Water Reuse in Corvallis:
Modeling Public Acceptance and a Plan for Public Involvement

by
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I understand that my research paper will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my research paper to any reader upon request.

Karen M. DuBose, Author

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Dedicated to Frank Angrisano.
Without you, I wouldn't be here. I will always miss you.

1. Introduction

Since 1975, the City of Corvallis has been treating wastewater from Corvallis homes and businesses at its Wastewater Reclamation Plant, and releasing the treated effluent into the Willamette River. Wastewater that passes through the plant goes through primary and secondary treatment, which removes the solids and most of the organic load in the water. The plant produces over 4 billion gallons of effluent every year. Recently, the Oregon Department of Environmental Quality (DEQ) tightened water quality regulations on the effluent released into the river. The Wastewater Reclamation Plant currently meets all of the new standards, except for temperature about four times a year. As the city grows, the associated increase in wastewater production will put the city in danger of exceeding water quality standards more frequently than it already does. In order to avoid future noncompliance with the standards, the city is exploring water reuse as a way to keep effluent from directly entering the Willamette River.

Water reuse is becoming an increasingly common practice around the world as cities face immediate crises in water supply or the question of ensuring adequate supply over the long term (Russell, Hampton, Lux, and Jeffrey, 2006; Asano, Burton, Leverenz, Tsuchihashi, and Tchobanoglous, 2007). Reclaimed water, also known as recycled or reused water, is water that has been used by a residence, business, or industry and then discharged into a municipal wastewater treatment system to remove contaminants. The water can then be reused for another purpose. Oregon Administrative Rules (1990) require that the level of treatment match the end use of the water. For example, water that will irrigate a school's playground area will require a higher level of treatment than

water used to irrigate a grass seed farmer's field because the public has a higher likelihood of coming into contact with the playground water. In Oregon, reclaimed water is most commonly used for agricultural irrigation. Other end uses for reclaimed water fall into one of six categories: landscape irrigation, industrial recycling and reuse, recreational and environmental uses such as wetland enhancement, non-potable urban uses like toilet flushing, and potable uses, which blend reclaimed water into the potable supply (Asano et al., 2007).

Water reuse has many benefits. Reclaimed water is a drought-proof source of water because it is available year-round, and its quality is consistent, having passed through a series of treatment steps (Dillon, 2000; Anderson, 2003). Using reclaimed water in place of freshwater leaves more freshwater available for other needs, either by reducing diversions from streams for environmental purposes, or by saving municipalities or other water users from having to search out new sources of water to supply increased demands (Anderson, 2003). Many cities are pursuing water reuse as part of sustainability initiatives, hoping to secure a long-term water supply without harming the environment (Stenekes, 2006). In certain parts of California, for example, treating wastewater to drinking water standards using energy-intensive reverse osmosis technology uses less energy than pumping 'new' water from distant sources to fulfill demand, and leaves those distant sources better able to support their own populations and ecosystems (B. Michalczyk, personal communication, September 8, 2008).

Water reuse is not inherently a sustainable activity, however, and the sustainability of a proposal must be judged on a case-by-case basis. The 1987

Brundtland Report emphasized three main themes that must be considered when planning for sustainable development: economics, society and the environment (World Commission on Environment and Development, 1987). A project that is good for the environment but socially and economically unsound cannot be considered sustainable. Using energy-intensive treatment technologies in California may be a sustainable alternative in certain parts of California, but may not be sustainable in Corvallis. The sustainability of water reuse depends not only on the technologies available, but also on what the water is used for, other alternatives available, and local social, economic and environmental conditions (Neubert, 2009). If done improperly, water reuse can have negative impacts. Risks include harm to the environment, human health, livestock and food safety due to excess nutrients, salts, pathogens, and other contaminants that may remain in the water after treatment (Moore, 2003).

Several water reuse programs have attracted international attention with their success. Orange County, California's Groundwater Replenishment System and Singapore's NEWater program have succeeded in supplementing their freshwater supplies with reclaimed water (Walsh, 2008), and both have received the Stockholm Water Prize. Despite these and other notable successes, public acceptance of water reuse is not guaranteed, even the most critical of water situations. In the face of increased demands, climate change and a recent biological opinion that affects their water supply, San Diego, California has been trying for nearly two decades to gain enough public acceptance to operate a water recycling facility large enough to meet their needs, but have had little success (Hartley, 2003; Bridgeman, 2004; Davis, 2007). In the damp

climate of the Pacific Northwest, water reuse programs may face the additional challenge of gaining the support of citizens whose overall impression may be that more than enough fresh water exists to supply current and future needs. Understanding what affects public acceptance in the community is a critical step to designing a program that will be supported by the community.

Gauging existing public acceptance is only a first step on the path to water reuse, however. A community may or may not be comfortable with water reuse, but lack of acceptance does not mean a program will ultimately fail, especially if the subject is approached well. Acceptance of water reuse and trust in the water authority can be cultivated with open communication and active involvement of the public in the process. Public involvement is a regulatory obligation in many regional, national and international bodies, and extensive involvement is increasingly becoming an expectation by the public (Russell, Hampton, Lux and Jeffrey, 2006). A thorough public involvement effort ensures that policy choices reflect the values and preferences of the public, and develop lasting support for those policies (McDaniels et al, 1999). If public involvement is approached with these goals in mind, the final water reuse program may find widespread acceptance, despite initial opinions.

With support from the city of Corvallis, the Oregon State University Master of Public Policy Program and the Institute for Water and Watersheds, this research was initiated to help Corvallis city managers explore questions related to public opinion about water reuse and strategies of public involvement in their city. First, I review the literature on public opinion of water reuse and public involvement. Next, I investigate the

variables affecting public opinion of water reuse and public involvement in Corvallis. With research and survey results as a foundation, I then present a set of suggestions for public involvement that will increase the effectiveness of Corvallis' public outreach efforts. While this study is primarily designed to support Corvallis' public involvement planning efforts, it also serves as a model for other water utilities in the Pacific Northwest and United States as they pursue their own water reuse programs.

2. Literature Review

2.1. Public opinion on water reuse

Much time and energy has been spent studying the factors that influence public acceptance with the goal of identifying factors that can universally be used to help predict public acceptance in any area (Russell and Lux, 2006). Most of the research on factors of acceptance for water reuse has focused on the use of reclaimed water for potable (drinking) uses, though other uses are often considered. Few published studies have been conducted on public acceptance of water reuse for strictly non-potable purposes. Still, potable reuse studies are useful because factors that affect public acceptance of potable reuse likely influence acceptance of non-potable uses as well.

Factors that have been found to significantly influence public acceptance of water reuse are shown in Table 1. Several of the studies included in Table 1 are reviews of other published and unpublished studies. The studies were not identical; each examined a slightly different set of influences on public acceptance. However, all studies included age, education and gender in their analyses. Only those variables that were found to

influence public acceptance are listed in Table 1. While every community is different, these studies together show that several factors appear to consistently influence an individual's acceptance of water reuse in their community.

Table 1. Demographic factors that have been found to influence public acceptance of reclaimed water

Study/location	Roseth, 2008 Australia	Po, Kaercherand Nancarrow, 2004, Worldwide review	McKay and Hurlimann, 2003 Australia	Bruvold, 1985, 1988 United States review	Marks, 2004 Worldwide review	Friedler, Lahav, Juzhaki and Lahav, 2006, Israel	Dolnicar and Schäfer, 2009, Australia	Nancarrow, Leviston, Po, Porter and Tucker, 2008, Australia
Degree of contact with water/'yuck' factor		X	X	X		X	X	X
Age	X	X	X	X		X	X	
Gender	X	X		X	X		X	
Prior knowledge of water reuse	X			X			X	
Income				X				
Occupation				X			X	
Education	X	X		X	X		X	
Length of residence in location				X				
Children present	X							
Primary language	X	X						
Home owner/renter	X							
Trust in utility		X			X			X
Attitude toward environment		X						
Place of residence	X	X						

In a review of nine surveys of public opinion regarding water reuse, Bruvold (1988) found that the degree of human contact with the water was the strongest indicator of public acceptance for water reuse when gauging general opinion of water reuse. Uses in which the respondent might never contact reclaimed water are more acceptable than those in which a respondent could expect to contact the water, especially when there is a possibility of ingesting the water. This psychological or emotional disgust response, called the 'yuck factor' by researchers, has been implicated as a major reason for objection to water reuse in a wide variety of studies (Po, Kaercher and Nancarrow, 2004; Hartley, 2006; Russell and Lux, 2009).

A respondent's level of education, age, prior knowledge of water reuse, income, gender, and length of time living in the city were also found to affect an individual's attitude toward water reuse (Bruvold, 1985). From Bruvold's studies, the concept of 'potable reuse man' was developed (see figure 1). Potable reuse man exhibits the characteristics that Bruvold found to positively influence acceptance. He is a young, highly educated man with a high-status job, a good understanding of water reuse, has not lived in the area for a long period of time, and is aware of water shortages in the area. Bruvold (1985) offers no explanation for why any of the variables he found impact opinion of water reuse. However, he did find

Figure 1. Potable reuse man (from Marks, 2004).

six studies that showed that those who believed in the existence of technology to safely and effectively treat wastewater so that it can be reused are more likely to support using the water for drinking than those that do not. One might presume, then, that a highly educated person may have learned about wastewater treatment technologies and water reuse at some point in his or her education.

Marks (2004) finds that potable reuse man may be extinct, if he ever existed at all; she finds that studies done since 1990 find that men are still more receptive than women to potable reuse and education still plays a part in some communities, but few other demographic trends emerge consistently. Marks (2004) suggests in her review of several studies that the presence of children has no effect, however Roseth (2008) found that having young children present in the home negatively affects acceptance in Australia, presumably because the children might ingest the water during play.

Russell and Lux suggest that attempts to identify demographic factors that universally affect public opinion are missing the point; "responses may be much more context-dependent than is assumed – far more influenced by contingent political and cultural factors and by local experience" (2006, p. 28). They believe that demographic studies can be useful on a local scale, but that all studies should focus less on demographics and the 'yuck factor' and more on other variables like individuals' previous experiences with reclaimed water, and local cultural or religious views about water (Russell and Lux, 2009). Along a similar vein, several researchers have identified the level of trust that an individual has in local management of public utilities as a major factor of acceptance; those that have a high level of trust in or have only had positive

experiences with the local utility are more likely to accept a water reuse proposal than those that have not (Kaercher and Nancarrow, 2003; Hurlimann and McKay, 2004; Hartley, 2006; Po, Friedler, Lahav, Jizhaki and Lahav, 2006; Stenekes, 2006; Nancarrow, Leviston, Po, Porter and Tucker, 2008).

Sustainability is another political and cultural factor that can influence public opinion on water reuse, though it is not directly mentioned by Russell and Lux (2009). In an analysis of seven surveys of public opinion, Bruvold (1988) found that when a specific water reuse proposal for a community was presented to respondents, economic, social and environmental considerations take precedence over the degree of human contact. Though Bruvold did not connect his findings to sustainability in his analysis, they are clearly similar to the Brundtland Report's findings on sustainability (World Commission on Environment and Development, 1987). Except for Bruvold's study, the effect of an individual's personal sustainability ethic on their acceptance of reclaimed water does not appear to have been examined in a quantitative manner in any other studies.

