Non-Point Source Pollution: Septic Leachate

A SUMMARY OF SEPTIC LEACHATE STUDIES & MITIGATION EFFORTS IN MONTANA

December 2019

Overview/Background

Septic Leachate as a National Water Pollution Issue

Non-Point Source (NPS) pollution comes from runoff, precipitation, drainage, atmospheric deposition, seepage or modification of hydrology. NPS pollution is caused by rainfall or snowmelt moving over and through the ground. The runoff then picks up natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, and ground waters. NPS can include excess fertilizers, pesticides, oil, sediment, salts, as well as bacteria and nutrients from livestock and faulty septic systems. The US Environmental Protection Agency cites that states report NPS pollution is the leading remaining cause of water quality problems. These pollutants have harmful effects on drinking water supplies, recreation, fisheries and wildlife.

Septic systems consist of a tank that receives household effluent from toilets, sinks, showers and washing machines, and a drainfield. Septic 'leachate' is the liquid that remains after the wastewater drains through septic solids. More than one in five households in the US (~21.5 million) have individual or small community septic systems. Septic systems that are properly planned, designed, sited, installed, operated and maintained can achieve satisfactory wastewater treatment. However, systems that are sited in densities that exceed the treatment capacity of regional soils and systems that are poorly designed, installed, operated or maintained can cause problems. Poor drainage, surface ponding, and groundwater contamination can result. The most serious documented problems involve contamination of surface waters and ground water with disease-causing pathogens, pharmaceutical compounds and nitrates. Other problems include excessive nitrogen discharges and phosphorus pollution, which increases algal growth, nuisance aquatic plants and lowers dissolved oxygen levels. The US Bureau of Census has indicated that at least 10 percent of onsite systems are no longer working, with some communities reporting failure rates as high as 70 percent.

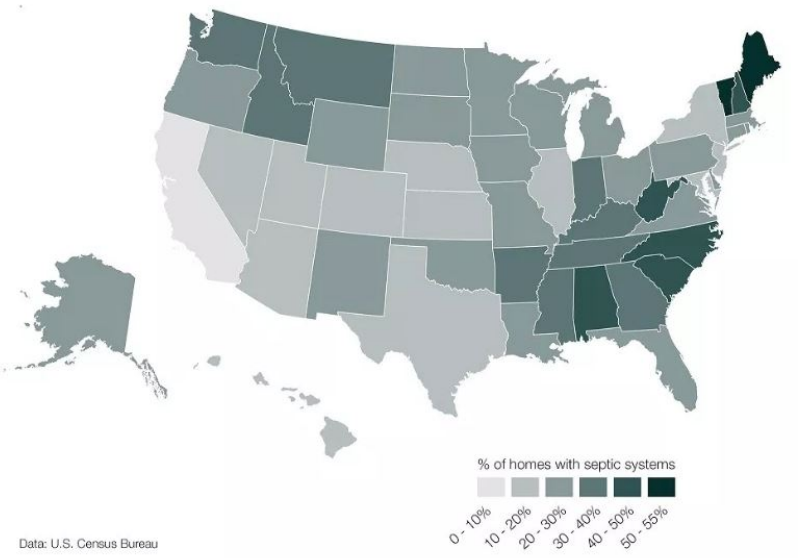

Figure 1: Percentage of Homes with Septic Systems Nationwide (US Census Bureau)

Best Management Practices have helped to address NPS by decreasing fertilization, better manage livestock and pet waste, install wells at greater distances from septic systems, and manage stormwater. However, decreasing septic leachate pollution is difficult because individuals are responsible for their own systems. For example, both hormones and pharmaceutical compounds were found in the groundwater near septic systems on Fire Island, New York, and in New England, according to a January 2015 study from U.S. Geological Survey. In Ohio, the state health department estimates that nearly one out of every three septic systems is failing. Researchers with the Baylor College of Medicine are discovering a resurgence of parasitic diseases in rural Alabama because of poor sanitation and

septic system failure. Nationally, some 28,821 miles of streams are designated as "threatened or impaired" by the U.S. Environmental Protection Agency (EPA) because of septic systems.

