

# **Ohio River Valley Region, Water Quality & Septic Systems**

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## Executive Summary

The Ohio River Basin spans over 204,000 square miles including 14 different states and a population of nearly 25 million (Ohio River Basin Consortium, n.d). The Ohio River has wide-ranging impacts on public health, providing millions of people with drinking water and recreational opportunities as well as supporting economies through transportation and shipping. Despite the immense impact of the Ohio River, The Ohio River Water and Sanitation Commission currently designates  $\frac{2}{3}$  of the Ohio River as impaired for contact recreation caused by E. coli or fecal coliform bacteria (Ohio River Water and Sanitation Commission, 2014). This is a major public health risk, as there are many diseases that are caused by consuming or coming into contact with this contaminated water such as cholera, dysentery, enteric fevers, and diarrheal diseases. Failing home sewage treatment systems (HSTS) is one of the primary drivers of fecal coliform bacteria within the Ohio River as the Ohio Department of Health estimates that around 31% of all septic systems in Ohio are experiencing some type of failure (Ohio Department of Health, n.d.).

To grasp why there are currently so many failing HSTS, our group partnered with the National Wildlife Federation (NWF) to collect and analyze current public data to develop a set of recommendations that provide next steps to mitigate the current HSTS problem in Ohio and help restore the Ohio River and its basin. Through an initial literature review, we were able to develop four main hypotheses that act as barriers to successful HSTS usage inside of Ohio: economic barriers, septic system policy and regulations, old infrastructure and improper environmental conditions, and lack of HSTS education. To collect data on these four main hypotheses, our project team conducted additional literature reviews, public document and survey searches, as well as a public servant interview.

Our research found that Ohio's septic system rules and regulations have historically been outdated and haphazard, leading to septic systems not being properly maintained by homeowners as well as septic systems being installed in inadequate environmental conditions. Our recommendations to the National Wildlife Federation are the following:

- Help facilitate increased communication between counties to help them design operation and maintenance programs that better reflect the unique environmental and social needs of each county while also maintaining effective and stringent septic system regulations.
- Work on methods of informing homeowners about proper septic system maintenance. Simultaneously, pressure needs to be placed on legislatures to update septic system policies.
- Continued implementation of the Mahoning County "Home Septic Treatment System Operation and Maintenance Program" with additional tracking of the social and environmental benefits from this program.

## Introduction & Background

Septic tanks are a type of sewage system that use natural filtration processes to manage and treat wastewater. Alternative to a typical household that has a system that connects to a city's main sewage line, a septic tank is typically found underneath the ground on a homeowners property, and uses natural processes and effective technologies to efficiently treat used water. Septic tanks are impermeable, often constructed of concrete, fiberglass, or polyethylene to prevent leaching (EPA, n.d). Drain and sewage systems on the property connect to these tanks and dispense directly into them. Tanks are typically placed away from the source of waste to avoid the smell that comes with them. They are very important for homes that have poor drainage or homes that do not have access to a municipal sewage network. They provide an environmentally safe way to dispose of wastewater that would otherwise contaminate local surface and groundwater.

Septic tanks are designed in a manner that holds wastewater long enough for sedimentation to occur (EPA, n.d). After the waste in water settles, there is a layer effect within the tank. Solid waste sinks to the bottom forming a layer of sewage known as "sludge", while oil, grease, and other waste that is less dense than water float forming a layer of waste known as "scum". The wastewater layer, known as effluent water, sits in the center of the tank and is released through a T-shaped outlet that prevents the sum or sludge from escaping the tank. It is typically released to a drain field, and this field further treats water as it percolates through the soil naturally purifying itself, eventually discharging to groundwater (EPA, n.d). In some cases water is partially treated before being released into the field. Although they are used mostly in rural areas, they are not exclusive to the rural setting.

