

HOMEOWNERS' KNOWLEDGE & AWARENESS OF SEPTIC SYSTEMS AND BARRIERS TO SEPTIC SYSTEM
MAINTENANCE IN NORTHWEST INDIANA: INFORMATION TO ENHANCE AGENCY OUTREACH AND
EDUCATION EFFORTS

BY

NATALIE A. JOHNSON

THESIS

Submitted in partial fulfillment of the requirements
for the degree of Master of Science in Natural Resources and Environmental Sciences
in the Graduate College of the
University of Illinois at Urbana-Champaign, 2016

Urbana, Illinois

Adviser:

Assistant Professor Bethany Brooke Cutts

ABSTRACT

This thesis examines northwest Indiana homeowners' knowledge and awareness of septic systems, the maintenance and care actions that homeowners are currently performing, and potential barriers to septic system maintenance. This information is used to make suggestions for effective local outreach and education efforts with the intention of changing current behavior and promoting an increase in proper septic system care and maintenance. The ultimate purpose of reducing septic system failure is to reduce *E. coli* from entering our local waters.

In northwest Indiana, the development of municipal sewer infrastructure has not kept pace with the spread of residential development, even in urbanized areas. Watershed managers and local health departments suspect that failing septic systems are adversely affecting surface and ground water quality in the region by releasing untreated or under-treated sewage into the environment. Homeowners are responsible for preventing system failure by performing regular maintenance and care. Environmental and public health agencies want to produce outreach and educational material that informs homeowners of how regular maintenance and care should be performed; as well as its importance to local water quality and community health.

A research team and I recruited 45 homeowners in northwest Indiana septic communities to participate in focus groups and surveys. We found (1) that most homeowners know that they have a septic system; (2) that homeowners have some knowledge of septic system maintenance and care, but do not fully understand how often these practices should take place, nor do they know of all of the preventative care practices that they should be following; (3) that homeowners may have some awareness of failing septic system's impact on public health, but are likely not motivated to maintain a system for this reason; and (4) that homeowners may have some awareness of failing septic system's impact on the environment, but are likely not motivated to maintain a system for this reason.

Though the sample size was smaller than intended, there was still value in the findings in that they provided some insight into the current level awareness of some northwest Indiana homeowners in regards to septic systems. Using this information, I applied the community-based social marketing technique to suggest ways of increasing northwest Indiana homeowner's awareness of the above with the intent that more homeowners may know how to maintain a septic system and reduce its likelihood of failing.

This thesis is dedicated to the memory of my Grandmother Phyllis Maas (1920-2015).
I bet you wish I would have selected another topic. Love you always.

ACKNOWLEDEMENTS

I would like to thank my patient and kind committee for their endless support and guidance throughout this project. I also want to thank the Northwest Indiana Septic System Coordination Work Group for their contributions to the study, and for inspiring me to pursue the topic of failing septic systems. I also want to send thanks to Jovana Kobb and Courtney Schmidt for helping me during many long hours of participant recruitment. Lastly, I would like to give special thanks to Lynne M. Westphal and Cherie Leblanc Fisher for sharing advice and helping guide me along the way. I owe the success of this project to the US Forest Service and many other devoted partners of the Urban Waters Partnership. I am extremely grateful for the guidance and words of encouragement you have offered me.

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION	1
CHAPTER 2: LITERATURE REVIEW	8
CHAPTER 3: METHODS.....	22
CHAPTER 4: RESULTS	29
CHAPTER 5: DISCUSSION.....	43
CHAPTER 6: CONCLUSION.....	56
CHAPTER 7: FIGURES & TABLES	60
CHAPTER 8: REFERENCES	71
APPENDIX A: RECRUITING SCRIPT.....	75
APPENDIX B: SURVEY CONSENT DOCUMENT	78
APPENDIX C: SURVEY WITH MODERATOR GUIDE	80
APPENDIX D: FOCUS GROUP RECRUITMENT REMINDER LETTER 1 (MICHIGAN CITY SAMPLE)....	84
APPENDIX E: FOCUS GROUP REMINDER LETTER 2 (MICHIGAN CITY SAMPLE).....	86
APPENDIX F: FOCUS GROUP CONSENT DOCUMENT.....	88
APPENDIX G: FOCUS GROUP MODERATOR GUIDE.....	90
APPENDIX H: FOCUS GROUP BROCHURES FOR REVIEW	98

CHAPTER 1: INTRODUCTION

Water quality in northwest Indiana and the threat of *E. coli* in the Little Calumet-Galien watershed

The Lake Michigan watershed of northwest Indiana (Figure 1), also known as the Little Calumet-Galien watershed, is a 604 square-mile area of land with a history of heavy industrial use, healthy and impaired waterways, and a vast potential for economic development and recreation along Lake Michigan and its tributaries. The watershed is bounded by Lake Michigan to the north and the Kankakee River to the south, and includes nearly half of Lake and Porter Counties, and the northernmost third of LaPorte County (Northwestern Indiana Regional Planning Commission [NIRPC], 2011). An estimated 770,000 residents live across the watershed, which includes the cities of Gary, Hammond, and Michigan City (NIRPC, 2011). Within and surrounding these communities are more than 1,775 miles of streams and 500 lakes and ponds, as well as the Indiana Dunes National Lakeshore (NIRPC, 2011).

Impaired water quality in rivers, streams, and Lake Michigan is a serious problem in the Little Calumet-Galien watershed. High bacteria counts regularly impair nearly half of the stream miles (622 miles), causing numerous beach closures during the summer (Indiana Department of Environmental Management [IDEM], 2012; NIRPC, 2011). According to the Indiana Department of Environmental Management's Indiana Lake Michigan Beach Monitoring Program Coordinator, there were 209 beach closures and advisories during the 2014 recreational beach season and 136 during the 2015 recreational beach season (M. Caldwell, personal communication, October 21, 2015). Almost all of these closures were directly related to high *Escherichia coli* (*E. coli*) levels commonly associated with untreated wastewater (U.S. Environmental Protection Agency [U.S. EPA], 2013). Because *E. coli* tests generally take 24 hours to process, beaches are often not closed until the day after water with high bacteria levels has been collected (U.S. EPA, 2002). As a result, residents and visitors may unknowingly expose themselves

to *E. coli* and associated pathogens that pose a health risk to anyone who consumes or comes in contact with the water.

Some sources of inadequately treated wastewater commonly found in the U.S., such as combined sewer overflows (CSOs) and wastewater treatment plant sanitary sewer overflows (SSOs), can be found in northwest Indiana. However, these instances are typically caused by wet-weather events. In northwest Indiana, a high level of *E. coli* remains constant in many waterways outside of wet-weather, leading watershed managers to suspect other sources. Another common source of *E. coli*, livestock, is less likely to be a contributing factor in this largely urbanized area, especially in nearshore communities. After ruling out some of these other potential sources, northwest Indiana watershed managers suggest that septic systems may be the source of untreated human waste entering waterways, causing a significant source of *E. coli* impairment in the Lake Michigan watershed.

Septic systems: A potential *E. coli* source

The United States Environmental Protection Agency (U.S. EPA) defines septic systems as a “decentralized form of wastewater treatment that allows homeowners and developers to build homes in areas not served by centralized sewers” (Halvorsen & Gorman, 2006). In the United States, 20% - 30% of homes use septic systems for wastewater treatment, and many are near large bodies of water (Ferrell & Grimes, 2005; Mohamed, 2009; Zarate-Bermudez, 2009; U.S. EPA, 2008). Septic systems are designed to treat wastewater by using bacteria naturally occurring in fecal matter and soil microbes to decompose human waste (Dawes & Goonetilleke, 2003; Hallahan, 2002, as cited in Ferrell & Grimes, 2005). In northwest Indiana, septic systems are often composed of a septic tank, a connecting pipe, and an absorption field or a dry well where wastewater enters the soil. The effectiveness of microbial removal depends on proper separation of solids, liquids, and oils in the septic tank as well as the soil type and soil thickness wastewater enters from the absorption field or dry well. Septic system

effectiveness also depends upon the age of the system and whether or not proper maintenance and care is taking place (U.S. EPA, 2014a).

However, a septic system that is not functioning properly is considered a failing system and is defined as a system that discharges effluent with pollutant concentrations exceeding established water quality standards, meaning proper decomposition has not taken place (U.S. EPA, 2014b). Homeowners are often alerted to failure when sewage backs up into the home or starts to pool on the surface near the septic tank, septic field or dry well. Failure can also take place unbeknownst to the homeowner, occurring entirely underground with no sign or warning. In order to prevent failure, the U.S. EPA recommends a professional inspection of the average septic system at least every three years and septic tank pumping (removal of excess sewage content) every three to five years (U.S. EPA, 2014a). The Indiana State Health Department also supports this regular schedule of maintenance (D. Ortell, personal communication, December 10, 2015). Moreover, certain items should never be disposed of down toilets or drains in homes with septic systems, such as feminine hygiene products, diapers, condoms, paper towels, bleach or other harsh chemicals, paint, grease or oil. These items are also capable of causing failure and keeping them out of the system can be considered a daily preventative maintenance measure.

Failure can also occur when a septic system is used beyond its lifespan. Although the average system lifespan ranges from 11 to 30 years, half of U.S. septic systems are estimated to be more than 30 years old (Ferrell & Grimes, 2005; Siegrist, Tyler, & Jenssen, 2001). In northwest Indiana, public records about septic system locations and ages vary across the region. Public health officials estimate that many septic systems are over 20 years old and were installed before installation permits were issued by county governments. Consequently, there are likely numerous failing septic systems that continue to be used and result in effluent discharges that do not meet water quality standards. Moreover, without knowledge of where these systems are, the health departments cannot take corrective action.

Additionally, proper septic system function is dependent on the type and thickness of soil in the absorption field or dry well is placed in. If wastewater cannot properly percolate through the soil or percolates too quickly, the system is likely to fail. Features such as rock or an abundance of clay may prevent or slow water from moving naturally through the soil. Conversely, soil that is primarily sand may cause water to move through the soil too fast, not allowing proper microbial breakdown to occur. According to the Natural Resources Conservation Service (NRCS), septic system absorption fields and dry wells placed in soils with features that are considered 'severely limited' (i.e. too much of one feature or not enough of another) require extra maintenance, higher costs and special designs, and will have other limitations that cannot be overcome without major amendments to the soil (Natural Resource Conservation Service [NRCS], 1993). A 'moderately limited' rating is applied to soils that have some properties, which require special septic system planning, design, or installation (NRCS, 1993). Septic systems in unsuitable soils like heavy clay or heavy sand are expected to experience higher failure rates. According to the most recent soil surveys conducted by NRCS and Soil Survey Staff, approximately 80% of the Little Calumet-Galien watershed's soil is 'severely limited,' likely caused by an overabundance of sand (Soil Survey Division Staff, 2012). Another 5% of the watershed has soil that is classified as 'moderately limited' (i.e. soil has somewhat favorable soil conditions for septic systems) (Soil Survey Division Staff, 2012). The remaining 15% of the watershed is unrated, meaning it is currently undefined by the NRCS (Soil Survey Division Staff, 2012). While in recent years, no state has directly measured its septic system rate of failure, northwest Indiana environmental and health agencies suspect a high rate of failure due to these soil conditions (EPRI, 2000).

While soil limitations and aging systems may be part of the causes of septic system failure, the potential for failure is only exacerbated when homeowners do not take proper maintenance action, are unaware they have a septic system, or do not know where their system is located. In summary, proper maintenance actions include pumping septic tanks every three to five years, inspecting system

components and function every three years, reporting signs of failure to the local health department, and replacing systems that have either failed or reached the end of their intended lifespan.

Homeowners should also be aware that a household has a septic in the first place and know where it is located so that the area may be kept clear from trees or other vegetation that may disrupt the system.

Ultimately, proper septic system function relies on informed, proactive homeowners (Halvorsen & Gorman, 2006). As a result, northwest Indiana's health departments rely on outreach and education to inexpensively promote proper septic system maintenance through voluntary actions by homeowners (Silverman, 2005).

Maintenance and care barriers

The U.S. EPA has concluded that properly functioning septic systems can protect public health and the environment, have lower capital and maintenance costs for rural areas, are appropriate for varying site conditions, and are best suited for ecologically sensitive areas (i.e. they reduce the amount of land disturbance by not having miles of pipe running to them) when a centralized system is unavailable (U.S. EPA, 2005). However, the agency has also acknowledged that many systems are failing and will continue to fail if barriers to proper maintenance action are not better understood and overcome (U.S. EPA, 2005). Suspected barriers include lack of awareness, maintenance misconceptions, regulatory constraints, fear of liability, and financial constraints (EPRI, 2000; Halvorsen & Gorman, 2006; U.S. EPA, 2005). In order to inform septic system owners of proper maintenance and care, organizations and agencies have created publications with messages to minimize these suspected barriers. In November of 2012, the U.S. EPA released a program called Septic Smart in order to promote basic homeowner awareness and proper care of septic systems. The program website contains various brochures, door hangers, manuals and booklets on how a septic system operates, the importance of maintaining a system, and tips to properly maintain a system (U.S. EPA, 2014b). However, there has been little research to understand if this information promotes action, and whether or not *suspected*

barriers are the *actual* barriers that affect homeowners from properly maintaining household septic systems.

Outreach and education efforts in northwest Indiana

In previous years, local northwest Indiana county health departments, the State of Indiana Health Department, the Indiana Department of Natural Resources' Lake Michigan Coastal Program and other interested local organizations promoted septic system awareness and proper maintenance using outreach materials the same as or similar to U.S. EPA's Septic Smart program. Local success of these efforts has gone unverified, but partnering organizations suspect these efforts may have had little effect. Furthermore, partnering organizations suspect that a number of northwest Indiana homeowners may not know that they have a septic system altogether.

As a result, this local group of agencies and organizations, known as the Septic System Coordination Work Group (SSCWG), wants to strengthen previous campaigns, making them more relevant to northwest Indiana homeowners by using data to inform their efforts. I designed the current study to meet SSCWG interests by focusing on the following objectives:

Objective 1. Gain some preliminary insight to northwest Indiana homeowners' septic system maintenance and care, and identify potential barriers to action.

Objective 2. Develop recommendations for piloting a community-based social marketing strategy in northwest Indiana that motivates homeowners to properly maintain household septic systems.

The study tested four hypotheses that I developed based on the SSCWG's working assumptions:

- **Hypothesis 1.** A high level of septic system owners will know that they have a septic system.
- **Hypothesis 2.** Septic system owners will have some (medium) understanding of required maintenance and how to prevent system failure.

- **Hypothesis 3.** Septic system owners will have a low awareness of septic system failure's impact on public health.
- **Hypothesis 4.** Septic system owners will have low awareness of septic system failure's environmental impact.

Since the reason for the study was ultimately to decrease or prevent *E. coli* and associated pathogens entering local ground and surface waters from septic systems, this particular study examines septic system maintenance and care as a pro-environmental behavior. The next section introduces pro-environmental behavior change as well as community-based social marketing strategy and its relevance to the current study.

CHAPTER 2: LITERATURE REVIEW

Pro-environmental behavior

Pro-environmental behavior is defined as behavior that minimizes negative impact on the environment, or contributes to the environment's improved health (Kollmuss & Agyeman, 2002; Krajhanzl, 2010). Many different theoretical frameworks have attempted to explain what makes people act pro-environmentally and what factors or barriers may foster or prevent this type of behavior from taking place (Kollmuss & Agyeman, 2002). For example, Ajzen's theory of planned behavior (TPB) suggests that intentions capture motivational factors and directly influence the behavior of a person (Ajzen 1991; Koger & Winter, 2010). Intention, then, is influenced by three determinants—attitude toward the behavior, subjective norm, and perceived behavioral control. Attitude is defined as an evaluative belief about a specific object or person, while subjective norm refers to the social pressure to perform the behavior (Greaves, Zibarras, & Stride, 2013; Koger & Winter, 2010). Perceived behavioral control refers to whether or not a person believes he or she can perform the behavior, and includes constraints such as inconvenience or task difficulty (Koger & Winter, 2010). The theory proposes that the stronger the intention is to act pro-environmentally, the more likely a person will perform the desired pro-environmental behavior.

Other researchers suggest that factors such as individuality, responsibility, and practicality lead to choosing pro-environmental behavior and are often left out of pro-environmental behavior models, creating a value-action gap (Blake, 1999; Kollmuss & Agyeman, 2002). The theory suggests these factors can act as a barrier to pro-environmental behavior. Someone may understand the environmental concern but may justify reasons not to act based on their attitude and temperament (Kollmuss & Agyeman, 2002). While empirical evidence supports both the TPB and Blake's value-action gap theory, researchers suggest that these proposed models are oversimplified and do not fully account for the many factors that may play a role in influencing pro-environmental behavior (Gifford & Nilsson, 2014).

For this reason, numerous frameworks, in addition to those described above, have been developed but no one has been deemed over-arching.

Although researchers do not yet agree on a preferred pro-environmental behavior theory, they do agree that environmental knowledge alone does not lead to pro-environmental behavior (Gifford & Nilsson, 2014; Kollmuss & Agyeman, 2002). While it is important for an individual to know how to act pro-environmentally, it does not necessarily mean that their knowledge will be sufficient. Unfortunately, today's environmental organizations and agencies still tend to rely on the outdated and ineffective method of information-intensive campaigns for fostering pro-environmental behavior, likely due to its simplicity (Kollmuss & Agyeman, 2002; McKenzie-Mohr, 2000; McKenzie-Mohr & Schultz, 2014). Yet, practitioners still want to make strides in changing behavior and are looking for effective means to do so. One approach is community-based social marketing, a proven approach for fostering socially responsible actions (behavior that benefits the larger society) such as pro-environmental behavior. The following section explores community-based social marketing, its elements, its theoretical grounding, and its effectiveness for fostering pro-environmental behavior.

What is community-based social marketing?

Community-based social marketing is a pragmatic approach to delivering information regarding socially-responsible behavior via the community and personal contact, removing the barriers that would likely stand in the way of the behavior (Kennedy, 2010; McKenzie-Mohr & Smith, 1999). Unlike traditional marketing, it does not rely on heavy media advertising associated with intensive-information campaigns (Kotler & Zaltman, 1971). Instead, it is a type of social marketing — marketing that has been designed to not only communicate knowledge, but communicate how to use this knowledge (Kotler & Zaltman, 1971). Pro-environmental community-based social marketing communicates environmental issue knowledge and how to use the knowledge to make pro-environmental behavior changes. It also

attempts to make pro-environmental behavior change easier by minimizing barriers. Additionally, the strategy communicates clear messages from a trusted local source typically within the community. These two elements, barrier-removal and emphasis on trust, are what sets this strategy apart other forms of marketing.

Researchers McKenzie-Mohr & Schultz (2014) outline a five-step process to approaching community-based social marketing:

- (1) *Identify the target behavior.* The first step of community-based social marketing is to identify a behavior that is end-state, meaning the behavior is going to make a direct impact on the goal, and non-divisible, meaning the behavior cannot further be divided into other behaviors which may have varying barriers associated with them (McKenzie-Mohr & Schultz, 2014; Schultz, 2013). For example, if the goal of a campaign is to reduce water consumption in the home, a target behavior may be turning off the faucet while brushing one's teeth. This behavior would directly impact the goal of reducing water consumption. Conversely, if the suggested target behavior is to purchase a WaterSense® labeled faucet, which is advertised to conserve water use, the purchase itself does not result in the end goal of reduced water consumption. Additionally, the purchasing behavior is divisible. A person could interpret that they need to purchase a WaterSense® labeled faucet for every room with running water. They may also interpret that they should purchase a WaterSense® labeled faucet for every type of water outlet (sinks, tubs, showers, etc.). Each action could potentially have a behavior-specific barrier that would cause someone not to act in the first place (McKenzie-Mohr & Schultz, 2014). In many cases, environmental agency campaigns have communicated non-end state and divisible behavior rather than targeting the real behavior change needed (McKenzie-Mohr & Schultz, 2014). As a result, the desired behavior change may not take place or may be slow to catch on.

