

**Public Water Reclamation Systems in North Carolina:
Why do public utilities produce reclaimed water, how have they tried to attract
reclaimed water customers, and how successful have those efforts been?**

by

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Executive Summary

Reclaimed water is highly treated wastewater that can be reused in a variety of ways including irrigation and industrial cooling. With a rapidly growing population and an increase in the amount of wastewater being produced, reclaimed water can assist North Carolina communities with conserving and extending existing water supplies and reducing the amount of wastewater discharged to surface waters. As of November 2006, thirty-three North Carolina public utilities had reclaimed water programs. This research examines the reasons North Carolina public utilities produce reclaimed water, the methods they use to attract reclaimed water customers, and the effectiveness of those efforts. Based on the survey results, recommendations are offered to help public utilities increase their effectiveness at attracting reclaimed water customers.

INTRODUCTION

Many communities around the world are approaching the limits of their available water supply and many are turning to water reclamation for help. Reclaimed water is highly treated wastewater that can be reused in a variety of ways including irrigation, manufacturing processes, industrial cooling, and fire protection. Although the need for additional water supply has been the impetus for numerous reclaimed water programs, several programs were created to provide communities with an alternate wastewater disposal method. Many communities are faced with rigorous and costly requirements for effluent discharge to surface waters, particularly the removal of nitrogen and phosphorous in wastewater; however, for many nonpotable reclaimed water applications this removal is unnecessary. Thus, some municipalities have implemented reclaimed water programs to reduce the need for costly nutrient removal or to ensure that their utilities remain within the mandated discharge limits.

BACKGROUND

Florida and California are leading states in the realm of reclaimed water.¹ Faced with similar challenges of significant population growth and shrinking water supplies, the motivation behind Florida's and California's water reclamation programs is the same, to extend existing water supplies. Their methods for attracting reclaimed water customers are also the same. Florida and California have state statutes and local ordinances that support and mandate the use of reclaimed water by customers who have the resource available to them.² Public utility customers in these states are expected to use the lowest water quality that is necessary for activities requiring the use of water.

Droughts and rapid population growth have presented the state of North Carolina with significant challenges. The Water 2030 Report produced by the North Carolina Rural Center states, "water supply shortages have forced localities to look for alternative and back-up resources. In 2002 more than 90 North Carolina water systems were placed under mandatory water conservation, and many others agreed to voluntary conservation".³ Despite these challenges, North Carolina must prepare for a tougher challenge that lurks ahead. The Rural Center declares, "By 2030, North Carolina's public water systems are projected to serve 9.8 million people, 70 percent more than today".⁴

RESEARCH PURPOSE

As of November 1, 2006, thirty-three public utilities in North Carolina had reclaimed water programs. This research examines the reasons North Carolina public utilities produce reclaimed water, the methods they use to attract reclaimed water customers, and the effectiveness of those efforts. Based on the survey results, recommendations are offered to help public utilities increase their effectiveness at recruiting customers for their water reclamation programs. Recommendations are also offered to local governing boards and state officials and departments.

METHODOLOGY

A list of active public reclaimed water systems was obtained from the North Carolina Department of Environment and Natural Resources' Division of Water Quality. Active reclaimed water systems were defined as systems that were operating as of November 1, 2006. An online survey was sent to representatives from the thirty-three public utilities with active reclaimed water systems. The online survey consisted of closed and open-ended questions (Appendix A). Utility Directors were the preferred survey participants, but for varying reasons Assistant Utility Directors and Reclaimed Water Superintendents were surveyed as needed. Fourteen public utility representatives completed the survey yielding a response rate of forty-two percent. The utilities' length of experience with their reclaimed water systems varied from one year to twelve years, with 6.3 years being the average length of time. With one exception, all fourteen utilities had been operating their reclaimed water systems for at least three years. A more detailed discussion of participating and nonparticipating utilities is included in Appendix B.

