

The Roanoke Island Water System Expansion Project: A Study of Residents' Viewpoints

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We dedicate this to our wonderful director, Robert Perry.

Dear Robert,



We want to thank you for your endless patience, your compassion, and most of all the unconditional love you've shown to your students and to this program. Your spirit is truly blessed and it has been a delight to learn from you over the past four months. Thank you for taking the time to get to know each of us on a personal level. We wish you the very best in your retirement and during your future life journey!

--Your 2012 OBXFS Students

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Abstract

Domestic water expansion has been a recurring theme in many coastal communities. Roanoke Island, a small island off of North Carolina's coast, recently underwent a fifty-six mile domestic water expansion project intended to improve the quality of drinking water and to provide increased firefighting capacity across Roanoke Island. Expansion of the system has been the subject of recent debate as many residents of Roanoke Island voiced clear opposition to the system and some discontent with the required fees imposed by Dare County's Board of Commissioners in order to fund the project. A survey was distributed to island residents and 19% responded to it. The survey aimed to identify the opinions held by Roanoke Island residents towards the domestic water expansion project. Data gathered from the survey revealed that more respondents approved of the domestic water expansion system than opposed it, and also thought it necessary.

Chapter I: Introduction

Roanoke Island is a barrier island 3 miles wide and 12 miles long located just behind North Carolina's northern barrier islands, the Outer Banks. According to the 2010 Census, the island is populated by approximately 6,700 citizens and has two small towns, Manteo and Wanchese. In 2011, funding and construction of an expanded central water system for the island was approved and begun. The goal for the new domestic water distribution system was to bring safer, cleaner drinking water to the citizens on Roanoke Island as well as provide the island with more dependable hydrants for fire safety (Sloop, 2012).

In choosing to examine the expansion of water across Roanoke Island, students participating in a semester long UNC field site experience saw an excellent opportunity to understand how policy is decided and implemented regarding vital water resources. The purpose of this study is to identify the opinions of Roanoke Island residents regarding the new water system's expansion. More specifically, this study aims to identify island residents' overall attitude regarding the new domestic water distribution system in unincorporated areas of Roanoke Island. This study also examines a number of related phenomena such as the decisions that individual property owners might make after being impacted by the system's expansion, and also whether any citizens on Roanoke Island were affected by inequitable distribution of the water. It was hypothesized from the start that there would be no issues regarding environmental justice and that the citizens of Roanoke Island would neither favor nor oppose the water system expansion project.

Access to safe drinking water is a protected right of citizens in the United States assured by the Safe Water Drinking Act (EPA, 2012). Many residents on Roanoke Island have experienced poor drinking water quality from their private wells as a result of their water coming

from: 1) sources (aquifers) being too close to underground septic system, and 2) having an unpleasant odor and/or taste (Sloop, 2011). Currently, Dare County has implemented a plan that has expanded the current supply of water to all of Roanoke Island. Several decades ago, those residents living in the incorporated area of Manteo, NC, and in small areas in close proximity to the incorporated area, received their drinking water from Dare County via a centralized system. The county's Board of Commissioners felt that the expanded system would not only improve the quality of the residents' drinking water, but would also decrease homeowner's fire insurance rates by improving the island's firefighting capacity (Sloop, 2012).

Looking at how the water expansion plan came about, it is noted that in 2006 the Dare County Board of Commissioners hired a private consulting company, CDM Smith Environmental Consultants (CDM), to develop a distribution plan that would provide more reliable, potable drinking water to all the residents of Roanoke Island beyond Manteo's city limits (Sloop, 2012). Beginning in 2009, CDM began designing the water system expansion which included the installation of approximately fifty-six miles of water line, a 300,000-gallon elevated water storage tank, a two million-gallon ground storage tank, and any necessary improvements to the existing Skyco Water Treatment facility. Construction on the project began in late 2010 and was completed by the early summer of 2012.

Residents were given the opportunity to voice their opinion about the project at Board of Commissioner's meetings that were open to public attendance. In June 2007, two public meetings were held, one at the community center in Wanchese on June 5th and the other at Roanoke Island Festival Park in Manteo on June 19th. At the meetings, the public could ask questions and voice their opinions. Attendance at both meetings was "to capacity". Later, the Board of Commissioners addressed the project at two meetings as it received final funding in

November 2011. All meetings and hearings were held by Dare County Commissioners according to statutory requirements. However, no referendum or similar effort was conducted by Dare County to determine the overall attitude of the island's citizenry regarding the water expansion project, nor was any such effort required.

In May 2011, property owners of Roanoke Island affected by the expanded Dare County water system were mailed a letter giving a broad outline of the project, a timeline for the project's completion, and also a breakdown of the fees to be paid by the property owner. Regardless of whether or not the landowner opted to connect to the new water system, each would be assessed a \$1,700 fee which could be paid upfront or over a ten year period, free of interest. If residents chose to connect to the new system, additional fees were assessed. If a property owner signed on before December 31st, 2012, the \$2,500 impact assessment fee would be waived and the following fees would be required: \$340.00 for the connection; \$107.00 as a security deposit; and a third variable fee paid to private plumbers for connecting the water line to the house on the property.

The Roanoke Island Water Expansion project has been the subject of citizen-led debate, both pro and con, in the recent past. This report examines some of the various attitudes and opinions of Roanoke Island residents regarding the water expansion project. Residents were asked by student investigators to respond to a set of questions on a survey designed by the investigators to gauge opinions on a range of topics related to the project. The survey was also used to obtain basic demographic information about respondents so that statistical information could be calculated from the gathered data. The surveys were hand-delivered to residents' doorsteps. Completed surveys were mailed back to the investigators over a two-week period. The sampling method conducted was a modified Dillman Method and produced a nineteen percent

response rate. It appears that this study is unique in that very few similar studies have been conducted that explore the attitudes of citizens regarding the expansion of a domestic water system across a coastal island.

Following execution of the survey and analysis of its results, the investigators summarized an array of opinions held by residents towards Roanoke Island's domestic water system expansion project, and those are presented in this report. In considering past studies, as well as all the information gathered herein, this report presents the findings of the eight UNC-Chapel Hill students who conducted the investigation. It also offers policy suggestions for the Dare County Board of Commissioners and other policy-makers interested in domestic water expansion projects.

Section: History of Domestic Water Delivery on Roanoke Island

Purpose

This section explores the history of Roanoke Island's water distribution systems. The aim is to develop an understanding of the historical progression regarding the provision of water to Roanoke Island's citizens. Ultimately, this will help to delineate the trajectory that has resulted in the recent expansion of the water system into unincorporated areas of Roanoke Island.

Manteo Water Distribution: 1940 to 1970s

The Town of Manteo's water distribution system is the oldest public distribution system in Dare County, dating back to the early 1940s. At the time of introduction, Manteo provided the only public sewage treatment facility in the county that served an entire municipality. A.C. Lindberg drafted original plans for the water system in December 1939; construction began shortly after in July 1940 by Works Progress Administration labor. The project was popular among local citizens who viewed the water system as providing a plentiful supply of water that would be free of foul taste and odor. The undertaking was primarily funded by a \$102,000 grant from the federal government; additional funds were made available through a \$37,000 general obligation bond. The main objective behind introducing the distribution system was to provide sufficient amounts of domestic water for residential use, and to suppress fires via hydrants. (McCain, July 11, 1985)

Construction of the system was completed in 1940. The new system provided water to the town from two deep groundwater wells. The water was treated and stored in two tanks. One of those was below ground, and the other was elevated. Combined, the two tanks stored 200,000

gallons of water, which was enough to service all 206 customers. Additionally, the introduction of this system reduced fire insurance rates by half. The reduction in fire insurance costs for users of the system roughly covered their sewer and water bills. (McCain, July 11, 1985)

As the town of Manteo continued to grow and develop, the need for water increased rapidly. In response to that need in Manteo, as well as on the beaches, Dare County planned a countywide water distribution system. Well tests were drilled during the late 1960s and early 1970s to determine the best location for a large water treatment plant on Roanoke Island (McCain, July 11,1985).

Dare County Distribution from 1975 to the Present

In the late 1970s, several beach towns developed the Dare Beaches Water and Sewer



Aerial view of northern Roanoke Island. Photo credit Evelyn Harris

Authority to assess the need of beach areas' water and sewer systems until the year 2000. The commission determined that there was a need to increase water sources, but could not find federal funding to do so given the small size of the region. Upon the request of the Authority, Dare County assumed the role of lead agency in the future development of a countywide water system. It would encompass the area from Oregon Inlet to the Currituck County

line and included Roanoke Island (McCain, July 7, 1985).

The voters of Dare County authorized a \$5.5 million bond to finance the regional water system. There was, however, debate about this financing. Public hearings revealed mixed feelings by residents about their ability to afford the new system, and about moving to a countywide distribution system. Ultimately, 60% of the voters favored adopting the construction of the new water system, which was completed in 1979. The Skyco Water Treatment Plant, located on Roanoke Island, began servicing Dare County in June of 1980. The Dare County water system allocated two million gallons of water to each town daily and sold it directly to the towns of Manteo, Kitty Hawk, Southern Shores and also to the Northern Dare beaches. The system was supplied by deep wells located three miles from the treatment plant on Roanoke Island. Those wells could produce up to 7.2 million gallons of water per day. The water was stored in two storage tanks near the plant. A ground-level tank could hold 2 million gallons and the other, an elevated tank, could hold 200,000 gallons (McCain, July 7, 1985).

By the late 1970s, both the Dare beaches and Roanoke Island saw a steady increase in population and tourism. In order to provide sufficient water for the



The Fresh Pond in Kill Devil Hills, November, 2012. Photo credit Karen Villeda

growing number of inhabitants, the Dare County Board of Commissioners undertook an extensive study of the regional water system, completed by Stephens Associates Economic and Planning Consultants (1973). The Skyco plant was working at maximum capacity, but still was not meeting the needs of the County during peak summer usage. The study predicted that the Dare County beaches' year-round population would increase from 3,000 in 1980 to nearly 10,000 by 2000. In addition, during peak summer months, the population could reach nearly 200,000 by the year 2000, nearly doubling from the 1980 summer population prediction. Ultimately, the study determined that in order to “achieve the growth forecast for the next 40 years, substantial public investment will be necessary. New water and sewer facilities and higher capacity access routes are needed... The public investment will assist the vast amounts of private capital necessary in developing a large recreation resort area” (Stephens, 1973). The Board of Commissioners then decided to re-activate Fresh Pond as a water source. Located in Kill Devil Hills, Fresh Pond provided water to Nags Head and Kill Devil Hills prior to the countywide water distribution, and served as another supply of water during peak seasonal use. The pond was reopened in order to supply an additional 1.5 million gallons of water daily to local residents (McCain, July 7, 1985). Although the reintroduction of Fresh Pond water in 1985 was a stopgap measure, it continued to be used for several years. According to officials in the Town of Nags Head, the Fresh Pond Water Treatment plant was permanently taken off-line and its permits were voided in June 2009.

In early 2011, funding was approved and construction of a water system expansion began on Roanoke Island. Approximately 56 miles of water lines were installed throughout unincorporated areas, along with 200 fire hydrants and two new water storage tanks. The water expansion caused controversy in the community, as it imposed a mandatory \$1,700 fee on

property owners whether they connected to the water system or not. If property owners decided to connect to the system, they would have to pay a \$447 connection fee by December 31, 2012. If they choose to connect after that, an additional impact assessment fee of approximately \$2,500 would be charged, according to the Dare County website.



Ground excavation for placement of new water line. Photo credit Karen Villeda

The county cited several reasons to implement this expansion on Roanoke Island. In public writings, they listed two leading motives. The first was to fulfill a desire to provide safe drinking water throughout the island, so that people would no longer have to rely on wells. Second, they believed Roanoke Island was in need of an expanded fire hydrant system to enhance safety. On that point, residents were informed that having increased fire protection could lower their homeowners' insurance

rates (Dare County Water Department, 2011).

A letter sent out to property owners stated the aforementioned benefits, along with the fact that property owners would be assessed the \$1,700 fee on each parcel of land they owned. Many people in the community expressed concern, and a public hearing was scheduled for November 7, 2011 to give residents the opportunity to speak with commissioners and the county manager. Twelve people came forward to speak at that hearing, and, when it concluded, an additional hearing was set for November 21, 2011. Several people attended that hearing as well. A primary concern expressed at the two hearings was that many people could not afford to pay for the water or the associated fees. Some people felt that being on a fixed income would keep them from being able to pay all of the fees, especially if they owned more than one parcel of

land. Additionally, residents expressed concern about the water system's potential to increase Roanoke Island's population density due to the fact that the present 20,000 square foot lot minimums could be reduced upon the addition of public water lines. And finally, several people were concerned about the quality of the water they would receive if they chose to connect to the expanded system (Dare County, 2011).

Commissioners responded to the strong public reaction by extending the period needed to pay the \$1,700 project fee; it was changed from seven years to ten years. Additionally, the county manager mentioned that the Board of Commissioners would waive interest rates; this became a motion that was unanimously approved. Commissioners also stated that they had explored grants as an option to help property owners pay the assessment fee, but the community did not qualify for any, other than one grant used to help build the system, according to the Dare County website.

