Springfield – Greene County, Mo

Integrated Plan for the Environment

INTEGRATED PLAN FOR THE ENVIRONMENT
ENVIRONMENTAL PRIORITIES TASK FORCE REPORT

FINAL DOCUMENT

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Task Force Facilitation & Report Preparation

By

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Introduction

The citizens of the Springfield-Greene County region recognize the importance of environmental stewardship and are widely recognized as a model community in this regard. Quality environmental resources are especially important to the Ozarks since much of our economic development, tourism, and overall quality of life is directly tied into the quality of our air, water, and land.

> *We cannot afford to ignore our Natural Environment. It provides us with a large portion of our economy, the food we eat, the water we drink, and the air we breathe. History is littered with glittering civilizations that ignored their environment and perished. Our region will prosper if we preserve our natural assets for ourselves and our children.*
>
> *Field Guide 2030 – A Strategic Plan to Springfield's Future*

Like many others across the nation, our community is addressing the challenge of increasingly stringent environmental regulations from every front. From stormwater and wastewater to air quality and drinking water, as regulations continue to evolve, our community is required to devote more money and resources to comply. This is a huge issue for communities who are struggling to meet these regulations with limited resources. The Environmental Protection Agency (EPA) realizes the struggle for communities and in June of 2012, released its "Integrated Municipal Stormwater and Wastewater Planning Approach Framework." This plan emphasized a commitment to work with states and communities to implement an integrated planning approach to address environmental objectives. The goal of the integrated planning process is to identify better ways to meet the regulatory requirements in a financially sustainable way.

In response to this opportunity, leaders from the City of Springfield, Greene County and City Utilities developed a local approach to integrated planning titled "A Citizen Focused Approach." This holistic approach proposes to use local knowledge to examine our environmental resources related to wastewater and stormwater as well as solid waste, drinking water, and air quality. The planning approach has received written approval from both the Missouri Department of Natural Resources (MDNR) and EPA Region 7. The Springfield – Greene County community is working hard to implement an Integrated Plan that will ensure our natural resources are protected in a manner that is affordable to our community.

Background

Why Do We Need an Integrated Plan?

Throughout the history of our society, we've made some good and bad choices that have impacted our environmental resources. Public sanitation and solid waste disposal have had an enormous positive impact on public health. However, some of our earlier waste disposal methods caused some significant degradation of the environment. As population densities increased and environmental issues became more prevalent, action was needed. In the early to mid-1970s, several pieces of federal legislation, including the Clean Water Act, Clean Air Act, and the Resource Conservation and Recovery Act (RCRA) were signed into law. Since that time, a great deal of progress has been made toward the restoration and ongoing protection of our natural resources. However, we believe that the time has come to take a step back and reevaluate how our community addresses these regulations.

The Problem

The regulatory activities of the last four decades have produced some huge improvements in our environmental resources, but the path we've taken has resulted in a siloed approach within the regulatory agencies as well as the individual communities. We know that many of our wastewater, stormwater, solid waste, and air quality issues are interrelated, but they are often addressed through different regulatory departments and under different pieces of legislation.

On the other hand, the money and resources needed to fund each of these regulatory initiatives comes from the same source. Whether in the form of utility bills, taxes, or fees; it is the citizens of our community that pay the cost of compliance. As more funding is needed to meet ever-increasing regulations, there is a very real chance that our community will find itself struggling to comply. Without looking at the big picture, there is also a risk that we will have devoted significant resources to certain regulatory drivers only to find that we were not addressing the community's most pressing environmental issues.

The Solution

We shouldn't fund environmental regulations on a "first come-first served" basis. Our Integrated Plan will take a holistic look at each of our environmental needs and prioritize our investments based on **the most effective solutions…to address the most pressing problems…that matter most to our community.** By looking at the big picture of environmental compliance, we can provide the greatest environmental benefit in a manner that is affordable to our citizens.

How Did We Get Here?

In June of 2012, EPA released its "Integrated Municipal Stormwater and Wastewater Planning Approach Framework" which emphasized a commitment to work with states and communities to implement an integrated planning approach to address environmental objectives. The intention of this process is presented well on EPA's website:

> *"An integrated planning process has the potential to identify a prioritized critical path to achieving the water quality objectives of the CWA [Clean Water Act] by identifying efficiencies in implementing competing requirements that arise from separate wastewater and stormwater projects, including capital investments and operation and maintenance requirements. This approach can also lead to more sustainable and comprehensive solutions, such as green infrastructure, that improves water quality as well as supports other quality of life attributes that enhance the vitality of communities. The CWA and implementing regulations, policy and guidance provide the necessary flexibility to implement an integrated planning process. …it is intended to be an option provided to help municipalities meet their CWA obligations by optimizing the benefits of their infrastructure improvement investments through the appropriate sequencing of work."*

According to this framework, integrated plans should include the following six elements:

Element 1: A description of the water quality, human health and regulatory issues to be addressed.

Element 2: A description of existing wastewater and stormwater systems under consideration and summary information describing the systems' current performance.

Element 3: A process which opens and maintains channels of communication with relevant community stakeholders in order to give full consideration of the views of others in the planning process and during implementation of the plan.

Element 4: A process for identifying, evaluating, and selecting alternatives and proposing implementation schedules.

Element 5: A process for evaluating the performance of projects identified in a plan.

Element 6: An adaptive management process for making improvements to the plan.

In response to this opportunity, leaders from the City of Springfield, Greene County and City Utilities developed a local approach to integrated planning titled "A Citizen Focused Approach". At the heart of this proposal are six guiding principles:

- Affordability – Ensure that the plan is affordable to the community's citizens.

- Effectiveness – Ensure that the plan addresses environmental issues in a manner whereby citizens receive the "biggest bang for their buck." Recognize that every community is unique, and ensure each community gets an opportunity to address the environmental needs that are greatest in their community.

- Fairness – Ensure that the plan results in all communities being treated equally and fairly.

- Attainability – Ensure that the plan outlines actions that can reasonably be accomplished within the "community affordability" limit.

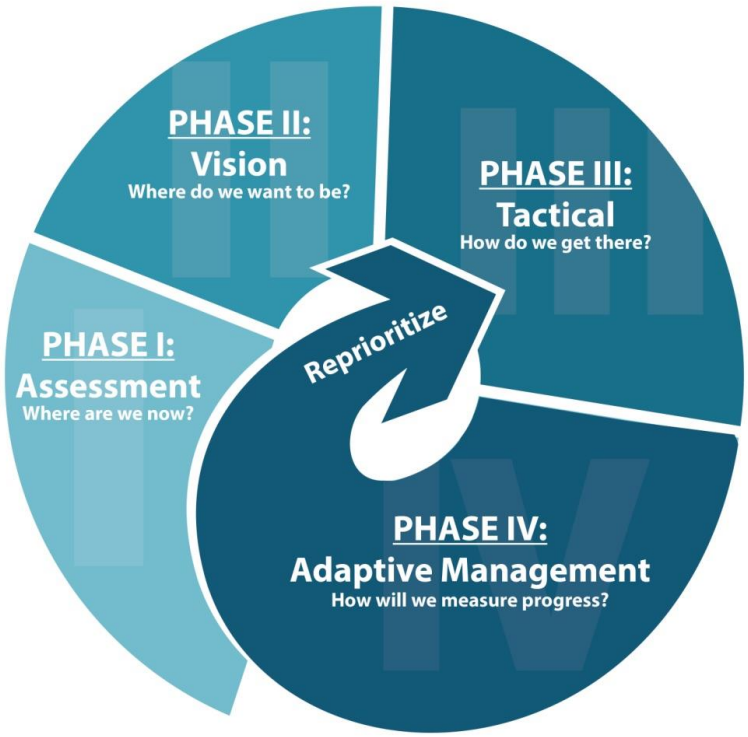
- Measurability – Ensure that the plan includes performance measures that track progress over time and indicate which projects are "best practices" that can/should be adopted or adapted by other communities, if applicable.

- Adaptability – Learning must be a part of the process moving forward. For the plan to be effective, we must be able to adjust and improve our plan based upon our experiences and results.

Furthermore, this approach proposes to develop local solutions using local expertise and community values to determine how we can best improve our environment while still making the solution affordable to our citizens. What makes the Springfield-Greene County approach unique is that it proposes to include, not only stormwater and wastewater, as the EPA guidance suggests, **but also includes resources related to solid waste, drinking water, and air quality.**

Description of the Integrated Planning Process

Implementation of the Integrated Plan will use a four-phased approach:



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PHASE I

This is the Assessment Phase and answers the question, "Where are we now?" During this phase, local stakeholder groups have been gathering data to assess the current status of our environmental resources. We realize that we can't measure success without first establishing a baseline from which to measure. One component of this phase involves creating a large, comprehensive GIS database that includes everything from stream sampling data and wastewater infrastructure to land use and geology. By using a common platform to share information, our stakeholder groups can better see how each of these environmental issues relates.

PHASE II

The second phase of our approach is our Vision Phase and answers the question, "Where do we want to be?" As a community, we have achieved success when…

- **Community resources are directed towards managing environmental issues using the most effective solutions to address the most significant problems in a way that is affordable to our citizens.**
- We are in full compliance with federal and state regulations while addressing the specific needs of our community.

- We have the ability to holistically address water, air, and solid waste issues allowing both our community and the regulators to operate more efficiently.
- We have a community culture that understands and supports the goal of high-quality environmental resources and supports these efforts through stakeholder involvement. Our community has a high level of trust that resources are being used to address environmental issues efficiently and effectively.
- Our community has a clear understanding of how funding and other resources will be used to improve environmental quality.
- Our community realizes a competitive advantage toward growth and economic development and an increase in quality of life as a consequence of this plan.
- We have identified specific goals relevant to each environmental resource (for example: we will address water quality at a watershed level).