FINDINGS

Motivations

Respondents were asked to rank a set of factors to assess their utilities' motivations for establishing reclaimed water systems. The participants were asked to rank these factors on a scale of 1 to 5 with 5 indicating that a factor was very important in the decision to implement a reclaimed water system and 1 if a factor was of no importance.

Table 1 (Motivational Factors)

One respondent was unaware of the motivational factors for his or her utility's decision to implement its reclaimed water program; therefore the results are based on thirteen responses. The two overarching reasons for the establishment of the

Motivational Factor	Avg. Response	Number (Percent) that Ranked Very Important or Important (4 or 5)
Helps meet discharge limits	3.2	7 (54%)
Conservation measure	3.2	5 (38%)
Mitigate water supply shortages	2.4	3 (23%)
Generate revenue	1.4	1 (8%)

reclaimed water systems appear to be related to water quantity—conserving water and mitigating water supply shortages—and water quality—meeting discharge limits. 'Helps meet discharge limits' was the factor most frequently indicated as being either very important or important.⁵ Respondents were also given the opportunity to indicate other motivational factors that were not listed. Among the responses were: the opportunity to serve as a pilot study, the ability to add points on grant applications, and the ability to control rates.

Customers

Eight of the fourteen utilities supply reclaimed water only to property managed by the utility or owned by the local government while the remaining six utilities serve external customers.

Table 2 (Type of Customer Served & Motivational Factors)⁶

Most of the utilities that ranked meeting discharge limits as the most important factor in establishing their reclaimed water systems also noted

Most Important Motivator (N=11)	Number (Percent) that Serve Internal Only	Number (Percent) that Serve External Customers
Conservation or Mitigate water supply shortages (5)	40%	60%
Meet discharge limit (6)	67%	33%

that they only served internal customers (i.e., the utility and/or property owned by the local government) while most utilities that ranked conservation or mitigation of water supply shortages as most important noted that they served external customers; most of these utilities also serve internal customers.

Four of the eight utilities that only serve internal customers have plans to expand the use of reclaimed water within and beyond the utility and local government. When asked to reply to the open-ended statement of "Explain the utility's progress at expanding the service to other customers" participants' responses included:

- We are expanding the reuse program on land the town purchased for future landfill use.
- We have applied for a grant to install a water storage tank and distribution system. The proposed distribution system will allow service to numerous parks, a golf course, schools and other potential users. Without grant funds, the project isn't economically feasible.
- We have just completed a 300,000 gallon a day reuse plant at the golf course that treats water from a major outfall that runs beside the course. We hope that this will lead to greater acceptance of reuse water for other uses. We may at some point connect the homes backing up to the golf

course and set a reuse rate. We see reuse as the way to meet both future sewer and water demands.

Table 3 (Reclaimed Water Customers)

The remainder of the findings will focus on the six utilities that already provide reclaimed water to customers beyond the utility and local government. The types of reclaimed water customers served by these utilities vary. The utilities were asked

Type of Customer	Number of Utilities Serving This Type of Customer
Industrial customers	3
Residential customers	2
Commercial customers	5

through a set of identified options what type of customers they serve with reclaimed water. The majority of these utilities provide reclaimed water to industrial and commercial customers. Only two provide reclaimed water to residential customers. Three of the utilities serve multiple types of customers, thus accounting for the overlap. The number of reclaimed water customers served ranged from one customer to five hundred customers, with one being the most frequent response.

Table 4 (Initial Methods for Attracting Customers)

The six utilities used different methods to attract customers. Utilities were asked, “When your utility began the reclaimed water program, how did your utility attract reclaimed water customers?”. Participants were able to choose from a set of identified factors and indicate any factor that was not listed by selecting other.