Section:Trends in Coastal North Carolina Domestic Water System

This segment of the report addresses the development of recent trends in domestic water supply in coastal North Carolina. These trends include 1) the general expansion of domestic water supplies by municipalities; 2) the use of federal stimulus funds for water systems expansion; and 3) the privatization of water systems due to the lack of public funds.

Water System Expansion

The Environmental Protection Agency maintains an online database of water distribution systems, called the Safe Drinking Water Information System (SDWIS). This database offers information about every water system in the country regarding the location, type, and population served as well as any water quality violations reported. As of September 26, 2012, the SDWIS database confirms that most counties and nearly all municipalities in coastal North Carolina possess some kind of public water distribution system (EPA, 2012). The coverage area of those systems varies greatly, as does the number of water quality violations within each system.

An increasing number of domestic water systems in coastal North Carolina lack in maintenance, repair and reinvestment. At the same time, cities and counties tout the benefits of water facilities *expansion*, especially in terms of economic development. In general, domestic water expansion plans are focused on increasing the capacity of specific pumping stations, refurbishing aging facilities, and in some cases, expanding the service area of centralized water. These interests compete because the funds for expansion often come from the same pool of money for maintenance and repair. As these competing interests of maintenance versus expansion are reconciled, a general lack of funding for public works, especially from the federal government, constrain municipalities' budgets.

Currituck County, for example, is consistently pursuing water and sewer facilities expansion, prompted by the poor water quality experienced in the 1980s. At that time, a patchwork of collective neighborhood systems and individual wells hampered both water quality and development potential in the county. Currently, a county well and reverse osmosis system allow for consistent, long-term development as well as the buy-out of smaller systems. These buy-outs temporarily increase rates for customers; however, it is claimed that customers benefit over the long-term (Hampton, 2011). The actual benefits to customers have not been studied and, once a system is absorbed by the county, the public has little or no input on the issue.

Federal Stimulus

Many local government bodies have capitalized on the funds offered to states by the stimulus package, or American Recovery and Reinvestment Act of 2009 (ARRA), prompting renewed investment in many underfunded water systems. According to an Environmental Protection Agency summary chart of allocations, North Carolina was appropriated approximately \$150 million towards water and sewer infrastructure (“SRF,” 2012). At the state level, this money was disseminated through the NC Division of Environmental and Natural Resources (DENR) Division of Water Resources and the NC Division of Water Quality, each operating their respective EPA Revolving Funds (NC D.E.N.R., 2012). The money in those revolving funds allows municipalities to borrow money from state and federal sources at favorable interest rates for reinvestment into their drinking water and wastewater systems.

Coastal North Carolina benefitted significantly from stimulus funds either in the form of grants or as loans to improve their water distribution. The following twelve coastal counties received ARRA funds for water and sewer projects: Brunswick, Camden, Carteret, Craven, Dare, Hertford, New Hanover, Onslow, Pasquotank, Pender, Perquimans, and Tyrrell (ARRA, 2012).

Dare County borrowed \$112,522 from the Drinking Water State Revolving Fund, which the ARRA paid for. These funds were used to install a mixer in a Kill Devil Hills water tower in an effort to improve water quality. In Hertford County, stimulus funds were used to extend water mains to provide water to residents using private wells (NC D.E.N.R., 2009). These kinds of capital investment projects may not have occurred without the facilitation of ARRA grants and loans. The stimulus, however, may have been one of the final opportunities for North Carolina counties to secure federal funding for water system expansion.

Privatization

Many local governments are finding that some of their traditional sources of income — federal and state grants — are being eliminated due to budget cuts. As a result, those governments often must seek other funding sources, including public-private partnerships.

Pender County is one coastal NC county that, in light of ambitious expansion efforts, has had to look for other sources of income. It aims to increase water pumping capacity, expand its county water system, and establish a sewer system (“Water and Water Infrastructure,” 2009). The Pender County Board of Commissioners (BOC) aims to achieve these goals in part through a public-private partnership. However, in its “2010-2012 Priority Implementation Plan,” Pender County’s BOC acknowledged that there is no framework for this kind of venture in North Carolina. As a result, the Board set a deadline for establishing that framework, expecting it to serve as an example for future public-private partnerships.

The private company involved in Pender County, Integra Water, entered into an agreement with the county in 2010. In 2011, however, Integra renegotiated the terms of agreement to down-size the project and its benefits. Further, in the new plan, residents and Integra Water will split the upfront costs “50-50,” with the county indefinitely paying increasing

subsidies to Integra (Clarke, 2011). Even with the watered-down specifications, Integra terminated the deal in late 2011, while claiming it would pursue other avenues for moving forward on the project. Whether the public-private project succeeds or not, the process reflects the fickle nature of some private enterprises. As of July 2012, the Integra-Pender partnership is uncertain, leaving Pender County without a definite answer to its plans for water expansion (Clarke, 2012).

The notion of public-private municipal works ventures is attractive due to a number of potential benefits, including greater efficiencies and improved cost-effectiveness. However, privatization can have negative results as well. In the Pender-Integra agreement, not only would Integra operate the sewer system as a private enterprise, but the county would have to pay a subsidy to Integra, earmarked to grow every year (Clarke, 2011). Despite paying subsidies, it is not clear how Pender County will be able to ensure that its private partner in the project would offer the highest level of service to its residents.

In response to these issues, environmental justice advocacy groups like Clean Water for North Carolina (CWFNC) are beginning to argue that privatization hurts consumers. Clean Water for NC argues that water is a resource that belongs to the public; private enterprise's move to control water reduces accountability for water management and, ultimately, results in higher prices for customers. Further, in many cases, these higher prices disproportionately affect the poor, forming the basis of concern about environmental justice (Hicks et al., 2011). CWFNC cites many cases of privatization in NC water systems that have experienced mismanagement, to the detriment of customers.

As an example of unsuccessful privatization, a company called Aqua North Carolina began to buy up small rural and suburban systems and are now intensifying their efforts to

acquire municipal water systems. Aqua NC has a mediocre track record consisting of high prices, poor service and a history of “outright mistreatment of water and sewer customers in NC,” reads one CWFNC newsletter. As the trend toward privatization continues, municipalities pursuing the shift from public management to private companies might want to proceed with caution to protect their citizens.

In sum, the issues facing residents of Coastal North Carolina include pressures to expand, privatize and modernize drinking water systems. The federal government provided a large pool of funds through the American Recovery and Reinvestment Act of 2009. Moving forward, municipal governments and water authorities may need to find creative ways to finance these systems, perhaps including privatization and joint private-public partnerships.

Section: Literature Review

This portion of the report presents a review of several previous studies that examine utilities and their expansion into geographic areas where they previously did not exist. This review has helped investigators to understand the significance of expanding domestic water availability on Roanoke Island and elsewhere. While domestic water provides many social, environmental, and economic benefits to Roanoke Island residents, there may be disparities in how that water is distributed and to whom it becomes available. Access to, and distribution of, utilities and essential resources such as water among residents in a specific locale varies, often depending on the income levels of the residents. Such inconsistencies can be of some concern, particularly when viewed through the lens of environmental justice.

Four studies were reviewed for this report. However, investigators became aware of additional studies during their literature search that also relate to the distribution, affordability and accessibility of utilities. While valuable, those studies were not as pertinent to this report as the ones discussed here.

A 2003 study conducted in Sweden by Hokby and Soderqvist evaluated the relationship between a resident's willingness to pay for environmental services and his or her dependence on a certain level of income. In addition, Kanninen and Kristrom (1992) performed a cost-benefit analysis on projects related to environmental improvements. Their research suggested that there is a direct relationship between residents' willingness to pay for an environmental service and the demand for that service. It was found that a 1% increase in income would result in a 0.6 to 1.3% increase in demand for an environmental service. Hokby and Soderqvist concluded that even small changes in income would change residents' demand for a particular environmental service, though those changes may not necessarily be extraordinary. This study offers insight into the

direct relationship between a person's income and his or her willingness to pay for an essential resource or environmental service. Interestingly, Hokby and Soderqvist note that there is a correlation between a resident's income and whether or not an environmental service is viewed as a necessity or as a luxury: the lower a resident's income, the more likely that an environmental service is perceived to be a luxury rather than as a simple necessity.

A 2008 study by M. Genius and E. Hatzakiin was undertaken in Rethymno, Greece, to determine the relationship between water supply shortages in that area and residents' willingness to pay for future projects involving water quality. Their results suggest that women, on average, are willing to pay more for higher water quality than men. They asserted that that occurred because women are more directly involved in the day-to-day needs of the household (cooking, washing, shopping for bottled water, etc.). The results also imply that individuals who drink bottled water and those who carry water from springs or from other towns are willing to pay more, on average, than tap-water drinkers because the service would lower the costs and inconvenience associated with buying and/or transporting drinking water. Moreover, those who complain about the smell of chlorine in water are willing to pay less for water, on average, and this might reflect their belief that the smell of chlorine is not likely to go away after the installation of a proposed water expansion project (Genius and Hatzakiin, 2008). Residents are also willing to pay less for water if they: 1) feel that water quality is a trivial matter; and/or 2) have high water bills; and/or 3) have been impacted by reductions in water quantity.

A study was conducted in 2011 by Wendel, Downs, and Mihelcicin in Tampa, Florida. It examined the distribution and accessibility to water as well as water quality. The study was conducted to evaluate the disparities in water accessibility between Tampa and an inner-city, lower socio-economic community in Tampa known as East Tampa, which is characterized by a

number of environmental justice issues and socio-demographic inequalities. Besides having high rates of building vacancies, deteriorating structures, and elevated crime and poverty, East Tampa has a much higher population density-to-water access point ratio than Tampa (Wendel et al., 2011). Inequitable urban development and privatization of natural resources led to these environmental injustices. The study suggested that better water access and improved access to water of higher quality leads to improved public health.

Concluding, the studies by Wendel et al. (2011), and Hokby and Soderqvist(2003) examined the role of water both as a public good and the degree to which it is valued. More specifically, the study by Hokby and Soderqvist (2003) examined the relationship between a user's willingness to pay for water and his or her level of income, while the study by Wendel et al. (2011) examined the relationship between the lack of water quality/accessibility and a low income urban area. Meanwhile, Genius et al. (2008) studied the relationship between residents' lifestyles and their preferences for water. These studies provide useful insights about water expansion projects in terms of providing equal access to an essential resource. While it is evident that people have an opinion about the overall fairness of water allocation systems, a study by Syme (1999) suggested that economic arguments are of less importance when deciding how water should be allocated (or reallocated), and that the inclusion of local people in the decision-making process is a major determinant of the fairness of water allocation in a particular locale.

Chapter II: Methodology

Research Question

The fundamental question of this study was: What are residents' overall attitudes regarding domestic water distribution on portions of unincorporated Roanoke Island?

Population

The population of this study was defined as the residents of the northern portion of unincorporated Roanoke Island, with the inclusion of Skyco and Toler Roads south of Manteo, NC. This population was chosen because they were affected by the new water expansion system approved by the Dare County Board of Commissioners. Some residents of unincorporated Dare County who lived in specific areas were excluded from the study due to either the lack of direct impact of the new water expansion system, or to the application of different zoning and ordinance regulations in those areas.

Sampling Procedure

The study used a hybrid hand-delivery and mail-back sampling method that most resembled the Dillman Total Design Method or Dillman Method (Dillman, 1978). The Dillman Method is a mail survey methodology that utilizes multiple mailings (typically four) to each respondent in order to increase the rate of response. When using the Dillman Method, anonymity is often sacrificed because in order to send subsequent mailings to residents that failed to respond, a record of respondents must be kept. In an effort to preserve anonymity in this study, multiple contacts to individuals were replaced by community-wide contacts through newspapers (i.e., *The Coastland Times*, and *Outer Banks Sentinel*) and website media (i.e., *Outer Banks Voice*). In addition, instead of mailing surveys out to respondents, surveys were hand-delivered to each residence in the study area. One survey was left at each residence.

A modified Dillman Method approach was used to expedite the distribution and response rate due to time and fiscal constraints. Hand-delivery of the surveys required a large initial commitment of time by the student investigators. The students (as well as one faculty member) went house-to-house over geographically pre-determined areas of Roanoke Island's target population. This was done by using a map of Roanoke Island, supplemented by the knowledge of local citizens and UNC faculty. Nine geographically distinct regions of population were selected for surveying and analysis purposes. Each area received hand-delivered surveys by a specific investigator. Moreover, each area —as well as the individual streets within any given area — was assigned identification numbers between 1000 and 9000 (Appendix D). After data analysis, the nine geographic regions were regrouped into five regions of similar survey responses (Appendix D). Surveys were placed near a home's entrance so that they could be seen and picked up by the resident. If a resident was outside, the investigator introduced him- or herself as a UNC-Chapel Hill student distributing surveys for a research project on the new water expansion system.

Approximately 900 surveys were distributed by the method outlined above to the targeted population between October 19 and 23, 2012. The survey packet consisted of a survey, a cover letter (Appendices A & B) and a pre-paid envelope addressed to the investigators' local post office box number. The mail-back method required little effort on the part of surveyed residents, and it did not cost them anything. In addition, this technique allowed residents ample time to offer detailed responses. Surveys returned to the researchers that had any identifying elements added by responders were discarded in order to protect their anonymity. The original deadline was set for October 31, 2012 for returned surveys. However, due to Hurricane Sandy, the deadline was extended to November 2, 2012.

