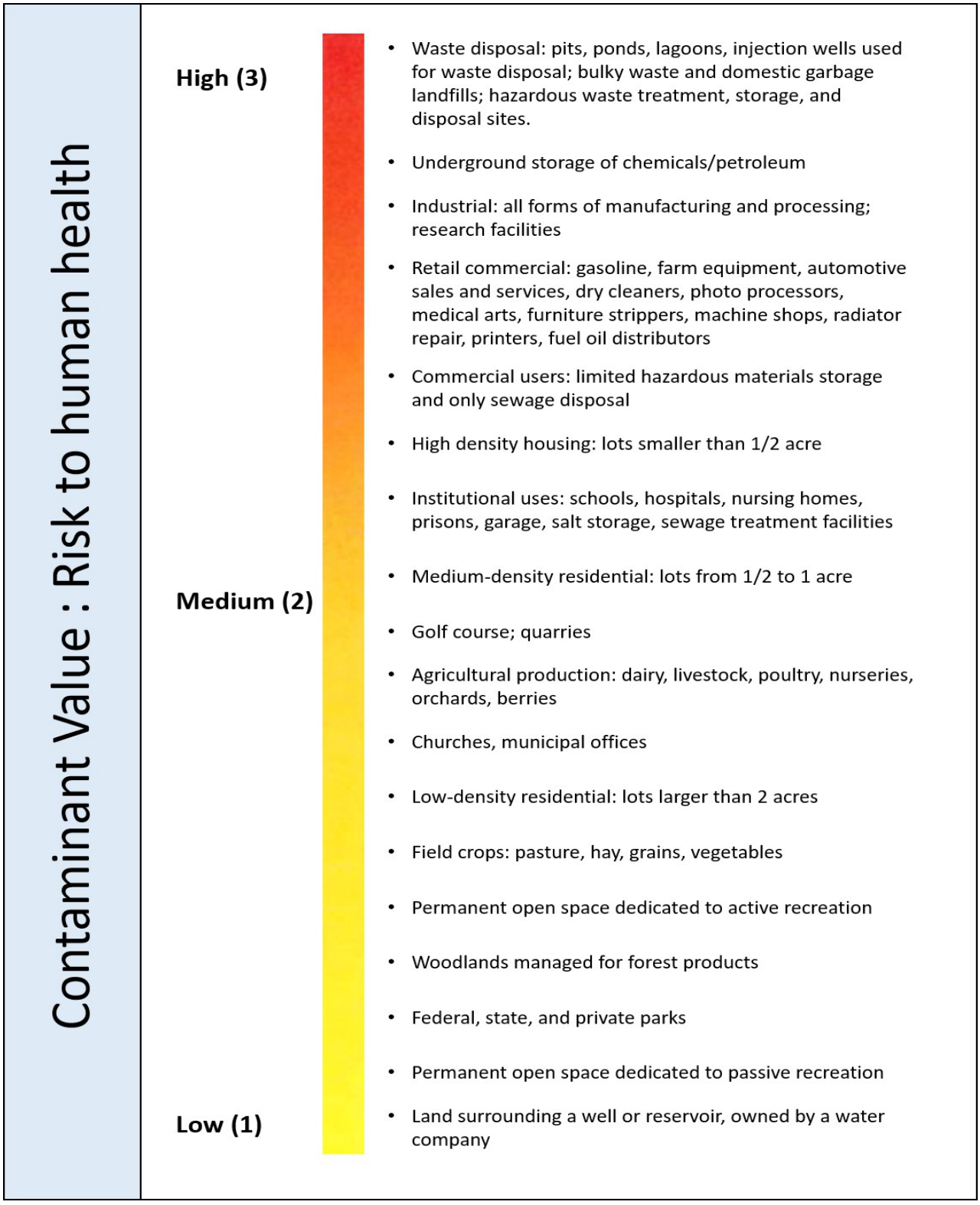


Table 5. Examples of the specific contaminants of concern. Note, this list is not comprehensive and should be used as a guide. The table is intended as guidance for determining contaminant values but should not be considered exhaustive (Adapted from Approved Kentucky SWAPP 1997).

	Contaminants of Concern																	
Contaminant Source	***Acids***	***Bases***	***Chlorides***	***Fluoride***	***Fe/Mn***	***Other Metals***	***Nitrate***	***Pathogens***	***Pesticides and Herbicides (SOC'S)***	***Petroleum Products (VOC'S)***	***Phenols***	***Radioactivity***	***Sodium***	***Solvents***	***Sulfate***	***Surfactants (Detergents)***	***Sediment/Turbidity***	***Contaminant Value***
COMMERCIAL																		
Above Ground Storage Tanks									X	X								**3**
Agricultural Chemical Business							X		X	X			X					**2**
Airports/ Heliports							X		X	X			X					**3**
Beauty Parlors		X				X								X		X		**1**
Boat Repair Facilities						X				X	X			X		X		**3**
Car Repair Facilities						X				X	X			X		X		**3**
Car Washes			X			X				X			X	X				**2**
Cemeteries									X							X		**2**
Dry Cleaning Facilities														X				**3**
Farm Machinery Repair Facilities						X				X	X			X		X		**3**
Furniture Stripping/ Painting	X	X				X												**2**
Gas Stations									X	X								**3**
Golf Course							X		X									**2**

Jewelry Metal Plating	X	X		X	X	X							X	X		X		**2**
Junkyards (Salvage Yards)	X				X	X								X	X			**3**
Laundromats								X						X		X		**2**
Lawn Care Chemical Use							X		X	X						X		**2**
Machine Shops	X	X				X								X		X		**2**
Medical and Veterinary Clinics								X				X		X		X		**2**
Medical and Veterinary Clinics								X				X		X		X		**2**
Photography Labs/Printers	X	X				X								X		X		**2**
Research Labs	X	X		X	X		X	X	X	X	X	X		X		X		**2**
Septic Systems (Commercial)			X		X	X	X	X					X	X		X		**2**
INDUSTRIAL																		
Abandoned Mine Lands	X				X										X		X	**2**
Active Oil and Gas Wells			X							X		X	X					**3**
Asphalt Plants										X								**2**
Class I UIC	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	**3**
Class II UIC			X							X		X	X	X				**2**
Class III UIC			X										X					**2**
Class IV UIC					X							X						**3**
Class V UIC	X	X	X		X	X	X	X	X	X				X	X	X	X	**2**
Haz / Mat Transfer Stations	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**3**
Haz/Mat Storage Facilities	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**3**
Improperly Abandoned Oil & Gas Well			X							X		X	X					**3**

Improperly Abandoned Water Well					X	X	X	X										**2**
Industrial Lagoons	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**3**
KPDES (Permitted Discharge) Sites	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**3**
Mining and Quarrying	X				X	X									X		X	**2**
Natural Gas Pipeline										X								**2**
Oil Pipeline										X								**3**
Petroleum Release sites									X	X								**3**
Superfund Sites	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**3**
Underground Storage Tank Sites									X	X								**3**
Wood Preserving Facilities						X				X	X			X	X	X		**2**
MUNICIPAL																		
Roads/ Highways	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**3**
Bridges Over waterways and Culverts	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**3**
Railroads	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**3**
Barge Traffic	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**3**
Stormwater Drains/ Detention Basins			X			X		X	X				X	X				**2**
Municipal Sewer Lines		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**3**
Schools, Colleges, Universities	X	X		X	X		X	X	X	X	X	X		X		X		**1**
Salt Domes			X							X			X		X			**1**
Sewage Lagoon/ Sludge/ WWTP			X		X	X	X	X					X	X		X		**3**

Parks																	X	**1**
Recreational Space																	X	**1**
Utility Corridors (Chemically Managed)									X	X						X		**2**
Hay and Pasture Land Use							X	X					X					**2**
Designated Conservation Reserve Program Agriculture Practices																	X	**1**
Row Crop Land Use							X	X	X	X			X				X	**3**
Animal Feeding Operations							X	X					X					**2**
Logging and Timbering (Silviculture)										X							X	**1**
WASTE																		
Const., Demolition, Debris Landfills																	X	**3**
Haz. Waster Generator and TSD Site	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**3**
Illegal Dumps	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**3**
Landfarms						X	X	X										**3**
Landfills (Contained)	X		X		X	X	X	X	X	X	X	X	X	X	X		X	**3**
Landfills (Non-Contained)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**3**
Special Waste Landfills	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**3**
RESIDENTIAL																		
Septic Systems (Residential)			X		X	X	X	X					X	X		X		**2**

Straight Pipe Sewage Discharge			X		X	X	X	X					X	X		X		**3**

(Contaminant Values: 1 = Low, 2 = Medium, 3 = High)

Table 6: Types of potential contaminant sources. The associated codes will be used to categorize the contaminant sources in the Division's ArcGIS CSI Database. Contaminant sources may have more than one potential associated contaminant. For example, it is assumed that most agricultural sources will generate fertilizer, pesticide, and sediment, and they need not be called out individually. Note this list is not exhaustive. For sources not specifically found here, "Other" categories exist for all source groups (commercial, industrial, agricultural, municipal, waste, and residential). Contaminant source codes will be added to CSI items for the ArcGIS database by Division staff on submission of the plan. (* = potential pathogen source). The most up to date table may also be found in the WHPP and SWPP CSI form.

Agricultural

Type	Contamination Type ID Code	Contamination Value**
Animal Burial/ Composting Sites*	A-1	3
Animal Feedlots*	A-2	2
Animal Waste Storage/ Disposal*	A-3	3
Confined Animal Feedlots (CAFOs)*	A-4	3
Row Crops: Corn, Soybean, Wheat	A-5	3
Crops: Orchards	A-6	3
Crops: Other	A-7	3
Dairy Facility*	A-8	3
Drainage Canals/ Tiles	A-9	2
Farm Chemical Distributor	A-10	2
Farm Machinery Repair Areas	A-11	3
Greenhouses/ Nurseries	A-12	3
Other Agricultural Sources	A-13	3
Pasture/Hay (Livestock)*	A-14	3
Pesticide/ Fertilizer/ Petroleum Storage & Transfer Areas	A-15	3
Silage Storage (Bulk)	A-16	2
Silviculture (Logging)	A-17	3
Stockyards*	A-18	3
Poultry*	A-19	3
Land Application of Manure*	A-20	3

Commercial

Type	Contamination Type ID Code	Contamination Value**
Airport/ Heliport/ Abandoned Airfield	C-1	3
Auto Repair Shops/ Body Shops	C-2	3
Barber and Beauty Shops	C-3	1
Boat Services/ Repair/ Refinishing	C-4	3
Car Washes	C-5	2
Car/ Boat/ Camper Dealerships	C-6	3
Carpet/ Tile Stores	C-7	2
Cemeteries*	C-8	2
Churches	C-9	2
Dry Cleaners	C-10	3
Equipment Rental/ Repair Shops	C-11	2
Fleet/ Truck/ Bus Terminals	C-12	3
Food Processing	C-13	2
Funeral Services/ Crematories	C-14	2
Furniture Repair/ Finishing/ Manufacturing Shops	C-15	3
Gas stations (existing & abandoned/ historic)	C-16	3
Golf Courses	C-17	2
Grocery/ Department Stores	C-18	2
Hardware/ Lumber/ Parts stores	C-19	2
Heating Oil Companies	C-20	3
Hospitals*	C-21	2
Junk Yards (Scrap and Auto)	C-22	3
Laundromats	C-23	2
Lawn/ Farm Stores	C-24	3
Marina/ Boat Docks	C-25	3
Medical/ Dental Offices/ Clinics*	C-26	2
Other Commercial Sources	C-27	3
Paint Stores	C-28	2
Pest Control Companies	C-29	3
Pharmacy	C-30	2
Print Shops/ Photo Shops	C-31	2
Railroad Lines	C-32	3

Railroad Yards/ Maintenance	C-33	3
Research Laboratories	C-34	2
Veterinary Offices/Pet Boarding*	C-35	2
Welding Shops	C-36	3

Industrial

Type	Contamination Type ID Code	Contamination Value**
Asphalt/ Cement/ Concrete Plants	I-1	2
Chemical Plant	I-2	3
Electric Substations	I-3	2
Electronic Manufacturing	I-4	3
Foundries and Metal Fabricators	I-5	3
Gravel Pits and Quarries	I-6	2
Historic Hazardous Material Site	I-7	3
Machine/ Metalworking shops	I-8	3
Metal Finishing/Plating	I-9	3
Military Base	I-10	3
Mine Wastes (Gob piles/ Tailings)	I-11	3
Mines: Abandoned	I-12	3
Mining: Surface/ Strip mines	I-13	3
Mining: Underground	I-14	3
Oil and Natural Gas Wells	I-15	3
Other Industrial Sources	I-16	3
Petroleum Product Production, Transport, and Storage Companies	I-17	3
Plastics/ Synthetics Producers	I-18	3
Power Plants	I-19	3
Wood Preserving/ Treating	I-20	2
Wood/Paper/ Pulp Mills	I-21	3
Distillery	I-22	3

Municipal

Type	Contamination Type ID Code	Contamination Value**
Bridges and Culverts	M-1	3
Composting/ Yard Waste Facility	M-2	2
Drinking Water Treatment Plants	M-3	2
Garages (Municipal)	M-4	2
Groundwater Recharge Ponds	M-5	2
Lift Stations	M-6	2
Major Roadways	M-7	3
Municipal Sewer Lines	M-8	2
Chemically Managed Utilities Corridors and Green Spaces	M-9	2
Other Municipal Sources	M-10	3
Salt Storage Areas	M-11	2
Schools	M-12	1
Storm Water Basins	M-13	3
Wastewater Application	M-14	3
Wastewater Treatment Plant*	M-15	2

Residential

Type	Contamination Type ID Code	Contamination Value**
Aboveground Storage Tank	R-1	2
Mobile Home Park/ Campground	R-2	2
Other Residential	R-3	2
Residential Septic*	R-4	2

Waste Management

Type	Contamination Type ID Code	Contamination Value**
Abandoned Dumps	W-1	3
Unknown Status Landfills	W-2	3
Recycling Facilities	W-3	3
Hazardous Wastes Landfills	W-4	3
Inactive/ Closed Landfills	W-5	2
Industrial Landfills	W-6	3
Municipal Landfills	W-7	3
Other Waste Disposal Sources	W-8	3

Radioactive Waste Disposal	W-9	3
Residual Waste Landfills	W-10	3
Biosolid Application*	W-11	3

Groundwater Conveyance

Type	Contamination Type ID Code	Contamination Value**
Agricultural Wells	G-1	3
Class I UIC Wells	G-2	3
Class II UIC Wells	G-3	2
Class III UIC Wells	G-4	2
Class IV UIC Wells	G-5	3
Class V UIC Wells (including large capacity septic systems)	G-6	2
Domestic Wells	G-7	2
Industrial Wells	G-8	3
Municipal Wells (PWS)	G-9	1
Other Wells	G-10	3
Springs	G-11	1

Guidance for choosing site identifiers (ID)

Site Identifiers for the CSI table vary by contaminant type and data source. The identifier is important from two perspectives:

- To differentiate it from other contaminants on the list
- To facilitate finding more information about the specific source (i.e. locate regulatory information in state and federal databases)

Table 7. Guidelines for site ID's for different contaminant sources.

Regulated Sources:	Regulated sources are assigned permit numbers that should be used as site IDs. A list of potential data sources that should use permit numbers includes, but is not limited to:
	• Superfund sites
	• Waste management permits
	• Underground Injection Control Systems
	• Underground storage tanks
	• Leaking underground storage tanks (LUSTs)
	• Oil and gas wells
	Contaminant sources regulated by the state of KY may also be stored in the Tools for Environmental Management and Protection Organizations database (**KY-TEMPO**). These sources are listed by Agency Identifier (AI) number. The AIs may be used instead of federal permit numbers, if none are available. (enter as AI - ####).
Databases:	Some databases will have identifiers associated with them that can be used place of permit number. For example, data from the Toxics Release Inventory (TRI) are associated with TRI ID numbers. These can be used as CSI site IDs, because they can be used to locate database information on the specific source, should it be needed.
Roads:	Route number (ex. KY-192)
Bridges & Culverts:	Division of Transportation Bridge ID number
Airports & Heliports:	Federal Aviation Administration identifier (ex. 07077.21*H)
Railroads:	Name of the railroad operator
Sources that lack permit, database, or other regulatory ID:	In the case of a contaminant source that is not found in a database, and therefore lacks any other identifiers, it is acceptable to pick a unique identifier for your inventory. If, for example, you were to inventory NPS pollution at a farm with no existing permits, you could name it Farm #1, or McDonald's Farm. It may also be appropriate to leave the identifier blank if there is sufficient identifying information as to the nature and location of the contaminant source.

Other Considerations:

Land Use: As mentioned earlier, states report that NPS pollution is the leading remaining cause of water quality problems. Identifying a single responsible source for the contamination resulting from NPS pollution is not always achievable, but PWS's may use land cover class to help prioritize best management practices that will have the greatest benefits to water quality.

The National Land Cover Dataset (NLCD 2019 or newer) can be used to determine land use cover within the protection zones, research existing or known water quality issues or environmental compliance issues and what best management practices would be most effective. For example, if analysis reveals that the majority of a PWS's the Zone 2 is dominated by cultivated crops, they may choose to prioritize agricultural BMPs and landowner and/or farmer education and outreach. Another scenario might include identifying areas with good riparian buffers to target for conservation easements, deed restrictions, or other water quality actions or activities.