(2) *Identify barriers and benefits.* Behavior change can happen more readily if the change in behavior is perceived as easy and within one's control. This is identified in Ajzen's theory of planned behavior as the determinant of perceived behavioral control (Ajzen, 1991). Barriers can influence the motivational factors to change a behavior, and can ultimately affect the willingness a person is prepared to put forth to perform the behavior (Ajzen 1991; Koger & Winter, 2010). For example, an individual may weigh costs and benefits of a pro-environmental behavior and choose the alternative with the highest benefit and lowest cost to themselves (i.e. money, effort or social approval) (Steg & Vlek, 2009). Similarly, benefits of behavior change may also influence motivational factors. For example, a person may participate in a recycling program if it means they are charged less for trash pickup. In order to identify these barriers and benefits, community-based social marketing encourages the use of social science research techniques such as focus groups, surveys, and observations to collect data among target audiences (McKenzie-Mohr & Schultz, 2014).

(3) *Strategy development.* In this stage, strategies are created or existing strategies are modified to increase the benefits or decrease the barriers identified from social science research techniques (McKenzie-Mohr & Schultz, 2014; Schultz, 2013). Part of the strategy includes developing ways to transfer information via the community or through personal, direct contact (Schultz, 2013). McKenzie-Mohr & Schultz suggests that the community is often considered a trusted source and may be favored over other sources (McKenzie-Mohr & Schultz, 2014). However, this may not be the case for all target audiences. Researchers propose that trust depends on shared values; frequent, relevant and timely communication; and the perception that an individual or entity is acting in the best interest of the greater good (MacMillan et al., 2005; Morgan & Hunt, 1994). Moreover, according to commitment-trust theory, individuals are committed to maintaining these relationships due to their benefits (Morgan & Hunt, 1994). They see the value in listening

to what an entity, organization, or person has to say. In community-based social marketing, it is important to identify the target audience's trusted source. If information is coming from a trusted source, it may be more readily accepted and acted upon.

(4) *Small-scale strategy pilot.* Like many programs, this step suggests piloting the developed strategies in order to evaluate their effectiveness in changing behavior. Additionally, this is an opportunity to determine the cost-effectiveness of a campaign (McKenzie-Mohr, 2014).

Campaign-developers are able to revise strategies to increase effectiveness or decrease cost prior to unrolling a campaign on a larger scale.

(5) *Broad-scale implementation and evaluation.* In the final step, the strategy is implemented on a broad scale. Evaluation is ongoing, and campaign-developers can continue to revisit and revise strategies as needed. Moreover, evaluation should attempt to measure directly the change of behavior rather than rely on self-reporting of the behavior change (McKenzie-Mohr, 2014).

Behavior change tools of community-based social marketing

In Step 3 of McKenzie-Mohr & Schultz's process for creating a community-based social marketing campaign, campaign-developers create strategies for changing behavior. These strategies consist of a series of behavior change tools to increase the benefits or reduce the barriers associated with the target behavior (McKenzie-Mohr, 2010; Kennedy, 2010). These tools include (1) commitments from participants; (2) offering prompts that remind participants how to act; (3) building a social norm; (4) designing effective, clear messages from trusted sources; (5) using incentives to further promote the target behavior; and (6) making the behavior change convenient (McKenzie-Mohr, 2010; Kennedy, 2010). These tools have had successful application to pro-environmental behavior change campaigns, which are further explained in this section.

Asking for Commitment

Soliciting commitments from individuals or groups, one of the tools for fostering behavior change, can be applied in several ways. Generally, individuals like to behave or be perceived as behaving consistently (McKenzie-Mohr, 2010; Vaidyanathan & Aggarwal, 2005). If someone commits to an action, their self-perception is altered, and any deviation from the commitment would be inconsistent with the self-perception (McKenzie-Mohr, 2010). The commitment-consistency theory explains an interesting occurrence where the influence of small commitments encourages a subject to perform larger or additional commitments for the sake of consistency (Vaidyanathan & Aggarwal, 2005). Therefore, an environmental entity/organization may ask for and receive a small commitment initially, and later ask for and receive a larger commitment with little to no hesitation from the person making the commitment. This foot-in-the-door technique has proven effective in fostering pro-environmental behavior, and is only strengthened when combined with other forms of soliciting commitment.

Another commitment strategy suggests asking for written commitments. Researchers have found that when a participant signs their name, they feel more accountable. These commitments tend to be more effective than verbal commitments. More so, researchers Pallak, Cook, & Sullivan have shown that public commitments are often more effective than both written and verbal commitments, and tend to have long-term behavior changes (as cited in McKenzie-Mohr et al., 2011). However, despite whether a commitment is verbal, written, or publically made, any freely given commitment is more likely to engage someone in undertaking a behavior versus no commitment at all.

Successful use of commitment in a pro-environmental behavior study is effectively demonstrated by researchers Katzev & Johnson's study of residential electricity consumption. Sixty-six residents were asked to curtail their home energy use by 10% (Katzev & Johnson, 1983). Researchers separated homeowners into four groups: Group 1 homeowners received a request to answer a short

energy conservation survey. Group 2 homeowners received a commitment request to reduce energy consumption by 10%. Group 3 homeowners received both an initial short energy conservation survey and, in a follow up visit, received a commitment request to reduce energy consumption by 10%. Lastly, Group 4 homeowners received no requests and were used as a control group. All homeowners who committed to reducing energy usage lowered their consumption rate significantly when compared to the control group. However, homeowners who participated in the initial survey request and then committed to the 10% reduction request contained more energy conservers and higher conservation rates than any other group (Katzev & Johnson, 1983). This supports that the foot-in-the-door commitment technique, an initial request and building to a larger request, can be effective in pro-environmental behavior change. Additionally, this particular study is of significance due to the amount of energy conservation that continued beyond the life of the study (Katzev & Johnson, 1983). Those who made commitments continued to curtail energy beyond the 12-week study, further demonstrating the power of commitment. This may possibly be attributed to 10% commitments being made in writing.

Providing a Behavior Prompt

Another behavior change tool is the prompt. A prompt is simply a reminder of what the desired behavior is and how to do it. It should be easy to understand and readily noticeable by the individual who would be performing the behavior. A prompt works best when it is not a coercion or appeal, but when it provides general information that emphasizes a positive behavior (McKenzie-Mohr et al., 2011; Schultz, 2013). It can come in many forms, such as a magnet, a sign, or even a person. Researchers Sussman, Greeno, Gifford, and Scannell demonstrate the success of using prompts as a strategy for increasing pro-environmental behavior in their study on increasing composting by cafeteria patrons (2013). In the study, researchers first developed signs that contained a simple message, "Please Compost Your Leftovers," as well as graphics associated with the action (Sussman et al., 2013). The signs

were placed at the compost bins where further signage clearly explained what should be composted and what should not be composted. After posting signs, researchers observed 1,060 individuals in the cafeteria. In comparison to baseline conditions (initial composting rate of 12.5%), signage increased composting behavior by 8% (composting increased to 20.5%). In addition to the signage prompt, the researchers introduced one and then two models, or individuals who would model composting behavior in an attempt to encourage others to do the same. One model in combination with the increased signage yielded no change. However, two models replicated the behavior of composting in front of individuals in the study, further increasing composting behavior of all patrons by 21.5% (a total of 42% of cafeteria users composting after the introduction of signage and two models). Modeling can be considered a strategy for increasing the social norm—another behavior change tool often used in community-based social marketing.

Building on a Social Norm

Social norm refers to the perceived social pressure to perform a given behavior (Ajzen, 1991). According to Schultz et al., social norms can be categorized into descriptive norms, behaviors in which the community commonly engages, and injunctive norms, the collective approval or disapproval from the community about a given behavior (as cited in Chaudhary & Warner, 2015). In the Sussman et al. study, two individuals modeling the behavior of composting in front of a study participant often resulted in the participant also composting (2013). By having more than one person perform the behavior at a given time, it created a descriptive social norm for the cafeteria. This example follows McKenzie-Mohr's guidelines for using norms: the norm was noticeable; it was connected to the time when the behavior was to take place; and it engaged people in the positive behavior of composting rather than focusing on avoiding an environmentally harmful action (McKenzie-Mohr, 2010). Overall, most individuals want to comply with the perceived common standard of behavior (Kennedy, 2010). Strategies that model or

communicate the desired pro-environmental behavior as a social norm may be more effective in reaching target audiences and promoting the desired behavior.

Using Trusted Sources for Communication

Clear communication is necessary to achieve any pro-environmental behavior change goal; however, it is equally important that communication is provided via a trusted or credible channel. Messages must be able to hold someone's attention in order to initiate behavior change (McKenzie-Mohr et al., 2011). It is important to reiterate that community-based social marketing separates itself from other social marketing because of its emphasis on personal contact and community delivery of a message. This type of connection may further foster trust and social norm.

Researcher Sønderskov also suggests that those who have higher generalized social trust (belief that people are generally trustworthy) are more likely to participate in socially responsible behavior such as pro-environmental behavior (Sønderskov, 2011). In Sønderskov's study, participants measured their overall expectations about people in general. This information was correlated with recycling behavior. Results indicated that those with higher levels of trust were more likely to participate in a recycling program. The reason for doing so is captured in the social exchange heuristic— a psychological mechanism that explains the preference to cooperate with others despite the opportunity for personal gain (Sønderskov, 2011; Yamagishi et al., 2007). By building on this sense of “people are generally trustworthy,” it is likely that using this personal, direct contact may have an increased effect of a person accepting behavior change information and acting on it.

Providing Incentives

Incentives, such as financial or social approval, can provide further motivation for pro-environmental behavior (McKenzie-Mohr, 2010). They are most effective when closely paired with the

behavior, when they are visible and when they reward positive behavior (McKenzie-Mohr, 2010). They can, however, also be costly if financial in nature and detrimental for a campaign if temporary (McKenzie-Mohr, 2010). Yet, if implemented properly, incentives can greatly impact behavior, especially when the pro-environmental behavior is low (McKenzie-Mohr, 2010). For example, many recycling studies, including Iyer & Kashyap's study, have demonstrated an immediate and dramatic increase in recycling behavior when the target audience was provided an incentive for recycling. In a 2007 study, a university residential hall cluster was encouraged to recycle over a 4-month period. The first residential hall was not offered any incentive for recycling. The second residential hall was offered a campus-sponsored party if they recycled more than the other residential hall. At the end of the study, both residential halls increased their recycling, however the incentivized hall increased their recycling more than the un-incentivized hall (Iyer & Kashyap, 2007).

Convenience

Convenience as a behavior change tool refers to community-based social marketing's second step—identify barriers and benefits to the action. Barriers, whether real or perceived, can quickly halt someone from behaving pro-environmentally. For example, in a review of personal and situational factors that affect recycling, researchers conveyed how distance of recycling location from the participant, method of collection, and sorting of recycling materials all affected an individual's willingness to participate in a recycling program (Schultz et al., 1995). In summary, the more an individual is inconvenienced (has to travel a distance to recycle, has to invest time in collection method or sorting), the less likely the desired behavior will take place (Schultz et al., 1995). Once barriers have been identified, strategies can be made to remove them. In the case of Schultz et al.'s overview, minimizing the barriers increased the likelihood of an individual performing the behavior.

A self-imposed barrier that environmental entities and organizations often create is employing fear appeal messaging which attempts to elicit a behavior change out of fear (McKenzie-Mohr et al., 2011; O'Neill & Nicholson-Cole, 2009). This should be used with great caution because all too often the audience misses the suggested behavioral response and focuses on just the threat itself (McKenzie-Mohr et al., 2011; O'Neill & Nicholson-Cole, 2009). In a 2009 study on climate change, researchers found that nonthreatening imagery and icons that connected to the audience's everyday emotions and concerns tended to be more engaging and effective than using fearful imagery (O'Neill & Nicholson-Cole, 2009). Effectively communicating a positive action that can be taken will leave target audiences feeling as though they can conveniently respond and make a difference rather than making a situation feel hopeless.

Relevant studies: Septic system maintenance and care in the Puget Sound region of Washington

To date, only a handful of studies have been conducted to confirm actual and suspected barriers to septic system maintenance and care and to develop strategies for addressing them. These studies all have been conducted for the Washington State Department of Health with the intention of implementing an informed septic system awareness campaign in the Puget Sound region. The primary location of the studies was Snohomish County, with the exception of a 2011 focus group study, which included neighboring counties. In 1997, the initial study used focus groups and surveys to examine potential barriers associated with alternative septic systems (non-traditional systems that use newer technology) and social marketing approaches to identify taglines and images that support basic septic system care and maintenance of any system (Adolfson Associates, Inc., 1997). Consecutive studies through 2011 investigated the effectiveness of newly developed outreach material to evaluate the initial strategy. Following each study, the Washington State Department of Health updated their action

strategy and associated outreach materials in an attempt to increase their effectiveness and reach specific audiences.

In 2011, the Washington State Department of Health compiled its most recent findings from online public opinion polling, telephone surveys, and focus groups from 2009 and 2011. Fifty residents participated in the interactive public opinion polling, which was used to develop a telephone survey that went out to 400 residents. Key findings from both of these studies included (Snohomish Health District, 2011):

- In polling and surveys, Snohomish County septic owners rated their knowledge and care of septic systems high, but when pressed for more information, gaps in knowledge and care practices emerged.
- There were no major differences in responses from suburban vs. rural communities in either study.
- In both polling and surveys, residents perceived the Snohomish County Health District as helpful with general information. However, residents also indicated they would not contact them if they needed information.
- In the interactive public opinion polling, residents indicated that certain care practices are confusing to homeowners. This includes not knowing what can and cannot go down the drain, not using a garbage disposal if you have a septic system, and use of additives.
- In the interactive public opinion polling, 1 in 4 residents thought concerns about septic system failure and its harm were just scare tactics.
- In the telephone surveys, majority of residents indicated each reason for maintaining a septic system as “critical.” Reasons included keeping families and pets safe, avoiding extra expense, avoiding trouble with the Health District or County, and keeping neighbors from complaining.

In 2009, Snohomish County Health District held two focus groups to test brochures, taglines, and website URLs. In 2011, the Thurston County Health Department and Tacoma-Pierce Health Department implemented four focus groups, including locations in Snohomish County. The second series of focus groups focused on refining existing messages, and creating a regional brand. Key findings included (Snohomish Health District, 2011):

- Both sets of focus groups indicated responsibility, financial savings, and health as motivators to care for a septic system.
- In the 2009 focus groups, residents liked straight forward, no nonsense information. Residents preferred short taglines. They also did not like humorous messages.

- In 2009 focus groups, suburban homeowners expressed concern that they would be forced to connect to the sanitary sewer.
- Residents in the 2009 focus groups indicated that the four mailers they were shown would not motivate anyone to read the mailer further or take any action. Mailers contained themes of 1) protect your family and pets health; 2) protect your septic system's health/protect family health; 3) protect your investment/protect family health; 4) protect family's health)
- In 2011 focus groups, residents specified that simple taglines emphasizing "you" in the title work best for regional use. The top tagline was "septic system care depends on you." However, no single message appealed to everyone.
- In 2011 focus groups, participants overwhelmingly agreed that direct mailers were the preferred method for receiving information on septic system care. Free workshops in public spaces also ranked high as an alternative approach for educating residents.
- Residents in the 2011 focus groups were given updated mailers with new themes and asked to rate their effectiveness. The most effective mailers had the themes 1) Keep solids, toxins, greases and oils out of the drain, and 2) Use water wisely.

Although the Washington State Health District studies are not called community-based social marketing by name, their strategy holds all of the elements and suggests behavior change tools found in community-based social marketing. The studies used social science data collection techniques (interviews, surveys, focus groups) to inform what behavioral changing strategies would be most effective for target audiences. They also implement their strategy, evaluate its effectiveness over time, and update it to make it more effective.

While the Washington studies demonstrated some insight into the current level of knowledge and behaviors of homeowners with septic systems, it looked at an audience that was significantly different than northwest Indiana homeowners. For one, the Washington study looked at suburban and rural landowners, whereas this study examined homeowners in more urban settings. Ecologically, the Puget Sound region is an estuarine system with different soils and habitats than northwest Indiana's freshwater Lake Michigan and dunal landscape. Lastly, northwest Indiana and the Puget Sound region differ economically. Northwest Indiana has higher poverty rates in some of its urban core populations (Gary, East Chicago, Hammond) and has a lower median income per household in comparison to the Puget Sound region. Because of this, findings from the Washington State Department of Health studies

do not best represent the local northwest Indiana perceptions. The Washington studies do, however, provide a model that the current study builds off of and provides useful data to compare to.

Overall, the literature and Washington studies suggest that community-based social marketing contains effective techniques for fostering pro-environmental behavior and may also be successful if applied to the specific behavior of septic system maintenance and care. The current study focused on the second step of community-based social marketing strategy development— Identify barriers and benefits. Data were collected via focus groups, interactive polling, and surveys. The next section outlines the northwest Indiana study and its connection to the above literature and Washington studies.

CHAPTER 3: METHODS

Recruitment and study participants

The desired target population for the study was homeowners with septic systems located in the northwest Indiana Lake Michigan watershed (Figure 1). In order to recruit participants, the Septic System Coordination Work Group (SSCWG) and I used regional maps of municipal sewer lines to identify where septic systems may be (i.e. locations that did not have sewer lines were more likely to have septic systems), and their location within the watershed. Using these boundaries, the research team and I recruited from the northwest Indiana neighborhoods of Long Beach, Michiana Shores, Trail Creek, Waterford, Beverly Shores, Ogden Dunes, Town of Pines, Dune Acres, Miller Beach, Crown Point, Merrillville, Hobart, and Winfield. I grouped neighborhoods into four subsets based on communities within a 10-mile radius of each other. A neutral facility within that 10-mile radius was identified as the site for the corresponding focus group. Residents from Long Beach and Michiana Shores were recruited to attend Focus Group 1 at the Long Beach Community Center. Residents from Trail Creek and Waterford were recruited to attend Focus Group 2 at the Michigan City Washington Park Senior Center. Residents from Hobart, Crown Point, Merrillville and Winfield were recruited to attend Focus Group 3 held at Lake County Purdue Extension Office in Crown Point. Beverly Shores, Town of Pines, Dune Acres, Ogden Dunes, and Miller Beach residents were recruited to attend Focus Group 4 at the Northwestern Indiana Regional Planning Commission building in Portage.

The recruitment team consisted of 2 undergraduate students, a member of the SSCWG, and me. I provided training to recruiters prior to going door-to-door, and also provided a script to increase consistency, keep the discussion on track, and cover all talking points (Appendix A). The recruitment team was responsible for obtaining a pre-determined number of participant commitments to attend the nearest focus group based on the number of households in the neighborhood. The goal was to have 6-

12 participants at each focus group. Pairs of researchers recruited from every fourth house to decrease the likelihood that committed attendees would know one another. We also sought more participants in larger neighborhoods over smaller neighborhoods because participants in larger neighborhoods may be less likely to know each other. As part of the recruitment script, we pre-screened prospective focus group attendees to ensure that the target population was most likely reached. Participants were required to own their home, to be older than 18, to not work for a government agency, and to not work for a home maintenance company. We sought participants that were more likely to have general knowledge of septic systems and were not experts on the topic. Furthermore, recruiters told participants the focus group was for household maintenance decision-making. Since there was no mention of septic systems, this increased the likelihood that participants would come to the focus group unrehearsed. Homeowners who committed to attending a focus group were given a reminder letter (Appendix D) and were encouraged to provide their contact information for a secondary reminder (phone, email, or mail) which I used for a one time follow-up (Appendix E). We informed participants that if they attended the focus group, they would be given a \$25 gift card to Lowe's home improvement store as an incentive.