The hybrid method of surveying described above was chosen to optimize the time, randomness and response rate of those surveyed. When considering the variables investigated, hand-delivery of the surveys seemed to be the fairest and most equitable way to distribute them across an assortment of geographic areas inhabited by a population that varied fairly widely in its demographics.

Instrumentation

The cover letter and the survey were designed by the students of the Outer Banks Field Site (OBXFS) with assistance from a consulting social science research expert, Dr. Adam Gibson, and UNC faculty. The cover letter informed all potential respondents that the OBXFS was conducting the survey; it also offered additional general information regarding the protection of respondent anonymity and how to proceed with answering survey questions. That questionnaire was designed to obtain information while remaining unbiased in its wording. In addition, the survey was developed to determine the knowledge, opinions, and other elements of Roanoke Island citizens regarding the water expansion system in unincorporated areas of the island. Many of the survey questions served as internal “checks” to help validate responses among those who submitted surveys. A number of questions offered a response scale to elicit each participant’s specific stand on an issue. At the end of the survey, an open-ended comment section was included so that participants could offer thoughts on any issue related to the water expansion project.

Analysis

In analyzing the surveys, the first step was to enter the data of all returned surveys into a database. This was accomplished by entering survey responses into a pre-formatted data entry sheet. No data that could be used to identify a particular respondent was entered into the

spreadsheet. If a survey was incomplete, the responses to questions that *had* been answered were included in the data.

Analysis also included the development of tables that presented the mean and standard deviation values for groups of related questions. These tables (Appendix C) offered much fundamental information but not a full analysis of all variables. Using pertinent variables, more sophisticated statistical analyses such as *t*-tests and ANOVA (ANalysis Of VAriance) were carried out using the statistical software Statistical Package for the Social Sciences (SPSS) 17.0. The purpose of these more sophisticated statistical analyses was to look for significant statistical differences between two or more response groups, for example between people of low or high socioeconomic status.

A proprietary socio-economic status (SES) formula was devised to develop ANOVAs. Non-equally weighed measures of education, income, age, and race variables were combined to allow for a more in-depth analysis, particularly of SES. Also, using spatial data, geographic areas that were surveyed could be examined to more accurately portray differences among those surveyed on Roanoke Island. This approach generated a wealth of data, some of which did not undergo full analysis, though it might have generated additional insights. The investigators decided on a set of seven research sub-questions that would help guide the creation of additional information sought by the survey:

1. What areas of unincorporated Roanoke Island are most affected by a possible environmental justice issue?
2. How can we measure environmental justice (EJ)?
3. What is the level of knowledge with respect to the water upgrades?
4. What are the demographics of Roanoke Island's unincorporated area?

5. Why are people for or against the water expansion project?
6. What percentage of people is planning on continued use of their wells even after they are supplied by county water?
7. What decisions do people plan to make regarding their choices for water use?

The collected data generated numerous separate *t*-test and ANOVA evaluations. All results presented in this report were generated from those two test types. As mentioned above, this research has produced a wealth of data that could be subjected to additional analysis. However, such analysis is beyond the scope of this study.

Validity and Reliability

Validity, with respect to surveys, can be broadly defined as the degree to which a question measured what it was supposed to measure (Vaske, 2008). There are many types of validity used to evaluate research, but the two most relevant forms in this case are face validity and construct validity. Face validity generally refers to the possibility that questions could have been misunderstood and was not considered to be significant in the context of this study.

Construct validity is a form of validity that depends on the way multiple variables are included in a theoretical construct and are signified in tools intended to measure that construct. In other words, it is the extent to which what was intended to be measured was actually measured. A “construct” refers to multiple concepts or variables. There was an effort to maintain and preserve construct validity in the survey by measuring variables and concepts in several ways. For example, socio-economic status was measured by collecting data on multiple variables (income, race, age and education level), including willingness to pay. The study’s reliability — the idea that other researchers could carry out the same research and, under the same conditions, generate the same results — is relatively strong due to the clearly defined variables, rigorous

sampling protocols and standard methodology applied. The reliability is reinforced by the use of similar research uncovered in the literature review. Internal consistency was not used as a method to determine reliability because no two questions on the survey were constructed to measure the same variable (Barber, et al, p. 27, 2008). Instead, construct validity was used to measure different aspects of the same variables by different, but similar, questions.

Assumptions

There were several major assumptions made in carrying out this research. First, it was assumed that everyone who responded to the survey answered the questions honestly. Second, it was assumed that everyone responding to the survey filled it out free of coercion and influence by any other entity. Third, it was assumed that respondents filled out the survey with the understanding that their identity was completely protected. Fourth, it was assumed that the manner in which the surveys were distributed would generate results that were both valid and reliable within the context of the study and the experience of the investigators. Fifth, it was assumed that the procedures used to collect and enter data, as well as the analysis methods, did not reflect any significant degree of bias on the part of the investigators. Lastly, it was assumed that the study reflected the opinions of surveyed residents about the Roanoke Island water expansion project.

Scope and Limitations

Time greatly limited the scope of this research project. Time constraints restricted the number of surveys that were distributed, the areas in which they were distributed, and their collection and analysis. This process was interrupted by Hurricane Sandy, which likely

introduced some limiting factors in both the participation of respondents and the collection of surveys. It was necessary to carry out the entire research project in fewer than four months.

In addition, the group of undergraduate students carrying out this work were relatively inexperienced in research procedure and methodology. Fortunately, faculty members and a consulting social science research expert helped to guide the research and offered many suggestions. Even so, the research does not reflect advanced abilities in methodology, analysis and interpretation of the data collected.

If more time and experience had been available, many more variables and their relationships could have been examined. The variables examined and the data presented are a product of constraints in time, available funds, and the experience of the field site investigators. Consequently, this study served to bring attention to only the most essential points.

Chapter III: Results

The total number of surveys that were included in our data is 176. Described here are statistics and tables constructed from the data on the surveys that were returned by Roanoke Island residents. Respondents were given the option to choose the questions they wanted to answer; and some did not answer all of the questions. The approximate 19% response rate over two weeks is considered to be an adequate rate of return for one initial mailing in the Dillman Total Design Method; usually consisting of four contact attempts (Dillman, 1978).

Demographics of Respondents on Roanoke Island

In the figure below, a summary of the overall composition of racial demographics among the people that returned the survey is presented. The vast majority of the respondents identified themselves as Caucasian (91%), followed by African-Americans (2%), Hispanics (2%), Asians (1%), Pacific Islanders (1%), and other (1%) (Figure 1).

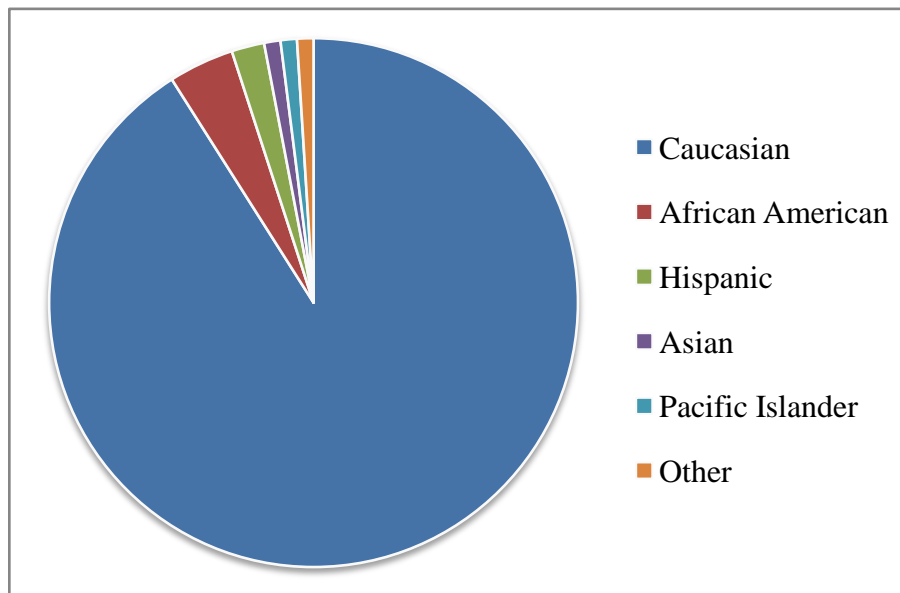


Figure 1.summary of survey respondents' racial demographics.

The most common income among the respondents was \$30,001-\$50,000, closely followed by \$50,001-\$75,000 (Figure 2). The category that was lowest in percentage chosen (3%) was \$0-\$15,000 (Figure 2).

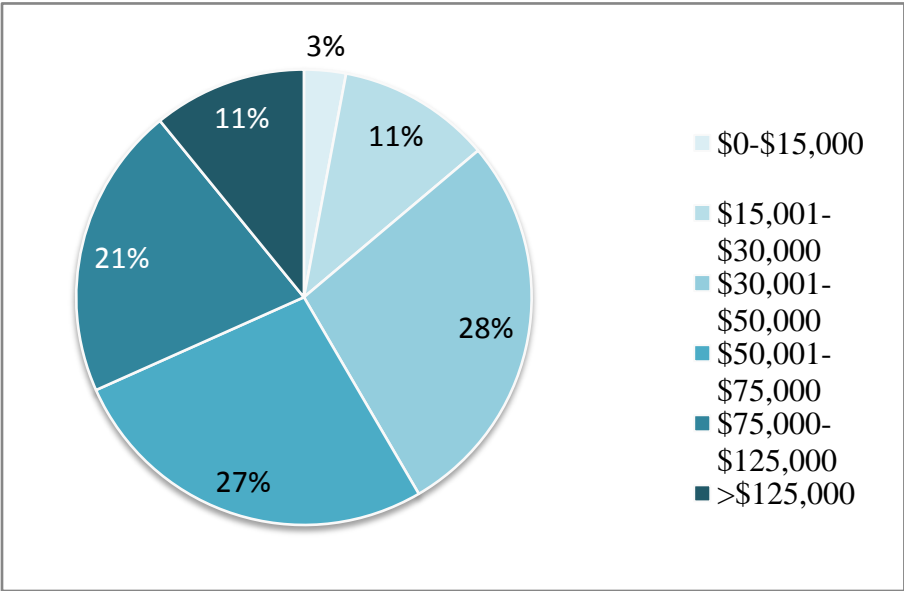


Figure 2. income ranges of survey respondents.

The largest category measured by the survey on education levels was represented by those who completed graduate school (22%) (Figure 3). Also, a considerable percentage (19%) had a college degree (Figure 3).

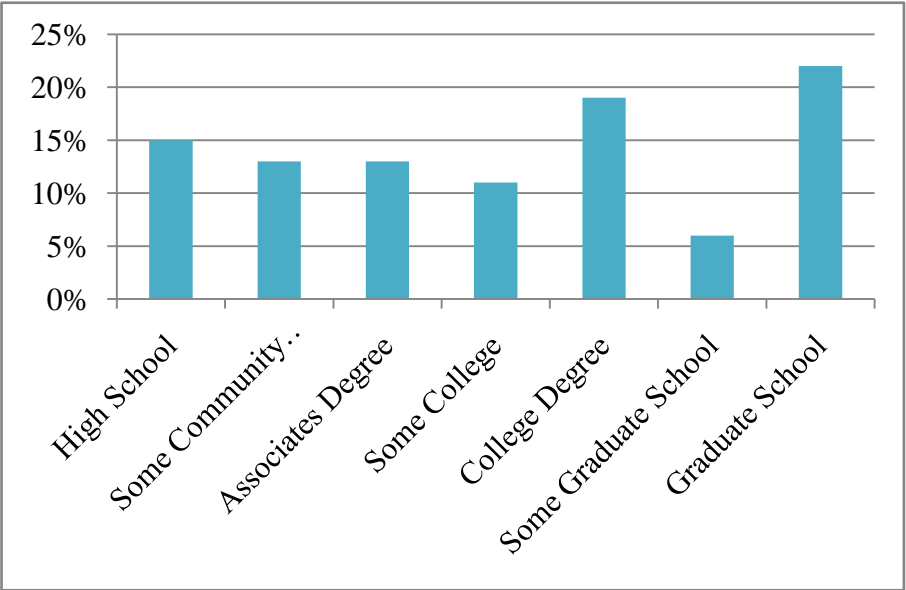


Figure 3. highest level of education attained by survey respondents.

At the heart of this investigation was the question of whether the residents surveyed were in favor or opposed to the Roanoke Island water system expansion. Respondents indicated that 59% favored the expansion, while 41% opposed it (Figure 4).