PHASE III

Phase III is our Tactical Phase and answers the question, "How will we get there?" During this phase, stakeholder groups will prioritize our community's environmental needs based on four key elements:

1. Identify and prioritize the most significant **Sources of Pollution:**

   Using a Multiple-Criteria Decision Analysis (MCDA) toolset developed specifically for the Integrated Plan, we are able to take a structured look at how different pollutants impact the natural environment and the relative significance of each source.

2. Identify and prioritize the most **Effective Solutions.**

   Using the Sustainable Return on Investment (SROI) approach developed by HDR, Inc., our planning team will evaluate the environmental, economic, and social costs and benefits for many of the solutions considered by our community. By finding the "triple bottom line", we can ensure that the most effective solutions are being targeted toward the most serious problems.

3. Capture our **Community's Priorities**.

   Here in the Ozarks, our quality of life and economic development are tied directly with the quality of our natural resources. We realize the importance of protecting these resources and the ways in which our community is unique. A citizen based Environmental Priorities Task Force has been assembled and with input from this group, our Integrated Plan will work to define the issues that our community is focused on. By proactively addressing the issues that our citizens find important, rather than simply reacting to the latest regulation, we will build trust and support for our programs.

4. Assess our community's **Financial Capability.**

   Our community applauds the efforts that EPA has made in working with the US Council of Mayors, American Water Works Association, Water Environment Federation, and others in finding new ways to assess community affordability. With the help of a Citizen Advisory Committee, our community will make an honest assessment of financial capability and take a candid look at how community resources should be allocated toward environmental stewardship.

The essence of our Integrated Plan lies at the nexus of these four key elements. It's here that we ask the question: "If we only had one dollar to spend, what is the most effective solution we could implement…to address the most pressing problem…that matters most to our community…and would be affordable to our citizens?"

Phase IV

The fourth phase of our approach is the Adaptive Management phase. We realize that a true Integrated Plan will never be complete. As we achieve success and lean more, the target will continue to move. This phase requires that we continue to refine our analysis, check the effectiveness of our solutions, and constantly reprioritize.

Environmental Priorities Task Force

The Environmental Priorities Task Force is one of the primary ways in which the Integrated Plan hopes to capture our community's priorities (see Phase III). By incorporating community priorities as one component of our decision making process, we hope to ensure that valuable community resources are directed toward effective solutions that fix pressing problems **in areas and on problems that matter most to our citizens.** Traditionally, environmental regulations are driven by technical, political, and legal priorities. While each of these factors play a vital role, it is important to recognize that the role of citizen input on community investments is just as important.

The Environmental Priorities Task Force was empaneled to help guide decision-making regarding environmental planning for the City of Springfield, City Utilities, and Greene County, Missouri. They are a citizen's task force formed to represent community interests. The Environmental Priorities Task Force charge included the following:

1. Develop an environmental **vision statement** for the community.
2. Develop specific **goals** relevant to each environmental resource.
3. Develop **policy statements** around the existing guiding principles of the Integrated Plan.
4. Conduct their work using the *Six Guiding Principles (Taken from A Citizen Approach – Springfield's Guide to Integrated Planning Submitted to USEPA/MDNR, 2013).*
    - Affordability – Ensure that the plan is affordable to the community's citizens.
    - Effectiveness – Ensure that the plan addresses environmental issues in a manner whereby citizens receive the "biggest bang for their buck."
    - Fairness – Ensure that the plan results in all communities being treated equally and fairly.
    - Attainability – Ensure that the plan outlines actions that can reasonably be accomplished within the "community affordability" limit.
    - Measurability – Ensure that the plan includes performance measures that track progress over time and indicate which projects are "best practices" that can/should be adopted or adapted by other communities, if applicable.
    - Adaptability – Learning must be a part of the process moving forward. For the plan to be effective, we must be able to adjust and improve our plan based upon our experiences and results.
5. Define community **environmental priorities.**
6. Define method for **allocating scarce resources** to support those priorities.
7. Develop criteria to be used by staff as they prioritize the most **significant solutions** to be implemented. The criteria developed will feed the Sustainable Return on Investment (SROI) tool to be used by staff to evaluate the "triple-bottom line" costs and benefits.

Task Force members are listed in Attachment 1.

The specific "how" or action steps to achieve the outcomes and priorities will be developed later by technical staff as part of the Integrated Planning process which includes the Multiple-Criteria Decision Analysis (MCDA) matrix and the Sustainable Return on Investment (SROI) approach.

Technical Support

With such a diverse group of members, it was important to educate the Task Force on the broad spectrum of environmental issues. This education allowed the Task Force to see the big picture and further understand the complexities associated with their recommendations. To this end, the Environmental Priorities Task Force was supported by a series of focus groups made up of technical staff from the three partnering agencies as well as community subject matter experts and regulatory staff from the Department of Natural Resources. Throughout the process, members of this group met to brainstorm and discuss how to educate the Task Force on the considerable number of issues that they would be asked to consider. Over a series of several meetings, members of this group developed presentations and material to educate the Task Force on items

related to Water, Air, and Land quality as well as regulatory drivers, legal considerations and local programs. A summary of the presentations are included here:

May 27 – Environmental Issues 101: Water, Air, and Land

Speakers: Tim Smith (Greene County), Errin Kemper (City of Springfield), and Sheila Shockey (Facilitator)

June 3 – Environmental Issues 102: Water as a Resource

Speakers: Kevin Barnes (Greene County), Todd Wagner (City of Springfield), Dr. Todd Brewer (City Utilities), Tim Davis (Greene County)

June 17 – Environmental Issues 102: Air Quality Issues

Speakers: Dr. David Fraley (City Utilities)

June 24 – Environmental Issues 103: Land Resource Issues

Speakers: Olivia Hough (City of Springfield)

July 8 – Regulatory Drivers

Speakers: Jan Millington (City of Springfield)

July 15 – Water Protection Initiatives

Panelists: Carrie Lamb (City of Springfield), Tim Davis (Greene County), Dr. David Fraley (City Utilities)

September 16 – Air Quality Protection

Speakers: Barbara Lucks (City of Springfield), Daniel Hedrick (City Utilities)

November 6 – Land Protection

Panelists: Olivia Hough (City of Springfield), Erick Roberts (City of Springfield), Dr. David Fraley (City Utilities)

December 2 – Sustainable Return on Investment & Final Recommendations Document

Speakers: Trent Stober (HDR)

During each meeting, Task Force members were asked to think about **what** issues were the most important to them as well as **where** they were important. Task Force members participated in several individual and group exercises designed to provide a forum for discussion and to make the group consider their priorities. At the conclusion of each meeting, the group was asked to discuss and further refine their recommendations, many of which developed out of the group exercises they participated in.

Recommendations from the Environmental Priorities Task Force

During the process, members of the Environment Priorities Task Force were shown the big-picture issues associated with overall environmental protection and developed a new paradigm that few people have the opportunity to witness. From this, the Task Force developed a vision statement, goals, policy statements, and identified priorities to guide Springfield, Greene County, and City Utilities in their Integrated Planning work. The recommendations are listed below.

Vision Statement

A vision statement identifies what you want to do in idealistic terms. It is future-oriented and creates a vivid mental picture of where you are headed. The environmental vision for Springfield-Greene County is as follows:

> Our community is committed to clean water, air, and land through responsible stewardship of our natural and economic resources for ourselves and future generations.

Goals

Goal statements are long-term and define what you intend to do to fulfill the beliefs and values expressed in your vision statement. More measurable goals with targeted outcomes will be developed once more baseline environmental data is available. The environmental goals for Springfield-Greene County are listed below:

- Protect and improve human health and the environment.
- Protect our watersheds so that people can use them for drinking water supply, fishing, swimming, boating, and wading.
- Sustain the quality of the environment for future generations.
- Protect air, water, and land resources as they support high quality food production.
- Protect the environment to attract/retain business and maintain our high quality of life.
- Maintain compliance with environmental regulations.

Policy Statements

The following are the recommended environmental policies that are statements of intention to influence and guide future decision-making:

- Focus our resources on activities that result in the most benefit to the environment and our citizens. Making environmental protection investments locally will also improve the environment regionally and globally.
- Work together on a watershed/airshed basis when making plans and taking actions to protect environmental resources.
- Engage and educate the public in pollution awareness and prevention.
- Understand the sources of pollution and invest in best available technologies to solve pollution problems effectively.

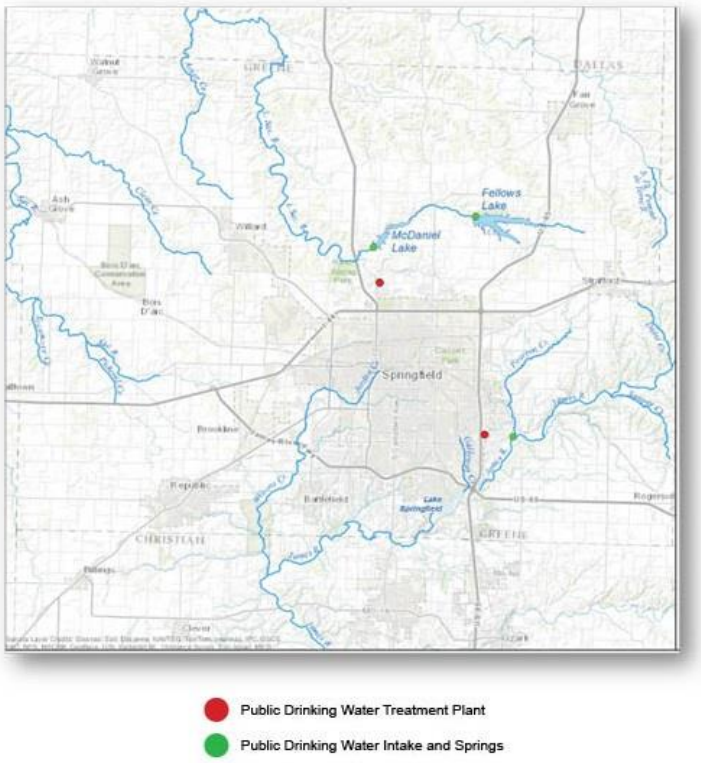
- Align resources with investments that achieve multiple benefits. Air, water, and land resources are connected. Target investment to improve air, water, and land resources in priority places.
- We are all responsible for environmental protection as generators of pollution and users of the environment.