2.2. Public involvement for water reuse programs

Identifying influences on public opinion of water reuse in a community is valuable, but as Russell, Hampton, Lux and Jeffrey (2006) note, it is only part of a much bigger picture. Utility managers must take what they learn from surveys and interviews with the public and design a public involvement plan for their particular political and cultural situation. Every community has a different situation; in some cases such as with Singapore's NEWater program, citizens may be more willing to comply with government

programs, or at least less willing to raise objections (Macpherson, 2003; Russell and Lux, 2006). Extensive public involvement may not be as necessary in Singapore as it is elsewhere. Even similar communities can find themselves with drastically different outcomes. San Diego and Orange County are relatively similar communities; they are similar in location and climate, both import a majority of their water, and they have similar ethnic compositions. Both gauged public awareness, concerns and interests toward water reuse several times during their planning effort, and each had a public involvement program (Hartley, 2003). Yet Orange County's water reuse program has earned international acclaim for its success, while San Diego's story strikes fear in the hearts of water utility managers (Friederici, 2007). Simply assessing public attitudes and information needs and proceeding with required public meetings is not enough to ensure that the program will be accepted by the community, especially for a subject as emotional as water reuse. Stenekes believes that the failure of water reuse projects is due more to a lack of engagement of the public "about deeply held risk and sustainability values" (2006, p. 126) than about lack of education about water reuse. A review of successful and unsuccessful public involvement programs can help identify ways to engage the public in just such a discussion. This information, combined with an assessment of public attitudes and acceptance can be combined to create a public involvement program for Corvallis that will have a good chance of success.

Public involvement for most government-funded projects is required by federal, state and local regulations in the form of comment periods and public meetings (Depoe and Delicath, 2004). Undertaking additional public involvement can be an expensive

endeavor for a municipality, both in finances and in time (Irvin and Stansbury, 2004), so it is important to know when a significant amount of public involvement is desirable, as opposed to a top-down approach. Comprehensive public participation (beyond required comment periods and public meetings) has many benefits for a water authority pursuing water reuse. Risk is a key area of concern for communities (Baggett, Jeffrey and Jefferson, 2006). The risk to human health is a major focus, (Russell and Hampton, 2006; Po et al., 2006), "but these are not the only matters people want to discuss, and at least a general idea of the potential economic and environmental benefits of water recycling figure just as prominently" (Russell, Hampton, Lux, and Jeffrey, 2006).

A comprehensive public involvement effort is one way municipalities attempt to sooth fears about the safety of water reuse. By involving citizens in the decision making process, municipalities can identify and resolve conflicts early rather than as the project nears completion, avoiding litigation costs and delays (Irvin and Stansbury, 2004; Environmental Protection Agency, 2004). Public participation can help to generate consensus on the benefits of a project, give the public a sense of control, increase willingness to pay additional fees to support reuse, and build trust in the water authority (Russell and Hampton, 2006).

Smith and McDonough (2001) suggest that the specific methods of public participation that are used are less important than ensuring that the decision making process is fair. They include as factors of fairness: representation of the diverse types of people involved; inviting citizen input; ensuring consideration of citizen comments and suggestions; and a clearly outlined rationale for the decision. Regardless of these factors,

however, Smith and McDonough found that some citizens judged the fairness of public participation solely on whether the outcome was what they wanted.

Webler and Tuler (2000) include more than fairness in their standards for successful public participation. They suggest there are seven dimensions to public participation related to fairness and competence in the process. These are: 1) access to the process, or the opportunity to speak and be heard; 2) power of citizens to influence processes and outcomes; 3) structural characteristics of the process including location, time, and availability of meetings; 4) personal behaviors of the participants such as respect, openness, honesty and listening; 5) access to both information from experts and local knowledge from citizens; 6) sufficient analysis of all information provided; and 7) the relationships and other conditions that the process built which might allow for similar future participation.

Alternately, Senecah (2004) condenses the requirements for effective public participation into three factors she calls the Trinity of Voice: access, standing and influence. Access refers not only to access to varied opportunities to express opinions, but also to access to information in multiple forms that allows citizens the opportunity to actively participate rather than simply react to presented plans. Standing is the legitimacy, respect, esteem and consideration that citizen input should be given. Influence is the product of access and standing. Influence means that everyone's ideas have been respectfully considered, regardless of whether they are incorporated into the final plan, and decision makers have a clear picture of what is at stake for all participants.

Regardless of how the various dimensions of the three theories above are organized, they all contain the same core elements. The first is that the public needs access to information in a variety of formats. Second, the public must have access to the decision making process, with plenty of opportunities to offer their comments, suggestions and opinions. Lastly, the public needs to feel that their participation is valued and that their comments are being respectfully considered and incorporated into the plan when possible.

Generally, few municipalities have published in-depth information on their water reuse public involvement experiences, but those that have support the theories of public participation described above. Trust in the water authority is mentioned most often as a core factor in a participant's judgment of the success of public involvement for water reuse programs (Hartley, 2003; Bridgeman, 2004; Hurlimann and McKay, 2004; Marks, 2004; Hartley, 2006; Ingram, Young, Millan, Chang and Tabucchi, 2006; Kahn and Gerrard, 2006; Russell and Hampton, 2006). Hartley (2003, 2006) emphasizes procedural and distributive fairness, along with the need to listen and take people's concerns seriously. In a review of three California projects, Bridgeman (2004) notes that early access to the process and openness of water authority planners to citizen comments are crucial to the success of projects. He also found that a comprehensive, long-term water quality monitoring program was as a key reason for the continued success of water reuse in southern Los Angeles County. Communication through a wide variety of media is also essential, as many citizens may not attend meetings and workshops (Ingram et al., 2006).

2.3. Hypotheses

Based on the reviewed studies, I expect to find the following:

- Low-contact uses such as irrigation of business park landscaping will be more acceptable than uses in which respondents might physically contact the water, such as irrigation of public parks.
- Younger respondents will have a higher acceptance of water reuse than older respondents.
- Men will have a higher acceptance of water reuse than women.
- Respondents from households without children will have a higher acceptance of water reuse than those with children.
- Respondents who have achieved higher education will have a higher acceptance than those with lower education.
- Those who are familiar with wastewater treatment and water reuse and are aware of the Willamette River water quality situation will have a higher acceptance of water reuse than those that are not.
- Those that have a high level of trust in the local water authority will have a higher acceptance of water reuse than those that do not.
- Those who have a high sustainability ethic, or who consider all the factors of sustainability when making decisions, will have a higher acceptance of water reuse than those who do not.

Successful methods for public involvement are likely to be those that:

- maximize the public's access to information,
- provide many and varied opportunities to participate in the decision-making process,
- leave citizens feeling that their comments and suggestions are being respectfully considered.

3. Approach and Methods

This research is a case study of Corvallis public opinion of water reuse and opportunities for public involvement. According to Robson (2002), using a case study approach allows for more flexibility than other study designs because the study design can develop during data collection as opposed to having a pre-specified design. Case studies allow for an in-depth analysis of a single case or several cases and use multiple sources of evidence to explore a phenomenon in the context of its social and physical setting. As a methodology, case studies allow the researcher to explore possible causes, factors, experiences and other determinants that influence the outcome (Robson, 2002).

This research uses a survey of Corvallis citizens to assess public opinion of water reuse and identify public involvement strategies that will increase the effectiveness of Corvallis' public outreach efforts.

3.1. Data collection

In December 2008, a survey was administered to 1,116 randomly chosen registered voters in Corvallis. An initial postcard was mailed to survey respondents notifying them that a survey would be arriving in the mail shortly. The survey was then

mailed to each randomly selected customer with a postage-paid business reply envelope. A cover letter that describes the purpose and importance of the survey was included with each survey. Approximately four weeks later, a reminder letter accompanied by another copy of the questionnaire was mailed to non-respondents. I received a total of 518 responses, for a 46% response rate.

Survey questions were written based on surveys conducted elsewhere in the United States and the world, as well as information derived from interviews with Corvallis Public Works staff. The final eight-page survey consisted of nineteen close-ended questions and a space at the end for respondents to write any extra thoughts, comments or ideas. Of the nineteen questions, six were demographic, including level of education, occupation, age of children in the household, and age of respondent. (A copy of the survey is provided in Appendix A.) Due to space considerations, little background information was given about reclaimed water in the survey or the cover letter that accompanied it. To help alleviate this lack of information, I chose to use the term 'recycled water' in the survey as opposed to the industry standard of 'reclaimed water.' The terms are used interchangeably all over the world, but in informal conversations with members of the public, I found that 'recycled' was easier for people to understand.

As noted above, previous surveys have not directly analyzed the impact of a respondent's sustainability ethic on their acceptance of water reuse in a quantitative manner. Sustainability was measured along three common themes of sustainability: economics, society and the environment. 'Sustainability' has become a popular buzzword, but there is much confusion about what the word means (Lemonick, 2009). In

the Oregon Sustainability Act of 2001, 'sustainability' is defined as "using, developing and protecting resources in a manner that enables people to meet current needs and provides that future generations can also meet future needs, from the joint perspective of environmental, economic and community objectives" (ORS 184.421). However, informal conversations during the writing of the survey revealed a wide variety of definitions of the term. Some people focused only on financial aspects of a project, while others took a holistic approach reflecting that of the Sustainability Act. In order to eliminate bias caused by the popularity of the word 'sustainability,' the question was designed without using the word itself. The question asked how important seven common factors of sustainability were when choosing an approach to meeting the new water quality requirements, with the goal of creating a sustainability index that could indicate the strength of the respondents' sustainability ethic. The factors listed were: prevent pollution, protect human health, be a long term solution, be energy efficient, be financially sound, protect fish and wildlife, and have low greenhouse gas emissions. A Likert scale with choices ranging from 1 = "not important at all" to 5 = "very important" allowed respondents to rate the importance of each factor.

To assess acceptance for particular uses of reclaimed water, I presented eleven uses in the questionnaire that are either seriously being considered for Corvallis or are common uses elsewhere in the U.S. Again, a Likert scale was used with choices ranging from 1 = "highly unfavorable" to 5 = "highly favorable" for each use.

3.2. Data analysis

Data from the surveys were entered by an undergraduate student assistant. A random sample of 40 surveys were checked to ensure data were entered correctly. Eight errors were found for an error rate of less than 0.3%. Comments were entered separately into Microsoft Word for analysis.

Frequency responses were calculated for each question. These frequencies were entered into the original survey alongside each respective response (Appendix A). Descriptive statistics were calculated where appropriate. Cross-tabulation was used to compare answers across demographic groups in order to determine whether there were differences in the responses among different groups of citizens.

To look for patterns in responses to the question that asked about acceptance for eleven uses of recycled water, a principal components exploratory factor analysis with varimax rotation was performed. Three groups of factors emerged during factor analysis of the eleven uses of reclaimed water. Three factor scores were calculated for each respondent – one for each high, moderate, and low contact uses. These factor scores were later used as the dependent variables in the regression analysis. Another factor analysis was performed on the sustainability question to see if any response patterns emerged, but no patterns were found. Therefore, an additive index was used to represent the strength of a respondent's sustainability ethic; scores for each of the seven indicators included in the question were added to create a single sustainability score. For example, if a

respondent chose "very important" (a score of 5) for all seven indicators, their total score would be 35.