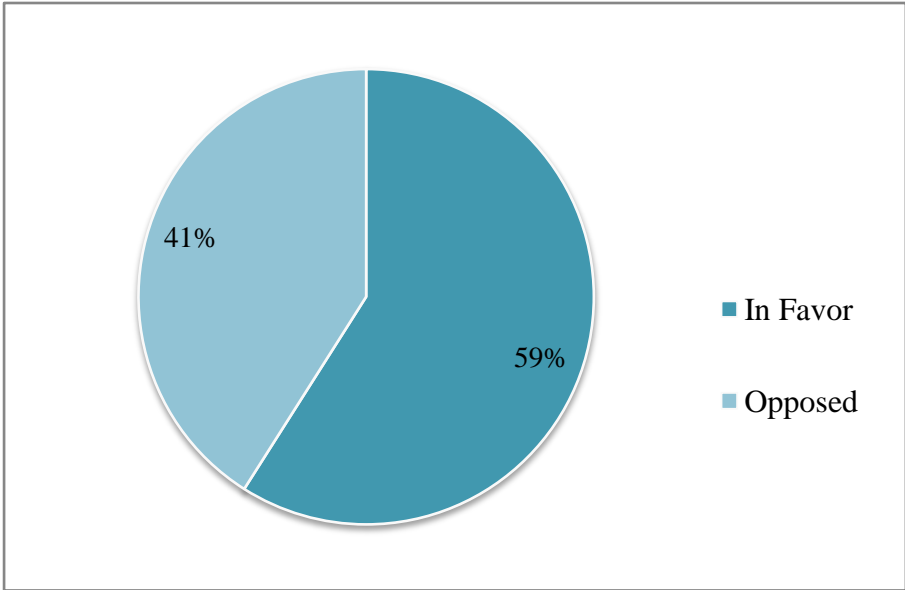


Figure 5. respondents' attitudes toward the water system expansion.

Socio-Economic Status

The graph below presents information about socio-economic status (SES), which is generated by combining data on education, income, and race. Figure 5 shows the SES of the five surveyed geographic areas on Roanoke Island. Note that Zone 4 has the lowest relative economic status among respondents (Appendix D, Map 2).

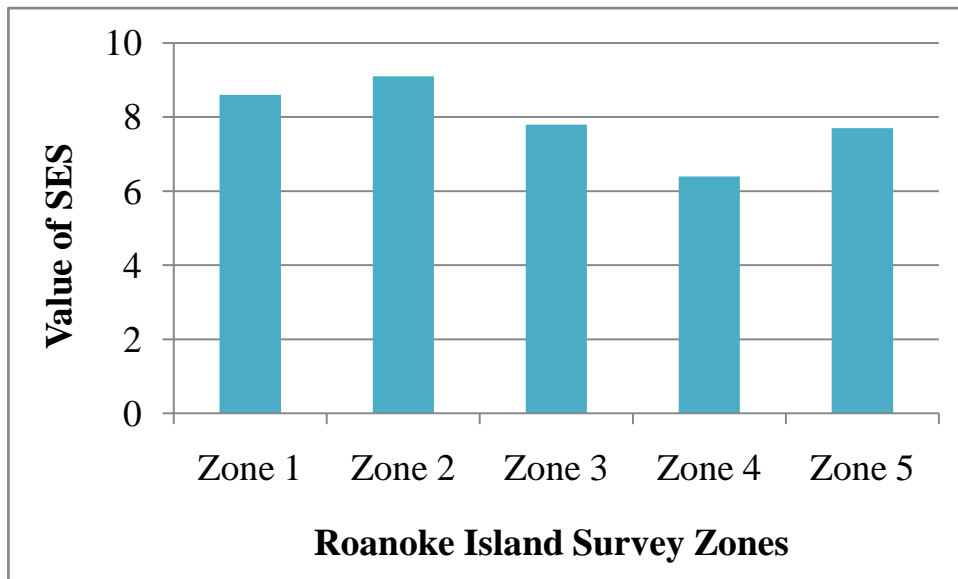


Figure 5. socio-economic status of survey respondents.

In their ability to pay for the water, respondents indicated that the majority could afford to pay with little or no difficulty (Figure 6). However, just under half of respondents had some difficulty or substantial difficulty being able to pay for the same service, while a few (4%) could not pay for it at all (Figure 6).

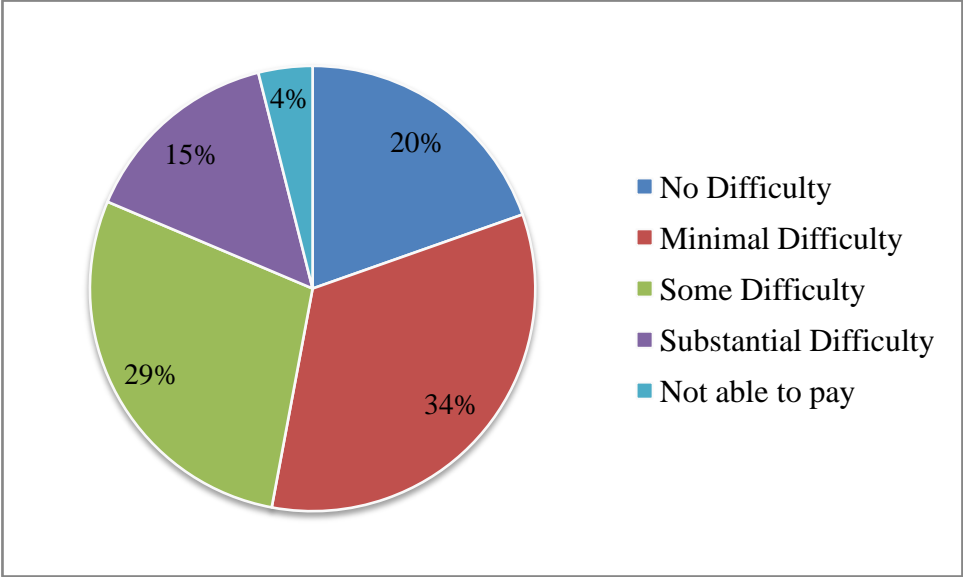


Figure 6. ability of survey respondents to pay for water service.

Respondents' Knowledge of Water Expansion Project

An additional element of this project was to gauge the level of knowledge about the water expansion project itself among respondents. Several charts convey information about this topic. A large number (67%) of residents reported they were notified 1-3 times, while considerably fewer (33%) reported they were notified more than 3 times (Figure 7).

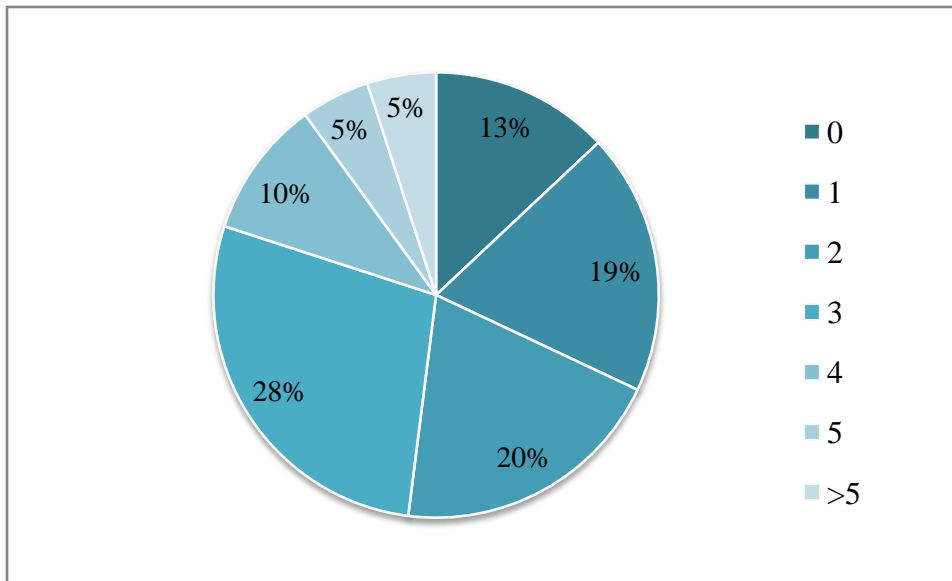


Figure 7. number of times residents claim that they were notified about the water expansion project.

Most respondents (68%) attended no public meetings held about the water expansion project. A considerably smaller percentage of respondents attended one or more public meetings (38%) (Figure 8).

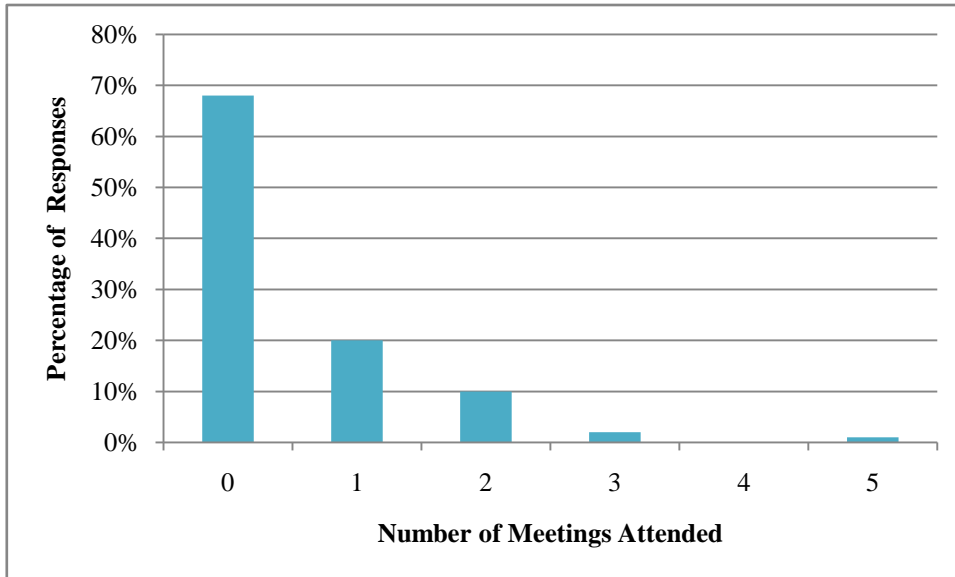


Figure 8. percentage of residents who attended meetings about the water expansion project.

Respondents indicated strong agreement (89%) with the statement “the water system will offer improved fire protection for homes.” A much smaller percentage (11%) felt that the system would not improve fire protection (Figure 9).

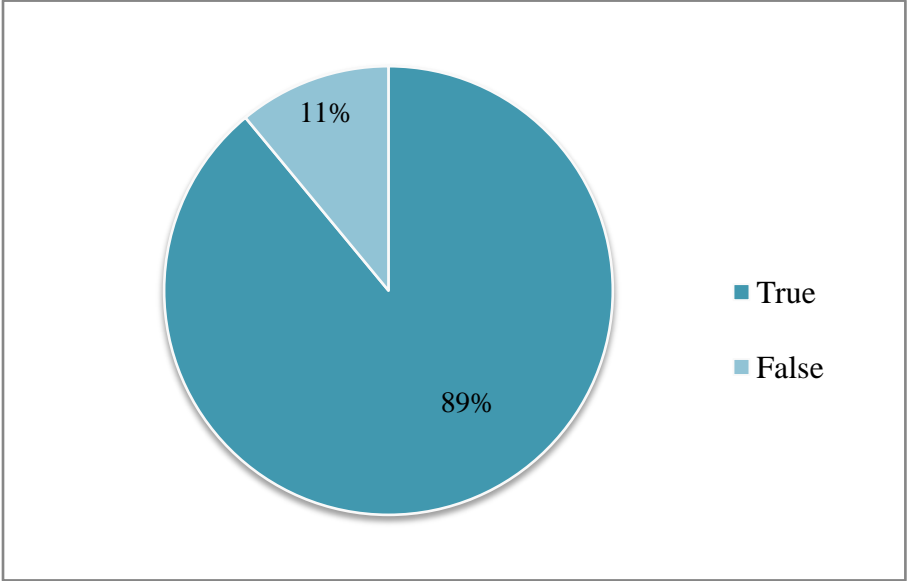


Figure 9. percentage of respondents who felt that the statement “The water expansion project will offer improved fire protection” was either true or false.

A large majority of respondents (84%) felt that connecting to the expanded water system was not mandatory (Figure 10).

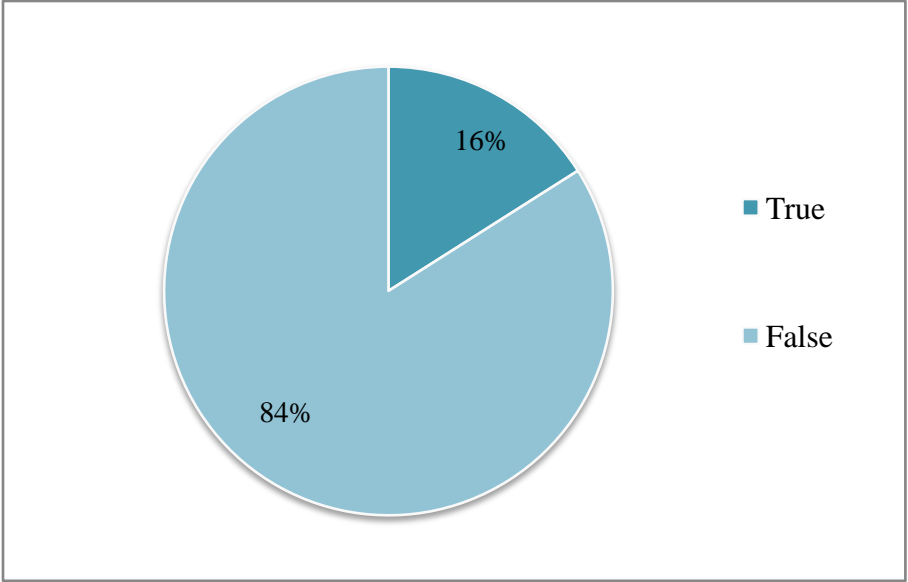


Figure 10. percentage of respondents who believed connection to the water expansion was mandatory.

