

# Province Lake Septic Survey Report



December  
2013

Septic Survey Report for Province Lake

Prepared For: The  
Province Lake  
Association



Prepared By: The  
Acton Wakefield  
Watersheds Alliance



December 2013

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## Introduction

This report serves to compile, summarize, and analyze data collected during the Province Lake Septic Survey conducted in August 2013 and is intended for residents, landowners, and local decision makers within the Province Lake watershed. The survey is part of a larger project to develop a watershed management plan for the Province Lake Watershed.

As this report demonstrates, there are a variety of different types of systems designed to deal with wastewater. Septic systems, outhouses, and even portable toilets help us to manage our wastewater to prevent undo harm to human health, aquatic life, or water resources. However, outdated or improperly maintained systems can release disease-causing bacteria into water bodies, causing gastrointestinal illness and ecosystem dysfunction. Soils can act as an efficient filter of phosphorus in subsurface wastewater systems; however failing systems have the potential to contribute excessive phosphorus into lakes and stream through groundwater. With septic effluent containing about one thousand times the concentration of phosphorus in lake waters (Gilliom and Patmont, 1983) a small amount of effluent can have a major impact on a lake as small as Province Lake. In natural conditions, the scarcity of phosphorus in a lake limits algae growth. However, when a lake receives extra phosphorus, algae growth increases dramatically. Sometimes this growth causes choking blooms, but more often it results in small changes in water quality that, over time, damage the ecology, aesthetics and economy of lakes. In Province Lake, the increase of phosphorus over time has resulted in cyanobacteria blooms. In addition to creating harmful toxins these bacterial blooms threaten Province Lake's aesthetic, recreational, ecological and economical value.

## Septic Survey Methods

A septic survey for Province Lake was designed based on surveys previously conducted by FB Environmental. A map was created using Geographic Information System (GIS) software to identify all the properties within the Province Lake watershed shoreland zone (250 ft of all streams and the lake). Town tax map information was then used to identify the names and mailing addresses of all parcel owners within the shoreland zone. A link to an online version of the survey was emailed to all members of the Province Lake Association with email addresses, and hard copies were mailed to the permanent mailing addresses of all others within the survey area. This led to 132 surveys being submitted before the date of the actual survey, vastly decreasing the amount of time and volunteers needed for the door-to-door survey. A chance to win a \$100 gift certificate to a local restaurant was offered to all who participated in the survey.

On August 24<sup>th</sup>, 2013, fourteen resident volunteers and seven technical leaders from Province Lake Association (PLA), Acton Wakefield Watershed Alliance (AWWA), F.B. Environmental (FBE) and NH Department of Environmental Services (NHDES) surveyed residents door-to-door at Province Lake. The

volunteers were split into seven groups, each led by a technical leader. Each group had a volunteer resident from their sector to “break the ice” with survey respondents. At the end of the day, each property had either responded online, via mail, or was visited by a survey team, resulting in 220 completed surveys. If no one was home at a survey site, survey teams left educational brochures (Appendix B) about septic systems, outhouses, and their effects on the lake.

The survey (Appendix A) included questions relating to the owner’s current wastewater system use, along with several other questions to gauge their perception of the lake and knowledge of conservation practices. Questions included the respondent’s perception of the Province Lake’s water quality, the age of the system, age of the house, occupancy, how often the system is pumped, the last time it was pumped, and about other types of water using machines.

The results of the septic survey are being used by F.B. Environmental to estimate the total phosphorus loading into the lake from wastewater systems. Loading estimates from the model are being used conjunction with results of the 2013 watershed survey in order to create a management plan for Province Lake.

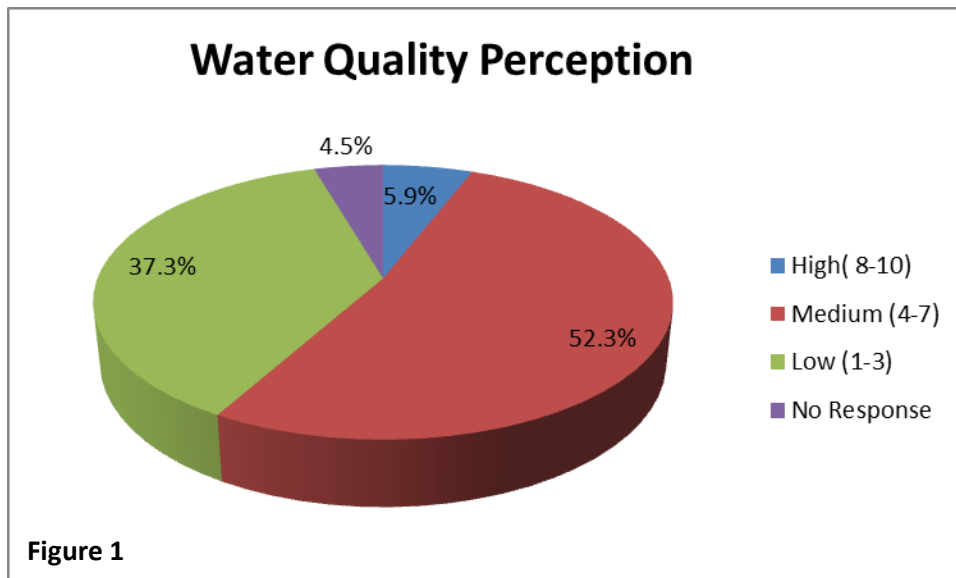
## Septic Survey Results

The survey questions were designed to work in conjunction with a land-use loading model which can estimate the amount of phosphorus septic systems are contributing to the lake. Questions like “How often do you have your wastewater system pumped?” factored in with “How close is your system to the lake?” can provide information about the potential for phosphorus in the system to reach the lake.