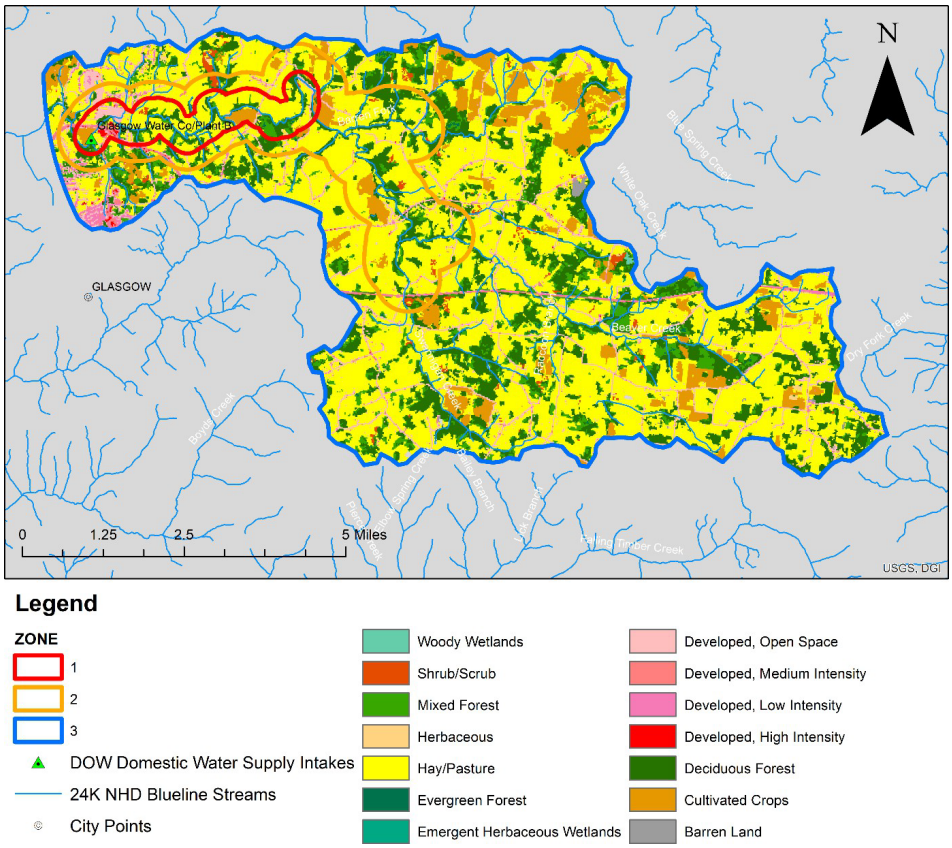


Figure 6. Example land use map of SWP areas.

Each susceptibility analysis in encouraged to include a table summarizing land use in each of the planning zones (see Table 8 for example), a brief narrative describing the findings, and any management recommendations that can be made from the analysis. A map of the land use cover might also be helpful for planning but is not required (Fig. 6).

Table 8. Example of a land use analysis table.

Impact	Land Use	Percent Cover (%)		
		Zone 1	Zone 2	Zone 3
Potential Stressors	Hay/Pasture	22.17	32.23	35.02
	Cultivated Crops	25.59	17.82	15.11
	Developed (Low, Medium & High Intensity)	23.18	5.8	3.2
Conservation Potential	Wetlands (Woody, Shrub/Scrub, Emergency Herbaceous, etc.)	0.01	0	2.9
	Forest (Mixed, Evergreen, Deciduous, etc.)	27.52	20.14	18.05

Hydrogeology: Another aspect to consider in analyzing potential sources of contamination is the potential for karst terrain or topography in the planning area. If possible, knowing delineated drainage basins, locations of conduits based on existing Karst Dye Traces or reports by KGS or USGS, and how they relate to potential contaminant sources are important for prioritizing protection and associated development, and emergency response. If possible, it is advisable to include maps showing karst development present in the planning area, and their relative proximity to other known contaminant sources.

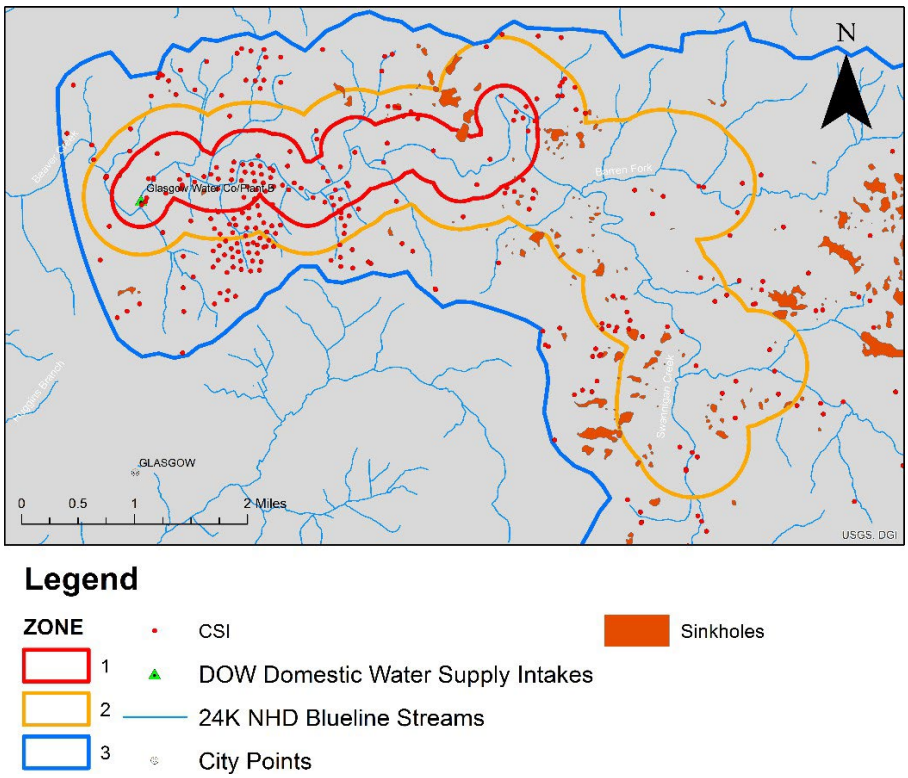


Figure 7. Example map of sinkhole locations relative to contaminant source inventory items.

CHAPTER 5
Source Water Susceptibility Analysis

Chapter 5: Source Water Susceptibility Analysis

Once protection areas have been delineated and contaminant sources have been inventoried, susceptibility of the PWS drinking water source to contamination that can pose treatment issues or public health concerns will be analyzed. This guidance covers the technical procedures and criteria to make a susceptibility analysis and is intended to help communities identify and prioritize risks posed to their water supply, providing the rationale for the development of management strategies needed to protect their sources of drinking water.

Characterizing Source Water Threats

PWSs can use a variety of information about potential sources of contamination, such as the natural landscape setting and infrastructure operation and management, to complete susceptibility determinations. Examples of this information include:

- Location of the potential contaminant(s) and proximity to source water(s);
- Type(s) and quantities of contaminant(s) stored at the location or discharge rates from a potential contaminant(s);
- Characteristics and properties of the potential contaminant(s) (such as solubility and toxicity);
- Estimate of contaminant(s) dispersion and dilution in the source water (such as contaminant fate and transport);
- Existing risk mitigation strategies (such as leak detection, spill containment, groundwater protection plans, best management practices, sanitary surveys, inspections, and runoff control);
- Physical integrity of the infrastructure well or intake (such as cracks or breaks in the wellhead or emergency operations); and,
- Sensitivity of the natural setting (such as presence/absence of confining layers in the aquifer, proximity to source, hydrogeology, and natural transport pathways).

Susceptibility Considerations

Numerous considerations are used in determining the susceptibility of a public water supply source to potential contamination. The degree of susceptibility is related to several factors that can be given varying weight related to site-specific circumstances, like proximity to the intake source. Factors include:

1. Contaminant Value: Contaminant source characteristics and threat to public health;
2. Proximity Value: Proximity of the potential source of contamination to the well or intake;
3. Hydrologic Sensitivity Value: Sensitivity Ranking of the Groundwater Sensitivity Regions of Kentucky in which the well(s) are located (groundwater only); all surface water systems, including springs, are considered highly susceptible; and
4. Likelihood of Release Value: Likelihood of the release of contaminant into source water (surface water only).

Contaminant Value

This factor is rated on a scale of 1-3, with 3 being of the most concern to human health. In the overall susceptibility calculation, this value is given a triple weight.

Proximity Value

The protection zone the contaminant is located within determines this value.

- Zone 1 = 3
- Zone 2 = 2
- Zone 3 = 1

The closer the proximity to the well or intake the higher the risk. In the overall susceptibility calculation, this value is double weighted.

Hydrologic Sensitivity Value

The sensitivity ranking of a region is defined as the ease and speed with which a contaminant can move into and within groundwater. The major factors that control this sensitivity are recharge to the system and flow rate and dispersion potential within the system. This factor is only used in the calculation of susceptibility for groundwater sources. Sensitivity rankings are not used in the calculation of surface water systems because they are all assumed to highly sensitive. This value is measured on a scale of 1-5 from lowest to highest sensitivity, respectively. The map below shows the Hydrologic sensitivity ratings for Kentucky. In the calculation for overall system susceptibility the value is not weighted. For access to the GIS data associated with these sensitivity regions in Kentucky you may download the data from Kentucky Geological Survey here (https://opengisdata.ky.gov/datasets/kygeonet::ky-groundwater-sensitivity-regions/explore?location=37.766213%2C-85.632243%2C7.87)

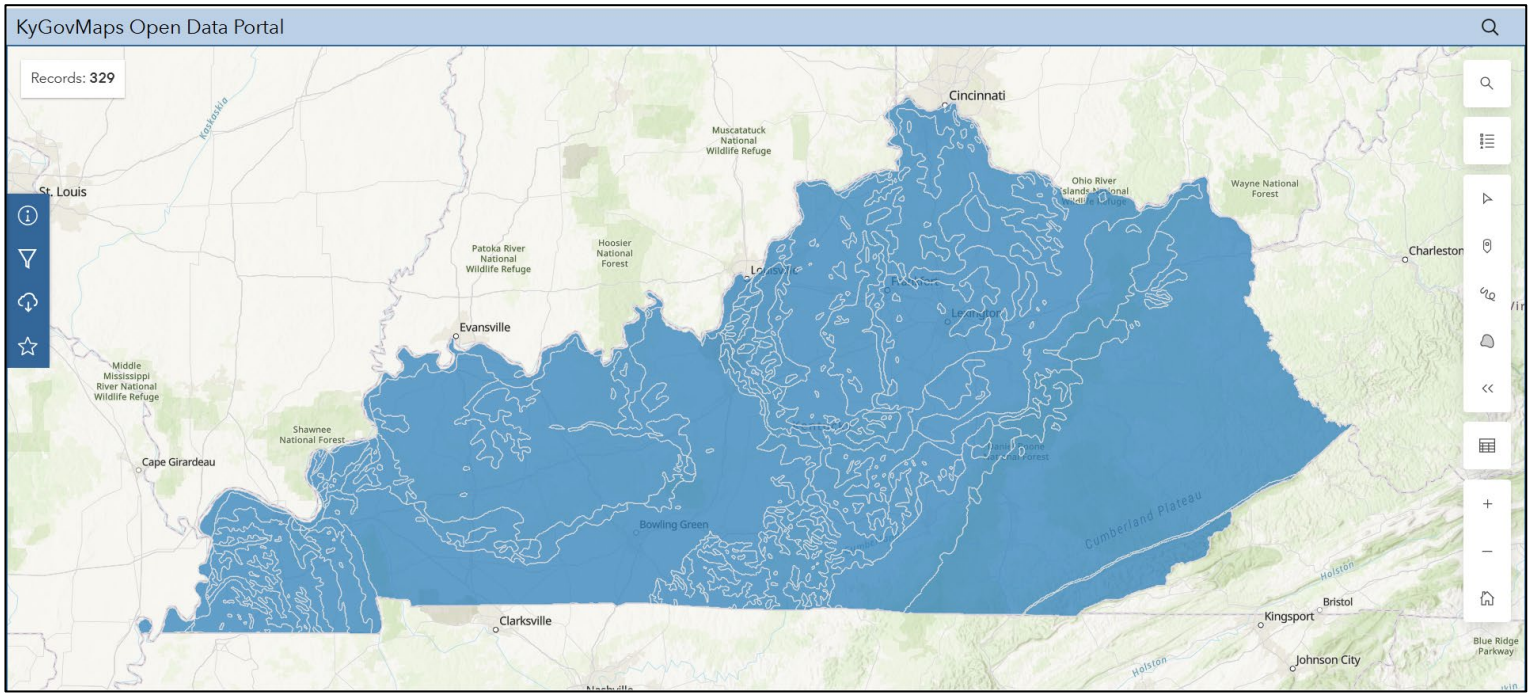


Figure 8. Groundwater sensitivity regions of Kentucky and their associated sensitivity ranking for use in susceptibility analysis can be viewed here.)

Likelihood of Release Value

Likelihood of release is considered a more relevant factor for surface water since there is no significant "natural protection or barriers" once a contaminant is released to surface water. This factor is not used for analyzing groundwater systems, except for springs. Ranked on a scale of 1-3, from least likely to most, this factor is unweighted. Likelihood of release is highly dependent on the nature of the individual contaminant source and may require case-by-case evaluation. Knowledge of on local terrain conditions may be used to justify the value assignment determined for a particular contaminant. Generally speaking, contaminant sources with protection plans, best management practices, or strong regulatory requirements can be rated lower than those without. For example, a facility that stores hazardous chemicals but has a GPP filed with the Division's Groundwater Section, or an Emergency Response Plan (ERP) registered with Kentucky Emergency Management (KYEM) has a lower likelihood of release than one without. In agriculture, a cattle operation that has worked with NRCS to install conservation easements or other best management practices is less likely to be a source of contamination to nearby streams, and then could rank lower. When these factors are unknown, the default value should be set to 2.

Table 9. Examples for how to determine Likeliness of Release Value for permitted sources.

Permitting Terminology	Likelihood of Release Value
Hazardous Waste TSD (Treatment Storage or Disposal Facility)	
Without any "Corrective Action"	2
In "Corrective Action" or "Post Closure"	3
Registered Hazardous Waste Generator	
Without any "Corrective Action"	2
In "Corrective Action"	3
KPDES (discharge)	1
Known wastewater release without a permit	3
KNODP	3
Federal Superfund site	2
State Superfund Site	
Active	3
Closed	2
Petroleum Release site	
Active	3
Closed	1
Waste Lagoon	3
Registered with Local Emergency Planning Committee	
With a contingency plan on file	2
Without a contingency plan on file	3

Susceptibility Determination

A Susceptibility Determination is made by evaluating the cumulative results of the susceptibility analysis as compiled in Tables 1 and 2 of Chapter 3. Although groundwater systems do not calculate likelihood of release in the susceptibility ranking these factors can be used to make management decisions if information concerning environmental compliance history and the use of BMPs is available.

Calculating the Susceptibility Ranking Score

The Division has developed two separate worksheets for groundwater and surface water to automatically calculate the numeric ratings for plan susceptibility analysis. The equations are as follows:

- Groundwater
    - Numeric Rating = (Proximity Value x 2)+(Contaminant Value x 3) + (Hydrologic Sensitivity Value)
- Surface Water
    - Numeric Rating = (Proximity Value x 2)+(Contaminant Value x 3) + (Likelihood of Release Value)

Numeric Rating is then translated to Susceptibility Ranking:

- Less than 10 = Low
- 10-15 = Medium
- Greater than 15 = High

It is important to note that susceptibility rankings should not be used to directly compare ground and surface water systems because the hydrologic sensitivity value and likelihood of release values are not the same. Rather, they approximate relative risk which can be used to prioritize protection activities for each individual PWS.

Other factors, such as prior history of source water contamination, occurrence of NPS, and well abandonment, loss or destruction may indicate how to prioritize management of land use activities. For example, if a water system has had problems with petroleum-based contaminants in the source water, the system may want to pay particular attention to potentially leaky underground or aboveground storage tanks in the area**.** The size of the area impacted may also be a consideration. For example, potential NPS contaminants from a large area of land cover classified as cultivated crops could be considered higher priority when compared to another watershed with a smaller area of the same land cover classes.

Well integrity is another factor that may be considered when making management decisions for WHPAs. For instance, a PWS well has surface water infiltrating the well casing would want to contact a certified well driller to meet current standards. Improperly constructed or damaged wells can allow contamination, particularly microbial contamination, to enter the well and the water supply.

The Susceptibility Determination must include a narrative summary of the susceptibility rating of the PWS, in addition to calculating the Susceptibility Rankings in the CSI worksheet (Tables 1 & 2)**.** This summary should outline priority potential contaminant sources and land cover classes in order to enable the PWS to develop management and protection strategies to address those priority concerns. The Division has included a template for the narrative summary that is located in Appendix B.

CHAPTER 6

Public Involvement

Chapter 6: Public Involvement

A well-informed and engaged public is critical to the success of a source water protection program. As more people become aware of the importance of protecting their drinking water source and what they can do to help, the more likely protection efforts are to succeed.

Requirements for public involvement are more stringent for new plans. The public should be solicited in the early stages of the planning process through the formation of the CSI planning team and further involved in reviewing the plan through a comment period. Reaching out to the public through surveys and public meetings can be useful in both determining where contaminant sources are located and in informing the public about their drinking water source and steps they can take to protect it.

The source water protection planning process is itself a tool for building awareness and support for developing and implementing management strategies and water supply planning efforts. Distribution of a summary of the source water assessment report raises awareness of community sources of drinking water that and encourages coordination and support in efforts to protect water quality. The information can be shared through a variety of methods including customer statements, public meetings, watershed festivals, and social media. EPA also requires community water systems to deliver a Consumer Confidence Report, also known as an annual drinking water quality report, to their customers. These reports provide valuable information about local drinking water quality to customers of community water systems. These reports summarize information about the local drinking water, including the source of water, a summary of monitoring results of detected contaminants, a description of any violations, and explanations of any additional health information. Various tools are available for sharing source water information and stories in compelling and widely accessible formats that dynamically blend text, images, charts, and maps.

The Division requires a 30-day public comment period for any new plans to be approved. Groundwater systems are required to provide public notice of each five-year update and make it widely available. Many PWS opt to provide a copy of the plan on a website and posting a link to it on monthly billing statements to notify bill-paying customers. Systems will need to provide documentation of how they informed the public about the updated plan, how they solicited feedback, and any comments. Meeting attendance and minutes must be submitted with the plans. For more information about required public notification, please consult 401 KAR 4:220 Water supply planning requirements.