Method	Number of Utilities
Provided reclaimed water free of charge	3
Provided reclaimed water at reduced rate	3
Mandated the use of reclaimed water	2
Other	2

The results show that in the beginning individual utilities used multiple methods to attract customers. The most frequently used methods were related to reclaimed water rates. Only two utilities mandated the use of reclaimed water. One utility indicated that it provided the water taps and waived the meter installation fee for reclaimed water customers. Another utility promoted the use of reclaimed water by distributing educational brochures, and customer mailings, implementing a reclaimed water hotline and newsletter, and having a full time Reclaimed Water Coordinator on staff. An independent survey of this utility’s reclaimed water customers indicated that as high as 60 percent believed these informational sources were helpful (see Appendix C).⁷ In addition, when asked whether they had any concerns about the safety of using reclaimed water for irrigation, 83 percent of the utility’s customers indicated that they did not have any concerns. Furthermore, 65 percent of the customers indicated that if they moved to another similar community, they would look for a home that used reclaimed water for irrigation.

Table 5 (Current Methods for Attracting Customers)

Respondents were asked, “Now that your program has been in place for a while, currently, how does your utility attract reclaimed water customers?”. The results show that individual utilities are using fewer methods to attract customers; most of the utilities now rely on one method. Notably, the number of utilities using methods related to water rates to attract customers decreased. One utility explained “We are still looking at how we can attract customers”.

Method	Number of Utilities
Provide reclaimed water free of charge	2
Provide reclaimed water at reduced rate	1
Mandate the use of reclaimed water	2
Other	1

Effectiveness

Utilities were asked, “Since beginning the reclaimed water program, has the number of customers increased, decreased, or remained the same?”. Four utilities indicated that the number of reclaimed water

customers remained the same and two indicated that the number of reclaimed water customers had increased. The two utilities that experienced an increase in the number of customers are also the two utilities that mandate the use of reclaimed water.

Respondents were asked to indicate whether their utilities were serving more, fewer, or about the same number of reclaimed customers than was projected when the decision was made to implement the program. Only one utility indicated that it was serving fewer customers than was projected. The remaining five utilities are serving about the same number of customers that was projected.

Table 6 (Effectiveness: Water Pumped)

Respondents were asked to indicate whether their utility was pumping more, less, or about the same amount of reclaimed water that was projected when the decision was made to implement the program. Most utilities are pumping about the same amount of reclaimed water that they projected. Only one utility noted that it was pumping more reclaimed water than was projected. This utility explained that after implementing the program it began the unanticipated practice of using reclaimed water for fire department training.

Utility Pumping Status	Number of Utilities
About the same amount of reclaimed water that was projected	3
Less reclaimed water than was projected	2
More reclaimed water than was projected	1

Table 7 (Purposes Met)

Utilities were asked to indicate whether their reclaimed water programs had met the purposes for which they were created. Three utilities indicated that their reclaimed water programs had met the purposes for which it was created. Only one utility indicated that its reclaimed water program had not met the purposes for which it was created.

Reclaimed Water Program & Purposes	Number of Utilities
Met the purposes for which it was created	3
Somewhat met the purposes for which it was created	2
Not met the purposes for which it was created	1

When asked the open-ended question of “Describe ways in which the program has exceeded original expectations” all respondents indicated that their programs had not exceeded expectations. When asked the open-ended question of “Describe ways in which the program has fallen short of original expectations” participants’ responses included:

- Operator training costs have been higher than expected along with chemical and plant operation overheads.
- We need to make an investment to gain reclaimed water customers. They need to be nonseasonal and have incentive. Currently, the culture is not geared toward water conservation because it is perceived that we have a strong water supply. We need to establish our policies for our program and then determine how we will attract our customers to this program.
- Lack of customers. We are currently serving a municipal golf course and approximately 200,000 GPD are used at the Water Reclamation Facility. The system capacity is 6.0 MGD. An industrial customer, who is also our largest wastewater contributor, that participated in obtaining a grant to construct distribution piping and elevated storage tank to provide its facility with reclaimed water ended up backing out of participating after the pipe and tank had been constructed due to not being able to get the company’s corporate attorney on board with using reclaimed water because of public perception.

RECOMMENDATIONS

The findings from the survey allow recommendations to be offered to assist public utilities with increasing their effectiveness at attracting reclaimed water customers. Local governing boards and state officials and departments are also provided with suggestions on how they can be involved in these efforts.