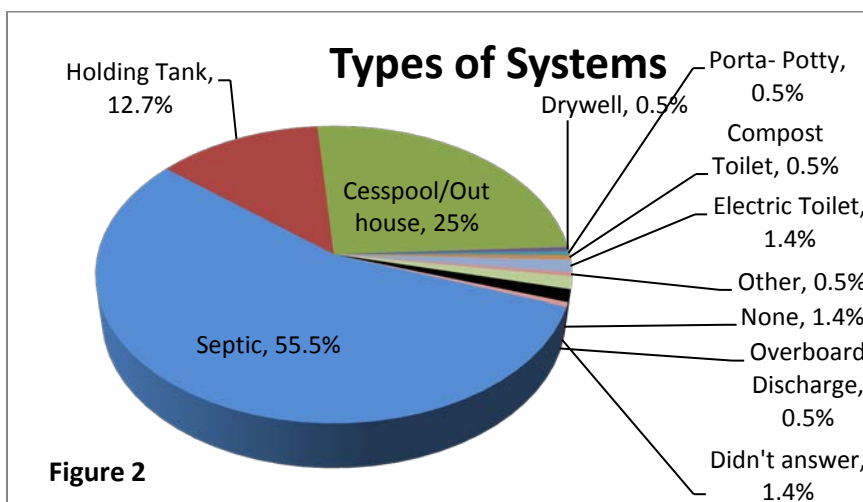
Out of the 427 total properties, 220 responded to the survey. 49 responses were completed online, 83 respondents sent their survey in via mail. 88 responses were completed in person on the day of the survey. The remaining residents were not at their residence on the day of the survey, had no building on the property, or refused to answer the survey.

In reference to the following figures: “No Response” indicates that the question was left unanswered by the respondent. “I don’t know” indicates that the question was asked but the respondent did not know the answer.

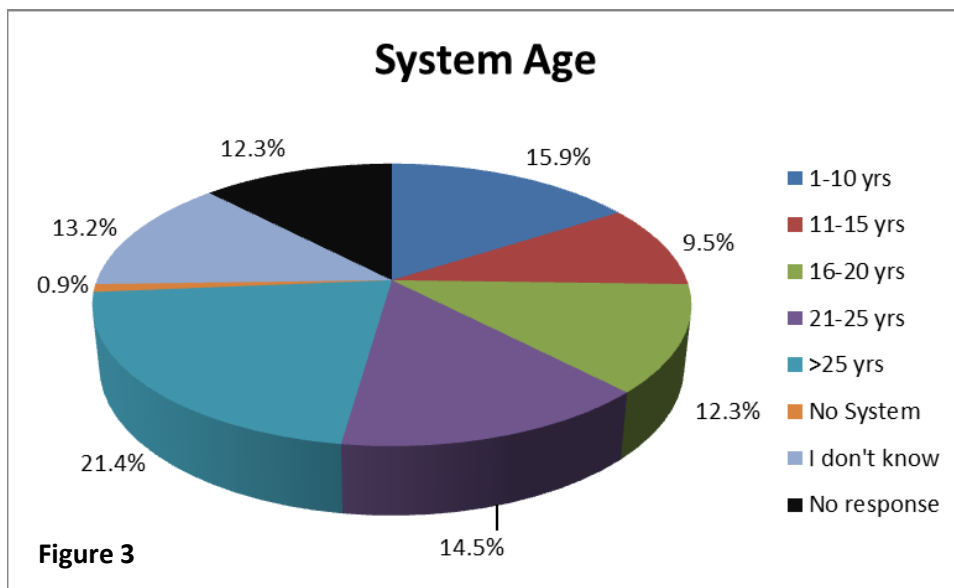
## Septic Survey Results By Question



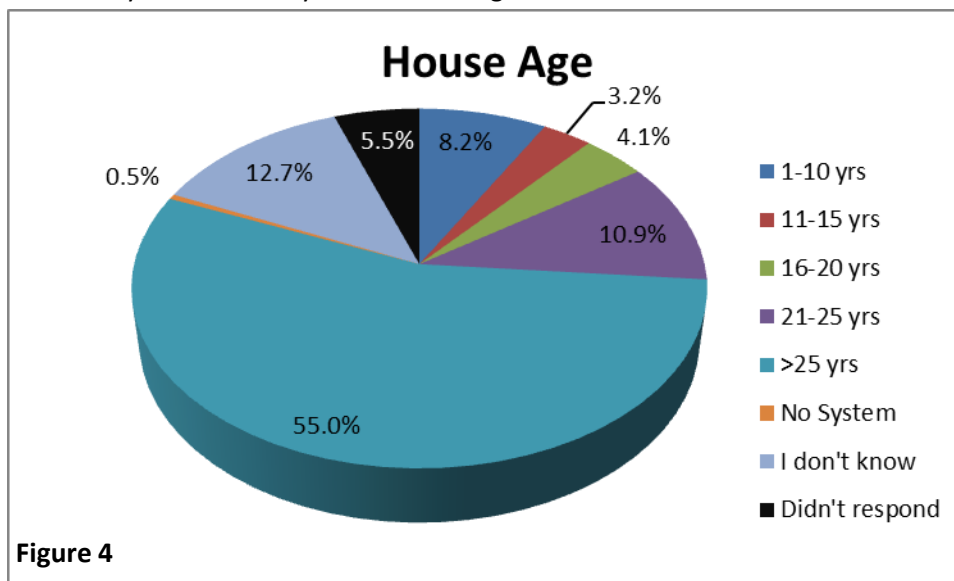
Most respondents (52.3%) perceived the water quality in Province Lake to be somewhere in between High and Low. A large portion of lake residents also found the Lake to have low water quality; likely due to the recent outbreaks of cyanobacteria. Only 5.9% of the residents of Province Lake felt the lake's water quality was high. 4.5% of residents who turned in the survey did not respond to this question.



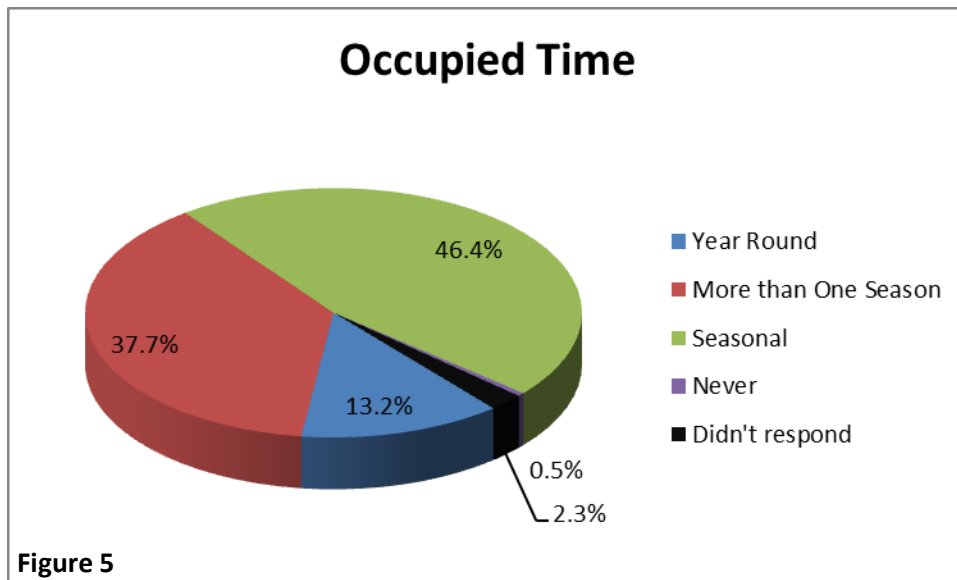
Only 55.5% of respondents answered that they had septic systems. Another 25.5% said they have a cesspool/outhouse, and 12.7% replied that they had holding tanks. 1.4% did not respond, and the remaining 4.9% was divided into various systems such as electronic toilets and porta-potties.