Public comment periods and/or meetings are not required for NCWSs, however posting a notice regarding the plan in a conspicuous public place is required. A public notice template is provided as part of the guidance. Of course, for any NCWS, any public comments and associated documentation are encouraged to be requested and submitted with plans.

When developing education and outreach materials for the public, the following best practices are recommended:

- Use plain English in reports
- Provide maps of the delineated protection area
- Inventory potential contaminant sources within the protection area
- List, rank, or otherwise prioritize importance of threats identified in the contaminant source inventory
- Check local community boards or the events calendar for workshops and meetings scheduled in your area where you can share information about source water protection
- Utilize public meetings or other media outlets to obtain direct community feedback

CHAPTER 7

Protection Planning

Chapter 7: Protection Planning

A management strategy identifies activities or projects needed to mitigate existing and future threats to source water quality and to improve the resilience of the water supply. It provides a roadmap for coordinating partner actions and may help leverage investment. A plan should:

- Characterize the source water protection area and inventory potential sources of contamination to define priorities;
- Identify protection strategies and partners;
- Define implementation tasks and milestones;
- Highlight resource needs (e.g., funding, expertise, staff);
- Determine a timetable for achieving the program goals; and
- Outline a process for periodically evaluating progress towards these goals.

Source water protection practices are actions taken to prevent contamination of surface and groundwater sources of drinking water. A variety of source water protection practices exist, and these measures can be tailored to address each threat, or an array of risks, specific to each PWS. In choosing protection practices, water systems and government officials should account for the types of contaminant threats, physical landscape, public input, and other site-specific factors identified during the assessment process. These include both regulatory strategies and non-regulatory strategies. Some examples of non-regulatory measures that are effective for source water protection are outlined below.

General Protection Practices

Conserving wetlands and forests in source water protection areas can help protect water quality, recharge aquifers, and maintain surface water flow during dry periods. These ecosystems also provide important fish and wildlife habitat. Communities utilize a combination of regulatory and voluntary approaches to address threats to their drinking water supply. Given that source water protection is not required in most localities and most water utilities cannot regulate their source watersheds, approaches through protection of water quality measures, open space, or disaster resilience may receive more widespread public support and participation. Examples of source water protection practices include:

- **Land use controls (such as zoning ordinances and growth controls)**- Many communities across the nation are facing challenges associated with natural resource degradation due to rapid growth and development. Local governments need to have legal authorities in place to shape development, protect resources, and gather the necessary information needed to develop effective resource protection ordinances. The EPA Model Ordinances to Prevent and Control Nonpoint Source Pollution website, an ordinance type overview, includes concepts and concerns frequently missing from local codes. These include aquatic buffers, erosion and sediment control, open space development, stormwater control operation and maintenance, illicit discharges and post construction controls. It also provides a sortable table where you can select the relevant topic to see a listing of related real-life examples of ordinances used by local and state governments around the nation.
- **Regulations, permits, and inspections**- These include reports to water system customers and specific source water protection plans such as a GPP. Consumer Confidence Reports (CCRs), also known as an annual drinking water quality report, which requires all PWSs to provide their customers with an annual water quality report. CCRSs give consumers information about their drinking water, including the water source, contaminants detected in finished water, health effects of contaminants when violations occur, likely sources of detected

contaminants, and availability of source water assessments. States and water suppliers should view these reports as a public information tool to educate and involve the public and to promote a dialogue between customers and their drinking water utilities. It is an opportunity that water systems can use to their advantage to explain how their community's drinking water supplies are protected and opportunities to get involved in protecting their source(s) of drinking water.

GPPs per 401 KAR 5:037 require the development of best management practices to prevent pollution of the groundwater such as secondary containment measures, spill response equipment, emergency contact information, employee training, conducting inspections and much more. The Division is working to prioritize GPP's in source water protection areas. An initial step towards building awareness and support is to distribute a summary of the source water assessment report explaining the implications of the findings and what actions individuals can take to help protect the water supply. Additional programs include the Underground Injection Control program, which protects underground sources of drinking water from endangerment by setting minimum requirements for injection wells.

- **Land conservation and "natural infrastructure" solutions**- The EPA Resources for Source Water Protection website provides additional resources from EPA and others for source water assessments, mapping tools, water quality data, modeling resources, and contaminant information.
- **Best management practices**- The EPA Online Training in Watershed Management website provides modules on how watershed management challenges such as urban runoff, cropland management, forestry and other issues are addressed by techniques that reduce environmental impacts.
- **Public education and outreach**- Communities, citizen groups, and individuals can take an active role in protecting their drinking water sources from contamination. The EPA How Can You Help Protect Source Water website provides resources and information about source water protection and steps that can be taken at the local level to protect your drinking water. Water systems can also give treatment plant and system tours and host or participate in events, science or job fairs with the community, schools, and other interested groups.
- **Cost share programs and financial incentives**- There are a variety of programs that can be used to provide funding to protect sources of drinking water at the local, state, and federal level. The EPA Source Water Protection Funding website identifies useful resources for finding financial assistance tools to help communities build a patchwork of funding strategies to meet their environmental and public health protection goals.
- **Hazard Mitigation-** The EPA Hazard Mitigation for Natural Disasters: a Starter Guide for Water and Wastewater Utilities encourages water and wastewater utilities to work with their local mitigation planners to implement priority projects using FEMA or other source funding. It provides an overview of the mitigation process, along with practical examples of mitigation projects to address the impacts of earthquakes, tornados, floods, drought, wildfires and power outages.

Source-Specific Protection Practices

The following are common sources of contamination, and the practices used to prevent and mitigate the impacts of pollution from those sources:

- **Nonpoint Source Agriculture**- Agricultural NPS pollution has been shown to be the leading source of water quality impacts. Agricultural activities that cause NPS pollution most generally occur in the absence of a management plan and include poorly located or managed animal feeding operations and waste storage and

application, overgrazing, improper cultivation and fertilizer application practices. The Agriculture Water Quality Act (AWQA) requires all landowners with 10 or more acres that are being used for agriculture or silviculture operations to develop and implement an Ag Water Quality Plan based upon guidance from the Kentucky Agriculture Water Quality Plan Financial assistance through NRCS's Environmental Quality Incentives Program (EQIP) and Clean Water Act Section 319 or other funds to focus state water quality monitoring and assessment efforts where they are most needed to track change and implement conservation systems that manage run-off in these high-priority watersheds.

- **Septic Systems**- Septic systems have the potential to contaminate drinking water wells or surface water bodies with nutrients and pathogens. The extent of this impact depends on proper use and maintenance practices of septic systems. Homeowners can take several steps to prevent their septic system from impacting nearby water sources. These vary by location in both complexity and cost and a professional should be consulted before making significant upgrades to septic systems.
- **Urbanization & Stormwater Runoff**- Stormwater runoff is generated from rain and snowmelt that flows over land or impervious surfaces, such as paved streets, parking lots, and rooftops, instead of soaking into the ground. Runoff can pick up and deposit harmful pollutants like trash, chemicals, and dirt/sediment into streams, lakes, and groundwater. Construction sites, lawns, improperly stored hazardous wastes, and illegal dumping are all potential sources of stormwater pollutants. To protect water resources, communities can employ management practices to control stormwater and prevent pollution including:
    - Public education and outreach with homeowners and businesses on topics such as proper use and storage of household toxic materials, equipment maintenance practices, and responsible lawn care and landscaping helps prevent pollution.
    - Erosion and sediment control measures help prevent sediment, chemicals, and nutrients from washing off construction sites.
    - Land use controls and/or incentives through source water protection ordinances restrain certain activities within a defined area, such as a source water protection area, or encourage certain land uses or best management practices. Local government officials can use subdivision growth controls, zoning ordinances, overlay districts and other land use controls to limit impervious surfaces, encourage open space, impose runoff-efficient site design standards, locate high-risk activities away from drinking water sources, or facilitate cluster development to reduce runoff.
    - Rain gardens collect rainwater from roofs, roads, and parking lots and allow it to soak into the ground. They can also provide important food and habitat for birds, butterflies, and other wildlife. Low Impact Development (LID) and green infrastructure systems and practices that preserve or use natural landscape features and processes temporarily slow down, detain, or filter contaminants from stormwater. Examples include bioretention facilities, rain gardens, vegetated rooftops, buffer strips, forested areas, grassed waterways, constructed wetlands, rain barrels and permeable pavements. Natural areas preserved through LID can also provide important habitat, flood protection, and access to open space.
    - The most effective storm water pollution prevention plans combine these measures and reflect local soil, precipitation, and land use conditions. EPA's National Pollutant Discharge Elimination System (NPDES) Permitting Program regulates storm water runoff from municipal separate storm sewer systems (MS4s), industrial activities, and construction activities. Operators of these sources might be required to obtain an NPDES permit before they can discharge stormwater. This permitting mechanism is designed to prevent stormwater runoff from washing harmful pollutants into local surface waters.

- **Chemical Storage Tanks**- Storage tanks, above- and below-ground) store petroleum or hazardous substances. The greatest potential threat from a leaking UST (LUSTs) is of groundwater contamination. EPA, states, territories, and tribes work in partnership with industry to protect the environment and human health from potential releases. Information on UST release prevention, clean-up and other resources can be found at the EPA's UST program website.
- **Forestry**- Sources of NPS pollution associated with forestry activities include removal of streamside vegetation, road construction and use, timber harvesting, and mechanical preparation for the planting of trees. Road construction and road use are the primary sources of NPS pollution on forested lands, contributing up to 90 percent of the total sediment from forestry operations. In addition to other water quality impacts, an excessive quantity of sediment in a water body can reduce the ability of aquatic organisms to successfully live, forage, and spawn. Harvesting trees in the area beside a stream can affect water quality by reducing the streambank shading that regulates water temperature and by removing vegetation that stabilizes the streambanks. These changes can harm aquatic life by limiting sources of food, shade and shelter, as well as decreasing areas suitable for species intolerant of warmer temperatures.
- **Industrial Wastewater**- Wastewater discharges from industrial and commercial sources may contain pollutants at levels that could affect the quality of receiving waters or interfere PWSs that receive those discharges. The NPDES permitting program establishes discharge limits and conditions for industrial and commercial sources with specific limitations based on the type of facility/activity generating the discharge. There are many resources for discharge requirements based on the sector generating the discharge. To see an overview of permitted dischargers for a region, go to EPA's How's My Waterway.
- **Abandoned Mines**- Abandoned mine drainage is water that is polluted from contact with mining activity, and normally associated with coal mining. It is a common form of water pollution in areas where mining took place in the past. There are several issues with abandoned mines that impact water quality:
    - Acid mine drainage (the most prevalent)
    - Alkaline mine drainage (this typically occurs when calcite or dolomite is present)
    - Metal mine drainage (high levels of lead or other metals drain from these abandoned mines)
    - Acid mine drainage is the formation and movement of highly acidic water rich in heavy metals. This acidic water forms through the chemical reaction of surface water (rainwater, snowmelt, pond water) and shallow subsurface water with rocks that contain sulfur-bearing minerals, resulting in sulfuric acid. Heavy metals can be leached from rocks that come in contact with the acid, a process that may be substantially enhanced by bacterial action. The resulting fluids may be highly toxic and, when mixed with groundwater, surface water and soil, may have harmful effects on humans, animals and plants.

Clean Water Act Tools for Source Water Protection

The Clean Water Act establishes the basic structure for regulating quality standards for surface water and discharges of pollutants into the waters of the United States. Given that the SDWA, which sets standards for the quality of drinking water delivered to customers, does not establish authority for protecting drinking water sources, the Clean Water Act provides the primary regulatory tool for protecting source water quality. Federal, tribal, and state water program managers and the public all play a role in ensuring that Clean Water Act programs are adequately protective of drinking water supplies. A number of Clean Water Act "tools" can be used to protect drinking water resources. Examples include:

- The National Pollutant Discharge Elimination System (NPDES): Set effluent limits on discharges of pollutants that are regulated as drinking water contaminants under the Safe Drinking Water Act

- Water Quality Standards (WQS): Establish WQS with criteria for regulated drinking water contaminants for waters designated for drinking water supply
- Impaired Waters and Total Maximum Daily Loads (TMDLs): Prioritize development of TMDLs and 319 restoration funds for source waters that fail to meet WQS

Another step in the source water protection process is to establish a framework for measuring the effectiveness of management strategies and tracking progress towards achieving established goals. Plans should be evaluated and, if necessary, revised in response to new information, such as changes to the watershed or source water protection area or other factors that could affect the relevance and efficacy of the plan. The periodic (or continuous) program evaluation allows for an adaptive management approach that can generate information about gaps or shortcomings. This information can be used to make adjustments to program elements, whether that be the source water protection vision, goals, source characterization, or implementation tasks. The evaluation component should not be viewed as a one-time task but as a continuous effort to reassess and revise strategies based on the latest available information. This will improve overall efficiency and quality of the program.

Demonstrating measurable progress is also critical to ensuring continued support for source water protection projects. Many stakeholders that have invested in planning and implementation will want to know if the plan is making a difference and whether resource gaps remain. Regularly sharing information on progress and implementation results with stakeholders creates transparency and can help maintain credibility and support for protection efforts. For example, some source water partnerships have issued ”report cards" or developed fact sheets, brochures, or annual reports to highlight successes. Several basic elements of an evaluation framework include:

- Measurable goals and objectives towards which progress can be tracked and implementation success evaluated.
- Interim milestones and benchmark values to gauge whether management measures are performing as expected and implementation tasks have been completed according to schedule. If monitoring data indicates that the program is not meeting benchmark values or making substantial progress, it may indicate a need to update the management approach.
- Criteria by which to measure progress towards meeting source water protection goals. These criteria are often expressed as indicators and associated interim target values. Indicators might reflect a water quality condition that can be measured (dissolved oxygen, nitrogen, total suspended solids) or an action-related achievement that can be measured (pounds of trash removed, number of volunteers at the stream cleanup, length of stream corridor revegetated). In all cases, it is important to select criteria that will provide quantitative measurements and that can be easily communicated with various audiences.
- A monitoring program to collect data to be used to track and analyze the effectiveness of implementation efforts, according to identified criteria.

CHAPTER 8

Preparing for Emergencies

Chapter 8: Preparing for Emergencies

Emergency preparedness and response planning are an indispensable part of any drinking water protection program. It is important for a PWS to develop and practice emergency response procedures that address its unique risk profile, as assessed through an all-hazards risk assessment. This will enable water system staff to take action to reduce the consequences of an incident and restore service to customers. Incidents can range from small main breaks or localized flooding to large-scale natural disasters and contamination of source or finished water. Emergency planning efforts should be coordinated with local and state partners, such as public health, law enforcement, and hazmat response. Examples of emergency preparedness and response measures can include:

- Conducting a risk assessment to identify and prioritize hazards that could affect the water system, such as wildfire, flooding, or contamination;
- Coordinating with local emergency responders and local organizations responsible for community preparedness, such as Local Emergency Response;
- Establishing emergency response procedures that provide specific instructions for water system personnel and emergency responders, in the event of an emergency situation (for more information, visit the EPA Emergency Response for Drinking Water and Wastewater Utilities webpage);
- Developing detection systems and notification protocols that provide early warning of malevolent acts, natural hazards, or contaminant spills (for more information, visit the EPA Water Quality Surveillance and Response webpage);
- Notifying managers of upstream facilities with potential for accidental releases that they are located within a source water area; and
- Implementing other measures to reduce risks.

Recent revisions to the Emergency Planning and Community Right-to-Know Act (EPCRA) under the America's Water Infrastructure Act (AWIA) require that community water systems have access to EPCRA Tier II information (i.e., hazardous chemical inventory data) and receive notification of specified hazardous substance releases. AWIA, Section 2018 revised the EPCRA, requiring that community water systems:

- Receive prompt notification of any reportable release of an EPCRA extremely hazardous substance (EHS) or a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substance (HS) that potentially affects their source water, and,
- Have access to EPCRA Tier II information (i.e., hazardous chemical inventory data) reported by facilities within a water system's source water area, when requested.

Community water systems can proactively plan for potential releases if they have access to hazardous chemical inventory data in their source water area. EPCRA Tier II information (i.e., hazardous chemical inventory data), combined with other relevant information, allows a water system to characterize the risk of source water contamination threats and prioritize source water protection and emergency planning activities.

Because a release of a hazardous substance into a source water area could compromise the ability of a community water system to deliver safe drinking water to its customers, it is critical that a system receive prompt notification in event of a hazardous substance spill so that it can either take actions to prevent contaminated water from entering its system or otherwise minimize the consequences of the release. More information about these important amendments to EPCRA is available via the EPA AWIA Section 2018 webpage.

AWIA Section 2013 requires community water systems serving populations greater than 3,300 to develop or update a Risk and Resilience Assessment and ERP. The ERP update must incorporate the findings of the Risk and Resilience Assessment. Information generated from a Risk and Resilience Assessments and related Emergency Response Plans can be used to update source water assessments and to inform selection and implementation of source water protection measures. To learn more about risk and resilience assessments and emergency response plans, visit the EPA AWIA Section 2013 webpage. EPA's Drinking Water and Wastewater Resilience webpage provides a variety of tools and guidance to support drinking water utility emergency preparedness and response, developing detection systems, and conducting resilience assessments.

Preparing for Drought

Many communities have faced water shortages and have had to declare drought emergencies and implement water restrictions. When dry conditions are prolonged, it can put a strain on source water, so systems need to be prepared for mitigation of drought. PWSs have been required to develop water shortage response plans and have the ability to enforce water use restrictions due to drought or other water shortage. These plans focus on procedures to enable PWSs to manage their supply, treatment, storage and distribution of water. Each water system can be complex and uniquely different with respect to types and number of source(s), source limitations and constraints, water quality, treatment processes, hydraulics and storage, distribution system size, types of water use (essential vs. non-essential), seasonal variations in demand, and even the risk tolerance of customers. However, all water systems should be able to maintain the provision of water throughout the water system under increasing worsening drought conditions in order to minimize adverse effects on public health or safety, economic activity, and environmental resources.

