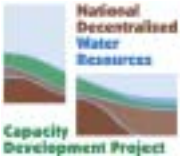


National Decentralized Water Resources Capacity Development Project

Evaluating Customer Response to Decentralized Wastewater Treatment Options

Primen, Inc.

Boulder, Colorado

June 2003

Evaluating Customer Response to Decentralized Wastewater Treatment Options

Submitted by Primen, Inc.,
Boulder, Colorado

NDWRCDP Project Number WU-HT-02-35

National Decentralized Water Resources Capacity Development Project (NDWRCDP) Research Project

Final Report, June 2003

NDWRCDP, Washington University, Campus Box 1150
One Brookings Drive, Cupples 2, Rm. 11, St. Louis, MO 63130-4899

DISCLAIMER

This work was supported by the National Decentralized Water Resources Capacity Development Project (NDWRCDP) with funding provided by the U.S. Environmental Protection Agency through a Cooperative Agreement (EPA No. CR827881-01-0) with Washington University in St. Louis. This report has been reviewed by a panel of experts selected by the NDWRCDP. The contents of this report do not necessarily reflect the views and policies of the NDWRCDP, Washington University, or the U.S. Environmental Protection Agency, nor does the mention of trade names or commercial products constitute endorsement or recommendation for use.

CITATIONS

This report was prepared by

Robert J. McKee, Ph.D.
Shawn McNulty, Ph.D.
Primen, Inc.
1750 14th St. Suite 200
Boulder, CO 80302

The final report was edited and produced by ProWrite Inc., Reynoldsburg, OH.

This report is available online at www.ndwrcdp.org. This report is also available through the

National Small Flows Clearinghouse
West Virginia University/NRCCE
P.O. Box 6064
Morgantown, WV 26506-6065
Tel: (800) 624-8301
WWCDMG22

This report should be cited in the following manner:
McKee, R. J. and S. McNulty. 2003. *Evaluating Customer Response to Decentralized Wastewater Treatment Options*. Project No. WU-HT-02-35. Prepared for the National Decentralized Water Resources Capacity Development Project, Washington University, St. Louis, MO, by Primen, Inc., Boulder, CO.

ACKNOWLEDGEMENTS

Appreciation is extended to the following individuals for assistance in the preparation of this report:

Bruce Douglas
Questa Engineering Corporation

David Lindbo, Ph.D.
North Carolina State University

Appreciation is also expressed to the NDWRCDP for their support of this work:

Principal Investigator
Jay R. Turner, D.Sc., Washington University

Project Coordinator
Andrea L. Arenovski, Ph.D.

NDWRCDP Project Steering Committee:

Coalition for Alternative Wastewater Treatment
Valerie I. Nelson, Ph.D.

Consortium of Institutes for Decentralized Wastewater Treatment
Ted L. Loudon, Ph.D., P.E.

Electric Power Research Institute
Raymond A. Ehrhard, P.E.
Tom E. Yeager, P.E.

National Onsite Wastewater Recycling Association
Jean Caudill, R.S.

National Rural Electric Cooperative Association
Steven P. Lindenberg
Scott Drake, P.E.

Water Environment Research Foundation
Jeff C. Moeller, P.E.

Members-At-Large:
James F. Kreissl
Richard J. Otis, Ph.D., P.E.
Jerry Stonebridge

ABSTRACT

The National Decentralized Water Resources Capacity Development Project (NDWRCDP) intends to develop a more comprehensive and accurate understanding of end-user response to various decentralized wastewater system management and technology options in order to evaluate whether, and how, there might be an opportunity for decentralized wastewater system regulators, local officials, and/or new providers to facilitate the introduction of professional management and new technologies or approaches.

To assist NDWRCDP to gain a better understanding of users' attitudes and preferences toward distributed wastewater treatment systems and management options, Primen analyzed the *Septic System Survey 2000* conducted by North Carolina State University. The survey explored homeowners' knowledge of, and experience with, septic systems and sewer systems; preferences for septic systems and sewer systems; perceptions about local water quality and affects on that water quality; and openness to paying for third-party maintenance and management of septic systems.

Despite the lack of market penetration made by advanced distributed wastewater treatment technologies (DWTT) and the current uncertainty about future adoption of these systems and of management and maintenance services, analysis of the *Septic System Survey 2000* indicates there are future opportunities for DWTT and related services. More specifically, there appears to be an opportunity for a maintenance/management service provided by private companies and for the adoption of new DWTT, which in part are related to a need to fill an informational gap that exists among homeowners.

EXECUTIVE SUMMARY

Background

The future market penetration of distributed wastewater treatment technologies (DWTT) and system management options is quite uncertain. Technological advancements have been made and customer interest has started to increase. However, there still is uncertainty in terms of technology performance, customer and regulatory acceptance, and the impact of interest group activities and agendas, among other issues. As a result of this, it is uncertain what will be the rate of increase at which decentralized wastewater treatment technologies, cluster systems, and innovative wastewater system management options will be adopted, and the timeline and market segments along which these options will be implemented.

The National Decentralized Water Resources Capacity Development Project (NDWRCDP) wishes to develop a more comprehensive and accurate understanding of end-user response to various decentralized wastewater system management and technology options in order to evaluate whether, and how, there might be an opportunity for decentralized wastewater system regulators, local officials, and/or new providers to facilitate the introduction of professional management and new technologies or approaches.

To assist NDWRCDP to gain a better understanding of users' attitudes and preferences toward distributed wastewater treatment systems and management options, Primen designed this research to achieve four objectives:

1. Identify customer attitudes regarding water quality and the adequacy of their current septic system, alternative wastewater solutions, and who has primary responsibility for wastewater issues.

2. Identify the contextual factors affecting customer attitudes and preferences related to water quality and wastewater issues.

3. Identify tradeoffs customers make between septic systems and connecting to sewer systems and their willingness to pay for third party septic system management.

4. Identify how different types of customers would make decisions about wastewater solutions differently.

Methodology

Primen designed this research to utilize existent market research—the Septic System Survey 2000—to address NDWRCDP's objectives. Because the data did not address all of the DWTT and management options that NDWRCDP would want to explore, and because the sample was limited to North Carolina residents, it was not possible to address each objective in the optimum level of detail. However, by using existing data, much of the research objectives were addressed more quickly and at less expense than would be required to initiate primary market research. This approach also provided an opportunity to identify which informational gaps still need to be filled by primary research.

The Septic System Survey 2000 was conducted by North Carolina State University and includes information from 527 homeowners with septic systems. The sample area included nine rural counties in far northeastern North Carolina. The data provides insights on the respondents' demographics; homeowners' knowledge about, and experience with, septic systems and sewer systems; preferences for septic systems versus sewer systems; perceptions about local water quality and effects on that water quality; and openness to paying for third-party maintenance and management of septic systems. The data does not address two areas of interest to NDWRCDP: Attitudes of first-time homebuyers or those who have not previously had septic systems; and willingness to pay for specific features of advanced DWTT.

Main Findings

Despite the lack of market penetration made by advanced distributed wastewater treatment technologies and the current uncertainty about future adoption of these systems and of management and maintenance services, analysis of the Septic System Survey 2000 indicates there are future opportunities for DWTT and related services. More specifically, there appears to be an opportunity for a maintenance/management service provided by private companies and for the adoption of new distributed wastewater treatment technologies, which in part are related to a need to fill an informational gap that exists among homeowners.

The first implication of the analysis is that there is an apparent opportunity for an information campaign to bolster support for both distributed wastewater treatment technologies and a third-party maintenance/management service. Homeowners correctly perceive that septic systems cost less than the expense to connect to a sewer system, but most of them do not know how much it would cost to connect. Homeowners also have little knowledge about indicators that a septic system is malfunctioning. Out of seven indicators, homeowners on average were familiar with only two. Moreover, those indicators of potential septic system problems that homeowners cited most frequently—toilets backing up, bad smells, and slow drains—are actually poor indicators. Homeowners' knowledge of septic systems is important in terms of their maintenance practices—the more knowledgeable they are the more apt they will be to perform such maintenance as pumping septic tanks.

The analysis also suggests that there may be a potential opportunity for a private, third-party distributed wastewater treatment system maintenance/management service. Septic systems are seen by many homeowners as permanent wastewater solutions that are expensive to replace; most

homeowners expect that they would have to pay that cost. Also, most people understand the need to perform routine maintenance such as inspections and pumping tanks, but many of these people do not have it done.

What also supports the launching of a maintenance/management service is that most of the people who prefer sewer service to septic systems do so because there are fewer worries and less on-site maintenance required; many homeowners also look for help in keeping their systems functioning. It is also likely there will be a growing need for such a service given that system age is a key driver to the occurrence of problems and that many systems are already old. The occurrence of problems, in turn, is a key driver to someone being willing to pay for a maintenance/management service and positively affects the amount they would pay.

The opportunity for such a service is somewhat tempered, however, by the amount homeowners would be willing to pay. The average amount homeowners stated they would be willing to pay for such a service—$70 annually—may be too low to support a quality service offering.

Currently, the replacement costs of systems depend on the local range of site and soil conditions that require a range of technical solutions. Therefore, although the market has been reluctant to adopt new distributed wastewater treatment technologies, there might be an opportunity for market penetration in the future. This contention is based on the age and types of systems in use and some homeowners' preference for septic systems.

Opportunities for Future Research

Though analysis of the of Septic System Survey 2000 data is useful in addressing the NDWRCDP's research needs, there clearly is an opportunity for future research. Particularly, there is an opportunity to conduct research that is improved in its representation of the U.S. population and in content that better addresses the NDWRCDP's specific research interests. Such research promises to yield a solid understanding of the current state of the DWTT market and better enable NDWRCDP to serve that market with new services and technologies.

TABLE OF CONTENTS

LIST OF FIGURES

1 BACKGROUND

The future market penetration of distributed wastewater treatment technologies (DWTT) and system management options is quite uncertain. Technological advancements have been made and customer interest has started to increase. However, there still is uncertainty in terms of technology performance, customer and regulatory acceptance, and the impact of interest group activities and agendas, among other issues. As a result of this, it is uncertain what will be the rate of increase at which decentralized wastewater treatment technologies, cluster systems, and innovative wastewater system management options will be adopted, and the timeline and market segments along which these options will be implemented.[1]

Attitudes on DWTT

Historically, American homeowners have typically relied upon one of two technologies for treating wastewater and biosolids. Homes located in or near population centers generally have access to municipally owned central sewer systems, while more isolated homes generally depend on privately owned on-site septic systems. Sewer systems generally are more expensive, with costs transferred to homeowners either explicitly, via use fees, or implicitly, through taxes. But sewer fees comprise a small portion of a family's annual expenses, the system requires no routine maintenance by the homeowner, and the majority of the waste is carried off-site, often reducing the immediate impact of any malfunctions. Though onsite septic systems are associated with lower property values and are perceived to be more liable to contaminate surrounding groundwater and running water, they are generally cheaper than sewer systems and may appeal to certain homeowners interested in minimizing their dependence on public systems.

Over time new wastewater technologies have been developed, but these new technologies have not been widely adopted. Factors that should facilitate the adoption of these systems, such as the reduction of federal grants for sewer construction and population expansion into geographies not traditionally served by sewer systems, have begun to increase customer interest, but have not yet coalesced to create significant levels of market penetration. In fact, a variety of competing factors, such as regulatory concerns about housing sprawl, system cost, and the organizational structure of system management and maintenance, have limited the rapid growth of market penetration for more advanced on-site wastewater systems.

Despite these developments, it is still possible that new organizational forms or the creation of new wastewater system management options will provide a mechanism by which many existing

[1] For an example of prior research that indicates the uncertainty of future market penetration paths for decentralized wastewater treatment systems see *Advanced On-Site Wastewater Treatment and Management Market Study: Volume 1: Assessment of Short-Term Opportunities and Long-Run Potential*, EPRI, Palo Alto, CA 2000: 1000612.

constraints can be overcome. Utilities, for example, and particularly rural cooperative utilities have experience in managing a variety of infrastructure-like shared services for their members. It is possible that a combination of professional system management and shared ownership might be devised that creates value for end customers, providers, and the surrounding environment.

In order to better determine whether such options are viable, however, a better understanding of current customer perceptions on this issue is required. Most existing public opinion research on this subject is either anecdotal, or at best, based on small sample sizes with unique populations. Additionally, although there is no shortage of expert opinion on the subject of customer attitudes and preferences regarding distributed wastewater treatment systems, expert opinion is not always correct. And perhaps more important, input from these types of sources does not provide the opportunity to understand how customers might react to options they have not yet encountered.

Objectives

The National Decentralized Water Resources Capacity Development Project (NDWRCDP) wishes to develop a more comprehensive and accurate understanding of end-user response to various decentralized wastewater system management and technology options in order to evaluate whether, and how, there might be an opportunity for decentralized wastewater system regulators, local officials, and/or new providers to facilitate the introduction of professional management and new technologies or approaches.

Customer/end-user response is not the only factor that will ultimately determine the rate at which DWTT systems penetrate the market. However, end-user response does matter, in part because of the direct impact that some users may have on the acquisition of these systems, but also because of the impact that they can have on affecting public policy on these issues, at the local level in particular.

To assist NDWRCDP to gain a better understanding of users' attitudes and preferences toward distributed wastewater treatment systems and management options, Primen designed this research to achieve four objectives:

1. Identify customer attitudes regarding water quality and the adequacy of their current septic system, alternative wastewater solutions, and who has primary responsibility for wastewater issues.

2. Identify the contextual factors affecting customer attitudes and preferences related to water quality and wastewater issues.

3. Identify tradeoffs customers make between septic systems and connecting to sewer systems and their willingness to pay for third-party septic system management.

4. Identify how different types of customers would make decisions about wastewater solutions differently.

2 METHODOLOGY

Project Approach

Primen designed this research to utilize existent market research—the Septic System Survey 2000 conducted by North Carolina State University—to address NDWRCDP's objectives. Because the data did not address all of the DWTT and management options that NDWRCDP would want to explore, and because the sample was limited to North Carolina residents, it was not possible to address each objective in the optimum level of detail. However, by using existing data, much of the research objectives were addressed more quickly and less expensively than by initiating primary market research. This approach also provided an opportunity to identify which informational gaps still need to be filled by primary research.

The Primen team's efforts began with defining a research plan to address the NDWRCDP's research objectives. This step included identifying the information within the Septic System Survey 2000 and quantitative methods that would be applicable to answering the research questions. (The Septic System Survey 2000 questionnaire is attached in Appendix A. The frequencies for the variables are also included.)

Analysis was then conducted per the analysis plan and with the data received from NC State. The initial findings were discussed with two subcontracted advisers on the project—Bruce Douglas, a senior project manager with Questa Engineering Corporation, and David Lindbo, a soil geologist at North Carolina State University involved in conducting the Septic System Survey 2000—and NDWRCDP staff.

The Primen research team presented findings from the data analysis and their implications that pertain to the initial research objectives posed by the NDWRCDP. The presentation to the Economics & Development Subcommittee was held January 22, 2003 at Washington University in St. Louis. Discussion from the presentation identified some additional issues for the Primen research team to explore.

The project culminated with this final report, which provides a comprehensive review of the analysis that was conducted and what can, and cannot, be concluded from the findings. As part of this report, Primen identified the strengths and weaknesses of the findings and additional primary market research that might be conducted that would be most appropriate in order to fill any informational gaps that remain.

Data

The Septic System Survey 2000 was conducted by North Carolina State University and includes information from 527 homeowners with septic systems. The sample area included nine rural counties in far northeastern North Carolina: Cambden, Chowan, Currituck, Dare, Gates, Pasquotank, Perquimans, Tyrell, and Washington.

It should be noted that a public septic system management entity exists in Pasquotank, Perquimans, Camden, and Chowan counties, which is operated by the PPCC Health District. The PPCC's service consists of annual inspections that are mandatory for septic systems that have pumps or drainage, which account for more than 50% of the systems in those counties. The homeowners who are required to receive the service are billed $50 on their annual taxes. Analyses included in this report were conducted excluding and including whether a respondent's county was served by PPCC. In most cases, including PPCC service availability did not change the results meaningfully and it is noted where inclusion of this variable affected the results.