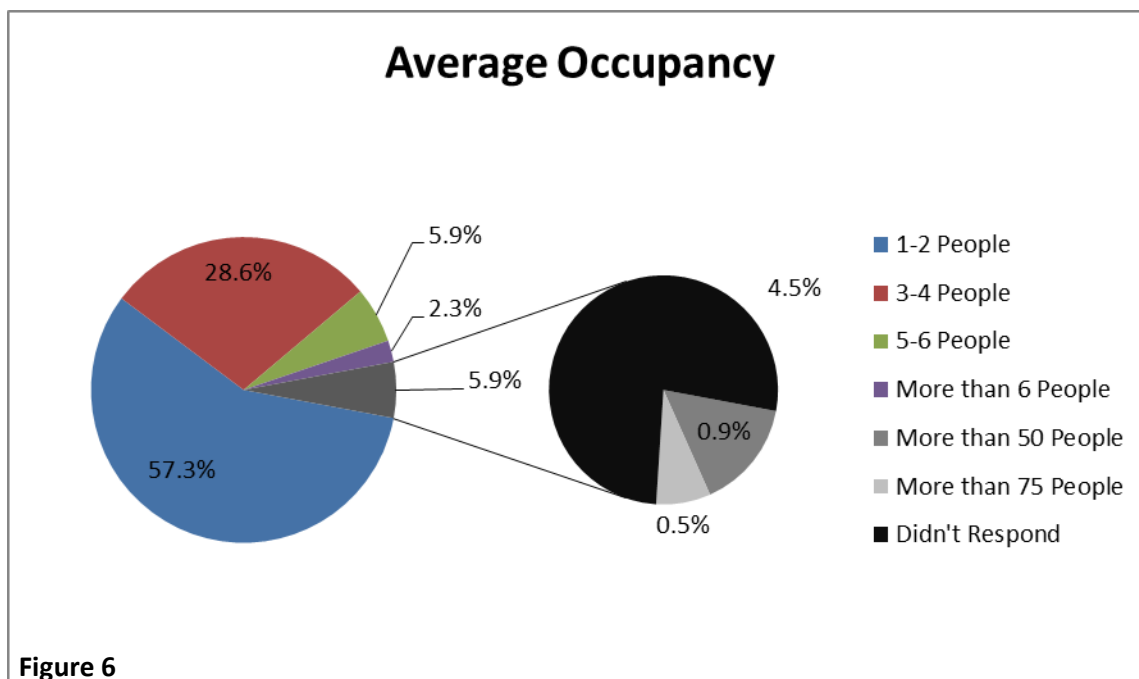
The age of the wastewater systems was well distributed; however, it is noteworthy that 21.4% of the systems (the largest percentage) were over 25 yrs old. 12.3% did not respond. These older systems are more likely than newer systems to damage Province Lake.



More than half of the houses (55%) were built prior to 1988; making them older than twenty-five years. and 8.2% of the properties were newly built (within the past 10 years). Many of the older properties have not had a newer wastewater system installed and are more likely to be damaging the lake through failure to treat wastewater.

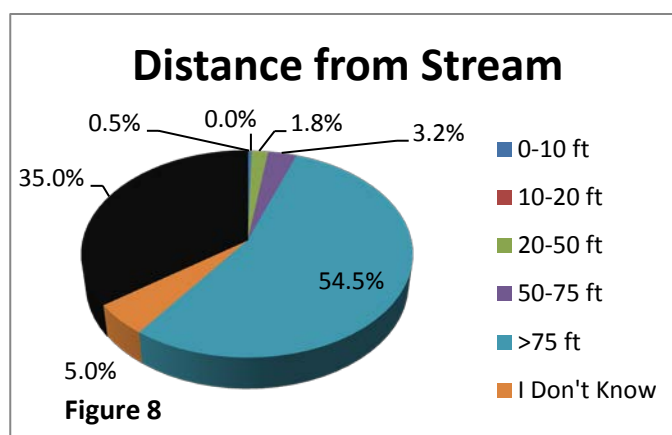
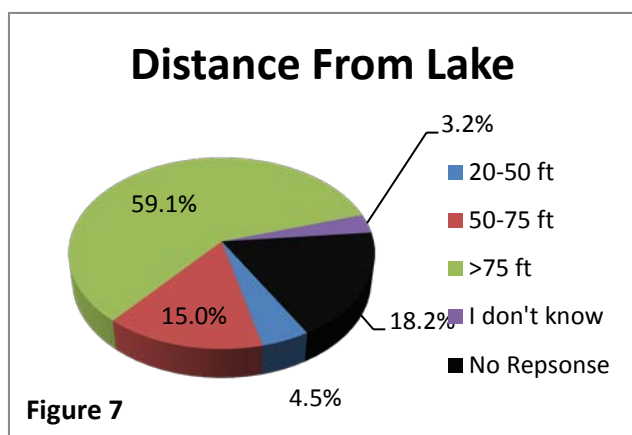


A large portion of respondents claimed to be seasonal residents (46.4% of respondents) while a mere 13.2% of respondents claimed to live on the lake year round. 37.7% of respondents claim to stay for more than one season, and 2.3 % did not respond. This information will contribute to finding how much usage the wastewater treatment systems receive throughout the year.