The Division is currently establishing a framework for plan development that defines the planning process, scope and completion requirements. In addition, the Division has published a Kentucky Drought Viewer which allows the public to see current drought conditions by county, and provides detailed information on the severity of drought conditions. Drought Action Levels and Water Shortage Watches and Warnings are intended to encourage increased awareness by water supply managers and help local governments communicate the severity of the drought situation or that a critical water shortage is imminent. (http://watermaps.ky.gov/). Drought in Kentucky is also tracked and updated regularly by the U.S. Drought Monitor (https://www.drought.gov/drought/states/kentucky).

Preparing for Flooding

Increased frequency of flooding in the Commonwealth underscores the need for source water protection planning to protect water supplies. Flood waters introduce a multitude of contaminants to source waters, and infrastructure damage may mean the water utility cannot safely provide water. Utility infrastructure should be planned and built with consideration of future flood risks. Severe event analysis or modeling cam be utilized to understand the impacts of heavy precipitation and the potential future risks to improve system preparedness. Natural infrastructure like riparian buffers and green infrastructure can reduce flood height and velocity, while simultaneously improving water quality and infiltration into the soil (USEPA 2014).

Planning for the Future

Water supply protection plans allow PWSs an assessment of the system to evaluate the existing availability of the source water, the ability of the source water to meet present demands, and the vulnerability of the existing source to contamination. If systems must modify their source waters, increase or decrease in water use, or if existing sources are highly vulnerable to contamination, a plan that focuses on managing those issues should also be developed. A plan will be created that describes why your system needs to expand production, how you plan to expand (e.g., location of proposed

sources and potential availability), and a timetable for when you plan to develop the sources. If new wells are or will be constructed or removed (plugged) within the system, then they need to be integrated into the plan. Systems also need to list all current interconnections with other water systems and the capacity of each potential alternative water supply to sustain normal operations in the case of scenarios that could threaten the water supply.

Plan Updates and Submittal Process

Water systems can seek guidance and assistance to complete source water protection plans from the Division and many other local regional, state, and federal agencies and organizations. Environmental consulting firms, state public health and environmental agencies, federal agencies (e.g., USDA, Natural Resources Conservation Service (NRCS), USGS, or EPA), state cooperative extension services, rural water associations, circuit riders (i.e., water system technical advisors), and environmental or engineering departments of local universities may all provide technical assistance and/or data to complete delineations, assessments, and plans. Many communities have found it helpful to talk with KRWA, the Division, and their ADD which have staff with knowledge and experience in developing and preparing plans.

The Division contacts each PWS when plans are due and provides assistance when needed. After plans are reviewed, the Division will issue an approval letter to the PWS and the regional ADD, or it will be returned with suggestions for revisions. Finalized plans need to include copies of public notices and education and outreach materials distributed. Additionally, public notification and meeting documentation must include how they informed the public about the updated plan, how they solicited feedback, and any comments, and meeting attendance and minutes must be submitted with the plans. Non-Community Water Systems are not required to have public meetings for 5-year updates but must post a public notice in a conspicuous place. A public notice template is provided as a separate document. However, public input and associated documentation are encouraged.

Plans should be evaluated and, if necessary, revised in response to new information, such as changes to land use in the watershed or source water protection area, or any other factors that could affect the relevance and efficacy of the plan. While currently not required for surface water, groundwater systems are required to conduct a review every five years. Program evaluation should not be viewed as a one-time task but as a continuous effort to reassess and revise strategies based on the latest available information. This will improve overall efficiency and quality of the program.

Demonstrating measurable progress is also critical to ensuring continued support for source water protection projects. Many stakeholders that have invested in planning and implementation will want to know if the plan is making a difference and whether resource gaps remain. Regularly sharing information on progress and implementation results with stakeholders creates transparency and can help maintain credibility and support for protection efforts. For example, some source water partnerships have issued report cards or developed fact sheets, brochures, or annual reports to highlight successes.

Source Water Protection Funding

A well-written source water protection plan can be a strong starting point for applying for financial assistance for source water protection. Public and private assistance and funding programs are available to help partners implement voluntary protection efforts throughout the states. The EPA hosts a Source Water Protection Funding website provides information on a variety of programs that can be used to provide funding to protect sources of drinking water at the local, state, and federal level. It also identifies useful resources for finding financial assistance tools to help communities build a network of funding strategies to meet their environmental and public health protection goals.

APPENDIX A

Resources and Glossary

APPENDIX A – Resources and Glossary

Resources for Source Water Protection

The following websites contain a variety of useful resources for Source Water Protection:

- **EPA Source Water Protection: EPA Source Water Protection**
- **Safe Drinking Water Act**
- **Association of State Drinking Water Administrators**
- **American Water Works Association**
- **Source Water Collaborative**
- **National Rural Water Association**
- **Kentucky Rural Water Association**
- **Ohio River Valley Water Sanitation Commission**
- **The Nature Conservancy**
- **Owensboro Municipal Utilities**
- **Louisville Water Company**
- **University of Kentucky Cooperative Extension Service**
- **Kentucky Groundwater Protection Program**
- **Kentucky Water Supply Protection Program**

Glossary of Terms

Activity	One or a series of related processes, natural or anthropogenic that occurs within a geographical area and may be related to a particular land use.
Aquifer	An underground saturated permeable geological formation that is capable of transmitting water in sufficient quantities under ordinary hydraulic gradients to serve as a source of groundwater supply.
Best Management Practices	Best management practices (BMPs) are methods that have been determined to be the most effective and practical means of preventing or reducing non-point source pollution to help achieve water quality goals. BMPS include both measures to prevent pollution and measures to mitigate pollution.
Condition	A drinking water condition refers to contamination that exists already and is associated with past activities.
Confined Aquifers	An aquifer that is bounded above and perhaps below by layers of geological material that do not transmit water readily.
Contaminant	The Safe Drinking Water Act (SDWA) defines "contaminant" as any physical, chemical, biological or radiological substance or matter in water. Drinking water may reasonably be expected to contain at least small amounts of some contaminants. Some contaminants may be harmful if consumed at certain levels in drinking water. The presence of contaminants does not necessarily indicate that the water poses a health risk.

Contaminant of Concern	A chemical or pathogen that is or may be discharged from a drinking water threat activity that could contaminate a drinking water source.
Contaminant Value	The contaminant value is based upon the toxicity and mobility characteristics of the contaminants usually associated with a particular land use. A site may have a number of various potential contaminants
Drinking Water Issue	A substantiated (through scientific means) condition relating to the quality of water that interferes or is anticipated to soon interfere with the use of a drinking water source by a municipal residential system or designated system.
Drinking Water Threat	An existing activity, possible future activity or existing condition that results from a past activity, (a) that adversely affects or has the potential to adversely affect the quality or quantity of any water that is or may be used as a source of drinking water.
Easements	A power invested in a qualified private land conservation organization or government to constrain, as to a specified land area, the exercise of rights otherwise held by a landowner so as to achieve certain conservation purposes.
Event	Occurrence of an incident (isolated or frequent) with the potential to promote the introduction of a threat into the environment. An event can be intentional as in the case of licensed discharge or accidental as in the case of a spill.
Existing Drinking Water Source	The aquifer or surface water body from which municipal residential systems or other designated systems currently obtain their drinking water. This includes the aquifer or surface water body from which back-up wells or intakes for municipal residential systems or other designated systems obtain their drinking water when their current source is unavailable or in the event of an emergency.
Groundwater	Subsurface water that occurs beneath the water table in soils and geological formations that are fully saturated.
Groundwater Recharge Area	The area where an aquifer is replenished from (a) natural processes, such as the infiltration of rainfall and snowmelt and the seepage of surface water from lakes, streams and wetlands, (b) from human interventions, such as the use of storm water management systems, and (c) whose recharge rate exceeds a threshold specified in the regulations. The Director's rules will specify the acceptable methodologies to determine groundwater recharge rates i.e. what qualifies as significant.
Hazard	In the context of this guidance, a hazard is equivalent to a contaminant and pathogen threat.
Hydrogeology	Hydrogeology is the study of the movement and interactions of groundwater in geological materials.
Hydrologic Functions	The functions of the hydrological cycle that include the occurrence, circulation, distribution, and chemical and physical properties of water on the surface of the land, in the soil and underlying rocks, and in the atmosphere, and water's interaction with the environment including its relation to living things.

Hydrologic Sensitivity	The hydrologic sensitivity of an area is defined as the ease and speed with which a contaminant can move into and within a system.
Land Use	A particular use of space at or near the earth's surface with associated activities, substances and events related to a particular land use designation.
Landfill	A landfill, as permitted by the Solid Waste Branch, is a site for the disposal of solid or special wastes that must be designed and operated to specific criteria. Landfills often include specific areas for sorting waste, containing leachate and monitoring groundwater. There are several different kinds of landfills based on the waste streams disposed there.
Likelihood of Release Value	Regulatory compliance history and the implementation of best management practices (BMP) at potential contaminant sources may indicate the likelihood of release of a contaminant from a particular facility. A facility that is in compliance with regulatory programs and implements best management practices, such as those in a groundwater protection plans, agriculture water quality plans, storm water BMP plans, and hazardous waste contingency plans may be considered less likely to release a contaminant that can reach the water source.
Model	An assembly of concepts in the form of mathematical equations or statistical terms that portrays a behavior of an object, process or natural phenomenon
Pathogen	A disease-causing organism.
Proximity Value	Proximity of the contaminant to the drinking water source. Values are higher closer to the source (Zone 1 =3, Zone 2=2, Zone 3=1).
Raw Water	Water that is in a drinking-water system or in plumbing that has not been treated in accordance with, (a) the prescribed standards and requirements that apply to the system, or (b) such additional treatment requirements that are imposed by the license or approval for the system.
Recharge	Recharge is the process by which water moves from the ground surface, through the unsaturated zone, to arrive at the water table.
Riparian Buffer	A riparian buffer or stream buffer is a vegetated area near a stream, usually forested, which helps shade and partially protect the stream from the impact of adjacent land uses. It plays a key role in increasing water quality in associated streams, rivers, and lakes, thus providing environmental benefits.
Risk	The likelihood of a drinking water threat (a) rendering an existing or planned drinking water source impaired, unusable or unsustainable, or (b) compromising the effectiveness of a drinking water treatment process, resulting in the potential for adverse human health effects.
Severity	The degree to which an impact is measured compared to an idealized value of some parameter of concern. In the case of water quality, the severity may relate to degree of measurable exceedance of some contaminant or pathogen. In the case of water quantity deviation from some measurable parameter (e.g. minimum annual flow, piezometric head or lake level) must also be established.

Solid Waste	Any nonhazardous discarded material resulting from industrial, commercial or household operations. It is defined by Kentucky statute in KRS 224.1-010. Special waste is specifically excepted from being solid waste.
Source of Contamination	The generating activity or discharge point for a particular contaminant.
Source Water	Source water is a raw, untreated supply of water- typically surface water (streams, rivers, lakes and reservoirs) or groundwater (aquifers) - from which water is taken periodically or continuously by a public water system (PWS) for drinking water
Stream Bank Stabilization	A vegetative, structural or combination treatment of streams designed to stabilize the stream and reduce erosion.
Subwatershed	An area that is drained by an individual tributary into the main watercourse of a watershed.
Surface Water	Water that is present on the earth's surface and may occur as rivers, lakes, wetlands, ponds, etc.
Susceptibility Ranking	The degree to which a water source is susceptible to a particular contaminant or combination of contaminants.
Tier II	An annual federal report that is mandatory for companies that store hazardous materials.
Time of Travel (TOT)	An estimate of the time required for a particle of water to move in the saturated zone from a specific point in an aquifer into the well intake.
Transport Pathway	Transport pathways are features or activities occurring at the surface that disturb the surface above the aquifer, or which artificially enhances flow to an aquifer. The presence of a transport pathway can increase the vulnerability rate of an area.
Unconfined Aquifer	An aquifer whose upper boundary is the water table.
Water Reserve	A proportion of surface water flow that must be sustained to support anthropogenic or ecological requirements.
Water Source	An aquifer or surface water body being used to supply drinking water.
Water Source Supply	The total amount of water flowing through a surface water or groundwater system.
Water Supply System	The group of surface water intakes and/or groundwater wells that pump water to supply a municipal water distribution system.
Watershed	A watershed is the area of land where all of the water that is under it or drains off of it goes into the same place. Its boundaries are defined by ridges of high land.
Wellhead Protection Area	The surface and subsurface area surrounding a water well or well field that supplies a municipal residential system or other designated system through which contaminants are reasonably likely to move so as to eventually reach the water well or well.

Useful Acronyms

ADD	Area Development District
AWIA	Americas Water Infrastructure Act
CAFO	Confined Animal Feeding Operation
CCR	Consumer Confidence Report
CEC	Contaminants of Emerging Concern
COC	Contaminant of Concern
CSI	Contaminant Source Inventory
CWS	Community Water System
DOW	Kentucky Division of Water (Division)
DWMAPS	Drinking Water Mapping Application to Protect Source Water
ECHO	Enforcement and Compliance History Online
EPA	Environmental Protection Agency
ERP	Emergency Response Plan
EPRCA	Emergency Planning and Community Right to Know Act
FSA	Farm Service Agency
GIS	Geographic Information Systems
GPP	Groundwater Protection Plan
KPDES	Kentucky Pollutant Discharge Elimination System
KRWA	Kentucky Rural Water Association
KSWAPP	Kentucky Source Water Assessment and Protection Program
KYEM	Kentucky Division of Emergency Management
LUST	Leaking Underground Storage Tank
MCL	Maximum Contaminant Level
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source Pollution
NRCS	Natural Resources Conservation Service
NTNCWS	Non-transient Non-community Water System
PWS	Public Water System
RD	Rural Development
SDWA	Safe Drinking Water Act
SOC	Sources of Contamination
SOCs	Synthetic Organic Compounds
SWAPP	Source Water Assessment and Protection Program
SWP	Source Water Protection
SWPA	Source Water Protection Area
TEMPO	Tools for Environmental Management and Protection Organization

TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TOT	Time of Travel
TRI	Toxic Release Inventory
UIC	Underground Injection Control
USGS	United States Geological Survey
VOCs	Volatile Organic Compounds
WHPA	Wellhead Protection Area
WHPP	Wellhead Protection Program
WMB	Watershed Management Branch
WQS	Water Quality Standard
WSS	Water Supply Section

APPENDIX B

Susceptibility Analysis Narrative Template for Surface Water Plans

APPENDIX B: Susceptibility Analysis Narrative Template for Surface Water Plans

TEMPLATE- *This template is intended as a guide for PWSs to write their Source Water Assessment Analysis and Protection Recommendations narrative. It is used to summarize the CSI inventory ranking results and highlight specific issues and management strategies for protecting the systems drinking water source. Text highlighted in yellow is intended to be replaced with system specific information. There should be no highlighted text when the document is finalized. Un-highlighted text may be left as is or altered to better reflect the needs of the individual plan. The following template includes sample maps and content for example purposes only. For a blank form please contact Dale Booth, dale.booth@ky.gov.*

For the most up to date forms visit the EEC Source Water Protection website.

KENTUCKY DIVISION OF WATER
SOURCE WATER ASSESSMENT AND PROTECTION PLAN
UPDATE FORM

Update Requirements:

This form should be used for updates to system Source Water Assessment and Protection Plans (SWAPPs). Please sign completed form and send to:

Kentucky Division of Water
Watershed Management Branch
Attention: Dale Booth
300 Sower Boulevard, 3rd Floor
Frankfort, Kentucky 40601 or dale.booth@ky.gov

For assistance, contact Dale Booth at (502) 782-6895 or dale.booth@ky.gov

Form Sections: Checklist

I. Surface Water Protection Area (SWPA) General Discussion

- ☐ System Information
- ☐ Source Water Area Protection Plan Changes
- ☐ SWPA Delineation
- ☐ Soils and Geology

II. Source Water Risks and Known Issues

- ☐ Impaired Water Bodies
- ☐ Nonpoint Source Pollution
- ☐ Point Source Pollution
- ☐ Contaminant Source Inventory

III. Protection Measures

- ☐ Existing Local Regulatory Measures
- ☐ Protection Recommendations
- ☐ Security of Access

IV. Emergency Response

- ☐ Emergency Measures and Contact List
- ☐ Procedures for Public Notification
- ☐ Potential Future Problems
- ☐ Alternative Water Supply

V. Public Involvement

- ☐ Documentation

Source Water Assessment and Protection Plan
Susceptibility Analysis and Protection Recommendations for
[PWS NAME]

I. Surface Water Protection Area (SWPA) General Discussion

A. System Information:

PWS Name: click to add text

PWS ID Number: click to add text **AI Number**: click to add text

WWD Permit #: click to add text **Permitted Amount (mgd):** click to add text

Contact Person/Title: click to add text

Mailing Address: click to add text

Telephone: click to add text **Email:** click to add text

Intake Location (decimal degrees): click to add text

Water Treatment Plant Location: click to add text

Service area: click to add text

County: click to add text **Area Development District:** click to add text

Interconnections: click to add text

Watershed (HUC 12#): click to add text

System Type*: click to add text
***Community; Non-Transient/Non-Community; Transient/Non-Community**

Source Type* (Source Name): click to add text
***River, reservoir, other**

Population Served: click to add text

Overall Susceptibility Rating (High, Medium or Low): click to add text

B. Source Water Area Protection Plan Changes:

Briefly summarize any changes to the Source Water Area Protection Plan (SWAPP) in this update.

Click to insert text

B. SWPA Delineation:

Delineation is the process of defining the area of land on which activities are likely to impact the quality of the drinking water source. This area is called a Source Water Protection Area (SWPA). Source Water Protection Areas (SWPAs) for surface sources of water that are fed by large watersheds are divided into three Zones, the largest of which may be smaller than the entire watershed upstream of the intake. Smaller watersheds may contain only one or two zones.