For local utility staffs

- Diversify customer recruitment methods. Utilities must go beyond financial incentives when recruiting reclaimed water customers. Utilities must become more aggressive at communicating the motivations behind their reclaimed water systems to their local communities. Overwhelmingly, reclaimed water programs were created to address local community challenges (e.g., mitigate water supply shortages, help meet discharge limits); by communicating this to their local communities, utilities are better positioned to encourage industrial, commercial, and residential customers to use reclaimed water.
- Educate potential customers. In addition to communicating the motives behind their systems, utilities must also educate their communities about the safety and benefits of reclaimed water. The independent survey discussed in a previous section suggests that when people are properly educated about reclaimed water, they are more willing to use the resource. This is useful information considering that one utility mentioned that they are hoping for “greater acceptance” regarding the use of reclaimed water in its community and another utility indicated that a customer “ended up backing out” due to public perception. Utilities must use various resources including newsletters, brochures, and staff to educate the community regarding the safety and benefits of reclaimed water.
- Initiate conversations with local governing boards regarding mandating the use of reclaimed water. The only utilities that experienced an increase in the number of reclaimed water customers were the utilities in communities that have local ordinances mandating customers to use reclaimed water when it is available to them; other public utilities should encourage their local governing boards to consider enacting similar ordinances.

For local governing boards and state officials and departments

- Publicly display support for the use of reclaimed water. Public utilities will need the support of their state and local officials to increase their effectiveness at attracting reclaimed water customers. Similar to states like Florida and California, support for the use of reclaimed water could be incorporated into State statutes and local ordinances with language that supports and encourages the use of reclaimed water and perhaps with language that mandates its use. Support should also be displayed on the websites of relevant state departments, such as the North Carolina Department of Environment and Natural Resources.

CONCLUSION

With the increase in the number of growing communities and in the amount of wastewater that is produced, water quality and water quantity issues will become even more important to North Carolina. The ability for reclaimed water to address these challenges must become the focus of reclaimed water programs around the State. Local and state legislative support, better promotion of reclaimed water by public utilities, and an educated citizenry will all play important roles in strengthening the effectiveness of current and future reclaimed water programs.

ENDNOTES

¹ Personal Interview, September 2005, Daniel Okun, nationally renowned reclaimed water expert and author of U.S. Environmental Protection Agency's Guidelines for Water Reuse.

² Florida: F.S. 403.064 and 373.250. California: Water Code Section 13550-13556.

³ The Rural Center, *Water 2030 Report 3: Water, Sewer & Stormwater Capital Nee*; p. 3

⁴ The Rural Center, *Water 2030 Report 3: Water, Sewer & Stormwater Capital Needs*; p. 1

⁵ Most respondents clearly distinguished which motivational factor was most important; only four respondents ranked more than one factor as being either very important or important.

⁶ The table accounts for 11 of the 14 participating utilities because one respondent was unaware of the motivational factors involved in his/her utilities decision to implement the reclaimed water program; one utility noted that the most important motivational factor was the opportunity to generate revenue—this utility serves external customers; and one utility indicated that the most important motivational factor was that having a reclaimed water system adds points to grant applications—this utility only serves internal customers.

⁷ In February 2003, Black & Veatch conducted a customer survey of the Town of Cary's reclaimed water customers. The survey was mailed to the 338 residential homeowners located in four neighborhoods near the North Cary Water Reclamation Facility. A total of 118 responses were received representing a total response rate of 35 percent.

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Charlotte Observer. "Water Reclamation Plant Runs After 6 Years." July 12, 2006.

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Florida Department of Environmental Protection Division of Water Resource Management. "2004 Reuse Inventory". June 2005

Klein, Maneen of Charlotte-Mecklenburg Utilities (Charlotte, NC). Personal Interview. Summer 2006

Reuse Coordinating Committee and the Water Conservation Initiative Water Reuse Work Group. "Water Reuse for Florida: Strategies for Effective Use of Reclaimed Water". June 2003.