The data provides insights on the respondents' demographics; homeowners' knowledge about, and experience with, septic systems and sewer systems; preferences for septic systems and sewer systems; perceptions about local water quality and effects on that water quality; and openness to paying for third-party maintenance and management of septic systems. The data does not address two areas of interest to NDWRCDP: Attitudes of first-time homebuyers or those who have not previously had septic systems, and willingness to pay for specific features of advanced DWTT.

Project Evaluation

The quality of research and how well it addressed the research questions was ensured by oversight from Dr. Shawn McNulty of Primen, as well as advisement from Dr. David Lindbo of NC State, and Mr. Bruce Douglas of Questa Engineering. NDWRCDP staff and Management and Economics Subcommittee members also received a presentation that outlined the research approach taken and the preliminary findings. Again, comments from this presentation were addressed by Primen staff in compiling this final report.

Furthermore, the Primen team views that the research approach effectively addressed the NDWRCDP's objectives, and was economically feasible given that the research was conducted within the contracted amount with data that was provided at no charge. And since the methods used in this project were those outlined in the research plan approved by NDWRCDP and that its staff and members has had an opportunity to review the preliminary results of that approach, it is apparent the organization viewed the approach as effective and economically feasible, as well.

Presentation of Findings

The findings yielded from analysis of the data will be presented in Chapter 3 and organized in the following manner: characteristics of users and septic systems; knowledge of septic systems; system problems; system maintenance; perceptions about and preferences for wastewater options; and attitudes about a third-party maintenance service.

3 FINDINGS

The findings will be presented in terms of what they suggest about the attitudes and preferences of the septic system users that comprise the sample. Though these findings might provide some insight about septic system users in general, since the sample was taken from a specific area of one state, some caution should be taken in the degree to which the findings are generalized to the entire population of septic system users in the United States.

Characteristics of Users and Systems

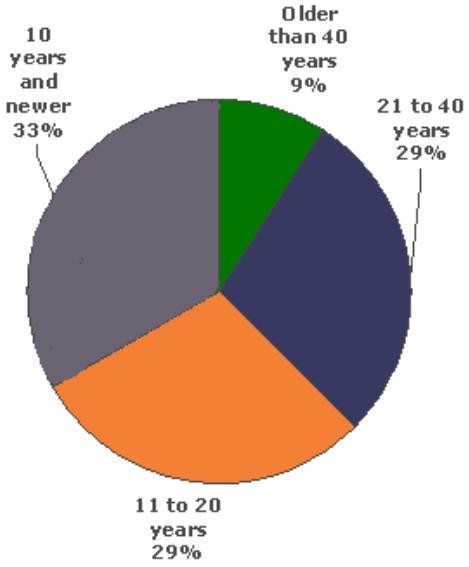
Assuming that property values are reflective of income, the sample somewhat contradicts the general perception that septic systems are associated with lower property values. While 16% of respondents earned $20,000 or less in 1999, 52% of the respondents had incomes between $20,000 and $50,000, 22% were between $50,000 and $80,000, and 10% earned more than $80,000. The age distribution of respondents is typical of homeowners, with the sample having a median age of 51 and 24% were 65 and older.

The sample did reflect the assumption that septic systems are found in highly rural areas, with 77% of respondents being residents of the county versus a subdivision or town (though note that the sample was restricted to fairly rural counties in NC). The homes tended to be larger, with 82% having three or more bedrooms, and having multiple occupants—14% of households consisting of one person, 42% consisting of two, and 44% consisting of three or more.

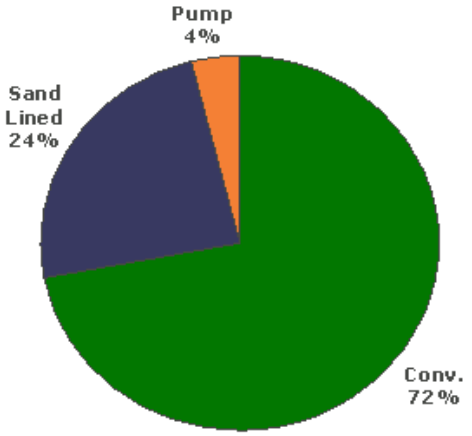
As shown in Figure 3-1, though most of the respondents' systems were built since 1980, there were many much-older systems operating. While 29% of homeowners had systems that were 21- to 40-years-old, 9% of respondents' systems were older than 40. Also, most of the septic systems in use are the conventional type consisting of a septic tank and a leach field, with 24% sand-lined and only 4% being a pump type (LLP or pressure manifold), which are used in such circumstances as when the leach field is located at a higher grade than the tank.

Septic System Knowledge

The findings indicate that while homeowners generally know where their septic systems are located and are familiar with the major components, they have less knowledge about the more-technical aspects of their systems, such as the type, its function, and its limitations. There also is a lack of knowledge regarding detection of malfunctions.



• **Excludes 16% of the sample who did not know.**



• **Excludes 45% of the sample who did not know.**

Figure 3-1
Septic System Age and Type

Respondents in general have a firm grasp of where their system is located, with 97% and 87% knowing the location of their septic tank and drain field, respectively. Figure 3-2 shows that most respondents also know the major components of their systems. For instance, 96% are familiar with the septic tank and 90% familiar with the drain field.

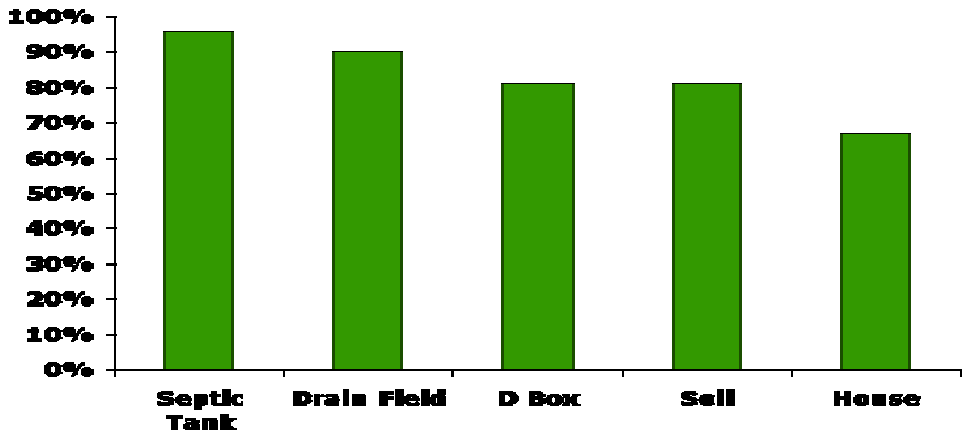


Figure 3-2
Percentage of Homeowners Who Recognize Each Component as Part of Septic System

However, homeowners have less knowledge about some of the more-technical aspects of their systems. For instance, 45% of respondents do not know what type of system they have. And though most respondents—79%—think septic systems are permanent wastewater management solutions, they are not clear on what function septic systems serve. Half think septic systems get rid of sewage and 27% think they treat sewage, but only 19% correctly think septic systems do both.

From Figure 3-3 it is clear that there is some lack of knowledge about where septic systems should be sited and soil limitations. And Figure 3-4 reports that many respondents were unaware of common indicators that a septic system is malfunctioning. However, given that this question gauged respondents' top-of-head knowledge in that interviewers did not read response options, homeowners might possibly be more familiar with symptoms of septic system problems if asked about them directly.

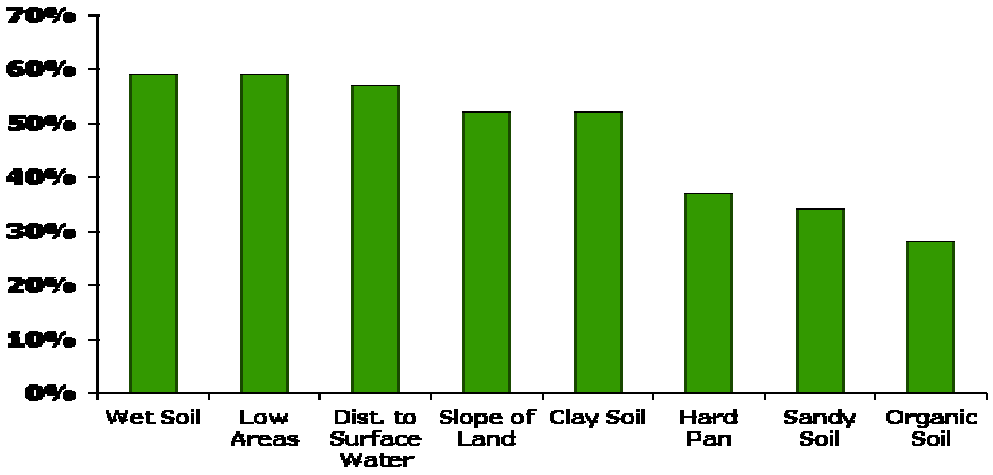


Figure 3-3
Percentage of Homeowners Who Recognize Limitations on Septic System Placement

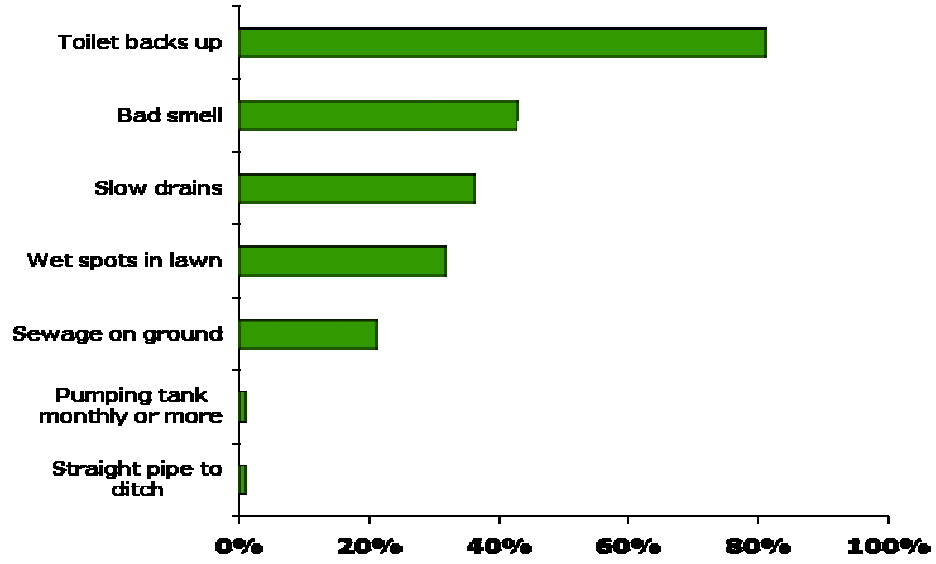


Figure 3-4
Percentage of Homeowners Who Identify Symptoms of Septic System Malfunction

Knowledge about indicators of malfunctions seems to vary somewhat by income and education, as shown in Figure 3-5. Familiarity with these indicators generally increases as levels of education and income increase. However, It is arguable that this figure might portray a measurement of sensitivity to septic system problems rather than knowledge of problems.

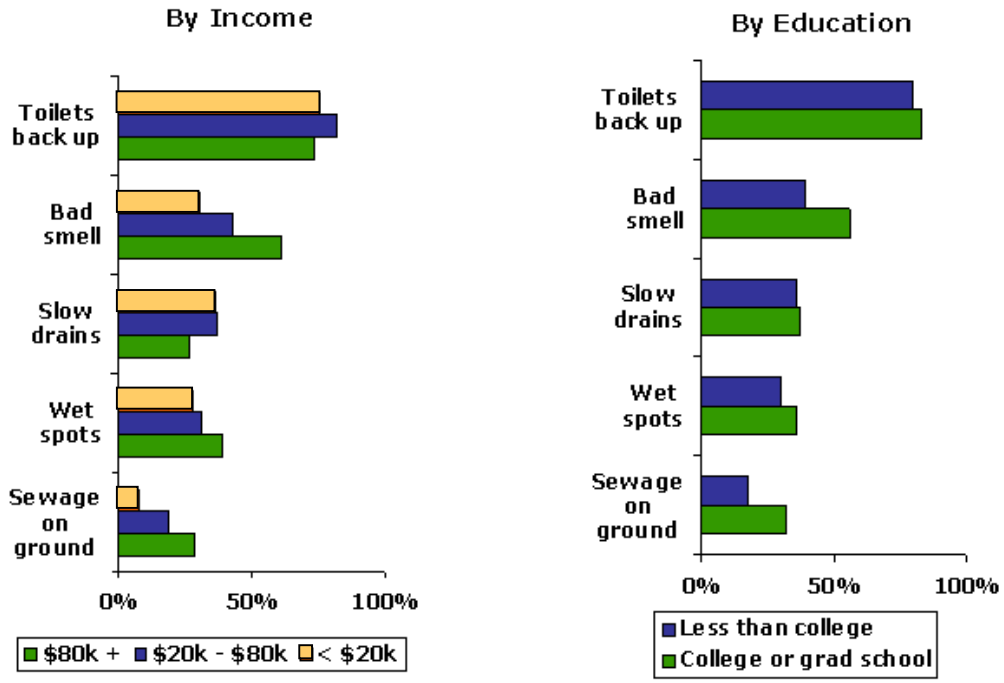


Figure 3-5
Knowledge of Key Symptoms of Septic System Malfunction by Income and Education Levels

Also, many respondents make no connection between water quality and septic systems. Though 54% of respondents said septic tanks at least have some effect on water quality, 46% think there is no effect. Incidentally, these proportions were about the same for respondents' perceptions about the effect sewer systems have on water quality.

A septic system knowledge index was created to measure respondents' knowledge more comprehensively.[2] The construction of the scale was designed by NDWRCDP members and includes variables that measure respondents' knowledge about such areas as the type of system they have, location of and familiarity with system components, limitations to system construction, and the purpose of septic systems. A description of how the index was constructed is included in Appendix B. Overall, the sample was fairly knowledgeable about their system, as defined by the NDWRCDP index—45% were considered to have a good knowledge, 52% had a fair knowledge, and 3% had a poor knowledge.

[2] We would like to note that this scale was referred to by NDWRCDP members as an index of system stewardship, but the name was changed because most of the contents of the index related to knowledge rather than actual behavior.

Further analysis was conducted to determine what were the main drivers of system knowledge. An OLS regression equation was specified to predict the effects on system knowledge from the following:

- Whether the PPCC served a respondent's county
- The highest amount the respondent was willing to pay for a maintenance/management service run by a health department or private utility
- Whether a respondent thought a homeowner should be responsible to pay for a failed system
- Whether a respondent thought a homeowner was best able to care for a system
- Education
- Age of the respondent
- Age of the septic system
- Perceptions about the cost of sewer systems relative to the cost of septic systems
- Whether the respondent lived in the country
- Environmental awareness[3]

After a series of step-wise OLS regressions, it was determined that only environmental awareness and whether the PPCC served the respondents' county were significant predictors of system knowledge ($p < .05$). Figure 3-6 reports the standardized coefficients of these two predictors and the R^2 of the final model.

Independent Variable	Standardized Beta	Significance
Counties served by PPCC	-.154	<.0005
Environmental awareness	.220	<.0005

N = 526 R-squared = .057

Figure 3-6
Effects on Septic System Knowledge

Homeowners in counties served by a government management service (PPCC) were less knowledgeable about septic systems than those in other counties—perhaps because they feel less of a need to attend to their septic systems. At the same time, homeowners who are more environmentally aware tend to also be more knowledgeable about their septic systems. The joint

[3] The construction of an environmental awareness scale was designed by NDWRCDP members and includes variables that measure respondents' knowledge about how septic systems, public sewer systems, factories, and other factors influence water quality. A description of how the index was constructed is included in Appendix C. It is evident that the sample was less knowledgeable about the impacts on water quality than they were about their septic systems—though 56% had high levels of environmental awareness, 22% had medium levels of awareness, and another 22% had low levels.

relationship between these variables and system knowledge is illustrated in Figure 3-7. It shows that the likelihood of having good system knowledge increases with increased environmental awareness levels and that this effect is intensified in areas that were not served by the government management service.