For the sustainability question (Q6) and the acceptance of various reclaimed water uses (Q7), if respondents did not know or had no opinion about that portion of the question, they were instructed to leave it blank. To maximize the amount of data available for factor and regression analysis, SPSS was used to estimate missing values using demographic patterns. The full data set with estimated values was then used in the analysis.

Question 4 on the survey assessed the respondent's level of knowledge about wastewater and reclaimed water by presenting six terms commonly used in the wastewater industry. This question was used to represent knowledge of water reuse in the regression analysis. For each term, respondents identified whether they knew what the term meant, had heard of it but did not know its meaning, or had not heard of the term at all. Binary variables for each term were formed such that if respondents knew what a term meant, they received a score of 1 for that term; if they had heard of it but did not know its meaning or had not heard of it at all, they received a score of 0. Scores for all terms were then added for a final score of knowledge for each respondent. If a respondent knew all six terms, their total score was 6; if they reported knowing only three terms, their score was 3.

Open-ended responses were tabulated and analyzed for patterns of similarities and differences. Comments were first read to determine general themes that emerged, then

grouped into each category. Results are provided in Appendix C. Representative comments are included in the results section where appropriate.

Multiple linear regression was chosen to model public acceptance of water reuse, using several of the variables found in the literature as well as the sustainability index as independent variables. These variables and their corresponding question numbers on the survey are listed in Table 2. In light of the focus that the city of Corvallis and its citizens place on the concept of sustainability, I added a measure of sustainability to the analysis, theorizing that those who accept the tenets of the sustainability movement may be more willing to accept water reuse than those who do not. Public acceptance of various uses of reclaimed water (Q7) were the dependent variables used in the regression analyses.

Table 2. Independent variables used in the regression and corresponding question on the survey. For the full text of the questions, see Appendix A.

Independent variables	**Question number**
Informed about wastewater treatment	Q1
Level of knowledge about wastewater	Q4
Aware of Corvallis' wastewater effluent problem	Q5
Strength of the individual's sustainability ethic	Q6
Trust in public works department to serve public interest	Q12a
Gender	Q14
Age	Q15
Level of education	Q16
Presence of children in the household	Q17

The model for the regression is as follows:

$$\text{Acceptance} = \beta_0 + \beta_1(\text{Informed}) + \beta_2(\text{Knowledge}) + \beta_3(\text{Aware}) + \beta_4(\text{Sustainability}) + \beta_5(\text{Trust}) + \beta_6(\text{Gender}) + \beta_7(\text{Age}) + \beta_8(\text{Education}) + \beta_9(\text{Children present})$$

Two factors identified in the literature as impacting public opinion of water reuse were removed from the regression due to multicollinearity. Trust in the Public Works Department to protect the environment was strongly correlated with trust to serve the public interest. Because protecting the environment is adequately covered by public interest, protection of the environment was removed. The survey also asked how long respondents had been living in Oregon, which was strongly correlated with age. Age was the more important factor in the regression, so length of time in Oregon was removed.

SPSS was used to perform the three multiple linear regression analyses, one for each group of uses identified during factor analysis: high contact (irrigate edible agricultural crops, school grounds and public parks), moderate contact (supply fire hydrants, car washes, flush toilets and cool buildings) and low contact uses (irrigation of business park landscaping, golf courses, nonagricultural crops, and use in industrial processes). Factor scores calculated during factor analysis were used as the dependent variables.

4. Results

4.1. Public opinion and attitudes about water reuse

4.1.1. Independent variables

Survey respondents were typically older and more educated than the general population, and more female than male (see Appendix A), which is consistent with political science literature about demographics of registered voters. Table 3 provides summary statistics for the sustainability index, knowledge level, and level of trust to serve public interest. As noted earlier, the sustainability index was designed to measure a respondents' sustainability ethic, or whether a respondent considers all three indicators of sustainability (economic, social and environmental) when considering a proposal. Corvallis residents tend to score high on the sustainability index. This is likely due to the influence of the university and the efforts of groups such as the Corvallis Sustainability Coalition. The community's level of knowledge about wastewater treatment, as measured by familiarity with six common wastewater terms, is also quite high.

Respondents were asked two questions about their level of trust in city government: how much they trust the Corvallis Public Works Department to serve the public interest, and how much they trust it to protect the environment. Overall, respondents have a good deal of trust in the Public Works Department (see table 3 and figure 2).

Table 3. Summary statistics for level of knowledge, trust and the sustainability index

	n=	Range	Mean	Median	Mode	Standard Deviation
Sustainability Index	511	14-35	31.1	32	35	3.8
Level of knowledge	517	0-6	4.6	5	6	1.4
Trust to serve public interest	494	1-4	3.1	3	3	0.7

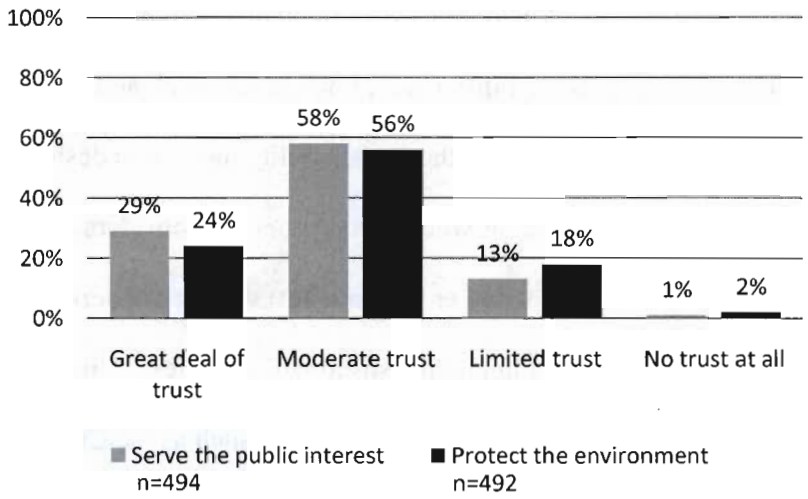

Figure 2. How much do you trust the Corvallis Public Works Department to serve the public interest and protect the environment?

Questions 1, 4 and 5 are independent variables designed to measure the level of awareness of wastewater and water reuse in Corvallis. Awareness of wastewater treatment in Corvallis was measured by asking how informed respondents felt they were. Figure 3 shows that the majority of respondents do not consider themselves well informed about wastewater treatment.

To measure knowledge of wastewater and identify which terms may be the most confusing for the general public, six terms of varying difficulty were offered and

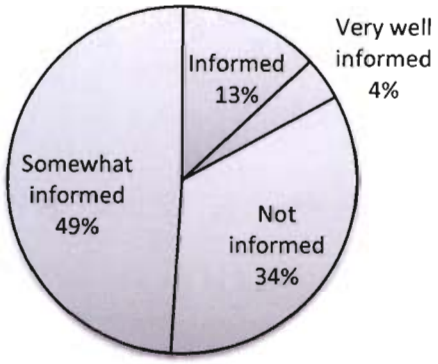

Figure 3. Responses for "In general, how well informed would you consider yourself to be concerning wastewater treatment in Corvallis?" (n=517)

respondents were asked to identify whether they knew each term, had heard of it but didn't know its meaning, or had not heard of it at all. Terms varied from "sewage," which is known by 97% of respondents, to "effluent," which only 50% of respondents reported knowing. Overall, there is a relatively high level of knowledge, with 34% of respondents reporting knowing all six terms, and 26% knowing all but one term. To measure awareness of water reuse, we asked whether respondents were familiar with the term "recycled water." Seventy-five percent of respondents reported knowing what the term meant, while 24% either had not heard of the term at all or had heard of the term but did not know what it meant.

Respondents read a short statement outlining the new water quality regulations on the Willamette River and how that might impact wastewater treatment in Corvallis. They were then asked if they were aware of the situation or not. Two-thirds of respondents

were unaware of the change in water quality standards and the impact that it might have on wastewater treatment and their sewer bill.

4.1.2. Dependent variables

Generally, survey respondents appear to accept water reuse in their community. Figure 4 shows the general acceptance of the various reclaimed water uses in the community. Support increased when the use was one in which respondents could expect only minimal contact with the water (e.g. irrigation of business parks and golf courses).

Uncertainty about the listed uses, measured by the number of respondents who chose "neutral," is relatively high for many uses (see Appendix A), often higher than

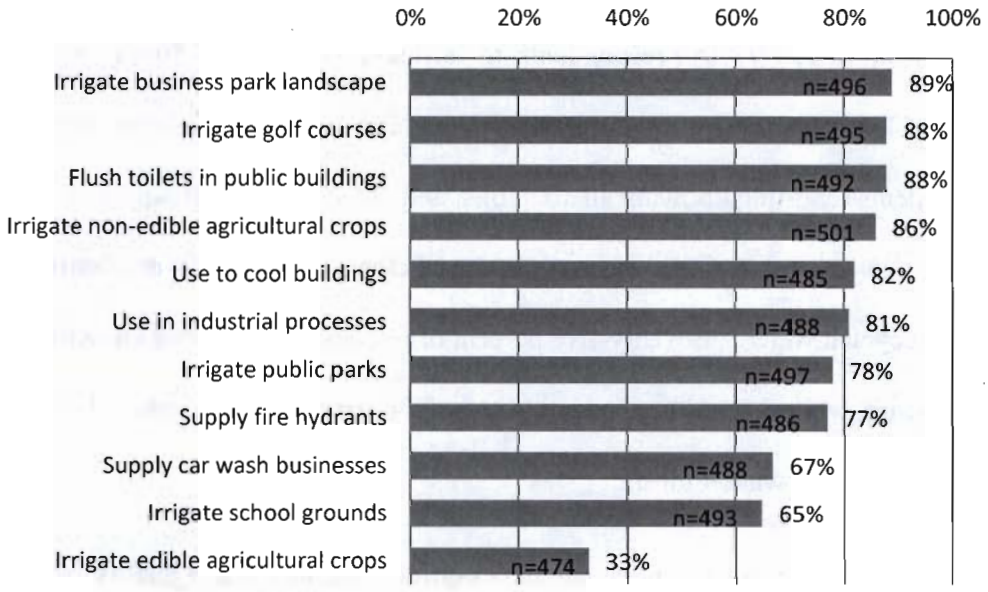

Figure 4. Percentage of respondents choosing "very favorable" or "favorable" for various recycled water uses.

those who describe the practices as unfavorable. High contact uses such as irrigation of edible agricultural crops, supply of car wash businesses, and irrigation of school grounds had the highest levels of uncertainty. Other uses that had high levels of uncertainty are those in which the general public may not be familiar with exactly how the water might be used, such as use in industrial processes, use to cool buildings, and supply fire hydrants. This uncertainty is likely a reflection of the lack of information provided by the survey. Several respondents noted that they would like more information to make a decision. For example, "I had difficulty answering many questions because I don't know how you would pipe the recycled water to the different locations it might be used," and "I'm assuming the wastewater won't make anyone ill. What about heavy metals? Are they treated in wastewater?"

A factor analysis on the dependent variables found in Q7 – the acceptance of water reuse for eleven listed uses – found that responses could be explained by three distinct factors (Table 4). Factor 1 included four variables: irrigate golf courses, irrigate landscaping in business parks, irrigate non-edible agricultural crops, and use in industrial processes. Factor 2 contained four variables: use to cool buildings, flush toilets in public buildings, supply fire hydrants in the city, and supply car wash businesses. Factor 3 included three variables: irrigate public parks, irrigate agricultural crops for human consumption and irrigate school grounds. These factors were labeled: 'low contact,' 'moderate uses' and 'high contact' respectively. Taken together, these three factors explained 71% of the variance in the eleven-item list of uses.