In response to low turnout at Focus Group 1, the research team made three changes:

- (1) We added a survey as an alternative participation method;
- (2) We increased the incentive offered to focus group participants; and
- (3) We increased the number of recruits to each focus group.

Homeowners who declined focus group attendance could take an on-site survey, which contained both multiple choice and open-ended questions (Appendix C). For focus group attendees, recruiters shared that each potential attendee would receive both a \$25.00 gift card and be included in a raffle for an additional \$100.00 gift card to Lowe's. This information was included in the recruiters' script for Focus Groups 2-4. Recruiters also increased the number of focus group commitments sought. In response to low turnout at Focus Group 3 where only one person attended, recruiters used additional recruitment

methods, including emailing homeowners using community association email directories, posting the opportunity to community associations' social media and by posting to a local community association's website for the final Focus Group. Table 1 captures the number of households recruited from, the number of commitment recruiters received, the number of actual focus group attendees, and additional procedure amendments:

Focus group procedure

Each focus group began by reviewing and agreeing to a verbal consent statement (Appendix F). The research team told participants that they could leave at any time without consequence, and offered food and beverages to make the session more appealing. I moderated each discussion while a secondary moderator only participated to help conversation flow as needed. Both of us used a moderator guide (Appendix G) for the sake of consistency. At least two note-takers were present at all times, as well as a technical expert who was able to assist with the polling equipment and PowerPoint slide transition. Each focus group was audio-recorded for transcription purposes, and lasted 90 minutes with the exception of focus Group 3, which lasted 30 minutes due to having only one participant.

Close-ended questions for septic system focus groups

Interactive polling took place after the consent agreement. I introduced the keypad system and demonstrated how to use it, using a sample question for respondents to practice with. I emphasized that information shared would not be identifiable with the person who responded. The first few questions pertained to age, gender, race, and income. I then told participants that the next set of questions would each follow with a graph to show the response rate of the room. These questions were related to septic systems. Response rate graphs were brought up during the open-ended discussion.

Open-ended discussion questions for septic system focus groups

After the interactive polling, I led the discussion using a series of questions that assessed homeowner knowledge of septic systems, maintenance and care of these systems, barriers to care and maintenance, and trusted sources of information. The moderator guide included probes to guide the conversation making sure each question was answered by some or all of the participants and that the topic of conversation stayed on track. This part of the discussion lasted for approximately 45 minutes. I then transitioned the discussion from measuring septic system awareness into discussing what existing septic system awareness campaigns participants may have heard of or seen. I gave participants three brochures on septic system maintenance (Appendix H) and asked attendees to express their opinions on each one. The brochures included a septic system awareness piece designed by local environmental non-profit Save the Dunes, a brochure developed from the U.S. EPA Septic Smart campaign, and a third brochure from West Virginia that was suggested for discussion by the SSCWG. Participants described what they did or did not like about each brochure, whether they thought the information was effective, and if they would feel motivated to act if they saw this information somewhere or received this information via mail. To further gather information on appealing and/or motivating messaging, I showed a series of 10-15 septic system related messages on the screen. These messages were taken from the Washington studies and included taglines such as “Care for your septic system” and “Don’t lose precious dollars down the drain.” A complete list of taglines is found at the end of the moderator guide in Appendix G. Each message was shown one at a time while participants were asked to express whether they liked or disliked the message and why, and if it would motivate them to think or act differently regarding septic system maintenance. I then asked if the message would motivate their neighbors to think or act differently regarding septic system maintenance.

Throughout each focus group, I made a point to pause and summarize the major points made during the discussion, giving the participants the opportunity to provide feedback or clarify the summary of the discussion. At the end of the focus group, I disclosed why I was collecting the information and provided contact information. I also offered the opportunity to share the completed research with participants should they want it.

Survey procedure

The recruitment team and I offered surveys during the recruitment process for Focus Groups 2-4. The surveys were modeled after the questions asked during the focus groups. Homeowners that declined to attend a focus group but agreed to participate in an on-site administered survey were given a consent statement (Appendix B) to read and verbally agree to, and were given a copy for their records. The recruitment pair provided a paper copy of the survey to consenting homeowners to read while one of the recruiters read the questions aloud to the homeowner. The survey administer followed a modified version of the survey (Appendix C) that included administration directions and prompts if the participant had trouble answering a question. The second recruiter recorded responses by hand. Upon conclusion of the survey, the recruitment pair asked for the copy of the survey back so that it would not be shared with neighbors who might have committed for one of the focus groups. The recruitment pair also left my business card in case the participant had any further questions. No incentives were provided for participation in the survey.

Data collection, entry & analysis

Focus group dialogue was audio recorded by two devices and saved to a CD for review. I transcribed focus group dialogue, and combined and cataloged responses by each question. This information was divided by common discussion themes such as knowledge, environment, health, location, barriers, beliefs about good practices, actions taken, and anecdotes. Information was further

coded by instances where knowledge or awareness of the subject was low, medium or high using Table 2 as a guide. I recorded the number of focus group participants with a certain level of knowledge or awareness by hand in the margins of the transcripts. I then summarized notes and codes into descriptive paragraphs. Supporting quotations from the transcriptions were also noted to further support key findings.

After summarizing focus group findings, I entered survey responses as well as responses from polling questions into spreadsheets. Then, I reviewed the survey and electronic polling entries and made connections to the summarized focus group data. Due to a small sample ($n=45$) and not all respondents answering every question, this information was not statistically valid for any one neighborhood nor of the region collectively. Instead, this information was used to further support the qualitative findings of the focus groups.

In order to reduce potential biases, I shared my interpretation of findings with my research team to determine whether or not the findings appeared accurate or whether I may have interpreted something differently than what she may have experienced at the same focus group. Additionally, I was able to review the notes taken by research assistants during the focus groups as well as during the surveys to review how they interpreted participants' responses. I was then able to determine whether or not they correlated with my own. When instances arose in which my interpretation differed from someone else's, I re-reviewed the notes and transcription to determine whether or not the interpretation was appropriate. Also, in these instances where a bias may have been present, I searched for negative evidence or evidence that contradicted my original interpretation. For example, after showing my interpretation of the focus groups to one of my research team members, the member stated that she had a different interpretation of whether or not homeowners were motivated to perform septic system maintenance and care because of their interest and care for the environment. Upon reexamining the focus group transcriptions and looking for whether or not I found evidence of her

interpretation (evidence that countered my initial finding), I was able to have a discussion with her to re-evaluate the interpretation and conclude what was the more representative interpretation. After taking these measures, I produced the study's final results and conclusion.

CHAPTER 4: RESULTS

A total of 45 homeowners participated in focus groups or on-site surveys. An overview of all participants is located in Table 3. The majority of participants were male (58%). The majority participant age range was in their 60s (29%). Nearly all participants asked to identify race/ethnicity identified as Caucasian (78%). Participants indicated a household income level above \$110,000 a year (24%), while others evenly reported household income levels between \$20,000 to \$109,999 (\$20,000 to \$49,999 (20%), \$50,000 to \$79,000 (20%), and \$80,000 to \$109,999 (20%)). Focus groups participants represented the communities of Michiana Shores, Long Beach, Trail Creek, Waterford, Hobart, Miller Beach, Ogden Dunes, and Beverly Shores. On-site survey participants represented Trail Creek, Miller Beach, Ogden Dunes, Beverly Shores, Crown Point, Town of Pines, and Merrillville. Of these communities, focus group and survey participants from Trail Creek had the highest participation rate (29%), while participants from Beverly Shores had the second highest participation rate (18%). The following looks at results from interactive polling used during the focus groups, focus group discussions, and on-site surveys.

Focus group interactive polling

Table 4 provides an overview of the focus group interactive polling responses. All participants indicated that the home from which they were recruited was their primary residence. Most participants indicated that they had owned their homes for 20 years or more (40%). Most participants reported having a septic system at their residence (65%), while other participants reported that they did not have a septic system (30%). Only one resident reported that she did not know if her household had a septic system. Of the residents that indicated they did have a septic system (n=13), residents identified their neighborhoods as Michiana Shores, Long Beach, Trail Creek, Waterford, Ogden Dunes and Beverly Shores. The majority of participants responded that their system was 20 years old or older (69%).

Overall, participants with reported septic systems (n=13) rated various levels of knowledge. Participants rated themselves very knowledgeable (38%), somewhat knowledgeable (23%), I don't know how to rate my knowledge (15%), not very knowledgeable (15%), and I don't know anything about septic system maintenance and care (8%).

Additionally, participants who indicated that they do not have a septic system (n=6) identified their neighborhoods as Miller Beach, Hobart, and Trail Creek. When asked to rate their knowledge of septic systems, half of these participants responded, "I don't know anything about septic system maintenance and care" (50%), and "I don't know how I'd rate my knowledge" (33%). One person indicated that he was somewhat knowledgeable about septic systems. Participants who reported not having septic systems also participated in the following focus group discussions.

Focus group discussion

Twenty participants participated in focus group discussions and responded to questions asked from a moderator guide (Appendix F). The following summarizes responses for each question as well as related discussions that stemmed from these questions (FG# = Focus Group Number):

How do homeowners find out they do or do not have a septic system?

Approximately seven participants in Focus Groups 1, 2, and 4 conveyed that they found out their home had or did not have a septic system during the home-buying process. Participants indicated this was directly communicated by the realtor or through the house listing:

Participant 1 _{FG1}: When I bought the home, I knew ... the real estate broker. And there was a septic system.

Participant 2 _{FG2}: That [having a septic system] was part of the discussion when you were talking about purchasing a house, or from all the homes that we looked at, at the time, that was part of the discussion.

Participant 3 F_{G2}: We... looked online for our home, all that information is listed for all the houses that we looked at.

Moderator: How did you first find out that your home has a septic system?

3-4 Unidentifiable Speakers F_{G4}: Real estate agent.

One person from Focus Group 4 provided a personal experience where she was misinformed during the home buying process and was told that her house was connected to the sanitary sewer. This was further confusing because she received monthly sanitation bills during a period of time until she and her husband realized they had a septic system. She recounted, "...We had been living there 4 or 5 years and had been paying the sanitation bill, and so we found out we had a septic tank and so we had to get our money back."

Other participants (three participants in Focus Groups 3 and 4) indicated that they were informed by the developer when they were building their house. In Focus Group 3, the participant stated that her family made a point to purchase property in an area that had city sewer. She stated, "The idea of having septic in our home was not appealing, not an appealing one. We had heard a couple of... statements from people that did have... septic systems ... it was a lot of maintenance..." However, a different participant (in Focus Group 2) indicated that when purchasing a home she looked for a house with a septic system, "We preferred to have a septic rather than city water. So, we knew." She further indicated that it wasn't so much the desire to have a septic system, but rather to be on well water rather than city water due to concerns of fluoride in city water.

What kinds of maintenance and care do homeowners know about? What do they do to maintain their own systems? Why?

When asked what kinds of maintenance and care homeowners are aware of, most participants provided responses that were partially consistent with U.S. EPA recommended practices for septic system maintenance and care. Participants share that they do these practices to prevent failure. Eight participants indicated that septic systems required pumping for overall function. However, these

participants didn't know how frequently pumping was supposed to occur or they gave a number contrary to the U.S. EPA recommended 3-5 years for pumping to maintain a septic system. The typical response was "every couple of years." There was only one participant in Focus Group 1 that stated that their household didn't take any action. She shared "I know we have lived there ten years and haven't done a darn thing, but we haven't had any problems either." The initial eight participants went on to clarify that they make their own judgments about when their tank needed to be pumped out. They indicated that the number of people living in the house or using the system determined when they would pump their septic tank:

Participant 4 _{FG1}: Right, one time we had... seven people living in our house, and now we have three. So, we don't have to do it [pump our tank] as much.

Participant 2 _{FG2}: I always thought that it [pumping a septic system] also depended upon the number of people in the family as to the need for cleaning it more often or less often. If there is a single person, you are not certainly going to need as much [pumping], but you have to maintain it because the activity of the house makes the septic work smoothly.

Participant 5 _{FG4}: It [pumping a septic system] has more to do with the amount you produce rather than how many sources there are you know.

Participant 6 _{FG4}: If I had a family of six I'd probably have it [septic system pumping] done every year and a half.

Participants were also asked if they sought regular inspections as part of maintenance and care. Most participants indicated this was part of moving into a new house. This was illustrated in Focus Group 4 when a participant stated, "We got our field inspected when we bought the house." Two other participants in Focus Group 4 agreed with this statement. Out of all the focus groups, no participants suggested this was a regular maintenance practice.

Participants were prompted to share additional maintenance and care practices that they were aware of. Less than half of the participants could name some of the U.S. EPA recommended practices other than pumping and inspection:

Participant 4 _{FG1}: Tampons can ruin your septic system. They can – they are just not good for – they don't dissolve and they can stay in there [septic tank] for a long time, and so they are not good.

Participant 7 _{FG1}: They're [tampons are] not biodegradable.

Participant 3 _{FG2}: ... Don't put grease down the drain, that kind of thing.

Participant 5 _{FG4}: You're not supposed to throw non-disposables down the toilet.

There was no mention of not putting products such as diapers, condoms, paper towels, bleach or other harsh chemicals, or paint down the drain.

After participants described what should not go down the drain, the discussion turned to the use of flushing additives, such as Rid-X, as part of regular maintenance and care. At least five participants in multiple focus groups (mentioned over 19 times total in Focus Groups 1, 2, and 4) indicated that they used additives as a method of septic system maintenance and care. Other focus group members gave non-verbal cues (head nods) that they too may also use additives or were supportive of its use, and none spoke against the use of such additives:

Participant 1 _{FG1}: I am not sure if Rid-X does a good job, but I put it in there once a month. I pour a great deal of it in once a month, and that is it. I haven't had any trouble and I pump it [septic tank] about every 2 years.

Participant 8 _{FG2}: ...I'm more conscious of what I'm sticking down, you know, in my garbage disposal... but we pump ours [septic tank] every year. I think we have done ours, we have lived there four years now, and I think we have pumped ours every year. We have a dual septic in our home and we still use the Rid-X religiously and we pump it every year.

Participant 5 _{FG4}: And, a couple of times a year throw in a bottle or two of the magic... bio-liquid.

Moderator: Magic Bio-Liquid?

Participant 5 _{FG4}: It replenishes the bacteria.

Participant 9 _{FG4}: Right, enzymes. Rid-X.

Participant 10 _{FG4}: Rid-X.

Participant 5 _{FG4}: I do [flush] it like twice a year. Something like twice a year.

Where do homeowners go to get relevant information on septic system care and maintenance?

Six focus group participants indicated that if they were looking for relevant information on septic system care and maintenance that they would go to a search engine such as Google and go to

several listed websites from there. Participants did not indicate that they would go to one website over another. The second highest choice (four participants in different focus groups) was going to a friend or a neighbor. No participants indicated that they would initially go to their local or state health department. After being probed further in the discussion, two focus group respondents from different groups said they may go to the health department, but it would not be their first choice. Two focus group members in Focus Group 1 adamantly stated that they would not go to the local health department (for Focus Group 1, this would be LaPorte County) for fear of regulatory action:

Moderator: What about the LaPorte County Health Department; would you ever call on them for any information?

Participant 1_{FG1}: No. I would not. Because they're going to come out there [to my house] right away and investigate and they're going to go down and punch holes all through the yard finding out where the septic is and then pretty soon they're going to say you're gonna need a mound [system]. Just that quick.

This same person also shared, "I depend upon somebody that I can trust that I have had work with.

Probably not the most legal person on earth, but it keeps my system working very well and I don't have any problems."

When asked about the U.S. EPA, participants suggested this would not be the first place they would go. This was illustrated in Focus Group 2:

Participant 8_{FG2}: I don't know that I would not trust them [U.S. EPA]. I don't know that it would be where I would go immediately unless I had a specific issue. Umm... maybe with where to put one, maybe with water tables that are in the area like maybe if it was construction? If I already had an existing home with an existing issue, it probably wouldn't be where I'd go unless there was a specific concern.

Participant 3_{FG2}: I agree.

Participant 2_{FG2}: So umm I don't know that the EPA or the Health Department -- unless it was a really strange issue, I don't know that I would go for them.

Participants in Focus Group 4 indicated that they would prefer to go to a local provider of information rather than the federal level altogether. There was also some suggestion in Focus Group 4 that U.S. EPA information was outdated or not appropriate for a small scale problem such as a household failure:

Moderator: Anybody who would not go to the health department? What about say we kind of had the environmental aspect going on here? What about the EPA? If EPA pops up in your search engine for information, trusted?

Participant 5 _{FG4}: I would but I happen to know that they're [U.S. EPA] behind in their thinking about things. By the time they get the information out its old.

Participant 9 _{FG4}: Outdated.

Participant 5 _{FG4}: Outdated, right.

Participant 6 _{FG4}: I would think also that if it was me, if I were doing the calling I would see the EPA and I would think well that's not the level I want to go to –

Participant 5 **FG4**: Local.

Participant 6 **FG4**: Local.

Participant 6 **FG4**: The municipal health department or the sanitary – I'd get local not federal.
Unison agreement

Who or what do homeowners think failing septic systems impact? Is failure a problem in their community?

Participants defined failure as toilets backing up, water coming out of the ground near the system, and foul smells. When asked who or what a failing septic system impacts, participants initially made connections to neighbors, finances, and aesthetics:

Participant 7 _{FG1}: The downwind neighbors will let you know.

Participant 4 _{FG1}: Yeah, you can smell it out there.

Participant 11 _{FG2}: Your finances [can be affected].

Participant 3 _{FG2}: Yeah, finances is a big one.

Participant 8 _{FG2}: Oh yeah.

Participant 2 _{FG2}: Your re-sale of your house.

Participant 8 _{FG2}: Sure. Your landscaping would be affected. It could be that your interior could be affected.

Participant 3 _{FG2}: Your neighbors might not like you as much anymore.

Participant 6 _{FG4}: ... if it's [septic tank] overflowing, their land, their yard is going to be flooded.

Moderator: Would you say decreased property value then?

Participant 6 _{FG4}: Well theirs is but not for mine.

Participant 5 _{FG4}: If you don't take care of your septic eventually it's going to back up and you're going to be the embarrassment of your community.

During the discussion, participants did not make immediate connections to septic system failure and the environment. Once asked, only two individuals had some concerns of septic system failure's impact on the environment. A participant from Focus Group 4 stated, "Since we stay in a sandy area too,

everybody in Miller [Beach], we have to have septic tanks and...I know a little bit about the environmental issue and it wouldn't be good for the sandy areas." Conversely, some focus group participants suggested that the sandy soil was better suited for managing septic systems. In Focus Group 2, a participant stated, "I think where we live too, our sand issue is actually kind of beneficial in that regard because it helps to pull away the water. It doesn't have a tendency to pool and such. That would be in our favor." The other individual from Focus Group 1 who had environmental impact concerns was more concerned about wildlife and related this to how failing septic systems may impact public health:

Participant 1_{FG1}: Animals can contract this [unspecific disease from septic systems]... So they could possibly migrate this disease [unspecific disease] from septic systems whatever it would be or some kid could get ahold of it. That's the only thing that I can think of that would cause, it [disease]... [but it]isn't there to happen. The sand is handling it.

Moderator: So ... could it be impacting the environment in any way?

Participant 1_{FG1}: Not if it's contained... it's a contained system.

Though the above individual makes mention of the possibility of animals contracting diseases from septic systems and potentially spreading it to youth, he also suggests that northwest Indiana's sandy soil is effectively moving wastewater away quickly and that septic systems are a contained system, suggesting that failing septic systems are not impacting the environment or likely public health.