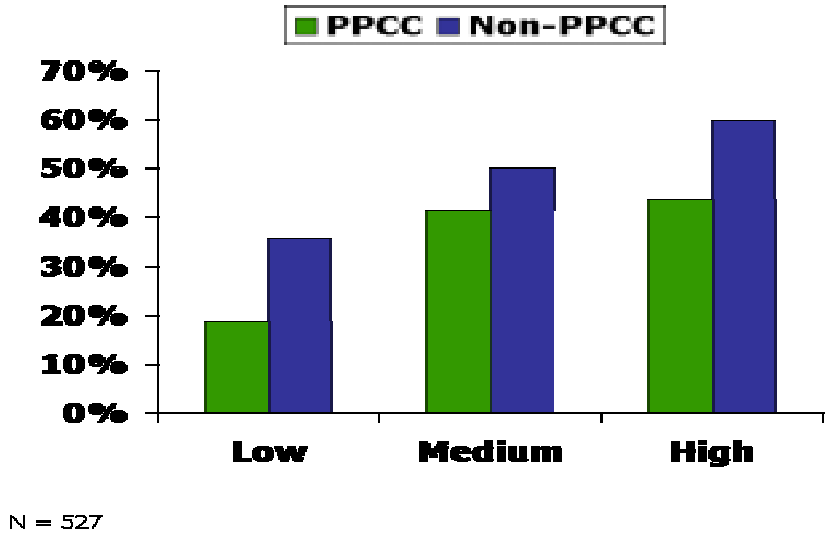


Figure 3-7
Percentage of Good System Knowledge by Environmental Awareness Levels

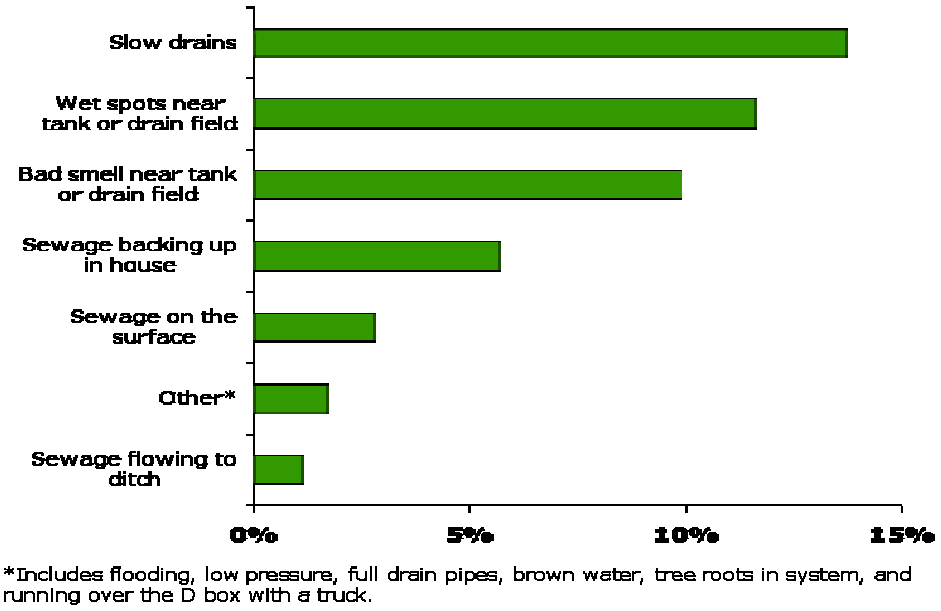
System Problems

The findings indicate that septic systems are not without maintenance problems. They also provide some insight into where these problems occur and how homeowners deal with them. About one-fourth of respondents reported having a problem with their septic system in the previous five years. While Figure 3-8 shows a slight trend towards more problems in the past five years being reported by respondents with systems more than 10 years old, these differences are not statistically significant.

It is interesting to note that 16% of respondents reported problems affecting the inside of their homes, while 7% reported problems that only affected the property outside of their home. Figure 3-9 also shows that the most commonly reported problems were slow drains and wet spots near the septic tank or drain field. It is evident, though, that homeowners do experience some serious problems such as sewage backing up into the house, floating to the surface, and floating into a ditch.

	21 yrs+	11 to 20 yrs	10 yrs or <
Any problems	***28%***	***29%***	***15%***
Slow drains	21%	14%	8%
Wet near tank	16%	13%	6%
Smell near tank	11%	15%	6%
Sewage in house	7%	7%	3%
Sewage on surface	6%	2%	1%
Other	3%	2%	1%
Sewage to ditch	1%	1%	1%

Figure 3-8
Percentage of Reported Problems by Age of Septic System



*Includes flooding, low pressure, full drain pipes, brown water, tree roots in system, and running over the D box with a truck.

Figure 3-9
Percentage of Homeowners Who Experienced Specific Problems in Past 5 Years

When homeowners perceive that problems are occurring, it is common that they will seek help. Of the homeowners who reported problems, 63% said they called someone to deal with at least one of the problems they experienced. Figure 3-10 shows that respondents most commonly seek repair service from an independent provider, such as a contractor/installer or a plumber, rather than calling the health department.

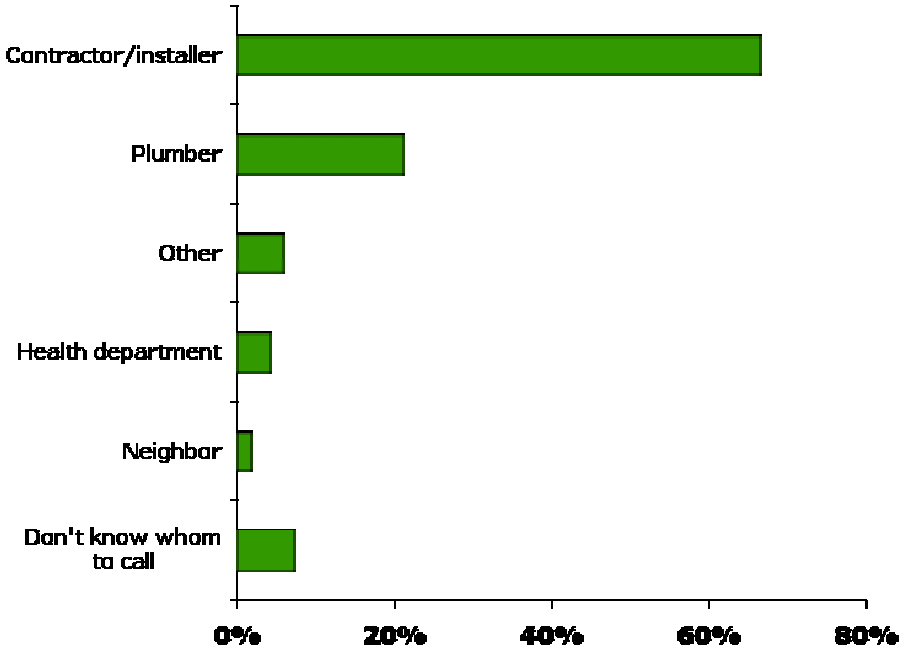


Figure 3-10
Who Homeowners Call to Deal With Septic System Problems

An analysis was conducted to determine the main drivers of the occurrence of problems with septic systems. A logit regression equation was specified to predict the effects on the log odds that someone experienced problems in the past five years from the following: whether the PPCC served a respondent's county; septic system knowledge; environmental awareness; education; age of the respondent; the number of people who lived in the home; the type of septic system; annual maintenance costs; income of the respondent; and the number of bedrooms in the home.

After a series of step-wise regressions, it was determined that only the age of the system was a significant predictor of whether someone experienced a problem with their system in the past five years ($p < .05$; $R^2 = .014$).[4]

The relationship between system age and system problems is illustrated in Figure 3-11. It is clear that for the most part the newer the home, the fewer problems experienced with the home's septic system.

[4] Because logit coefficients are less straightforward to interpret as are OLS coefficients, the actual coefficients from the logit equations presented here are not reported. However, the significance levels of the independent variables that meaningfully affect the dependent variable and the R^2 of the equations are reported.

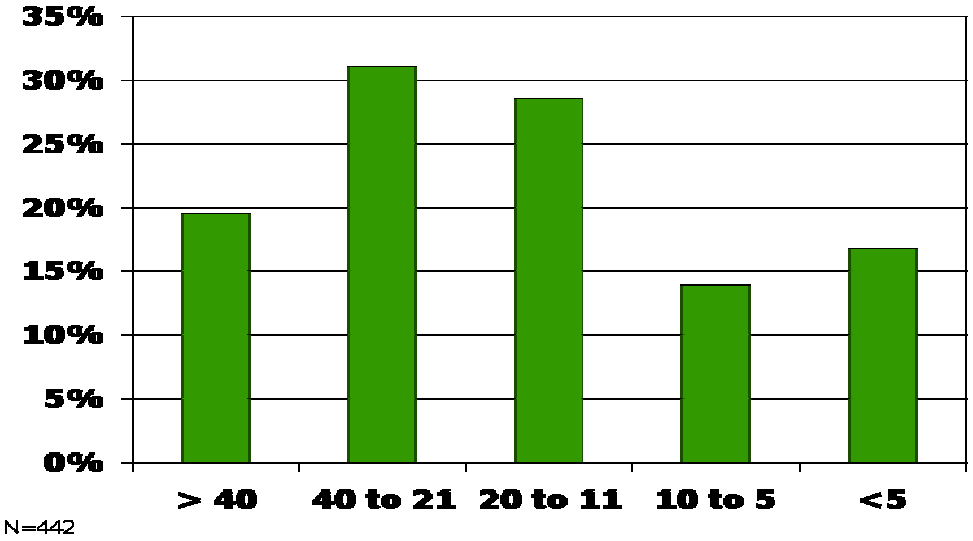


Figure 3-11
Percentage of Homeowners Who Experienced Problems in the Last Five Years by System Age

Maintenance Practices

The general finding regarding maintenance is that respondents understand the need to maintain their systems, but this is not reflected in respondents' actual practices. Overall, 85% of respondents reported that some form of maintenance is required for septic systems. Figure 3-12 shows that the most familiar forms of maintenance are pumping the tank and establishing grass cover.

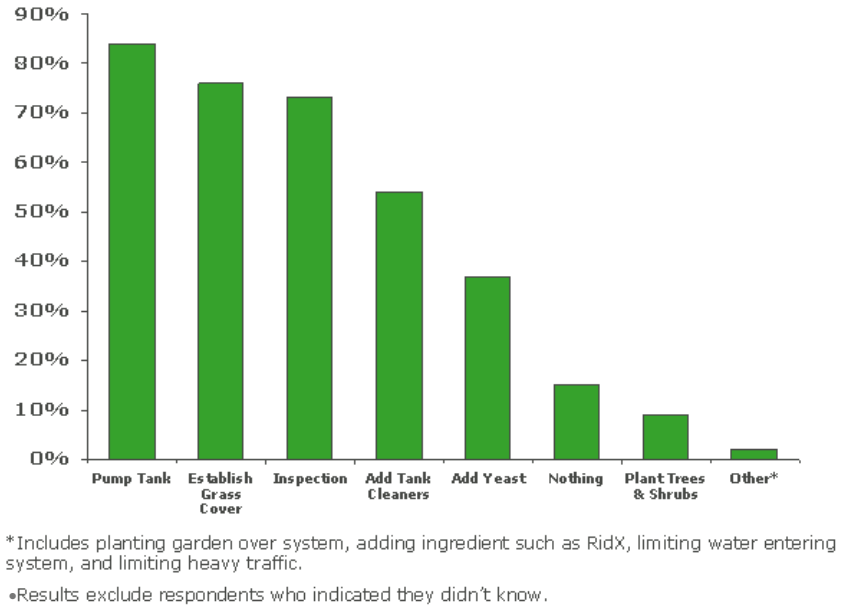


Figure 3-12
Homeowners' Perceptions of System Maintenance Requirements

It is clear, though, that maintenance is not faithfully conducted. For instance, 73% of homeowners said it is necessary to conduct inspections—one of the most commonly cited forms of maintenance, as shown in Figure 3-12—but only 15% have someone other than themselves conduct these periodically. And while homeowners on average spent $37 on maintenance annually, 69% of homeowners did not spend anything.

Figure 3-13 also shows the comparison between how frequently septic tanks should be pumped according to respondents, and how often tanks actually are pumped. Of those who believe their systems should be pumped at least once every five years, only 58% have done so in the past five years.

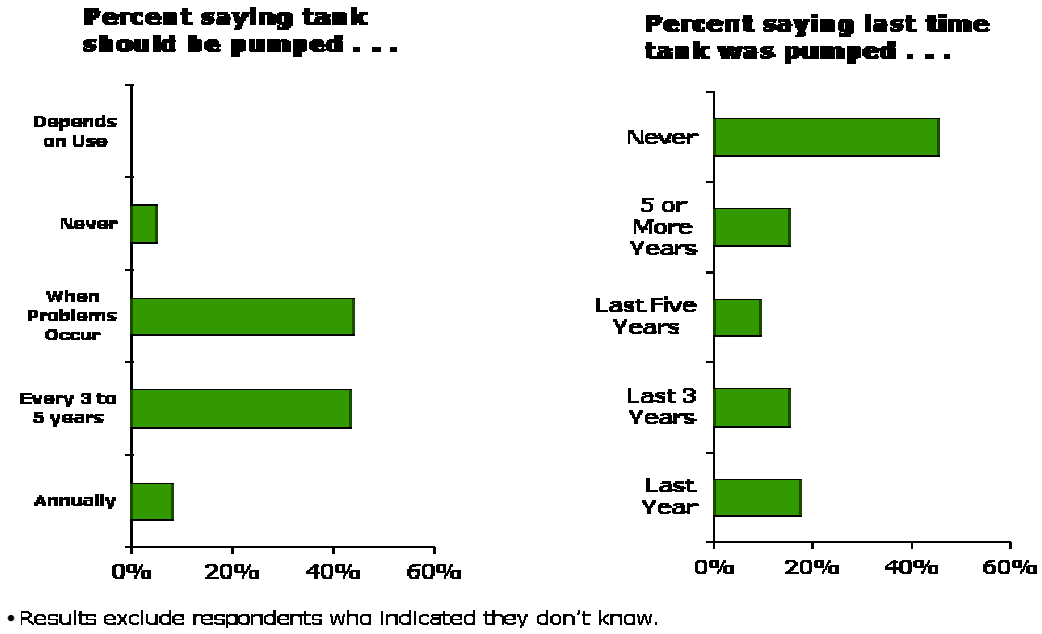


Figure 3-13
Homeowners' Perceptions of How Often Septic Tanks Should be Pumped Vs. Frequency Tank Is Pumped

An analysis was conducted to determine the main drivers of pumping a septic tank in the past five years for homeowners who did not experience system problems within that timeframe. A logit regression equation was specified to predict the effects on whether these homeowners pumped their septic tank in the past five years from the following:

- Whether the PPCC served a respondent's county
- Age of the septic system; septic system knowledge
- Environmental awareness
- Education
- The time someone lived in the home
- Age of the respondent

- Whether a respondent thought a homeowner should be responsible to pay for a failed system
- Whether a respondent thought a homeowner was best able to care for a system

After a series of step-wise logit regressions, it was determined that only the age of the system and respondents' knowledge of their system were significant predictors of whether someone who has not experienced a problem pumped their septic tanks in the past five years ($p < .0005$ and $p = .005$, respectively; $R^2 = .133$).

The relationship between system age and system knowledge in their effect on whether a tank was pumped is illustrated in Figure 3-14. It is clear that if homeowners are knowledgeable about their system then the older the system is, the more likely they are to have pumped their tank in the past five years. For those homeowners with poor or fair system knowledge, the likelihood to pump a tank does not increase with the age of a system.