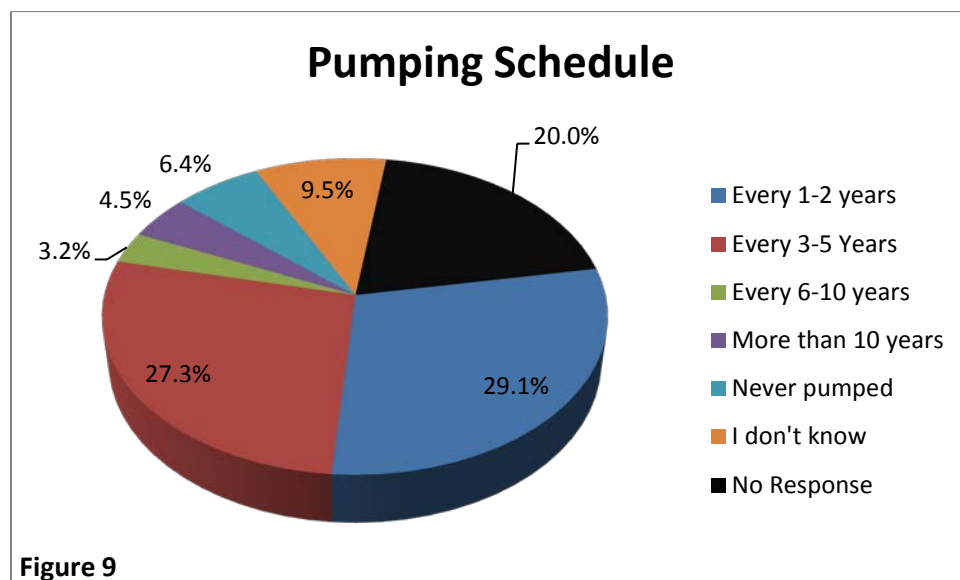


The majority of respondents (57.3%) had an average of 1-2 people occupying their residence during their stay, while 2.3% had more than 6 people. There are several notable outliers to this dataset, such as the three campgrounds that had 50+ people each. To include these with the “More than 6” responses would be misleading, so new categories were created to accommodate their larger scale.



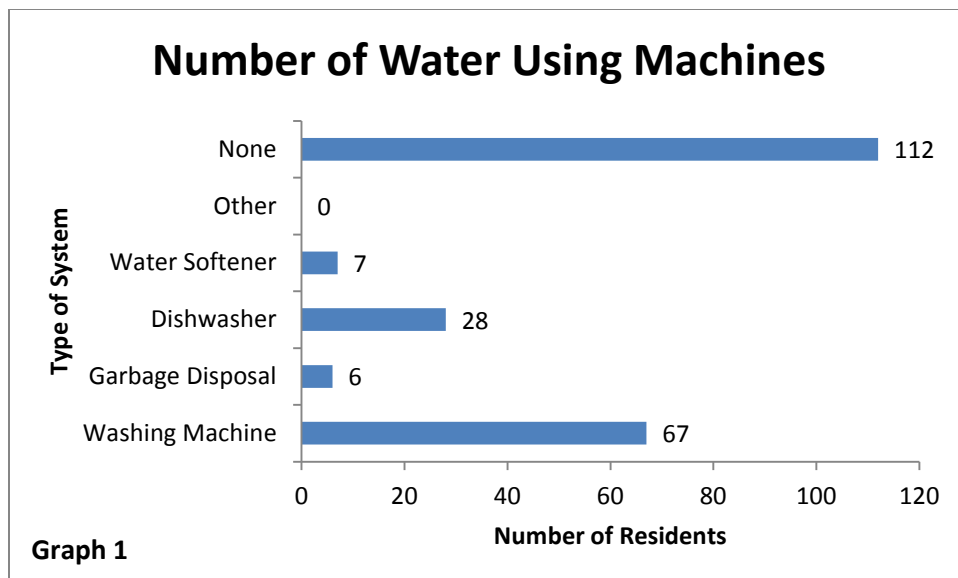


Most wastewater systems were greater than 75 feet away from the water (59.1% for lakes, 54.5% for streams). However, 10 systems (4.5%) were within 20-50 ft of the lake and one system was less than ten feet from the stream. If these systems at the water's edge fail, there is much less ability for the soil to filter out phosphorus and bacteria before they enter the lake.

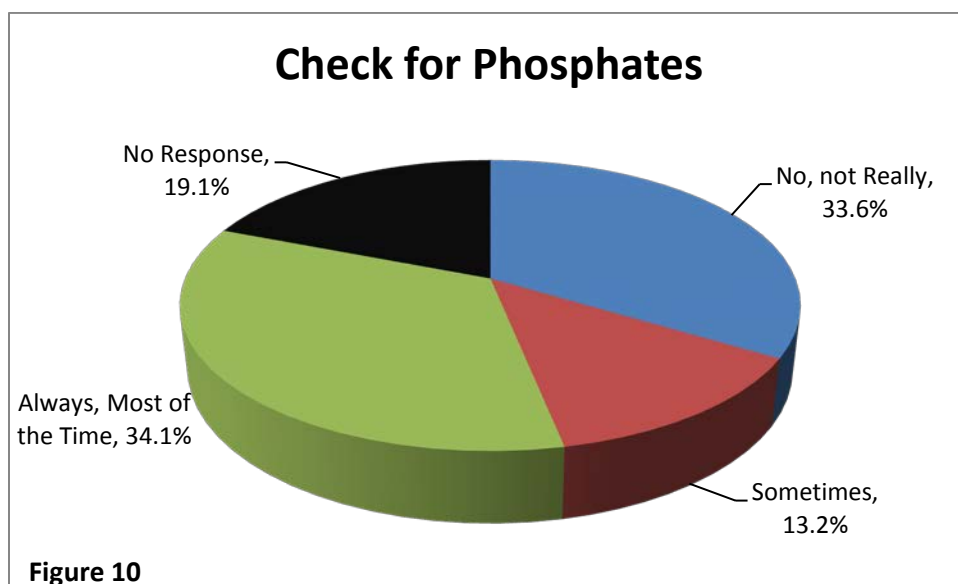


Approximately 29% of residents have had their systems pumped every 1-2 years, 27.3% of residents have had their systems pumped every 3-5 years. 4.5 have had their systems pumped every 10 years or more.

Some residents (12.3%) had their systems pumped in 2013, including several who were reminded that their system needed pumping upon reception of the survey. 5.0% responded that they've never had their systems pumped, however some of these can be accounted for as newly installed systems. 30.9% of respondents chose not to reply to this question; this may be because they'd face repercussions if identified as not pumping enough.