Other than the above suggestion from Focus Group 1, most participants did not acknowledge septic system failure's potential impact on public health until asked directly, meaning people either did not consider or did not perceive failing septic systems as a threat to public health. When asked directly, one individual in Focus Group 1 suggested that "public health could be horrible if it could seep into your well." In Focus Group 4, participants were prompted on whether or not a failing septic system could impact a well. Respondents disagreed and suggested the setback distances between septic systems and wells adequately prevented contamination:

Moderator: ... do you think that [failing septic systems] could be impacting well water?

Unison disagreement

Participant 6_{FG4}: They are far enough apart.

Participant 9_{FG4}: Yeah, that's mandated.

Participant 6 _{FG4}: Mandated how far apart they've got the well is from the septic tank.

Participant 5 _{FG4}: Do you drink your well water?

Participant 12 _{FG4}: Oh, yeah.

Participant 6 _{FG4}: Oh, yeah. Sure it's perfectly okay.

In Focus Groups 1 and 4, participants discussed *E. coli* contamination of Lake Michigan, a public health and environmental health impact according to health departments and the U.S. EPA. However, participants in these focus groups generally did not believe failing septic systems were the primary contributor to high *E. coli* levels. In one instance, a participant in Focus Group 4 suggested combined sewer overflows were the cause of high *E. coli* levels. She shared, "...Don't you think that if an individual septic system fails it's going to have some localized effect? The lake gets much more impacted when there are storms and Chicago opens up its sewers and drains it into the lake. Then you get the *E. coli* warnings and stuff on the lake and that comes from big things, much bigger than localized systems failing. In Focus Group 1, a participant did connect failing septic systems to *E. coli*, but also indicated that he had not heard this was a problem in his community. Through the discussion, the participant suggests failing septic systems may contribute to high *E. coli* in Lake Michigan, but then participants also suggest other sources such as combined sewer overflows, agriculture, and non-point source pollution as contributors:

Participant 7 _{FG1}: [White Ditch] goes right through Grand Beach and comes out their end and dumps right into the lake.

Participant 1 _{FG1}: I was on the board of water so I know where I'm coming from... it all goes into Lake Michigan and it gets all the farm runoff, it gets all the septic, gets all the cows, gets all the animal, and it goes into Lake Michigan. Now that's bad too.

Moderator: And, why is that bad?

Participant 7 _{FG1}: Fecal coliform [associated with *E. coli*]. Closes the beach. Can't swim. Get infection. You have during the summer the swimming season, beaches are monitored, they [unspecified monitor] take samples. No swimming today, count's too high. Usually when we [Long Beach-Michiana Shores area] get prevailing winds coming from Hammond, Gary in that particular area around the currents, that'll do it. If there's excessive flooding, heavy rains, it'll bring it [fecal coliform/*E. coli*] up in your communities that do have great sewage systems can't handle it even [reference to combined sewer overflows]. And that brings it up [combined sewer overflows]. And then mother nature takes care of it [*E. coli*], dissipates it by the water.

Participant 1 _{FG1}: It's not unusual for Michigan City to open up their tanks in Trail Creek [referring to combined sewer overflows], when you get a big down pour of rain. [Michigan City]

open them up and then they go [sewage/stormwater is released]. And that's wrong. I remember when I was a kid fishing it used to be real bad at times.

Moderator: ... when you said that White Ditch is taking the septic runoff and the runoff from the field..., would you say that it's septic runoff of failing systems or just any septic system?

Participant 1 _{FG1}: No, no no. It would probably be failing if it [septic system] did anything.

Participant 7 _{FG1}: Well you [referring to another participant] did mention that some of the runoff would come from agricultural.

Participant 1 _{FG1}: Agricultural.

Participant 7 _{FG1}: Because you could go up 100 miles to other tributaries and then contaminate that so it strictly wouldn't be a failing system, it would be mother nature as itself.

What do homeowners perceive as barriers to septic system maintenance and care?

Participants were asked what they perceive as barriers to septic system maintenance and care. The greatest response (6 focus group members) from participants was that a lack of knowledge is the primary barrier for septic system maintenance. A participant in Focus Group 1 suggested that “maybe somebody just doesn’t know that you should ... pump it every once in a while, but then if you don’t have any problems and its working okay then ... you might not need to.” In Focus Group 2, a participant proposed, “they [septic system owners] don’t know any better.” Another suggestion, the barrier of cost, was supported by 4 focus group members in different groups. However, a participant in Focus Group 4 stated, “preventative [maintenance] cost is pretty reasonable. It's just the education of knowing when to do it.”

While there was a strong suggestion for lack of knowledge being the primary barrier, there was also an instance in Focus Group 4 where a participant shared a personal experience in which he suggests his neighborhood has the knowledge needed to appropriately maintain and care for septic systems, “We had a town council ordinance was offered that people would have to by ordinance have it checked every two years or they couldn't get parking permit. And it failed by lack of a second because four members of council said no way. We're all intelligent, we're all educated, we all know what's going on, so no. Don't infantilize us.”

A smaller number of participants suggested that having a septic system underground may cause people to not consider maintaining it. This “out of sight, out of mind” mentality was suggested by three focus group participants. However, participants in the focus groups also indicated that they don’t believe most people are trying to avoid maintenance and care. Rather, there is some other circumstance causing them not to maintain a septic system.

What messages and taglines appeal to homeowners with septic systems?

Researchers asked participants to look at three brochures related to septic system maintenance and care. The brochures came from: 1) Save the Dunes Conservation Fund, a local northwest Indiana environmental non-profit; 2) the U.S. EPA’s Septic Smart Program; and 3) the National Small Flows Clearing House, a program managed by West Virginia University’s National Environmental Services Center. The brochures from each organization are found in Appendix G. Participants were asked how each brochure may or not have appealed to them and what they thought were the highest motivational messages for eliciting change in septic system maintenance and care practices. The brochures from Save the Dunes and from U.S. EPA’s Septic Smart were favored. In Focus Group 2, one participant expressed “this [Save the Dunes’ brochure] one for me, because I feel like I don’t know anything, this was intimidating and it’s pretty basic. What can I do to help? How do I know if something’s wrong? Don’t do this, you should do this, why should you do this?” In Focus Group 4, a participant shared “... this one [U.S. EPA brochure] is colorful and it gets your attention right away, and if you forget anything you can go right here to the website ...” Overall, participants said that simple messages and brightly colored layouts made them want to look at them. Participants also liked fewer words that resulted in quick reads. The general consensus from all focus groups was that the West Virginia brochure had too many words.

One participant in Focus Group 4 interpreted that each brochure has a different purpose and addresses a different issue: “well I would say each one of these identifies a different issue. This one, Septic Sam, [U.S. EPA brochure] is how you identify whether you have one [a septic system] or not. Get pumped [Save the Dunes’ brochure] is if you have a problem, what you need to do, and this one [West Virginia brochure] so you own a septic system is how it works and what to put in it. It doesn’t address getting pumped.” When further probing if one was more meaningful over another, one participant in Focus Group 1 shared the following exchange:

Moderator: So...would you yourself pick up this brochure?

Participant 7 _{FG1}: No.

Moderator: And why is that?

Participant 7 _{FG1}: Well I know the septic system. I’m familiar with it, like I said this is good basic information for somebody who's not knowledgeable. Now if you had a drop mailing and you put this in in all the mailboxes you can maybe find maybe 50% of the people don’t know anything about a septic system don't even know they have one in their backyard.

During the tagline discussion, participants favored lines that contained the word “you.” One of the most favored tagline was “septic system care depends on you,” and is illustrated in a participant’s comment from Focus Group 1, “I would go right to that. It is very basic, this is where you go for this information, get it done.” Participants were indifferent to messages with public health and environmental messages. Overall, no single message or theme appealed to all participants. The tagline “Your family. Your septic system. Get the connection?” was met with the response “no” and consistent shaking of the heads in all focus groups. Focus group participants in Focus Group 4 noted that the tagline “Care for your septic tank and drainfield,” does not apply to all homeowners since not everyone has a drainfield. Overall, a participant in Focus Group 4 summarized what most participants indicated regarding messages: “Personal and short and positive rather than don’t let this or this happen.” However, when discussing taglines and what might motivate a homeowner to maintain a septic system if they are not already doing so, participants of the focus groups indicated that they felt most people are

already taking care of their septic system. This was illustrated in Focus Group 1, “I can't think of any self-respecting person having a septic system that doesn't work, I really can't.”

On-Site surveys

Twenty-five participants participated in on-site surveys (Table 6). Majority of participants indicated the home where they were recruited from was their primary residence (92%), and nearly half of participants indicated a home ownership length of 5 to 9 years (44%). Of the residents that indicated they do have a septic system (n= 24), residents identified their neighborhoods as Trail Creek, Miller Beach, Ogden Dunes, Beverly Shores, Crown Point, Town of Pines, and Merrillville. Only one participant reported that she did not have a septic system. Of the residents that reported they do have a septic system (n= 24), majority responded their system was 20 years old or older (50%). The participants with septic systems (n=24) rated various levels of knowledge. Participants rated themselves very knowledgeable (25%), somewhat knowledgeable (42%), I don't know how to rate my knowledge (13%), and not very knowledgeable (17%). No one indicated that they do not know anything about septic system maintenance and care (0%). All participants (n=25) were asked who informed them if they had or did not have a septic system. Majority responded that their real estate agent or seller informed them (68%). Other responses included overseeing installation of the system during the home building process. Out of the participants that indicated they had septic systems (n=24), most indicated that they have their system inspected regularly (84%). Also out of the participants that indicated that they have septic systems (n=24), a high number indicated that they have their septic system pumped regularly (96%). Survey administrators asked reported septic system owners where they go for trusted sources of information. The largest response category was a professional septic system business (29%). Other responses included the internet (21%) and town hall or community center (21%). One participant

indicated they would contact the health department. One other participant indicated that they would contact the U.S. EPA.

Survey administrators asked participants with septic systems (n=24) what they thought prevents someone from maintaining a septic system. Lack of knowledge was rated the highest (67%). Survey administrators then asked all participants (n=25) if failing septic systems are a problem in their community. Respondents with septic systems and without systems mostly responded no (64%) while 36% responded yes. Researchers asked all participants (n=25) whether they were concerned about failing septic systems impacting specific people or places. Participants indicated concern that failing septic systems could impact enjoyment of their property (68%), property value (68%), family's health (72%), nearby wildlife (56%), and also impact water quality (56%).

Researchers also asked a series of open-ended questions, including if and how often they had their septic system inspected. For those that had septic systems, the most frequent responses were every 2 years or less (32%) and that they don't have their system regularly inspected (32%). Some participants indicated that they only have their septic system pumped upon moving in or only do so when there is a problem (n=8). When asked how often septic system owners were supposed to pump a septic system, most responses fell within 2 years or less (40%) with the second highest response being that they did not pump their household system regularly (24%). Researchers also gave participants the opportunity to provide additional concerns they may have in regards to septic systems in the form of an open-ended question. Of the participants who responded (n=9), roughly half of the respondents reiterated their concern for failing septic system's impact to the environment (56%).

CHAPTER 5: DISCUSSION

The purpose of this research was to better understand northwest Indiana homeowners' knowledge and awareness of septic systems, the maintenance and care actions that homeowners are currently performing, and potential barriers to septic system maintenance. The study was designed to help develop a community-based social marketing strategy that improves local outreach efforts, such as those involved with the Septic System Coordination Work Group (SSCWG). The study effectively addressed two multi-part objectives:

Objective 1. Gain some preliminary insight to northwest Indiana homeowners' septic system maintenance and care, and identify potential barriers to action.

Objective 2. Develop recommendations for piloting a community-based social marketing strategy in northwest Indiana that motivates homeowners to care and properly maintain household septic systems.

The study tested four hypotheses that were developed based on the SSCWG's suggestions:

- **Hypothesis 1.** A high level of septic system owners will know that they have a septic system.
- **Hypothesis 2.** Septic system owners will have some (medium) understanding of required maintenance and how to prevent system failure.
- **Hypothesis 3.** Septic system owners will have a low awareness of septic system failure's impact on public health.
- **Hypothesis 4.** Septic system owners will have low awareness of septic system failure's environmental impact.

This section goes on to explore implications relative to each hypothesis and associated discussion, and makes recommendations for piloting a community-based social marketing strategy that motivates homeowners to care for their household septic system.

Hypothesis 1. A high level of septic system owners will know that they have a septic system.

The research team and I recruited both focus group and on-site survey participants from areas where septic systems were suspected, but not officially confirmed. Eighty-two percent of the study's participants (n=37) reported that they had a septic system. Those who indicated that they did not have a septic system came from the neighborhoods of Miller Beach, Hobart, and Trail Creek. These neighborhoods are known to have some mixes of unsewered and sewerred areas, so it is plausible that these respondents were accurately aware that their household did not have a septic system. Overall, there was only one participant in Focus Group 2 who indicated that she did not know if her household had a septic system.

Furthermore, participants clearly identified how they found out whether their home had a septic system or not. Most study participants indicated that they found out during the home-buying process, while others shared that they found out when their home was being built. In two instances (Focus Groups 2 and 3), participants indicated that they specifically searched for a household or property that met the criteria of having or not having a septic system. Overall, these results support Hypothesis 1. A high level of septic system owners will know that they have a septic system.

Participants further demonstrated awareness of having a septic system by being able to answer how old their household septic system was. Out of all of participants reporting to have septic systems (n=37), 10 indicated that they did not know the age of the system. However, this question also provided some insight to public health official's suspicions that many septic systems in northwest Indiana may be over 20 years old or older. Forty percent of focus group participants and 50% of survey participants reported that their household septic system was 20 years or older. According researchers, the average system lifespan ranges from 11 to 30 years (Ferrell & Grimes, 2005; Siegrist, Tyler, & Jenssen, 2001). It is

possible that even though these systems are being maintained, they may be reaching the end of their lifespan and, consequently, discharging effluent that does not meet water quality standards.

Hypothesis 2. Septic system owners will have some (medium) understanding of required maintenance and how to prevent system failure.

At the beginning of each focus group, I asked participants to rate their knowledge of septic system care and maintenance. Participants that reported that they have septic systems (n=13) rated their knowledge of septic system maintenance and care as very knowledgeable (38%), somewhat knowledgeable (23%), I don't know how to rate my knowledge (15%), not very knowledgeable (15%), and I don't know anything about septic system maintenance and care (8%). In surveys, participants with septic systems (n=24) rated themselves very knowledgeable (25%), somewhat knowledgeable (42%), I don't know how to rate my knowledge (13%), and not very knowledgeable (17%). Overall, combined totals demonstrated that most participants considered themselves either very knowledgeable (31%) or somewhat knowledgeable (36%). In the focus group discussions, when asked what kinds of maintenance and care practices participants knew of and what actions they took themselves, participants gave responses that were partially consistent with U.S. EPA recommended practices. For example, eight focus group participants indicated that septic systems required pumping for overall function. However, these participants didn't know how frequently pumping was supposed to take place or they gave a number contrary to the U.S. EPA recommended 3-5 years for pumping to maintain a septic system. Additionally in the focus groups, inspections were identified as part of the home-buying process rather than part of regular maintenance and care. None of these participants indicated that they would have an inspection thereafter. Conversely, a higher number of survey takers (84%) responded that they did have regularly scheduled inspections.

Overall, the participants in both focus groups and surveys appeared to have some knowledge of how to maintain a septic system, but not a full understanding. Many participants made their own

judgements as to when their household tank needed to be pumped out. Participants could also name some of the items that should not be put down the drain such as grease, tampons, and other non-biodegradables. Additionally, additives such as Rid-X frequently came up as a commonly used form of maintenance and care in both focus groups and surveys. According to the U.S. EPA Septic Smart Program Coordinator, this is an inadequate form of maintenance and may do more harm to septic system function than good (Pepper, personal communication, November 19, 2015). As a result, these findings support Hypothesis 2. Septic system owners will have some (medium) understanding of required maintenance and how to prevent system failure.

The finding that septic system owners have some (medium) understanding of required maintenance and how to prevent system failure was consistent with Snohomish Health District's public opinion study. In their study, a high number of homeowners with septic systems rated themselves as "very knowledgeable" about septic system maintenance and care. However, when asked to give more information on septic systems, homeowners could not identify when practices should take place nor could they identify a great number of practices beyond pumping (Snohomish Health District, 2011). Both the Snohomish Health District study and this study suggest that lack of knowledge may be a potential barrier to septic system care and maintenance. Furthermore, in my study the research team and I asked both focus group participants and survey participants with septic systems what they thought prevents someone from maintaining a septic system. Lack of knowledge was rated the highest by all participants of the focus groups and surveys.

In addition to lack of knowledge, one of the other suspected barriers considered by the SSCWG considered is that people do not care about maintaining septic systems and willfully take no action. However, according to our study, it appeared that participants did maintain and care for their household septic system and that this was perceived as a subjective norm. In Focus Group 1, a participant emphasized "I can't think of any self-respecting person having a septic system that doesn't work, I really

can't." In Focus Group 4, a participant added "If you don't take care of your septic eventually it's going to back up and you're going to be the embarrassment of your community." Surveys further supported that most participants suggested maintaining a septic system was a standard practice, meaning they participated in some form of maintenance and care even if it was not necessarily adequate by U.S. EPA standards. Overall, there were only two people in the study who openly admitted that they did nothing to maintain their septic system.

Furthermore, when applied to the theory of planned behavior (TPB), people may have a higher intention to perform septic system care and maintenance because it is an expected action or subjective norm (Ajzen 1991; Koger & Winter, 2010). In our study, we saw that most people indicated that they did care for their household septic system. In several instances, participants indicated that septic system maintenance and care was a standard behavior to be performed by those who have them. When we look at these findings from the perspective of the value-action gap theory, participants with septic systems seemed to believe that the level of maintenance and care that they were currently taking was appropriate. For example, in Focus Group 1, a participant stated, "I can't think of any self-respecting person having a septic system that doesn't work, I really can't." This comment received head nods of agreement from two other members within this focus group. It is likely these participants and potentially participants in the other focus groups felt that they were acting responsibly by caring for their septic systems as they currently were. Overall, it appeared that participants had limited knowledge of how to effectively maintain and care for a septic system. According to Blake, information generates knowledge, which then shapes attitudes, leading to behavior (1999). Without the correct information on how to properly maintain and care for a septic system, participants determined their behavior was adequate. It would seem in our study the greatest barrier is not knowing what and how often someone should be implementing maintenance and care practices. As a result, there appears to be a greater need

to properly inform northwest Indiana homeowners how to take care of their septic system rather than persuade them to maintain septic systems.

Another possible barrier that a small number of participants indicated is the barrier of cost. Four focus group members suggested this barrier as well as 8 survey takers. However, a participant in Focus Group 4 also stated that, “preventative [maintenance] cost is pretty reasonable. It's just the education of knowing when to do it.” While cost may have been suggested as a lesser barrier, it is also possible that self-reporting participants did not want to suggest that they may have other priorities for how they spend their money, especially if maintaining a septic system is a subjective norm such that it is expected by their neighbors and fellow community members. Additionally, it is also possible that those maintaining their household septic system are not investing a lot of money because they are not currently maintaining their system as often as they should. If they were to properly maintain their system according to U.S. EPA's recommendations, it is possible that cost may emerge as a greater barrier.

Hypothesis 3. Septic system owners will have low awareness of septic system failure's impact on public health.

In Focus Group 1, one participant indicated that failing septic systems may impact wildlife which could carry diseases and potentially spread it to youth. However, this was the only instance in the focus groups that a participant suggested septic system failure's potential impact on public health without being directly asked. Overall, focus group participants initially suggested that failing septic systems would smell, affecting their neighbors. Participants also suggested that their personal finances could be affected and their property value decreased. When asked to consider whether or not a failing septic system could impact something such as well water, one individual in Focus Group 1 acknowledged that “Public health could be horrible if it could seep into your well.” However, in Focus Group 4, participants unanimously disagreed and suggested the setback distances between septic systems and wells

adequately prevented contamination. Overall, focus group participants demonstrated a low level of concern for failing septic system's impacts to public health.