Many things need to happen for septic thanks to operate as they are intended. The tank must be well designed. The drain field must be rigorously evaluated. Sandy or limestone soils are too porous and often allow waste to percolate too quickly into the water table. Soils that are too compact, like clay, cause the waste to flow directly into rivers and streams. The drain field must also be located far enough away from waterbodies that the soil microbes have time to digest. Too much density is also bad for septic as it overwhelms the treatment capacity of the soil or raises the water table too high. Even properly installed and maintained septic systems have a finite life expectancy – between 15-30 years depending on site specific conditions. Added up, failing septic systems and the threats they cause are a relatively new recognized and serious feature of the nation's unaddressed water pollution problem.

In Montana, there is no requirement to maintain or inspect septic tanks. We have some of the lowest standards in the US. Oversight and enforcement of operational requirements to keep septic systems from leaking raw wastes onto the land or into ground and surface water is weak across much of outer suburban and rural America where most systems are installed. There are no federal rules that address septic systems, it is up to the states, counties and tribes to regulate, so there is a lot of variability in implementation and enforcement of standards. Montana Department of Environmental Quality provides standards for design, but local governments oversee the installation of septic systems.

Studies

Summary of Montana Septic Leachate Studies/Literature by Date

The bulk of existing studies and literature in Montana regarding septic leachate has been conducted in the Flathead Basin. On Flathead Lake alone, over half of the homes are on private septic fields.

- *2014 – Investigation of Water Quality in Dayton, Montana (Bansak, T. and S. Rosso. Report to Project Partners by Flathead Biological Station and the Flathead Lakers).*
    - Environmental regulations exist to protect human health and surface and ground waters. Protective measures include proper construction and siting of septic systems and drainfields. Soil absorption sites in drainfields typically exhausted after 15-30 years. Dayton residents raised concern about possible water contamination, including septic systems that may be failing. The surface water sites at Dayton Creek and Winery Spring yielded some concerning results, particularly in for nutrients and bacteria found in ditches, including total coliform and *E. coli*. Phosphorus levels in the ditches were consistently higher than long term mean for the lake. Degraded water quality and presence of bacteria in the creeks and diches pose threats to Flathead Lake water quality as well as human health. This may be caused by an interception of groundwater flow of septic leachate from seasonally inundated septic systems.
- *2012 - Investigation of Septic Leachate to the Shoreline Area of Whitefish Lake (RRG-11-1474. Prepared for Whitefish County Water District by Whitefish Lake Institute).*
    - Study determined spatial and temporal extent of septic leachate to the shoreline area, and provided a scientific basis for identifying ecological threats to the lake, economic threats to the

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community, and potential public health risks resulting from water quality impacts. Presence of Optical Brightening Agents provide excellent indication of septic system failure. Study methods included fluorometry, dissolved organic carbon, fluorometry/DOC ratio, *E. coli* enumeration, human DNA biomarkers, conductivity, total dissolved solids, and GIS methodologies and tools. Septic leachate contamination confirmed at City Beach Bay, Viking Creek and Lazy Bay. The study also found medium - high potential for contamination in additional areas of the lake.