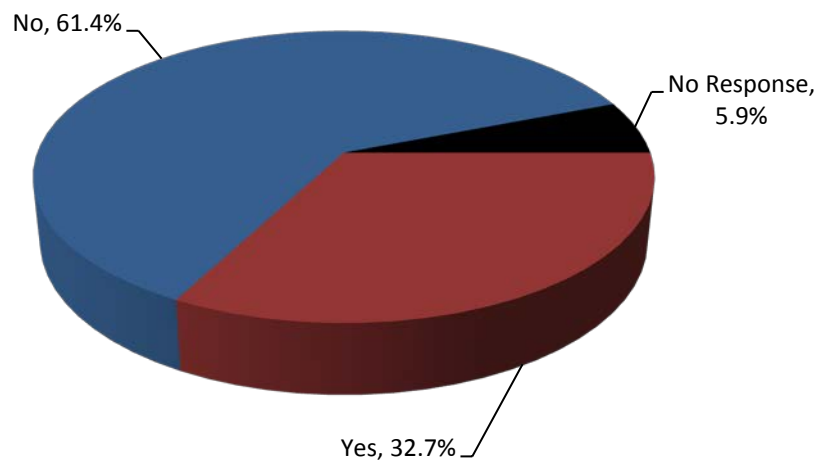


Sixty-seven (67) residencies had washing machines and 28 had dishwashers. These are mostly the year round homeowners on the lake.



Over one third of respondents claimed they always check their soaps and detergents for phosphates, and 33.6% of respondents claimed they do not check. 13.2% of respondents said they sometimes check their soaps and detergents for phosphates. 19.1% did not respond.

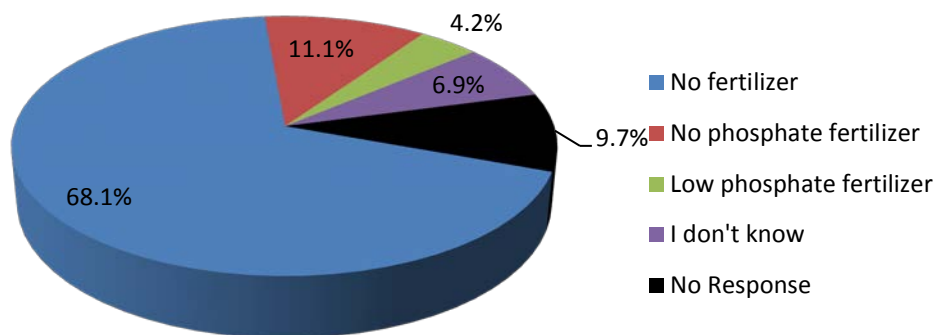
### Grassed Lawn within 100 ft of Lake



**Figure 11**

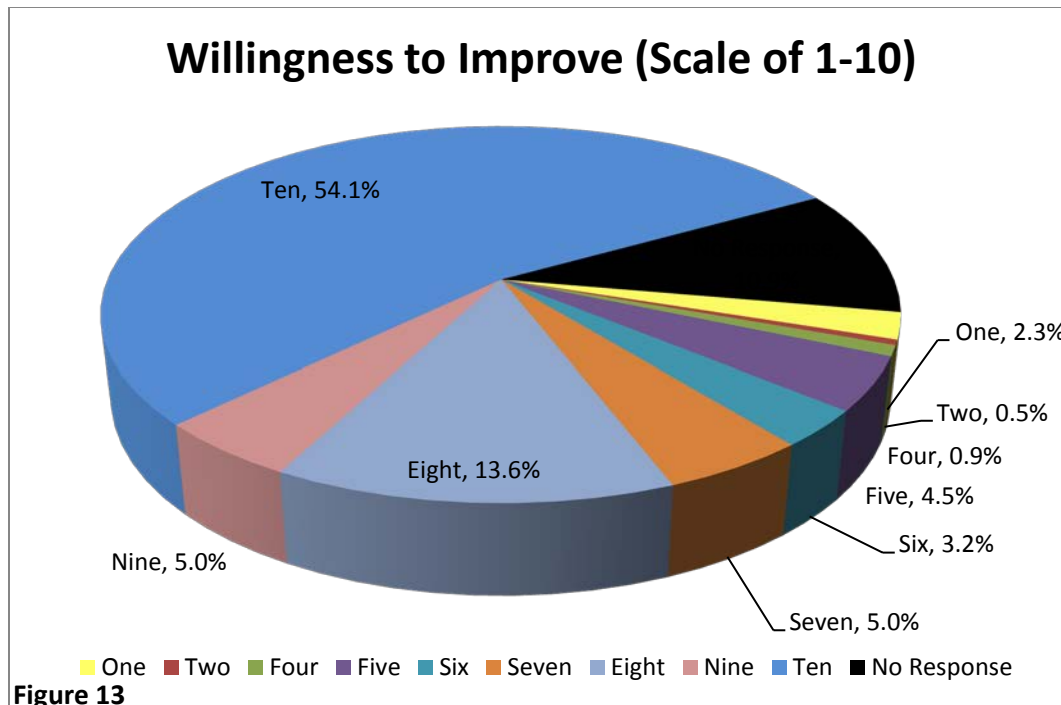
Nearly one third of respondents had a grassed lawn within 100 ft of the lake or a stream, while 61.4% did not. 5.9% did not respond. Grassed lawns tend to have a greater impact on the lake than forested land due to their inability to filter nutrients and infiltrate runoff as effectively.