Important Residents' Preferences About the Water System

Residents placed different degrees of value on certain advantages conferred by the expanded water system. For example, 69% of respondents felt that having safe and clean drinking water was either very important or extremely important (Figure 11). The findings for Figure 11 are nearly identical to the degree residents felt it important to have a reliable source of drinking water (Figure 12).

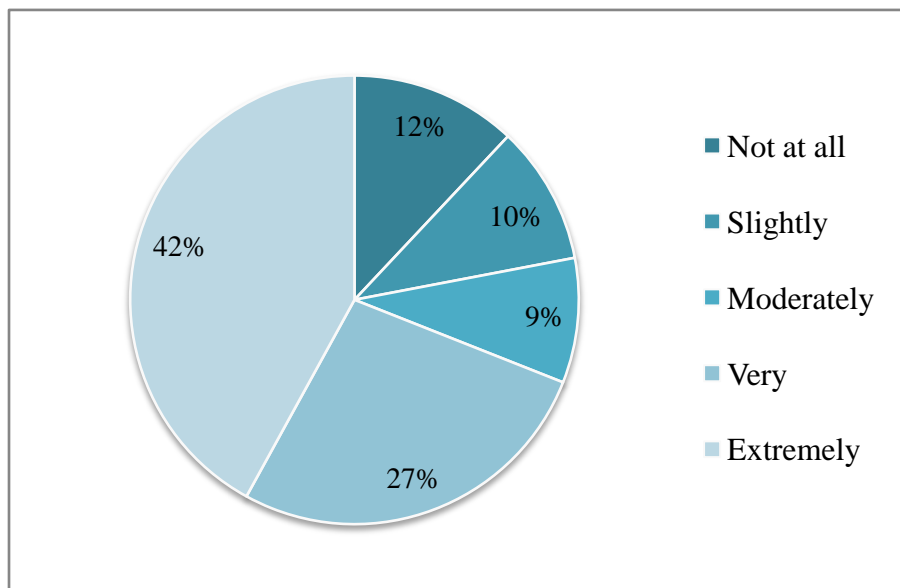


Figure 11. degree to which respondents felt that it was important to have safe and clean drinking water.

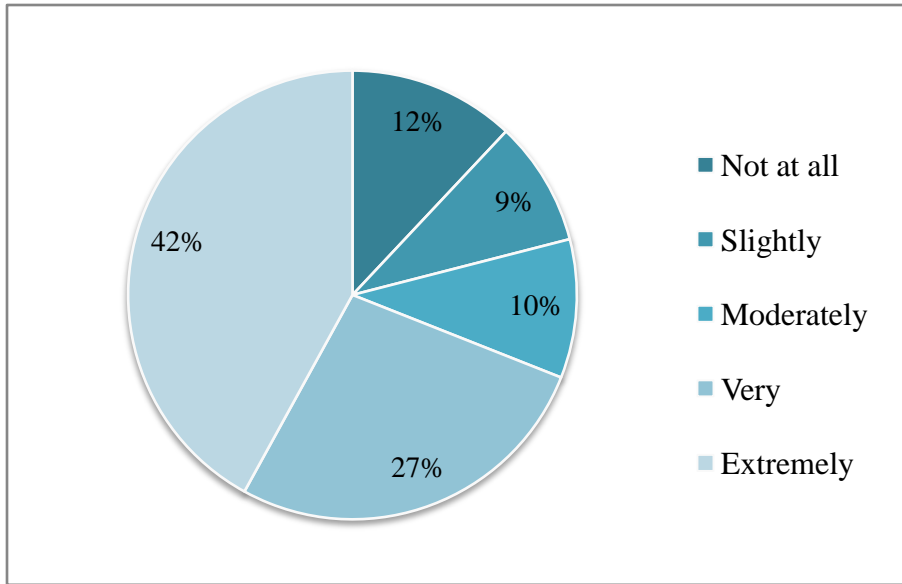


Figure 12. degree to which respondents felt that it was important to have a reliable water source.

Residents' Decisions About Connecting to the Water System

The following four figures relate to respondents' decisions about connecting their homes to the water expansion project. Because survey respondents could answer more than one option for each question, many chose to respond "yes" to more than one option. 40% of respondents decided to not connect to the expanded water system at the time this study was conducted (Figure 13).

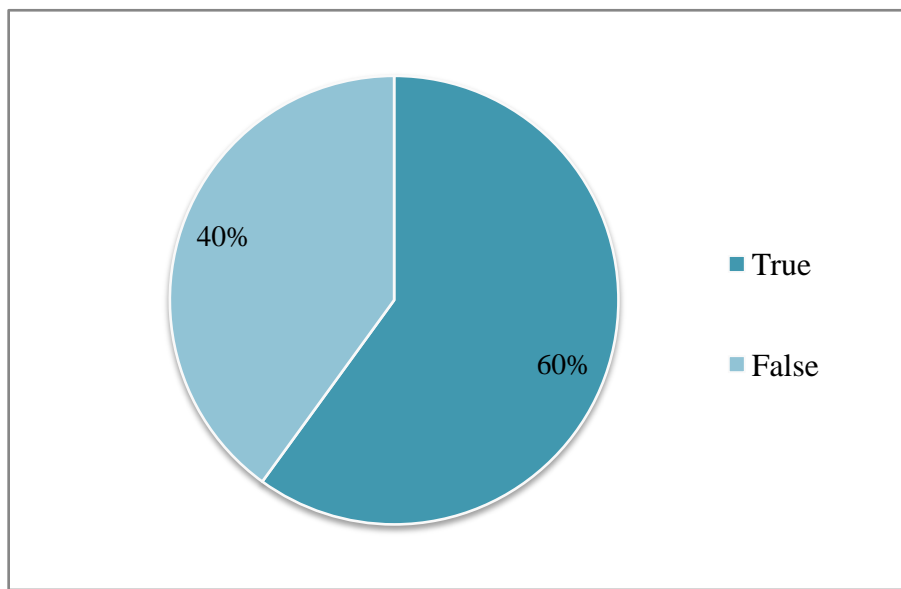


Figure 13. percentage of respondents who answered the statement "I decided to hook-up to the new water system."

The majority of respondents chose to either connect to the water system, pay the tap fee, or both (88%), while only a small percentage (12%) chose to not connect or pay the tap fee (Figure 14).

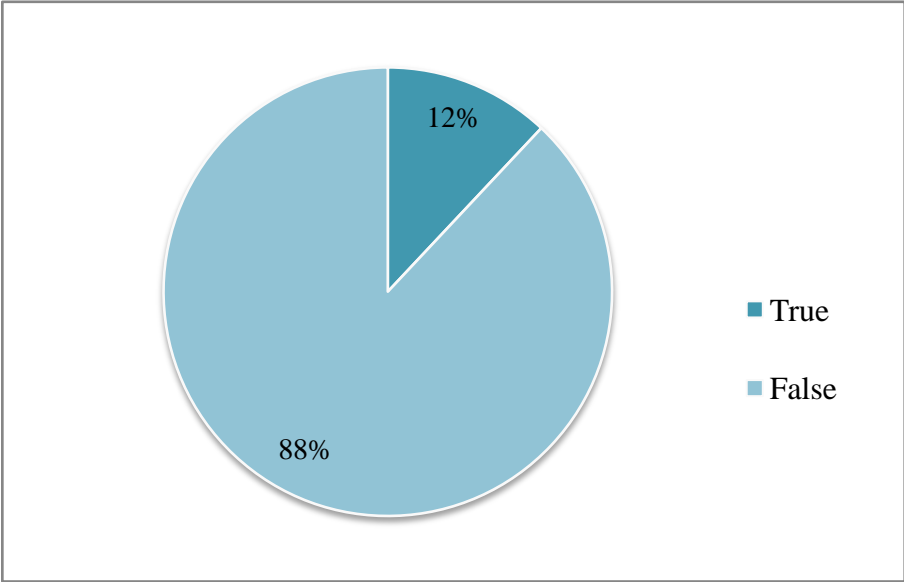


Figure 14. percentage of respondents who answered the statement "I Decided to Not Hook-Up to the New Water System or Pay the Tap Fee."

Thirty-three percent of respondents did not connect to the new water system despite paying the tap fee (Figure 15).

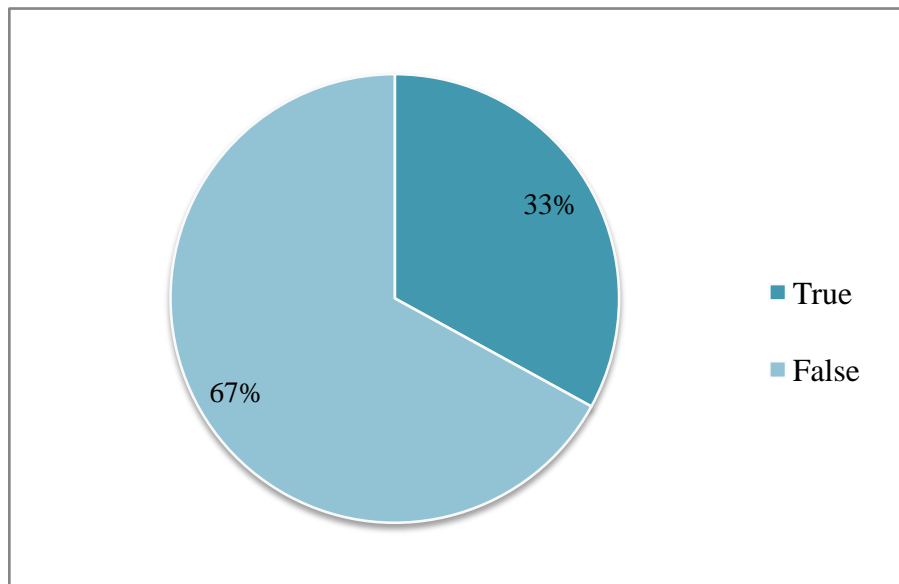


Figure 15. percentage of respondents who answered the statement "I decided to pay the tap fee, but not hook up to the new water system."

About half of respondents (53%) decided to continue using their private wells for outdoor use. (Figure 16).

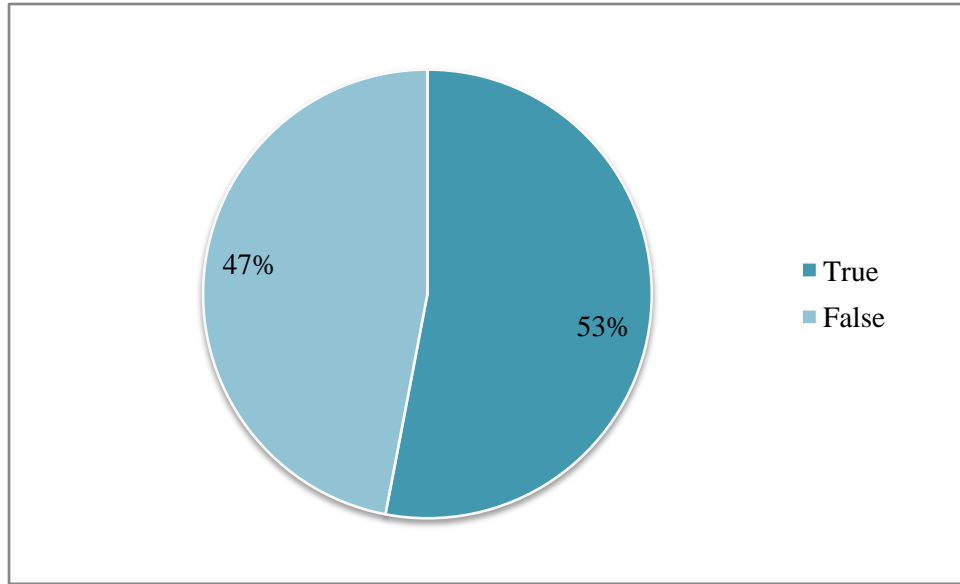


Figure 16. percentage of respondents who answered the statement "I decided to keep my existing well for outdoor use."

Free Response Questions Analysis

The survey included two free response questions. Question “9a” asked “Are you in favor of the water system expansion project?” Question “9b” was a free response follow-up question and asked, “Why or why not?” The second free response question (15) (Appendix B) offered respondents the ability to voice additional comments or concerns. Of the 176 surveys received, 101 (57%) included free response comments.

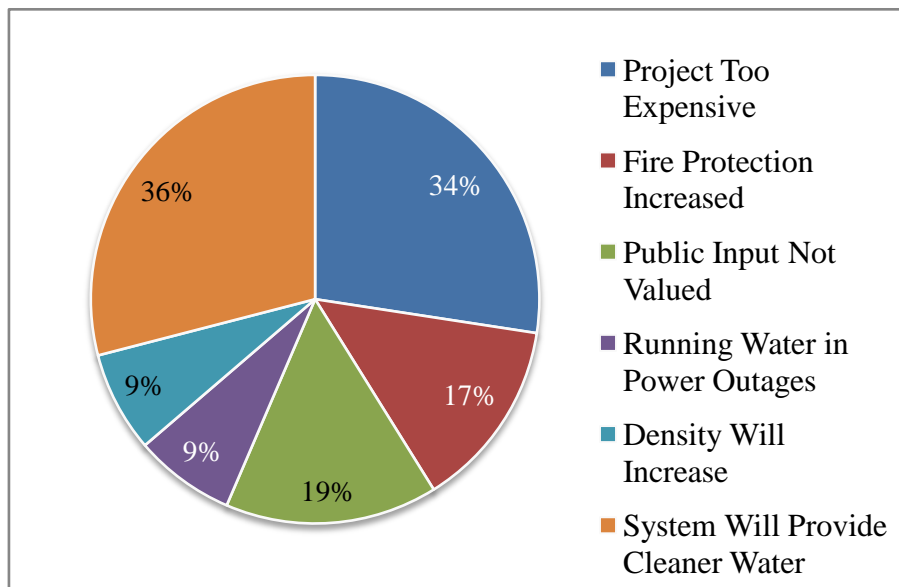


Figure 17. the written free responses of respondents fell largely into six general categories reflecting a range of sentiments.