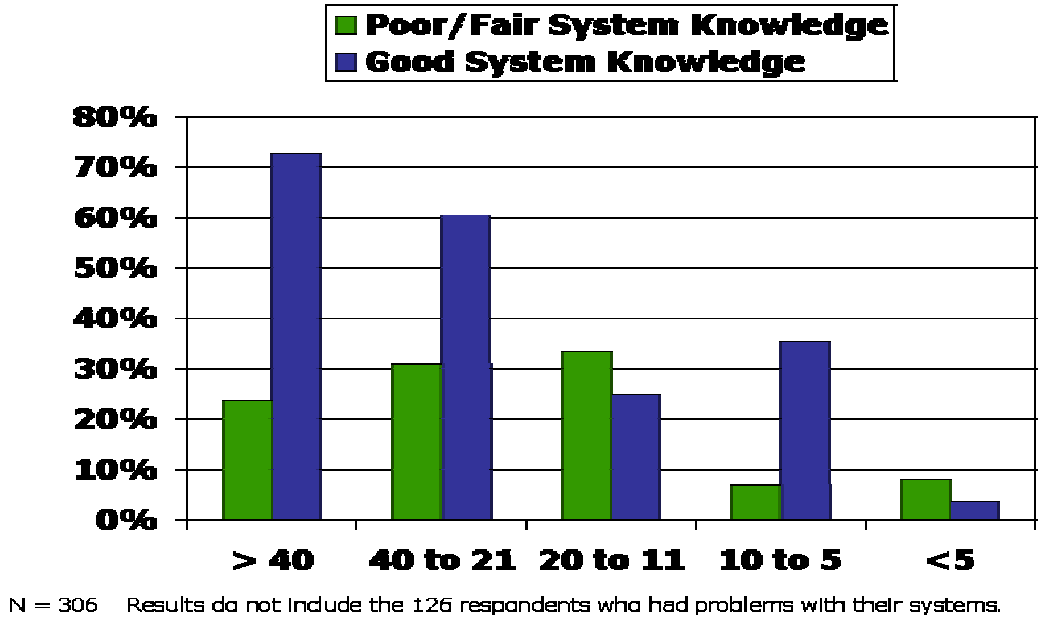
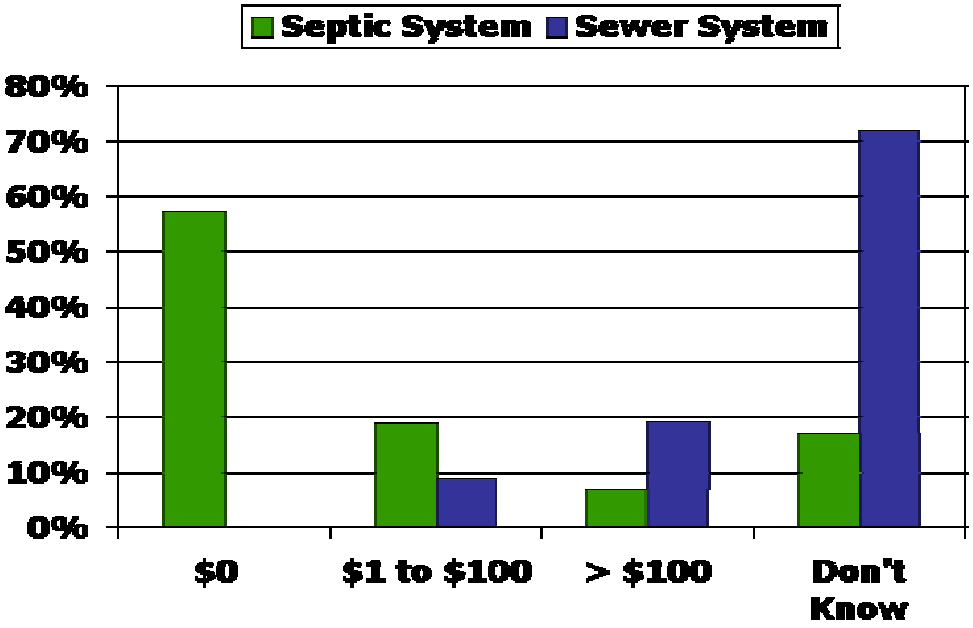


Figure 3-14
Percentage of Homeowners Who Pumped Septic Tanks in Last Five Years by System Age and System Knowledge

Comparison of Wastewater Options

Homeowners generally perceive sewer service to be more expensive than septic systems, but if the costs were held constant, most would prefer sewers. Most homeowners expect that replacing their septic system would be expensive—54% think it would cost more than $1,000. And though 40% did not have an idea of how much it would cost, 88% think that homeowners should be responsible for covering the costs of a failed system. Figure 3-15 shows that most respondents are unsure of what sewer service would cost annually. The actual and relative differences in costs between sewer and septic systems cannot be determined across the board—even at the county level. A community specific analysis would be required to determine the actual relative annual costs of septic and

sewer. But it is clear in Figure 3-16 that most homeowners perceive sewer service to cost more than it does to maintain their septic system.



• Annual septic system maintenance costs are based on homeowners' experience.

• Annual cost of sewer service is homeowners' best guess on the assumption that it were possible for them to connect to the nearest sewer system.

Figure 3-15
Homeowners' Estimates of Annual Septic and Sewer System Costs

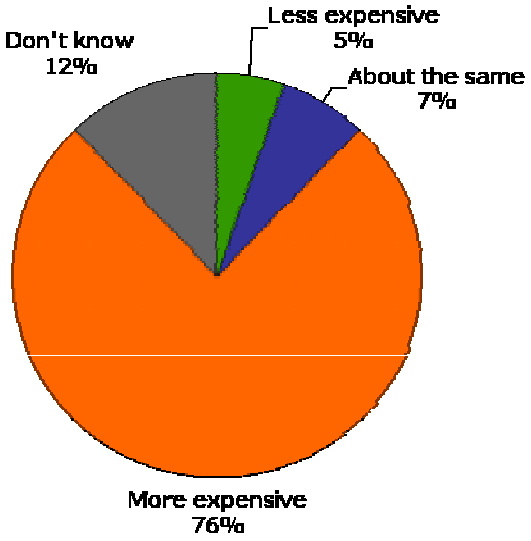


Figure 3-16
Homeowners' Perceptions of Cost of Sewer Service Compared to Current Cost of Septic System

If cost were not an issue, however, most homeowners—61%—would prefer sewer service to a septic system. However, it is worth noting that 39% still favor septic systems, even if sewer service cost the same. Figure 3-17 shows that homeowners' stated reasons for preferring sewers are peace of mind and the lack of maintenance requirements.

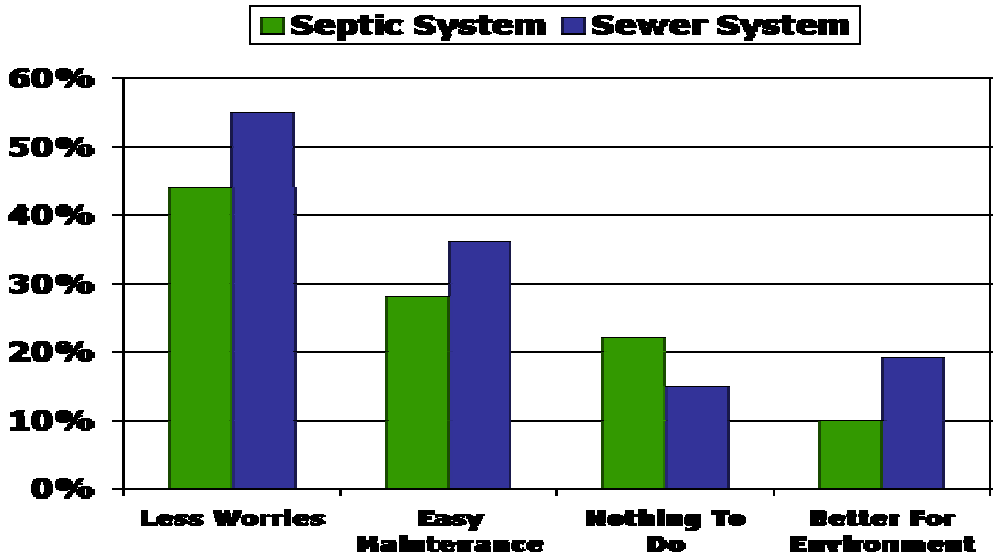


Figure 3-17
Homeowners' Bases for Preference for Septic and Sewer Preferences

However, a logit regression (R^2 = .179) indicates that preference for sewers is also affected by the following[5]:

- Homeowners' septic system maintenance expense ($p < .0005$)
- Whether they experience problems with their systems ($p < .0005$)
- Perceptions about the cost of sewer service ($p = .015$)
- The amount of time lived in the home ($p = .008$)
- Environmental awareness ($p = .002$)
- Respondent's age ($p = .001$)

The regression analysis indicates that the more someone thinks sewers are more expensive than septic systems and the longer someone lives in their home the less likely they are to prefer sewers. But the more environmentally aware someone is, the older they are, the more they spend on system maintenance, and if they experienced a problem with their septic system in the past five years, the more likely they are to prefer sewers.

[5] The factors found not to affect preference for sewers included whether the PPCC served a respondent's county; whether someone lived in the country; education; knowledge about a system; whether a respondent thought a homeowner should be responsible to pay for a failed system; and whether a respondent thought a homeowner was best able to care for a system.

The analysis also yielded some interesting findings in terms of the relationships between these drivers in how they affect preference for sewers. Figure 3-18 shows the preference for sewers by a homeowner's age and their environmental awareness. It is clear that for people 45 and younger, preference for sewers does not vary in any meaningful way by levels of environmental awareness. However, for the older age group the more environmentally aware someone is, the more they prefer sewers.

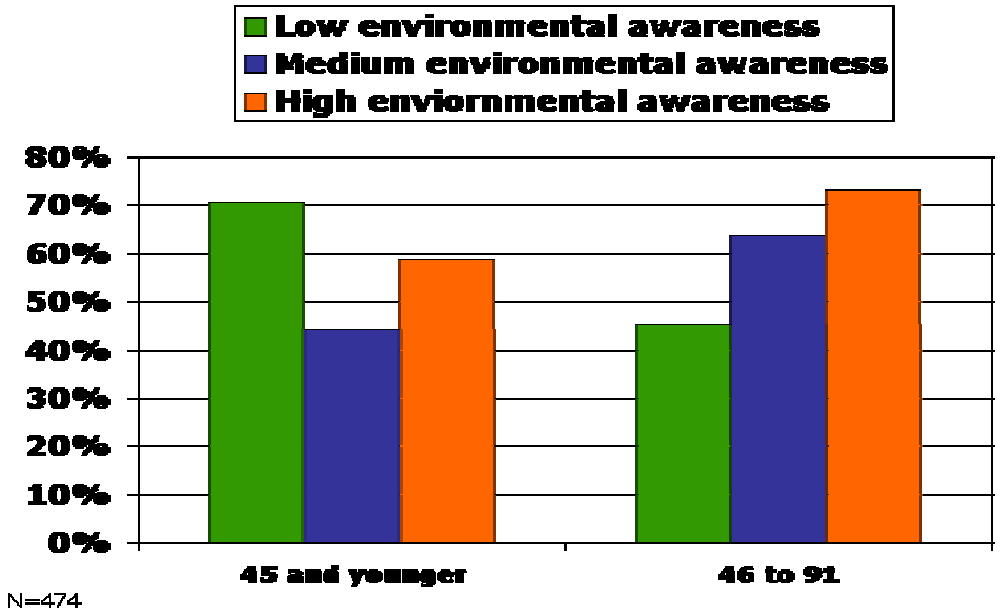


Figure 3-18
Homeowners' Preferences for Sewers by Age and Environmental Awareness

Another interesting relationship exists between the amount spent on annual septic system maintenance and whether system problems were experienced in the past five years. This relationship is illustrated in Figure 3-19. It appears that homeowners who experience problems are more likely than those who have not experienced problems to prefer sewers up to the point where they spend $100 annually on maintenance and the degree to which sewers are preferred increases with the amount spent. But when homeowners reach the point where they spend more than $100, they prefer sewers regardless of whether problems have been experienced.

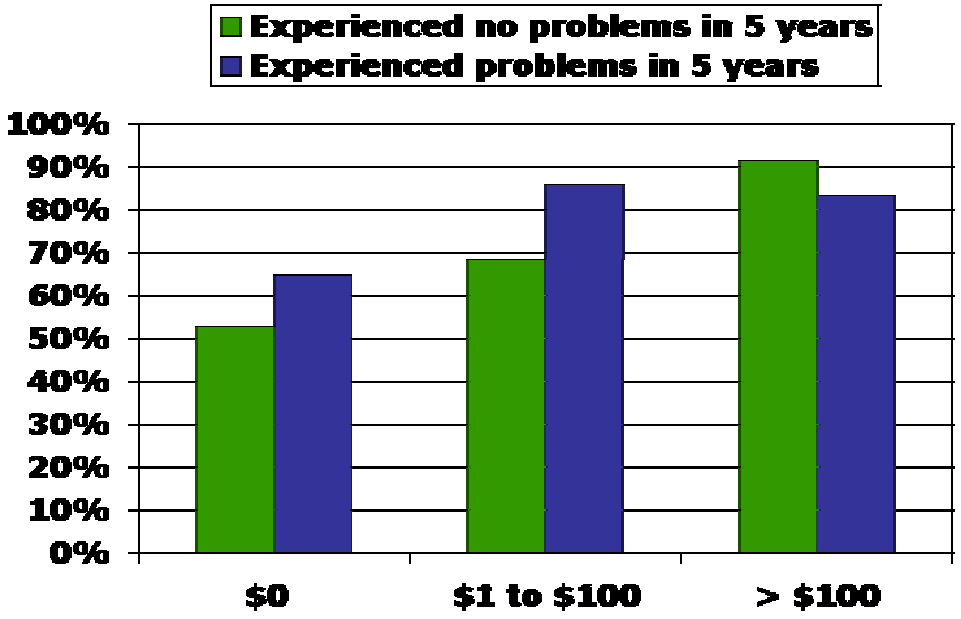


Figure 3-19
Homeowners' Preferences for Sewers by Annual Maintenance Costs and System Problems Experienced

Attractiveness of Maintenance/Management Service

The general finding in regards to the attractiveness of a maintenance/management service is that most people would be willing to pay something for such a service and be equally open to a private company or county government as a provider of this service.

Homeowners on average said they would pay $70 annually to their local health department or private utility to inspect, manage, troubleshoot, and repair their septic system. Overall, 75% of respondents said they would pay something for this service. In regards to the amount, 61% said they would be willing to pay more than what they currently spend on system maintenance, and 26% would pay between $101 and $500. Such an expenditure would support only a lower level management service, which might be sufficient for conventional onsite systems but not for appropriate management of advanced systems.

The willingness to pay for such a maintenance/management service, and the amount that is acceptable, varies by such factors as the homeowners' location, their income, the age of the system, the amount homeowners currently spend on maintenance, and the occurrence of problems with their septic system. Figure 3-20 shows a trend that such a service is valued most by homeowners with higher incomes, those who live in a town, and those whose septic systems are 10 years old or newer.

It is also evident in Figure 3-21 that the more that someone spends on maintenance annually, the more willing they would be to pay for a maintenance/management service and the more money they would be willing to spend.