### Lawn Fertilization



**Figure 12**

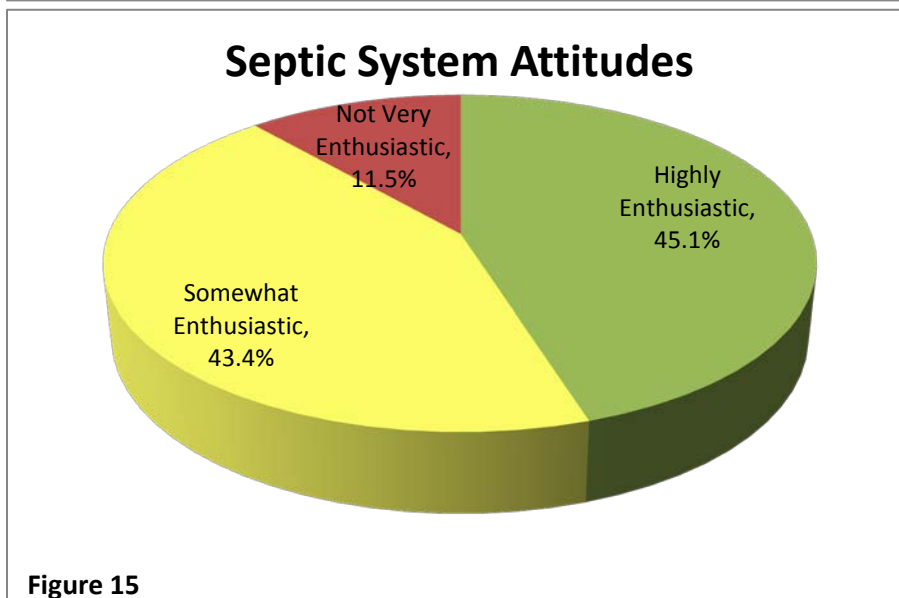
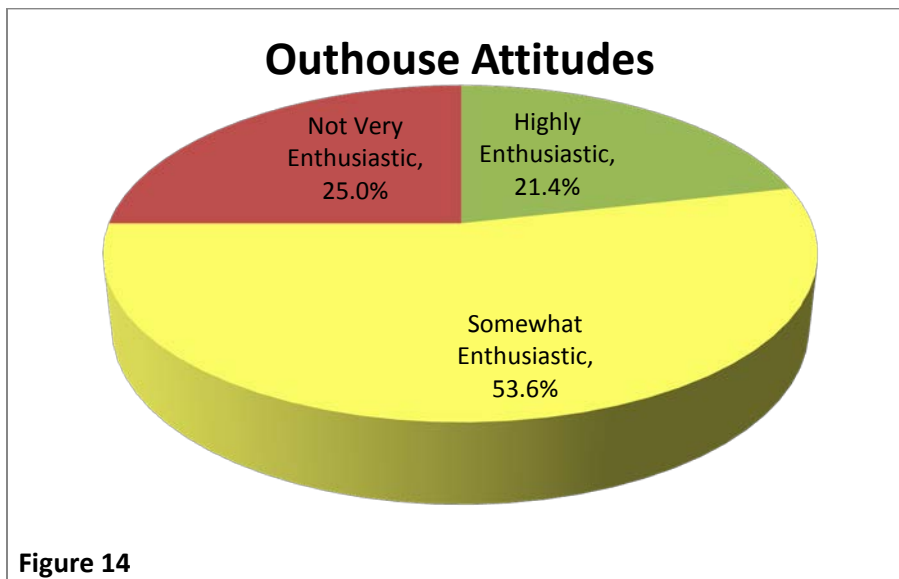
Of the homes with grassed lawns within 100 feet of the lake, 68.1% do not use fertilizer; 11.1% use phosphate free fertilizer and 4.2% use low phosphate fertilizer. 6.9% didn't know what kind of fertilizer they used and 9.7% did not respond.



**Figure 13**

72.7% of respondents are very willing (rated 8-10 on a scale of 1-10) to correct problems identified on their property to improve water quality. Still, 2.8% of respondents were less willing (ranked willingness 1-3). 13.6% had a medium willingness to fix their properties (ranked 4-7). 10.9% did not respond. This is very encouraging for future efforts to correct pollution issues on Province Lake.

## Septic Survey Results By System Type



In general, septic system owners were more inclined to have a positive attitude about fixing the lake and partaking in conservation practices. Attitude was based on how often responders check for phosphates in detergents (used as a bellwether for their knowledge of lake health) and the willingness of the owner to make improvements to their property.

## Phosphorus Loading Estimates from Wastewater Systems

The septic survey tells us that septic waste is a major concern for Province Lake. The large percentage of systems which are older than 25 years along with the high number of cesspools/outhouses both indicate potential wastewater pollution in Province Lake. Wastewater system phosphorus loading was modeled as the second largest source of phosphorus to Province Lake from the watershed with a contribution of approximately 107.2 kg (14%) of phosphorus per year. Results show that the combined categories of old septic systems, cesspools, and outhouses were estimated to provide over 81% (87.2 kg) of the phosphorus load from wastewater systems. The single biggest risk for wastewater treatment failure is inundation of systems by groundwater, which greatly enhances the transport of phosphorus and pathogens from the system to the lake. It is critical to ensure not only adequate setbacks (horizontal distance) from the lake, but also good vertical separation from the seasonally high groundwater table. A strong wastewater inspection and maintenance program can reduce phosphorus and bacteria loading to Province Lake. (FB Environmental, 2013)

## Recommendations

### The Province Lake Association

- Prioritize outreach to target landowners with older systems (>25 years), landowners with systems that are within fifty feet of a stream or the lake, and residents who rarely or have never had their systems pumped.
- Distribute copies of the septic survey report to residential property owners within the target groups and encourage property owners to make improvements to their properties.
- Apply for funding to fix potential septic system problems identified in the survey; especially at heavy usage sites such as the several campgrounds along the lakeshore.
- Continue to educate landowners on the importance of maintaining septic systems and the effects of the phosphorus-based products on the lake quality.
- Educate municipal officials about lake water quality issues and work cooperatively to find solutions.

### Individual Landowners

- Properly maintain wastewater treatment systems. Pump tanks regularly (every 2 to 3 years for a year round residence; 4-5 years for seasonal occupancy) and upgrade marginal systems.
- Call or email the Province Lake Association for advice on how to fix septic issues. You can also call the NH DES for free advice on how to get started.
- Join the Province Lake Association to get involved with their activities to improve the water quality in Province Lake. Reach them through the PLA website [www.provincelake.org](http://www.provincelake.org) or call them at (207) 200-3234

### Towns of Wakefield, Effingham, and Parsonsfield

- Enforce septic system ordinances to continue to support restoration efforts at Province Lake.
- Participate and support the long-term watershed management plan.

## Summary & Next Steps

Information gathered from the Province Lake Septic Survey provides a snapshot of the state of wastewater systems in the Province Lake watershed. This information was used to estimate just how much phosphorus is entering Province Lake from wastewater systems compared to other sources of phosphorus in the watershed. Wastewater treatment systems contribute to roughly 14% of the total amount of phosphorus load entering Province Lake. Reducing phosphorus loading from wastewater systems in the watershed should be considered a high priority to help reduce the overall phosphorus load which will ultimately help decrease the potential for future cyanobacteria blooms in the lake. Survey results can be used to prioritize watershed upgrades to where they are most needed. The Province Lake association intends to work with its partners including federal, state, and local organizations to assist property owners that require assistance upgrading wastewater systems through grant funding or other options.