Chapter IV: Conclusion

The Dare County Water Expansion Project, which brought county water to unincorporated areas of Roanoke Island, yielded a mix of emotions and attitudes among residents impacted by the project. This investigation aimed to identify residents' attitudes regarding domestic water distribution on portions of unincorporated Roanoke Island. To do so, surveys were distributed and collected and the results were analyzed. This report's Results chapter presented those essential findings. In this chapter, investigators explore the implications of the data by considering what residents felt and, more importantly, by considering what may have led to the views expressed. This portion of the study also looks to provide a mechanism for understanding how local-level county projects might impact citizens. Additionally, this chapter offers suggestions for policy-makers based on the collected data.

In order to effectively interpret the data, the rate of response must be considered first. As described in the Results chapter, the rate of response was approximately 19%. A more acceptable rate of response for research of this nature should be greater than 60% (Vaske, 2008). The investigators, therefore, do not know the opinions of the roughly 80% of residents who received a survey but did not return it.

At the outset, the Roanoke Island community expressed views both opposing and supporting the project. Opposition, however, was more evident in the number and type of responses, generally voiced at two Dare County Board of Commissioners meetings where the expansion project was open to public comment. Furthermore, residents held a range of opinions as to why the expansion was occurring, including improving fire safety, reducing lot sizes (thereby possibly allowing for the construction of more homes), providing additional water for the beach communities, and lowering fire insurance rates. In general, the returned surveys

revealed an overall positive attitude towards the expansion project among Roanoke Island residents.

Looking at the data more closely, 59% of respondents favored expansion, versus the 41% that did not favor the expansion (Figure 4). Additionally, 57% of respondents said that they believed that the expansion project was necessary (Appendix C, Table 9). The study also revealed that having a reliable source of water was either “extremely important” or “very important” to 69% of the individuals surveyed (Figure 13). This is evident in the 60% of respondents who decided to hook up to the new water system.

While there were opponents who stated that they were not adequately notified of the expansion, 87% of respondents stated they had been notified at least once about the project (Figure 7). The data also reveals that most respondents felt adequately notified about the expansion project and that they were given information about how much the system would cost as well as other elements of how the project would affect them. A copy of the official letter about the water expansion project that was sent out to residents of unincorporated Roanoke Island by the county administration can be found in Appendix E.

Investigators found that 69% of respondents stated that they had had an opportunity to voice their opinion to the Board of Commissioners (Appendix C). While most individuals did not choose to exercise that option, it is an essential element of local governmental procedure that residents be given the opportunity to voice their thoughts and concerns. Interestingly, 68% of the respondents did not attend any public meetings about the expansion even though 87% of responding residents indicated that they were notified at least once about the public hearings being held, respectively. This could indicate wide tacit approval of the project and/or that many

residents felt that the project was inevitable and, consequently, that there was no possibility that it could be reconsidered by voicing an opinion.

The feeling among some residents that the Board of Commissioners had “forced” this project on residents, as well as the sentiment that respondents were not given much voice in the matter, found partial support in the free response sections of the survey, presented in the Results chapter. While it is evident that the majority of respondents believed that the expansion project was necessary, and that they were notified at least once about it, the free response portion of the survey revealed that a large number of respondents felt that the Board of Commissioners gave them little or no choice about the water expansion system’s implementation.

Additionally, the free response result section made evident respondents’ feelings that the project was too expensive for them. Interestingly, free responses also indicated that respondents were pleased about the increased fire protection, via fire hydrants, and the safe, reliable source of drinking water the expansion will provide. Other notable comments, not included in Figure 17, include the approximately 6% of people who remarked that they believed the project was actually for the benefit of beach-front communities, and the 4% of respondents who felt that the installation of an island-wide sewage system would have been more beneficial to the community. Moreover, 14% of survey participants responding to the free-response questions indicated that they were neither for nor against the project; their written opinions reflected feelings that both favored and opposed the water expansion project.

While there was an overall response in favor of the expansion project among survey respondents, it was noted that the inequitable distribution of water, a possible environmental justice issue, became evident upon close examination of the data. The investigation revealed that the differences in socio-economic status of residents were related to their ability to pay the fees

associated with participation in the water expansion project. The surveys were distributed broadly throughout nine areas of northern Roanoke Island, and consolidated to five areas for statistical purposes (Appendix D, Map 2).

An analysis of those five areas revealed some noteworthy relationships between socio-economic status (SES; composed of a combination of data measuring age, education, income, and race) of residents, and the attitudes expressed by residents toward the expansion project. The respondents of lower SES, who primarily live in Area Four of the survey region, had a lower ability to pay the water expansion fees and, therefore, were less likely to connect to the new water system. A possible consequence of this lower ability to pay is that those residents are not able to participate in the benefits of clean, safe and more reliable water made available by the expansion project. Moreover, the requisite payment of a bimonthly water-use bill, in addition to the per-property cost of \$1,700, may be unduly burdensome. In addition, respondents with a lower SES stated that they would have difficulty being able to pay for the water provided by the system expansion.

The data supports the conclusion that the water expansion project presents something of an environmental justice concern among some residents of Roanoke Island. The study suggests that there were significant differences in the ability to pay between respondents with high SES versus medium to low levels of SES. Responses that showed the greatest disapproval of the expansion project were geographically related to those respondents that had the least ability to pay.

Ultimately, results from this study suggest a number of possible inferences and implications regarding the recent water expansion project on Roanoke Island. It is apparent that the majority of respondents believed that the expansion project was a beneficial and necessary

undertaking. However, the data also suggests that some respondents were not content with how the Dare County Board of Commissioners decided upon and executed the project. A large number of respondents who voiced an opinion in the free response section of the survey felt that the Board had already made a decision to implement the project before any hearings occurred, and, consequently, those residents felt that their opinions, when voiced, were of little consequence. This may indicate a lack of trust among some respondents regarding the actions or motivations of the deciding governmental body.

One aim of this report was to provide suggestions for policy makers regarding future decisions related to expanding utility systems into already inhabited areas. Because so many residents expressed a dislike for the manner in which the water expansion project was implemented, investigators suggest that future projects be implemented only after conducting a more thorough assessment of public opinion regarding the specifics of the project. It is understood that county officials followed the letter of the law in implementing this project, however, the suggestion above is offered in an attempt to honor the spirit of the law, which is to encourage public participation.

Along with gauging public opinion more accurately, investigators suggest a more thorough and efficient manner of notifying residents about the long-term consequences of major public projects. For example, the delivery of high quality, centralized public water to properties may allow more home building to occur due to a reduction in lot size requirement. The sharing of all possible likely consequences of a project by governing authorities would constitute an excellent step toward diminishing residents' confusion, misunderstanding, and perhaps even mistrust.

And finally, investigators suggest that avenues to help residents of limited or very limited means to connect to the expanded public water system be developed so that they, too, can benefit from the improved dependability and quality of the water delivered by a system that passes by their property. While the county did provide an avenue to finance the project over ten years, to limit the financial burden placed on residents, there is not yet a system in place to help residents of lower SES pay the plumber's fees to connect the system and to help pay the bimonthly water bill. Since water is an essential resource upon which many measures of health and well-being depend, it is essential to find a public mechanism to help underwrite some portion of the fees of low income residents. Perhaps a temporary change in the local property tax code could provide low-income residents with a means by which to allow them to become water system users.

Given the three suggestions just made, investigators would like to emphasize that the Dare County Board of Commissioners successfully notified the public by residents' preferred method, which was by mail (Appendix C, Table 11). Furthermore, the defrayal of the \$1,700 project fee over a ten year period free of interest, was well received by residents. This type of compromise is a positive element that can be applied to future projects. Additionally, extending the deadline to connect to the new system at the reduced rate is another helpful effort by the County, as it shows flexibility and receptiveness to public need. The investigators encourage this kind of positive engagement with the public as well as incorporating some other suggestions to ensure continued rewarding work by local government.

In sum, we eight student investigators have gained an immense amount of knowledge regarding how local policy is developed and implemented by studying the Roanoke Island water expansion project. We greatly appreciate the participation and good will of all the residents of

Roanoke Island, water plant personnel, local officials and county employees with whom we interacted in carrying out this project. Thank you, residents of Roanoke Island!

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Appendices

Appendix A: Survey Cover Letter



**UNIVERSITY OF NORTH CAROLINA
AT CHAPEL HILL
OUTER BANKS FIELD SITE**
A Survey About the Roanoke Island Water System Expansion Project

October, 2012

Dear Resident:

We invite you to participate in a research project investigating public attitudes regarding the Roanoke Island Water System Expansion Project. We are students from the University of North Carolina at Chapel Hill involved in a semester-long field course known as the Outer Banks Field Site, which is based in Manteo. We will use the information you provide for a student research project aimed at better understanding the formulation of public policy.

In order to participate, please mail your completed survey using the enclosed envelope. Also, please note that responses must be mailed by Friday, October 25th.

This survey is voluntary and anonymous; you are free to refuse to answer any question. In addition, you may stop answering questions at any time, for any reason.

Information from this survey will be summarized in a final research document, which will be made available to the public in both electronic and printed formats. The findings from this study will also be summarized at a public presentation that will occur at the Roanoke Island Festival Park Art Gallery on December 13th at 2:00 PM. You are invited to the presentation regardless of whether or not you choose to participate in the study.

If you have any questions about this project, please feel free to contact our faculty advisor and Co-Director of the Outer Banks Field Site, Robert Perry, at 252-305-4569. His email address is rtperry@email.unc.edu.

Thank you for your participation!

Best wishes,
Students of the Outer Banks Field Site
Manteo, North Carolina

Appendix B: Survey

Thank you for taking the time to complete this survey. Your opinions are important to us. This survey asks about your personal beliefs and opinions related to the Roanoke Island Water System Expansion Project. Please understand that this survey is voluntary and anonymous. Also, you are free to not answer any question for any reason.

1. The following statements relate to your beliefs about the role of government. With check marks, please indicate the extent to which you agree or disagree with the following statements.

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
a. It is the responsibility of the government to provide safe drinking water to the public.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. It is the responsibility of the government to protect the public from water pollution.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. The following questions relate to your knowledge of the water system expansion project. If you believe the statement is true, please indicate "True." If you believe the statement is false, please indicate "False."

	True	False
a. The water system expansion project will offer improved fire protection.	<input type="checkbox"/>	<input type="checkbox"/>
b. Connection to the expanded water system is mandatory.	<input type="checkbox"/>	<input type="checkbox"/>
c. The water system expansion project reduced the minimum required lot size in unincorporated Roanoke Island.	<input type="checkbox"/>	<input type="checkbox"/>

3. The following questions relate to your personal involvement in the water system expansion project. Please answer each question as it relates to you personally.

a. How many times were you notified about the water system expansion project?
I was notified _____ times about the water system expansion project.

b. How many public meetings did you attend regarding the water system expansion project?
I attended _____ meetings about the water system expansion project.

c. Did you seek out any further information about the Yes No

water system expansion project?

4. Are you the owner of this property?

Yes

No

a. If Yes, please continue to the **NEXT**
question (**4b**)

If No, please **SKIP** to question **8**.

b. How many properties do you own that will be affected by the water system expansion project?

I own _____ properties that will be affected by the water system expansion project.

5. What did you decide to do with regard to the water system expansion project? (Mark all that apply)

I decided to hook up to the new water system (i.e., public water will be connected to one or more of my properties).

I decided to pay the tap fee, but not hook up to the new water system.

I decided to not hook up to the new water system or pay the tap fee.

I decided to keep my existing well for outdoor use.

6. When deciding what to do with regard to the new water system, how important was each of the following:

	Not at all Important	Slightly Important	Moderately Important	Very Important	Extremely Important
a. Having safe and clean drinking water.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Having a reliable source of water.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Your current level of income.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Your personal opinions about the Dare County Board of Commissioners' decision-making process.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7. The following questions relate to your ability to pay for the water system expansion project.

a. How much will the water system expansion project cost you?

The water expansion project will cost me \$ _____.

b. How do you intend to pay for the amount listed above?

c. Please rate your ability to pay for the costs of the water system expansion project.

	I am not at all able to pay.	I am able to pay only with substantial difficulty.	I am able to pay with some difficulty.	I am able to pay with minimal difficulty.	I am able to pay with no difficulty.
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8. The following questions relate to your personal attitudes and beliefs about the water system expansion project. Please indicate the extent to which you agree or disagree with the following statements.

	Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
a. I had the opportunity to voice my opinions to the county commission.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. The water system expansion project is necessary.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. The water system expansion is too expensive.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. The water system expansion project will lead to increased housing development.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. A major purpose of the water system expansion project is to provide water to Nags Head and other beach communities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

9. Are you in favor of the water system expansion project?

a. Yes

No

b. Why or why not?

10. Which of the following is your preferred form of notification about the water system expansion project? (Check one)

Directly from neighbors

Flier on your door

Internet

Local news

Mail

Newspaper

Property management / rental agency

Radio

Social media (i.e., Facebook or Twitter)

Other (please specify): _____

11. Which of the following represents your highest level of education? (Check one)
- Some High School
 - High School
 - Some Community College courses
 - Associates Degree
 - Some Four Year College courses
 - Bachelor's Degree
 - Some Graduate Level Courses
 - Graduate Degree
 - Other (please specify): _____

12. Which of the following best represents the race you identify with? (Check all that apply)
- Caucasian (White)
 - African American
 - Hispanic or Latino
 - Asian
 - American Indian
 - Pacific Islander
 - Other (please specify): _____

13. Which of the following represents your household income level per year? (Check one)
- Less than \$15,000
 - \$15,001 - 30,000
 - \$30,001 - 50,000
 - \$50,001 - 75,000
 - \$75,000 – 125,000
 - More than \$125,001

14. The following questions relate to your age and how long you have lived on Roanoke Island.
- a. How old are you?
I am _____ years old.
 - b. How long have you live on Roanoke Island?
I have lived on Roanoke Island for _____ years.

15. Additional comments or concerns? Please use the space provided to tell us about additional thoughts or feelings you have regarding the water system expansion project.

THANK YOU!

On behalf of the students at the University of North Carolina at Chapel Hill Outer Banks Field Site (OBXFS) we thank you for taking the time to complete our survey. Your responses will help us evaluate public opinion of the Roanoke Island Water System Expansion Project.

If you have any questions about our project, feel free to contact us at:

OBXFS
P.O. Box 370
Manteo, NC
27954

Or email OBXFS Co-Director Robert Perry at: rtperry@email.unc.edu

Appendix C: Survey Results Summary Tables

Table 1. Summary of general attitudes towards water.

Statement	Disagree			Agree			<i>M</i>	<i>SD</i>
	-3	-2	-1	1	2	3		
It is the responsibility of the government to provide safe drinking water to the public.	7%	10%	5%	17%	28%	33%	1.3	1.9
It is the responsibility of the government to protect the public from water pollution.	3%	1%	2%	7%	40%	47%	2.1	1.3

Table 2. Summary of water system expansion knowledge.

Statement	<i>n</i>	True	False
The water system expansion project will offer improved fire protection.	175	89%	11%
Connection to the expanded water system is mandatory	177	16%	84%
The water system expansion project reduced the minimum required lot size in unincorporated Roanoke Island.	135	44%	56%
People answering no questions correctly.	2	2%	
People answering one question correctly.	17	13%	
People answering two questions correctly.	75	56%	
People answering three questions correctly.	39	29%	

Table 3. Summary of personal involvement in the water system expansion project.

Question	<i>n</i>	<i>M</i>	<i>SD</i>
How many times were you notified about the water system expansion project?	148	2.5	2.0
		<u>Percentages</u>	
0 times	19	13%	
1 time	28	19%	
2 times	30	20%	
3 times	42	28%	
4 times	14	10%	
5 times	8	5%	
> 5 times	7	5%	
How many public meetings did you attend regarding the water system expansion project?	173	.5	.8
		<u>Percentages</u>	
0 meetings	117	68%	
1 meeting	34	20%	
2 meetings	18	10%	
3 meetings	3	2%	
4 meetings	0	--	
5 meetings	1	< 1%	
		<u>Yes</u>	<u>No</u>
Did you seek out any further information about the water system expansion project?	173	32%	68%

Table 4. Summary of ownership.

Question	<i>n</i>	Yes	No
Are you the owner of this property?	178	94%	6%
	<i>n</i>	<i>M</i>	<i>SD</i>
How many properties do you own that will be affected by the water system expansion project?	165	1.3	0.9

Table 5. Summary of decisions about the water system expansion project.

Decision	<i>n</i>	Percentage
I decided to hook up to the new water system.	103	60%
I decided to pay the tap fee, but not hook up to the new water system.	57	33%
I decided to not hook up to the new water system or pay the tap fee.	21	12%
I decided to keep my existing well for outdoor use.	91	53%

Table 6. Summary of potentially important aspects of the water system expansion project decision process.

Statement	Not at all important			Extremely important		<i>M</i>	<i>SD</i>
	0	1	2	3	4		
Having safe and clean drinking water.	12%	10%	9%	27%	42%	2.8	1.4
Having a reliable source of water.	12%	9%	10%	27%	42%	2.8	1.4
Your current level of income.	25%	13%	21%	17%	25%	2.1	1.5
Your personal opinions about the Dare County Board of Commissioners' decision-making process	33%	8%	16%	21%	23%	1.9	1.6

Table 7. Summary of the ability to pay for the water system expansion project.

	<i>n</i>	<i>M</i>	<i>SD</i>
How much will the water system expansion project cost you?	128	\$2601.3	\$1898.0
		Percentage	
\$500 or less	7	5%	
\$501 – \$1,000	9	7%	
\$1,001 – \$1,500	3	2%	
\$1,501 – \$2,000	29	23%	
\$2,001 – \$2,500	40	31%	
\$2,501 – \$3,000	18	14%	
\$3,001 – \$3,500	6	5%	
\$3,501 – \$4,000	3	2%	
\$4,001 – \$4,500	1	< 1%	
\$4,501 – \$5,000	1	< 1%	
\$5,001 – \$5,500	1	< 1%	
\$5,501 – \$6,000	2	2%	
\$6,001 – \$6,500	1	< 1%	
\$6,501 – \$7,000	2	2%	
\$7,001 or greater	5	4%	

Table 8. Summary of self-assessed ability to pay for the costs of the water system expansion

Able to pay with no difficulty	Able to pay with minimal difficulty	Able to pay with some difficulty	Able to pay with substantial difficulty	Not able to pay	<i>M</i>	<i>SD</i>
0	1	2	3	4		
20%	34%	29%	15%	4%	1.5	1.1

Table 9. Summary of personal attitudes and beliefs about the water system expansion project.

Statement	Disagree			Agree			<i>M</i>	<i>SD</i>
	-3	-2	-1	1	2	3		
I had the opportunity to voice my opinions to the commission.	15%	12%	4%	12%	41%	16%	0.7	2.1
The water system expansion project is necessary.	20%	17%	6%	18%	27%	12%	0.1	2.2
The water system expansion is too expensive.	7%	11%	7%	20%	27%	29%	1.1	1.9
The water system expansion project will lead to increased housing development.	7%	17%	10%	19%	27%	20%	0.7	2.0
A major purpose of the water system expansion project is to provide water to Nags Head and other beach communities.	20%	28%	12%	10%	15%	16%	-0.4	2.2

Table 10. Summary of water system expansion project favorability.

	<i>n</i>	Yes	No
Are you in favor of the water system expansion project?	159	59%	41%

Table 11. Summary of preferred notification method

Contact method	<i>n</i>	Percentage
Directly from neighbors	8	5%
Flier on your door	28	17%
Internet	9	5%
Local news	13	8%
Mail	96	58%
Newspaper	9	5%
Property Management / rental agency	0	0%
Radio	1	< 1%
Social media	1	< 1%
Other	1	< 1%

Table 12. Summary of education level

Education level	<i>n</i>	Percentage
Some high school	0	0%
High school	27	15%
Some community college	23	13%
Associates degree	22	13%
Some college	20	11%
College degree	34	19%
Some graduate school	10	6%
Graduate degree	39	22%

Table 13. Summary of race

Race	<i>n</i>	Percentage
Caucasian (White)	163	91%
African American	4	2%
Hispanic or Latino	3	2%
Asian	2	1%
Pacific Islander	2	1%
Other	2	1%

Table 14. Summary of income

	<i>n</i>	Percentage	<i>M</i>	<i>SD</i>
Income level	166	--	3.8	1.3
Less than \$15,000	5	3%	--	--
\$15,001 – \$30,000	18	11%	--	--
\$30,001 – \$50,000	46	28%	--	--
\$50,001 – \$75,000	44	27%	--	--
\$75,001 – \$125,000	34	21%	--	--
More than \$125,000	19	11%	--	--

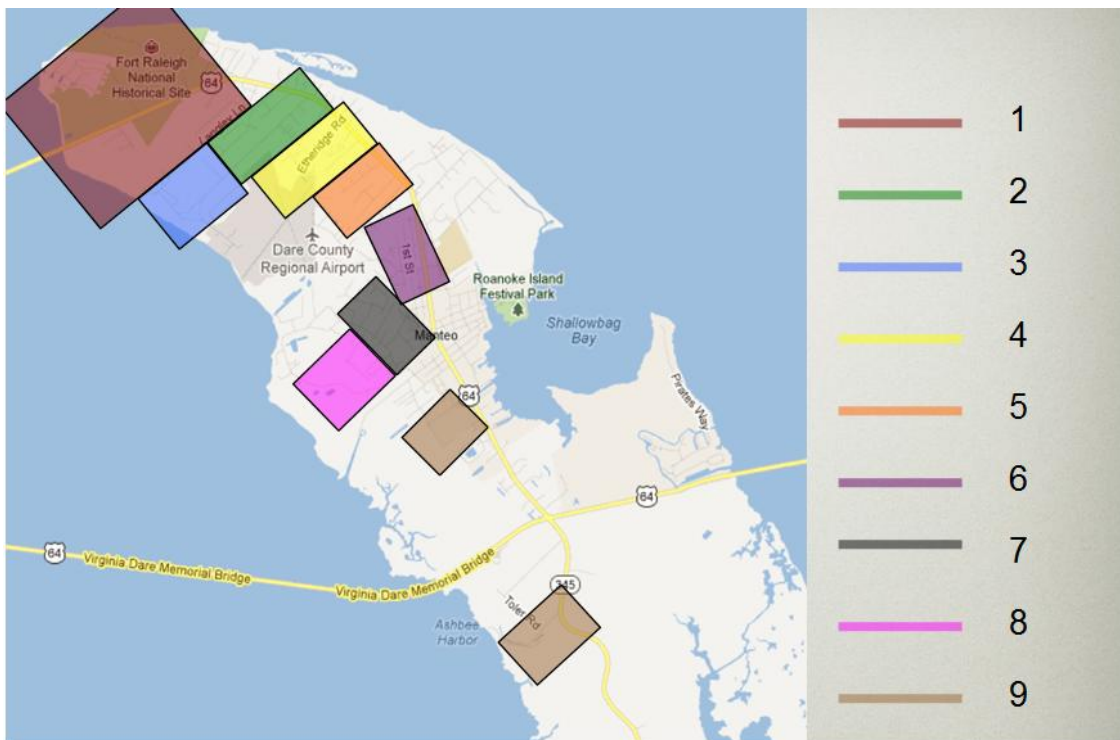
Table 15. Summary of age

	<i>n</i>	Percentage	<i>M</i>	<i>SD</i>
Age	173	--	58.6	13.1
30 and below	7	4%	--	--
31 – 35	4	2%	--	--
36 – 40	9	5%	--	--
41 – 45	7	4%	--	--
46 – 50	16	9%	--	--
51 – 55	15	9%	--	--
56 – 60	34	20%	--	--
61 – 65	29	17%	--	--
66 – 70	25	14%	--	--
71 – 75	14	8%	--	--
76 – 80	7	4%	--	--
81 and above	6	3%	--	--

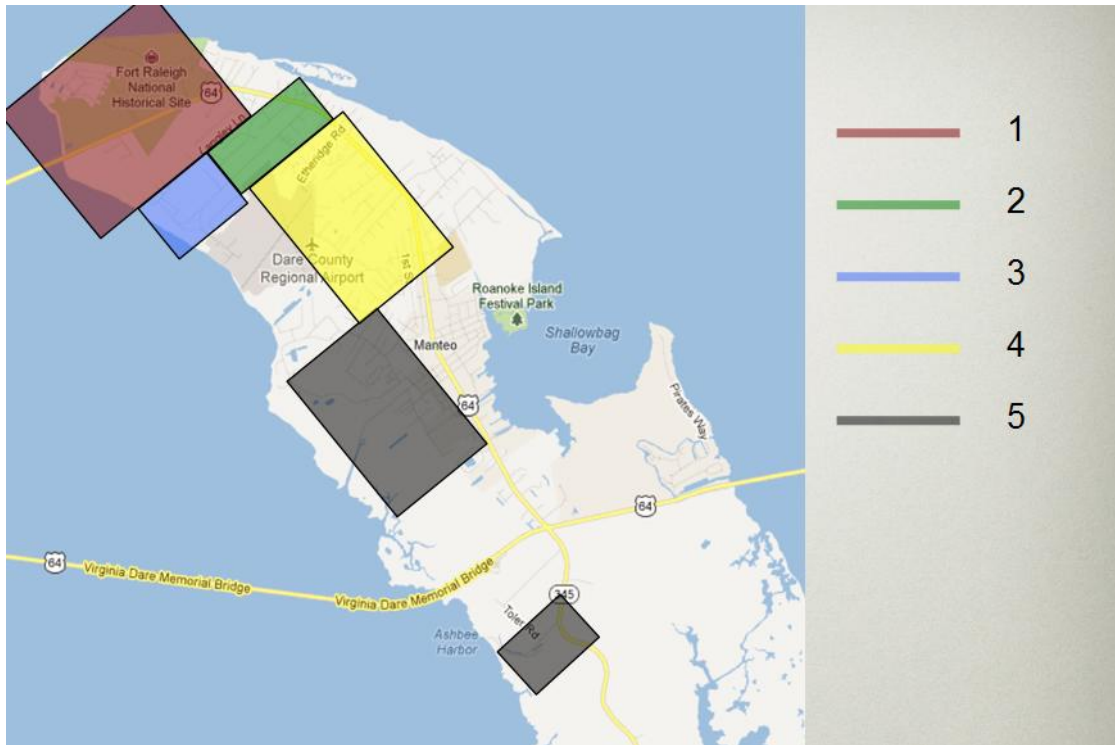
Table 16. Summary of the number of years lived on Roanoke Island