	Nothing	$1 to $100	$101 +
Income			
< $20k	27%	52%	21%
$20k to $80k	19%	52%	29%
$80k +	27%	24%	49%
Area			
County	24%	52%	24%
Subdivision	27%	43%	30%
Town	29%	37%	35%
System Age			
21 years +	31%	47%	22%
11 – 20 years	22%	53%	25%
10 years or <	23%	47%	31%

Figure 3-20
Maximum Amount Homeowners Willing to Pay for Maintenance/Management Service by Income, Area, and System Age

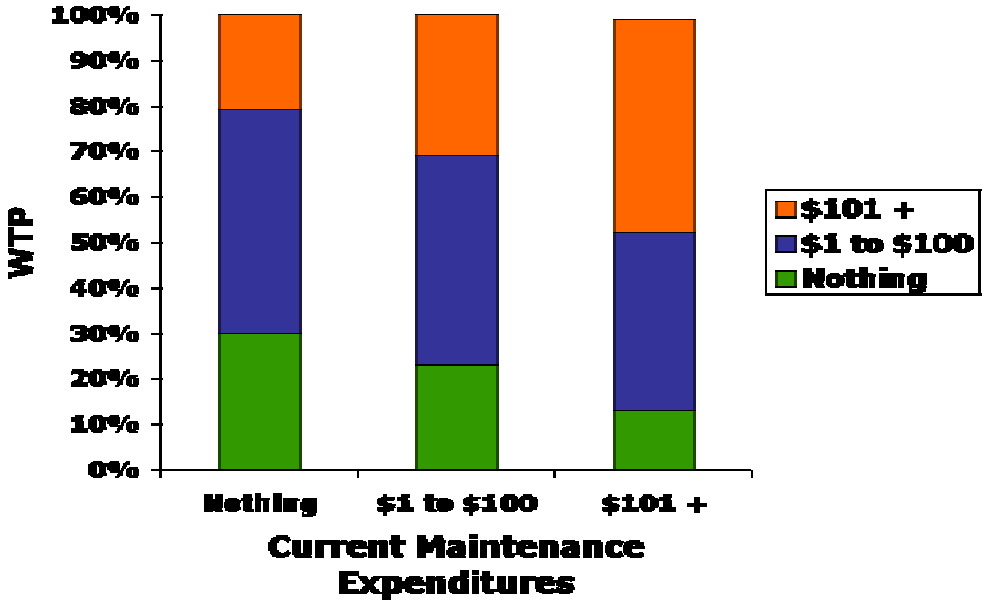


Figure 3-21
Homeowners' Current System Maintenance Costs Vs. Amount Willing to Pay for Maintenance/Management Service

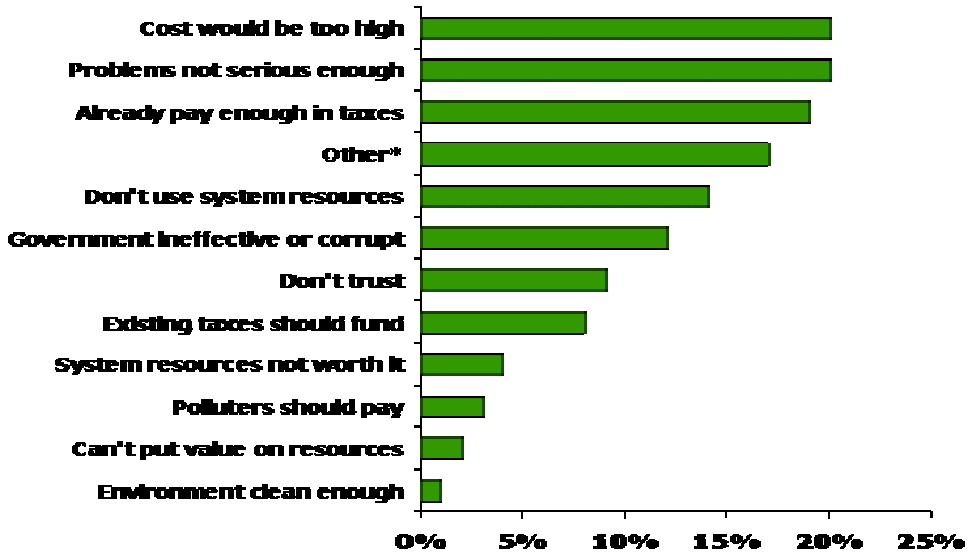
Homeowners' experience with system problems and their repair practices also are related to their openness to a maintenance service. Figure 3-22 shows that people who have experienced problems within the past five years, compared to those who have not, are more likely to value a maintenance service. It also is clear that problems that affect the living conditions of someone's home—such as smells and wet spots near the septic tank—are drivers for willingness to pay for a maintenance service. And it appears that people who have repaired problems themselves in the past would be willing to pay to have it done by someone else and place a high value on that service.

	Nothing	$1 to $100	$101 +
Problems Past 5 Yrs?			
No	26%	51%	23%
Yes	19%	45%	36%
Smell near tank	17%	39%	44%
Wet spot near tank	18%	38%	44%
Fixed Problem Themselves?			
No	20%	50%	30%
Yes	17%	31%	51%

Figure 3-22
Maximum Amount Homeowners Willing to Pay for Maintenance/Management Service by Experience With Problems and Repair Practices

It also should be noted that 25% of homeowners would not be willing to pay for such a service. The main reasons for this unwillingness to pay, as shown in Figure 3-23, are related to cost, a perceived lack of need, and negative attitudes about the government.

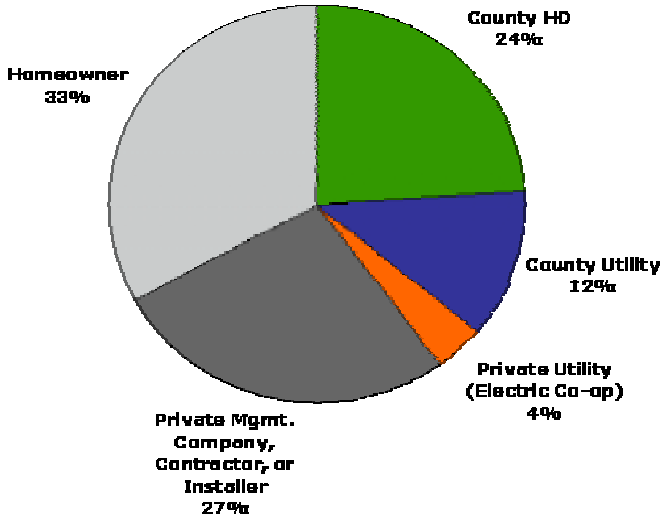
In regards to preferences for a maintenance/management service provider, homeowners are equally likely to seek service from a private company as they would from a government entity. Homeowners, in general, are pleased with how their counties regulate, manage, and oversee septic systems, with 68% saying their health department does a good job or better. But Figure 3-24 shows that while about a third of respondents would trust a county entity to provide a maintenance/management service, an almost equal amount would prefer either a private utility, contractor, or other type of private company. The primary preference of homeowners—33% of them—is for them to perform required maintenance. This concept universally has not occurred.



*Includes that the homeowner should be responsible, septic system operates well, the respondent doesn't make such decisions, more information was needed, and service should have a one-time payment.

•Results based on 130 respondents who were unwilling to pay for a maintenance/management service.

Figure 3-23
Homeowners' Reasons for Lack of Willingness to Pay for Maintenance/Management Service



• "Electric co-op" was not emphasized in the response option presented to homeowners, so many may have been referring to an investor-owned utility.

• Results do not include respondents who didn't know.

Figure 3-24
Homeowners' Preference for Who Is Best Able to Manage and Maintain Septic Systems

An OLS regression equation was specified to determine what affected the amount homeowners were willing to pay. The predictors used in the equation were:

- Whether the PPCC served a respondent's county
- Age of the septic system
- Septic system knowledge
- Environmental awareness
- Education
- Income
- Whether a problem was experienced in the past five years
- The time someone lived in their home
- Respondents' rating of the county health department in regulating and managing systems
- Whether someone lived in the country
- Whether the tank was pumped in the past five years
- Perceptions about cost of sewer service

Figure 3-25 reports the results of the final OLS equation of a series of stepwise regressions.

Independent Variable	Standardized Beta	Significance
Time lived in home	-.106	.036
County served by PPCC	-.099	.041
Income	.113	.026
Problem experienced in the past five years	.120	.012

N = 411 R-squared = .059

Figure 3-25
Effects on Amount Willing to Pay for Maintenance/Management Service

It is apparent that the more years someone lived in their home and if they lived in a county served by the PPCC government management service, the less money they would be willing to spend on a maintenance/management service. But the higher one's income and if they experienced a problem

with their system in the past five years, the more money they would be willing to spend on a service.[6]

An interesting relationship also emerged between income and the occurrence of a problem with a system in affecting the amount someone was willing to pay for a maintenance/management service. As is illustrated in Figure 3-26, increasing income levels has a slight effect in increasing someone's willingness to pay between $101 and $500 for a service when they have not experienced a problem with their septic system in the past five years. However, when a problem with someone's system has occurred, increases in income dramatically increased someone's willingness to pay between $101 and $500 for a service.

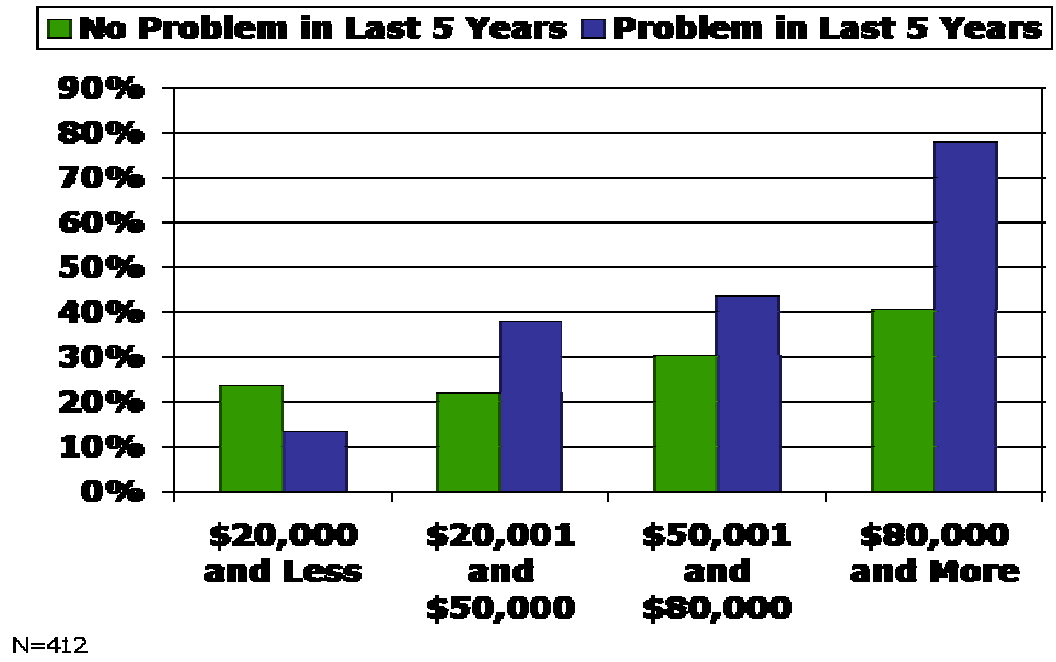


Figure 3-26
Percentage Willing to Pay Between $101 and $500 for a Maintenance/Management Service by Income and Occurrence of System Problem in Last Five Years

Though environmental awareness did not significantly affect the amount someone was willing to pay for a maintenance/management service, it did have an interesting relationship with the occurrence of system problems in affecting someone's willingness to pay between $101 and $500 for the service. As is illustrated in Figure 3-27, for homeowners who did not experience problems with their septic system in the past five years, increases in environmental awareness had a slight effect in increasing willingness to pay between $101 and $500 for a maintenance/management

[6] The coding for the independent variables measuring problems experienced in the past five years and whether someone's county is served by the PPCC are dichotomous. The coding for income is indicated for Q45 in the questionnaire attached in Appendix A. And the coding for the variable measuring the time someone lived in their home is 1 for two years or less; 2 for three to five years; 3 for six to 10 years; 4 for 11 to 15 years; 5 for 16 to 20 years; 6 for 21 to 25 years; 7 for 26 to 30 years; and 8 for 31 years or longer.

service. However, when a system problem did occur, increases in environmental awareness dramatically increased willingness to pay between $101 and $500 for a service.

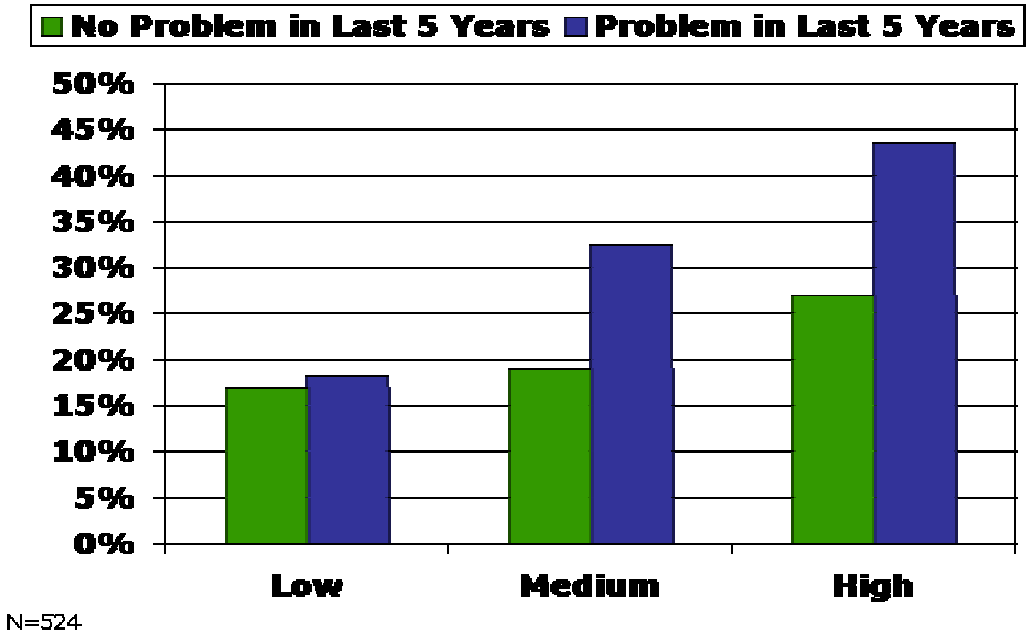


Figure 3-27
Percentage Willing to Pay Between $101 and $500 for a Maintenance/Management Service by Environmental Awareness and Occurrence of System Problem in Last Five Years

Information Channels

Given the findings thus far, there is a clear opportunity for a campaign to inform homeowners about wastewater issues. Such an effort might be used to alter attitudes and behavior, such as by targeting homeowners who are unwilling to pay for a maintenance service or to provide information to those who have less than a solid knowledge about their septic systems. Conversely, an information campaign also might be used to reinforce the behavior of those with high levels of knowledge about their septic systems and who actively care for them. The question becomes, then, what are the best communication channels through which to reach these different groups of people?

The Septic System Survey 2000 addresses various methods through which to spread information, such as meetings, the Internet, individual contact with experts, and printed information received in the mail. However, there are several caveats surrounding this data and its applicability to NDWRCDP's purposes is limited for a couple of key reasons.

First, the survey questions about communication assume that the homeowner proactively seeks information, rather than being the mere receiver of information. The nature of the questions, then, raises the risk that respondents greatly over-report their inclination to be reached via these channels, particularly because there is an element of social desirability to receive this information.

In short, there is a strong possibility that more respondents would say they would attend a county septic system information meeting, for instance, than would actually attend one.

The second element of the questions about communication channels that limit their applicability for the NDWRCDP is that embedded in them is the assumption that the information is government sponsored. Thus, given the findings that indicate some skepticism about government's role in overseeing septic systems, it is possible that the amount of homeowners who would be receptive to government-sponsored information is different than the amount of homeowners who would be receptive to information that came from another source such as a private utility.

Despite these concerns, though, it is worthwhile to look at these data in terms of what they indicate about homeowners' preference for each of the communication channels and how this relative preference might vary by such factors as the level of information people posses about septic systems, environmental awareness, preference for sewer systems, and willingness to pay for a maintenance/management service.

Figure 3-28 shows that respondents are more likely to obtain information about the care and maintenance of their septic system through the Internet or a meeting, versus calling an expert or writing for information. This trend persists when other key factors are considered.