## References

Gilliom, R.J., and Patmont, C. (1983). Lake phosphorus loading from septic systems by seasonally perched groundwater. *Water Pollution Control Federation: 55*(10), 1297-1305.

FB Environmental. "Province Lake Nutrient Modeling: Estimating Phosphorus Loads using Lake Loading Response Modeling". October 2013

## **Appendix A: Province Lake 2013 Septic Survey**



**2013 PROVINCE LAKE SEPTIC SURVEY**

Thank you for participating in the Province Lake Septic Survey! **When you return this survey or complete it online you will be entered in a drawing for a \$100 gift certificate to Mulligan's Woodfire Tavern.** You are being asked for this information because your property is within 250 feet of Province Lake. Our records indicate that you have not yet completed the online or paper copies of this survey so we would like to ask you a few questions.

The Province Lake Septic Survey is a part of the Province Lake Watershed Plan currently being developed by the Province Lake Association. In order to develop an accurate lake response model and to evaluate the potential cumulative impacts that septic systems around the lake may have on lake water quality, we are visiting properties within 250 feet of the lake and its tributaries. The information will provide a better understanding not only of the state of the septic systems in the area, but will also help us to identify opportunities for future outreach activities and where resources may be needed.

**1. On a scale of 1 to 10, where ten is the best, what is your perception of the water quality in Province Lake? (circle one)** 1 2 3 4 5 6 7 8 9 10

**2. Do you have a septic system, or other wastewater system? (circle one)**

Septic      Overboard Discharge      Holding Tank      Cesspool/Outhouse      Town Other\_\_\_\_\_

**3. Do you know where your septic tank and leach field are located? (circle one)**

Yes      No      Not Sure

**4. How old is the septic system? (circle one)**

1-10 years    11-15 years    16-20 years    21-25 years    Older than 25 years    I don't know

**5. How old is the house? (circle one)**

1-10 years    11-15 years    16-20 years    21-25 years    Older than 25 years    I don't know

**6. Is this home used year-round or seasonally? (circle one)**

Year Round      More than one season (50-150 days/year)      Seasonal (less than 50 days/year)

**7. What's the average occupancy? (circle one)**

1-2 people      3-4 people      5-6 people      More than 6 people

**8. What is the approximate distance of your septic system from the lake or stream? (circle one)** Lake or Stream?

0-10 feet    10-20 feet    20-50 feet    50-75 feet    Greater than 75 feet    I don't know

**9. How often do you have your wastewater system pumped? (circle one)**

Every 1-2 years    Every 3-5 years    Every 6-10 years    More than 10 years    Never pumped    I don't know

**10. When was the last time it was pumped?\_\_\_\_\_**

**11. Which of the following water-using machines do you have in your house/camp? (circle all that apply)**

Washing Machine    Garbage Disposal    Dishwasher    Water Softener    Other\_\_\_\_\_

**IMPORTANT: PLEASE FILL OUT THE BACK OF THIS SURVEY!**

Sector-Site\_\_\_\_\_

Surveyors\_\_\_\_\_

**12. When buying laundry detergents or dish detergents, do you check the labels to buy no-phosphate or low phosphate products? (circle one)**

No, not really                      Sometimes                      Always, most of the time

**13. If you have a garbage disposal, how often do you use it when you are at the house? (circle one)**

Always                      Frequently                      Seldom                      Never

**14. Do you have a grassed lawn area within 100 feet of the water? (circle one)**

Yes                      No

**14A. If Yes, do you use: (circle one)**

No Fertilizer                      No-Phosphate Fertilizer                      Low Phosphate Fertilizer                      I don't know

**15. How willing (where 10 is most willing) would you be to make improvements to your property to help protect the lake's water quality if technical assistance were provided? (circle one)**

1   2   3   4   5   6   7   8   9   10

**Last Name:** \_\_\_\_\_ **Property Address:** \_\_\_\_\_  
(required) (required)

**Map/Lot # (if known):** \_\_\_\_\_

☐ Yes, please send me results of this survey, and enter me in the raffle for the \$100 gift certificate to Mulligan's WoodFire Tavern at the Province Lake Golf Club.

**My email address is:** \_\_\_\_\_ OR

**My mailing address is:** \_\_\_\_\_

**THANK YOU!**

**The results of this survey will be available on the PLA website and included in the Province Lake Watershed Management Plan.**

## **Appendix B: Province Septic Survey Brochure & Handout**

## Septic Systems and Lakes

Failed or improperly functioning private residential septic systems threaten nearby waterbodies.

When a septic system is not working properly, untreated wastewater can enter the lake, directly or almost directly. Though a septic system is designed to eventually return “clean” wastewater to the groundwater, the waste must first go through the whole process of bacterial action and passage through appropriate materials that filter it.

### **Untreated Waste Can Be Harmful to Health**

Waste from a home that has not passed through a functioning septic system can carry bacteria into the water body. The presence of E. coli bacteria demonstrates the presence of fecal material in the water. E. coli are seen as a marker; when they are in the water, other health hazards (bacteria or viruses) associated with human or animal waste may be present. (While not prevalent in the US, diseases such as cholera and typhus are water-borne.)

### **Nutrients Harmful to Lakes**

Untreated residential wastewater is also heavy with nutrients that feed unwanted plant and algae growth in lakes and ponds. Algae blooms and thriving invasive plants can be supported by nutrients from septic systems that are not working well.

Untreated septic waste can also contain chemicals that are harmful to plants, aquatic life and humans, such as chlorines and various chemicals and hormones used in pharmaceutical and personal care products. Some of these are altered or removed as the waste passes through the microbial and filtration action of a septic system, but reach the lake water when the system is not working properly.

## Record of Pumping Service/ Maintenance

Date	Service & Provider

Acknowledgements: The Province Lake Association and AWWA are grateful for the use of materials from the Lake Sunapee Protective Association and the NH Dept of Environmental Services.

Funding for this project was provided in part by a Watershed Assistance Grant from the NH Department of Environmental Services with Clean Water Act Section 319 funds from the US Environmental Protection Agency.