Watershed Priorities

The following lists the water quality objectives, in priority order, and describes the watersheds were these objectives are most important:

1. Protect our drinking water sources: McDaniel Lake, Fellows Lake, Upper James River, Fulbright Spring Recharge Area, and Upper Little Sac.
2. Support aquatic life in waterways where people fish and consume fish they catch: Lower James River, Sac River, Little Sac River, and McDaniel/Fellows Lake.
3. Protect water from pollution in Lower James River, Upper James River, Sac River, and Little Sac River in areas where people swim.
4. Protect waterways used for irrigation and that support livestock and wildlife.
5. Protect Lower James, Wilsons Creek, and Little Sac so people can wade and boat in these waterways.
6. Improve the aesthetics of Wilsons Creek. There is an important trail system in this watershed and it is positioned upstream of important recreational uses.

Figure 1. Important Water Resources



Air Quality Priorities

The following lists the air quality objectives in priority order. Human health protection should be the top priority.

1. Maintain air quality standards attainment to protect human health.
2. Protect our food supply through air quality initiatives.
3. Maintain air quality standards attainment creating an environment that attracts/retains businesses and supports the economy.
4. Reduce greenhouse gas emissions.
5. Protect air quality to maintain visibility and reduce the degradation of building.

Land Resource Priorities

The following lists the land resource protection objectives in priority order:

1. Continue to monitor existing sites that are required by law with potential risk to human health & priority waterways.
2. Invest in environmental clean-up of sites in priority locations:
    - 2.1. Clean & protect sites that have the greatest risk of human exposure to pollutants.
    - 2.2. Clean & protect sites upstream of our highest priority streams and groundwater.
    - 2.3. Clean & protect sites with the highest economic re/development potential.
    - 2.4. Clean & protect sites that provide the greatest aesthetic and/or community benefit.

Overall Priorities

The following outcomes desired are listed in priority order by tiers. Tier I is the most important outcome. Tier II desired outcomes are the second most important. Tier III outcomes are third most important and Tier IV outcomes are fourth most important. In general, those outcomes that are protective of human health are most important.

Tier I

- Clean and healthy drinking water supply

Tier II

- Reduction in health related air quality issues
- Protected fish and other aquatic life
- Streams or lakes that are clean enough to swim in
- Attainment of air quality standards to attract and retain businesses

Tier III

- Reduction in greenhouse gas emissions
- Reduction of air quality impacts on food supply
- Clean water from streams and lakes for crop irrigation, livestock and wildlife watering

Tier IV

- Fish are safe to eat
- Streams and lakes clean enough to boat and wade in
- Aesthetic beauty of our lakes and streams

Environmental Background & Baseline Information

During the Integrated Planning process, the Environmental Priorities Task Force learned the environmental and regulatory issues facing the community. The extensive pool of information is summarized in the sections below. From this information, numerous discussions and a variety of activities, goals, and priorities evolved.

Water

Why protect our water resources?

Protecting our water quality is important for a number of reasons, primarily because it is vital to life. We need to protect it for drinking water, water for industrial uses, recreation (boating, fishing, hiking, wading), economic stability and growth, and quality of life. Water quality is particularly important to the environmental and economic health of Springfield and the surrounding communities because of the impact on two important lakes used for recreation and tourism: Table Rock Lake and Stockton Lake. Our region's water resources are tremendous assets for residents and a draw for tourists who desire clear, clean lakes for recreation.

Our public drinking water supply comes from surface water and groundwater from the following sources: Fellows Lake, McDaniel Lake, Stockton Lake, Fulbright Spring, deep groundwater wells, and the James River. Tens of thousands of residents rely on groundwater wells for their drinking water. Droughts and reduced water supplies drive home our need for clean water every day.

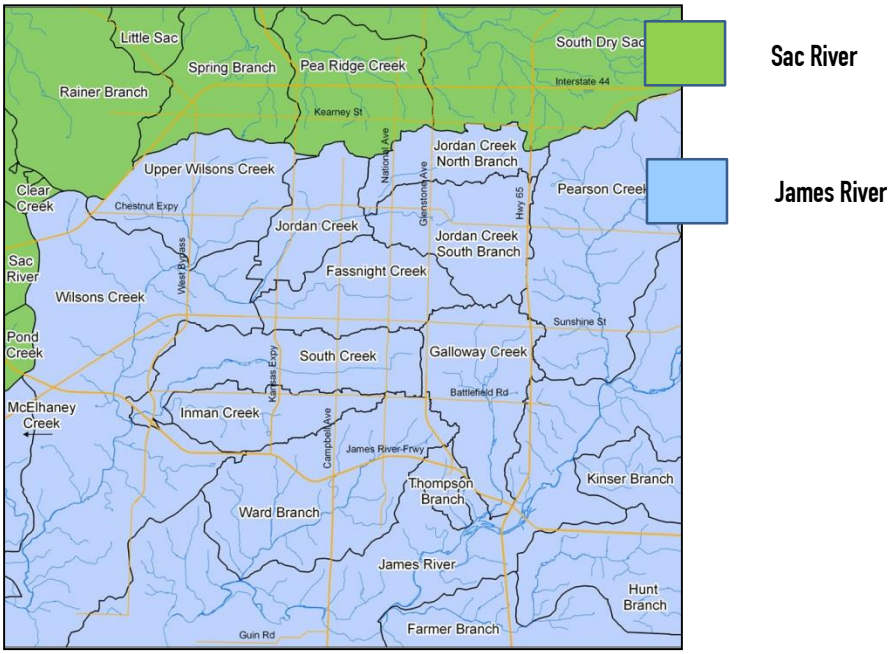
What water resources are we trying to protect?

Springfield is located on top of a major watershed divide. The area south of about Division Street drains south into the James River which flows into Table Rock Lake and the White River into Arkansas. The area north of this line drains north to the Sac River which flows into Stockton Lake and the Osage River system, which drains to the Missouri River in central Missouri. Within the larger James River and Sac River watersheds are many smaller streams. Table 1 lists the various sub-watersheds within each major watershed. Figure 2 shows the major watersheds in the urban service area of Springfield.

Table 1. Watersheds of Springfield area

Sac River Watershed	James River Watershed	
Pea Ridge Creek	Pearson Creek	Galloway Creek
Spring Branch	Fassnight Creek	Thompson Branch
South Dry Sac	Lower Jordan Creek	Inman Creek
Little Sac	N. Branch Jordan Creek	McElhaney Creek
Pond Creek	S. Branch Jordan Creek	Ward Branch
Rainer Branch	Upper Wilsons Creek	Kinser Branch
Clear Creek	Lower Wilsons Creek	Hunt Branch
	South Creek	Farmer Branch

Figure 2. Sac River and James River Watershed



Source: http://www.springfieldmo.gov/stormwater/watershed.html

Groundwater protection is a high priority for Greene County and the Springfield areas since many residents, as well as industrial and commercial enterprises, utilize the groundwater resources in the Springfield Plateau and Ozark aquifers for drinking water and manufacturing. The three hydrogeological units present in the Springfield and Greene County area include the Springfield Plateau aquifer, the Ozark confining unit, and the Ozark aquifer.

The Springfield Plateau aquifer yields sufficient supplies for domestic use. The Ozark confining unit generally separates the surface Springfield Plateau aquifer from the Ozark aquifer. The Ozark aquifer is the primary groundwater source in the region and yields up to 1,000 gallons per minute which makes it suitable for municipal and industrial supplies.

Groundwater quantity, groundwater quality, and karst geology are three major issues for groundwater protection.

How do we use the water resources?

The Missouri Department of Natural Resources (MDNR) establishes which waterways are protected, the beneficial uses of each waterway, and the corresponding water quality criteria to protect those uses. MDNR is also responsible for determining if a waterway is not meeting those criteria. If it is found that the criteria for a certain water body is not being met, MDNR will place the water body on a list of 'impaired waters' (called the 303(d) list) and establish corrective action for reducing the source of impairment or pollution. The corrective action is called a Total Maximum Daily Load (TMDL), designed to discover the pollutant and reduce it. The intent of the Clean Water Act is to improve water quality to meet designated uses, with the goal of making all surface waters clean enough to be "fishable and swimmable."