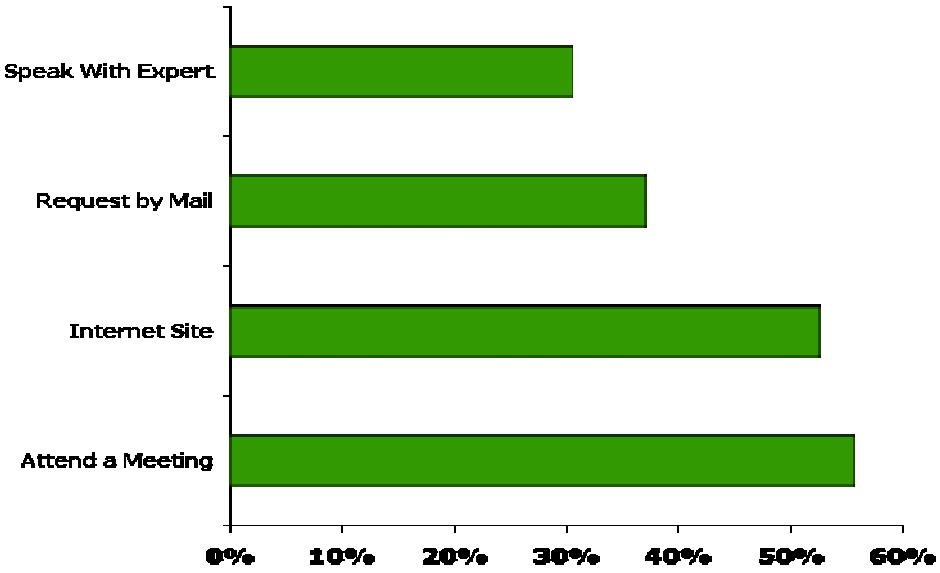


Figure 3-28
Percentage of Homeowners Who Are Very Likely to Use Methods of Information

Further analysis indicates that homeowners seem to make a tradeoff in their efforts—they either are willing to pay for a maintenance/management service and/or want sewer service or they opt to learn about how to care for the system. Thus, the less someone is willing to pay for a maintenance/management service or the less they prefer sewers, the more likely they are to access information through the various channels. These trends are illustrated in Figure 3-29 and Figure 3-30.

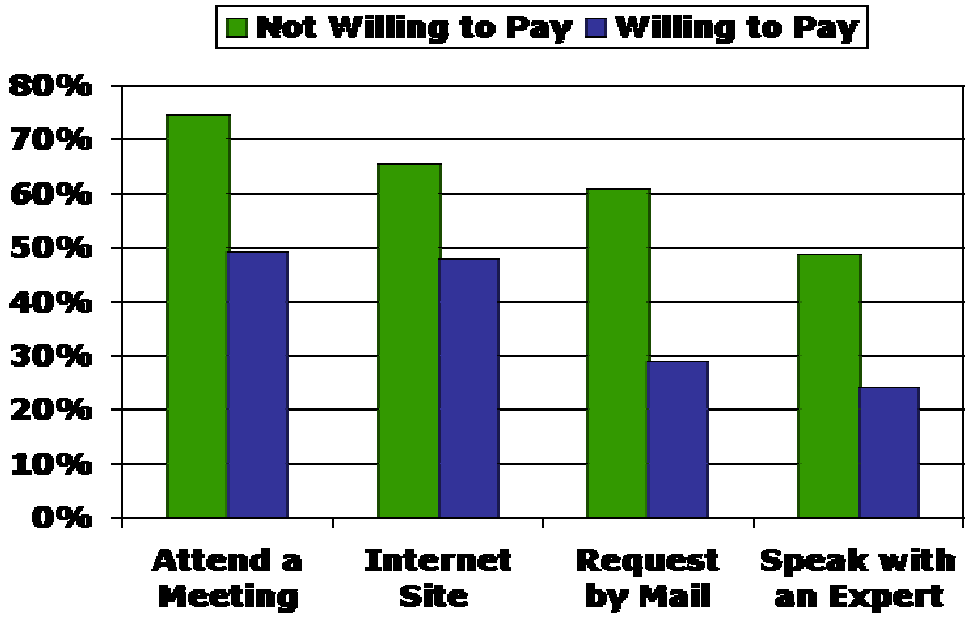


Figure 3-29
Percentage of Homeowners Who Are Very Likely to Use Methods of Information by Willingness to Pay for a Maintenance/Management Service

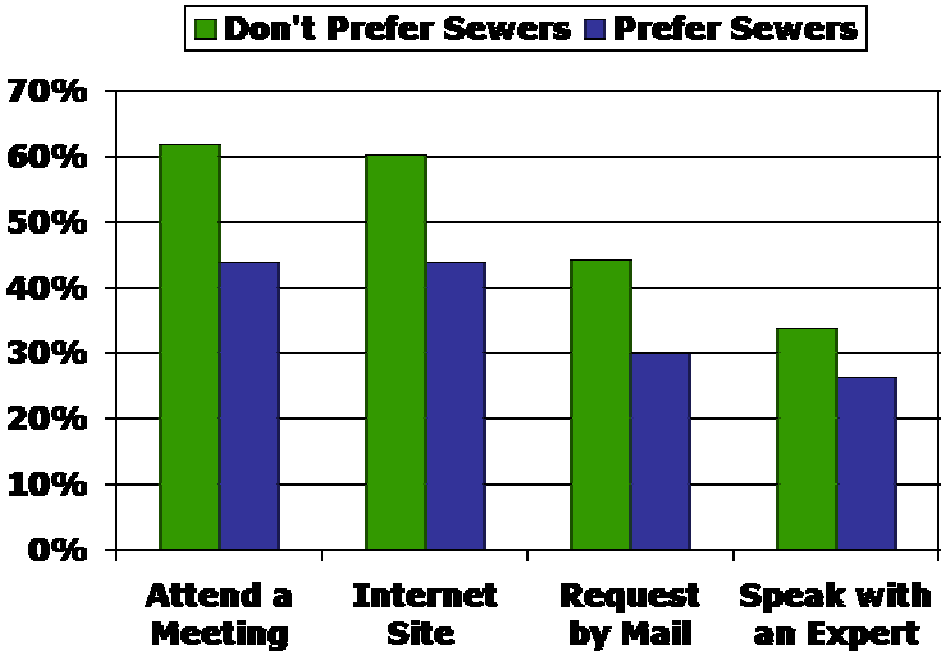


Figure 3-30
Percentage of Homeowners Who Are Very Likely to Use Methods of Information by Preference for Sewers

These findings further support the notion that meetings and the Internet seem to be more effective than offering material through the mail or over the phone in communicating information about wastewater issues to homeowners, including those who prefer sewers to septic systems and those not willing to pay for a service.

Another trend revealed in these findings is that those homeowners who are less knowledgeable about septic systems and the environment are more likely to seek out information than more knowledgeable homeowners (especially via meetings or the Internet). These trends are illustrated in Figure 3-31 and Figure 3-32. These findings are consistent with the earlier one that the largest number of homeowners think they can manage their systems by themselves, especially if they can get information about their system.

With this chapter serving as a backdrop, the discussion now will turn to what these findings indicate about the opportunities that exist to increase homeowners' knowledge about wastewater treatment solutions, for a private distributed wastewater maintenance/management service, and for the adoption of new distributed wastewater treatment technologies. These will be addressed in Chapter 4.

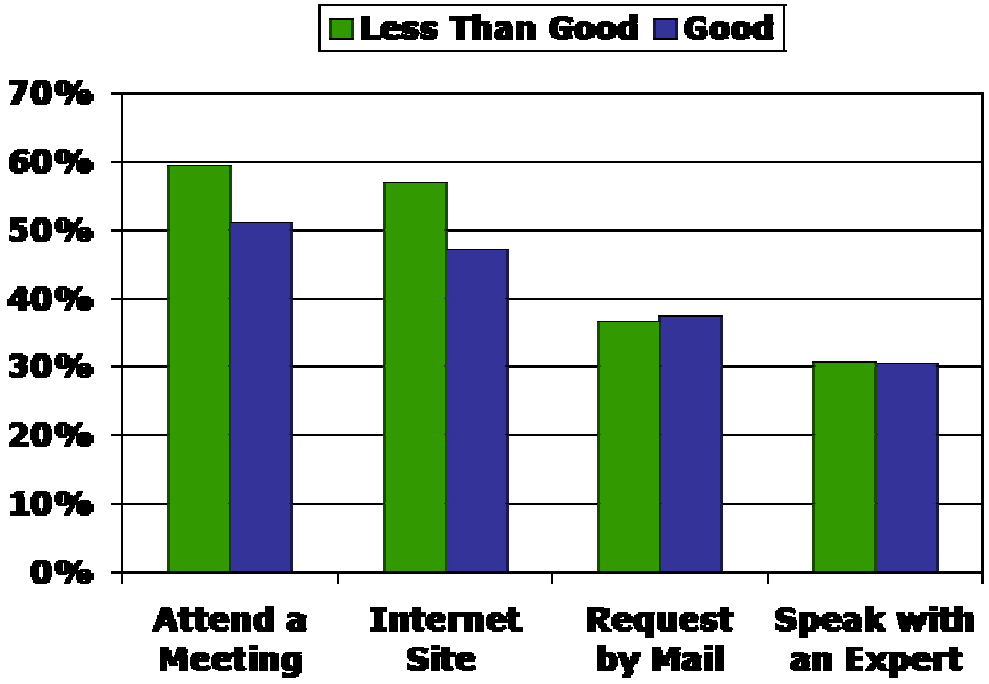


Figure 3-31
Percentage of Homeowners Who Are Very Likely to Use Methods of Information by Levels of Septic System Knowledge

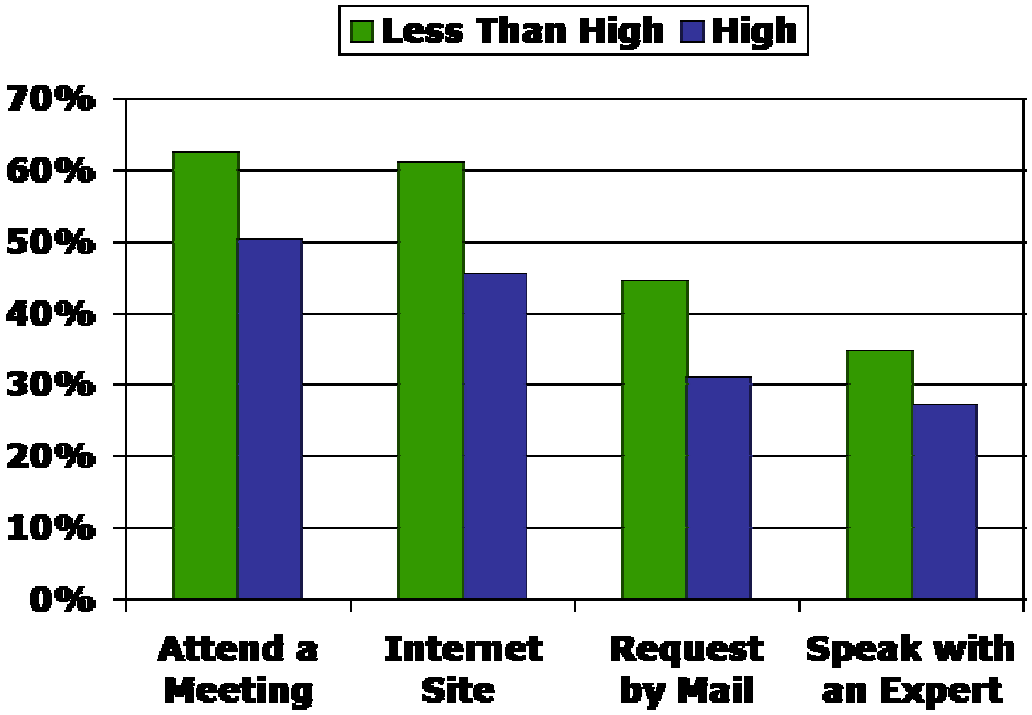


Figure 3-32
Percentage of Homeowners Who Are Very Likely to Use Methods of Information by Levels of Environmental Awareness

4 CONCLUSION

Despite the lack of market penetration made by more-advanced distributed wastewater treatment technologies and the current uncertainty about future adoption of these systems and of management and maintenance services, analysis of the Septic System Survey 2000 indicates there might be future opportunities for DWTT and these services. More specifically, there appears to be an opportunity for a maintenance/management service provided by private companies and for new distributed wastewater treatment technologies, both of which in part are related to a need to fill an informational gap that exists among homeowners.

Opportunity for Information Campaign

The first implication from the analysis is that there is an apparent opportunity for an information campaign to bolster support for both distributed wastewater treatment technologies and a third-party maintenance/management service. This contention is based on the findings related to homeowners' knowledge about costs of different wastewater treatment options, system operations, and the relationship between water quality and wastewater treatment systems.

In regards to knowledge about the cost of wastewater treatment options, homeowners correctly perceive that septic systems cost less than sewer service. But most homeowners do not know exactly how much it would cost to connect—or how much more it would cost than a septic system.

Likewise, homeowners have little knowledge about what are the indicators that a septic system is malfunctioning. Out of seven indicators, homeowners on average were familiar with only two. Moreover, those indicators of potential septic system problems that homeowners cited most frequently—toilets backing up, bad smells, and slow drains—are the indicators that directly affect peoples household activities. This reveals that people think of the indoor plumbing drainage system and the septic system as one system. Two of these common symptoms, slow drains and toilets backing up, may be either an indoor plumbing problem or a septic system problem.

It is evident in the findings that homeowners' knowledge of septic systems is important in terms of their maintenance practices—the more knowledgeable they are, the more they will pump their septic tanks and have other maintenance performed. Homeowners' knowledge about the effects that septic systems have on water quality also appear to be lacking, given that almost half of the respondents said septic tanks have no effect on water quality.

Not only do these findings imply an opportunity to launch an information campaign to fill in these knowledge gaps, such a campaign would be just as likely to be received by people less sophisticated about septic systems and the environment as those who are. It is possible that with more knowledge about the actual expense of sewer service, homeowners would be more apt to

prefer septic systems. It is also possible that more homeowners would be attracted to a maintenance/management service if they were more informed about when their system is malfunctioning and what effects it could have on their water quality.

Given the findings regarding homeowners' preferences for different channels of communication, it might be best for an information campaign to use Internet sites and meetings/workshops. The latter forms also have been known to provide homeowners with hands-on knowledge that can be passed on to other homeowners. This survey did not address the receptiveness of homeowners to different sources of information (for example, local government, private sector, and university extension) via these channels.

Furthermore, the finding that homeowners in counties served by a government management service were less knowledgeable about septic systems than those in other counties may indicate that service providers and county agencies in counties without government management are compensating with more homeowner education. The outcome from understanding this relationship should be to enable educational outreach to users of managed and unmanaged systems, as all homeowners need to be able to understand their systems enough to know when to call their local service provider or management entity with a problem.

Opportunity for Private Maintenance/Management Service

It is also clear from the analysis that there is a potential opportunity for a private, third-party distributed wastewater treatment system maintenance/management service. This is based on findings related to homeowners' perceptions of the function and cost of septic systems, their maintenance and repair practices, their willingness to pay for a professional maintenance/management service, and the level of effort associated with maintenance.

The contention that there is an opportunity for such a service is first based on how people view their systems. Septic systems are seen by many homeowners as a permanent wastewater solutions that are expensive to replace. Moreover, most homeowners expect that they would have to pay the cost of replacing their system.

There also appears to be an opportunity for a maintenance/management service based on homeowners' perceptions and practices as they relate to maintenance. First of all, most people understand the need to perform routine maintenance such as inspections and pumping tanks, but in actuality this maintenance often is not done. For instance, of the people who said systems should be pumped at least once every five years, more than 40% have not followed this practice. Another related data point that supports the launching of a maintenance/management service is that most of the people who prefer sewer service to septic systems do so because there are fewer worries and less on-site maintenance required.

Many homeowners also look for help in keeping their systems functioning. For instance, of the homeowners who experienced problems in the previous five years—who account for about one-fourth of the sample—more than 60% of them called someone to perform the repairs. It is also likely there will be a growing need for such a service given that system age is a key driver to the occurrence of problems and that many systems are already old—40% were built in 1980 or earlier.

The occurrence of problems, in turn, is a key driver to someone being willing to pay for a maintenance/management service and positively affects the amount they would pay.

Also, three-quarters of respondents said they would be willing to pay for a maintenance/management service. There is an opportunity for a privately provided service given that there is some skepticism about government involvement in overseeing septic systems and that respondents were just as likely to say they would prefer a private company as a provider as they would a government.

