

Integrated Planning Opportunities Alternatives Analysis – Septic System Elimination

Greene County, Missouri

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Introduction

The City of Springfield (City), Greene County, and City Utilities of Springfield have developed an approach for integrated planning to best protect local environmental resources in an evolving regulatory landscape. The Integrated Plan (IP), titled “A Citizen Focused Approach,” provides a holistic plan designed to prioritize investments based on the most effective solutions to address the most pressing problems that matter most to the community. Implementation of the IP includes a four-phased approach, which is designed to be iterative: 1) Assessment (What is the current status of the environment?), 2) Vision (Where do we want to be?), 3) Tactical (How will we get there?), and 4) Adaptive Management (What adjustments need to be made?).

Identifying and prioritizing the most effective solutions using the Sustainable Return on Investment (SROI) approach is a critical component of the tactical phase. The SROI process is an economic analysis method for analyzing triple bottom-line (i.e., economic, social and environmental) outcomes of investments and policies. This approach provides a comparison between the general cost of a solution to the benefits achieved so that a more informed investment decision can be made.

The SROI process was used here for estimating the sustainability value of septic system elimination, including social and environmental benefits and financial costs. The methodology entailed projecting the value of impacts over a 25-year planning horizon and applying a discount rate to bring future values into today’s dollars. A description of this opportunity and details of the SROI analysis are provided below.

Opportunity Description

Septic system elimination involves disconnecting properties from existing septic systems and connecting them to the municipal sewer system. The average age of a septic system in the Springfield Urban Service Area is 44 years. With an expected service life of 25 years, a majority of those systems are likely failing unless they have been replaced or rehabilitated by the owner. An estimated 71% of all septic systems in the Urban Service Area are failing or not functioning properly. Elimination of septic systems is expected to reduce transport of contaminants to waterbodies. Typical septic system decommissioning involves filling in the existing septic tank and abandoning lateral lines in place following connection to the municipal sanitary sewer.

Environmental and Social Benefits

A significant benefit of implementing septic system elimination is improved water quality. Water quality improvements were determined using a water quality index (WQI) approach. The WQI is a composite scoring system that evaluates the conditions of a waterbody on a scale of 0 to 10 based on different community priorities and indicators. The economic value of a change in water quality is determined by the number of people that benefit and an individual’s “willingness-to-pay” for that change. A one point change to the WQI is worth about \$40 for a direct user and \$14 for in indirect user based on EPA studies (Van Houtven et al., 2007).

HDR evaluated the change in the WQI from septic system elimination based on estimated reductions in nutrient (as measured by total phosphorus and total nitrogen) and bacteria (as measured by *E. coli*) loading. Reductions were estimated for major watersheds within Greene County with systems that can be connected to the Springfield sewer system, which include Little Sac River, Middle James, Upper James, and Wilson’s Creek (Table 1).



Table 1. Estimated Pollutant Load Reductions from Septic System Elimination in Greene County Watersheds

Description	Little Sac River	Middle James	Upper James	Wilson's Creek	Total
Estimated Existing Number of Septic Systems within the Springfield Urban Service Area	257	843	203	256	1,590
Septic Systems Eliminated with Sewer Extension ¹	28	354	149	181	712
Estimated Reduction in Nitrogen Loading to Surface Water, lbs/yr	1,140	17,162	7,269	7,609	33,180
Estimated Reduction in Phosphorus Loading to Surface Water, lbs/yr	61	1,594	684	470	2,809
Estimated Reduction in <i>E. coli</i> Loading to Surface Water (count/day)	4.0E+08	9.0E+09	3.9E+09	2.5E+09	1.6E+10

1. Based on septic systems located within 600 feet of a regional sewer connection line.

Estimated improvements from septic system elimination are projected to have a positive impact on a number of community priorities including aquatic life, waterbody aesthetics, primary and secondary contact recreation, and clean drinking water. In terms of the WQI, it was estimated that septic system elimination will increase it up to 0.027 points depending on the watershed (Figure 1).

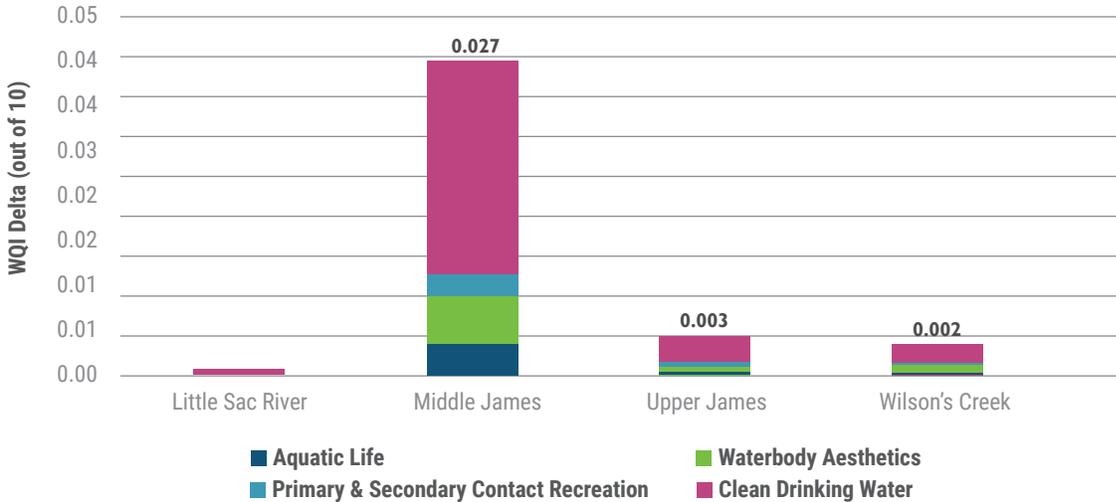


Figure 1. Changes to the Water Quality Index from Septic System Elimination

In addition to water quality benefits, septic system elimination is projected to positively impact regional economic development and increase existing home values. For purposes of estimating economic benefits, existing vacant land within 600 feet of regional sewer connection lines was anticipated to be 95% residential and 5% commercial. Average per-acre property values were estimated from local listings at \$10,000 for vacant land, \$20,000 for residential land, and \$100,000 for commercial land. Existing homes that will directly benefit from septic system elimination were anticipated to increase in value \$10,000 on average.