The following is a list of the designated uses for water bodies in our region:

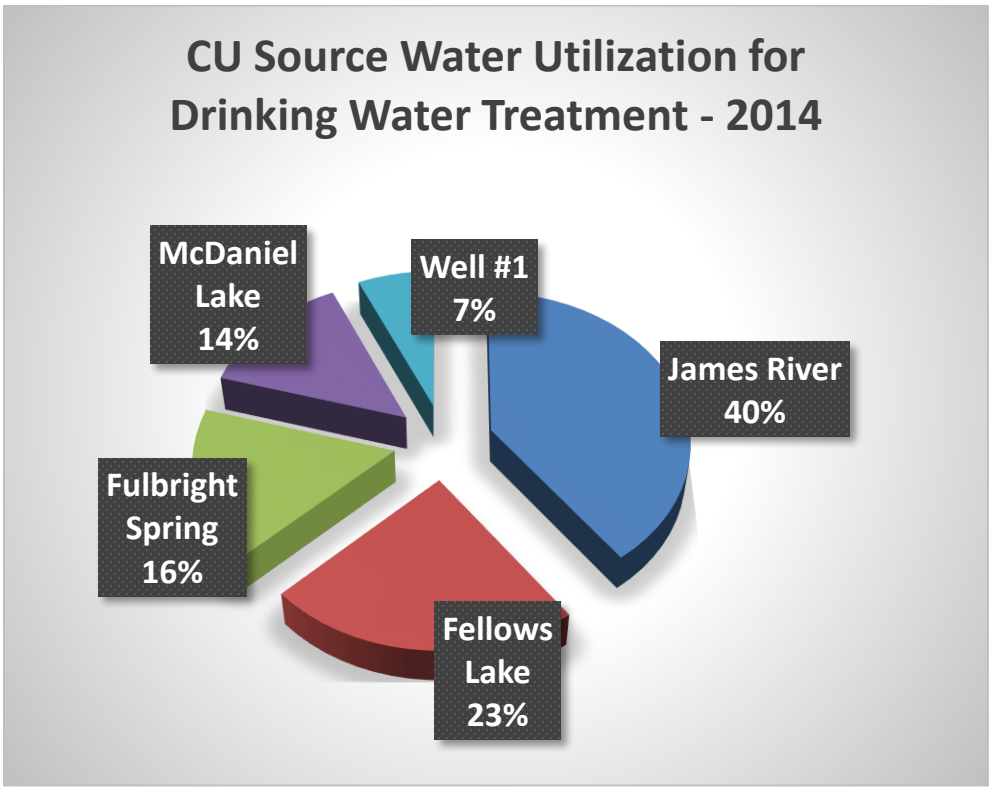
- Protection of Warm Water Aquatic Life - Waters in which naturally occurring water quality and habitat conditions allow the maintenance of a wide variety of warm-water biota, including naturally reproducing populations of recreationally important fish species.
- Cool Water Fishery - Level of protection assigned to waters in which naturally occurring water quality and habitat conditions allow the maintenance of a sensitive, high quality sport fishery (including smallmouth and rock bass) and other naturally reproducing populations of recreationally important fisheries.
- Whole Body Contact Recreation - Activities in which there is direct human contact with the raw surface water to the point of complete body submergence. The raw water may be ingested accidentally and certain sensitive body organs, such as the eyes, ears, and the nose, will be exposed to the water. Although the water may be ingested accidentally, it is not intended to be used as a potable supply unless acceptable treatment is applied. Water so designated is intended to be used for swimming, water skiing, or skin diving. **Category A** includes public swimming areas and **Category B** includes waters designated for whole body contact recreation that are not public swimming areas.
- Secondary Contact Recreation - Uses include fishing, wading, commercial and recreational boating, any limited contact incidental to shoreline activities, and activities in which users do not swim or float in the water. These recreational activities may result in contact with the water that is either incidental or accidental and the probability of ingesting appreciable quantities of water is minimal.
- Industrial process water and industrial cooling water - Water to support various industrial uses.
- Irrigation - Application of water to cropland or directly to plants that may be used for human or livestock consumption. Occasional supplemental irrigation, rather than continuous irrigation, is assumed.
- Livestock and Wildlife Watering - Maintenance of conditions to support health in livestock and wildlife.

- Drinking water supply - Maintenance of a raw water supply which will yield potable water after treatment by public water treatment facilities.

City Utilities (CU) provides the majority of the public drinking water supply in the community, serving an estimated 180,000 people. CU provides water to residential, commercial, and industrial customers plus visitors to the area. In addition to City Utilities, there are six municipal water systems and three rural water districts providing drinking water to customers; approximately 95,000 people in Greene County rely on either municipal or private wells as their source of drinking water.

CU's drinking water comes from surface water and groundwater from the following sources: Fellows Lake, McDaniel Lake, Stockton Lake, Fulbright Spring, deep groundwater wells, and the James River. CU currently operates two drinking water treatment plants that utilize a mixture of surface (lake and river), groundwater under the influence of surface water (spring), and groundwater sources. The surface water and spring sources account for approximately 90-95% of the City of Springfield's drinking water supply – these waters are treated to provide drinking water for the citizens of the Springfield Metro area. The approximate fractions of source water utilization are presented in Figure 3.

Figure 3. Drinking Water Sources for City Utilities and Springfield, MO



What is negatively affecting our waterways?

Our waterways are affected by wastewater from cities and failing septic tanks, as well as pollutants found in stormwater runoff from commercial, residential, industrial, and agricultural land uses in our community. Our waterways are also negatively affected by increases in runoff rate and volume resulting in stream bank erosion, as well as other changes such as removal of trees/vegetation along our streams. In addition, water pollution can come from buried sources such as leaking underground storage tanks and contaminated soils,

as well as pollutants deposited from the air. Table 2 provides a summary of major factors that can negatively affect our waterways.

Table 2. Source and impact of various factors affecting waterways

Pollutant	Source	Impact
Bacteria	Animal and human waste: pets, wildlife, livestock, septic systems, sanitary sewer overflows.	Causes people to get sick if ingested – public health issue. Can impact aquatic communities.
Nutrients: Nitrogen and Phosphorus	Animal and human waste. Improperly applied fertilizer from lawns, recreational fields, and agriculture carried by stormwater runoff. Detergents with phosphorus. Air pollution falling to land and water.	Causes algae to grow in water resulting in less clear water. These conditions are less appealing for recreation. As it dies, algae uses up the oxygen in the water which can kill fish and aquatic life. Increases cost to treat drinking water and can cause taste and odor problems. Nitrates in drinking well water are a health hazard to infants and young children.
Toxins	Improper disposal of chemicals (household and business). Air pollution falling to land and water.	Human and animal health; toxic to fish and aquatic life. Bioaccumulation of toxins in fish.
Increased sediment load	Increased volume and velocity of stormwater runoff. Erosion of stream banks. Stormwater runoff from urban and agricultural areas carrying sediment from the land.	Aesthetic issues. Changes in physical condition of the stream. Affects habitat for aquatic life. Increases drinking water treatment costs. Source of nutrients and carrier of other pathogens.
Trash	Improper disposal of trash.	Aesthetic. Clogs water intake pipes, increasing treatment costs.

		Clogs culverts, drainages, and streams with potential to impact bridge structures. Can impact health/survival of aquatic life.
Bank erosion	Increased volume and velocity of stormwater runoff. Removal of trees/vegetation along banks by humans, livestock/geese causes erosion. Mowing/agriculture to edge of waterway.	Aesthetic. Source of sediment (see above impacts). Soil and property loss. As banks erode, trees fall over. Loss of trees affects water quality and habitat for aquatic life.
Loss of riparian buffer (area with trees and vegetation along a stream)	Development/agriculture next to a waterway. Stream channelization and modifications.	Loss of habitat for aquatic life and wildlife. Riparian buffers can filter pollutants so their loss can degrade water quality.
Changes in stream flow	Increased volume and velocity of stormwater runoff from development. Less groundwater recharge due to impervious cover.	Affects habitat and lifecycle/survival of aquatic life. Bank erosion. Reduced groundwater quantity

What is the quality of our water resources?

Water quality is measured by a set of criteria established under the Clean Water Act (CWA) regulations, which are enforced by the state of Missouri. The state's water quality criteria established by MDNR includes chemical, physical, and biological properties that are necessary to protect the beneficial uses of a water body (Tables 3 and 4, and Figure 4). These criteria are separated into numeric criteria and narrative criteria. Numeric criteria are specific limits on the amount of pollutants in the water. Examples of narrative criteria are prohibitions on used tires, solid waste, and substances that cause unsightly color or offensive odor. The narrative criteria also prohibit physical, chemical, or hydrologic changes that impair the natural biological community. The criteria are meant to achieve the goal of the CWA to attain fishable/swimmable waterways throughout the United States.

Point sources of pollution are specific points of origin where pollutants are released. Nonpoint sources are diffuse pollution sources that are not recognized to have a single point of origin. To meet the water quality criteria and achieve the overall CWA goal, point sources of pollution are required to meet numeric pollutant limits such as not exceeding a specified concentration of metals in their discharge, or non-numeric pollutant limits such as reducing the discharge of pollutants to the "Maximum Extent Practicable." The requirements are mandated through permits issued under the National Pollutant Discharge Elimination System (NPDES) permitting program. The impact of nonpoint sources of pollution on waterways is generally addressed on a voluntary basis because it is unregulated.