Overall, there appears to be an opportunity for the service provided by a private third-party because of the value homeowners place on their system and professional services, as well as their maintenance practices. It is possible that homeowners would gravitate toward such a service given that they would want to stave off an expensive system replacement, they know that it is important to conduct routine maintenance, and not only do they trust professionals, but many prefer to deal with private companies. An improved information program also might dispel the myth that homeowners can perform the maintenance their systems require.

If an effective maintenance/management program could be priced for about $100 for conventional systems or as much as $300 to $500 for more-advanced systems and would cover inspection of the septic tank and leach field area and measurement of solids, it may not be acceptable to owners who have not had a problem in the last 5 years. A stronger case for the financial benefits and environmental need will have to be developed to address owners who have not had recent septic system problems or have lower incomes. Inspections including measurement of solids can have a direct benefit of determining appropriate septic tank pumping intervals. This can have a positive benefit of only requiring pumping when needed. The pumping fees could be included in maintenance management. However, owners of tanks that need too frequent pumping may be required to pay a penalty for household practices that lead to excessive solids accumulation.

Opportunity for New Distributed Wastewater Treatment Technologies

A third implication from the findings is that there is a wide variation in the local perception of capital cost of replacing septic systems. In the counties surveyed, 40% did not know the cost of replacement. Of those who estimated cost of replacement, 31% estimated costs at less than $2,000, 36% estimated costs at less than $ 4,000, and 19% felt onsite system replacement would cost less than $8,000. Although the specific costs cannot be extrapolated to other areas, the general variability in expectation of costs is likely to occur elsewhere. This wide range of perceived replacement costs may be a barrier to widespread use of advanced treatment technologies, unless one or more of the following occurs: the technologies are either allowed or mandated by public health codes; the capital and management costs become competitive with existing range of onsite wastewater system technologies; the community case can be made for the managed advanced treatment technology’s cost-effectiveness relative to sewers; or an equalization of the variability of system replacement costs can be achieved through management.

Currently, the replacement costs of systems depend on the local range of site and soil conditions that require a range of technical solutions. Therefore, although there has been reluctance in the market to adopt new distributed wastewater treatment technologies, an opportunity may exist for

market penetration in the future. This contention is based on the age and types of systems in use and some homeowners' preference for septic systems.

System age is relevant to the discussion of system replacement. About 40% of homeowners said their systems were older than 20 years, with about a quarter of them older than 40 years. And close to three-quarters of the systems in use are conventional systems, with few more-sophisticated systems in place. Furthermore, even if it were assumed that the costs for both systems were the same, about 40% of homeowners said they would prefer septic systems to sewer service. These findings indicate that there is a potential market for new DWTT.

This survey did address the opportunities for annual fees associated with septic system management. But the concept of incorporating capital replacement cost into annual fees for onsite systems was not specifically addressed. Nor was the concept of having a management entity completely responsible for repair and replacement of septic systems. However, an Responsible Management Entity (RME) that is responsible for inspections, operation, maintenance, repair and replacement of all septic systems in an area could set fees to cover capital costs of septic system repair and replacement. Savings that might be achieved through cost efficiencies of increasing the longevity of existing infrastructure via proper operation and maintenance of properly functioning septic systems could be allocated to a capital fund. This capital could then be invested into replacement of improperly functioning septic systems using the most appropriate technology for the environmental conditions based on long-term capital and operation and maintenance costs. This could serve to drive the market toward wider use of cost-effective advanced treatment technologies.

Opportunity for Future Research

Though analysis of the of Septic System Survey 2000 data is useful in addressing the NDWRCDP's research needs, there clearly is an opportunity for future research. Particularly, there is an opportunity to conduct research that is improved in its representation of the population, in the methodological approach in terms of providing breadth and depth of knowledge about homeowners' attitudes and behavior, and in content that better addresses the NDWRCDP's research interests.

Representation

One obvious improvement that could be made by additional research is in regard to how representative is the sample of the population of interest. Though they might reflect attitudes and behavior of owners of homes with septic systems throughout the U.S., the findings only directly represent a small geographic area in northeast North Carolina.

It is suggested that future research is based on a sample that is more representative of the population in which the NDWRCDP is interested—either select areas throughout the U.S. or the nation overall. How representative the sample is will directly affect how representative the findings are. And what constitutes the sample will depend solely on what population NDWRCDP is

interested in addressing. At a minimum, however, future surveys should include homeowners currently on sewer systems to determine how they view DWTT.

Methodological Approach

As with quantitative research methods in general, this study yielded a breadth of information about the subject of interest—it provided an understanding of the attitudes and behavior of many homeowners. However, also typical of quantitative work, it was lacking in terms of the depth of knowledge it yielded. For instance, while the analysis was able to identify that respondents are just as likely to select a private provider of a maintenance/management service as they are a government provider, it did not provide information on which to draw any conclusions as to why.

Given the limitations of research based solely on a quantitative approach, it would be ideal if future research employs both quantitative and qualitative methods. This is certain to yield knowledge with both depth and breadth of the subject, thus enabling the NDWRCDP to understand people's attitudes and behavior and to explore why people think and act the way they do.

Along with a public opinion survey of a large enough sample to adequately represent the population of interest, it is suggested that a series of in-depth interviews or focus groups be conducted. These interviews would be structured and focused on the same issues covered in the survey, but enable the research to drill further down into respondents' comments and understand them more than is enabled in a quantitative survey.

Content

Any future research also should be more specifically focused on the NDWRCDP's research questions. In the current product, not specifically measuring characteristics and issues of interest was one of the tradeoffs of using secondary research. Thus, given the NDWRCDP's interests, we offer the following suggestions for future research:

- The information channels addressed should be geared more toward the ones that the group envisions would be used in an information campaign. Likewise, NDWRCDP also should attach to these channels the types of sponsors in which the group is interested.
- The measurement or willingness to pay for a maintenance/management service should be geared more towards the specific types of services and providers that NDWRCDP is considering.
- Given NDWRCDP's interests in these areas, future research should address attitudes toward different types of distributed wastewater treatment technologies, their operational characteristics, and required maintenance; cluster applications; and arrangements in which a third-party such as a Responsible Management Entity is an owner/operator of septic systems.
- The specific benefits and detriments of DWTT and their relative importance as seen by homeowners should be addressed.

- Though they were included in the *Septic System Survey 2000*, first-time homeowners and people who recently moved into their home and did not previously have a septic system should be identified so that any analysis could take this into consideration.
- The research should address when homeowners actually have wastewater treatment options and how homeowners obtain information about their wastewater treatment options.
- The research should explore more the tradeoffs homeowners make in operating septic systems versus connecting to sewers in terms of costs, the ongoing effort required of the homeowner, the level of control the homeowner has, and the associated environmental impact imposed by the options.
- Given the potential effects that it could have on attitudes and behavior relating to wastewater treatment options, future research should consider the role governments or RMEs play in managing and maintaining septic systems and the political environment relating to DWTT.
- The frequency of actual septic system problems, how those problems are remedied and by whom, and what are the associated expenses, should be addressed.
- The research also should focus on what constitutes annual maintenance in the minds of homeowners and the associated expenses.
- Finally, we suggest future research instruments explicitly describe for respondents terms and concepts in a manner that is generally understood by homeowners rather than using jargon. Furthermore, it is suggested that in cases where there might be confusion about the material being presented or when respondents might be unfamiliar with a concept the instruments should include information to educate the respondents to ensure that the instrument reliably measures respondents' attitudes and behavior.

In conclusion, it would be worthwhile for the NDWRCDP to conduct further research that it is based on a sample that is representative of the population in which the group is interested, employ a method that enables researchers to explore respondents attitudes and behavior regarding wastewater treatment, and that the content of the research instruments specifically addresses the group's research questions. We think such research would yield a solid understanding of the current state of the DWTT market and better enable NDWRCDP to provide resources to the industry.

5 LIST OF ACRONYMS AND ABBREVIATIONS

DWTT	Distributed Wastewater Treatment Technologies
Logit	Logistic Regression
NDWRCDP	National Decentralized Water Resources Capacity Development Project
OLS	Ordinary Least Squares Regression
PPCC	Pasquotank, Perquimans, Camden, and Chowan counties Health District (NC)
RME	Responsible Management Entity

A SEPTIC SYSTEM SURVEY—2000

SEPTIC SYSTEM SURVEY — 2000

(919) 555-1234 *ID: 1001*

CHOWAN COUNTY *COUNTY: 041*

ID1 *(1-4)*
Card1 1 *(5)*
County *(6-8)*

CONTACT STATUS

	1	2	3	4	5	6	7	8	9	10	11	12
TIME												
DATE												
STATUS												

STATUS CODES

AM	*ANSWERING MACHINE*	***CI***	*COMPLETED INTERVIEW*	***HI***	*HOUSEHOLD INELIGIBLE*	***PC***	*PARTIALLY COMPLETED*
BG	*BUSINESS / GOVERNMENT*	***CL***	*CAN'T LOCATE*	***NA***	*NO ANSWER*	***RF***	*REFUSED*
BS	*BUSY SIGNAL*	***DL***	*DEAF / LANGUAGE*	***NL***	*NO LISTING*	***TI***	*TERMINATED INTERVIEW*
CB	*CALL BACK*	***FX***	*FAX / MODEM*	***OS***	*OUT OF SERVICE*	***WN***	*WRONG NUMBER*

I N T R O D U C T I O N

Hello, my name is _____, and I am calling from N. C. State University. Have I reached [*REPEAT NAME OR NUMBER ABOVE*]? [*IF YES*] We are conducting a research survey about water quality and sewage disposal in our state. All respondents to this survey have been chosen randomly from among eastern North Carolina residents and all information provided will be completely confidential. May I please speak with the male or female head of the household who may be able to best answer questions about water quality and sewage disposal? *N*

A. Do you own your home or do you rent your home?
- Own / buying 1
- Rent ..... [*HI - END INTERVIEW*] 0

1(527)

IF RENT: SINCE THE REST OF THE INTERVIEW APPLIES TO HOMEOWNERS ONLY, THAT'S ALL THE QUESTIONS I HAVE FOR YOU. THANKS FOR YOUR TIME.

B. Does your home have a septic tank?
- Yes 1
- No/Don't know ... [*HI - END INTERVIEW*] ... 0

1(527)

IF NO: SINCE THE REST OF THE INTERVIEW APPLIES TO HOMEOWNERS WITH SEPTIC TANKS ONLY, THAT'S ALL THE QUESTIONS I HAVE FOR YOU. THANKS FOR YOUR TIME.

1. When was your septic system installed? _____
   (*OR, ALTERNATELY,* When was your house built?) _____
   - *[ED CODE]* ___ ___ ___ ___ *1900-2000 (443)*
   - Don't know ..... 9998 *9998 (84)*

2. What type of septic system do you have?
   [*READ LIST*]
   - Conventional ..... 01 *1(210)*
   - Sand lined trench ..... 02 *2(70)*
   - Pump (LLP or Pressure manifold) ..... 03 *3(12)*
   - Other [*SPECIFY*] _____ .... ___ ___
   - Don't know ..... 98 *98(235)*

3. Do you know where the septic tank is located?
   - Yes ..... 1 *1(514)*
   - No ..... 0 *0(13)*

4. Do you know where the drain field is located?
   - Yes ..... 1 *1(457)*
   - No ..... 0 *0(70)*

5. Within the last **five years**, have you had any of the following problems... [*READ ITEM*]?

	Yes	No	
A. Slow drains	1	0	1(72) 0(454)
B. Sewage backing up in house	1	0	1(30) 0(497)
C. Bad smell near tank or drain field	1	0	1(52) 0(475)
D. Wet spots near tank or drain field	1	0	1(61) 0(466)
E. Sewage on the surface	1	0	1(15) 0(512)
F. Sewage flowing to ditch	1	0	1(6) 0(521)
G. Other [*SPECIFY*] _____ [*ED CODE*] ___ ___			1(9)

IF "NO" TO ALL ITEMS GO TO Q 8

6. [*IF ANY ITEM ABOVE "YES"*] Did you, **personally**, fix (any of) the problem(s)?
   Yes.....1 No.....0 — 1(35) 0(90)

7. [*IF ANY ITEM ABOVE "YES"*] Did you **call someone** to fix (any of) the problem(s)?
   Yes.....1 No.....0 — 1(79) 0(46)

8. Do you think any of the following **are** limitations to **where** a septic system may be located... [*READ ITEM*]?

	Yes	No	
A. Distance to surface water	1	0	1(285) 0(212)
B. Low lying areas	1	0	1(306) 0(210)
C. Slope of the land	1	0	1(261) 0(241)
D. Wet soil	1	0	1(302) 0(207)
E. Clay soil	1	0	1(256) 0(240)
F. Sandy soil	1	0	1(175) 0(333)
G. Hard pan	1	0	1(165) 0(282)
H. Organic soil	1	0	1(128) 0(328)

9. Which of the following are parts of the septic system... [*READ ITEM*]?

	True	False	
A. The house	1	0	1(343) 0(166)
B. The septic tank	1	0	1(501) 0(23)
C. The "D" box	1	0	1(375) 0(88)
D. The drain field	1	0	1(466) 0(52)
E. The soil	1	0	1(416) 0(97)

10. Is a septic system designed to **treat sewage** or to **get rid of sewage**?
    Treat sewage.....1
    Get rid of sewage.....2
    Both.....3
    Neither.....4
    Don't know.....8
    — 1(129) 2(233) 3(90) 4(18) 8(57)

11. Is a septic system designed to **act as a temporary solution until sewer is available** or to **act as a permanent method for wastewater management**?
    Act as a temporary solution until sewer is available.....1
    Act as a permanent method for wastewater management..2
    _____
    Both.....3
    Neither.....4
    Don't know.....8
    — 1(62) 2(377) 3(36) 4(3) 8(49)

12. What sort of maintenance should be done to a septic system... [*READ ITEM*]?	Yes	No	*N*
A. Nothing	1	0	*1(80) 0(441)*
B. Add yeast	1	0	*1(176) 0(301)*
C. Add tank cleaners	1	0	*1(267) 0(232)*
D. Pump out tank	1	0	*1(438) 0(82)*
E. Inspect for damage/sufficiency	1	0	*1(374) 0(142)*
F. Establish grass cover	1	0	*1(392) 0(122)*
G. Plant trees and shrubs	1	0	*1(49) 0(472)*
H. Other [*SPECIFY*] _____ ....[*ED CODE*] ___ ___			*1(11)*

13. How often should a septic tank be pumped? [*READ LIST*]	Yearly	1
	Every 3 to 5 years	2
	When there is a problem	3
	Never	4
	Depends on frequency of use…..	5
	Don't know	8

14. When was the last time your septic tank was pumped? [*READ LIST*]	Within the last year	1
	Within the last three years	2
	Within the last five years	3
	Five or more years ago	4
	Never	5
	Don't know	8

15. Other than yourself, does anyone periodically inspect your septic system?	Yes	1
	No .....[*GO TO Q17*]	0
	Don't know.....[*GO TO Q17*]	8
16. [*IF "YES"*] Who?	Plumber	1
	Family Member	2
	County or Gov. HD Inspector	3
	Landowner	4
	Septic Company	5
	Friend	6
	Water/Sewer Department	7

17. How would you know if your septic system was <u>not</u> working properly? [*DO NOT READ LIST - CIRCLE ALL MENTIONED*]	Bad smell	1
	Slow drains	1
	Toilet backs up	1
	Sewage on ground	1
	Wet spots in lawn	1
	Pumping tank monthly or more	1
	Straight pipe to ditch	1
	Don't know	1
18. If you have a problem with your septic system whom do you call? [*DO NOT READ LIST - CIRCLE ALL MENTIONED*]	Neighbor	1
	Contractor/installer	1
	Plumber	1
	Health Department	1
	Other [*SPECIFY*] _____ _____. [*ED CODE*] ___ ___	
	Don't know	1

N
1(225)
1(189)
1(426)
1(110)
1(166)
1(4)
1(4)
1(12)
1(8)
1(349)
1(110)
1(22)
(30)
1(38)