Cost Considerations

Costs associated with septic system elimination in Greene County were estimated based on the anticipated sewer extension construction costs and increased operation and maintenance (O&M) costs at the wastewater treatment plant (WWTP). O&M costs were based on wastewater treatment plan costs estimated at \$617 per million gallons per day (MGD) of flow. Sewer extension construction costs were estimated at \$15 million based on laying approximately 74,700 feet of 8-inch gravity sewer and 13,300 feet of 4-inch laterals using current construction costs (Table 2).

Table 2. Estimated Cost for Septic System Elimination in Greene County

Description	Little Sac River	Middle James	Upper James	Wilson's Creek	Total
Septic Systems Eliminated with Sewer Extension	28	354	149	181	712
Increase Flow to WWTP (MGD)	0.007	0.1	0.04	0.05	0.2
Annual Operation and Maintenance Cost	\$1,660	\$21,000	\$8,830	\$22,300	\$42,200
Sewer Extension Construction Costs (millions)	\$1.2	\$7.8	\$3.6	\$2.3	\$15

SROI Results

Table 3 presents final results of costs and benefits of septic system elimination. The 25-year present value capital costs plus O&M costs total about \$15.2 million. However, these costs are more than offset by improvements water quality, regional economic development benefits, and increase property values, which total about \$17.5 million. Overall, the total net value of septic system elimination would generate about \$2.5 million more in benefits than total lifecycle costs with a benefit-cost ratio of 1.2.

Table 3. Summary of Present Value Costs of Septic System Elimination (\$2018, Millions)

Types of Benefits and Costs	Present Value of Impact
Environmental	
Water Quality Impacts	\$2.4
Social	
Regional Economic Development	\$9.0
Property Value Gains	\$6.3
Costs	
Capital Expenditures	(\$14.5)
Operations and Maintenance	(\$0.7)
Totals	
Financial Lifecycle Cost	(\$15.2)
Total Social, Environmental Benefits	\$17.7
Total Value - All Costs and Benefits	\$2.5
Benefit-Cost Ratio	1.2

Figure 2 provides a graphical presentation of the value created relative to cost by accounting for several uncertainties that can raise or lower the perspective on total value. Taking into account these uncertainties, it is estimated that that the benefit-cost ratio could range from about 0.8 to 1.7 with a 20% chance of it being above or below that range. These calculations were based on the total potential property area that could benefit from regional wastewater service. The benefit-cost ratio could be improved by selecting only projects that yield a greater return. More detailed information on this SROI analysis can be provided in a separate technical appendix.

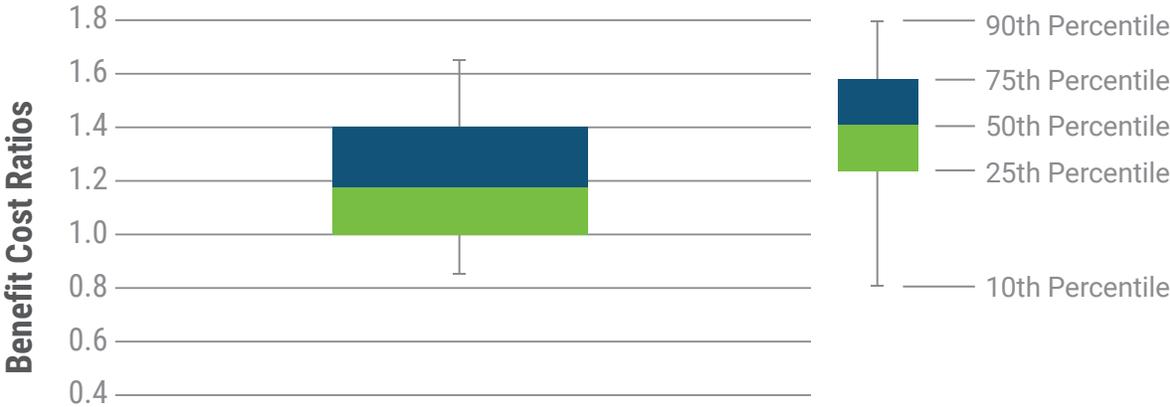


Figure 2. Range of Potential Benefit Cost Ratios for Septic System Elimination

Summary

Septic system elimination will likely realize benefits that would outweigh the costs. Eliminating septic systems in Greene County was estimated to result in approximately \$15.3 million in regional economic development and improved property values and about \$2.4 million in water quality improvements. Accounting for uncertainty, the benefit-cost ratio potentially ranges from 0.8 to 1.7, with an average of 1.2. Presumably, however, some septic system elimination projects will be more cost effective than others. Targeting select areas will likely result in a much higher benefit for the corresponding cost. More detailed information on this SROI analysis can be provided in a separate technical appendix.

References

Van Houtven, G., J. Powers, S.K. Pattanayak. 2007. Valuing Water Quality Improvements in the United States Using Meta-Analysis: Is the Glass Half-Full or Half-Empty for National Policy Analysis? *Resource and Energy Economics*. 29(2007), 206-228