On the other hand, survey takers demonstrated a higher concern for public health. Seventy-two percent of survey respondents (n=18) indicated concern for their family's health when directly asked by a survey administrator. However, it unknown whether or not these participants would have arrived at this conclusion without being directly asked. Yet, according to the number of participants in the focus groups who stated that they have concern for public health before and after being asked (n=2) and the number of survey takers who responded that they were concerned for their family's health (n=18), this does not support Hypothesis 3. Septic system owners will have low awareness of septic system failure's impact on public health. Results demonstrated that study participants may instead have some (medium) awareness of septic system failure's impact on public health.

However, these findings are inconsistent with findings in the Snohomish Health District's study. Snohomish's study found that one of the primary reasons people were compelled to maintain his or her septic system was because of the implications to public health (Snohomish Health District, 2011). Unlike Snohomish's study, participants in our study indicated that they maintained their household septic system because it was a subjective norm— a responsibility that they may have as a homeowner and a neighbor. They provided maintenance because they did not want their system to fail. It is also possible that Snohomish County participants indicated that their primary reason for maintaining a septic system was public health implications because they were aware the study was being conducted by their local health department. Overall, our participants may have had some awareness of public health implications, but may not necessarily be motivated to maintain their septic system to protect public health. This was further supported in the tagline study. Participants were mostly indifferent towards taglines that had public health messages. Overall, it seemed our study's participants may have a weak connection to public health implications and failing septic systems.

Hypothesis 4. Septic system owners will have low awareness of septic system failure's environmental impact.

During the focus groups, participants did not make immediate connections to septic system failure and the environment. Once asked, only two individuals had some concerns of septic system failure's impact on the environment. A participant from Focus Group 4 stated, "since we stay in a sandy area too, everybody in Miller [Beach], we have to have septic tanks and...I know a little bit about the environmental issue and it wouldn't be good for the sandy areas." The other individual was the participant from Focus Group 1 who made the connection to wildlife and to public health (youth). These were the only two instances in the focus groups that participants suggested septic system failure's potential impact on the environment without being directly asked, possibly meaning people either did not consider or did not perceive failing septic systems as a threat to the environment. When asked to consider environmental implications, participants in Focus Group 1 and a participant in Focus Group 4 initiated a discussion on *E. coli* levels in Lake Michigan. However, in both instances, the participants concluded that they did not think that failing septic systems were a problem in their communities and that the primary cause for high *E. coli* levels in Lake Michigan was due to combined sewer overflows. In Focus Group 1, the participant went on to also suggest livestock as a potential contributor as well. Overall, when I further asked all focus groups whether they felt failing septic system impacted the environment, participants demonstrated a low level of concern.

Similar to the public health discussion, survey takers demonstrated a higher concern for the environment. Fifty-six percent of survey respondents (n=14) indicated concern for wildlife impacts, and the same number of respondents indicated concern for impacts to local waterways. Furthermore, the survey administrators and I also gave participants the opportunity to provide additional concerns they may have in regards to septic system failure. Out of the participants who responded (n=9), roughly half of the respondents reiterated their concern for failing septic system's impact to the environment (n=5; 56%). Again, it is unknown whether or not these participants would have arrived at this conclusion

without being directly asked. Yet, according to the number of participants in the focus groups who stated that they have concern for the environment (n=2) and the number of survey takers who responded that they are concerned for the wildlife (n=14) and local waterways (n=14), this does not support Hypothesis 4. Septic system owners will have low awareness of septic system failure's impact on the environment. Results demonstrated that study participants may instead have some (medium) awareness of septic system failure's impact on the environment.

During the discussion on potential environmental impacts, an interesting point was made about the sand. The participant in Focus Group 4 didn't give a clear response why failing septic systems would not be good for sand, but it is interesting that in another focus group, a small number of participants proposed the opposite, suggesting that sandy soil was better suited for managing septic systems because septic system effluent can percolate faster. The Natural Resource Conservation Service specifically states that sandy soils are considered 'severely limited' and that septic systems placed in these soils require extra maintenance in order to function (NRCS, 1993). The same soils that could cause a septic system to fail and quickly transport inadequately treated wastewater to nearby rivers and streams were actually seen positively by some focus group participants because they drew wastewater away faster and didn't result in yard or household flooding.

Overall, our participants may have had some awareness of environmental implications of failing septic systems, but may not necessarily be motivated to maintain their septic system to protect the environment. Furthermore, most participants did not seem to think septic system failures impact water quality and that threats such as combined sewer overflows were the cause of high *E. coli* levels in local waterways. This was further supported in the tagline study. Participants were mostly indifferent towards taglines that had environmental messages, unlike Snohomish's study where the key tagline, "septic systems impact water quality," tested well. While it may be important to inform homeowners that

failing septic systems can impact the environment, it also does not appear to be an initial motivating factor to maintain a household septic system.

However, participants did seem to be motivated to maintain household septic systems for the sake of their neighbors. When applying the theory of planned behavior to the study's findings, there is some indication that the participants have: 1) the intention to properly maintain septic systems; 2) a positive attitude towards doing the behavior; and 3) viewed maintenance and care behavior as a normative action within their community. Moreover, the study yields that lack of knowledge is more likely the bigger barrier to action rather than the barriers of individuality, responsibility, and practicality as suggested by the value-gap theory. With this being said, this increases the likelihood that northwest Indiana homeowners may actually implement proper septic system maintenance and care practices if informed through a meaningful community-based social marketing campaign that includes recommendations based on the study's findings.

Recommendations

The current study indicates that knowledge is likely one of the more significant barriers to northwest Indiana septic system maintenance and care. However, researchers have agreed that environmental knowledge alone does not lead to pro-environmental behavior (Gifford & Nilsson, 2014; Kollmuss & Agyeman, 2002). In order to deliver knowledge while making it meaningful to homeowners, we suggest using the technique of community-based social marketing. The following section explores *Objective 2* "Develop recommendations for piloting a community-based social marketing strategy that motivates homeowners to care for their household septic system." Using the findings from the current study, the findings from the Snohomish Health District studies, and application of McKenzie-Mohr's guide to Fostering Sustainable Behavior using community-based social marketing, the following

recommendations have been made to inform the SCWG and future campaigns for outreach and education on septic system maintenance and care in northwest Indiana:

- (1) *Use local trusted sources for communication:* According to our study's results, the majority of homeowners found out that their house had or did not have a septic system during the home-buying process. In order to reach northwest Indiana homeowners, especially new homeowners, a realtor may be a reliable way to inform homeowners that their household has a septic system. Additionally, this may be a good opportunity for a realtor to share educational material on septic system maintenance and care, providing information first hand to homeowners on how to properly maintain a system. This may address the common study response that "no one have ever told them [how to maintain a septic system]."

In addition to utilizing realtors to share information, community groups (ideally local groups that would contain neighbors or friends in a given community) may also be a trusted source for distributing information. A high number of study participants indicated that they would go to a friend or a neighbor for relevant information on septic system care and maintenance. By sharing information at the community or even neighborhood level, the social exchange heuristic suggests that it is likely that this information may be more readily adopted by septic system owners (Yamagishi et al., 2007). Furthermore, septic system owners identified that they would go to a search engine and look for information on septic systems if they needed more information. Ideally, it would be beneficial for every community with septic systems to clearly post information on how to properly maintain a septic system and who to contact if they suspect a problem. If each community association or neighborhood posted this information, it is more likely this could be retrieved by a search engine as one of the first results. For example, if I am a homeowner in Long Beach and I want to know about septic systems, I may search "Long Beach, IN septic system." As a resident, if one of the first website suggestions was my local

community or neighborhood page sharing what to do to properly maintain a system and where to go for more information, I may be more receptive of this information. Furthermore, this also builds on septic system maintenance and care as a subjective norm. If the community as a whole is promoting the practice, it is likely that more people within that community will want to conform to that standard.

(2) *Clearly communicate the problem and the action.* According to our study, the majority of participants do not think failing septic systems are a problem in their community. It is important for messages to clearly indicate that septic systems are failing in specific communities.

Additionally, messages that remind residents that septic system maintenance and care depends on “you” appear to be most effective with audiences. Messages that rely heavily on protecting public health or protecting the environment may not be as effective as messages that remind people that septic systems will not fail if “you” do the following care and maintenance practices. Also, the steps to maintain a septic system should be clear and concise.

(3) *Create a prompt.* As shown in Sussman, Greeno, Gifford, and Scannell’s research, prompts are beneficial to ongoing behavior change (2013). Therefore, homeowners may benefit from reminders. It may be helpful to create a magnet or another simple display that reiterates basic information on maintenance and care. Additionally, if the desired action is to have more people pumping or inspecting their septic system on a certain time interval, it may be beneficial to recruit model participants to place a sign in their yard stating that they are a good neighbor and had their septic system pumped and/or inspected with a reminder on how often this should occur. This type of model can also serve as a prompt for other homeowners to take action.

(4) *Create a commitment.* Because commitments have proven effective in other pro-environmental behavior change campaigns, I suggest also using commitment as a tactic to encourage more people to take on a preventive maintenance practice. Whether a commitment is verbal, written,

or publically made, any freely given commitment is likely to engage someone in undertaking a behavior versus no commitment at all. During septic system awareness week, it may be effective to go door to door asking for written pledges committing to get a household septic system pumped or inspected. If the person has recently pumped his or her septic system, you can ask for a pledge for them to pump or inspect his or her septic system in the next 3-5 years.

CHAPTER 6: CONCLUSION

Environmental and public health agencies want to produce outreach and educational material that informs homeowners of how regular maintenance and care should be performed, as well as its importance to local water quality and public health. This study was conducted to gain some insight on northwest Indiana homeowners' knowledge and awareness of septic systems, the maintenance and care actions that homeowners are currently performing, and potential barriers to septic system maintenance. Using information gained from this study, environmental and health agencies will be able to develop an informed community-based social marketing approach to promoting proper septic system maintenance and care.

The research team and I used focus groups and surveys to reach 45 homeowners in northwest Indiana communities likely to have septic systems. The majority of homeowners reported that they had a septic system. Participants also shared that they were informed their house did or did not have a septic system during the home-buying process or during the building process. Overall, participants had a high awareness of whether they did or did not have a septic system. Knowledge of proper maintenance and care of septic systems was medium. Though participants mentioned U.S. EPA practices such as pumping, indicating that they had some understanding of maintenance and care, participants provided limited responses regarding how often a certain practice should take place or what the forms of daily maintenance and care are. Overall, study participants appeared to have some awareness about septic system failure and public health implications as well as environmental implications, but this was only when we asked participants directly. It seemed as though participants would not have arrived at these connections had they not been directed there in the first place.

While the study provided some insight to northwest Indiana homeowners, it is important to understand the study has limitations. One of the greatest limitations was the size of the sample. Only a small number of septic system owners in northwest Indiana participated in focus groups and surveys.

Study results cannot be generalized to represent all homeowners with septic systems in northwest Indiana. Also, representatives from many of the neighborhoods in Lake County and central Porter County were absent from this study. Since these representatives live farther away from Lake Michigan, it would have been helpful to see if they reached different conclusions. Additionally, Focus Groups 1-3 did not have enough participants to meet the 6-12 participant standard. If there were more participants in attendance, more points of view could have been shared. Moreover, while there were less than a desired number of attendees, this was not for lack of trying. Over 460 households were approached during recruitment (Table 1) and even more potential participants reached via email and community websites. Recruitment for the current study was very challenging and the willingness of homeowners to talk to recruiters at their residence was very limited.

Another limitation was having such a high number of participants in the study who likely did not have septic systems. This further limited the number of participants who could contribute to the conversation, especially when asking questions such as "What do you do to maintain your septic system?". This is also related to another limitation of the study, which was the inability to confirm whether or not those reporting to not have septic systems were accurate. Since this data is either confidential or non-existent, it was impossible to go beyond self-reporting.

Lastly, there was the limitation of lack of additional researchers analyzing the data. I was the primary coder and analyzer of the data. Findings were shared with the second moderator of the focus groups to double check whether or not findings seemed off from what she experienced. Also, if there was anything different or that may have represented a bias, I re-examined the transcripts and notes, and looked for negative evidence. However, had additional researchers coded the data for themselves and presented their own analysis for comparison, this would have increased the study's reliability and ensured that I did not inject any personal biases.

Despite a smaller sample size, it is likely that if we had increased the number of participants in the study we would still have many additional homeowners unable to identify many U.S. EPA practices or when they should be done. Moreover, I suspect that there are many more septic system owners who use additives such as Rid-X as a form of regular maintenance and care. I also suspect that many others across northwest Indiana do not connect septic system failure to public health or to the environment. Perhaps the only factor that may change if the study had a larger audience would be the barriers to implementation. It is possible cost may have come up more so as an additional barrier to septic system maintenance and care, especially if we had attendance from lower income areas.

There are many opportunities to expand this study and look at other factors that may influence septic system maintenance and care behavior. Other opportunities for future studies include:

- 1) Investigate whether or not incentives, such as discount pumping, promote proper maintenance.
- 2) Investigate whether or not legislation that enforces septic system maintenance and care practices may affect how people maintain household systems.
- 3) Investigate whether or not septic system failure awareness differs from near shore communities vs. inland communities.
- 4) Investigate the actual impact of septic system failure to Lake Michigan in northwest Indiana.

In conclusion, this study gives organizations and agencies some insight into crafting a meaningful outreach and education campaign that ensures proper septic system maintenance and care is taking place across northwest Indiana. The study also suggests lack of knowledge may be the greatest barrier to proper septic system maintenance and care, and that most participants may already be motivated to perform maintenance and care due to these actions being considered a social norm. By using proven behavior change tools and disseminating information at the trusted community-level, organizations and agencies have the opportunity to promote necessary behaviors to reduce septic system failure. Overall, it is important to use the recommendations provided here and test the strategy for effectiveness. With

constant evaluation of effectiveness and making changes to better reach homeowners, there is a great likelihood that those interested in championing septic system outreach and education campaigns can promote the necessary behaviors that will ultimately lead to improved water quality and public health.

CHAPTER 7: FIGURES AND TABLES

Figure 1. Map of northwest Indiana area watersheds (US EPA, 2013)



Table 1. Overview of focus group & survey recruitment, methods of recruiting, and actual participation.

Focus Group Recruitment Date	Number of Houses Approached	Number of Commitments Received for Focus Group Attendance	Additional Recruitment Method	Number of Actual Participants at Focus Group	Number of Surveys Administered During Recruitment
Focus Group 1 November 2014	68	14	N/A	4	N/A
Focus Group 2 March 2015	131	27	N/A	4	15
Focus Group 3 April 2015	155	16	N/A	1	7
Focus Group 4 May 2015	113	17	Email: 437 Municipal Website: Unknown Number Reached	11	3
Total	467	74	---	20	25

Table 2. Knowledge and awareness ratings of focus groups and surveys for data analysis.

Hypothesis	Assessment Questions	Data Interpretation		
		Low	Medium	High
Hypothesis 1. A high level of septic system owners will know that they have a septic system.	Do you have a septic system at this residence?	Respondent indicates they does not know.	Respondent gives a partially confident answer.	Respondent answers confidently indicated that they have or do not have a septic system.
		Examples: I don't know if I have a septic system.	Examples: I think that I may have a septic system.	Examples: I know that I do or do not have a septic system.
		I don't know if I am on city sewer.	I think that I do not have a septic system.	I know where my septic system is.
Hypothesis 2. Septic system owners will have some (medium) understanding of required maintenance and how to prevent system failure.	How would you rate your knowledge of septic system care and maintenance? What kinds of maintenance do septic systems require? How often? How do you take care of your system?	Respondent is not able to give an answer with U.S. EPA's recommended guidelines. Respondent does not know.	Respondent is able to give an answer partially consistent with U.S. EPA's recommended guidelines. Respondent has some information but not all.	Respondent gives answer consistent with U.S. EPA's recommended guidelines.
		Examples: If you use additives, you do not have to take any other action.	Examples: You only need to perform maintenance when you see that there is a problem.	Examples: A septic tank needs regular maintenance, every three to five years.
		You never have to pump a septic system.	Maintenance occurs every other year (or year contradictory to U.S. EPA's recommendations). You pump based on the number of people in your household.	Maintenance starts in the home by not pouring grease down the sink and communicating with inspectors.

Table 2 (cont.)

<p>Hypothesis 3. Septic system owners will have low awareness of septic system failure's impact on public health.</p>	<p>Why do you perform these actions?</p>	<p>Respondent makes no correlation or doesn't know.</p>	<p>Respondent makes some correlation.</p>	<p>Respondent makes a clear correlation.</p>
	<p>Do you think failing septic systems are a problem in your community?</p>	<p>Examples: I do not know if they do or do not.</p>	<p>Examples: I could see them presenting a problem if they're too close to a well.</p>	<p>Examples: A failing septic system can make you sick and you can come into contact with one in a number of ways.</p>
	<p>Who or what do you think are affected by a failing septic system?</p>	<p>No I do not believe it causes any harm since it's underground.</p>		
	<p>Can failing septic systems threaten public health?</p>			
<p>Hypothesis 4. Septic system owners will have low awareness of septic system failure's environmental impact.</p>	<p>Why do you perform these actions?</p>	<p>Respondent makes no correlation or doesn't know.</p>	<p>Respondent makes some correlation.</p>	<p>Respondent makes a clear correlation.</p>
	<p>Do you think failing septic systems are a problem in your community?</p>	<p>Examples: I do not know if they do or do not.</p>	<p>Examples: I could see failing ones pose a threat if animals got into them.</p>	<p>Examples: A failing septic system can make you sick and you can come into contact with one in a number of ways.</p>
	<p>Who or what do you think are affected by a failing septic system?</p>	<p>No I do not believe it causes any harm since it's underground.</p>		
	<p>Can failing septic systems impact the environment?</p>			

Table 3. Focus group and survey participant demographic overview.

Participant Overview	Focus Group 1	Focus Group 2	Focus Group 3	Focus Group 4	Survey Participants	Total	Total %
No. of Participants	4	4	1	11	25	45	100%
Gender							
Male	2	---	---	6	18	26	58%
Female	2	4	1	5	6	18	40%
Other	---	---	---	---	1	1	2%
Age							
20s	---	1	---	---	2	3	7%
30s	---	1	---	1	1	3	7%
40s	---	---	---	---	9	9	20%
50s	1	1	1	1	2	6	13%
60s	1	---	---	5	7	13	29%
70+	2	1	---	4	4	11	24%
Race/Ethnicity							
African American	---	---	---	3	3	6	14%
Asian/Pacific Islander	---	---	---	---	---	---	---
Caucasian	----	3	---	8	21	32	78%
Hispanic/Latino	---	---	1	---	1	2	4%
Native American	---	---	---	---	---	---	---
Other	---	---	---	---	---	---	---
Household Income							
Less than \$20,000	---	---	---	---	---	---	---
\$20,000 to \$49,999	2	1	---	2	4	9	20%
\$50,000 to \$79,999	1	2	---	2	4	9	20%
\$80,000 to \$109,999	1	---	1	1	6	9	20%
\$110,000 or more	---	1	---	---	10	11	24%
Neighborhood ID							
Michiana Shores	1	---	---	---	---	1	2%
Long Beach	3	---	---	---	---	3	7%
Trail Creek	---	3	---	---	10	13	29%
Waterford	---	1	---	---	---	1	2%
Hobart	---	---	1	---	---	1	2%
Miller Beach	---	---	---	4	2	6	13%
Ogden Dunes	---	---	---	2	1	3	7%
Beverly Shores	---	---	---	5	3	8	18%
Crown Point	---	---	---	---	3	3	7%
Town of Pines	---	---	---	---	2	2	4%
Merrillville	---	---	---	---	4	4	9%

Table. 4 Focus group interactive polling responses.