Ohio has a very large problem with septic system maintenance and upkeep. Prior to a new septic system policy in 2012, the statewide rules had not been adjusted for over 35 years. This lack of oversight has been seen in the extremely high failure rate of Ohio septic systems. By 2014, 31% (193,988) of the existing systems in the state had reported failures (Figure 4). This comes despite the nearly 1.3 billion dollars that the state has provided in low interest loans to areas with high failure rates since 1989 (Phillips et al. 2014). Additionally, during this time there were many septic systems installed with the cookbook one size fits all septic system design. This design doesn't account for soil type, and as a result has been one of the major contributors to the septic system failure rate. An additional factor that has contributed to high failure rates in Ohio is that most of Ohio's soils are not suited for traditional leach fields (Vedachalam et al., 2012 & Figure 3). Unfortunately, since 2014 there has been no new data on the failure rate of septic systems, or any updates that policies have made significant improvements to the septic system problems in Ohio.

This is also an ideal time to start a project like this. The H.R.5376 "Build Back Better Act" infrastructure bill was passed by the House of Representatives on November 19, 2021. This bill addresses and allocates funding for a multitude of issues involving public health such as sewer and stormwater maintenance, and other water systems. Section 110030 assigns 150 million dollars in the form of grants for the repair, construction, or replacement of septic systems

specifically for low-income homeowners (H.R.5376, 2021). Which provides a great opportunity for the State of Ohio to focus efforts towards re-enforcing and rebuilding its septic systems for households that need it.

Restoring and protecting the water quality of the Ohio River is one of the top priorities for the National Wildlife Federation. The degradation of the river had made it the most polluted in the country, which poses a distinct danger to the 15 states that surround the river (NWF, n.d.). Additionally, due to the vital importance of the Ohio River for its economic, natural, and societal benefits, it is vitally important that action be taken to better understand the issues facing the river, and develop solutions to address water quality.

## **Methods**

Beginning this project, we were introduced to conducting a project looking at how septic systems affect the water quality in the Ohio River Basin. Based on our extensive research, we found that there were four major categories that affect septic systems update timing and therefore water quality. These four major factors were education, economic, policy, and environmental barriers to secure proper septic system management. After speaking with our client with the National Wildlife Federation, we came to the conclusion that we could have a more significant impact on this broad issue by narrowing down the scope of our project to focus solely on two of our hypotheses. Considering the previous extensive research on environmental effects of septic systems, we were able to cut that barrier out as further research on the topic would not be the most beneficial to the citizens of Ohio (Vedachalam, 2012). We also cut our educational factors for now, because we thought this was encompassed in the responsibility of policy and policy makers. However, moving forward we suggest future projects take a two pronged approach to implementing policy, first passing important policy and then educating citizens on how it impacts their lives.

Once we had established our two hypotheses as to why there is such a problem with septic tank pollution in the Ohio River Basin we conducted an extensive literature review. This was done so that we would have viable information to either prove or disprove our hypotheses, and to also see what the leading experts in the fields had to say on the topic. We conducted a three pronged approach to this research, by looking at the actual policies in place, studies done on why systems fail, and the resources the Ohio government made available online.

We first reviewed the actual policy governing septic system maintenance in Ohio and looked at local ordinances to see if there were discrepancies. When it comes to state level regulation, the best policy comparisons we can see are across states. Through multi-state analysis we were able to directly compare septic policies, how recently they were passed and how controlling they were. We were able to compare Michigan and Ohio specifically for their most recent rules on septic systems.

We then looked at peer reviewed scientific studies done on why septic systems failed. This was difficult because there is not a lot of academic work done on this very specific problem, and we were not able to find any studies on the Ohio River Valley itself. However, we were able to find studies done in other parts of the country and could use these results as a baseline to compare.

Additionally, we were able to find many resources that discussed the cost of installation, maintenance, and repair of septic systems (Figure 1 & 2). Lastly, we looked at the resources that the Ohio Department of Health made available to homeowners. These were useful in identifying if there was adequate information that homeowners could use, and thus allowing us to determine where the lack of education problem stemmed from. Through this literature review we were able to identify what we believed to be a good plan for improving the septic system issues from both the economic and policy factors.

## **Results & Recommendations**

We thought that there needed to be more information for homeowners with septic systems. The primary time when a homeowner learns about septic systems is when they are buying their house and the realtor has to say whether there is one. However after this there are no required reminders for homeowners to check their system, and unless it fails, many may not know that their system is faulty. Additionally, it is very expensive to replace a septic system, and many homeowners may not have access to the financial resources needed to do this. While there are plenty of resources online about how to get loans to ease this financial burden as well as information on how to maintain a system, many people might not know that they should use them. So we think that there should be a program where people join and the state will help with the financial burden of inspecting and maintaining the systems.