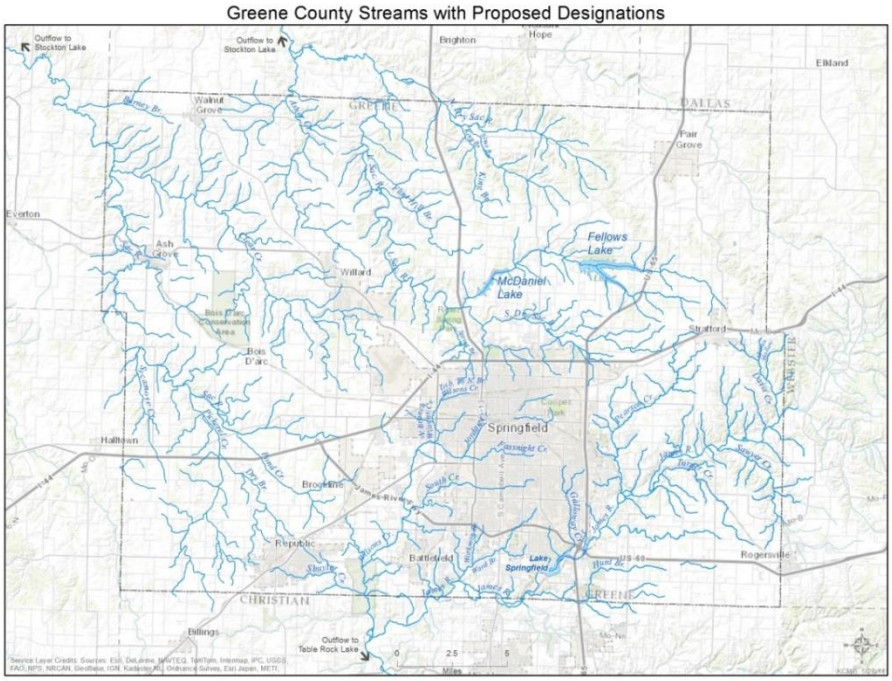
Table 3. July 1, 2014 Designated Uses for Regional Water Resources – James River Watershed

		Proposed Designated Use										
Watershed	**Water Body**	**Protection of Warm Water Aquatic Life**	**Cold Water Fishery**	**Cool Water Fishery**	**Drinking Water Supply**	**Industrial Water Supply**	**Irrigation of Crops**	**Livestock and Wildlife Watering**	**Secondary Contact Recreation**	**Whole Body Contact Recreation A (for public swimming areas or waters with documented existing whole body contact recreational use by the public.**	**Whole Body Contact Recreation B (waters designated for WBC not contained in category A)**	**Human Health Protection Fish Consumption**
James	Davis Cr.	√					√	√	√		√	√
James	Fassnight Cr.	√					√	√	√		√	√
James	Galloway Cr.	√					√	√	√		√	√
James	Hunt Br.	√					√	√	√		√	√
James	James R.	√		√	√		√	√	√	√		√
James	Jordan Cr.	√					√	√	√		√	√
James	Millan Hollow	√					√	√	√			√
James	North Branch Wilsons Cr.	√					√	√	√		√	√
James	Pearson Cr.	√					√	√	√	√		√
James	Sawyer Cr.	√					√	√	√		√	√
James	Shuyler Cr.	√					√	√	√		√	√
James	South Cr.	√					√	√	√		√	√
James	Trib. to N. Br. Wilsons Cr.	√					√	√	√		√	√
James	Turner Cr.	√					√	√	√		√	√
James	Ward Br.	√					√	√	√		√	√
James	Wilsons Cr.	√					√	√	√		√	√
James	Workman Br.	√					√	√	√		√	√
James	Trib. to Workman Cr.**	√					√	√	√		√	√

Table 4. July 1, 2014 Designated Uses for Regional Water Resources – Sac River Watershed

		Proposed Designated Use										
Watershed	**Water Body**	**Protection of Warm Water Aquatic Life**	**Cold Water Fishery**	**Cool Water Fishery**	**Drinking Water Supply**	**Industrial Water Supply**	**Irrigation of Crops**	**Livestock and Wildlife Watering**	**Secondary Contact Recreation**	**Whole Body Contact Recreation A (for public swimming areas or waters with documented existing whole body contact recreational use by the public.**	**Whole Body Contact Recreation B (waters designated for WBC not contained in category A)**	**Human Health Protection Fish Consumption**
Sac	Asher Cr.	√					√	√	√		√	√
Sac	Burney Br.	√					√	√	√		√	√
Sac	Clear Cr.	√					√	√	√		√	√
Sac	Dry Br.	√					√	√	√		√	√
Sac	Flint Hill Br.	√					√	√	√		√	√
Sac	King Br.	√					√	√	√		√	√
Sac	L. Pomme de Terre R.	√					√	√	√		√	√
Sac	L. Sac R.	√		√			√	√	√	√	√	√
Sac	Mutton Hollow	√					√	√	√		√	√
Sac	N. Dry Sac R.	√					√	√	√		√	√
Sac	Pea Ridge Cr.	√			√		√	√	√		√	√
Sac	Pickerel Cr.	√					√	√	√		√	√
Sac	Pomme de Terre R.	√					√	√	√	√		√
Sac	Pond Cr.	√					√	√	√		√	√
Sac	S. Dry Sac R.	√					√	√	√	√	√	√
Sac	S. Fk. Pomme de Terre R.	√					√	√	√	√		√
Sac	Sac R.	√					√	√	√	√	√	√
Sac	Selph Br.	√					√	√	√		√	√
Sac	Sims Br.	√					√	√	√		√	√
Sac	Spring Br.	√					√	√	√		√	√
Sac	Sycamore Cr.	√					√	√	√		√	√
	Various Small Streams	√					√	√	√		√	√

Figure 4. July 1, 2014 Proposed Designated Uses for Regional Water Resources



Waterways not meeting the water quality criteria are deemed 'impaired' by MDNR. MDNR's list of impaired waterways in our area is provided in Table 5. The James River and the Little Sac River were listed as impaired in 1998. The James River was listed as impaired due to excess nutrients that caused significant algae blooms. The Little Sac River was listed as impaired because the levels of bacteria exceeded the water quality criteria. TMDLs were developed for the James River and the Little Sac River in 2001 and 2006, respectively. It is anticipated that numeric water quality criteria for nutrients will be passed by MDNR in the near future that may be lower than the target levels for the James River TMDL. This could result in Lake Springfield, Table Rock Lake, and possibly other smaller streams being listed as impaired.

Requirements for phosphorus removal at wastewater treatment plants in the James River watershed have dramatically decreased the phosphorus levels and resulting algae blooms in the James River and that arm of Table Rock Lake. Efforts are ongoing to reduce the amount of phosphorus to the James River from stormwater runoff and agriculture.

The Little Sac watershed is largely rural. Runoff from Springfield and the surrounding urbanized areas is estimated to account for only 2-6% of the bacteria in the river. Efforts to reduce bacteria will need to mostly focus on other sources which include failing septic tanks, springs, livestock, and wildlife. The City and County must address both of these TMDLs as part of their stormwater programs by conducting stream monitoring, and focusing education and implementation efforts on best management practices that reduce nutrients and bacteria.

Pearson Creek, Wilsons Creek, and Jordan Creek have also been determined by MDNR to be impaired. Pearson Creek and Wilsons Creek were listed as impaired in 1998 because the diversity and abundance of macro invertebrates (aquatic insects) are low compared with pristine streams such as Bull Creek and the North Fork River. Jordan Creek, a tributary of Wilsons Creek, was listed for the same reason in 2008. A specific pollutant causing the impairment has not been identified. TMDLs for these streams were issued by EPA in 2011 but were later withdrawn for both technical and legal reasons.

Table 5. Impaired Waterways and TMDL Status in the Springfield/Greene County Area

Waterway	Impairment Pollutant	Pollutant Source	TMDL Status
James River	Nutrients	Urban Point and Nonpoint Sources (e.g. wastewater treatment plants and stormwater runoff), Agricultural Nonpoint Sources	Issued 2001; Updated 2004
Little Sac River	Fecal Coliform	Point and Nonpoint Sources	Issued 2006
Pearson Creek	Unknown (causing low macroinvertebrate populations)	Unknown	Withdrawn. New one not yet issued.
	Bacteria Unkown	Multiple Point and Nonpoint Sources	Not yet issued
Wilsons Creek	Unknown	Multiple Point Sources and Urban Nonpoint Sources	Withdrawn. New one not yet issued.
	Bacteria	Point Sources and Urban Nonpoint Sources	Not yet issued
Jordan Creek	Unknown	Urban Nonpoint Sources	Withdrawn. New one not yet issued.

Public drinking water systems, the EPA, and state regulatory agencies all recognize the need to identify potential sources of contamination to drinking water sources of supply. The EPA required (in the early 2000s) that individual states conduct source water assessments – termed *Source Water Assessment and Protection*, or **SWAP**, reports - for drinking water utilities in order to determine what contaminants each system was most likely to encounter in source waters. In Missouri, the MDNR conducted the assessments and generated the SWAP reports for each public water system (PWS).

Any body of water may reasonably be expected to contain some contaminants. The types of contaminants depend on many factors and can originate from a wide range of sources such as: Point discharges from industrial land uses and waste water treatment facilities and non-point sources such as natural stream erosion, recreational activities on or near the water, failing septic systems, leaky sewer pipes and storm water runoff from areas of urbanization and agricultural land uses.

Water Challenges

There are a number of challenges facing water quality in the Ozarks:

- Karst Topography - The geology of the Springfield area is made up of limestone and dolomite, resulting in surface water and ground water that are connected by sinkholes, caves, and springs. This issue is somewhat unique to our region and is not often addressed within the framework of the regulations. With 95,000 people receiving groundwater from wells as their main source of drinking water, it is critical that we understand the connection between land contamination and our drinking water sources.
- Point and Non-Point Sources - The Clean Water Act places stringent regulations on point source pollution while there is little regulation of non-point sources. As a result, there are significant sources of pollution for which there is little to no regulatory authority to address.
- Historic Sources - Historic land use can have an influence on water quality even today, but these impacts are often unknown or unstudied.
- Public Education - Impacts to water quality are often not well understood by the public. For example, relatively few people consider the effect that lawn or agricultural fertilizer, pet waste, or chemical disposal may have on our waterways. Even fewer people have a full understanding of the regulations that limit pollution to our water sources.