Table 4. Exploratory factor analysis of reclaimed water uses question [1]

Reclaimed water uses	Factor 1 (Low contact)	Factor 2 (Moderate contact)	Factor 3 (High contact)
Irrigate landscaping in business parks	**.891**		
Irrigate golf courses	**.875**		
Irrigate non-edible agricultural crops (grass)	**.724**		
Use in industrial processes	.543	.498	
Use to cool buildings	.425	**.660**	
Supply fire hydrants in the city		**.788**	
Supply car wash businesses		**.788**	
Flush toilets in public buildings		**.729**	
Irrigate school grounds			**.859**
Irrigate public parks	.436		**.766**
Irrigate agricultural crops for human consumption			**.697**
Eigenvalue	5.156	1.458	1.151
Percent variance explained [2]	26.719	24.736	19.140

[1] n=518. Only factor loadings larger than .40 are shown. Items that cross-loaded were retained in scales where loadings were highest. Variables coded on a 5-point scale where 1 = "not at all important" and 5 = "very important."

[2] Total variance explained = 70.595%

Variables associated with each factor were subsequently examined for internal consistency using Cronbach alpha reliability analysis. The Cronbach alpha reliability coefficients were .853 for low contact (factor 1), .827 for moderate contact (factor 2) and .757 for high contact (factor 3). Bruvold (1988) identified the degree of human contact with the water as a major predictor of public acceptance. The three groups correspond well with the literature: responses were increasingly negative for uses in which the likelihood of a respondent contacting or ingesting the water increased.

In order to determine whether support of water reuse was affected by the cost and sustainability of the proposal, respondents were asked whether they would support a recycled wastewater program if it was cheaper and if it was more sustainable than continuing to discharge the water into the Willamette River. I also gauged support to reuse the water as drinking water if regulations were to allow it (they currently do not). Figure 5 presents the results of these three questions. Sustainability is a very important factor for respondents, with 91% agreeing that they would support a recycled water program if it were more sustainable than releasing the water into the Willamette River. Seventy-four percent of respondents agreed that they would support water reuse if it were cheaper than continuing to discharge into the river.

Only 38% of respondents agreed that they would support using reclaimed water for drinking if regulations allowed it. Respondents were also asked where the water should be used if a decision was made to recycle Corvallis' wastewater. The majority of respondents (73%) said that the water should be sent wherever it is needed, whether in or outside of city limits (see figure 6). Sixteen percent of respondents preferred it be used only within city limits.

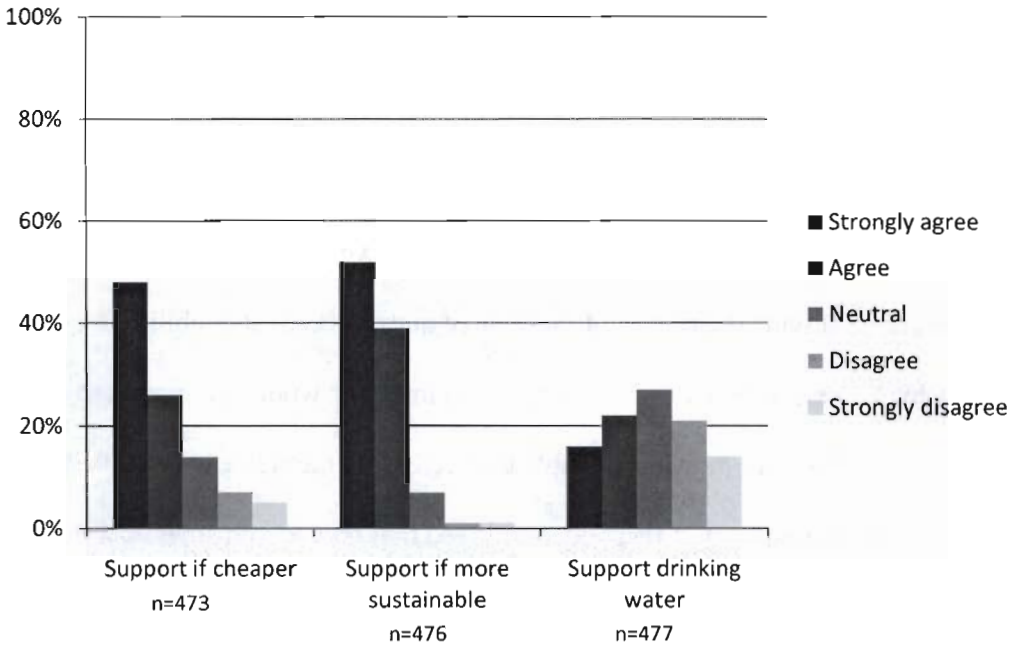

Figure 5. Acceptance of water reuse if it is cheaper or more sustainable than discharging into the river, and acceptance of turning reclaimed water into drinking water if regulations allowed it.

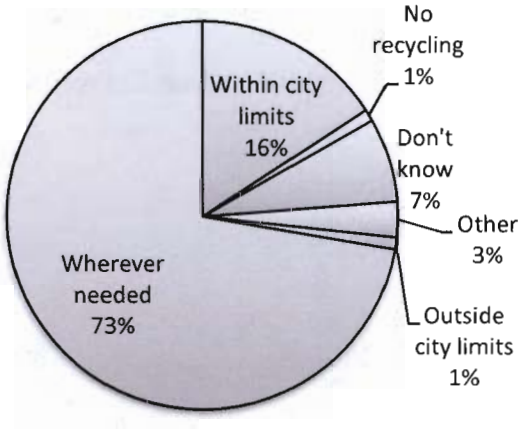

Figure 6. If a decision is made to recycle Corvallis' wastewater, where should it be used? (n=502)

4.1.3. Bivariate analysis for dependent variables

Age, gender, education level, occupation and presence of children in the household were used as independent variables in bivariate analysis. Gender appears to affect the acceptability of using reclaimed water for drinking. Women are less likely to accept potable reuse, with 33% of women agreeing that they would accept potable reuse as opposed to 42% of men.

The age of respondents appears to affect responses for several variables measured. For knowledge of wastewater and recycled water, as measured by the knowledge of six terms, older respondents were more likely to know more of the terms than other age groups (r^2=0.19, table 5). Additionally, respondents 45 or more years old were twice as likely as younger ones to be aware of the water quality situation on the Willamette River ($p<0.0001$, table 6). Age was also a factor in acceptance of potable reuse, with younger respondents accepting using the water for drinking more often than older respondents ($p=0.001$, table 7).

Table 5. Age and the number of terms known.

Number of terms known	18-24	25-44	45-64	65+
0	0%	1%	1%	0%
1	2%	2%	1%	1%
2	9%	9%	5%	4%
3	9%	15%	11%	15%
4	13%	22%	19%	20%
5	21%	27%	28%	23%
6	47%	25%	35%	36%
n=	48	133	215	105

Pearson's correlation $r^2 = 0.19$, n = 501

Table 6. Age and awareness of water quality problems on the Willamette River.

	18-24	25-44	45-64	65+
Yes	17%	17%	34%	39%
No/ Don't know	83%	83%	66%	61%
n=	48	133	215	106

$\chi^2 = 20.251$, df = 3, $p < 0.0001$, n = 502

Table 7. Means scores for age and acceptability for potable reuse (drinking).

Age	Mean	Standard Deviation	n
18-24	3.69	1.07	45
25-44	3.05	1.27	127
45-64	2.98	1.24	199
65+	2.86	1.09	90

1 = strongly disagree, 5 = strongly agree
F = 5.64, df=3, p = 0.001, n = 461

The level of education that respondents have achieved appears to affect the response for how well informed respondents consider themselves (p=0.04, table 8).

Table 8. Education and whether respondents were informed about wastewater treatment.

	Some College	College	Graduate School
Not informed	40%	29%	30%
Somewhat informed	49%	53%	46%
Informed	10%	12%	18%
Very well informed	1%	6%	5%
n=	117	161	185

$\chi^2 = 13.232$, df = 6, p = 0.04, n = 463

Occupation appears to affect respondents' knowledge of wastewater, awareness of the Willamette River water quality situation, and the acceptance of using reclaimed water to irrigate school grounds. Forty-nine percent of university professionals reported

knowing all six terms presented to measure knowledge of wastewater and water reuse, followed by retired respondents at 34%. Only 27% of school teachers and 19% of students were the familiar with all six terms. "Recycled water" was more likely to be known by university professors and least likely to be known by school teachers (86% and 63%, respectively). Retired respondents were most aware of the water quality situation on the Willamette River ($p = 0.02$, table 9). When asked about the acceptability of using reclaimed water for irrigation of school grounds, twenty-one percent of school teachers and twenty-three percent of retired people rated the use unfavorable or highly unfavorable.

Table 9. Occupation and awareness of water quality problems on the Willamette River.

	Business owner	University Professional	School Teacher	Retired	Student
Yes	30%	27%	20%	39%	13%
No/don't know	69%	73%	80%	59%	87%
n=	47	38	30	120	64

$\chi^2 = 16.92$, df = 4, $p = 0.02$, n = 299

Exploring the relationship between the presence of children and acceptance of water reuse, I found that whether or not a respondent has children and the age of those children appears to affect acceptance of water reuse for school irrigation. In order to see whether having younger children in a household affected response, I sorted respondents into those with no children, those that had a child age 0-10 years old (regardless of if there were other children older than 10 years old in the household), and those that had only children aged 11 or older. Results show that respondents with older children (11+

years of age) appear somewhat more likely to consider irrigation of school grounds (p = 0.07) favorable or highly favorable than those with no children or young children.

Table 10. Mean scores for acceptance of reclaimed water irrigation of school grounds, sorted by the presence and age of children in the respondent's household.

Presence of children	Mean	Standard Deviation	n
No children	3.74	1.18	324
Children age 10 or less	3.79	1.18	76
Children age 11 or older	4.11	1.07	66

1 = highly unfavorable, 5 = highly favorable
F = 2.65, df= 2, p = 0.07, n = 466

Multivariate analysis: modeling acceptance of water reuse in Corvallis

Multiple linear regression was used to model public acceptance of water reuse. Three regressions analyses were performed, one each with low, moderate and high contact as the dependent variable. Results from the three regression analyses show that several variables strongly affect the acceptance of water reuse in Corvallis (table 11). For high contact uses, there is strong evidence that acceptance is higher for men (p=0.004) and those who have a strong sustainability ethic (p=0.051). Contrary to what one might expect, those who are aware of the Willamette River water quality problems are less likely to accept water reuse for high contact uses (p=0.000).

For moderate contact uses of reclaimed water, a strong sustainability ethic and higher levels of education positively influence acceptance (p=0.003 and p=0.028, respectively). Having children present in the household may have a small negative influence on acceptance of moderate contact uses of reclaimed water (p=0.088).

Low contact uses are more supported by women (p=0.029) and those who know about wastewater treatment and water reuse (p=0.009). Those who have a high level of trust in the Corvallis Public Works Department to serve public interest may also be slightly more likely to accept low contact uses (p=0.067).