As it turns out, there was already a very similar plan that was created in a small county in Northern Ohio called Mahoning county, called the “Home Septic Treatment System Operation and Maintenance program”. There was very little written about it, but a local newspaper picked up the story and we were able to reach out and speak with the reporter about the people impacted by this new policy and to get their opinions on it. We were able to do an interview with the Director of Public Health in this county, which we have recorded in our appendix (Welch *et al.*, 2022). This interview gave us insight into public reaction, logistics of the program, and the efficacy of protecting water quality.

### **Summary of Recommendations:**

- We recommend that the National Wildlife Federation support local governments and nonprofits in three main ways: 1) Strengthen statewide policy, 2) increase the distribution of information to homeowners, and 3) continue the implementation of the Mahoning County Home Septic System Operation and Maintenance Program.
- In order to strengthen state wide policy, lobbyists with environmental interest need to put pressure on the Ohio Legislature. It is likely that Ohio citizens were informed that the last time the septic systems were updated was summer of 2010, they would be on the side of updated regulation. Getting constituents on the side of progress will pressure the legislature to bring septic system regulation back to front of mind in policy.

- Create a framework that simplifies how counties share information about implementation and tracking of their septic system programs. The Director of Environmental Health for Mahoning county expressed the difficulties of how he had to personally go to other counties to hear about their programs. It would be much more beneficial if there was a system of coordination between all of the counties to facilitate information and data sharing in regards to their septic system programs. The National Wildlife Federation has the scope to track multiple counties at once, and that data will be beneficial to any states that face these issues in the future.

### **Client Impact**

Our client, the National Wildlife Federation, asked us to gather more information about the state of the septic system issue in the Ohio River Valley. We believed that it was important that we understand this issue better from a policy, educational, and economic background. After conducting our research, we created three different deliverables for the NWF. The first is a handout that can be used to help homeowners understand more about their own septic systems, and to find resources to help them pay for system maintenance and repair. The second deliverable was a case study on the new Mahoning County “Home Septic Treatment System Operation and Maintenance program”, along with an interview with the director of health for the county. The goal of this case study was to understand the pitfalls of creating a program like this in Ohio, and use their successful program as a guide for other counties. The last deliverable is this research paper, which will be given to both the NWF as well as Mahoning County officials to be used in whatever way they see fit. We recommend that the next team should focus on studying the implementation of the Mahoning County program, and explore how it can be expanded to other counties in Ohio.

## Appendixes

Figure 1

Septic System Components	Average Installation Cost	Best Soil Type
Leach Fields	\$7,250	Gravel/Clay (not suited for 97.6% of Ohio soil)
Mound Systems	\$14,150	Sandy soil and herbaceous areas
Drip Irrigation Systems	\$19,750	Mix of clay and sandy soil
Cookbook System	\$8,200	Does not consider soil type (major contributor to 31% failure rate)

Figure 2

	Median Per Capita Income in 2019
Rural Ohioans	\$42,891
Average Ohioans	\$50,199

Figure 3: Principle Reasons for Sewage System Failure (2012 ODH Survey)

Issue	Percent Accounted For
Soil Limitations	33%
Design Issues	14%
Site Limitations	25%
Installation Issues	3%
No Leach Field	14%
Direct discharge exceeds limits	43%

System Owner Abuse	17%
Unapproved System	7%
Old System (age)	44%
Other	1%

Figure 4: System Failures by Region (2012 ODH Survey)

<b>OEPA District</b>	<b>Central</b>	<b>Northeast</b>	<b>Northwest</b>	<b>Southeast</b>	<b>Southwest</b>	<b>Total</b>
<b>Existing Systems Reported</b>	54,813	236,386	117,819	87,943	131,532	628,493
<b>Failing Systems Reported</b>	20,512	90,380	45,560	12,267	24,269	193,988
<b>Failure Rates</b>	37%	38%	39%	15%	18%	31%

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