# Septic Systems

*How do they work?*

*How do you maintain them?*



Province Lake Association

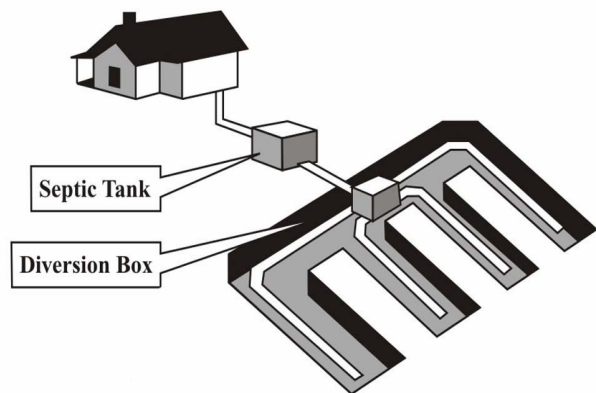
PO Box 24  
Effingham, NH 03882  
[www.provincelake.org](http://www.provincelake.org)

In partnership with  
Acton Wakefield Watersheds Alliance



PO Box 235, 254 Main Street  
Union, NH 03887

# Anatomy of a Septic System



## Septic Tank

All wastewater leaving your house goes out an underground pipe and dumps into your septic tank, a large cement or plastic chamber. Here, the solids settle to the bottom, and a layer of scum made up of soaps, grease and other lighter-than water elements floats on the top.

All effluent contains bacteria, and there are anaerobic bacteria (that do not need oxygen to work) in the sludge layer in the tank. These bacteria go to work decomposing the solid materials and reducing them to sludge which remains in the septic tank.

The layer above the sludge and beneath the scum is a liquid layer with dissolved or suspended waste.

## Diversion Box

When wastewater enters the tank, a compensatory volume of the liquid layer in the septic tank passes on to the other end, past a baffle which holds back solids, into a pipe that empties in a distribution or diversion box (D box).

The D box has multiple exits, and from it the water passes into a number of perforated pipes. From these pipes, it disperses into the material of the leach field or bed. Wastewater can flow by gravity or be pumped between the different parts of the system.

## Leach Field

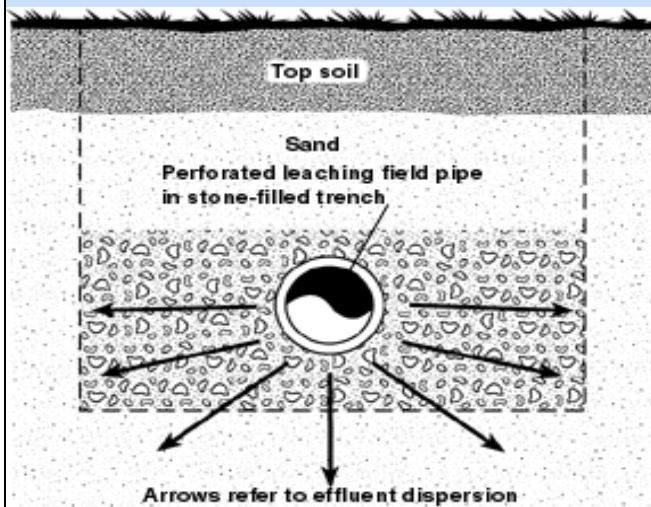
A typical leach field is made up of layers of sand and/or gravel that allow the wastewater to pass through at an appropriate rate into the soil below.

Septic system design relies on permeable soils which will filter the wastewater or effluent as it passes through, so when a leach field is constructed, stone, permeable gravel and other suitable materials are brought in to construct the bed, and regulations require adequate depth of good permeable soil where the leach field is made.

## Back into the Groundwater

The process of filtering or percolating through the soil cleanses the wastewater. Dissolved waste and bacteria cling to soil particles or are eaten by microorganisms that require oxygen for the process. Eventually the resulting “clean” water becomes part of the underground water systems, or groundwater.

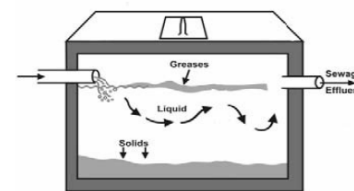
## Cross Section of a Leach Field



## For More Information

For more information, please contact the DES Subsurface Systems Bureau at (603) 271-3501 or go on-line at <http://des.nh.gov/organization/divisions/water/ssb/index.htm> for detailed information. Subsurface Systems Bureau; 29 Hazen Drive, PO Box 95; Concord, NH 03302-0095.

# Septic System Maintenance



Cross Section of a septic tank with grease, liquid, and solid layers

## Pump Out Regularly

The most important thing is to have your septic tank pumped regularly, to remove accumulated sludge and scum before it begins to clog your leach field. The usual recommended interval is every two to three years. The company that pumps your tank can keep you posted on the condition of the tank and whether you are pumping frequently enough.

If you use a garbage disposal you must pump much more frequently.

## Other Things To Do To Extend the Life of Your System

- Conserve water – so the soil around the leach field does not become too saturated. Use low flow fixtures, and fix leaks.
- Do not flush bulky items like disposable diapers, sanitary pads or paper towels.
- Do not put chemicals down the drain or toilet – they can kill the bacteria needed to break down solid waste. They can also pass through and into the soil, then the groundwater, with the water leaving the leach field – and end up in well or lake waters.
- Do not use a garbage disposal, particularly if it was not included in the original design of your system. (They require significantly larger tanks and leach fields.)

## For Your Leach Field

- Do not drive or take heavy machinery across it. The weight can compact the soil, inhibiting filtration, as well as break the pipes.
- Keep trees from growing on or near it. Their roots can clog or break up the pipes.



# Types of Outhouses



There are two kinds of outhouses; vault privy and pit privy. Vault privies hold waste in a cement or plastic container. Pit privies consist of a hole dug under the outhouse, and waste is held directly in the hole. Pit privies pose a more serious threat to groundwater as they allow direct contact between the ground and the waste. Both vault and pit privy style outhouses should be pumped frequently.



Don't linger too long in the outhouse.  
For there's creatures livin' in that hole.

When your work there is done,  
Pull your pants up and run  
If you want to be savin' your soul!

# Proper Outhouse Maintenance

Here are some helpful tips about  
proper outhouse maintenance  
provided by Cabinlife.com



- Put a vent going from the pit through the top of the roof. This allows methane gas to escape.
- Add lime or ash to the pit frequently. This helps to aid the decomposition while reducing odor.
- Keep a separate lined and covered trash pail in the outhouse. Place toilet paper in this pail, and change it frequently to tame excessive smells. When you want to, add the sealed bag to your household trash and take it to the transfer station. Toilet paper isn't easily digested by the bacteria in an outhouse, and makes the outhouse fill up more quickly.

**Pump Frequently!!!**