Table 11. Regression coefficients for factors of water reuse acceptance in Corvallis, Oregon

Independent Variable	**High Contact**	**Moderate Contact**	**Low Contact**
Informed	-0.018	-0.093	-0.088
	(0.794)	(0.157)	(0.184)
Knowledge of	0.004	0.059	**0.100**
wastewater	(0.909)	(0.120)	**(0.009)**
Aware of problem	**-0.394**	-0.043	-0.019
(1=yes)	**(0.000)**	(0.694)	(0.862)
Sustainability index	**0.026**	**0.040**	0.022
	(0.051)	**(0.003)**	(0.101)
Trust to serve public	0.111	0.080	0.125*
interest	(0.109)	(0.237)	(0.067)
Gender (1=male)	**0.279**	0.068	**-0.208**
	(0.004)	(0.474)	**(0.029)**
Age	-0.003	-0.003	-0.003
	(0.324)	(0.355)	(0.306)
Education	-0.020	**0.090**	0.029
	(0.627)	**(0.028)**	(0.485)
Children present	-0.045	0.172*	-0.165
(1=no)	(0.663)	(0.088)	(0.104)

P-values for the coefficients are in parenthesis. Bold values are significant at 95%; * denote significance at 90%. (n=444)

4.2. Public outreach

Results from this study so far indicate that public outreach may be needed to garner support for a water reuse project, depending on the use that is selected by the city. Several variables appear to influence public opinion, and it may be necessary to target certain groups with information about water reuse and outreach efforts. Using results from several survey questions about preferred information sources and public outreach efforts, this section illustrates how such a public outreach effort could take shape.

There are many sources of information about water reuse, but the public may not consider some sources credible. Corvallis citizens appear to value information from many different sources (figure 7). Scientists are very highly trusted, and Oregon State University scientists are trusted more than any other source of information. State agencies and city reports of regular testing were also frequently identified as credible.

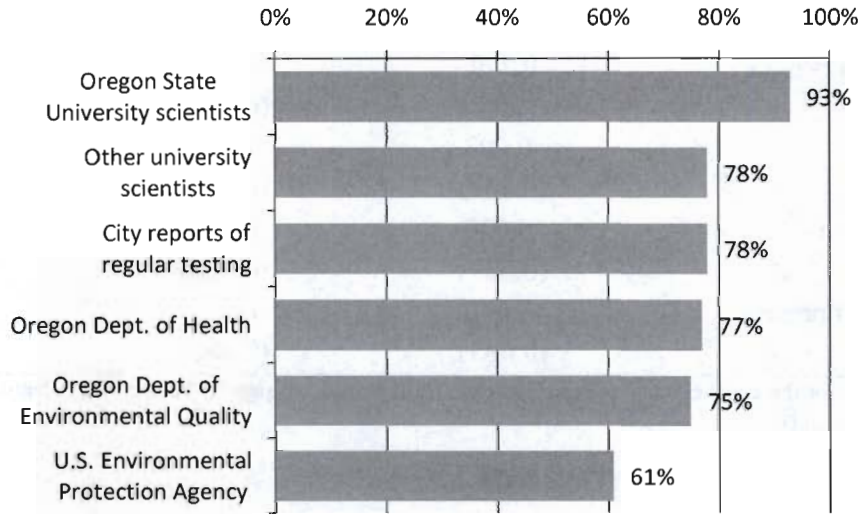

Figure 7. There are many sources of information concerning the use of treated wastewater. Which of the following sources would you find credible? (n=498)

Several respondents noted that whatever sources of information were provided, they would be considered more valuable if they were unbiased, independent sources.

Extensive public involvement can be a very expensive endeavour, both in time and money, so it is important to evaluate how much the public values citizen participation. If they strongly value participation, public involvement efforts should be more extensive than if they do not value participation. To gauge how much citizens value public participation over the increased costs to government that participation can cause, respondents were asked how much they valued public participation, especially if it adds to the cost of government. Respondents clearly value public participation, with only 6% believing that citizen participation is of little value and adds needlessly to the cost of government (figure 8). A clear majority values citizen involvment enough that they approve of some increase in the cost of government.

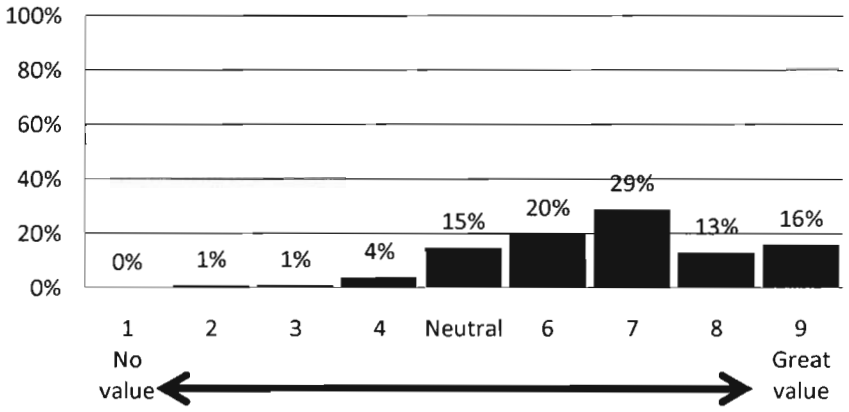

Figure 8. Where would you locate yourself on the following scale? 1=citizen participation is of no value and adds needlessly to the cost of government; 9=citizen participation is of great value even if it adds to the cost of government. (n=504)

Since respondents appear to approve of some increase in the cost to government due to public participation and because certain groups may need to be specifically targeted with information, it is important to assess which methods of communication are preferred by citizens. Citizens will need to know about issues and the city's plans to address them if they are to effectively participate in public processes. To identify communication methods through which the city can notify residents of their plans for water reuse, respondents were asked about the best ways to communicate with them regarding a water reuse project (figure 9). A large majority (71%) of respondents would like to read about plans for water reuse in the *Corvallis Gazette Times* newspaper. Articles in *The City* monthly newsletter (59%) and pamphlets mailed to their homes (57%) were the next most frequently chosen methods of communication. Focus

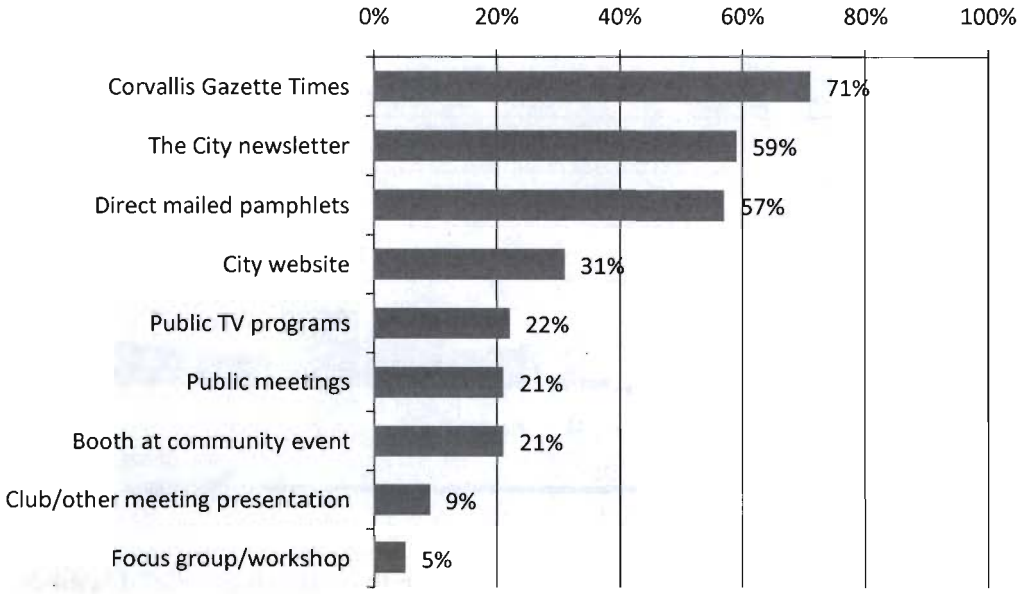

Figure 9. What are the best ways to communicate with you concerning how Corvallis will meet the new Willamette River regulations? (n=513)

groups/workshops and presentations at clubs or other meetings were chosen least frequently (5% and 9% respectively). Several respondents suggested email as an additional way to keep them informed.

Older respondents were most likely to select the *Corvallis Gazette Times* ($p = 0.04$) and *The City* newsletter ($p < 0.0001$) as a source of information (table 12). *The City* is least effective for communicating with students; only 34% of students report that it is a good communication method. Preference for non-print media communication appears to also be affected by age (table 13). Television programs on public channels may be an effective way to reach retired citizens and those younger than 24 and older than 65 years.

Table 12. Preference for the *Corvallis Gazette Times* and *The City* newsletter by age.

		18-24	25-44	45-64	65+
Gazette Times	Selected	64%	65%	71%	85%
	Not selected	36%	35%	29%	15%
The City	Selected	28%	53%	63%	71%
	Not selected	72%	47%	36%	29%
	n=	47	133	214	104

Gazette Times: $\chi^2 = 13.21$, df = 3, $p = 0.004$, n = 498
The City: $\chi^2 = 29.46$, df = 3, $p < 0.0001$, n = 498

Table 13. Preference for television programs on public channels by age.

	18-24	25-44	45-64	65+
Selected	45%	22%	12%	36%
Not selected	55%	78%	88%	64%
n=	47	133	214	104

$\chi^2 = 36.42$, df = 3, $p < 0.0001$, n = 498

Public meetings and presentations at clubs and other similar gatherings are an interactive way to communicate with citizens because they allow for conversations to develop between citizens and officials. Though generally few people chose presentations to clubs and other groups, age appears to affect respondents' preference for such presentations, with the youngest and oldest respondents preferring such meetings most ($p = 0.02$, table 14).

Table 14. Preference for presentations at clubs or other meetings by age.

	18-24	25-44	45-64	65+
Selected	13%	8%	5%	17%
Not selected	87%	92%	95%	83%
n=	47	133	214	104

$\chi^2 = 15.06$, df = 3, $p < 0.0001$, n = 498

Several comments written on the survey indicate that Corvallis citizens may not have always felt that their thoughts and comments have been adequately considered. For example, "When I have attended public meetings I've found that the people in charge listen politely to public input and then do what they already had decided – especially the city council."

5. Discussion and Recommendations

5.1. General Findings

The results of this study indicate that if Corvallis chooses to pursue water reuse, the citizens should be generally supportive. Lower contact uses should gain higher acceptance from the public than high contact uses, though high contact uses should not be ruled out since more than half of respondents favor using the water for irrigation of public parks and schools. Using the water for irrigation of food crops is likely to receive the least amount of support from the public.

According to the data, a water reuse program that adheres to the principles of sustainability is more likely to succeed than one that does not. This supports Bruvold's (1988) conclusion that for specific water reuse proposals, the most important factors of public acceptance are the health effects, environmental effects, treatment cost, and distribution costs of water reuse, along with the quantity of water conserved because of water reuse. The degree of contact with the water will still likely be a factor for Corvallis citizens, but less so than the sustainability of a project. The majority of respondents believe that the water should be sent wherever it is needed. There is, however, a small group of respondents who believe that the water should be used inside city limits. This, along with the strong support for sustainability, suggests that if a use within the city is found to be more sustainable than one outside of the city, the in-city use would be preferred.