	<i>n</i>	Percentage	<i>M</i>	<i>SD</i>
Number of years	174	--	23.9	18.3
1 or less	6	3%	--	--
2 – 5	12	7%	--	--
6 – 10	35	20%	--	--
11 – 15	21	12%	--	--
16 – 20	19	11%	--	--
21 – 25	18	10%	--	--
26 – 30	10	6%	--	--
31 – 35	12	7%	--	--
36 – 40	8	5%	--	--
41 – 45	6	3%	--	--
46 – 50	7	4%	--	--
51 – 55	6	3%	--	--
56 – 60	5	3%	--	--
61 or more	9	3%	--	--

Appendix D: Map of Survey Distribution Area on Roanoke Island



Map 1. the nine areas of northern Roanoke Island where investigators distributed surveys
Courtesy of: Google Maps
Credit: Adam Gibson



Map 2.five areas representing similar data trends from the nine areas where surveys were distributed. These areas were used in the development of the study's statistics.

Courtesy of: Google Maps

Credit: Adam Gibson

Appendix E: Packet Sent to Homeowners Regarding Water Expansion Project



ROANOKE ISLAND

Water System Expansion Project

*Important Information
For Residents & Property Owners*



Dare County Water Department
252.475.5990 • www.DareNC.com



ROANOKE ISLAND

Water System Expansion Project

May 15, 2011

Dear Roanoke Island Property Owner,

The water system for your area is now being expanded to make water service available to all properties on Roanoke Island. In addition to providing quality drinking water for island homes and businesses, this expansion will offer improved emergency water resources for the Roanoke Island Fire Department to use when fighting fires in our community. According to local fire department officials, this improvement could also positively impact your fire insurance rating, reducing your insurance premium.

This major expansion project is being coordinated by the Dare County Water Department and involves the use of independent contractors who are performing the digging and water line work in area neighborhoods. The project is already well underway and scheduled to be complete in June of 2012.

Whenever possible, water line improvements will be placed in the public right of way. If placed in the public right of way or in an existing utility easement, an easement from you will not be necessary. If the improvements will be placed in a private street adjacent to your property or on your property, an easement will be required. If an easement is required, you will receive a letter from Dare County and will also be contacted by Gulf Coast Property Acquisition, Inc., agents for the County. If you are contacted about an easement, we encourage you to respond at your earliest convenience in order to facilitate construction in a timely cost effective manner, which will help keep future usage fees to a minimum.

Please be aware that there will be an assessment made for all property owners along the new water line who do not already have access to Dare County water. This is a one-time assessment that is required for each parcel, whether you decide to connect to the water system or not. The assessment amount is a flat rate of \$1,700.00 for each lot, regardless of the size of the property.

A bill for this required assessment will be sent to you by fall 2011. It can be paid in full by June 1, 2012, or you may pay it in seven (7) equal annual payments of principal with interest at 5% per year. If you choose the option of paying in annual installments, the first payment will be due June 1, 2012.

All property owners have the opportunity to connect to the expanded water line route; however, connection is not mandatory. In an effort to help you make the transition from your existing well to the expanded water system, Dare County is offering the following special rate and incentive for those who choose to become subscribers before March 31, 2012.

Continued...

Dare County will waive the usual \$2,500.00 impact fee for all new initial subscribers prior to March 31. Instead, you will only pay a \$340.00 connection fee plus a \$107.00 security deposit for a standard ¾-inch water service connection.

After March 31, 2012 the initial subscriber period will end and an impact fee of \$2,500.00 will be required in addition to the \$340.00 connection fee and \$107.00 security deposit for a standard ¾-inch water service connection.

After fees have been paid, the Water Department will install a water meter within the right-of-way or easement on your property when water service becomes available in your neighborhood. It will be each homeowner's responsibility and expense to run the necessary valves and piping from the water meter to the residence.

You may keep your existing wells for outdoor use. However, they may not be connected to any piping that ties into the water system.

To become an "initial subscriber" on the new Roanoke Island water system, you must complete the enclosed service agreement and return it before March 31, 2012. Send the completed agreement to:

**Dare County Water Department
600 Mustian Street
Kill Devil Hills, NC 27948**

Throughout this project, we are committed to providing you with ongoing updates about when construction will be done in your neighborhood and when the contractor expects to complete each phase of the project.

For the work schedule or for more information, visit the Dare County website www.darenc.com and watch for special notices on The Government Channel (Channel 20 for Charter Cable customers).

The Dare County Water Department recognizes that major projects, such as this, can cause a certain amount of disruption and questions. Please know that we are working hard to minimize any inconvenience to the community we are proud to serve. If you have any questions about the Roanoke Island water expansion project and how it will affect you, please call the Dare County Water Department at 475-5990.

Sincerely,



Ken Flatt, *Utilities Director*



ROANOKE ISLAND

Water System Expansion Project

PROJECT OVERVIEW

The primary needs met by system expansion include:

- Providing safe, reliable water service to all on Roanoke Island not served by the Manteo Water System, eliminating dependence on individual wells on Roanoke Island.
- Improved fire protection throughout the island with the included hydrant system.
- The system expansion could have a positive impact on homeowners' insurance rates, according to local fire officials.

Here are key facts of the water system expansion project at a glance:

- The Dare County Board of Commissioners approved project funding and construction began in early 2011.
- Approximately 56 miles of water line will be installed.
- The hydrant system of over 200 hydrants will assist Roanoke Island Fire Department in improving fire protection for Roanoke Island.
- A new 300,000 gallon elevated water storage tank at the end of Bowsertown Road will be completed to provide water storage for the system.
- A new 2 million gallon ground storage tank at the Skyco Water Plant will also be constructed.
- The Skyco Water Plant Pump Station Facility will receive necessary improvements to meet the increased water handling requirements for Roanoke Island.
- Project completion is estimated to be June 2012.



The construction project has four separate phases:

1. Middle Roanoke Island (Hwy 264 North to Burnside Road) –Construction Underway
2. Northern Roanoke Island (Burnside Road to the Manns Harbor Bridge) – Construction Underway
3. Skyco-Wanchese Water Main (Skyco Water Plant to Baumtown Rd) –Construction expected to start in September 2011.
4. Wanchese Community (All streets and roads in the community of Wanchese) – Construction expected to start in September 2011.

Throughout this project, we are committed to providing you with ongoing updates about when construction will be done in your neighborhood and when the contractor expects to complete each phase of the project.

For more information, visit the Dare County website www.darenc.com and watch for special notices on The Government Channel (Channel 20 for Charter Cable customers).

The Dare County Water Department recognizes that major projects, such as this, can cause a certain amount of disruption and questions. Please know that we are working hard to minimize any inconvenience to the community we are proud to serve. If you have any questions about the Roanoke Island water expansion project and how it will affect you, please call the Dare County Water Department at 475-5990.

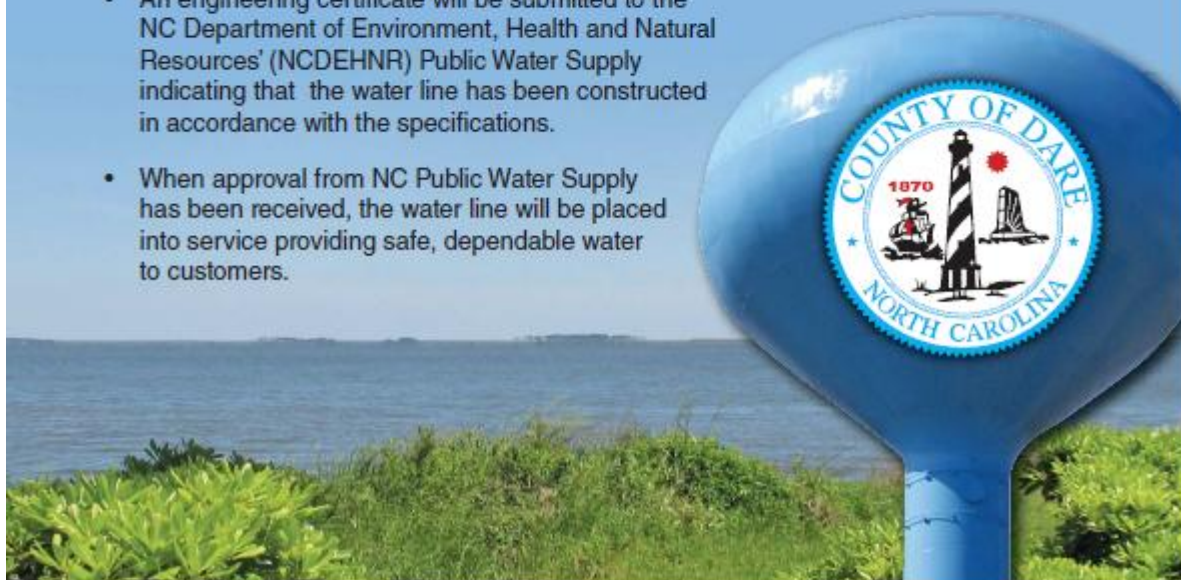
WATER LINE CONSTRUCTION PROCESS

The general process used during water line installation:

- Crews will locate all underground utilities (power, telephone, and cable) that are located along the water line route to avoid affecting existing utilities. Spray painted markings on the ground and flags placed where lines are located indicate that this step of the process has been completed.
- Construction crews will make videos of the property before construction begins so there is a record of what the area looks like prior to breaking ground. This will assist crews in restoring the area as closely as possible after construction.



- Crews will post a door hanger notification at each individual residence at least three days prior to beginning construction.
- Water line construction requires temporary removal of driveway sections and other items that may lie in the right of way. These will be put back in place after construction. Mailboxes may be removed for a few hours during construction but will be returned promptly.
- Fire hydrants, valves, and valve markers will be installed after the water lines are in place.
- Once the water line and accessories (hydrants and valves) are installed, the excavated area is backfilled with the removed soil. Stone will be placed as a temporary filler where driveways were cut during construction.
- Construction areas will be finished, graded and seeded in sections at a later time after work in that area is complete.
- Crews will repave multiple driveways as construction is finished in each area.
- Once a large enough section of the new water line is installed, it will be filled with water and pressure tested.
- Service connections along the water line route will be installed for customers who choose to become initial subscribers and connect to the water system. Service connection does not include valves and piping from the water meter to the residence, which is the responsibility and expense of each homeowner.
- Once pressure tests have been completed, the water line is flushed and disinfected with chlorine. Bacteriological tests will be done to ensure the water line has been properly disinfected.
- An engineering certificate will be submitted to the NC Department of Environment, Health and Natural Resources' (NCDEHNR) Public Water Supply indicating that the water line has been constructed in accordance with the specifications.
- When approval from NC Public Water Supply has been received, the water line will be placed into service providing safe, dependable water to customers.





COUNTY OF DARE

Water Department
800 Mustian Street, Kill Devil Hills, NC 27948

Ken Flatt
Utilities Director

Phone: (252) 475-5990
Fax: (252) 441-2239

APPLICATION FOR WATER SERVICE

WATER DEPARTMENT USE ONLY	
Date Received _____	Rect. # _____
Deposit _____	Meter # _____
Conn. Fee _____	ID # _____
Impact Fee _____	Account # _____
EAP Fee _____	Installed _____

Name of Owner _____ Phone # _____

Mailing Address _____

Address of Water Service _____

Subdivision _____ Lot # _____ Block # _____ Parcel # _____

Type of Occupancy: Residence Motel (_____ Units) Apartments (_____ Units)
 Restaurant (Seating Capacity _____) Other _____

SIZE TAP APPLIED FOR: _____

I hereby apply for water service for the above-designated property. Enclosed is a total application fee of \$ _____ for the meter size indicated. I understand and agree to abide by the water rate and rules and regulations as adopted by the Board of Commissioners of Dare County. I also understand that the County is not obligated to provide the service requested.

Signature of Applicant or Authorized Agent

FIELD CREW USE ONLY	
Meter # before is _____	Meter Location _____

NOTE: Please complete this form, and mail the original to:
Dare County Water Department, 600 Mustian Street, Kill Devil Hills, NC 27948. If you have any questions about completing this form, please call us at (888) 998-9283 or (252) 475-5990. Thank you.

LAND OF BEGINNINGS