The Rural Center, "Water 2030 Report 3: Water, Sewer & Stormwater Capital Needs". 2004

WEBSITES

State of California, <http://www.swrcb.ca.gov/recycling/munirec.html>

http://www.lgc.org/freepub/PDF/water/water_recycling_reuse.pdf

State of Florida, <http://www.dep.state.fl.us/water/reuse/wmdprog.htm>

Town of Cary, North Carolina. Utilities Webpage, <http://www.townofcary.org/depts/pwdept>

APPENDIX A

Reclaimed Water Survey

Please complete the following identifying information

1. Name of Utility:
2. Approximate number of utility accounts: _____ or unsure
3. Approximate number of reclaimed water accounts:
4. Year reclaimed water program was created:

Questions

1. What were the motivating factors involved in your utility's decision to implement a reclaimed water program? Rank the factors below on a scale of 1 to 5, with 5 being very important and 1 being not important.

-Conservation measure	-Generate revenue
-Helps meet discharge limit	-Other
-Mitigate water supply shortages	-Unsure
2. Does your utility supply reclaimed water **only** to property managed by the utility or owned by the local government? Put an X in the appropriate box
 - **Yes** (if yes, skip to question 3) • **No** (if no, skip to question 4)
3. Did your utility plan to expand to the service to other customers? If yes, explain the utility's progress at doing so. **This will complete the survey for your utility.**
4. To whom does your utility supply reclaimed water? Place an X for all that apply.

-Industrial Customers	-Residential Customers
-Commercial Customers	-Other
5. What is most (by volume) of your utility's reclaimed water used for? Select only one by placing an X.

• Golf course irrigation	• Small scale commercial irrigation
• Residential irrigation	• Other
• Industrial cooling water	• Don't know

6. When your utility **began** the reclaimed water program, how did your utility attract reclaimed water customers? Select all that apply.

- Provided reclaimed water free of charge
- Promoted water to target customers
- Mandated the use of reclaimed water
- Other
- Provided reclaimed water at a reduced rate (compared to drinking water)
- Unsure

7. **Now** that your program has been in place for a while, currently, how does your utility currently attract reclaimed water customers? Select all that apply.

- Provided reclaimed water free of charge
- Promoted water to target customers
- Mandated the use of reclaimed water
- Other
- Provided reclaimed water at a reduced rate (compared to drinking water)
- Unsure

8. Please indicate which option is most accurate; select only one.
Since beginning the reclaimed water program, the number of customers using reclaimed water has:

- Increased
- Decreased
- Remained the same
- Unsure

9. Please indicate which option is most accurate; select only one.
Currently my utility is **pumping**:

- More reclaimed water than was projected
- Less reclaimed water than was projected
- About the same amount of reclaimed water that was projected
- Unsure

10. Please indicate which option is most accurate; select only one.
Currently my utility is **servicing**:

- More reclaimed water customers than was projected
- Fewer reclaimed water customers than was projected
- About the same number of reclaimed water customers that was projected
- Unsure

11. Please indicate which option is most accurate; select only one.
The reclaimed water program has:

- Met the purposes for which it was created
- Somewhat met the purposes for which it was created