Participant Overview	Focus Group 1	Focus Group 2	Focus Group 3	Focus Group 4	Total	Total %
No. of Participants	4	4	1	11	20	100%
Is this your primary residence?						
Yes	4	4	1	11	20	100%
No	---	---	---	---	---	---
How long have you owned your home?						
2 years or less	---	2	---	---	2	10%
2 to 4 years	1	1	---	1	3	15%
5 to 9 years	---	---	---	3	4	20%
10 to 19 years	1	---	1	2	4	20%
20 years or more	2	1	---	5	8	40%
Do you have a septic system?						
Yes	4	1	---	8	13	65%
No	---	2	1	3	6	30%
I don't know	---	1	---	---	1	5%
How old is your current septic system?						
2 years or less	---	---	---	---	---	---
2 to 4 years	---	---	---	---	---	---
5 to 9 years	---	---	---	---	---	---
10 to 19 years	1	---	---	---	1	5%
20 years or more	3	1	---	5	9	45%
I don't know	---	1	---	3	4	20%
I do not have a septic system	---	2	1	3	6	30%
How would you rate your knowledge of septic system care and maintenance?						
I'm very knowledgeable	3	1	---	1	5	25%
I'm somewhat knowledgeable	---	---	---	4	4	20%
I don't know how I'd rate my knowledge	---	1	---	3	4	20%
I'm not very knowledgeable	---	---	---	2	2	10%
I don't know anything about septic system maintenance and care	1	2	1	1	5	25%

Table 5. Focus Group interactive polling response overview for participants with (w/) septic systems; without (w/out) septic systems; and participant doesn't know if they have a septic system.

Focus Group Participants With (W/SS) Septic Systems; Without (W/O SS) Septic Systems; and I don't know if I have a Septic System	Total Number of Participants W/SS	Total Number of Participants W/O SS	Total Number of Participants that don't know if septic systems	Total All Participants	Total Participants (%)
No. of Participants	13	6	1	20	100%
Neighborhood ID					
Michiana Shores	1	---	---	1	5%
Long Beach	3	---	---	3	15%
Trail Creek	1	1	1	3	15%
Waterford	1	---	---	1	5%
Hobart	---	1	---	1	5%
Miller Beach	---	4	---	4	20%
Ogden Dunes	2	---	---	2	10%
Beverly Shores	5	---	---	5	25%
Crown Point	---	---	---	---	---
Town of Pines	---	---	---	---	---
Merrillville	---	---	---	---	---
Is this your primary residence?					
Yes	13	6	1	20	100%
No	---	---	---	---	---
How long have you owned your home?					
2 years or less	---	1	1	2	10%
2 to 4 years	3	0	---	3	15%
5 to 9 years	2	1	---	3	15%
10 to 19 years	3	1	---	4	20%
20 years or more	5	3	---	8	40%
How old is your current septic system?					
2 years or less	---	---	---	---	---
2 to 4 years	---	---	---	---	---
5 to 9 years	---	---	---	---	---
10 to 19 years	1	---	---	1	5%
20 years or more	9	---	1	10	50%
I don't know	3	---	---	3	15%
I do not have a septic system	---	6	---	6	30%

Table 5 (cont.)

How would you rate your knowledge of septic system care and maintenance?						
I'm very knowledgeable	5	---	---	5	25%	
I'm somewhat knowledgeable	3	1	---	4	20%	
I don't know how I'd rate my knowledge	2	2	---	4	20%	
I'm not very knowledgeable	2	0	---	2	10%	
I don't know anything about septic system maintenance and care	1	3	1	5	25%	

Table 6. Survey responses with septic systems versus those without systems.

Survey Participants With (W/SS) Septic Systems; Without (W/O SS) Septic Systems	Survey Responses W/SS	Survey Responses W/O SS	Survey Total Responses	Survey Total Responses (%)
No. of Participants	24	1	25	
Neighborhood ID				
Michiana Shores	---	---	---	---
Long Beach	---	---	---	---
Trail Creek	10	---	10	40%
Waterford	---	---	---	---
Hobart	---	---	---	---
Miller Beach	1	1	2	8%
Ogden Dunes	1	---	1	4%
Beverly Shores	3	---	3	12%
Crown Point	3	---	3	12%
Town of Pines	2	---	2	8%
Merrillville	4	---	4	16%
Is this your primary residence?				
Yes	22	1	23	92%
No	2	---	2	8%
How long have you owned your home?				
2 years or less	---	---	---	---
2 to 4 years	2	---	2	8%
5 to 9 years	10	1	11	44%
10 to 19 years	---	---	7	28%
20 years or more	---	---	5	20%
How old is your current septic system?				
2 years or less	---	---	---	---
2 to 4 years	---	---	---	---
5 to 9 years	4	---	4	16%
10 to 19 years	5	---	5	20%
20 years or more	12	---	12	48%
I don't know	3	---	3	12%
I do not have a septic system	---	1	1	4%
How would you rate your knowledge of septic system care and maintenance?				
I'm very knowledgeable	6	---	6	24%
I'm somewhat knowledgeable	10	1	11	44%
I don't know how I'd rate my knowledge	3	---	3	12%
I'm not very knowledgeable	4	---	4	16%
I don't know anything about septic system maintenance and care	---	---	---	---
How did you first find out that your home had a septic system?				
Real estate agent or seller	16	1	17	68%
Local or state health department	---	---	---	---
Neighbor or friend	---	---	---	---
Other (please indicate)	8	---	8	32%
Do you have your septic system inspected?				
Yes	21	---	21	84%
No	2	1	3	12%

Table 6 (cont.)

	1	---	1	4%
I don't know				
How often do you have your system inspected?				
2 years or less	8	---	8	32%
3-5 years	3	---	3	12%
6+ years	2	---	2	8%
I don't know how often	3	1	4	16%
I don't have my system inspected regularly	8	---	8	32%
Do you have your septic system pumped?				
Yes	23	---	23	92%
No	1	1	2	8%
I don't know	---	---	---	---
How often do you have your system pumped?				
2 years or less	10	---	10	40%
3-5 years	5	---	5	20%
6+ years	3	---	3	12%
I don't know how often	---	1	1	4%
I don't have my system pumped regularly	6	---	6	24%
Where do you go for trusted sources of information?				
Internet	5	---	5	20%
Septic System Business	7	1	8	32%
Neighbor or Friend	4	---	4	16%
Town Hall or Community Center	5	---	5	20%
Realtors	1	---	1	4%
Health Department	1	---	1	4%
US EPA	1	---	1	4%
Other	---	---	---	---
What do you think prevents someone from maintaining a septic system?				
Knowledge	16	1	17	68%
Out of Sight, Out of Mind	1	---	1	4%
Cost	4	---	4	16%
General Avoidance or Not Caring	3	---	3	12%
Do you think failing septic systems are a problem in your community?				
Yes	5	---	5	20%
No	16	---	16	64%
I don't know	3	1	4	16%
Are you concerned that failing septic systems in your community may impact your enjoyment of your property?				
Yes	16	1	17	68%
No	8	---	8	32%
I don't know	---	---	---	---
Are you concerned that failing septic systems in your community may impact your property value?				
Yes	16	1	17	68%
No	8	---	8	32%
I don't know	---	---	---	---

Table 6 (cont.)

Are you concerned that failing septic systems in your community may impact your family's health?				
Yes	17	1	18	72%
No	7	---	7	28%
I don't know	---	---	---	---
Are you concerned that failing septic systems in your community may impact nearby wildlife?				
Yes	13	1	14	56%
No	11	---	11	44%
I don't know	---	---	---	---
Are you concerned that failing septic systems in your community may impact water quality in nearby rivers, streams or lakes?				
Yes	13	1	14	56%
No	11	---	11	44%
I don't know	---	---	---	---

CHAPTER 8: REFERENCES

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179-211.
- Blake, J. (1999). Overcoming the 'value-action gap' in environmental policy: Tensions between national policy and local experience. *Local Environment*, 4(3), 257-278.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101.
- Chaudhary, A.K., Warner, L.A. (2015). Promoting behavior change using social norms: Applying a community based social marketing tool to extension programming. *Journal of Extension*, 53(3). <http://www.joe.org/joe/2015june/tt4.php>.
- Dawes, L., & Goonetilleke, A. (2003). An investigation into the role of site and soil characteristics in on-site sewage treatment. *Environmental Geology*, 44(4), 467-477.
- EPRI. (2000). *Advanced on-site wastewater treatment and management market study: Volume 2: State reports*. <http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=TR-114870>.
- Ferrell, G. M., & Grimes, B. H. (2005). Effects of centralized and onsite wastewater treatment on the occurrence of traditional and emerging contaminants in streams. *Journal of Environmental Health*, 76(6), 18-27.
- Fielding, K.S., McDonald, R., & Louis, W.R. (2008). Theory of planned behaviour, identity and intentions to engage in environmental activism. *Journal of Environmental Psychology*, 28(4), 318-326.
- Ganesan, S. & Hess, R. (1997). Dimension and levels of trust: Implications for commitment to a relationship. *Marketing Letters*, 8(4), 439-448.
- Gifford, R., & Nilsson, A. (2014). Personal and social factors that influence pro-environmental concern and behavior: A review. *International Journal of Psychology*, 49(3), 141-157.
- Halvorsen, K.E., & Gorman, H.S. (2006). Onsite sewage system regulation along the great lakes and the US EPA "homeowner awareness" model. *Environmental Management*, 37(3), 395-409.
- Indiana Department of Environmental Management. (2012). *2012 Section 303(d) List of Impaired Waters*. <http://www.in.gov/idem/nps/3937.htm>.
- Iyer, E.S. & Kashyap, R.K. (2007). Consumer recycling: Role of incentives, information, and social class. *Journal of Consumer Behavior*, 6, 32-47.
- Katzev, R., & Johnson, T. (1984). A social-psychological analysis of residential electricity consumptions: The impact of minimal justification techniques. *Journal of Economic Psychology*, 3, 267-284.
- Kennedy, A. (2010). Using community-based social marketing techniques to enhance environmental regulation. *Sustainability*, 2, 1138-1160.

- Kerr, N.L., Aronoff J., & Messe, L.A. (2000). Methods of small group research. In H.T. Reis & C.M. Judd (Eds.), *Handbook of research methods in social and personality psychology* (pp. 160-189). Cambridge, England: Cambridge University Press.
- Koger, S. M., & Winter, D.D.N. (2010). *The psychology of environmental problems*. New York, New York: Psychology Press.
- Kollmuss, A., & Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, 8(3), 239-260.
- Kotler, P., & Zaltman, G. (1971). Social marketing: An approach to planned social change. *Journal of Marketing*, 35, 3-12.
- Krajhanzl, J. (2010). Environmental and pro-environmental behaviour. *School and Health*, 21, 251–274.
- MacMillan, K., Money, K., Downing, S. (2005). Relationship marketing in the not-for-profit sector: an extension and application of the commitment–trust theory. *Journal of Business Research*, 58, 806-818.
- McKenzie-Mohr, D. (2000). Promoting sustainable behavior: An introduction to community-based social marketing. *Journal of Social Issues*, 56(3), 543-554.
- McKenzie-Mohr, D. (2010). *Fostering sustainable behavior: Community based social marketing*. <http://www.cbsm.com/public/images/FosteringSustainableBehavior.pdf>.
- McKenzie-Mohr, D., Lee, N.R., Schultz, P.W., & Kotler, P. (2011). *Social marketing to protect the environment: What works*. Thousand Oaks, CA: Sage.
- McKenzie-Mohr, D., & Schultz, W. (2014). Choosing effective behavior change tools. *Social Marketing Quarterly*, 20(1), 35-46.
- McKenzie-Mohr, D. & Smith, W. (1999). *Fostering sustainable behavior: an introduction to community-based social marketing*. Gabriola Island, BC: New Society Publishers.
- Mohamed, R. (2009). Why households in the United States do not maintain their septic systems and why state-led regulations are necessary: Explanations from public goods theory. *International Journal of Sustainable Development and Planning*, 4(2), 41-55.
- Moody, D.W. (1990). Groundwater contamination in the United States. *Journal of Soil and Water Conservation*, 45(2), 170-179.
- Morgan R.M., Hunt SD (1994). The commitment-trust theory of relationship marketing. *Journal of Marketing*, 58, 20-38.
- Natural Resources Conservation Service [NRCS]. (2012). *Web soil survey*. <http://websoilsurvey.nrcs.usda.gov/>.
- Northwestern Indiana Regional Planning Commission. (2011). *2040 Comprehensive regional plan*. <http://www.nirpc.org/2040-plan/plan-documents.aspx>.
- O'Neill, S., & Nicholson-Cole, S. (2009). “Fear won’t do it” Promoting positive engagement with climate change through visual and iconic representations. *Science Communication*, 30(3), 355-379.

- Perkins, R.J. & Hanson, P. (1990). Rural residential development: Evolution of a septic system regulatory program. *Journal of Soil and Water Conservation*, 45 (2), 226-229.
- Schultz, P.W. (2014). Promoting pro-environmental behavior. *European Psychologist*, 19(2), 107–117.
- Schultz, P.W., Oskamp, S., Mainieri, T. (1995). Who recycles and when? A review of personal and situational factors. *Journal of Environmental Psychology*, 15(2), 105-121.
- Siegrist, R.L., Tyler, E.J., & Jenssen, P.D. (2001). Design and performance of onsite wastewater soil absorption systems. In *National research needs conference proceedings: Risk-based decision making for onsite wastewater treatment*. http://ndwrcdp.werf.org/documents/Research_needs_proceedings_cd.pdf.
- Sheppard, S. & Jones, H. (2013). Researching the ‘researched’ about research. *Market & Social Research*, 21(2), 40-47.
- Silverman, G.S. (2005). The effectiveness of education as a tool to manage onsite septic systems. *Journal of Environmental Health*, 68(1), 17-22.
- Snohomish Health District. (2011). *Final report: Snohomish county septic system program*. <http://cfpub.epa.gov/npstbx/files/Snohomish%20County%202011.pdf>.
- Soil Survey Division Staff. (1993). Soil survey manual. Soil Conservation Service. *U.S. Department of Agriculture Handbook*, 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_054256.
- Steg, L. & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, 29(3), 309-317.
- Sussman, R. Greeno, M., Gifford, R., Scannell, L. (2013). The effectiveness of models and prompts on waste diversion: a field experiment on composting by cafeteria patrons. *Journal of Applied Social Psychology*, 43, 24–34.
- Sønderskov, K. M. (2011). Explaining large-N cooperation: Generalized social trust and the social exchange heuristic. *Rationality and Society*, 23(1), 51-74.
- United States Environmental Protection Agency [U.S. EPA]. (2002). *Time-Relevant Beach and Recreational Water Quality Monitoring and Reporting*. http://water.epa.gov/type/oceb/beaches/upload/2003_03_28_ORD_NRMRL_pubs_625r02_017_beaches_complete.pdf.
- United States Environmental Protection Agency [U.S. EPA]. (2005). *Decentralized Wastewater Treatment Systems: A Program Strategy*. http://www.epa.gov/owm/septic/pubs/septic_program_strategy.pdf.
- United States Environmental Protection Agency [U.S. EPA] (2013). Map of Northwest Indiana Area Watersheds. [Map] <http://www.epa.gov/sites/production/files/2014-07/documents/nwi-map.pdf>.
- United States Environmental Protection Agency [U.S. EPA]. (2014a). *Septic Systems (Onsite/Decentralized Systems)*. <http://www.epa.gov/septic>.

United States Environmental Protection Agency [U.S. EPA]. (2014b). *Septic Systems (Onsite/Decentralized Systems)*. <http://water.epa.gov/polwaste/npdes/swbmp/Preventing-Septic-System-Failure.cfm>.

Vaidyanathan, R., & Aggarwal, P. (2005). Using commitments to drive consistency: Enhancing the effectiveness of cause-related marketing communications. *Journal of Marketing Communications*, 11(4), 231–246.

Vaske, J.J. (2008). *Survey Research and Analysis: Applications in Parks, Recreation and Human Dimensions*. State College, PA: Venture Publishing, INC.

Yamagishi, T. Terai, T., Kiyonari T., Mifune, N., & Kanazawa, S. (2007). The social exchange heuristic: Managing errors in social exchange. *Rationality and Society*, 19(3), 259-291.

Zarate-Bermudez, M.A. (2009). Enhancing the public health perspective on onsite wastewater systems. *Journal of Environmental Health*, 72(3), 59-61.

APPENDIX A. RECRUITING SCRIPT

Recruiting Script

Hello. I'm [name] with [identify affiliation and role in study]. I promise that I am not selling anything. I am collecting information for a graduate research project with Purdue Calumet and University of Illinois. May I speak to whoever is most responsible for home maintenance decisions?

If different person is asked to come to the door, repeat above info.

I'm working on a research project to find out how people in northwest Indiana make home maintenance decisions.

Do you own your home?

If renter, say thank you for your time, we are looking for homeowners. Have a good day/evening.

Does anyone in your household work for a home maintenance company? (Like a painter, roofer, plumber, remodeler?) Does anyone in your household work for the local, state or federal government? We want to make sure that you don't have any biases towards the questions we will be asking.

If yes, say thank you for your time, we are looking for people who do not work for the county. Have a good day/evening.

Do you own your home?

If renter, say thank you for your time, we are looking for homeowners. Have a good day/evening.

Does anyone in your household work for a home maintenance company? (Like a painter, roofer, plumber, remodeler?)

If yes, ask what kind of company? If anything related to septic systems, say thank you for your time, we are looking for people who do not work in home maintenance. Have a good day/evening.

If no to all of the above...

We are inviting people in your community to participate in a group discussion about home maintenance on [date] at [location] from [time]. It will be made up of 6 to 12 people like yourself and will last about 90 minutes. To thank you for your time, you will receive a \$25.00 Lowe's gift card for your participation. Also if you attend, you will be entered into a drawing for an additional \$100.00 Lowe's gift card. At no time will we attempt to sell you anything and

your name will never be associated with the opinions you share. Would you be interested in participating?

If yes... Provide information on date/time/location. Ask for their name and how they would prefer to be contacted with a reminder (email, phone, mail).

We want to stress how important your participation is to us. We have talked with many people to find just the right ones to hold the discussion with. In the next few weeks, if you realize that you cannot attend, please call us right away so that we can attempt to find a replacement for you. *Provide contact information.* Here is who to call if you need to cancel or have any questions. Also, please do not send anyone else to the meeting in your place. We will send you a confirmation letter by your preferred method. Thank you, we look forward to seeing you then.

If no...

Instead, are you interested in participating in a short survey today? This information will also contribute to the research project, and will only take approximately 15 minutes to complete.

If no...

Thank you for your time, and have a good day.

If yes...

I will ask you a series of questions, and I will write down your responses. All of your responses will remain anonymous and have no identifiable information. You will not receive any incentive such as the gift card for taking this survey. Today's home maintenance topic will focus on septic systems. Before we begin, do you have a septic system?

If no....

Thank you for your time, but we are surveying only people who have septic systems. Have a good day.

If yes or I don't know...

Thank you. Please review this statement (*hand person the verbal consent for survey document*) and state whether you agree or disagree.

If agree, provide copy of survey so that the survey-taker may follow along. Read each question aloud, and write responses. Upon completion, take back the copy of the survey, thank the participant, and provide them with a business card for further contact if desired.

APPENDIX B. SURVEY CONSENT DOCUMENT

Please Read Before Participating in Today's Survey

Through Purdue University-Calumet and the University of Illinois Urbana-Champaign, we are conducting research on how and why homeowners perform specific home maintenance activities.

Please read the following, then let me know if you agree or disagree.