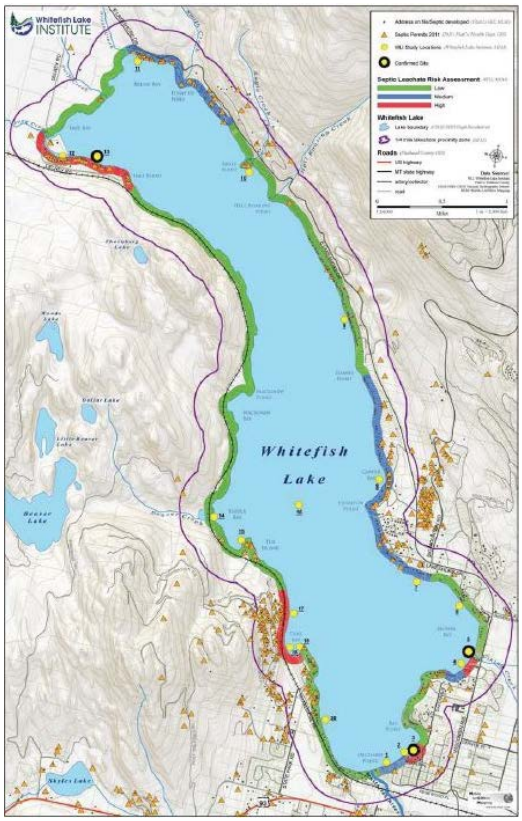

Figure 2: Septic Leachate Contamination & Risk Map

- *2007 - Assessment of septic leachate: A survey of Lake McDonald, Glacier National Park (Hauer, F.R. FLBS Report 199-07. Prepared for Glacier National Park by Flathead Lake Biological Station, The University of Montana).*
    - Lake McDonald is one of the most oligotrophic large lakes in the US, with particularly low concentrations of phosphorus, low algal productivity, and very high water clarity. However, numerous locations near shoreline homes/cottages have elevated levels of algal growth, which could be indicative of slow leaking septic systems. In a dye study, evidence of leaking septics was evident; in one case a complete septic failure was confirmed. Recommendations include connecting homes within the central system area within 5 years and ensuring all septic leach fields are at least 200 meters away from the shoreline.
- *1997 – Water Quality Data and Analyses to Aid in the Development of Revised Water Quality Targets for Flathead Lake, Montana (Stanford, J.A., B.K. Ellis, J.A. Craft and G.C. Poole. FLBS Report 142-97. Flathead Lake Biological Station, University of Montana).*
    - Deterioration of water quality demonstrated by long-term analyses; management of nutrient loading to preventing excess algal blooms in the water column and shoreline is the primary water quality concern in Flathead Lake. Anthropocentric nutrient loading must be reduced to reverse trends of increasing primary productivity. Algae growths are heaviest in areas of high nutrient input from shoreline sources, including septic systems.
- *1996 – Contribution of Nearshore Nutrient Loads to Flathead Lake (Makepeace. S. and B. Mladenich. Prepared for US EPA by the Confederated Salish & Kootenai Tribes Natural Resources Department).*
    - Diminished water quality indicators increasing since 1977; increased algal blooms and decreased water clarity. Onsite septic systems contribute to phosphorus loading, accounting for 2-6 percent of total loading to lake. Proactive attempts to reduce nutrient loading counteracted by growth within basin. Report does not address nutrient loading that may occur during failure of septic systems.