Air

Why is air quality important?

Springfield, Greene County, and City Utilities are committed to air quality protection through proactive educational efforts with businesses and non-profit alliances, in addition to compliance with state and federal regulations. Managing air quality in the region is important to the health of citizens, the economy, and the environment.

The federal and state regulatory agencies set how much of each type of air pollutant is allowed in the air. These levels are set nationally based upon health impacts and environmental studies. Air monitors are located in each region to measure the concentration of pollutants in the air. If air quality in the Springfield-Greene County region does not meet the regulations, it is called non-attainment. If non-attainment is sustained over a certain period of time, the region has to develop a series of actions to be taken to get back into attainment of air quality standards.

There are serious economic consequences should the Springfield-Greene County region go into non-attainment of air quality standards. This could limit the types of businesses able to move into the region or place restrictions on existing businesses. Also, should the region move into non-attainment status and not make the required progress, the region could lose federal transportation funds, which would further impact economic development.

What is polluting the air?

Air pollution comes from many different sources. Some sources are natural such as windblown dust and smoke from wildfires. Other sources are man-made such as emissions from automobiles, factories, power

plants, construction equipment, small businesses, and open burning. These air pollutants can be solids, liquids, or gases. Six common air pollutants (also known as "criteria pollutants") are found all over the United States. They are **ground-level ozone**, particle pollution (often referred to as **particulate matter**), **carbon monoxide**, **sulfur oxides**, **nitrogen dioxides**, and **lead**. These pollutants can harm human health, animal health, and the environment, and can cause property damage. Of these six criteria pollutants, particulate matter and ground-level ozone are the most widespread health threats.

Ground-level ozone is a pollutant that forms when emissions from man-made sources such as cars, lawn mowers, and industry react with heat and sunlight. Ground-level ozone is invisible, so high concentrations can occur even when the air appears clear. For health reasons, the Environmental Protection Agency (EPA) sets a limit on how much ozone our air can contain. Areas that do not meet these standards must develop and carry out plans to reduce the amount of ground-level ozone in their air, which often means reducing emissions. The current national standard for ground-level ozone is not too exceed 75 parts per billion (ppb) over an average 8-hour period.

Smoke, soot, dust, and dirt particles are included in a group known as **particulate matter** or particle pollution. Particulate matter (PM) is an airborne mixture of liquid droplets and solid particles made up of organic chemicals, metals, acids, or dust particles. There are two groups of PM that matter the most since they can easily be inhaled. PM_{10}, are particulate matter smaller than 10 micrometers and are frequently found near roadways and dust-creating industries. Fine particles, or $PM_{2.5}$, are 2.5 micrometers and smaller. $PM_{2.5}$ hangs in smoke coming from burning oil, coal, wood or residential waste; smog, haze, and vehicle exhaust. In addition to size distinction, these smaller particles may have a different chemical composition than larger particles.

Carbon monoxide (CO) is a colorless, odorless gas produced by the incomplete combustion of fuels. The major source of CO in our community is motor vehicles. According to the U.S. EPA, air quality has greatly improved in recent years, but vehicles on the road—even newer, cleaner models—still account for at least 25% of air-polluting emissions nationwide. Carbon monoxide affects healthy and unhealthy people. Increased levels of carbon monoxide reduce the amount of oxygen carried by hemoglobin around the body in red blood cells. The result is that vital organs, such as the brain, nervous tissues and the heart, do not receive enough oxygen to work properly.

Sulfur dioxide is a gas from the sulfur oxides family. It is invisible and has a nasty, sharp smell like a struck match. It reacts easily with other substances to form harmful compounds, such as sulfuric acid, sulfurous acid and sulfate particles. About 99% of the sulfur dioxide in air comes from human sources. The main source of sulfur dioxide in the air is industrial activity that processes materials that contain sulfur, e.g. the generation of electricity from coal, oil or gas that contains sulfur.

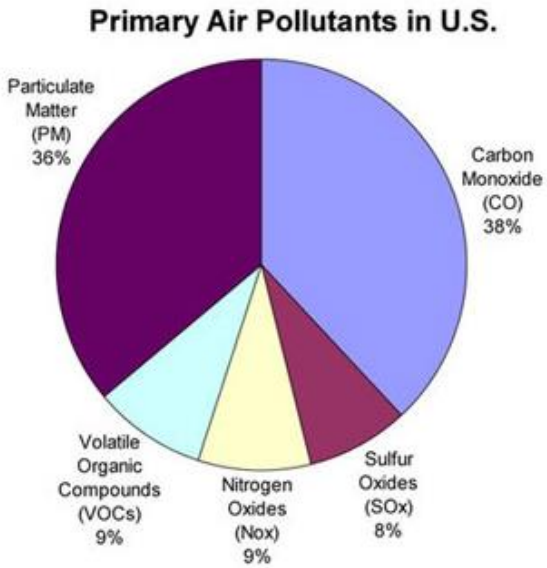


Figure 5. Primary Air Pollutants

Nitrogen oxides, or NOx, is the generic term for a group of highly reactive gases, all of which contain nitrogen and oxygen in varying properties. Many of the nitrogen oxides are colorless and odorless. However, one common pollutant, nitrogen dioxide (NO2) along with particles in the air can often be seen as a reddish-brown layer over many urban areas. Nitrogen oxides form when fuel is burned at high temperatures, as seen in a combustion process. The

primary manmade sources of NOx are motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fuels. NOx can also be formed naturally. NOx causes a wide variety of health and environmental impacts because of various compounds and derivatives in the family of nitrogen oxides, including nitrogen dioxide, nitric acid, nitrates, nitric oxide, and nitrous oxide, a regulated greenhouse gas.

Lead is a soft metal that is found in air in the form of very small particles. Lead can get into the air naturally through soil erosion, volcanic eruptions, and sea spray. In the past, motor vehicles were the major contributor of lead emissions to the air. Major sources of lead emissions to the air today are ore and metals processing and piston-engine aircraft operating on leaded aviation gasoline. Lead in the air is a problem not only because people may breathe it in, but also because people, particularly children, can swallow lead dust that has settled onto surfaces like soil, dust, and water. Lead in soil and dust stays around for many years because it does not decay or decompose. Lead ingestion has been linked to several health issues and complications.

Greenhouse gases are substances that absorb the sun's UV rays and reemit them as infrared rays. The resulting infrared heat is trapped in the atmosphere and causes a warming effect similar to the glass in a greenhouse or a parked automobile. The most prevalent greenhouse gases are water vapor, carbon dioxide (CO_2), and methane. In one regard, this heat trapping is responsible for moderating global temperatures and making the earth's surface habitable. Scientists are now concerned, however, that a buildup in the concentrations of these gases could cause climate impacts in the coming decades. EPA recently began regulating greenhouse gas emissions under the Clean Air Act. To date, EPA has finalized rules on emissions from some mobile sources and on new stationary sources of fuel combustion. EPA has also proposed regulations on new, and more recently, existing fossil-fuel power plants.

What are the sources of air pollutants?

The sources of pollution can be divided into the following categories:

- Natural – Natural activities in the environment can actually cause air pollution.
- Area – Smaller-size facilities that release lesser quantities of pollutants into the air. Area sources are defined as sources that emit less than 10 tons per year of a single air toxic, or less than 25 tons per year of a combination of air toxics. Though emissions from individual area sources are often relatively small, collectively their emissions can be of concern - particularly where large numbers of sources are located in heavily populated areas.
- Stationary – These sources may release air pollution from equipment leaks, when materials are transferred from one location to another, or during discharge through emission stacks or vents
- Mobile – Mobile source air pollutants are compounds emitted from highway vehicles and non-road equipment which are known or suspected to cause cancer or other serious health and environmental effects. Mobile sources are responsible for direct emissions of air pollution and contribute to precursor emissions which react to form secondary pollutants.

Table 6. Sources of Air Pollutants in State of Missouri, 2011 (By %)

Pollutant	Agriculture	Dust	Fuel Combustion	Industrial Processes	Misc.	Mobile	Solvent	Biogenics*
Particulates (PM 2.5)	22.2%	68.1%	4.5%	1.1%	1.2%	2.9%	0.0%	0.0%
Ammonia	95.2%		1.7%	0.2%	0.9%	2.0%	0.0%	0.0%
Carbon Monoxide			9.7%	5.9%	1.9%	71.9%	0.0%	10.6%
Lead			4.0%	83.6%	0.5%	11.6%	0.3%	0.0%
Nitrogen Oxides			19.7%	3.1%	0.3%	70.9%	0.0%	6.1%
Sulfur Dioxides			88.0%	11.4%	0.1%	0.5%	0.0%	0.0%
Volatile Organic Compounds (VOCs)			1.2%	0.5%	2.4%	8.5%	4.5%	82.9%

[*Biogenic denotes naturally occurring sources of biological origin. A striking example is the emission of organic isoprene from Missouri's oak forests.]

The following is a list of the man-made sources commonly polluting air in the United States:

Area

- Businesses (dry cleaners, auto body shops, printers, painting operations, gas stations, etc.)
- Homes (wood combustion, furnaces, paint and solvent use, etc.)
- Office buildings (heating sources, etc.)
- Wildfires
- Waste disposal (landfills)
- Agricultural sources (open burning, pesticide application, tilling, feedlots, etc.)