The survey will take 10-15 minutes. Your participation is completely voluntary and you may stop at any time. Any information provided will be anonymous. Upon completion of the study, this survey copy will be shredded.

You are welcome to keep a copy of this statement. If you have any questions regarding the research, contact:

Natalie Johnson

Purdue University, Calumet

(219) 989-4156

natalie.johnson@purduecal.edu



If you have any questions regarding your rights as a participant in this study or any concerns or complaints, please contact the IRB Administrator of Purdue University Social Sciences Institutional Review Board at (765) 494-5942, irb@purdue.edu.

You may also contact the University of Illinois Institutional Review Board at (217) 333-2670 (collect calls will be accepted if you identify yourself as a research participant) or via email at irb@illinois.edu.



Please say "I agree" if you consent to participate in the study. Or say "I disagree" if you do not consent to participate.

APPENDIX C. SURVEY WITH MODERATOR GUIDE

Survey administrator instructions (do not read this to the participant): Once the survey participant has verbally agreed to participate in the survey, ask the following numbered questions and record his or her response. If the participant immediately answers “I don’t know” or is unclear of the question, use the prompts in *italics* to encourage his or her response. If the participant offers more information than what is asked in the question, use the white space on the paper, the back, or an additional piece of paper to take notes. You should try to finish administering the survey in 10-15 minutes.

Thank you for agreeing to participate in our survey. I’m going to ask you some questions about today’s home maintenance topic— septic systems. Please give us your best answer. You can say “I don’t know.” You can also stop the survey anytime.

- 1) How long have you owned this home?

- 2) Is this your primary residence? Yes/No

- 3) How old do you think your septic system is? *If you’re not sure, do you know when your home was built? Has there been any major work to the yard that might be when a drain field or tank may have been installed?*

- 4) How much do you think you know about how to care for a septic system and maintain it so that it works? Would you say:
 - A) I’m very knowledgeable
 - B) I’m somewhat knowledgeable
 - C) I don’t know how I would rate my knowledge
 - D) I’m not very knowledgeable
 - E) I don’t know anything about septic system maintenance and care

- 5) How did you first find out that your home had a septic system? *Who told you that this house has a septic system? Did you read it somewhere before or after buying it?*
 - A) Real estate agent or seller
 - B) Local or state health department
 - C) Neighbor or friend
 - D) Other (please indicate)

Other:

- 6) Do you have your septic system inspected? And, if so, how often? *This would be when a professional comes out to check on the system and make sure it’s working. They may also check to see if it needs to be pumped or repaired.*

- 7) Do you have your septic system pumped? And, if so, how often? *This would be when a professional comes out with a big truck (sometimes called a honey dipper) and hose to drain the contents of the tank and haul away.*

- 8) What have you heard about how often a septic system should be inspected? *Has anyone ever told you if or when this should happen? Have you read it somewhere?*

- 9) What have you heard about how often a septic system should be pumped? *Has anyone ever told you if or when this should happen? Have you read it somewhere?*

10) If you needed to find out information on septic system care, where would you go? *This would be the source you would find most reliable to tell you the right information quickly and conveniently.*

- A) Town hall or community center
- B) Local or state health department
- C) U.S. EPA
- D) Neighbor or friend
- E) Internet
- F) Business for handling septic waste
- G) Other (please indicate)

Other:

11) What do you think might prevent someone from caring for and maintaining their septic system? *Why do you think some people don't pump their tanks or inspect them?*

12) What do you think might motivate people to have their systems inspected, pumped, or repaired if they currently are not? *What may change the mind of people who are not currently doing any pumping or maintenance on their system?*

13) Do you think failing septic systems are a problem in your community? *Have you heard others say it is?*

14) I'm going to read a few statements and I would like you to answer with yes or no. Are you concerned that failing septic systems in your community may impact: *If the person answers "no" to question 13, you may want to ask: Do you think some people are concerned that failing septic systems in your community may impact:*

Your enjoyment of your property? Yes/No

Your property value? Yes/No

Your family's health? Yes/No

People's health in your community? Yes/No

Nearby wildlife? Yes/No

Water quality in nearby rivers, streams or lakes? Yes/No

Something not mentioned? Yes/No (please indicate)

Other:

Thank you so much for your participation! I have two more questions left. Remember, if you do not want to respond, you do not have to.

15) Are you Male/Female/I don't want to respond?

16) What age range do you fall into?

- A) 20s
- B) 30s
- C) 40s

- D) 50s
- E) 60s
- F) 70+
- H) I don't want to respond

17) How do you identify your race/ethnicity?

- A) African American
- B) Asian/Pacific Islander
- C) Caucasian
- D) Hispanic/Latino
- E) Native American
- F) Other
- G) I don't want to respond

18) What range does your total household income fall into?

- A) Less than \$20,000
- B) \$20,000 to \$49,999
- C) \$50,000 to \$79,999
- D) \$80,000 to \$109,999
- E) \$110,000 or more
- F) I don't want to respond

Survey administrator instructions continued (do not read this to the participant): If the participant offers any additional information, you can continue to take notes for about another 5 minutes, but you should then thank them and politely say you have more surveys to administer. After each house, take several minutes to make sure each answer is legibly recorded, and that your notes will make sense to someone else reading them (i.e. Natalie). Do this before you go to the next house so that you do not get participants confused. End your survey with this...

Thank you for your time today. This information will be used to design outreach material on septic system maintenance, and it will also be used as part of a graduate student's thesis. All of the information which you have provided will remain anonymous. If you would like to find out more information on the study, or would like a final copy once it is completed, please contact Natalie Johnson (*provide business card*). Thank you again, and have a good day.

APPENDIX D. FOCUS GROUP RECRUITMENT REMINDER LETTER 1 (MICHIGAN CITY SAMPLE)

Thank you for your interest in attending the neighborhood focus group on home maintenance on:

Wednesday, March 25, from 7:00PM to 8:30PM at the Washington Park Senior Center in Michigan City (Two On The Lake, Michigan City, Indiana 46360)

By participating, you will help further the efforts of researchers with Purdue University, Calumet and the University of Illinois Urbana-Champaign. *As an incentive for attending, we will provide you a \$25.00 Lowe's gift card. Also if you attend, you will be entered into a drawing to win an additional \$100.00 Lowe's gift card.* This is our way of saying "thank you" for advancing our student research.

Your participation is very important to us. If for any reason you cannot attend, please call Natalie Johnson, Research Team Lead, so that we can attempt to find a replacement for you. Please bring this letter with you as proof of invitation, and do not send anyone else in your place. We look forward to seeing you on Wednesday, March 25.

Sincerely,



Natalie Johnson
Research Team Lead
Purdue University Calumet
(219) 989-4156
Natalie.Johnson@purduecal.edu

Directions: From Hwy 12, turn onto Pine Street in Michigan City, heading north. Continue straight to remain on Pine Street/Franklin Street. Franklin Street turns right and becomes Lake Shore Drive. Turn left into Washington Park Main Gates (no fees are being collected at this time). Once inside the park, take the first road on the right. At the stop sign, make a left and drive up the hill. The Senior Center is located on the left.

APPENDIX E. FOCUS GROUP REMINDER LETTER 2 (MICHIGAN CITY SAMPLE)



March 20, 2015

Dear Sir or Madame:

Recently, a member of your household expressed interest in our student research on home maintenance decision making, and was invited to attend our upcoming focus group on **Wednesday, March 25, from 7:00PM to 8:30PM at the Washington Park Senior Center in Michigan City (Two On The Lake, Michigan City, Indiana 46360)**. By participating, you will help advance the efforts of student researchers with Purdue University, Calumet and the University of Illinois Urbana-Champaign. *As an incentive for attending, we will provide you a \$25.00 Lowe's gift card. Also if you attend, you will be entered into a drawing to win an additional \$100.00 Lowe's gift card.* This is our way of saying "thank you" for your participation.

We ask that only one person per household attend, preferably the person who considers himself or herself as the primary home maintenance decision maker. If no one from your household is able to attend, please call Natalie Johnson, Research Team Lead, at (219) 989-4156 so that we can attempt to find a replacement for you. Please bring this letter with you, or the letter you received during door to door recruitment, as proof of invitation. We ask that you kindly do not send anyone else in your place, but rather contact the research lead if you are unable to attend, have further questions, or have received this letter in error.

A map of the focus group location can be found at: <http://bit.ly/1ExQBAN>. Washington Park is not collecting fees at this time, and therefore there is no cost to park or to participate in our research. We are grateful to you for your interest, and hope that you will consider joining us on Wednesday, March 25.

Sincerely,

A handwritten signature in black ink that reads "Natalie Johnson".

Natalie Johnson
Research Team Lead
Purdue University Calumet
(219) 989-4156
Natalie.Johnson@purduecal.edu

APPENDIX F. FOCUS GROUP CONSENT DOCUMENT

Please Read Before Participating in Today's Focus Group

Through Purdue University-Calumet and the University of Illinois Urbana-Champaign, we are conducting research on how and why homeowners perform specific home maintenance activities. **Please read the following, then let me know if you agree or disagree.**

Today you will be participating in a focus group and survey which should take approximately 90 minutes. There are minimal risks associated with focus groups and surveys. Your participation is voluntary. If you do not wish to participate, you may stop at any time. During the group interview, or focus group, we will not be able to guarantee confidentiality because we will be discussing information as a group. We also cannot guarantee that others in the group will not repeat stories to others outside of the group. Therefore, please do not share any information that you do not want others to know.

Today's session will be audio-recorded and written notes will be taken to ensure an accurate and complete record of each conversation. During the analysis following the study, the recorded and written information will be kept under lock on a password protect hard drive at Purdue University, Calumet. Only trained research team members will have access to the information. Also during today's session, you will also be asked to participate in a short anonymous survey. This, too, will be kept under lock at Purdue University, Calumet, and only shared with trained research team members during the analysis.

After analysis of the focus group and surveys takes place, all paper or electronic copies of focus group information or surveys will be deleted or shredded. At no time will your name or other identifiable information appear on any final study documents.

You are welcome to keep a copy of this statement. If you have any questions regarding the research, contact:

Natalie Johnson
Purdue University, Calumet
(219) 989-4156
natalie.johnson@purduecal.edu



If you have any questions regarding your rights as a participant in this study or any concerns or complaints, please contact the IRB Administrator of Purdue University Social Sciences Institutional Review Board at (765) 494-5942, irb@purdue.edu.

You may also contact the University of Illinois Institutional Review Board at (217) 333-2670 (collect calls will be accepted if you identify yourself as a research participant) or via email at irb@illinois.edu.



Please say "I agree" if you consent to participate in the study. Or say "I disagree" if you do not consent to participate.

APPENDIX G. FOCUS GROUP MODERATOR GUIDE

Gathering as a group

--- 3 minutes ---

Introduction and Ground Rules

--- 7 minutes ---

The moderator will begin by welcoming the participants to the meeting location and thank them for their participation. The moderator will provide a brief introduction, indicating that he or she is a researcher with the University of Illinois and Purdue University Calumet. The following will be presented to the group:

Purpose of meeting:

This group is one of a series of meetings that are being held in Northwest Indiana. The purpose is to talk about issues related to household maintenance issues.

Format:

- 1) Focus groups are a way to gain information on people's feelings and beliefs about a certain topic. We will begin with a series of questions using electronic clickers, and then move into a discussion. The process will last about 90 minutes.
- 2) This will be a group discussion.
- 3) I will initiate topics and keep the discussion on track, and make sure that everyone is heard.
- 4) Challenging views are welcome. Disagreement is acceptable. This is a safe environment and all statements and opinions are welcome.
- 5) Speak up and share. If you're not participating, I may direct a question specifically to you.
- 6) Try not to speak over each other.
- 7) You can ask each other questions (and choose to respond or not to respond).
- 8) Notes will be taken and the session will be recorded.
- 9) Names will be changed; information will be completely confidential.
- 10) Please respect the confidentiality of other participants outside of this group setting.
- 11) At any time if you have to use the restrooms, please feel free to. *Provide location of restrooms.*
- 12) For your participation, you will receive a \$25.00 gift card to a home supply store at the end of the session. I will also ask at the end of the session for your name tag back. We will fold them and draw for an additional \$100.00 worth of gift cards to Lowe's.
- 13) Overall the goal of today's focus group is gain information on household maintenance as part of a Master's thesis project.

Introduction:

Before we begin, I would like you to look around the room. Are there any two people that know each other? If so, we would like to protect everyone's privacy as best as possible. If you were the later person to arrive, please excuse yourself. You will receive the \$25.00 gift card on your way out. For our remaining participants, you were asked to verbally agree to a consent statement before entering the room. *Show statement.* Does anyone have any final objections? Great! Please introduce yourself using your first name only, and provide the name of the community in which you live.

Close-ended questions for septic system focus groups

--- 5 minutes ---

The moderator will introduce the key pad system and demonstrate how to use them. It will be emphasized that information shared will not be identifiable with the person who responded. Explain that for some of the questions,

the response rate will be shown on the screen. The close-ended question section may be substituted for the survey copy (Attachment F).

Sample

To make sure that we are using the clickers correctly, I have a sample question that does not coincide with the study. *Show question.* Using your clickers, please select the answer that you feel best represents your preference. At any time, you can change your answer. The last letter that you choose on your clicker will be the selected answer provided.

Sample Clicker Q: What is your favorite pizza topping?

- 1) Sausage
- 2) Pepperoni
- 3) Vegetable
- 4) I don't like pizza

The moderator will go to the next screen to show the response rate of the room.

This information is presented as a graph and represents what pizza topping is most preferred in the room. Are there any questions, or problems using the clicker? Now we will move on to the next three questions, which are strictly demographic, and will not be shown in graph form on the screen. At any time you have problems using the clickers, please raise your hand and I will assist.

Clicker Q1: What gender are you? Anonymous

1. Male
2. Female
3. Other

Clicker Q2: What age range do you fall into? Anonymous

1. 20s
2. 30s
3. 40s
4. 50s
5. 60s
6. 70+

Clicker Q3: How do you identify your race/ethnicity? Anonymous

1. African American
2. Asian/Pacific Islander
3. Caucasian
4. Hispanic/Latino
5. Native American
6. Other

Clicker Q4: What is your total household income? *Anonymous*

1. Less than \$20,000
2. \$20,000 to \$49,999
3. \$50,000 to \$79,999
4. \$80,000 to \$109,999
5. \$110,000 or more

The next four questions relate to the home in which we recruited you from. Please choose the answer best represents. This time, responses will be shown in graph form, much like our pizza topping example. Again, no one will be identified with their response.

Clicker Q3: How long have you owned a home?

1. 2 years or less
2. 2 to 4 years
3. 5 to 9 years
4. 10 to 19 years
5. 20 years or more

Show graph

Clicker Q4: Is this your primary residence?

1. Yes
2. No

Show graph

Clicker Q5: Do you have a septic system at this residence?

1. Yes
2. No
3. I don't know

Show graph

Clicker Q6: How old is your current septic system?

1. 2 years or less
2. 2 to 4 years
3. 5 to 9 years
4. 10 to 19 years
5. 20 years or more
6. I don't know
7. I do not have a septic system

Show graph

Clicker Q7: How would you rate your knowledge of septic system care and maintenance?

1. Very knowledgeable
2. Somewhat knowledgeable
3. Less knowledgeable
4. I do not know how to care for and maintain a septic system

Show graph

Open-ended discussion questions for septic system focus groups

45 minutes

The moderator will introduce the next section, which will be discussion-focused. Probes may be used to encourage further discussion if needed.

We will now move on to our next section where we will have a group discussion. You won't need your clickers anymore. What will happen is I will ask a question to all of you. You are more than welcome to answer, but please try to speak one at a time. I urge you to answer truthfully and openly. As you may have gathered on our last clicker question, our discussion is going to focus on septic system maintenance.

1) How did you first find out that your home had a septic system?

Probe: If people have indicated that they do not have a septic system or are uncertain, ask how do they know that their home does not have a septic system?

Probe: Who, if anyone, informed you that you have a septic system or do not have a septic system? Was the information provided helpful?

Probe: Was the information brought up during the home buying process? Did your realtor bring it up?

Probe: Was there recorded information that identified that your home was on a septic system or sewer? And if so, what? Was the information readily available?

2) Tell me, in general, what kinds of maintenance do septic systems require? How often?

Probe: So I've been hearing annual, is there anything done day to day? Monthly? Or Other times?

Probe: How often does a septic system need to be pumped? How often do they need to be inspected?

Probe: What actions you take yourself and what actions may be taken by a professional.

3) How do you take care of your system?

Probe: How would someone find a qualified contractor to inspect or pump a septic?

4) Why do you perform these actions?

Probe: When do you know it is time to perform these actions?

Probe: What information led you to take these actions?

5) Where do you go to get relevant information on septic system care and maintenance?

Probe: Who do you trust most to get this information from? Why?

Probe: The least? Why?

Probe: Television? Newspapers? Radio? Brochures?

6) What are the signs of a failing septic system are?

Probe: Outside of the house? Inside of the house?

7) Do you think failing septic systems are a problem in your community?

Probe: Have you heard of people having failed septic systems in your community?

Probe: Who or what do you think are affected by a failing septic system?

Probe: How do failing septic systems affect other people?

Probe: Do you think that failing septic systems can affect public health? The environment?

8) What might prevent someone from caring for or maintaining their septic system?

Prompt: Money: How much do you think a repair costs? A pump out?

Prompt: Just don't care: Why are people concerned with other home maintenance but not septic systems?

Prompt: Other examples?

9) Has anyone ever seen or received any public educational materials on caring for septic systems, something like a billboard, postcard, or public service announcement on radio or television?

--- 25 minutes ---

10) I'm going to show you some examples of outreach materials for homeowners about septic system care. Please tell me what you like or dislike about them. *Present by passing out handouts to each person. Provide time to read. Examples will be discussed one at a time.*

a. US EPA Septic Smart Brochure

i. *Have you seen this brochure?*

ii. *Have you heard of EPA Septic Awareness Week?*

b. Trail Creek Watershed Brochure

- c. West Virginia Brochure
- d. *Do you think these materials would motivate people to have their system inspected, pumped, or repaired?*

11) Here are some phrases and messages that have been suggested for educational campaigns about septic systems. Let me know what you think of each one. *Show phrases one at a time on screen.* Please give your quick impression. What words or phrases (messages) might effectively motivate someone to care or maintain their septic system?

Probe: Can you think of anything of any other phrases or messages that might motivate people?

12) What other things do you think might motivate people to have their systems inspected, pumped, or repaired if they are not already inclined to do so?

Probe: Different places have different rules and laws on how septic systems are maintained, some home purchase process, laws every three years, prove that you have pumped and maintained their septic system... what do you think might work best here, what sounds like strengths or weaknesses about these policies? Are there incentives that may make someone act? Regulations or policies? Coupons?

Probe: Are you aware of any current regulations, policies, incentives, coupons, other?

Phrases:

- *Care for your septic system*
- *How's your Septic System?*
- *Your family. Your septic system. Get the connection?*
- *Septic system care depends on you*
- *A healthy home needs a healthy septic system*
- *Does your home have a dirty secret?*
- *What happens after you flush?*
- *Don't lose precious dollars down the drain*
- *Protect your investment*
- *Keep your septic bugs happy*
- *Care for your septic tank and drainfield*
- *Septic systems and the environment—it's all connected*
- *Your septic system may be out of sight, but it shouldn't be out of mind*
- *Don't let your septic system drain your wallet*

- *Septic problems stink*

13) Are there any final thoughts?

Conclusion

--- 5 minutes ---

I want to thank everyone for coming out today. This information will be used to design outreach material on septic system maintenance, and as part of a graduate student's thesis. In any reporting, your name and the name of your community will be changed to maintain your anonymity. If you would like to find out more information on the study, such as the final outreach material designed from these focus groups, please contact Natalie Johnson. *Provide business card*. Final information will not be available for likely 6 months or until all focus groups have been completed. For any additional questions feel free to ask the research team on your way out. You will collect your \$25.00 gift card as you leave. Have a good night.