Results from the survey indicate that there may be a significant amount of discomfort in the community about water reuse. Many people seem at least somewhat aware of the practice, but as other studies have found, they are uncertain about the risks associated with it and would like to know more before making a decision. Offering tours of other water reuse programs in Oregon may help to educate citizens, allowing them to see and smell what a program in Corvallis might be like.

Likewise, increasing awareness of the new Willamette River water quality standards and their impact on city wastewater treatment operations is also likely to increase acceptance of water reuse, especially for high contact uses. It will be important for citizens to know that there is a solid reason behind the proposal for reuse, and that they city is not embarking on this project lightly. The literature on water reuse concludes that trust in the utility increases acceptance of reuse, and this study supports that conclusion for low contact uses. This suggests that education efforts for such uses may not need to be as widespread and comprehensive as if the city pursues moderate to high contact uses. However, education efforts may need to include basic information about water quality. If people understand that the water is considered safe enough to be released into the Willamette River – and has been for over thirty years – they may be more likely to believe that water reuse is safe for at least low contact purposes.

While trust in the city to serve public interest and protect the environment is generally high, citizens prefer to get information about water reuse from a wide variety of sources. Oregon State University scientists are considered most credible by the community, but all sources of information listed received high scores. Regular testing of

reclaimed water quality with results made available to the public is a strategy that will help to build trust, ensuring the community that the city is continuing to put the health of its citizens and the environment first.

Public outreach efforts should include providing sources of information to the public through articles in the *Corvallis Gazette Times, The City* newsletter and direct-mailed pamphlets. Outreach need not be limited to these three, however; using many different communication methods and providing varied opportunities for feedback from the public has helped other communities win acceptance from the public. If Corvallis finds that increased public outreach is necessary, using multiple communication methods should increase acceptance of a water reuse program. Though a comprehensive program would be more expensive than a program that simply follows regulatory protocol, a clear majority of Corvallis citizens value public involvment enough that they approve of at least some increase in the cost of government. Therefore, if more public outreach is needed, the city should pursue it. Relying solely on public meetings for dissemination of information and solicitation of feedback would be a mistake for Corvallis. Only 21% of Corvallis respondents chose public meetings as one of the best ways the city can communicate its water reuse plans to them. If the city wants to ensure that a majority of citizens are aware of the project and have had the chance to give their opinion, they will have to do more than the required set of public meetings to win widespread support from the public. A survey such as the one presented here is a good way to educate, gauge public opinion and receive feedback, but other methods should be used so as to include as many citizens as possible.

Especially when asking the public for feedback, the city should clearly explain what the public's role in the decision is, whether as simply advisors or as the primary decision makers, and describe how comments will be used. The city should keep the process as transparent as possible, and make a special effort to incorporate comments and suggestions from the public into the final plan.

5.2. Policy recommendations for the city of Corvallis

The majority of citizens approve of water reuse, at least hypothetically. The city should generally expect the most support for uses in which the public can expect the least amount of contact with the water such as irrigation of business park landscaping and golf courses. From here, city managers have several options, depending on what approach to public involvement they wish to take. Some municipalities have chosen to involve the public early by asking for public input as to how they would like the city to proceed and what uses of reclaimed water they prefer the city pursue. Others have chosen to assess the options and choose a preferred option to present to the public. Past experience indicates that Corvallis residents will at least want to consider several options and recommend their preference to the city (D. Hanthorn, personal communication, October 16, 2008). Survey results on the level of public involvement that citizens prefer supports this conclusion. Regardless of how the city decides to narrow down the number of reuse options to explore, they will need to examine the sustainability of each use, including social, economic and environmental factors. Results of this survey indicate that the sustainability of reuse options will affect acceptance. Choosing a sustainable option will help the city maintain its commitment to sustainability as well.

Once a set of preferred options has been identified, the city should communicate these options to the community through articles in the *Corvallis Gazette Times*, *The City* newsletter and/or pamphlets mailed to households. Then they will need to assess public opinion of their proposal again. Though this study shows that the community appears to accept reclaimed water, Bruvold (1988) found that opinion changes when specific water reuse proposals, with defined costs, benefits and risks, are put forth. With this second assessment of opinion, the city should be able to identify whether an extensive public education and outreach campaign is required. If a significant amount of objection to water reuse is found, city managers will need to determine the cause of opposition. If it is due to a simple lack of knowledge or understanding about water reuse, an extensive public education campaign may be enough to turn public opinion. If as Stenekes (2006) suggests, deeply held beliefs and values about risk and sustainability are the cause of objection, the city will need to engage the public in a discussion about the community's values, future, and other approaches they could take to solve the problem.

Regardless of whether an extensive public education campaign will be required, the city will need to have information available about water reuse for those citizens who will want to know further details. Respondents in this study preferred to get information from a wide variety of sources, and the city should strive to offer as many sources of information as possible. Because scientists were so highly rated as a source of information, Corvallis may want to consider hiring local OSU scientists to do testing to prove the safety of reclaimed water uses or make presentations at public meetings or workshops.

If city managers decide to engage in water reuse, depending on the use chosen they may want to consider changing zoning or building ordinances to encourage the use of reclaimed water. For example, some cities have changed building codes or included new permit requirements to force the use of reclaimed water in new developments. A common way to encourage rather than force the use of reclaimed water is to offer it to customers at a lower cost than tap water. This tactic recoups less of the cost of treatment of wastewater than selling it at the same price as tap water, but creates an incentive for those who are using large volumes of water for non-drinking purposes to use reclaimed water instead. To provide assurance that the water is being used according to safety guidelines, the city could train site managers to oversee the use of the water in each reuse location, as the city of Livermore, California does (D. Atkins, personal communication, September 8, 2008).

5.3. Study Limitations

Flaws may exist in my conclusions. First, responses on the survey may not accurately depict reality. Russell and Lux (2006) note a wide variety of problems with using surveys, especially when asking respondents to self-report their own levels of knowledge about an issue. Respondents can be influenced by a wide variety of circumstances including preceding questions or discussion in the survey. On a more personal level, respondents may self-report higher knowledge of a subject so as not to appear ignorant. Also, as Russell and Hampton (2006) note, "attempting to poll the views of people who have thought little about the issues before being confronted with a questionnaire on them is of limited value." Due to space considerations, little

information about water reuse was included in the survey, and several respondents noted on the survey that they would have liked more information. Clearly, more information about the quality of the water, financial, safety and other factors is needed before respondents can offer a real opinion on water reuse, and responses could change dramatically based on that information. One respondent stated:

> I had difficulty answering many questions because I don't know how you would pipe the recycled water to the different locations it might be used. If you have to build extensive and expensive infrastructure I would oppose – if you don't have to tear up the city to install new pipes I would accept all proposed uses for recycled water.

In addition, positive results of acceptance should be not be taken as hard and fast acceptance of water reuse but as a general predilection toward acceptance. When faced with a particular proposal, opinions may change for many reasons – nimbyism, cost of a project, fear of risks, and so forth. As noted above, Bruvold (1988) showed that in hypothetical studies designed to gauge general acceptance of water reuse, the degree of contact the respondent would have with the water was the best predictor of acceptance. In surveys that asked about specific water reuse proposals designed for the respondents' communities, Bruvold found that acceptance relied less on contact with the water and more on beliefs about the health effects, environmental effects, treatment and distribution costs, and the potential of the project to help conserve water. Because a specific water reuse proposal has not been developed for Corvallis, this study of public opinion should be considered hypothetical in nature, and the results not reliable as the sole predictor of acceptance of a specific proposal.

While this study is meant primarily to support Corvallis' public involvement planning efforts, it also serves as a model for other water utilities in the Pacific Northwest and United States as they pursue their own water reuse programs. Despite all of the above findings, though, no public involvement program, no matter how well-designed and executed, can assure that the public will accept water reuse for their community. Certainly, findings from this study can help utility managers design a public involvement plan that will have an increased chance of success, but there are no guarantees.

6. References

Anderson, J. (2003). The environmental benefits of water recycling and reuse. *Water Science and Technology: Water Supply, 3* (4), 1-10.

Asano, T., Burton F., Leverenz, H., Tsuchihashi, R., and Tchobanoglous, G. (2007). *Water Reuse Issues, Technologies, and Applications*. San Francisco: McGraw-Hill.

Baggett, S., Jeffrey, P. and Jefferson, B. (2006). Risk perception in participatory planning for water reuse. *Desalination, 187,* 149-158.

Bridgeman, J. (2004). Public Perception Towards Water Recycling in California. *The Journal, 18* (3), 150-154.

Bruvold, W.H. (1985). Obtaining Public Support for Reuse Water. *Journal – American Water Works Association, 77* (7), 72-77.

Bruvold, W.H. (1988). Public Opinion on water reuse options. *Journal – Water Pollution Control Federation, 60* (1), 45-49.

Cooperative Research Centre for Water Quality and Treatment. (2008). *Community Views on Recycled Water – The Impact of Information.* Salisbury, Southern Australia: Roseth.

Davis, R. (2007, April 30). 'Perfect Storm' Brewing for San Diego's Water Supply. *Voice of San Diego.org.* Retrieved February 15, 2009 from http://www.voiceofsandiego.org/articles/2007/04/30/news/01water043007.txt

Depoe, S.P. and Delicath, J.W. (2004) Introduction. In S.P. Depoe, J.W. Delicath, and M.A. Elsenbeer (Eds.), *Communication and Public Participation in Environmental Decision Making* (1-10). Albany, New York: State University of New York Press.

Dillon, P.J. (Ed.). (2000). Water Reuse in Australia: Current Status, Projections and Research. *Proceedings of Water Recycling Australia 2000.* Adelaide, 99-104.

Dolnicar, S. and Schäferm A.I. (2009). Desalinated versus recycled water: Public perceptions and profiles of the accepters. *Journal of Environmental Management, 90*, 888-900.

Environmental Protection Agency. (2004). *Guidelines for Water Reuse* (EPA Publication No. EPA/625/R-04/108). Washington, DC: U.S. Government Printing Office.

Friederici, P. (2007, September 17). Facing the Yuck Factor: How has the West embraced water recycling? Very (gulp) cautiously. *High Country News.* Retrieved April 19, 2009 from http://www.hcn.org/issues/354/17227

Friedler, E., Lahav, O., Jizhaki, H., and Lahav, T. (2006). Study of urban population attitudes toward various wastewater reuse options: Israel as a case study. *Journal of Environmental Management, 81,* 360-370.

Hartley, T.W. (2003). *Water Reuse: Understanding Public Perception and Participation.* Alexandria, VA: Water Environment Federation.

Hartley, T.W. (2006). Public perception and participation in water reuse. *Desalination, 187,* 115-126.

Hurlimann, A. and McKay, J. (2004). Attitudes to Reclaimed Water for Domestic Use: Part 2. Trust. *Water, 31* (5), 40-45.

Ingram, P.C., Young, V.J., Millan, M., Chang, C. and Tabucchi, T. (2006). From controversy to consensus: The Redwood City recycled water experience. *Desalination, 187,* 115-126.

Irvin, R.A. and Stansbury, J. (2004). Citizen Participation in Decision Making: Is It Worth the Effort? *Public Administration Review, 64* (1), 55-65.

Kahn, S.J. and Gerrard, L.E. (2006). Stakeholder communications for successful water reuse operations. *Desalination, 187,* 191-202.