Stationary

Electric Generating Units (EGU):

- Coal-fired power plants
- Gas-fired power plants

Non-Electric Generating Units (Non-EGU):

- Factories
- Industrial and commercial boilers
- Chemical processing
- Large petroleum storage facilities
- Sewage treatment plants
- Mining and milling

Mobile

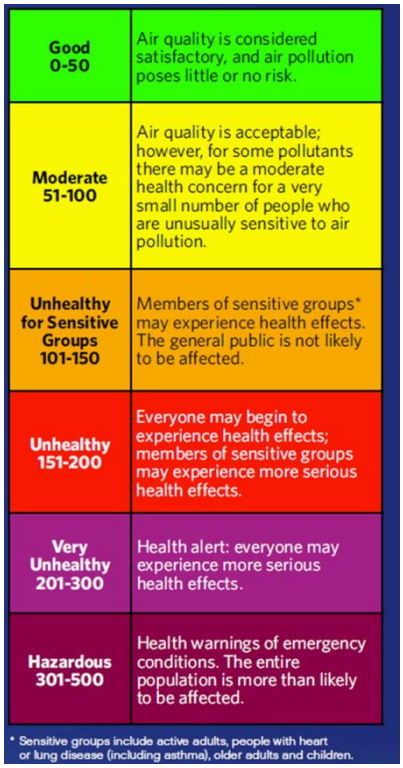
On-road:

- Cars
- Motorcycles
- Trucks
- Heavy-duty trucks (Semi-tractor trailers, dump trucks, etc.)

Non-road:

- Construction equipment (excavators, bull dozers, skid steers, etc.)
- Lawn and garden gasoline-powered equipment (lawn mowers, grass trimmers, chain saws, leaf blowers, chippers, etc.)
- Off-road motorcycles and ATV's
- Golf carts
- Snowmobiles
- Boats
- Farm equipment (tractors, sprayers, balers, etc.)

Figure 6. EPA Air Quality Index



Good 0-50	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate 51-100	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups 101-150	Members of sensitive groups* may experience health effects. The general public is not likely to be affected.
Unhealthy 151-200	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy 201-300	Health alert: everyone may experience more serious health effects.
Hazardous 301-500	Health warnings of emergency conditions. The entire population is more than likely to be affected.

* Sensitive groups include active adults, people with heart or lung disease (including asthma), older adults and children.

What is the air quality in Springfield area?

Air quality is measured using an index developed by the United States Environmental Protection Agency (EPA). The Air Quality Index (AQI) tracks ground-level ozone and particle pollution. The index is divided into value ranges, which are color coordinated, and given a descriptor. Each color code/value range corresponds to a different level of health concern. The specific colors of the Air Quality Index makes it easier to understand where the air quality falls on the scale. Standardized public health advisories are associated with each AQI range

Figure 7 is the mean Air Quality Index for Springfield for the years 1999 – 2009, compared to both the Missouri and U.S. mean for the same timeframe. The left coordinate shows the Air Quality Index. "Good" air days are in the 0-50 range on the chart. The lower the number, the better the air quality. Springfield's Average Air Quality Index generally follows the Missouri average and the US mean. The general trend is improvement in air quality. It's important to remember these are averages so in a given year, there could be several days when the air quality was not as healthy for individuals.

Figure 7. Air Quality Index -- Springfield Missouri Mean vs. Missouri and US Mean, 1999 to 2009.

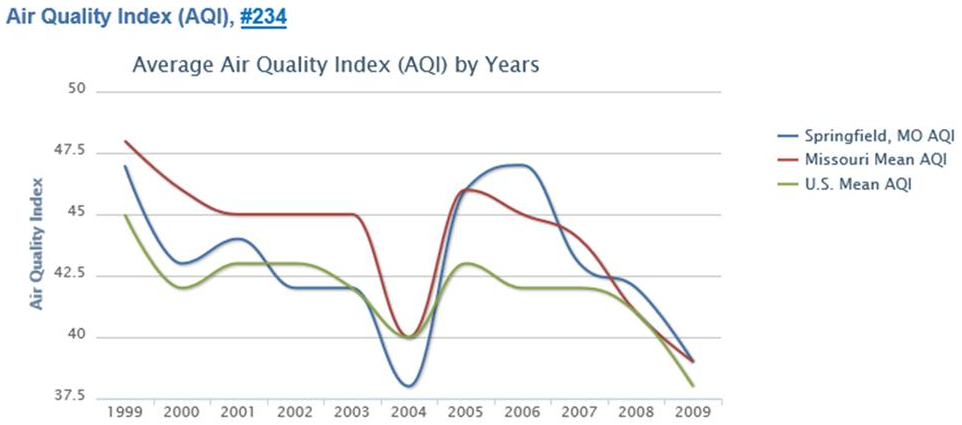
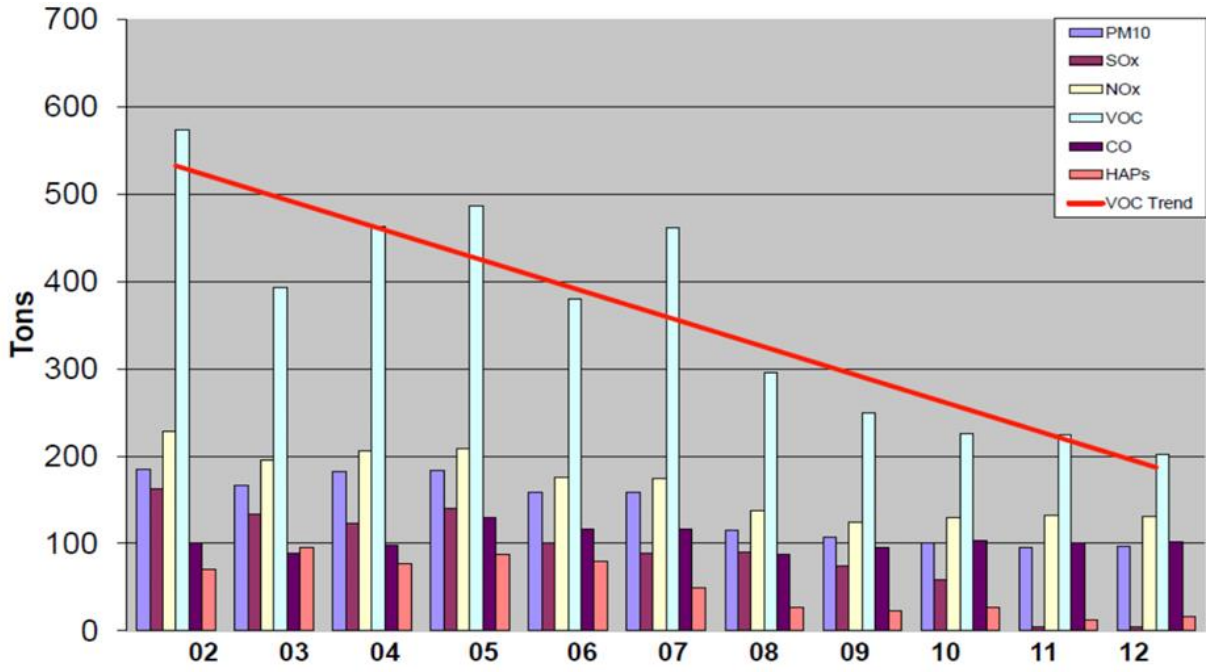


Figure 7: Source www.USA.com, Springfield Air Quality

Figure 8 represents Springfield's industrial air emissions from 2002 through 2012. All levels of Air Quality Index pollutants have dropped during that timeframe, with the assistance of businesses and leadership paying close attention to regulations and new processes of reducing pollution production.

Figure 8. Springfield, Missouri Industrial Air Emissions, 2002 - 2012



Data collected over the years also shows:

- An overall reduction in emissions of SOx from City Utilities Power Plants from 1980 to 2012.
- Ground-level ozone below the 2008 National Ambient Air Quality Standards.
- A reduction in particulate matter between 2003 and 2013 with levels below the 2012 threshold limits.

Air Quality Challenges

There is a common misperception that someone else is polluting the air. But much of the man-made pollution is caused by citizens' every day activities. As the region grows, meeting air quality standards will become more challenging. More people mean more sources of pollution. Because the sources of pollution are scattered, it is difficult to use regulation to get real improvement. Education and outreach to citizens and businesses is the key to air quality improvement.

Regulations are also changing and becoming more stringent. Hot, dry weather makes it difficult to meet regulations in the summer months on a consistent basis. One of the major challenges is that the region's air quality is not always dependent upon the efforts of Greene County residents, government agencies, and businesses. Air pollution comes to our region from far away so collaboration on a broader scale is important.

In the event the region goes into nonattainment of Air Quality Standards, there may be serious economic impacts. Nonattainment could limit the types of businesses attracted to the region or place additional restrictions on existing businesses. Also, in the event of nonattainment or lack of the required air quality progress, federal transportation dollars for transportation system expansion are at risk.

The quality of our air, land, and water are all connected. Pollute the air and those pollutants can fall onto the land and be carried into the water during a rainfall. Pollute the land and it can find its way into our streams or

groundwater. Pollute the water and it can have impacts both locally and as far away as the Gulf of Mexico. Sources of pollution can be natural or from a variety of human activities.

Land

Who and what is polluting our land?

People are polluting the land through the improper use or disposal of the following:

- Chemicals – industrial and household waste
- Petroleum products
- Heavy metals
- Trash and debris – business and households
- Fertilizers and pesticides
- Wastewater – failing septic tanks and poor animal waste management

Industrial and household waste includes many chemicals such as surfactants, lubricants, solvents, glues, and acids and bases. These chemicals are important in the manufacture of many products we use every day and depend on, such as cleaning solutions, pharmaceuticals, oils, and greases. Improper handling of these chemicals or their waste products can lead to contamination of the land.