The general definitions for each protection zone are below, followed by waterbody-specific delineation requirements:

- **Zone 1**: **Critical Zone.** Closest to the intake, and therefore most susceptible to a contamination event. A spill may reach the water supply very quickly through a tributary or overland within 1 hour or less.
  - **Lakes/Reservoirs**: From ¼ mile downstream of intake to 1 mile upstream of intake, extending ¼ mile landward from the shoreline at normal summer pool.
  - **Rivers**: From ¼ mile downstream of intake to 5 miles upstream of intake, with buffer zones extending ¼ mile from each bank. This designation will include any tributary stream in this zone that is 3rd order or higher. This coincides with Kentucky's five-mile policy, which prohibits Kentucky Pollutant Discharge Elimination System (KPDES) discharges within five miles upstream of a water supply intake.
- **Zone 2: Zone of Responsibility.** Encompasses Zone 1 and includes the areas from 1 to 5 hours from the intake based on flow of 2 to 10 miles per hours. Contaminants in this zone represent a significant potential threat to the water source.
  - **Lakes/Reservoirs:** From ¼ mile downstream of intake to 5 miles upstream of intake, extending ½ mile landward from the shoreline.
  - **Rivers:** From ¼ mile downstream of intake to 10 miles upstream of intake, with buffer zones extending ½ mile from each bank. This designation will include any tributary stream in this zone that is 3rd order or higher.
- **Zone 3: Zone of Potential Impact.** *S*urrounds Zones 1 & 2 and extends to the upper portions of the contributing area. Contaminant would reach the intake within 2.5 hours to 12.5 hours from time of release.
  - **Lakes/Reservoirs:** From ¼ mile downstream of intake to 10 miles upstream of intake, extending to the watershed boundary of tributary streams, as defined by 12-digit hydrologic unit codes.

- **Rivers:** From ¼ mile downstream of intake to 25 miles upstream of intake, extending to the watershed boundary of tributary streams, as defined by 12-digit hydrologic unit codes.

Describe the delineations for the system. If any changes were made to the zone delineations in this update, please describe your methods. Include a map showing the SWPA Zones:

click to add text

C. Soils and Geology:

Soils characteristics largely determine how potential contaminants are transported through the ground, and geological factors have unique effects on water quantity and quality problems.

The following is a brief description of the General Soil Classifications located within the watershed:

Click here to enter text.

II. Source Water Data and Identified Challenges

A. Impaired Waterbodies

Briefly summarize any water quality information that might impact the availability of water for your system. For current information regarding the assessment status of Kentucky's waterways, please consult the most recent Integrated Report to Congress (https://integrated-report-site-kygis.hub.arcgis.com/).

click to add text

B. Monitoring Data

Briefly summarize any recent water quality monitoring data that is available that relates to the current status of source water quality.

click to add text

C. Known Issues

Briefly summarize any information about issues that the PWS is currently experiencing (for example, seasonal algae blooms, taste and odor issues, elevated nutrients.

click to add text

III. Source Water Risks and Susceptibility

A. Nonpoint Source Pollution

Use this section to identify and discuss sources of nonpoint source pollution that may be impacting the water source. You may wish to summarize the land cover from the National Land Cover Database.

Nonpoint source (NPS) pollution or "polluted runoff" is created when rain, snowmelt, irrigation water and other water sources run over the land, picking up potential contaminants and transporting them to local water bodies. Some of these contaminants occur naturally in the soil.

NPS pollution is also called "people pollution" because much of it is the result of normal daily human activities. With each rainfall, herbicides, pesticides, fertilizers, animal manure and household chemicals are washed from impermeable surfaces and other land areas into storm drains, ditches, sinkholes or streams that flow into nearby waterways. As with most Kentucky surface water sources of supply, SOURCE NAME is subject to potential nonpoint source contaminants.

The following are various types of land cover that occur in the Source Water Protection Area from which NPS pollution is likely to originate.

Commercial, Industrial and Transportation Land Cover: This land cover type indicates areas of impermeable cover (rooftops, parking lots, etc.) which change the groundwater recharge dynamics, flow dynamics (and downstream erosion), and potentially increase the amount of pollutants in storm water and other water-related runoff.

Forest/Woodlands Land Cover: This type of land cover could be subject to logging which may result in soil erosion if BMPs are not carefully applied. Conversely, forested lands that are properly conserved may be of benefit in reducing runoff pollution.

Pasture and Hay Land Cover: When BMPs are poorly applied, cattle or any other livestock grazing in these areas could result in stream bank erosion and manure runoff into water bodies.

Row Crops Land Cover: The presence of this land cover type indicates the potential for agricultural activities, which could result in soil erosion or fertilizer and pesticide runoff if BMPs are poorly applied.

Residential Land Cover: The presence of this type of land cover may be indicative of chemical use on a wide scale from individual homes. Activities such as vehicle washing, the application of lawn chemicals and other maintenance related activities in residential areas can generate potential contaminants. Furthermore, soil erosion may occur from construction that takes place in expanding residential areas.

(You may choose to include maps of land use types. Contact the Water Supply Section for assistance)

Land Use Characteristics

Table 1. Land use in the SWPA zone (2019 National Land Cover Dataset (NLCD)).

Impact	**Land Use**	**Percent cover (%)**		
		Zone 1	**Zone 2**	**Zone 3**
Potential Stressors	*Hay/Pasture*			
	Cultivated Crops			
	Developed			
Conservation Potential	*Wetlands*			
	Forest			

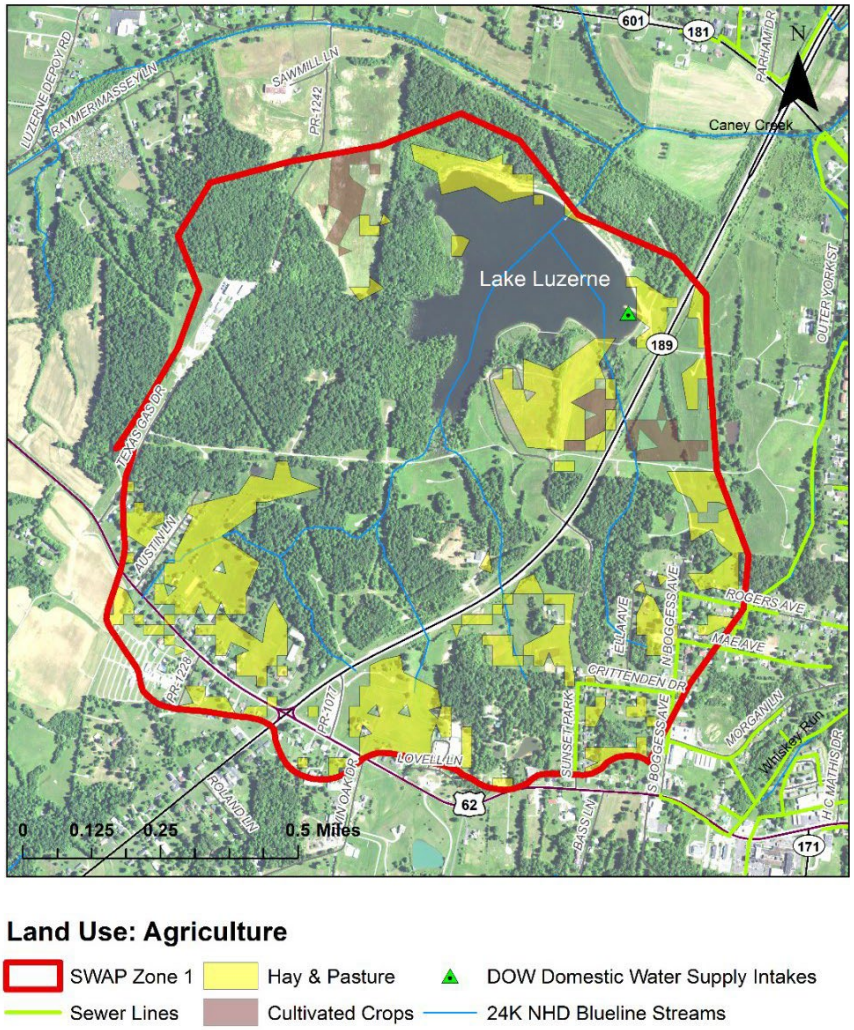


Figure 1. EXAMPLE: Highlights the location of agricultural land use within the SWPA (NLCD 2019)

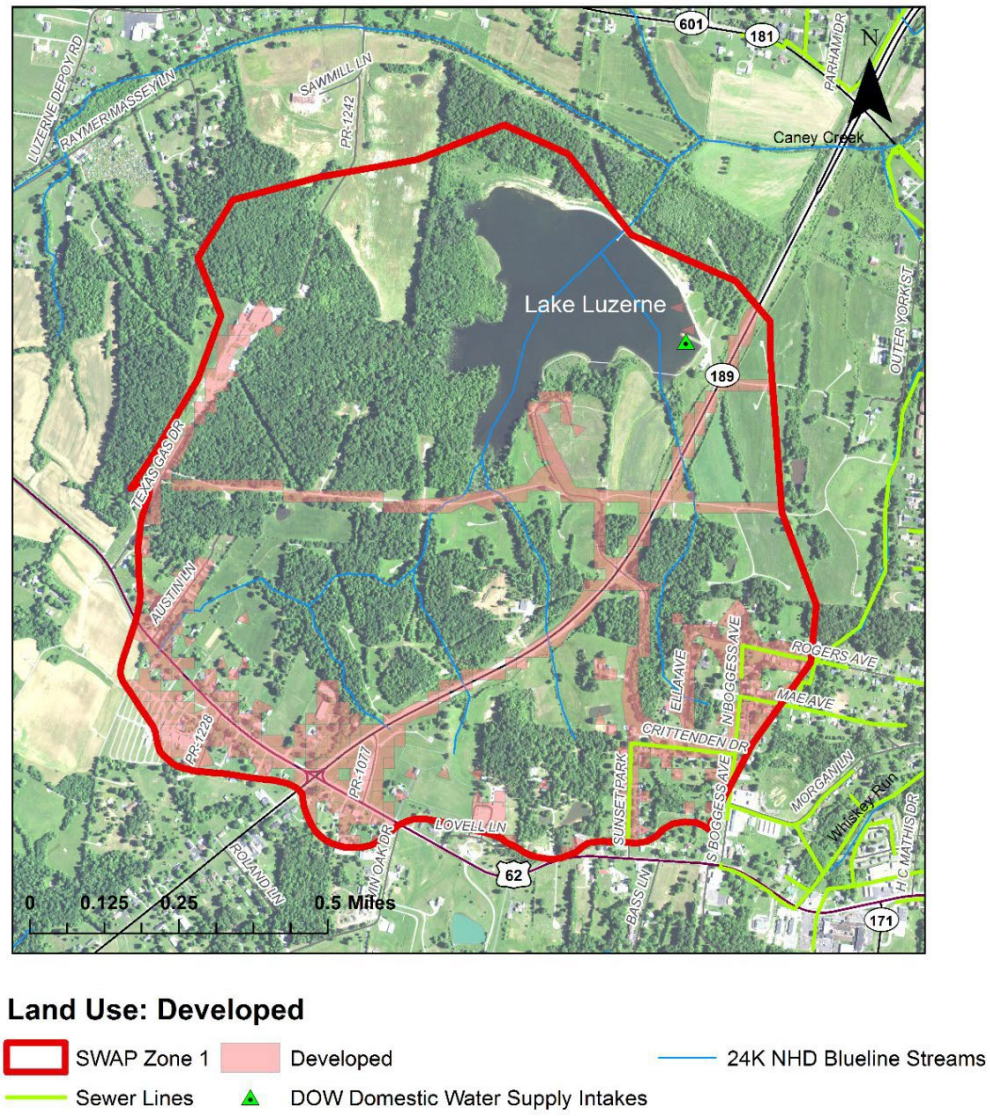


Figure 2. EXAMPLE: Highlights the location of developed land use within the SWPA (NLCD 2019)

click to add text

B. Point Source Pollution

The U.S. Environmental Protection Agency (EPA) defines PS pollution as "any single identifiable source of pollution from which pollutants are discharged, such as a pipe, ditch, ship or factory smokestack." Factories and sewage treatment plants are two common types of point sources.

i. Kentucky Pollutant Discharge Elimination System (KPDES) Permits

All PS discharges to waters of the Commonwealth require a permit through KPDES. Such permits include effluent limitations that are developed from technology-based and water quality-based criteria. The following are some examples of pollutant dischargers that are permitted and monitored under the KPDES program: wastewater treatment facilities, various industrial operations, stormwater discharge, combined sewer systems, mining operations, and certain land farming operations.

click to add text

C. Contaminant Source Inventory

Potential Contaminant Source Sites: Potential contaminant sites are those locations, in delineated protection areas, where human activities are taking place that are likely to create risk of contaminants entering the source of public water supply.

Potential Contaminant Source Types: Contaminant sources may have more than one potential associated contaminant. For example, it is assumed that most agricultural sources will generate fertilizer, pesticide, and sediment, and they need not be called out individually. The Contaminant Source Inventory categorizes potential contaminant sites into designated types. A list of potential Contaminant Types can be found in **Appendix C**. For more information about the pollutants associated with each type, please refer to the Kentucky Source Water Planning and Protection (KSWAPP) Guidance.

Planning Team: Potential contamination points were identified by a planning team including the Kentucky Division of Water and PUBLIC WATER SYSTEM NAME.*[and/or other partners who assisted with the CSI. Describe the planning team, who assisted with the CSI.]*

The planning team included:

Insert names and qualifications as appropriate

Methods: The Contaminant Source Inventory (CSI) was completed through a database search conducted by the Kentucky Division of Water, reviewing aerial photography, and through on-the-ground surveys by the utility *(Describe any other methods/steps used for developing the CSI inventory; i.e. windshield surveys, databases, state assistance).*

Through this review, **#** potential contaminant source types were *identified (the following is an example of the level of discussion expected, edit, add to, or delete sections as necessary):*

Row Crops: Corn, Soybean, Wheat: Row crops make up 1.9% of estimated land use in Zone 1. The presence of this land cover type indicates the potential for agricultural activities, which could result in soil erosion or fertilizer and pesticide runoff if best management practices (BMPs) are poorly applied.

Gas stations (existing & abandoned/historic): Harkins Station is located in Zone 1. The business includes four underground storage tanks (USTs) and a large capacity septic system. Both gasoline and sewage from onsite wastewater may leak from these storage systems, introducing harmful bacteria, chemicals, and nutrients to the water source.

Mobile Home Park/Campground: This location houses a mobile home park with a large capacity septic system. Improper maintenance of the system may result in sewage leakage that can introduce harmful bacteria and nutrients to the water source.

Major Roadways: HWY 62 and HWY 189 cross the SWPA Zone 1. Vehicle emissions along major roadways contain varying amounts of toxic substances that can be carried by runoff to streams and lakes. Furthermore, accidental spills of hazardous materials from trucks and cars could potentially contaminate source waters.

Municipal Sewer Lines: Sewer lines are located in the southeastern portion of the protection zone including the following streets: Sunset Park, Crittenden Drive, North Boggess Avenue, Rogers Avenue, and Mae Avenue. Bacteria and nutrients may enter the drinking water source if the lines break or are poorly maintained.

Pasture (livestock): Approximately 16.5% of estimated land use in Zone 1 is designated Hay/Pasture. This indicates the potential for livestock usage of the area. When BMPs are poorly applied, cattle or any other livestock grazing in these areas could result in stream bank erosion and manure runoff into water bodies.

Petroleum Product Production, Transport and Storage Companies: A natural gas pipeline passes through Zone I. Pipeline breaks or poor maintenance may result in contamination of the water source. Oil and natural gas pipelines range in size from just a few inches in diameter up to several feet in diameter. Intrastate pipelines, generally smaller distribution pipelines, are regulated by the Kentucky Public Service Commission. Interstate pipelines are regulated by the U.S. Department of Transportation Office of Pipeline Safety.

Residential Septic: It is estimated that approximately 37 homes in the protection Zone may be utilizing septic systems for onsite wastewater treatment. Improper maintenance of these systems may result in sewage leakage that may reach the drinking water source, introducing harmful bacteria and nutrients.

For a complete listing of all the identified potential contaminant sources for this PWS, see the contaminant source inventory table and map (**Appendix D**).

IV. Protection Measures

A. Existing Local Regulatory Measures

Utilize this section to describe any relevant planning and zoning ordinances that affect the source water protection areas. This may include rules regarding waste management, development limits, and emergency response.

Click to add text

B. Protection Recommendations

Use this section to highlight the contaminants of highest concern and lay out measures to address them. Include any education/outreach, specific infrastructure initiatives, conservation actions, and/or development recommendations.

The following section contains recommendations for preventing contamination of the drinking water source from the identified contaminant types. *(the following is an example of the level of discussion expected; edit, add to, or delete sections as necessary):*

Row Crops: Corn, Soybean, Wheat:

1. Provide guidance to landowners and partner with University Extension agents to ensure compliance with Agriculture Water Quality Act (AWQA).
2. Encourage implementation of voluntary BMPs above the minimum required by the AWQA. BMP manuals for specific types of operations are available.
3. Work with Landowners and Extension to help development and implementation of on-farm Nutrient Management Plans (NMPs).
4. All storage or use of pesticides and fertilizers should be monitored by the appropriate authorities.

Resources:

Resources for Nutrient Management Planning and Ag Water Quality Planning: https://www.uky.edu/bae/awqp

University of Kentucky Extension Services: https://extension.ca.uky.edu/

Kentucky State University Extension Services: https://www.kysu.edu/academics/college-acs/school-of-ace/co-op/index.php

Pasture (Livestock):

1. Provide guidance to landowners and partner with University Extension agents to ensure compliance with AWQA.
2. Encourage implementation of voluntary BMPs above the minimum required by the

AWQA. BMP manuals for specific types of operations are available.