Lemonick, M.D. (2009, March 9). Top 10 Myths about Sustainability. *Scientific American.* Retrieved April 4, 2009, from http://www.sciam.com/article.cfm?id=top-10-myths-about-sustainability

Macpherson, L. (2003). Winning minds to water reuse: the road to NEWater. Proceedings from WateReuse Association 2003: *19th Annual WateReuse Symposium: Water Reuse—A Resource Without Boarders*, San Antonio, Texas.

Marks, J.S. (2004). Advancing Community Acceptance of Reclaimed Water. *Water, 31* (5), 46-51.

McDaniels, T., Gregory, R., and Fields, D. (1999). Democratizing Risk Management: Successful Public Involvement in Local Water Management Decisions. *Risk Analysis, 19* (3), 497-510.

Moore, L. (2003). Reclaimed Water: Managing the Legal Risks. *Water, 30* (8), 70-74.

Nancarrow, B.E., Leviston, Z., Po, M., Porter, N.B. and Tucker, D.I. (2008). What drives communities' decisions and behaviours in the reuse of wastewater. *Water, Science and Technology, 57* (4), 485-491.

Neubert, S. (2009). Wastewater reuse: how "integrated" and sustainable is the strategy? *Water Policy, 11*, 37-53.

Oregon Administrative Rules (OAR) Chapter 340, Division 55, 1990. Retrieved May 4, 2008 from http://arcweb.sos.state.or.us/rules/OARs_300/OAR_340/340_055.html

Po, M., Kaercher, J.D. and Nancarrow, B.E. (2003). *Literature Review of Factors Influencing Public Perceptions of Water Reuse.* Australian water conservation and reuse research program, Australian Water Association, CSIRO.

Robson, C. (2002). *Real World Research.* Malden, MA: Blackwell Publishing.

Russell, S. and Hampton, G. (2006). Challenges in understanding public responses and providing effective public consultation on water reuse. *Desalination, 187,* 215-227.

Russell, S., Hampton, G., Lux, C., and Jeffrey, P. (2006). Participatory Planning for Water Recycling Schemes in Australia: a handbook of principles, tools and guidance. Retrieved April 5, 2009 from http://www.uow.edu.au/science/chem/aquarec/pdf/wp5/wp5-2.pdf

Russell, S. and Lux, C. (2006). Water Recycling and the Community: *Public responses and consultation strategies, a literature review and discussion.* Retrieved April 5, 2006 from http://www.uow.edu.au/science/chem/aquarec/pdf/wp5/wp5-1.pdf

Russell, S. and Lux, C. (2009). Getting over yuck: moving from psychological to cultural and sociotechnical analyses of responses to water recycling. *Water Policy, 11*, 21-35.

Senecah, S. (2004) The Trinity of Voice: The Role of Practical Theory in Planning and Evaluating the Effectiveness of Environmental Participatory Processes. In S.P. Depoe, J.W. Delicath, and M.A. Elsenbeer (Eds.), *Communication and Public*

Participation in Environmental Decision Making (1-10). Albany, New York: State University of New York Press.

Smith, P.D. and McDonough, M.H. (2001). Beyond Public Participation: Fairness in Natural Resource Decision Making. *Society and Natural Resources, 14*, 239-249.

Stenekes, N. (2006). *Sustainability and Participation in the Governing of Water Reuse: The Case of Water Recycling.* Retrieved from Australasian Digital Theses. (http://handle.unsw.edu.au/1959.4/28292)

Walsh, B. (2008, December 6). Sewage That's Clean Enough to Drink. *Time.* Retrieved April 14, 2009, from http://www.time.com/time/health/article/0,8599,1866469,00.html

Webler, T. and Tuler, S. (2000). Fairness and Competence in Citizen Participation: Theoretical Reflections from a Case Study. *Administration and Society, 32,* 566-595.

World Commission on Environment and Development. (1987). *Our Common Future*. Oxford, UK: Oxford University Press.

Appendix A

Wastewater Recycling Survey

Results: Frequency Distributions

(Percentages may not add up to 100 due to rounding)

Sample Size: 1116
Surveys Returned: 518
Response Rate: 46%

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SECTION 1

In this first section, we would like to ask you some general questions about your interests, activities and knowledge about wastewater and recycled water. Please circle your answers.

Q-1 In general, how well informed would you consider yourself to be concerning wastewater treatment in Corvallis?

34% Not informed
49% Somewhat informed
13% Informed
4% Very well informed

Q-2 How often do you talk about city issues with your family, friends, or other acquaintances?

7% Never
29% Hardly ever
52% Sometimes
13% Often

Q-3 Overall, how much impact do you think PEOPLE LIKE YOU can have in making policy decisions in Corvallis?

9% No impact at all
44% A small impact
37% A moderate impact
11% A big impact

Q-4 For the following terms, please indicate if you know what the term means, have heard of the term but don't know its meaning, or have not heard of the term at all.

	Have not heard of the term at all	Have heard of the term but don't know its meaning	Know what the term means
a. Potable water	7%	9%	84%
b. Wastewater	1%	9%	91%
c. Greywater	18%	17%	65%
d. Sewage	1%	2%	97%
e. Recycled water	4%	21%	75%
f. Effluent	21%	30%	50%

Q-5 Since 1954, wastewater (or sewage) from Corvallis homes and businesses has been treated and released into the Willamette River. The plant treats over 4 billion gallons of wastewater every year.

The Oregon Department of Environmental Quality (DEQ) is tightening water quality regulations on the Willamette River. The new standards will impact the city's ability to continue discharging treated wastewater into the river. These tightened regulations over time could force the city to upgrade the plant or face fines, both of which could eventually impact your sewer bill.

Were you aware of this situation? 29% Yes 66% No 6% Unsure

Q-6 How important are each of the following when choosing an approach to meeting the new water quality regulations in the Willamette River? If you have no opinion of one, please leave it blank.

		Not Important at All	Limited Importance	Somewhat Important	Important	Very Important
a.	Prevent pollution	0%	1%	3%	29%	68%
b.	Protect human health	0%	0%	1%	13%	85%
c.	Be a long term solution	0%	0%	6%	27%	66%
d.	Be energy efficient	1%	2%	13%	33%	51%
e.	Be financially sound	0%	1%	9%	33%	56%
f.	Protect fish and wildlife	0%	1%	6%	27%	65%
g.	Have low greenhouse gas emissions	4%	5%	15%	28%	48%
h.	Other_____	0%	0%	3%	16%	81%

SECTION 2

Recycling treated wastewater is one way to help meet the new water quality regulations in the Willamette River. In this section, we are interested in what uses of recycled water you would accept in Corvallis.

Q-7 How much do you favor the use of recycled wastewater for each of the following? If you don't know or have no opinion of a use, please leave it blank.

		Highly Unfavorable	Unfavorable	Neutral	Favorable	Highly Favorable
a.	Irrigate golf courses	2%	2%	8%	25%	63%
b.	Irrigate landscaping in business parks	1%	2%	8%	27%	62%
c.	Irrigate public parks	1%	8%	13%	31%	47%
d.	Irrigate school grounds	4%	14%	17%	27%	38%
e.	Irrigate non-edible agricultural crops (grass)	2%	4%	8%	29%	57%
f.	Irrigate agricultural crops for human consumption	15%	26%	26%	20%	13%
g.	Use in industrial processes	1%	2%	16%	27%	54%
h.	Use to cool buildings	2%	2%	14%	27%	55%
i.	Flush toilets in public buildings	1%	3%	8%	25%	63%
j.	Supply fire hydrants in the city	2%	5%	17%	27%	50%
k.	Supply car wash businesses	3%	8%	21%	25%	43%
l.	Other_____	0%	0%	12%	6%	82%

Q-8a There are many sources of information concerning the use of treated wastewater. Which of the following sources would you find credible? Circle all that apply.

92% Oregon State University scientists

78% Other university scientists

76% Oregon Department of Environmental Quality

78% Oregon Department of Health

61% U.S. Environmental Protection Agency

78% City reports of regular testing on recycled water to ensure quality

3% Other (please specify)_____

Q-8b Which of the above sources do you think is the *most* credible?

OSU scientists: 28% All university scientists: 18%
Oregon DEQ: 19% Oregon DOH: 10%
EPA: 9% City reports: 15%
Other: 1%

Q-9 Please indicate how much you agree with the following statements. If you don't know or have no opinion, please leave it blank.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. I would support a recycled wastewater program if it were **cheaper** than continuing to discharge treated wastewater into the Willamette River.	5%	7%	14%	26%	48%
b. I would support a recycled wastewater program if it were **more sustainable** than continuing to discharge treated wastewater into the Willamette River.	1%	1%	7%	39%	52%
c. If regulations allowed it, I would support a program that recycles wastewater by using appropriate treatment to turn it into drinking water.	14%	21%	27%	22%	16%

Q-10 If a decision was made to recycle Corvallis' wastewater, where should it be used? Please choose only one.

16% The water should be kept for use within city limits.
1%. The water should be sent outside of city limits.
73% The water should be sent wherever it is needed, whether inside or outside city limits.
1% The water should not be recycled.
7% Don't know/no opinion
3% Other (please specify)_____

Q-11 What are the best ways to communicate with you concerning how Corvallis will meet the new Willamette River regulations? Circle all that apply.

59% Articles in *The City* monthly newspaper
57% Mailed informational pamphlets
5% Focus groups/workshops
9% Presentations at clubs or other meetings
71% The *Corvallis Gazette Times* newspaper
21% Public meetings
21% Informational booths at community events
22% Television programs on public channels
32% Information on the City of Corvallis website
5% Other (please specify)_____

Q-12 How much do you trust the Corvallis Public Works Department to:

	No Trust at All	Limited Trust	Moderate Trust	Great Deal of Trust
a. Serve the public interest	1%	12%	57%	29%
b. Protect the environment	2%	18%	56%	24%

Q-13 There has been considerable debate over efforts to increase *citizen participation* in government policy making. Where would you locate yourself on the following scale regarding these efforts? Please circle your response.

1---------2---------3---------4---------5---------6---------7---------8---------9

Citizen participation is of no value and adds needlessly to the cost of government.

Neutral

Citizen participation is of great value even if it adds to the cost of government.

0%-----1%------1%------4%-----15%------20%-----29%------13%-----16%

SECTION 3

In order to better understand the results of this survey, we would like to know a little more about you. Remember that all responses are anonymous.

Q-14 What is your gender? 54% Female 46% Male

Q-15 What is your current age in years _____ ?

18-24 years: 10%
25-39 years: 22%
40-64 years: 48%
65+ years: 21%

Q-16 What level of education have you completed?

0.4% Grade School
0.4% Middle or junior high school
6% High school
1% Vocational school
23% Some college
32% College graduate
36% Graduate school
1% Other _____

Q-17 If there are children living in your household, what are their ages? (Circle all that apply)

67% No children 10% 0-5 years 8% 6-10 years 10% 11-15 years 12% 16+ years

Q-18 How long have you lived in Oregon? _____(in years)

0-1 year: 3%
2-5 years: 11%
6-10 years: 8%
11+ years: 78%

Q-19 Which best describes your occupation?

9% Business Owner/Self-employed
2% Clerical/Administrative
0% Entrepreneur
7% Education Professional - University
6% Education Professional - School Teacher
6% Engineering
1% Farming/Fishing
4% Healthcare
6% Homemaker
1% Hospitality/Food Service
2% Laborer
1% Legal
3% Management
5% Other government (federal, state, local)
23% Retired
1% Sales
13% Student
10% Other: _____

Thank you for your time! Please return your completed survey in the stamped envelope provided.