Gasoline, diesel fuels, oils, lubricants, and similar petroleum products are found everywhere in our community and our daily lives. Petroleum products leak or spill into the environment through accidents and improper storage and handling at industrial facilities, commercial enterprises, and other businesses. Some leakage of oils, greases, and fuels is common from our vehicles through regular use and care. Petroleum products may also be improperly handled or disposed at residential properties.

Heavy metals are ubiquitous in our environment since many are used in products and manufacturing processes. One common source of heavy metals is brake linings. Metal fragments of the brake linings are worn off from cars and trucks every time the brakes are applied. The metal fragments land on the road surfaces where they can be blown by the wind or transported to water resources via stormwater runoff.

Lead mining from near surface geologic formations was a lucrative enterprise during the 19th century. Mining practices at the time were not as strict as today and waste piles from the mining operation, also known as chat piles, were left at the surface. Chat piles may contain levels of lead that are unsafe for the environment; therefore less vegetation grows on the waste piles. Lead contaminated soil washed away in stormwater runoff and blew dust across the area. Lead is toxic to people, plants, and animals. Some of these former lead mining areas, in other parts of the U.S., have been remediated under the Superfund and Brownfields programs.

In addition, the use of lead in gasoline was standard practice up until the mid-1970s. Lead was emitted through tailpipes and settled onto the ground and building surfaces. Lead was also common in paint products used throughout interior surfaces of homes, schools, and buildings. Human exposure to lead occurred through breathing dust and dirt particles with lead adhered to them and through hand-to-mouth contact.

Trash and debris from businesses and households that is improperly handled litters our land, highways, cities, and country. Especially during windy weather, trash can easily blow great distances despite our best efforts to keep it in trash receptacles.

The improper application and over-use of fertilizers and pesticides on urban and agricultural lands can result in pollution of soils, streams, lakes and groundwater. This is a situation where the old adage 'if a little is good, a lot is better' does not apply.

Wastewater from failing septic tanks and poor animal waste management can result in pollution of streams, lakes, and groundwater through stormwater runoff or through the shallow surface soil and karst geology in Greene County, which allows pollutants to move into groundwater and surface in springs, waterways, and drinking water wells.

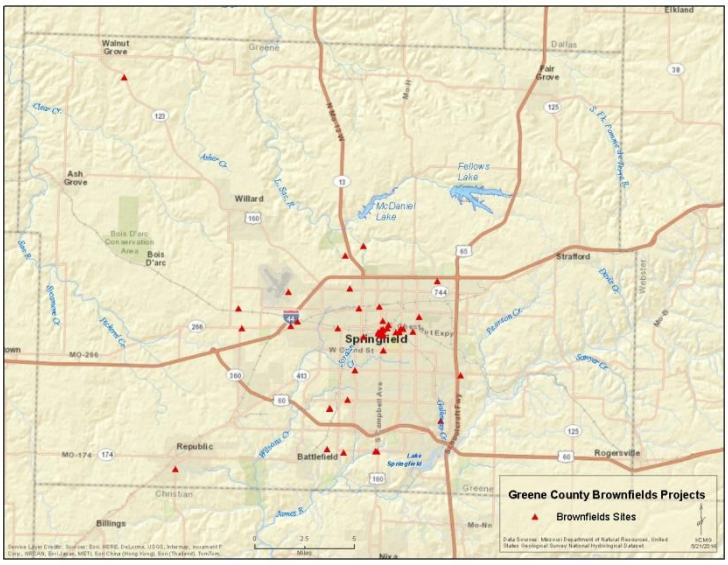
Where does land pollution come from?

Land pollution comes from people's activities in the past and today. Historical pollution sources often come under the umbrella of "old ways of doing business" since at the time, standard practices were being followed. For example, many industrial facilities buried chemical wastes on site, often in drums. Commercial enterprises using chemicals, such as dry cleaners, took their waste to the local dump or just 'threw it on the ground out back.' Standard practice for storage of fuel at service stations used single-layer metal tanks that were not lined and buried in the ground, which over time corroded and leaked. Chemical products were stored in drums that may have leaked or spilled, often outside.

A variety of materials were used in manufacturing and products that later were found to be hazardous to human health and the environment. Asbestos containing materials (fireproofing, insulation, roof and siding tiles, soundproofing) and lead based paint are two of the most common. As products were used and became worn, materials were released into the environment.

Old dump sites were often selected based on topography – a ravine or low area that was easy to unload debris. These disposal sites were used prior to regulations and local codes controlling these sites, often resulting in leaching of chemicals and land contamination. Old mining sites were often used as disposal sites or landfills once the mining operations ceased.

Figure 9. Brownfields Sites in Greene County



Illegal Activities continue as a source of land pollution. Illegal dumping of debris and chemical products, illicit discharges of waste onto land areas, and improper chemical and biological material handling are sources of land pollution.

Improper Management of Industrial and Household Waste

Historically, industrial and household waste was disposed of in the same landfill. The Fulbright and Sac River Landfills are former landfills operated by the City of Springfield. At the time of operation, they accepted domestic and industrial wastes from the region, usually mixed together. This was considered standard practice at the time. Landfills during this time period also did not have impermeable linings to prevent any waste from leaching into the subsurface soils and groundwater. These facilities became a Superfund site as will be discussed in greater detail later.

Air Pollution

Pollution of the land from air sources can be natural or from a variety of human activities – deposition of emissions from power plants, quarries and mineral extraction, industrial manufacturing facilities, windblown dust off construction sites and agricultural land, particulates and pollen, and vehicular emissions. Air pollutants are deposited on the ground surface during dry weather periods and during precipitation. The sources can be local, from across the country, or from across the world.

Fertilizers and Pesticides

Weed and insect control applied to lawns, golf courses, and agriculture lands can be sources of land pollution if these products are not applied properly. Quantity, timing, and application method are all important to ensure correct usage of the product. Excess product can become airborne or enter water resources via runoff. Product can leach through the soil and enter groundwater resources.

Land management practices that cause erosion are another source of land pollution. Since the 1930's, the United States has worked diligently through local Soil and Water Conservation Districts to protect top soil and prevent soil erosion. Eroded soil can carry chemicals (fertilizers and pesticides) and pollutants (metals, bacteria, petroleum products) onto other properties and into streams, lakes, and sinkholes.

Littering continues to be a source of land and sight pollution despite anti-litter laws passed decades ago. States and communities have utilized a variety of programs to prevent littering and cleaning up the litter deposited and blown throughout our communities. Illegal dumping of personal trash, bulky items, and lawn debris is another source of land pollution.

What are the regulations?

Land resources are governed primarily by local statutes and codes such as zoning and development codes. An important aspect of land issues is the way other regulations overlap with/or impact land use. A handful of federal and state regulations govern solid and chemical wastes, both historical and current. Historical land use practices may have complex and far-reaching consequences under current regulations. Air and water quality regulations are intertwined and can impact decisions, revenue, and financial expenditures of local government.

Solid waste management is governed by federal and state law. Local codes assist with enforcement of these regulations. The local landfills are in compliance with federal, state, and local regulations for solid waste. A rigorous recycling program is in place to reduce the amount of solid waste disposed in the landfills. Historical landfills are closed, contained and monitored.

Springfield investigated over 200 historical industrial sites and remediated several sites with soil contamination. The remediated properties have been repurposed. Properties of concern remain in the older industrial districts and former mining areas. Some of these properties are located along streams.

Land Resource Challenges

Challenges to protecting our land resources are numerous and overlap with air and water quality issues.

- Complicated interconnection of air, water, and land

  All natural resources are connected to each other – high quality land is dependent on how humans treat the land as well as the water, air, plants, animals, and habitats. Land quality issues are directly tied to groundwater protection due to aquifer recharge areas and karst geology. Recharge areas and karst geology pose challenges to groundwater quantity and quality issues.

- Karst Geology

  The transport of contaminants in karst geology is often very complicated. Understanding and mapping karst geology is difficult because it may not follow land surface topography, also groundwater flow in karst geology often crosses between surface watersheds. Because of the karst geology in our region, it is even more important to protect the land resources.

- Competing interests and goals for the community

  Environmental protection and economic development are often seen as opposite goals in communities. In actuality, they go hand-in-hand. Quality of life is associated with clean air, water, and land as well as recreational and open spaces. People want to live, work, and play in communities that have a balance of natural and human amenities.

- Finding and correctly identifying sources of land pollution

  Identifying the pollutants, locations, and the sources of land contamination can be a long and extensive process, sometimes taking several years. It is investigative work that requires diligence and patience.

- Finding new, acceptable places to dispose of waste

  New landfills and hazardous waste facilities are especially difficult to site and permit because of local opposition ("Not in My Backyard"). Shipping waste to other communities or disposal facilities is very expensive and generally adds to the cost of environmentally sound waste disposal.

- Cost and legal issues to clean up polluted property

  Remediation of contaminated land from historical practices is very costly – from the investigation phase identifying pollutants, sources, and location; the feasibility study of potential solutions; to the remediation. It can take several years to complete the process. Remediation techniques can be expensive and may include long-term monitoring.

- Polluted land impacts our water resources and agriculture

  Pollutants that adhere to soil particles can easily erode and flow into streams, lakes, sinkholes, and groundwater resulting in contaminated sediments or water pollution. Some pollutants in the soil can leach into the subsurface and impact groundwater.

- Lack of awareness about problems and solutions

  Integrated protection of our natural resources and wise use and management of land takes dedication, time and resources on the part of land owners, local government, and the community. Such efforts are not easy, but pay dividends in the long term for a healthy and prosperous community.

- Regulatory Challenges

  Regulatory oversight, assistance, and enforcement is limited by financial and personnel resources at the federal and state levels.