3. Work with Landowners and Extension to help development and implementation of on-farm NMPs.
4. All storage or use of pesticides should be monitored by the appropriate authorities.

Resources:

Resources for Nutrient Management Planning and Ag Water Quality Planning: https://www.uky.edu/bae/awqp

University of Kentucky Extension Services: https://extension.ca.uky.edu/

Kentucky State University Extension Services: https://www.kysu.edu/academics/college-acs/school-of-ace/co-op/index.php

Gas stations (existing & abandoned/ historic):

1. Educate facilities about Groundwater Protection Plans (GPPs) and encourage compliance.
2. Work with business owners and partner with the local health department to ensure they are educated on how to maintain large capacity septic systems.
3. Ensure compliance with all federal requirements.

Resources:

Muhlenberg County Health Department: http://www.muhlenbergcountyhealthdepartment.com/2018/

Energy and Environment Cabinet Underground Storage Tanks Branch: https://eec.ky.gov/Environmental-Protection/Waste/underground-storage-tank/Pages/default.aspx

Kentucky Division of Water Groundwater Protection Planning: https://eec.ky.gov/Environmental-Protection/Water/GW/Pages/GWGPP.aspx

Mobile Home Park/Campground:

1. Partner with the local health department to ensure the business owners are educated on how to maintain large capacity septic systems.

Resources:

Muhlenberg County Health Department: http://www.muhlenbergcountyhealthdepartment.com/2018/

Major Roadways:

1. Require the adoption and application of highway maintenance and runoff BMPs.
2. Limit highway construction or avoid waterways. Modify designs to limit runoff,

especially drain spouts on bridges to minimize salt de-icing runoff to waterways.
3. Post signs indicating presence of SWPA on major roads.
4. Evaluate and consider detention basins at new bridges at high-traffic/threat crossing to contain spills.

Resources:

Best Management Practices (BMPs) for Controlling Erosion, Sediment, and Pollutant Runoff from Construction Sites: https://eec.ky.gov/Environmental-Protection/Forms%20Library/09BMPManual_Final.pdf

Guidance for use of Native Plantings on Roadsides: https://www.environment.fhwa.dot.gov/env_topics/ecosystems/roadside_use/vegmgmt_rdsduse.aspx

Municipal Sewer Lines:

1. Ensure that the public knows how to report problems with sewer to the local Waste Water Treatment Plant and emergency responders.
2. Support efforts to maintain and improve sewer infrastructure.
3. Keep up-to-date inventory of sewer line locations.

Petroleum Product Production, Transport and Storage Companies:

1. Ensure that spill response plans are in place in the event of a pipeline failure.

Residential Septic:

1. Educate private landowners about the necessary steps to maintain a functional onsite wastewater treatment system.
2. Work with the local health department to identify and correct problem areas.
3. Implement zoning requirements that require setbacks from waterways.
4. Support expansion of sewer service to unsewered areas.

Resources:

Muhlenberg County Health Department: http://www.muhlenbergcountyhealthdepartment.com/2018/

C. Security of Access

Use this section to discuss the security measures that are taken or planned to prevent contamination of the drinking water supply.

Click to add text

V. Emergency Response

A. Emergency Response Measures and Contact List

Provide a description of Contingency and Emergency Response Planning. Complete the Emergency Response Phone List, Procedures for Public Notification, identification of Potential Future Problems and the procedures to establish Alternative Water Supplies. This section must also address how often the SWAPP will be reviewed and updated.

Click to add text

Emergency Response Phone List

Fill in all Blanks and Phone Numbers with appropriate information.

Local Emergency Response	Phone Number
Plant Operator:	PHONE NUMBER
Nearest fire department.	PHONE NUMBER
Nearest city police or law enforcement	PHONE NUMBER
Muhlenberg County Office of Emergency Management	PHONE NUMBER
Local Emergency Dispatch Click here to enter text.	PHONE NUMBER

State and Federal Assistance	Phone Number
Kentucky DOW (Frankfort)	(502) 564-3410
Kentucky DOW Associated Field Office FIELD OFFICE	PHONE NUMBER
Kentucky Environmental Response Team 24 hour response line	(502) 564-2380 (800) 928-2380
Kentucky State Fire Marshall	(502) 573-0382

Any Other Pertinent Contacts	Any Other Pertinent Numbers
Click here to enter text.	PHONE NUMBER

Click here to enter text.	PHONE NUMBER
Click here to enter text.	PHONE NUMBER

B. Procedures for Public Notification

Describe the public notification process and provide contacts for those media outlets. If the system uses methods other than traditional media please list them.

Click here to enter text.

Newspaper, Television, and Radio Stations	Phone Numbers
Click here to enter text.	PHONE NUMBER
Click here to enter text.	PHONE NUMBER

C. Potential Future Problems

Describe the most likely scenarios that could threaten the water supply. In this section you may want to consider discussing any known development projects in the watershed, like the proposed water line extension

Click here to enter text.

D. Alternative Water Supply (Short and Long Term Solutions)

Describe the short term and long-term water supply alternatives that address each of the potential future problems identified above. List all current interconnections with other water systems. Discuss the capacity of each potential alternative water supply to sustain normal operations.

Click here to enter text.

VI. Public Involvement

Newly established PWSs must hold a public meeting to gather stakeholder input on the Source Water Protection Plan. For updates to a plan, the system is required to show proof of public notice. The system must also show that the plan has been made accessible to the public. This may be through posting the document to their website or providing information to customers about how to request a copy of the plan.

Describe the public involvement and any public notices released related to this plan. Provide copies of

public notices related to SWAPP meetings and activities (newspaper, websites, social media, etc), should be provided as an appendix to this plan. Other examples of documentation to include records SWAPP public meeting attendance, minutes, comments, as well as copies of educational materials distributed.

Click here to enter text.

Certification Signature (TO BE COMPLETED BY PLANNING REPRESENTATIVE):

"I certify that this document and all attachments were prepared under my direction or supervision. The information submitted is, to the best of my knowledge and belief, true, accurate, and complete."

Signature:_____ **Date:** Click here to enter text.

Printed Name/Title: Click here to enter text.

Assistance:

For any assistance, please contact Source Water Protection Staff:

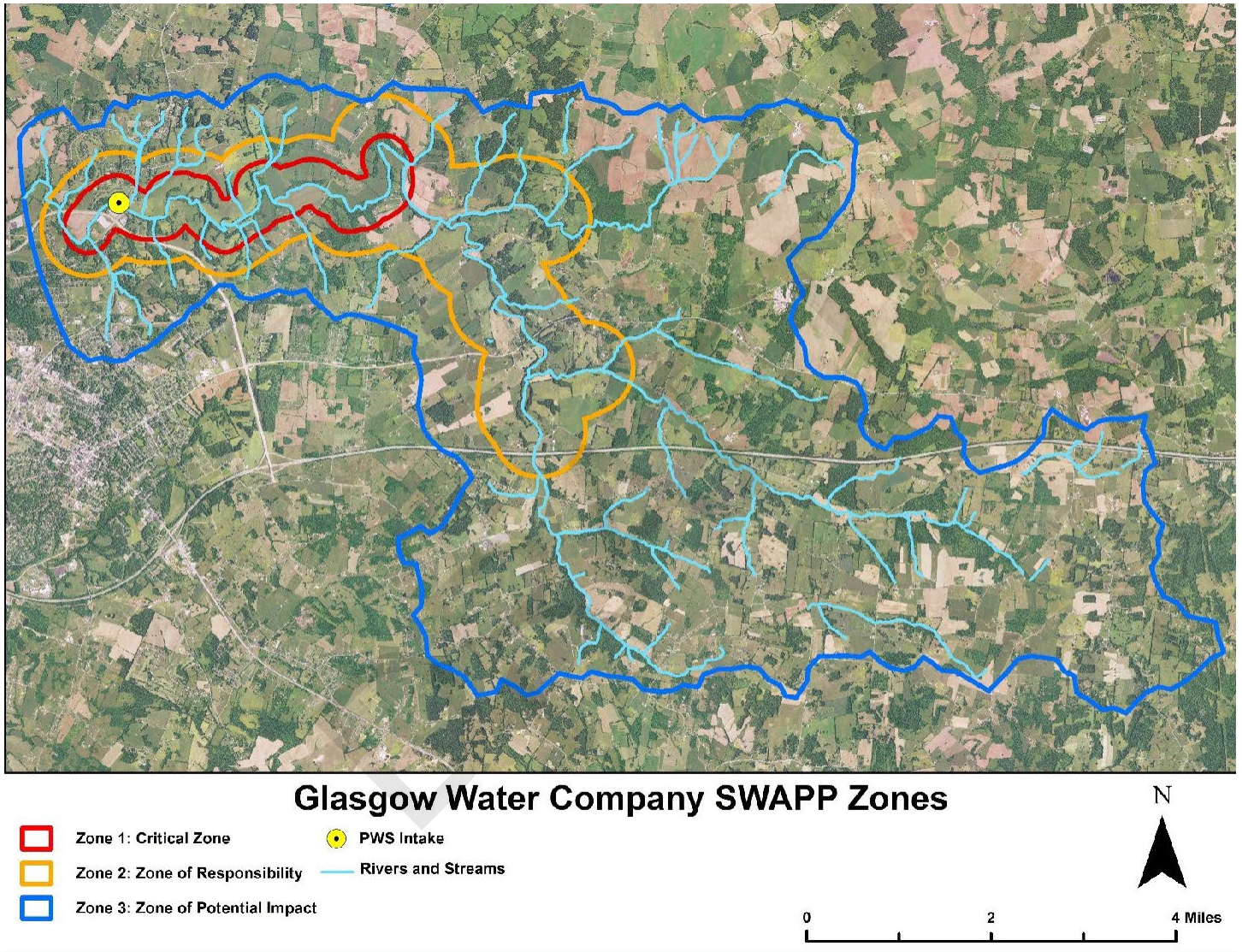
Dale Booth
(502) 782-6895
Dale.booth@ky.gov

Please sign and return completed form to:

Kentucky Division of Water
Watershed Management Branch
Attention: Dale Booth
300 Sower Boulevard, 3rd Floor
Frankfort, Kentucky 40601
or dale.booth@ky.gov

APPENDIX A:

SWPA Delineation and Treatment Plant Location for [System Name]


Glasgow Water Company SWAPP Zones
Zone 1: Critical Zone
Zone 2: Zone of Responsibility
Zone 3: Zone of Potential Impact
PWS Intake
Rivers and Streams
N
0
2
4 Miles

Example Map

APPENDIX B:

Water Quality Assessment Summary from the 2022 Integrated Report to Congress

Optional. For information from the IR visit the Assessment tab of the Division of Water's "Integrated Report to Congress on the Condition of Water Resources in KY, 2022 Cycle" https://integrated-report-site-kygis.hub.arcgis.com/. Contact DOW for assistance with this tool

Assessment Unit Summary

- **Unit Name:** Luzerne Lake
- **AU ID:** KY-1220
- **Description:** Entire Reservoir
- **County:** Muhlenberg
- **Overall Category:** 2b
- **Assessment Date:** 07/15/2022

2022 Reporting Cycle

Warm Water Aquatic Habitat is full support, category 2

Basis for Listing: Designated use found to be fully supporting, basis for listing is not applicable.

Monitoring:

- **Data Types:** Physical/Chemical and Observational
- **Sample Date Range:** 07/25/2019 - 09/09/2019
- **Programs:** Ambient Lakes - Rotation

Primary Contact Recreation is not assessed, category 3

Secondary Contact Recreation is full support, category 2

Basis for Listing: Designated use found to be fully supporting, basis for listing is not applicable.

Monitoring:

- **Data Types:** Observational
- **Sample Date Range:** 07/25/2019 - 09/09/2019
- **Programs:** Ambient Lakes - Rotation

Fish Consumption is not assessed, category 3

Domestic Water Supply is full support, category 2b

Basis for Listing: Designated use previously found to be impaired, but is now found to be meeting and has been proposed for delisting.

Parameters:

- Nutrient/Eutrophication Biological Indicators | category 2b | Meeting and proposed for delisting

Monitoring:

- **Data Types:** Physical/Chemical
- **Sample Date Range:** 01/01/2010 - 12/31/2020
- **Programs:** Ambient Lakes - Rotation, Monthly Operating Reports - PWS, and Program unspecified (historic assessment decision carried forward from previous cycle)

APPENDIX C:

Potential Contaminant Source Types

Potential Contaminant Source Types List:

Contaminant sources may have more than one potential associated contaminant. For example, it is assumed that most agricultural sources will generate fertilizer, pesticide, and sediment, and they need not be called out individually. Note this list is not exhaustive. For sources not specifically found here, "Other" categories exist for all source groups (commercial, industrial, agricultural, municipal, waste management, groundwater conveyance, and residential)

* Indicates potential pathogen source
** Contamination Value should be treated as a recommendation. If there is information that suggests that particular site warrants a higher or lower value, such as a history of violations or use of BMPs, it is at the discretion of the plans author to adjust the value. For more information, refer to KSWAPP Guidance.

Agricultural

Type	Contamination Type ID Code	Contamination Value**
Animal Burial/ Composting Sites*	A-1	3
Animal Feedlots*	A-2	2
Animal Waste Storage/ Disposal*	A-3	3
Confined Animal Feedlots (CAFOs)*	A-4	3
Row Crops: Corn, Soybean, Wheat	A-5	3
Crops: Orchards	A-6	3
Crops: Other	A-7	3
Dairy Facility*	A-8	3
Drainage Canals/ Tiles	A-9	2
Farm Chemical Distributor	A-10	2
Farm Machinery Repair Areas	A-11	3
Greenhouses/ Nurseries	A-12	3
Other Agricultural Sources	A-13	3
Pasture/Hay (Livestock)*	A-14	3
Pesticide/ Fertilizer/ Petroleum Storage & Transfer Areas	A-15	3
Silage Storage (Bulk)	A-16	2
Silviculture (Logging)	A-17	3
Stockyards*	A-18	3
Poultry*	A-19	3
Land Application of Manure*	A-20	3

Commercial

Type	Contamination Type ID Code	Contamination Value**
Airport/ Heliport/ Abandoned Airfield	C-1	3
Auto Repair Shops/ Body Shops	C-2	3
Barber and Beauty Shops	C-3	1
Boat Services/ Repair/ Refinishing	C-4	3
Car Washes	C-5	2
Car/ Boat/ Camper Dealerships	C-6	3
Carpet/ Tile Stores	C-7	2
Cemeteries*	C-8	2
Churches	C-9	2
Dry Cleaners	C-10	3
Equipment Rental/ Repair Shops	C-11	2
Fleet/ Truck/ Bus Terminals	C-12	3
Food Processing	C-13	2
Funeral Services/ Crematories	C-14	2
Furniture Repair/ Finishing/ Manufacturing Shops	C-15	3
Gas stations (existing & abandoned/ historic)	C-16	3
Golf Courses	C-17	2
Grocery/ Department Stores	C-18	2
Hardware/ Lumber/ Parts stores	C-19	2
Heating Oil Companies	C-20	3
Hospitals*	C-21	2
Junk Yards (Scrap and Auto)	C-22	3
Laundromats	C-23	2
Lawn/ Farm Stores	C-24	3
Marina/ Boat Docks	C-25	3
Medical/ Dental Offices/ Clinics*	C-26	2
Other Commercial Sources	C-27	3
Paint Stores	C-28	2
Pest Control Companies	C-29	3
Pharmacy	C-30	2
Print Shops/ Photo Shops	C-31	2
Railroad Lines	C-32	3

Railroad Yards/ Maintenance	C-33	3
Research Laboratories	C-34	2
Veterinary Offices/Pet Boarding*	C-35	2
Welding Shops	C-36	3

Industrial

Type	Contamination Type ID Code	Contamination Value**
Asphalt/ Cement/ Concrete Plants	I-1	2
Chemical Plant	I-2	3
Electric Substations	I-3	2
Electronic Manufacturing	I-4	3
Foundries and Metal Fabricators	I-5	3
Gravel Pits and Quarries	I-6	2
Historic Hazardous Material Site	I-7	3
Machine/ Metalworking shops	I-8	3
Metal Finishing/Plating	I-9	3
Military Base	I-10	3
Mine Wastes (Gob piles/ Tailings)	I-11	3
Mines: Abandoned	I-12	3
Mining: Surface/ Strip mines	I-13	3
Mining: Underground	I-14	3
Oil and Natural Gas Wells	I-15	3
Other Industrial Sources	I-16	3
Petroleum Product Production, Transport, and Storage Companies	I-17	3
Plastics/ Synthetics Producers	I-18	3
Power Plants	I-19	3
Wood Preserving/ Treating	I-20	2
Wood/Paper/ Pulp Mills	I-21	3
Distillery	I-22	3

Municipal

Type	Contamination Type ID Code	Contamination Value**
Bridges and Culverts	M-1	3
Composting/ Yard Waste Facility	M-2	2
Drinking Water Treatment Plants	M-3	2
Garages (Municipal)	M-4	2
Groundwater Recharge Ponds	M-5	2
Lift Stations	M-6	2
Major Roadways	M-7	3
Municipal Sewer Lines	M-8	2
Chemically Managed Utilities Corridors and Green Spaces	M-9	2
Other Municipal Sources	M-10	3
Salt Storage Areas	M-11	2
Schools	M-12	1
Storm Water Basins	M-13	3
Wastewater Application	M-14	3
Wastewater Treatment Plant*	M-15	2
Wastewater Lagoon	M-16	3

Residential

Type	Contamination Type ID Code	Contamination Value**
Aboveground Storage Tank	R-1	2
Mobile Home Park/ Campground	R-2	2
Other Residential	R-3	2
Residential Septic*	R-4	2
Chemically Managed Green Space (Fertilizer/Pesticides)	R-5	2

Waste Management

Type	Contamination Type ID Code	Contamination Value**
Abandoned Dumps	W-1	3
Unknown Status Landfills	W-2	3
Recycling Facilities	W-3	3
Hazardous Wastes Landfills	W-4	3
Inactive/ Closed Landfills	W-5	2

Industrial Landfills	W-6	3
Municipal Landfills	W-7	3
Other Waste Disposal Sources	W-8	3
Radioactive Waste Disposal	W-9	3
Residual Waste Landfills	W-10	3
Biosolid Application*	W-11	3

Groundwater Conveyance

Type	Contamination Type ID Code	Contamination Value**
Agricultural Wells	G-1	3
Class I UIC Wells	G-2	3
Class II UIC Wells	G-3	2
Class III UIC Wells	G-4	2
Class IV UIC Wells	G-5	3
Class V UIC Wells (including large capacity septic systems)	G-6	2
Domestic Wells	G-7	2
Industrial Wells	G-8	3
Municipal Wells (PWS)	G-9	1
Other Wells	G-10	3
Springs	G-11	1

APPENDIX D:

Contaminant Source Inventory, Susceptibility Ranking Table, and Map

Susceptibility Ranking Methodology:

The following factors were used in establishing a "Susceptibility Ranking" for the intake: **(1) Contaminant Value** and contaminant characteristics; **(2) Proximity** of the potential source of contamination to the intake or well; and **(3) Likelihood of Release** for the contaminant source (for surface water sources only).