You can use space below for any other comments, thoughts, ideas or concerns you'd like to share about the new Willamette River water quality standards or recycled water.

Appendix B: Response to Open-Ended Question

Forty respondents provided additional comments at the end and elsewhere on the survey. These comments are discussed under the following five themes: support for water reuse, opposition to water reuse, comments and questions on uses, public participation, and miscellaneous comments.

Support for water reuse

Sixteen respondents expressed support for water reuse. Most supporting comments referenced sustainability either directly or indirectly as a reason to pursue reuse.

In this day and age, there is no valid reason for dumping any amount of waste, treated or otherwise, into our rivers. Cost of sustainable practices should be irrelevant, there shouldn't be a price limit on our future.
I think the greatest challenge is to get the public to think about long-term needs of society rather than short-term effects on their individual wallets. We should be willing to pay higher sewer bills and taxes, if needed, to assure environmental high quality and preservation for future. Challenge for government is to get people to think that way.
Q9a: of course I would support a recycled water system if it were cheaper than current dumping practices, but I would not support it primarily based on that statement alone.
We would benefit from multiple stage WW treatment plants like in Silverton at the Oregon Gardens. Constructed wetlands w/ duckweed, cattails and other aquatic plants can successfully polish 2^{ndary} ww to w/in drinking water standards. Multiple gravity fed ponds are necessary. Wastewater is a misnomer – it's a resource! Hope your survey is productive.
The Willamette needs to be cleaned up again, and it needs to stay that way this time. That is the top priority. It may be expensive, but you can't put a price on preserving a source of life.
We must seriously consider this option. Use of recycled water in all application where there is minimal health risk should be explored and encouraged. Paying people small incentives to use recycled water should be an option.
If we can recycle it at a moderate price then my family is all for it. We must/have to recycle it or treat it somehow before discharging it. I'm all for the recycling of wastewater whether its [*sic*] here or any place else. I feel that all of recycling in some form is necessary/maybe should be mandatory to help ensure a greener, more sustainable

future. I also think that we all could do a little bit more to help the earth out. If everyone did their part in recycling, we wouldn't have as many problems with greenhouse gases, holes in the ozone, and global warming, when I said everyone I meant the whole world/planet!
Water quality standards in the Willamette River should be seasonal, so the winter flow can discharge to the river and summer flows be used for irrigation.
I fully support use and reuse of greywater, wastewater, and recycled wastewater. As a rate payer, I will support any cost or rate increases to make this happen.
The Willamette River is a natural treasure. Discharges into the river without treatment should be at an absolute minimum. With an EPA regional office on the OSU campus, Corvallis should be the leader in the state about cleaning up the Willamette River. At this time, I would not eat a fish caught in the Willamette River.
I think recycled water is a smart choice because it could reduce total water use and that impact on our state and local environment. I think eventually with sufficient regulations and reaching out to the community it will be accepted as drinking water. Oregon may not be in as tough of a spot as some areas of the country, but we can still be a leader and embrace comprehensive solutions.
Do what is best for me, the environment and my grandchildren's kids.
Good survey. Water will be a major problem in the future. We need to conserve/efficiently utilize it. Solutions should begin now, not after there's a crisis. We may need to pay more for water to do it properly (probably will).
I would support treating wastewater even if it costs more than not.
It is a good idea to treat the wastewater no matter the economic cost. The ecological benefits far outweigh any short term costs this program could have. As a whole, people need to begin thinking and acting in a sustainable manner. With climate change rapidly occurring we could find ourselves in a position of containing climate change because it is too late to prevent it. That is why wastewater treatment is so important.
Q9a: but cost would not be the only factor. Cheap is good but I am willing to support the costs of additional reuse projects.

Opposition to water reuse

Three respondents voiced opposition to water reuse. All three comments noted financial reasons and/or the need to build additional infrastructure as a reason for their opposition.

While recycled wastewater as drinking water is a somewhat scary turnoff to most of us, I don't believe that a separate infrastructure for recycled water only would make any financial sense.
It would be different if we didn't have an abundance of water most of the year. But we do – so I don't think that is where the effort and $ should be going.
There is only one drinking water delivery system. There is no way to deliver recycled water without trucking it or building a complete second water system. If it is clean enough to recycle it is clean enough to put back in the river.

Comments and questions on potential uses of reclaimed water

Ten respondents wrote comments about the potential uses we listed for reclaimed water, or had questions about the safety of each use and level of testing the water would receive.

Recycled water is fine for watering around town. I think it should be cleaned enough not to harm wildlife at all.
I have played golf on several courses that one used to absorb treated wastewater from sewage treatment plants. Not sure how extensive the treatment was but frankly, some could have used some more treatment.
Q7f: This was hard to decide. I think water use for food crops would be #1 importance but I would have to consider safety first so I answered "neutral" Q7a: If golf courses paid big bucks for water (given the water wasn't needed elsewhere) I would support it.
Love the idea of using recycled H2O for landscaping et. al. Hope it will be publicized where used.
The use in a fire hydrant is totally of in left field. Number one it would require a separate line just for the hydrants. Number two it would be used only sporadically whenever a fire was to occur. Perhaps using a line to fill a water tanker truck for fire use would be a

better idea, but then again fires are seasonal and random.
Tour the Tule Wetlands in Union County – treatment of wastewater by wetlands. Very effective. Work w/ DEQ to get BMPs for wastewater usage – agriculture having difficult time w/ wastewater reuse on crops.
I had difficulty answering many questions because I don't know how you would pipe the recycled water to the different locations it might be used. If you have to build extensive and expensive infrastructure I would oppose – if you don't have to tear up the city to install new pipes I would accept all proposed uses for recycled water. However, I don't know that I trust the treatment technology/capacity to be comfortable returning it into the potable water system.
Q7: I'm assuming the wastewater won't make anyone ill. What about heavy metals? Are they treated in wastewater? If so, then for food crops or school grounds or parks. What if the system malfunctions and untreated water is used? What safeguards?
It's hard to answer questions about wastewater unless you describe what exactly it is and how the standards are changing and why.
IF you proceed with the avocations of using waste water as a drinking water source you could very well kill unsuspecting humans including yourselves. You need to do a lot more research into what is in the water. Standard water testing is not enough.

Comments on Public Participation

Seven respondents had comments relating to public participation. Several of these comments were negative feelings about the city's past efforts at public participation.

If you would like to give a presentation to Academy of Life Long Learning (A.L.L.) this would be a good way to get the word out. On OSU alumni website.
Q13: [Chose a low number] Because citizens are ignored by city staff and not "really" a participant. I tried to give input on the new bus stop (suggested bathrooms) and was rebuffed by the "opinion seekers". I tried to enforce noise ordinances about barking dogs and was told "that is what dogs do." I tried to get a fair look at residences zoned as business charges for water and was blown off. So the city does what it wants to do without really responding to citizen input so I don't waste my time. I completed this survey only in that I am interested in recycling water and use of rainwater.

When I have attended public meetings I've found that the people in charge listen politely to public input and then do what they already had decided – especially the city council.
In all public meetings, workshops and published materials, city council, various commissions and govt employees shoud make sure general public can follow their (govt's) discussions. Avoid or explain uncommon acronyms, references to ordinances the public may be unaware of, etc. At a recent televised city council meeting an informed person (ordinary citizen or commission member – don't remember which) gave a lengthy presentation that I found hard to follow – and so did the council. Only one member (Belstein) had a comment (brief) and I had the distinct impression that council members didn't follow the presentation too well. Finally, the city attorney had the courage to speak up and say that frankly, he couldn't follow what was said. I suspect govt employees and ordinary citizens alike don't clearly understand things because presentations are too rapid and filled with technical terms. This is not a criticism of the city council or any particular branch of city govt. I just think we need more simplifying and clarification.
Q13: [chose 9] A wide range of ideas encourages creativity. People from dif [*sic*] areas of concern and expertise cross-pollinate solutions.
I will answer your questions to the best of my knowledge. I is my experience that people in our government do not conceder [*sic*] the general public as part of the government or hear the what the people that come to meeting have to say.
My responses may be somewhat biased. I recently spent several weeks working in Australia on a recycled water project and the big "issue" was that there was little or no public input into how the water was to be used by the state. Uses included power generation and possibly drinking water. I think failing to make the public a part of the decision made acceptance more difficult. However, there needs to be a balance against the publics knee jerk response to simply reject recycled water without the knowledge of how it is used and how its produced). Good, informed decisions by the public are needed in conjunction with the scientific community (not just the elected officials).

Miscellaneous comments

Miscellaneous comments included thoughts on conservation, greywater, using independent testing to prove safety, and concerns about fiscal responsibility.

I would like to see programs put into place that inform and encourage water recycling at the home level. Use of greywater was illegal. Affordable ways to make changes at home.
Water conservation seems a critical part of reducing wastewater headed towards the Willamette.
Thanks for the opportunity to give answers to these questions. I've been interested in greywater used by households but realize that is not moving very quickly through the systems. Is this a systemwide alternative to that (greywater)?
I've always thought it was crazy to use drinking water for non-food purposes (I love to garden and our water bill goes way up in the summer). We don't have the money or the space to install a gray-water catch system. I try to be efficient – using the water that comes out before it gets hot enough to wash dishes, for instance – but I know I'm spitting in the ocean. I have no idea what the solution might be, if any.
I feel an independent testing agency with a reputation for not putting any "spin" on results is important. Also an agency not getting state or fed $$. Water quality is really important to me. My family goes out of our way to refill bottles of H2O from Winco..where the city H2O is filtered through a variety of ways. I've read the city's H2O reports and they have been confusing with nothing to reference results to or, if they state that a result of Corvallis H2O is below EPA standard – I mistrust it as I feel that the EPA "drops the ball" on what they feel is acceptable content in our H2O.
We replaced our conventional electric water heater with a gas Rinnai tankless system. While it is energy efficient, the system wastes drinking water during the time hot water line purges itself of cold water. Water vs. energy…?
Wastewater treatment is great. The problem with such programs is they become "waste money" programs. What ends up happening is wastewater costing more than well water. The people get sold a green eco image that turns out to be an expensive lie. The people get told to buy some outrageous expensive process that does not work. It is very important to take time to test prototypes – not charge right in. It might be great to link wastewater treatment to solar energy and fertilizer manufacture. Also, depending where such work is to be done, make sure there is land to expand into in the future. Also, never

trust a professor "expert" who has never run such a facility. ☺ Do trust Bill Lunch!
The Willamette River is a natural treasure. Discharges into the river without treatment should be at an absolute minimum. With an EPA regional office on the OSU campus, Corvallis should be the leader in the state about cleaning up the Willamette River. At this time, I would not eat a fish caught in the Willamette River.
Don't know. It's better to have info from more than one source (preferably unrelated sources). One aspect is the basic info on what are acceptable standards. The other is city testing to see if standards are met.
Get a good program and stay with it – be very selectful in administration.
I don't agree with fluoridation. People shouldn't be forced to drink fluoride. Those who believe it is a good thing should apply only to their teeth with toothpaste or mouth rinse. It has no place in our water supply. There should be studies done on the higher incidents of some serious chronic illnesses in this area and how they are related to pollution, additives, etc. Lou Gherig's disease is very high here (ALS) for example.