APPENDIX H. FOCUS GROUP BROCHURES FOR REVIEW

PROPER MAINTENANCE

Your septic system is not a trash can. Don't flush anything besides human waste and toilet paper.

NEVER FLUSH:

- ✗ Cooking grease or oil
- ✗ Feminine hygiene products
- ✗ Condoms
- ✗ Dental floss
- ✗ Diapers
- ✗ Cigarette butts
- ✗ Coffee grounds
- ✗ Cat litter
- ✗ Paper towels
- ✗ Pharmaceuticals
- ✗ Household chemicals like antibacterial cleaners, gasoline, oil, pesticides, antifreeze, and paint or paint thinners



INSPECTION RECORD

DATE	SERVICE PROVIDER	COST	NOTES



444 Barker Road, Michigan City, IN 46360

NON-PROFIT
U.S. POSTAGE
PAID
MICHIGAN CITY, IN
PERMIT NO. 217

SAVE TRAIL CREEK!
PUMP YOUR SEPTIC TANK EVERY 3-5 YEARS
KEEP OUR WATER CLEAN.

GET PUMPED!

PROTECT YOUR SEPTIC TANK



FAILING SEPTIC TANKS ARE ONE OF TRAIL CREEK'S BIGGEST PROBLEMS.

Do your part to protect Trail Creek. Inspect your septic system every 3 years and have it pumped every three to five years.

CLEAN WATER STARTS IN YOUR BACKYARD

A SEPTIC TANK'S CONNECTION TO YOU

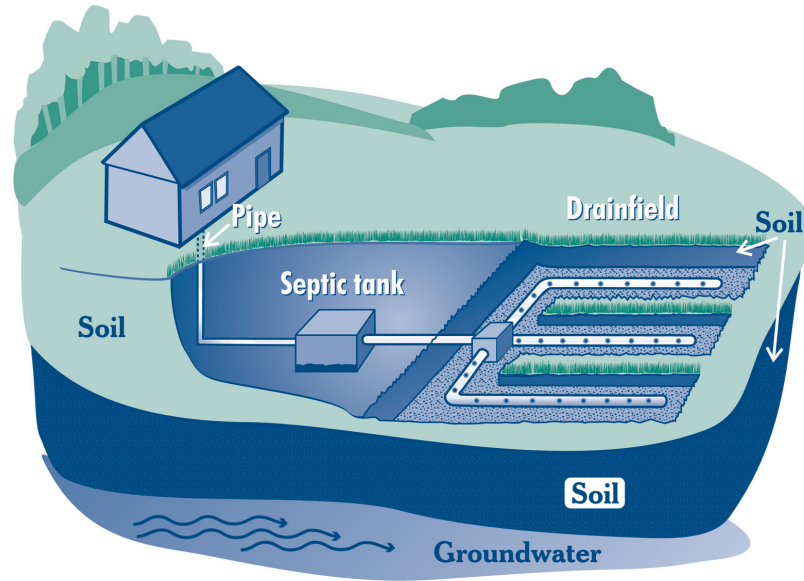
Clean water starts in your backyard. The decisions you make will impact whether the water you drink, play in, or catch fish from is clean. A healthy septic system will:

- save you money,
- protect the value of your home,
- keep the environment clean, and
- keep you and your family healthy.

A septic tank is designed to remove most pollutants if operating properly. However, if it is not, household wastewater from your septic tank or your neighbor's may find its way into your drinking water. This improperly treated sewage also poses the risk of contaminating nearby waters, such as Trail Creek, which can then carry contaminated water to Lake Michigan.

SEPTIC 101

Wastewater from your toilet and sinks run out of your house from one main drainage pipe into a septic tank. Its job is to hold the wastewater long enough to allow solids to settle down to the bottom (forming sludge), while the oil and grease floats to the top (as scum). The liquid wastewater then exits the tank into the drainfield. If the drainfield is overloaded with too much liquid, it can cause sewage to flow to the ground surface or create backups in toilets and sinks. Finally, the wastewater seeps into the soil, naturally removing harmful bacteria, viruses, and nutrients.



Source: US Environmental Protection Agency

IS MY TANK FAILING?

CALL A SEPTIC PROFESSIONAL IF YOU NOTICE:

- Wastewater backing up into household drains.
- Bright green, spongy grass on the drainfield, even during dry weather.
- Pooling water or mud around your septic system or in your basement.
- A strong odor around the septic tank and drainfield.



444 Barker Road, Michigan City, IN 46360
219.879.3564

KEEP IT HEALTHY: PROTECT & INSPECT!

Your septic system contains a living collection of organisms that digest and treat waste. Pouring toxins down your drain can kill these organisms and harm your septic system. Know what is safe to put into your system by looking at the list on the back of this panel.

AND DON'T FORGET:

- Inspect at least every three years by a septic service professional.
- Get pumped every three to five years or as recommended.

To learn more about what you can do, visit EPA.GOV/SEPTICSMART.

HANDY TIPS!

Avoid chemical drain openers for a clogged drain. Instead, use boiling water or a drain snake.

Never pour cooking oil or grease down the drain!

Never pour oil-based paints, solvents, or large volumes of toxic cleaners down the drain. Latex paint waste should be disposed of at a hazardous waste facility.

Eliminate or limit the use of a garbage disposal.

Space out loads of laundry, especially when raining.

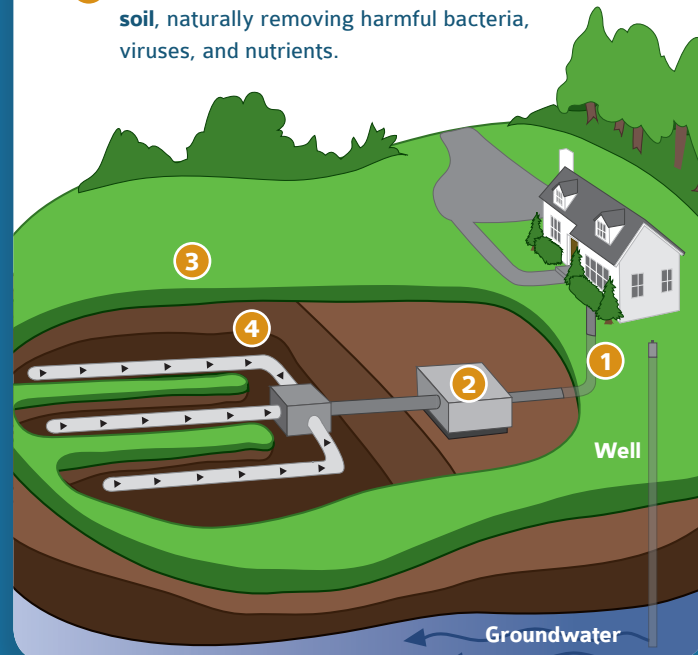
CLIP AND SAVE



How does a septic system work?

This is a simplified overview of how a septic system works.

- 1 All water runs out of your house from one main **drainage pipe** into a septic tank.
- 2 The **septic tank** is a buried, water-tight container usually made of concrete, fiberglass or polyethylene. Its job is to hold the wastewater long enough to allow solids to settle down to the bottom (forming sludge), while the oil and grease floats to the top (as scum). Compartments and a T-shaped outlet prevent the sludge and scum from leaving the tank and traveling into the drainfield area.
- 3 The liquid wastewater then exits the tank into the **drainfield**. If the drainfield is overloaded with too much liquid, it will flood, causing sewage to flow to the ground surface or create backups in toilets and sinks.
- 4 Finally, the wastewater percolates into the **soil**, naturally removing harmful bacteria, viruses, and nutrients.



SepticSmart Helps Protect Your Home and Family

If you have a septic system, it's extremely important to keep up with its proper care and maintenance. The U.S. Environmental Protection Agency's SepticSmart initiative helps ensure that we all know how to do our part to safeguard our community's health and protect the environment. It can also protect your family and keep you from spending thousands of dollars repairing or replacing a damaged system.



For more information on how you can be SepticSmart, please visit:
www.epa.gov/septicmart



EPA-832-B-12-003
September 2012

Do your Part— Be SepticSmart!

A simple guide to the proper care and maintenance of your septic system.



Why is it important to properly maintain my septic tank?

It saves you money.

Malfunctioning systems can cost \$3,000-\$7,000 to repair or replace compared to maintenance costs of about \$250-\$500 every three to five years.

It protects the value of your home.

Malfunctioning septic systems can drastically reduce property values, hamper the sale of your home, and even pose a legal liability.

It keeps your water clean and safe.

A properly maintained system helps keep your family's drinking water pure, and reduces the risk of contaminating community, local, and regional waters.

It keeps the environment clean.

Malfunctioning septic systems can harm the local ecosystem by killing native plants, fish, and shellfish.

Do I have a septic system? If so, how can I find it?

Here are a few tips to determine if you have a septic system and how to locate it.

You most likely have a system if:

- You are on well water.
- The water line coming into your house does not have a meter.
- Your neighbors have a septic system.

You can find your septic system by:

- Looking on the "as built" drawing for your home.
- Checking in your yard for lids or manhole covers.
- Using an inspector/pumper, who can also help you find exactly where the system is located.

What can I do to help maintain my system?

Protect it and Inspect it.

A typical septic system should be inspected at least every three years by a licensed contractor and your tank pumped as recommended by the inspector (generally every three to five years).

Think at the Sink.

- Your septic system contains a living collection of organisms that digest and treat waste. Pouring toxins down your drain can kill these organisms and harm your septic system.
- Oil-based paints, solvents, and large volumes of toxic cleaners should not enter your septic system. Even latex paint cleanup waste should be minimized.
- Eliminating the use of a garbage disposal can reduce the amount of fats, grease, and solids entering the septic tank and ultimately clogging the drainfield. Increased disposal use results in more frequent pumping.

Don't Overload the Commode.

A variety of household products can clog and potentially damage septic system components.

Do not flush:

- Feminine hygiene products
- Condoms
- Diapers
- Cigarette butts
- Coffee grounds
- Cat litter

For a complete list, visit www.epa.gov/septicmart.

Don't Strain your Drain.

It's simple. The less water you use, the less water that enters the septic tank, which decreases its workload. Here are a few easy ways to save water:

- Run dishwasher and washing machine only when full.
- Repair leaky toilets and pipes.
- Use high-efficiency toilets and faucets.

For more information on how you can save water, visit EPA's WaterSense program, www.epa.gov/watersense.

Shield your Field.

It's equally important to protect your drainfield.

- Do not park or drive on your drainfield.
- Plant trees the appropriate distance from the drainfield to keep roots from growing into the system.
- Keep roof drains, sump pumps and other rainwater drainage systems away from the area. Excess water slows down or stops the treatment process.

How do I know if my septic system is not working properly?

Mind the Signs!

Here are a few signs of septic system malfunction. If you discover any of these warning signs, call a licensed septic tank contractor immediately. One call could save you thousands of dollars.

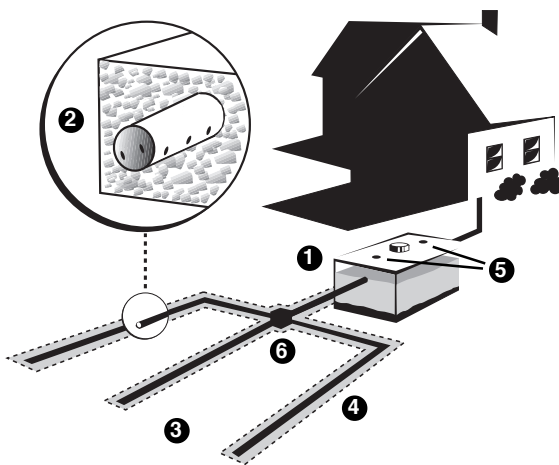
- Wastewater backing up into household drains.
- A strong odor around the septic tank and drainfield.
- Bright green, spongy grass appearing on the drainfield, even during dry weather.

So . . . now you own a septic system

More than 25 million homes, encompassing almost 25 percent of the U.S. population, dispose of domestic wastewater through onsite (unsewered) systems. According to the American Housing Survey for the United States, in 1993 1.5 (million) out of every 4 (million) new owner-occupied home starts relied upon a form of onsite sewage disposal.

One of the major differences between owning an unsewered versus a sewer home is that unsewered wastewater treatment and disposal systems must be maintained by the homeowner. Treatment and disposal of wastewater should be one of the primary concerns of any homeowner in an unsewered area.

The most common way to treat and dispose of wastewater in rural homes is through the use of an onsite disposal system. The majority of onsite disposal systems in the United States are septic systems.



- 1 septic tank
- 2 4" perforated pipe
- 3 absorption field
- 4 crushed rock or gravel lined trench
- 5 inspection ports
- 6 distribution box

Typical Septic System Fig. 1

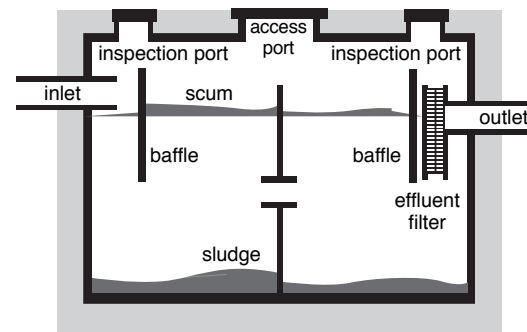
HOW IT WORKS

A typical septic system contains two major components: a septic tank and the absorption field (see Figure 1). Often, a distribution box is included as part of the system to separate the septic tank effluent evenly into a network of distribution lines that make up the absorption field. The septic tank is usually made of concrete, fiberglass, or plastic, is typically buried and should be watertight. All septic tanks have baffles (or tees) at the inlet and outlet to insure proper flow patterns (see Figure 2). Most septic tanks are single compartment; however, a number of states require two-compartment tanks or two single compartment tanks in series.

While typically designed to hold a minimum of 750–1000 gallons of sewage, the size of the tank may vary depending upon the number of bedrooms in the home and state and local regulatory requirements. The primary purpose of the septic tank is to separate the solids from the liquids and to promote partial breakdown of contaminants by microorganisms naturally present in the wastewater. The solids, known as sludge, collect on the bottom of the tank, while the scum floats on the top of the liquid. The sludge and scum remain in the tank and should be pumped out periodically (see Figure 2).

Solids that are allowed to pass from the septic tank may clog the absorption field. Keeping solids out of the absorption field not only prevents clogging, but also reduces potentially expensive repair or replacement costs and helps ensure the ability of the soil to effectively treat the septic tank effluent. Therefore, an additional safeguard in keeping solids out of the absorption field is the use of effluent filters on the outlet of the septic tank (see Figure 2).

The wastewater (effluent) coming out of the septic tank may contain many potentially disease-causing microorganisms and pollutants (i.e., nitrates, phosphates, chlorides). The effluent is passed on to the absorption field through a connecting pipe or distribution box. The absorption field is also known as the soil drainfield, the disposal field, or the leachfield. The absorption field contains a series of underground perforated pipes, as indicated in Figure 1, that are

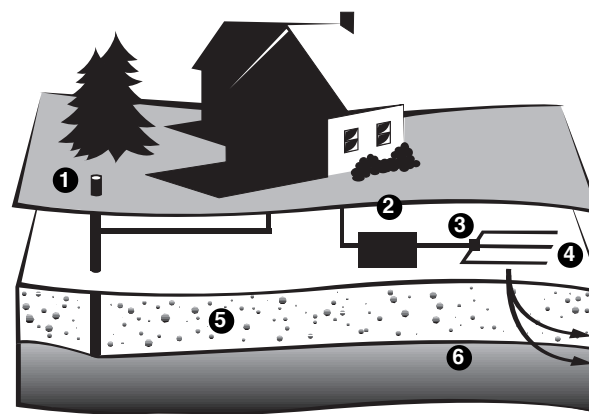


Cross-section of a two-compartment septic tank

Fig. 2

sometimes connected in a closed loop system, as illustrated on the front cover, or some other proprietary distribution system

The effluent is distributed through the perforated pipes, exits through the holes in the pipes, and trickles through the rock or gravel where it is stored until absorbed by the soil. The absorption field, which is located in the unsaturated zone of the soil, treats the wastewater through physical, chemical, and biological processes. The soil also acts as a natural buffer to filter out many of the harmful bacteria, viruses, and excessive nutrients, effectively treating the wastewater as it passes through the unsaturated zone before it reaches the groundwater (see Figure 3).



- 1 drinking water well
- 2 septic tank
- 3 distribution box
- 4 absorption field
- 5 soil absorption (unsaturated zone)
- 6 groundwater (saturated zone)

Wastewater treatment and disposal in soil Fig. 3

Wastewater contains nutrients, such as nitrates and phosphates, that in excessive amounts may pollute nearby waterways and groundwater supplies. Excessive nutrients in drinking water supplies can be harmful to human health and can degrade lakes and streams by enhancing weed growth and algal blooms. However, the soil can retain many of these nutrients, which are eventually taken up by nearby vegetation.

What to Put In, What to Keep Out

- Direct all wastewater from your home into the septic tank. This includes all sink, bath, shower, toilet, washing machine and dishwasher wastewaters. Any of these waters can contain disease-causing microorganisms or environmental pollutants.
- Keep roof drains, basement sump pump drains, and other rainwater or surface water drainage systems away from the absorption field. Flooding of the absorption field with excessive water will keep the soil from naturally cleansing the wastewater, which can lead to groundwater and/or nearby surface water pollution.
- Conserve water to avoid overloading the septic system. Be sure to repair any leaky faucets or toilets. Use low-flow fixtures.
- Do not use caustic drain openers for a clogged drain. Instead, use boiling water or a drain snake to open clogs.
- Do not use septic tank additives, commercial septic tank cleansers, yeast, sugar, etc. These products are not necessary and some may be harmful to your system.
- Use commercial bathroom cleaners and laundry detergents in moderation. Many people prefer to clean their toilets, sinks, showers, and tubs with a mild detergent or baking soda.

continued . . .

- Check with your local regulatory agency if you have a garbage disposal unit to make sure that your septic system can accommodate this additional waste.
- Check with your local regulatory agency before allowing water softener backwash to enter your septic tank.
- Your septic system is not a trash can. Do not put grease, disposable diapers, sanitary napkins, tampons, condoms, paper towels, plastics, cat litter, latex paint, pesticides, or other hazardous chemicals into your system.
- Keep records of repairs, pumpings, inspections, permits issued, and other system maintenance activities.
- Learn the location of your septic system. Keep a sketch of it handy with your maintenance record for service visits.
- Have your septic system inspected every 1–2 years and pumped periodically (usually every 3–5 years) by a licensed inspector/contractor.
- Plant only grass over and near your septic system. Roots from nearby trees or shrubs may clog and damage the absorption field.
- Do not drive or park over any part of your septic system. This can compact the soil and crush your system.

In summary, understanding how your septic system works and adhering to these few simple rules will ensure that your septic system is a safe and economical method for treating and disposing of your wastewater onsite.

So . . . now you own a septic system

One in a series of three brochures designed to aid you in caring for your septic system.



For more information regarding the care of your septic system, contact your local health department.

More information about septic systems is available from the National Small Flows Clearinghouse (NSFC) through other brochures in this series:

Groundwater protection and your septic system,
Item #WWBRPE21

The care and feeding of your septic system,
Item #WWBRPE18

For more information about this or other NSFC products, please contact us by writing to:

National Small Flows Clearinghouse
West Virginia University
P.O. Box 6064

Morgantown, WV 26506-6064
or phone:

(800) 624-8301, (304) 293-4191
or fax: (304) 293-3161

www.nsfc.wvu.edu



Helping America's small communities meet their wastewater needs



Helping America's small communities meet their wastewater needs