The Proximity Ranking: based on the SWPA in which the contaminant is located (SWPA 1=3; SWPA 2=2; SWPA 3=1).

Contaminant Value: 1-3 scale. This value is based upon its potential threat to human health; consult the Contaminant Source Types and KSWAPP guidance for more information.

Likelihood of Release: 1-3 scale. Regulatory compliance history and the implementation of best management practices (BMP) at potential contaminant sources may indicate the likelihood of release of a contaminant from a particular facility. A facility that is in compliance with regulatory programs and implements best management practices, such as those in a groundwater protection plans, agriculture water quality plans, storm water BMP plans, and hazardous waste contingency plans may be considered less likely to release a contaminant that can reach the water source.

Numeric Rating = (Proximity Value x 2)+(Contaminant Value x 3)+(Likelihood of Release Value)

Susceptibility Ranking: Numeric Rating less than 10 = Low; 10-15 = Medium; greater than 15 = High.

Contaminant Source Inventory and Susceptibility Analysis for

PWS Name (PWSID #)

CSI Map ID #	Site ID	Contaminant Source Type	CS CODE	Name	Address	Lat	Lon	Quantity	Zone	Proximity Value	Contaminant Value	Likelihood of Release	Numeric Rating	Susceptibility Ranking	Contaminant Notes
1															
2															

CSI Totals	Low	0
	Med	0
	High	0

Overall Susceptibility Ranking (Low, Med, High)	

(See the form "SWPP CSI ranking table" for directions and tables that calculate the Susceptibility Ranking automatically)

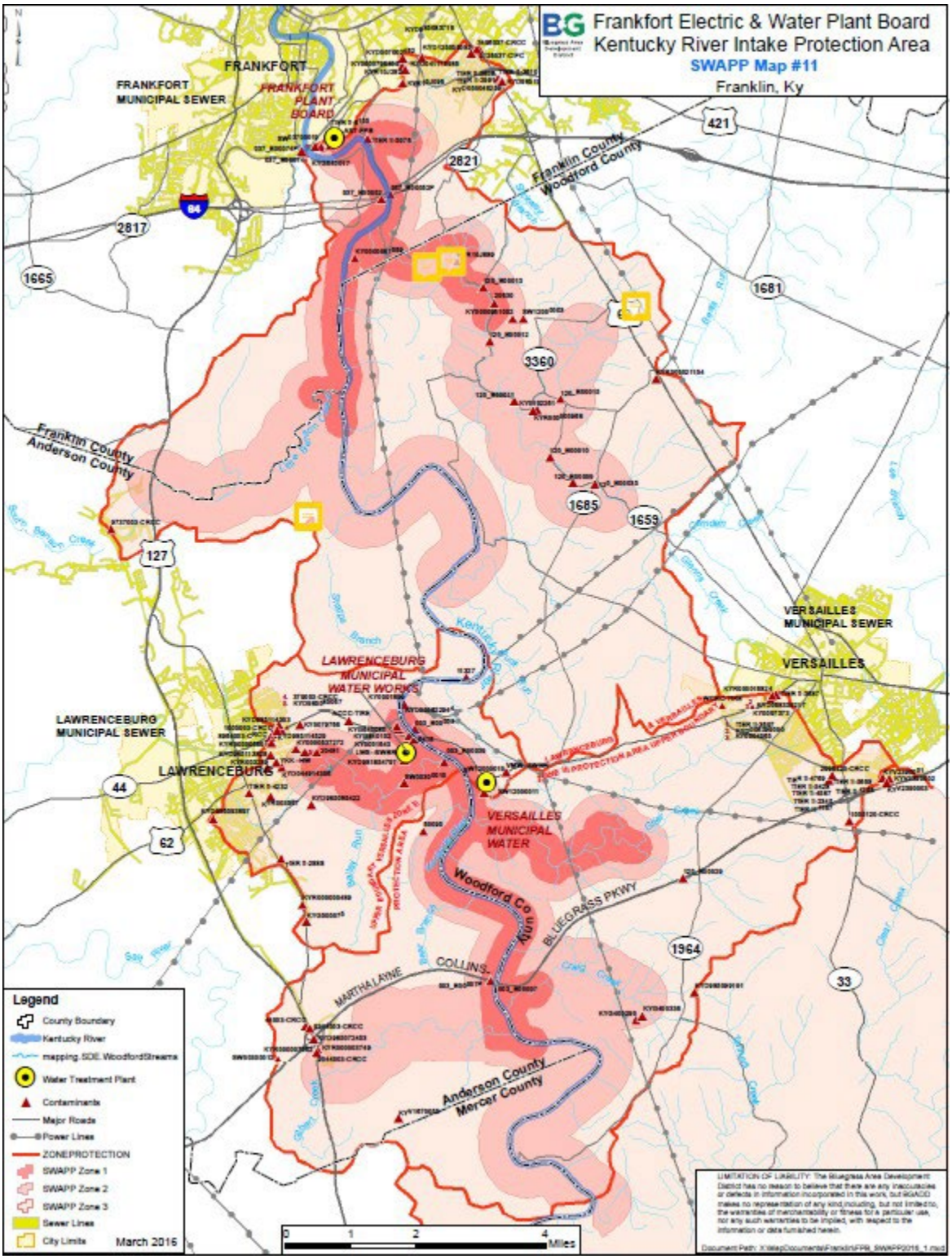


Figure 3. EXAMPLE: Locations of Potential Contaminants Franklin Plant Board.

APPENDIX E:

Public Participation Documentation

APPENDIX C

Susceptibility Analysis Narrative Template for Wellhead Plans

APPENDIX C: Susceptibility Analysis Narrative Template for Wellhead Protection Plans

For most up to date forms visit the EEC Source Water Protection website.

KENTUCKY DIVISION OF WATER
WELLHEAD PROTECTION PLAN
UPDATE FORM

Update Requirements:

This form should be used for updates to system Source Water Assessment and Protection Plans (SWAPPs). Please sign completed form and send to:

Kentucky Division of Water
Watershed Management Branch
Attention: Dale Booth
300 Sower Boulevard, 3rd Floor
Frankfort, Kentucky 40601 or dale.booth@ky.gov

For assistance, contact Dale Booth at (502) 782-6895 or dale.booth@ky.gov

Form Sections: Checklist

I. Wellhead Protection Area (WHPA) General Discussion

- ☐ System Information

II. Wellhead Protection Plan Updates

- ☐ Treatment Plant Updates
- ☐ Water Withdrawal and Water Quality
- ☐ Change or Modification to Groundwater Source
- ☐ Planning Team
- ☐ WHPA Delineation
- ☐ WHPA Map
- ☐ Contaminant Source Inventory

III. Protection Measures

- ☐ Management Strategies
- ☐ Security of Access

IV. Emergency Response

- ☐ Emergency Measures and Contact List
- ☐ Potential Future Problems
- ☐ Alternative Water Supply

V. Public Involvement

- ☐ Public Notice Documentation

Wellhead Protection Plan
Susceptibility Analysis and Recommendations for
[PWS NAME]

VII. Wellhead Protection Area (WHPA) General Discussion

A. System Information:

PWS Name: Click here to enter text.

PWS ID Number: Click here to enter text. AI Number: Click here to enter text.

Contact Person/Title: Click here to enter text.

Mailing Address: Click here to enter text.

Telephone: Click here to enter text. Email: Click here to enter text.

System Type*: Click here to enter text.
*Community; Non-Transient/Non-Community; Transient/Non-Community

Source*: Click here to enter text. *Well(s) or Spring(s) and total number of each

AKGWA #(s): Click here to enter text.

County: Click here to enter text. ADD: Click here to enter text.

WWD Permit #: Click here to enter text. Permitted Amount (mgd): Click here to enter text.

Population Served: Click here to enter text.

B. Wellhead Protection Plan Changes:

Briefly summarize any changes to the Wellhead Protection Plan (WHPP) in this update.

Click to insert text

Update Form Instructions:

Please complete each section that applies to any system or WHPP updates and submit the supporting documentation. Please indicate if a section is not applicable to this update. **Sections 4 and 6 through 11 are required for every 5-year update**.

Please sign certification on the last page upon completion.

Section Updates:

Section 1: Treatment Plant

If the treatment plant location has changed then provide a new location map below. This can be a county roadmap or a GIS-produced map. Please use the area below to provide relevant details, or to indicate that no change has occurred.

Click here to enter text.

Section 2: Water Withdrawal and Water Quality

If there have been changes in water withdrawal rates or water quality since the last submittal, provide a discussion of the relevant details in the space below (include new Water Withdrawal Permit Number if applicable). Include supporting documentation as an attachment.

Click here to enter text.

Section 3: Change or Modification to Groundwater Source

If the system has changed or modified the wells or springs being used, provide the following: 1) a description of changes/modifications; 2) copies of the relevant form(s) (Kentucky Water Well Record, Well Maintenance & Plugging Record, Well Inspection Form or Spring Inventory Record); and 3) any other information relating to well construction (i.e., installation logs, driller's logs, lithological or geophysical logs), below.

Click here to enter text.

Section 4 (REQUIRED): Planning Team

Effective water supply protection requires community involvement and public awareness. Identify the planning team consisting of a leader and at least two team members, with their respective titles, below.

Leader:

Click here to enter members with titles.

Team Members:

Click here to enter members with titles.

Section 5: WHPA Delineation

If the system is revising a Wellhead Protection Area (WHPA) delineation, or if a new groundwater source has been added since the last submittal, provide a site-specific description of the local geology and aquifer. Include references for published literature. Provide a summary of any aquifer tests (i.e. pumping tests, slug tests, tracer tests), including data gathering and evaluation methods. Show calculations and supporting data for each WHPA delineated or revised. Include the detailed hydrogeologic report as an attachment.

Click here to enter text.

Section 6 (REQUIRED): WHPA Map

Provide a WHPA map that shows each groundwater source labeled with the appropriate AKGWA #, all protection zones identified and the Contaminant Source Inventory (CSI) point locations. If no changes have occurred since the last submittal, then a copy of the most recent WHPA/CSI map can be resubmitted. To view the most recent delineations for your system, please visit the Source Water Protection Viewer. Please contact program staff for assistance.

Click here to enter text.

Section 7 (REQUIRED): Contaminant Source Inventory

Provide an updated CSI in table format. This can be created using the spreadsheet template provided, and copied into the space below. If no changes occurred since the last update, the table can be pulled from previous WHPP documents. Each contaminant source listed should have a Contaminant Source ID # that corresponds to the WHPA map in Section 6. The CSI table must show the susceptibility determination ranking for each contaminant source. Include a brief narrative discussion of the overall system susceptibility. For more information on potential sources of contamination, please visit the DOW's Web Tools for SWP Planning website. Please contact program staff for assistance.

Click here to enter text.

Section 8 (REQUIRED): Management Strategies

Provide a discussion of the previous and newly proposed management strategies to prevent source water contamination. This discussion must include the previous management strategies that were implemented as well as the goals that were met. Next, include any NEWLY proposed management strategies, associated goals, implementation plans and the party responsible for implementation. For information about wellhead protection strategies please visit the DOW's Source Water Protection Strategies website.

Previous Management Strategy Update:

Click here to enter text.

Newly Proposed Management Strategies:

Click here to enter text.

Section 9 (REQUIRED): Contingency and WHP Planning

Provide a description of Contingency and WHP Planning. Complete the Emergency Response Phone List, Procedures for Public Notification, identification of Potential Future Problems and the procedures to establish Alternative Water Supplies. This section must also address how often the WHPP will be reviewed and updated.

Emergency Response Phone List

Fill in all Blanks and Phone Numbers with appropriate information.

Local Emergency Response	Phone Number
Plant Operator	PHONE NUMBER
Nearest fire department.	PHONE NUMBER
Nearest city police or law enforcement	PHONE NUMBER
COUNTY	PHONE NUMBER
Local Emergency Dispatch Click here to enter text.	PHONE NUMBER

State and Federal Assistance	Phone Number
Kentucky DOW (Frankfort)	PHONE NUMBER
Kentucky DOW Associated Field Office (FO) ENTER FO NAME	PHONE NUMBER
Kentucky Environmental Response Team 24 hour response line	(502) 564-2380 (800) 928-2380
Kentucky State Fire Marshall	(502) 573-0382

Any Other Pertinent Contacts	Any Other Pertinent Numbers
Click here to enter text.	PHONE NUMBER
Click here to enter text.	PHONE NUMBER
Click here to enter text.	PHONE NUMBER

Procedures for Public Notification:

In the event of a water system emergency that would threaten the health or life of the public, use the following procedure. Prepare and broadcast an advisory, including directions for the public. Describe the public notification process and provide contacts for those media outlets. If the system uses methods other than traditional media please list them.

Click here to enter text.

Newspaper, Television, and Radio Stations	Phone Numbers
Click here to enter text.	PHONE NUMBER
Click here to enter text.	PHONE NUMBER

Potential Future Problems:

Describe the *most likely* scenarios that could threaten the water supply.

Click here to enter text.

Alternative Water Supply (Short and Long Term):

Describe the short term and long-term water supply alternatives that address each of the potential future problems identified above. List all current interconnections with other water systems. Discuss the capacity of each potential alternative water supply to sustain normal operations.

Click here to enter text.

Schedule for Update and Review:

The Wellhead Protection Plan will be reviewed regularly and updated every five years as required by regulation.

Section 10 (REQUIRED): Copies of Public Notices and Education Materials

Provide copies of wellhead protection public notices and education materials distributed.

Click here to enter text.

Section 11 (REQUIRED): Public Meeting Documentation***

Provide the record of WHPP public meeting attendance, minutes and comments.

Click here to enter text.

***Non-Community Water Systems are not required to have public meetings for 5-year updates, but must post a public notice in a conspicuous place. A public notice template is provided as a separate document. However, public input and associated documentation are encouraged. Please contact program staff if you have any questions.

Certification Signature (TO BE COMPLETED BY PLANNING REPRESENTATIVE):

"I certify that this document and all attachments were prepared under my direction or supervision. The information submitted is, to the best of my knowledge and belief, true, accurate, and complete."

Signature:_____ **Date:** Click here to enter text.

Printed Name/Title: Click here to enter text.