19. There are many ways people might get information about the proper care and maintenance of their septic system. How likely would you be to use each of the following methods to get more information? How about... [READ ITEM]? Would you be Very Likely, Somewhat Likely, or Not Likely to... [READ ITEM]? *[CIRCLE ONE RESPONSE FOR EACH ITEM]*

	Very Likely	Somewhat Likely	Not Likely	Don't Know	*N*
A. Attend a county septic system information meeting	1	2	3	8	*1(292) 2(138) 3(95) 8(2)*
B. Request information by mail from the county	1	2	3	8	*1(195) 2(206) 3(95)*
C. Visit an Internet Web site for information	1	2	3	8	*1(275) 2(149) 3(101) 8(2)*
D. Call the county to speak to a septic expert for specific information	1	2	3	8	*1(160) 2(202) 3(163) 8(2)*

20. Do you have a garbage disposal?
- Yes ..... 1 *1(46)*
- No ..... 0 *0(481)*

21. How do you dispose of cooking oil and grease?

[*DO NOT READ LIST - CIRCLE ALL MENTIONED*]
- Pour down the drain ..... 1 *1(14)*
- Trash can (with no container) ..... 1 *1(76)*
- Sieve in can and toss in garbage ..... 1 *1(255)*
- Throw in woods/ditch, etc. ..... 1 *1(90)*
- Other [*SPECIFY*] _____ *1(106)*
- Don't know ..... 1 *1(4)*

22. Do you ever dispose of any of the following down the drain, in a sink, tub or toilet... [*READ ITEM*]?

	Yes	No	
A. Facial tissue	1	0	*1(158) 0(369)*
B. Hygiene products	1	0	*1(57) 0(468)*
C. Kitty litter	1	0	*1(3) 0(524)*
D. Old paint	1	0	*1(1) 0(526)*
E. Pesticides	1	0	*1(1) 0(526)*
F. Solvents	1	0	*1(10) 0(517)*

23. Do you or anyone in your household ever use... [*READ ITEM*]?

	Yes	No	
A. **Commercial toilet bowl cleaners** to clean or disinfect your toilets	1	0	*1(360) 0(165)*
B. **Bleach** to clean or disinfect your sinks, tubs, showers or toilets	1	0	*1(330) 0(194)*
C. **Ammonia** to clean or disinfect your sinks, tubs, showers or toilets	1	0	*1(120) 0(406)*
D. **Powdered cleansers** to clean or disinfect your sinks, tubs, showers or toilets	1	0	*1(292) 0(234)*

24. If your septic system were to stop working, about how much would it cost to replace it?

[*DO NOT READ LIST*]
- $500 or less ..... 1 *1(13) 2(19)*
- $501—$1,000 2
- $1,001—$2,000 ..... 3 *3(97)*
- $2,001—$4,000 ..... 4 *4(115)*
- $4,001—$8,000 ..... 5 *5(59)*
- More than $8,000 ..... 6 *6(15)*
- Don't know ..... 8 *8(209)*

			N
25.	What is the **yearly** maintenance cost for your septic system? $_____	*[ED CODE]* ___ ___ ___ ___ Don't know..... 9998	*1-3000 (438)* *9998 (89)*
26.	If you were able to connect to the nearest sewer system, what do you think sewer service would cost you each **year**? $_____	*[ED CODE]* ___ ___ ___ ___ Don't know..... 9998	*9-2000 (148)* *9998 (379)*
27.	In general, do you think the cost for sewer service would be **less**, about **the same**, or **more** than your current septic system cost?	Less for sewer..... 1 About the same..... 2 More for sewer ..... 3 Don't know..... 8	*1(28)* *2(36)* *3(399)* *8(64)*
28.	If costs were the same, would you rather be on a **municipal sewer** or a **septic system**?	Municipal sewer ....[*GO TO Q29*] .. 1 Septic system.....[*GO TO Q30*] .. 2 Don't know.....[*GO TO Q31*] .. 8	*1(294)* *2(188)* *8(45)*
29.	Why would you prefer to be on a **municipal sewer**? [*DO NOT READ LIST - CIRCLE ALL MENTIONED*]	Easy maintenance..... 1 Less worries..... 1 I do not have to do anything..... 1 Better for environment ..... 1 Other [*SPECIFY*] _____ _____.[*ED CODE*] ___ ___ ***GO TO Q31***	*1(106)* *1(162)* *1(45)* *1(55)* *1(19)*
30.	Why would you prefer to be on a **septic system**? [*DO NOT READ LIST - CIRCLE ALL MENTIONED*]	Easy maintenance..... 1 Less worries..... 1 I do not have to do anything..... 1 Better for environment ..... 1 Other [*SPECIFY*] _____ _____.[*ED CODE*] ___ ___	*1(52)* *1(82)* *1(42)* *1(18)* *1(35)*
31.	How would you rate the job your county Health Department does in regulating, managing and overseeing the county's septic systems? Would you say...? [*READ LIST*]	Excellent.....5 Very good.....4 Good.....3 Fair .....2 Poor .....1 Don't know.....8	*5(36)* *4(92)* *3(136)* *2(77)* *1(48)* *8(138)*
32.	Who should cover costs if your septic system fails? Should it be...? [*READ LIST*]	The home owner.....1 The county.....2 The state .....3 A private utility such as an electric coop .4 Don't know.....8	*1(465)* *2(26)* *3(5)* *4(7)* *8(24)*

33. We already pay for some environmental programs through taxes and fees. If the local health department or a private utility was able to inspect, manage, troubleshoot, and repair your septic system so that you would not have to worry about it, would you and your household be willing to pay...[*START WITH HIGHLIGHTED VALUE*] **each year**?

[*IF YES, CONTINUE WITH NEXT HIGHEST VALUE UNTIL RESPONDENT SAYS "NO", "DON'T KNOW", OR YOU REACH $200.00*]

[*IF NO OR DON'T KNOW, CONTINUE WITH NEXT LOWEST VALUE UNTIL RESPONDENT SAYS "YES" OR YOU REACH $10.00*]

	Yes	No	DK	
A. 10	1	0	8	*1(98) 0(133)*
B. 25	1	0	8	*1(106) 0(179)*
C. 50	1	0	8	*1(112) 0(213)*
D. 75	1	0	8	*1(89) 0(210)*
E. 100	1	0	8	*1(98) 0(187)*
F. 125	1	0	8	*1(73) 0(182)*
G. 150	1	0	8	*1(58) 0(149)*
H. 175	1	0	8	*1(58) 0(98)*
I. 200	1	0	8	*1(47) 0(66) 0(130)*

34. [*IF YES TO $200 OR IF NO TO $10*] What is **the most** that you and your household would be willing to pay each year for this? [*ROUND TO NEAREST WHOLE DOLLAR*]

AMOUNT WILLING TO PAY:

$_____.00 *5-500 (46)*

IF YES TO **ANY** AMOUNTS, OR WILLING TO PAY, GO TO Q36

35. [*IF NO TO ALL AMOUNTS AND NOT WILLING TO PAY ANYTHING*]

Why would you **not** be willing to pay anything?

[*DO NOT READ LIST. CIRCLE ALL MENTIONED*]

	Yes	
A. Cost / amount too high	1	*1(26)*
B. Polluters should pay	1	*1(4)*
C. Government not effective or corrupt	1	*1(16)*
D. Don't trust	1	*1(11)*
E. Take from existing taxes	1	*1(10)*
F. Already paying enough in taxes	1	*1(24)*
G. Can't put dollar value on resources	1	*1(3)*
H. Oppose this type of question	1	*1(2)*
I. Environment is clean enough	1	*1(1)*
J. Problems not serious enough	1	*1(26)*
K. System resources not worth it	1	*1(5)*
L. System resources not important	1	*1(0)*
M. Don't use system resources	1	*1(18)*
N. Other [*SPECIFY*] _____ .... [*ED. CODE*] ___ ___		*N 1(22)*

36. Who do you feel is best able to inspect, manage, trouble-shoot, and repair your septic system? Should it be...?

[*READ LIST*]

The County Health Department	1
A county utility (i.e. - a county water & sewer department)	2
A private utility (i.e. - an electric co-op)	3
A private management company / contractor / septic installer	4
You as an individual responsible for your system	5
Don't know	8

1(115) 2(56) 3(21) 4(129) 5(158) 8(48)

37. There's disagreement about how much effect different sources of pollution have on water quality in your area. Do you think [*BEGIN WITH HIGHLIGHTED ITEM -- READ ENTIRE LIST*] has/have a **lot**, **some**, or **almost no** effect on water quality in your area?

	A Lot of Effect	Some Effect	Almost No Effect	
A. City or other public sewer systems	2	1	0	*2(85) 1(191) 0(226)*
B. Household septic tanks	2	1	0	*2(57) 1(224) 0(239)*
C. Factories or other industries	2	1	0	*2(160) 1(162) 0(201)*
D. Yard or garden waste	2	1	0	*2(57) 1(182) 0(285)*
E. Fertilizer used on crop land	2	1	0	*2(126) 1(220) 0(174)*
F. Litter or garbage	2	1	0	*2(121) 1(211) 0(192)*
G. Livestock waste	2	1	0	*2(146) 1(186) 0(187)*
H. Fertilizer used on home lawns or gardens	2	1	0	*2(87) 1(220) 0(215)*

38. How many years have you lived in your house? _____

[ED CODE] ___ ___
Don't know 98
Refused 99

<1-78 (524) 98(1) 99(2)

39. How many people live in your house? _____

[ED CODE] ___ ___
Don't know 98
Refused 99

1(71) 2(220) 3(98) 4(95) 5(20) 6(12) 7(4) 8(2) 9(1) 10(1) 99(3)

40. How many bedrooms are there in your house? _____

[ED CODE] ___ ___
Don't know 98
Refused 99

1(8) 2(84) 3(310) 4(93) 5(22) 6(3) 7(1) 8(1) 10(1) 99(4)

41. Is your home located in the county, in a subdivision, or in town?

In the county 3
In a subdivision 2
In town 1
Refused 9

3(403) 2(74) 1(49) 9(1)

42. How would you rate the quality or purity of your home drinking water as it comes from the faucet? Would you say it is excellent, good, fair, or poor?

Excellent 4
Good 3
Fair 2
Poor 1
Don't know 8
Refused 9

4(94) 3(218) 2(131) 1(78) 8(4) 9(2)

43. What is the highest grade of school you have completed?

One	01	1 Year Associate	13
Two	02	2 Year Associate	14
Three	03	1 Year, College, No Degree	15
Four	04	2 Year, College, No Degree	16
Five	05	3 Year, College, No Degree	17
Six	06	**Bachelor's** (BA, BS, AB)	18
Seven	07	Some Graduate, No Degree	19
Eight	08	**Master's** (MS, SW, MA, MBA, M. Ed., M. Eng.)	20
Nine	09	**Professional** (MD, DDS, DVM, LLB, JD)	21
Ten	10	**Doctorate** (Ph. D., Ed. D.)	22
Eleven	11	**Refused**	99
H. S. Grad. / GED / Equivalent	12		

N
2(1)
3(1)
4(1)
6(3)
7(5)
8(13)
9(9)
10(13)
11(25)
12 (202)
13(5)
14(40)
15(26)
16(46)
17(14)
18(78)
19(18)
20(14)
21(5)
22(4)
99(4)

44. In what year were you born? _____

LAST TWO DIGITS OF BIRTH YEAR:

19_____

Refused 99

1909-1981 (516)
99(11)

45. Which of the following categories best represents your **family's** approximate 1999 total **combined** income before taxes? Please include all income sources such as wages, salaries, pension dividends, net farm income, and government payments.

[*READ CATEGORIES.* -- *BEGIN WITH PROMPT: "WOULD YOU SAY IT WOULD BE ABOVE OR BELOW $30,000 / $60,000?"*]

Less than $5,000	01
Between $5,000 and $10,000	02
Between $10,001 and $20,000	03
Between $20,001 and $30,000	04
Between $30,001 and $40,000	05
Between $40,001 and $50,000	06
Between $50,001 and $60,000	07
Between $60,001 and $80,000	08
Between $80,001 and $100,000	09
Between $100,001 and $200,000	10
More than $200,000	11
Don't know	98
Refused	99

1(6)
2(15)
3(43)
4(65)
5(81)
6(71)
7(46)
8(46)
9(24)
10(13)
11(4)
98(14)
99(99)

46. CODE RESPONDENT'S GENDER (DO NOT ASK UNLESS UNSURE):

Male	1
Female	2

1(230)
2(297)

THAT'S ALL THE QUESTIONS I HAVE FOR YOU. DO YOU HAVE ANY QUESTIONS FOR ME? THANKS FOR YOUR TIME. GOODBYE.

B SYSTEM KNOWLEDGE INDEX

The following questions are combined to create a rating index for good, fair, or poor knowledge of septic systems.

On-Site Septic System Steward Index Rating:

(Total Index Value = 50 points)

Good	35–50
Fair	20–34
Poor	Below 20

Q2. What type of septic system do you have? If you do know, and say what type system you have, you receive 5 points.

	Rated Points
Conventional	5
Sand lined trench	5
Pump (LLP or Pressure manifold)	5
Other [*SPECIFY*] _____	5
Don't know	0

Q3. Do you know where the septic tank is located?

Yes	5
No	0

Q4. Do you know where the drainfield is located?

Yes	5
No	0

Q8. Do you think any of the following **are** limitations to **where** a septic system may be located…[*READ ITEM]*?

	Yes
A. Distance to surface water	1.25
B. Low lying areas	1.25
D. Wet soil	1.25
G. Hard pan	1.25

Q9. Which of the following are parts of the septic system...[*READ ITEM]*?

	(All True = 5 pts)	True	False
A. The house	1		0
B. The septic tank	1		0
C. The "D" box	1		0
D. The drainfield	1		0
E. The soil	1		0

Q10. Is a septic system designed to **treat sewage** or to **get rid of sewage**?

Treat sewage	1
Get rid of sewage	1
Both	5
Neither	0
Don't know	0

Q13. How often should a septic tank be pumped?

Yearly	1
Every 3 to 5 years	5
When there is a problem	1
Never	0
Don't know	0

Q12. What sort of maintenance should be done to a septic system?

	Yes	No
A. Nothing	0	0.714
B. Add yeast	0	0.714
C. Add tank cleaners	0	0.714
D. Pump out tank	0.714	0
E. Inspect for damage/sufficiency	0.714	0
F. Establish grass cover	0.714	0
G. Plant trees and shrubs	0	0.714

Q21. How do you dispose of cooking oil and grease?

B. Trash can (with no container)……4
C. Sieve in can and toss in garbage……5

Q22. Do you ever dispose of any of the following down the drain, in a sink, tub or toilet?

(All No = 5 pts)	Yes	No
A. Facial tissue	0	0.833
B. Hygiene products	0	0.833
C. Kitty litter	0	0.833
D. Old paint	0	0.833
E. Pesticides	0	0.833
F. Solvents	0	0.833

C ENVIRONMENTAL AWARENESS INDEX

The following questions are combined to create a rating index for good, fair, or poor environmental awareness.

Environmental Index Rating (Total Index Value = 16 points)

High	10–16
Medium	4–9
Low	Below 4

Q37. There's disagreement about how much effect different sources of pollution have on water quality in your area. Do you think [*BEGIN WITH HIGHLIGHTED ITEM—READ ENTIRE LIST*] has /have a **lot**, **some**, or **almost no** effect on water quality in your area?

	A Lot or Some Effect	Almost No Effect
A. City or other public sewer systems	2	0
B. Household septic tanks	2	0
C. Factories or other industries	2	0
D. Yard or garden waste	2	0
E. Fertilizer used on crop land	2	0
F. Litter or garbage	2	0
G. Livestock waste	2	0
H. Fertilizer used on home lawns or gardens	2	0

Printed on recycled paper in the United States of America.

WU-HT-02-35

NDWRCDP • Washington University, Campus Box 1150, One Brookings Drive, Cupples 2, Rm. 11, St. Louis, Missouri 63130-4899 • USA

This report is available online at www.ndwrcdp.org. This report is also available through the National Small Flows Clearinghouse • West Virginia University/NRCCE, P.O. Box 6064, Morgantown, WV 26506-6064 • USA Tel: (800) 624-8301 • WWCDMG22