-Not met the purposes for which it was created

12. Describe ways in which the reclaimed water program has exceeded original expectations.

13. Describe ways in which the reclaimed water program has fallen short of original expectations.

APPENDIX B

**Descriptive Characteristics of Participating and Nonparticipating Utilities
with Reclaimed Water Systems**

	Geographic Region	Population of locality
Participating Utilities/Localities		
City of Raleigh	Piedmont	276,093
Town of Carolina Beach	Coastal	4,701
Johnston County	Coastal	121,965
Town of Cary	Piedmont	94,536
Town of Oak Island	Coastal	6,571
City of Wilson	Coastal	44,405
Charlotte-Mecklenburg	Piedmont	1,321,446
City of Lexington	Piedmont	19,953
Town of Pikeville	Coastal	719
Anson County	Piedmont	25,275
City of Ocean Isle	Coastal	426
City of New Bern	Coastal	23,128
Town of Morehead City	Coastal	7,691
City of Hendersonville	Mountain	10,420
Nonparticipating/Localities		
Town of Burgaw	Coastal	3,337
Brunswick County	Coastal	73,143
City of Sanford	Piedmont	23,220
City of Goldsboro	Coastal	39,043
City of Washington	Coastal	9,583
Town of Warsaw	Coastal	3,051
Town of Apex	Piedmont	20,212
Town of Benson	Coastal	2,923
Town of Farmville	Coastal	4,302
Town of West Jefferson	Mountain	1,081
South Brunswick Water & Sewer Authority	Coastal	--
Town of Macclesfield	Coastal	458
Town of Louisburg	Piedmont	3,111
Town of Clayton	Coastal	6,973
Macon County*	Mountain	29,811
Town of Hertford	Coastal	2,070
Town of Rosman	Mountain	490
Town of Mount Olive	Coastal	4,567
Town of Magnolia	Coastal	932
Population		
population average for all 32	68,301	
population average for participating utilities	139,809	

population average for participating utilities w/o Charlotte-Mecklenburg	48,914	
population average for nonparticipating utilities	12,684	
population median for participating utilities	21,541	
population median for participating utilities w/o Charlotte-Mecklenburg	19,953	
population median for nonparticipating utilities	3,820	
Geographic Region		
number of coastal participating utilities	8	
number of coastal nonparticipating utilities	13	
number of piedmont participating utilities	5	
number of piedmont nonparticipating utilities	3	
number of mountain participating utilities	1	
number of mountain nonparticipating utilities	3	

*Charlotte-Mecklenburg Utilities serves the city and county, thus a combined population is provided

**Operated by City, reclaimed water used for County landfill

Population figures per 2000 US Census

Population figures for counties are not total populations; they are populations for the individual county
Geographic region classification per NC Rural Center

APPENDIX C

Black & Veatch International Company’s Survey of the Town of Cary, North Carolina

In February 2003, Black & Veatch conducted a customer survey of the Town of Cary’s reclaimed water customers. The survey was mailed to the 338 residential homeowners located in four neighborhoods near the North Cary Water Reclamation Facility. A total of 118 responses were received representing a total response rate of 35 percent. The survey included 11 open-ended and closed-ended questions.

The document is formally entitled the “Results of Reclaimed Water System Customer Survey”. In the executive summary, Black & Veatch explains “To encourage a high response rate, the surveys did not include respondents name or address. However, the surveys were color-coded by neighborhood to get a limited idea of demographic influence on the survey results”. Below are the survey question and results for the three questions that were referenced in my paper.

Question 4 of the Black & Veatch Survey

Question

Please rate the informational sources provided, from most to least helpful.
(Please indicate how helpful the following materials are by circling a number from 1 to 5, with 1 reflecting the most helpful and 5 reflecting the least helpful).

Results

	Most Helpful	Helpful	Neutral	Not Very Helpful	Not Helpful	No Response
Reclaimed water hotline/customer service	13%	37%	45%	1%	4%	42%
Speaking directly to the reclaimed water coordinator	39%	28%	30%	1%	3%	34%
Customer mailings	18%	60%	16%	4%	2%	19%
Community e-mail	11%	39%	30%	12%	7%	33%
Educational brochures	15%	45%	31%	3%	5%	22%
Bud newsletter	12%	44%	33%	6%	5%	26%
BUD-TV	4%	16%	51%	18%	12%	42%
Web site	11%	27%	43%	14%	5%	40%

Question 6 of the Black & Veatch Survey

Question

Do you have any concerns about the safety of reusing water for irrigation?

Results

17% Yes 83% No

Question 9 of the Black & Veatch Survey

Question

If you move to another community similar to Cary, will you look for a home with reclaimed water provided for irrigation?

Results

65% Yes 35% No