Assistance:

For any assistance, please contact Wellhead Protection Staff:

Dale Booth
(502) 782-6895
Dale.Booth@ky.gov

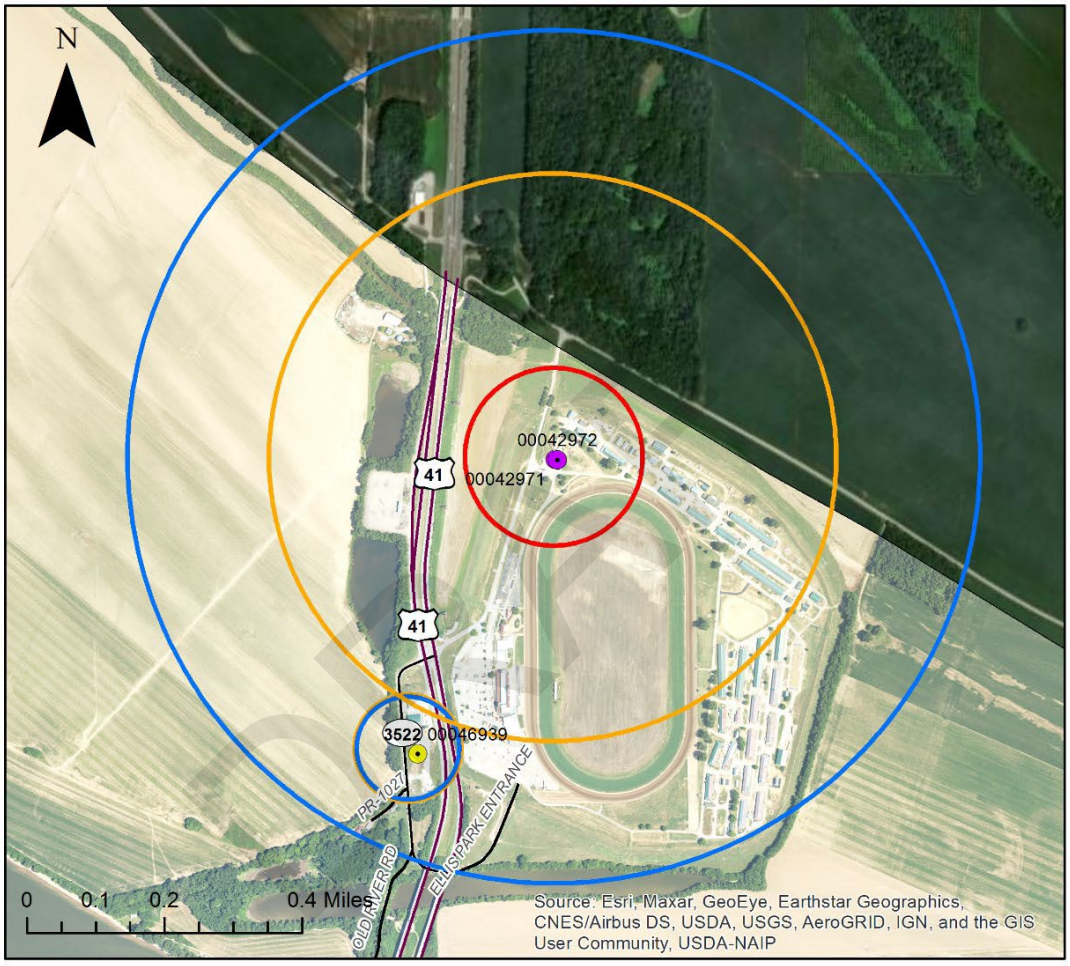
Allan Shingleton
(502) 782-6907
Allan.Shingleton@ky.gov

Please sign and return completed form to:

Kentucky Division of Water
Watershed Management Branch
Attention: Dale Booth
300 Sower Boulevard, 3rd Floor
Frankfort, Kentucky 40601
or Dale.Booth@ky.gov

APPENDIX A:

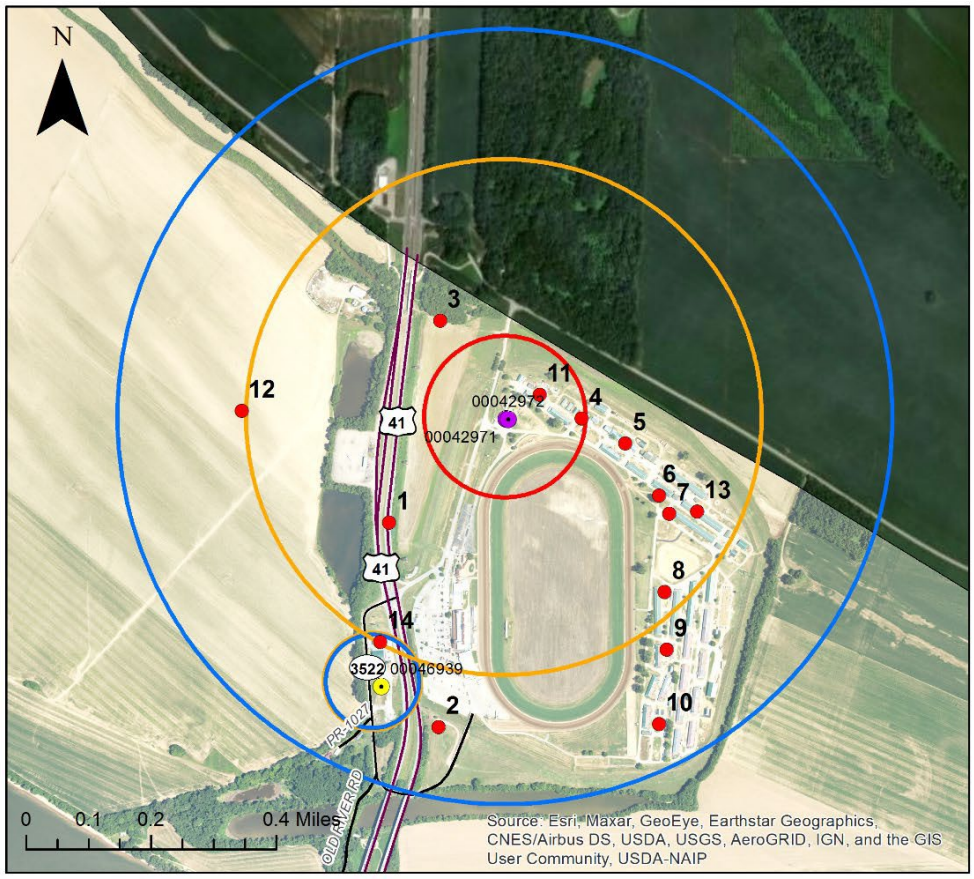
WHPA Delineation and Well Locations for [System Name]



(Example Map)

APPENDIX B:

Contaminant Source Inventory Map



Potential Contaminant Sources

Water Wells (PWS)

Trocadero Plaza Well

Wellhead Protection Zones

Zone 1: 180 Day time of travel for potential contaminant

Zone 2: 10 year time of travel

Zone 3: Hydrologic Boundary

(Example Map)

Contaminant Source Inventory and Susceptibility Analysis for

[INSERT WATER SYSTEM NAME AND PWSID#]

Instructions (section may be deleted on submission):

Use the following table to list and rank potential contaminants identified during the contaminant source inventory.

Include Lat/Lon or addresses when possible. Enter the WHPA in which the contaminant occurs.

Multiple, similar sources that are clustered can be listed once with the Quantity identified.

The Proximity Ranking is based on the WHPA in which the contaminant is located (WHPA 1=3; WHPA 2=2; WHPA 3=1).

Contaminant Value is on a 1-3 scale, based upon its potential threat; consult the Contaminant Source Types Values guide.

Hydrologic Sensitivity: The physical, chemical, geological, hydrological, and biological characteristics of the area over which, or through which, the contaminants move to the aquifer have various capabilities to detain or attenuate contaminant releases. Consult the Hydrologic Sensitivity tab.

The spreadsheet will use the values entered to calculate the Numeric Rating for each contaminant source.

- Numeric Rating = (Proximity Value x 2)+(Contaminant Value x 3) + (Hydrologic Sensitivity Value)

This will determine the Susceptibility Ranking: Numeric Rating less than 10 = Low; 10-15 = Medium; greater than 15 = High.

Please contact SWP/WHPP staff if you have any questions.

Contact:

Dale Booth; Dale.booth@ky.gov; 502-782-6895
Ryan Parks; Ryan.parks@ky.gov; 502-7824039

CSI Map ID #	Site ID	Contaminant Source Type	CS CODE	Name	Address	Lat	Lon	Quantity	Zone	Proximity Value	Contaminant Value	Hydrologic Sensitivity	Numeric Rating	Susceptibility Ranking	Contaminant Notes
1	*Example 1*	*Agricultural Well*	*G-1*	*Residence - Frank Crain*		*37.701*	*-85.9*	*1*	*1*	*3*	*3*	*3*	*18*	*HIGH*	*Agriculture*
2															
3															
4															
5															

CSI Totals		
	Low	
	Med	
	High	

Overall Susceptibility Ranking	

Click here for a CSI Form in Excel Format with self-calculating Numeric Rating and Susceptibility Ranking

APPENDIX C:

Potential Contaminant Source Types

Potential Contaminant Source Types List:

Contaminant sources may have more than one potential associated contaminant. For example, it is assumed that most agricultural sources will generate fertilizer, pesticide, and sediment, and they need not be called out individually. Note this list is not exhaustive. For sources not specifically found here, "Other" categories exist for all source groups (commercial, industrial, agricultural, municipal, waste management, groundwater conveyance, and residential)

* Indicates potential pathogen source

** Contamination Value should be treated as a recommendation. If there is information that suggests that site warrants a higher or lower value, such as a history of violations or use of BMPs, it is at the discretion of the plans author to adjust the value. For more information, refer to KSWAPP Guidance.

Agricultural

Type	Contamination Type ID Code	Contamination Value**
Animal Burial/ Composting Sites*	A-1	3
Animal Feedlots*	A-2	2
Animal Waste Storage/ Disposal*	A-3	3
Confined Animal Feedlots (CAFOs)*	A-4	3
Row Crops: Corn, Soybean, Wheat	A-5	3
Crops: Orchards	A-6	3
Crops: Other	A-7	3
Dairy Facility*	A-8	3
Drainage Canals/ Tiles	A-9	2
Farm Chemical Distributor	A-10	2
Farm Machinery Repair Areas	A-11	3
Greenhouses/ Nurseries	A-12	3
Other Agricultural Sources	A-13	3
Pasture/Hay (Livestock)*	A-14	3
Pesticide/ Fertilizer/ Petroleum Storage & Transfer Areas	A-15	3
Silage Storage (Bulk)	A-16	2
Silviculture (Logging)	A-17	3
Stockyards*	A-18	3
Poultry*	A-19	3
Land Application of Manure*	A-20	3

Commercial

Type	Contamination Type ID Code	Contamination Value**
Airport/ Heliport/ Abandoned Airfield	C-1	3
Auto Repair Shops/ Body Shops	C-2	3
Barber and Beauty Shops	C-3	1
Boat Services/ Repair/ Refinishing	C-4	3
Car Washes	C-5	2
Car/ Boat/ Camper Dealerships	C-6	3
Carpet/ Tile Stores	C-7	2
Cemeteries*	C-8	2
Churches	C-9	2
Dry Cleaners	C-10	3
Equipment Rental/ Repair Shops	C-11	2
Fleet/ Truck/ Bus Terminals	C-12	3
Food Processing	C-13	2
Funeral Services/ Crematories	C-14	2
Furniture Repair/ Finishing/ Manufacturing Shops	C-15	3
Gas stations (existing & abandoned/ historic)	C-16	3
Golf Courses	C-17	2
Grocery/ Department Stores	C-18	2
Hardware/ Lumber/ Parts stores	C-19	2
Heating Oil Companies	C-20	3
Hospitals*	C-21	2
Junk Yards (Scrap and Auto)	C-22	3
Laundromats	C-23	2
Lawn/ Farm Stores	C-24	3
Marina/ Boat Docks	C-25	3
Medical/ Dental Offices/ Clinics*	C-26	2
Other Commercial Sources	C-27	3
Paint Stores	C-28	2
Pest Control Companies	C-29	3
Pharmacy	C-30	2
Print Shops/ Photo Shops	C-31	2
Railroad Lines	C-32	3

Railroad Yards/ Maintenance	C-33	3
Research Laboratories	C-34	2
Veterinary Offices/Pet Boarding*	C-35	2
Welding Shops	C-36	3

Industrial

Type	Contamination Type ID Code	Contamination Value**
Asphalt/ Cement/ Concrete Plants	I-1	2
Chemical Plant	I-2	3
Electric Substations	I-3	2
Electronic Manufacturing	I-4	3
Foundries and Metal Fabricators	I-5	3
Gravel Pits and Quarries	I-6	2
Historic Hazardous Material Site	I-7	3
Machine/ Metalworking shops	I-8	3
Metal Finishing/Plating	I-9	3
Military Base	I-10	3
Mine Wastes (Gob piles/ Tailings)	I-11	3
Mines: Abandoned	I-12	3
Mining: Surface/ Strip mines	I-13	3
Mining: Underground	I-14	3
Oil and Natural Gas Wells	I-15	3
Other Industrial Sources	I-16	3
Petroleum Product Production, Transport, and Storage Companies	I-17	3
Plastics/ Synthetics Producers	I-18	3
Power Plants	I-19	3
Wood Preserving/ Treating	I-20	2
Wood/Paper/ Pulp Mills	I-21	3
Distillery	I-22	3

Municipal

Type	Contamination Type ID Code	Contamination Value**
Bridges and Culverts	M-1	3
Composting/ Yard Waste Facility	M-2	2
Drinking Water Treatment Plants	M-3	2
Garages (Municipal)	M-4	2
Groundwater Recharge Ponds	M-5	2
Lift Stations	M-6	2
Major Roadways	M-7	3
Municipal Sewer Lines	M-8	2
Chemically Managed Utilities Corridors and Green Spaces	M-9	2
Other Municipal Sources	M-10	3
Salt Storage Areas	M-11	2
Schools	M-12	1
Storm Water Basins	M-13	3
Wastewater Application	M-14	3
Wastewater Treatment Plant*	M-15	2

Residential

Type	Contamination Type ID Code	Contamination Value**
Aboveground Storage Tank	R-1	2
Mobile Home Park/ Campground	R-2	2
Other Residential	R-3	2
Residential Septic*	R-4	2
Chemically Managed Green Space (Fertilizer/Pesticides)	R-5	2

Waste Management

Type	Contamination Type ID Code	Contamination Value**
Abandoned Dumps	W-1	3
Unknown Status Landfills	W-2	3
Recycling Facilities	W-3	3
Hazardous Wastes Landfills	W-4	3
Inactive/ Closed Landfills	W-5	2
Industrial Landfills	W-6	3

Municipal Landfills	W-7	3
Other Waste Disposal Sources	W-8	3
Radioactive Waste Disposal	W-9	3
Residual Waste Landfills	W-10	3
Biosolid Application*	W-11	3

Groundwater Conveyance

Type	Contamination Type ID Code	Contamination Value**
Agricultural Wells	G-1	3
Class I UIC Wells	G-2	3
Class II UIC Wells	G-3	2
Class III UIC Wells	G-4	2
Class IV UIC Wells	G-5	3
Class V UIC Wells (including large capacity septic systems)	G-6	2
Domestic Wells	G-7	2
Industrial Wells	G-8	3
Municipal Wells (PWS)	G-9	1
Other Wells	G-10	3
Springs	G-11	1

APPENDIX D:

Susceptibility Calculations

Susceptibility Ranking Methodology:

The following factors were used in establishing a "Susceptibility Ranking" for the intake: **(1) Contaminant Value** and contaminant characteristics; **(2) Proximity** of the potential source of contamination to the intake or well; and **(3) Hydrologic Sensitivity** for the contaminant source (for surface water sources only).

The Proximity Ranking: based on the SWPA in which the contaminant is located (SWPA 1=3; SWPA 2=2; SWPA 3=1).

Contaminant Value: 1-3 scale. This value is based upon its potential threat to human health; consult the Contaminant Source Types and KSWAPP guidance for more information.

Hydrologic Sensitivity: The sensitivity ranking of an region is defined as the ease and speed with which a contaminant can move into and within groundwater. The major factors that control this sensitivity are recharge to the system and flow rate and dispersion potential within the system. This factor is only used in the calculation of susceptibility for groundwater sources. This value is measured on a scale of 1-5 from lowest to highest sensitivity, respectively. The map below shows the Hydrologic sensitivity ratings for Kentucky. In the calculation for overall system susceptibility the value is not weighted. For access to the GIS data associated with these sensitivity regions in Kentucky you may download the data from Kentucky Geological Survey (http://www.uky.edu/KGS/gis/sensitivity.htm).

Numeric Ranking:

Numeric Rating = (Proximity Value x 2)+(Contaminant Value x 3)+(Hydrologic Sensitivity Value)

Susceptibility Ranking: Numeric Rating less than 10 = Low; 10-15 = Medium; greater than 15 = High.

APPENDIX E:

Public Participation Documentation

Include any Public notice documentation. This may include flyers (with location of posting indicated), Notices in the local newspaper, or posting to a website and sharing the link through customer billing or mailings. See the Public Notice Fact Sheet for more information.

APPENDIX D: References

American Rivers Foundation (ARF); the Forest Guild; Mountain Conservation Trust of Georgia. 2013. **Protecting Upstream Forests for Clean Water Downstream, A Guide for Etowah River Communities, Water Providers and Forest Landowners**. Available online at: https://www.americanrivers.org/wp-content/uploads/2016/05/AmericanRivers_forests-to-faucets-report.pdf

AWWA. 2018. **Sourcewater Protection Justification Toolkit.** Available online at: https://www.awwa.org/wp-content/uploads/Source-Water-Protection-Toolkit.pdf

Commonwealth of Kentucky Source Water Assessment and Protection Program (KSWAPP).1997. Kentucky Department for Environmental Protection, Division of Water, Frankfort.
Kentucky Wellhead Protection Program October 1, 1996. 1996. Kentucky Department for Environmental Protection, Division of Water, Frankfort.

Ray, J. R., Webb, J.S., O'dell, P. W., 1994. **Groundwater Sensitivity Regions of Kentucky**. Kentucky Department for Environmental Protection, Division of Water, Groundwater Branch, Frankfort.

Meradji, S., Basher, N. S., Sassi, A., Ibrahim, N. A. 2025. **The Role of Water as a Reservoir for Antibiotic-Resistant Bacteria.** Antibiotics 2025, 14, 763. Available online at: https://www.mdpi.com/2079-6382/14/8/763

Postel, S. L.; Thompson Jr., B. H. 2005. **Watershed protection: Capturing the benefits of nature's water supply services.** Natural Resources Forum 29 (2005) 98–108. Available online at: http://198.235.134.122:8080/bitstream/handle/123456789/106/Postel%26Thompson_WatershedProtection_2005.pdf?sequence=1

Price, J. I., Heberling, M. T., Nietch, C. T. 2018. **Economic Support for Decisions on Source Water Protection.** J Am Water Works Assoc. 2018. 110(9): 56–61. doi:10.1002/awwa.1153.

Unrine, J. M., McCoy, N., Christian, W. J., Gautam, Y., Ormsbee, L., Sanderson, W., Draper, R., Mooney, M., Cromer, M., Pennell, K., Hoover, A. G. 2024. S**patial and seasonal variation in disinfection byproducts concentrations in a rural public drinking water system: A case study of Martin County, Kentucky, USA.** PLOS Water 3(3): e0000227. https://doi.org/10.1371/journal.pwat.0000227

US Environmental Protection Agency. 2012. **The Economic Benefits of Protecting Healthy Watersheds**. EPA 841-N-12-004. Available online at: https://www.epa.gov/sites/default/files/2015-10/documents/economic_benefits_factsheet3.pdf

US Environmental Protection Agency. 2014. E**nhancing Sustainable Communities with Green Infrastructure.** EPA 100-R-12-006. Available online at: https://www.epa.gov/system/files/documents/2024-03/green-infrastructure.pdf

World Resources Institute. 2013. Gartner, T., Mulligan, J., Schmidt, R., and J. Gunn (Eds.). **Natural Infrastructure: Investing in Forested Landscapes for Source Water Protection in the United States.** Available on-line at: https://wriorg.s3.amazonaws.com/s3fs-public/wri13_report_4c_naturalinfrastructure_v2.pdf