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- *1989 - Whitefish County Water & Sewer District Facilities Plan (Christian, Spring, Sielbach & Associates).*
    - Septic drainfields causing leachate to enter lake; continued use not viable. Study found 10% failed septic systems and 22% that were not performing properly. Fourteen sites were less than 100' from the lake. Total phosphorus entering soil from septic tanks is 46% of current balance of lake.
- *1989 – A Study of Shoreline Septic Leachates in Echo Lake, Montana (Hauer, F.R. FLBS Report 104-89. Flathead Lake Biological Station, the University of Montana).*
    - Echo Lake appears to have a very close association with groundwater. Increase in algal blooms, aquatic plant growth and fish kills. The lake appears to need only relatively small additional nutrient loadings to hasten the eutrophication process. Interconnectivity of lake to surrounding groundwaters may be occurring deeper in lake (than along shoreline as was found to be the case in Flathead Lake).
- *1988 – Study of Shoreline Sewage Leachates in Flathead Lake, Montana (Hauer, F.R. FLBS Report 099-88.* Flathead Lake Biological Station, the University of Montana).
    - Study conducted lake-wide evaluation of seeps and springs to identify locations most susceptible to increased nutrients as a result of failing septic systems. Septic leachates important nutrient source along shorelines where groundwaters flow into the lake, particularly during times when water circulation is reduced. 35 sites were identified via fluorometry, conductivity or high algal growth to warrant further investigation.
- *1986 – Investigation of Septic Contaminated Groundwater Seepage at Whitefish Lake (Jourdonnais et al. Flathead Lake Biological Station).*
    - A study sponsored by the Whitefish County Water and Sewer District and conducted by the investigated septic contaminated groundwater seepage as a nutrient source to Whitefish Lake. Evidence of septic contaminated groundwater and surface water along shoreline locations around the lake detected. This report was instrumental in providing baseline data for comparison in 2012.
- *1986 – Final Progress Report of an Evaluation of Water Quality and Shoreline Septic Leachates in Echo Lake, Montana* (Hauer, F.R., J.A. Stanford and J.H. Jourdonnais. FLBS Report 089-86. Flathead Lake Biological Station, the University of Montana).
    - Echo Lake, near Big Fork experienced significant development along shoreline areas in the 1980s. Study results indicated an increase in productivity resulting in anoxic conditions and algal blooms within Echo Lake.
- *1985 – Verification of Shoreline Sewage Leachates in Flathead Lake, Montana (Jourdonnais J.S. and J.A. Stanford.* FLBS Report 082-85. Flathead Lake Biological Station, the University of Montana).
    - Documents nutrient pollution and impacts such as nuisance and harmful algae blooms to Flathead Lake from domestic sewage. Detection of leachates in surface waters during low pool provided information on general locations of problem areas along the shoreline, including Lakeside and Polson Bay. This study also increased the body of knowledge on sampling for septic leachates, including the use of seepage meters, fluorometry, and detection of Optical Brightening Agents as indicator. 9/14 sites were found to have relatively high levels of septic leachates.
- *1984 – Laboratory Analysis of Color Infrared Aerial Photographs (US EPA).*

  - Aerial photos were stereoscopically examined for indications of malfunctioning septic systems. And determined several septic systems failing along lakeshore of Whitefish Lake. Local, state and federal agencies concerned over deteriorating water quality of Whitefish Lake. EPA study indicated significant drainfield failures; 85 possible failed septic systems of the 147 investigated.
- *1981 – Flathead County Sanitarian Dye Studies (Whitefish County Water and Sewer District).*
  - Dye tests confirmed that septic tank effluent was entering Whitefish Lake from a number of sites along the eastern shore. Also found a number of additional septic failure areas beyond the lakeshore.

Recommendation/Moving Forward

After completing a report on Whitefish Lake (2012), the Whitefish Lake Institute, the City of Whitefish, and other partners worked to address the septic leachate issue at the local level. The City offered affected neighborhoods deferred annexation and other incentives. Additionally, the City of Whitefish, DNRC, Flathead Conservation District and the Whitefish County Water District funded Preliminary Engineering Reports for two neighborhoods which detailed mitigation strategies and associated cost estimates. However, due to funding complexities, the need for a Rural Special Improvement District, and the involvement of multiple jurisdictions, among other concerns, mitigation of the issue has not moved forward to date.

Recently, the Whitefish Lake Institute drafted septic leachate “study bill” language for consideration of the Flathead Basin Commission, who have prioritized non-point source pollution in strategic planning efforts. The Flathead Basin Commission is now working to coalesce a group of Flathead County legislators to carry a septic leachate study bill in the next legislative session.

The proposed study bill is not intended to further explore this issue scientifically. There exists a preponderance of evidence locally, regionally and nationally that septic systems create water quality issues. Rather, the study bill is intended to identify the socio-economic hurdles that are preventing mitigation of this issue in Montana.

Your support in this effort will ensure that this issue will be closely examined, and that solutions will be identified to fully inform local and state government so that tools will become available to address this concern to the world class aquatic ecosystems that we all share.