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What's in a name? Branding reclaimed water☆

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ABSTRACT

Reclaimed water is often presented as a cost-effective, reliable, and safe solution to increasingly common water shortages in the United States and across the globe, but studies have shown that consumers tend to object to the use of this water. Broad adoption of this technology will require consumer acceptance or at least tolerance of it, and studies have suggested that better branding could minimize consumers' concerns. In this study, we first test twenty-one potential branding names for reclaimed water using survey responses to identify the top-six most favored names. We then determine whether an opportunity for consumers to try reclaimed water can change their preferences. The results suggest that the common names for this water, such as Recycled, Reclaimed, Nontraditional, Treated Wastewater, and Reused, are the least appealing, as they all scored at the bottom. In contrast, names that invoke desirable characteristics of the water—Pure, Eco-Friendly, and Advanced Purified, were viewed significantly more favorable than the others. Having an opportunity to taste reclaimed water treated to a potable standard seems to clarify consumers' preferences by increasing the differences in favorability between the names. Based on these results, it appears that while there are a couple of appealing names, the most consistently preferred is Pure Water.

"Pure water is the world's first and foremost medicine." – *Slovakian Proverb*

1. Introduction

Reclaimed water is often presented as a cost-effective, reliable, and safe solution to increasingly common water shortages in the United States and around the world (Chen et al., 2013). However, numerous studies have shown that reclaimed water is often rejected by consumers (Menegaki et al., 2007; Bakopoulou et al., 2008; Menegaki et al., 2009; Hui and Cain, 2017; Ellis et al., 2018) because it invokes feelings of disgust (a "yuck" factor) related to wastewater, driving consumers to oppose its use, particularly for drinking and cooking (Fielding et al., 2018; Savchenko et al., 2019). Several large-scale potable reclaimed water projects have been derailed by public resistance in the United States (Hummer and Eden, 2016) and Australia (Uhlmann and Head, 2011; Morgan and Grant-Smith, 2015), making it difficult for policymakers to address water crises. However, there is some evidence that this negative public reaction could be minimized and perhaps, in some cases, eliminated through better branding of reclaimed water (Menegaki et al., 2009; Rock et al., 2012; Lee and Tan, 2016). Widespread adoption of reclaimed water is critical for meeting the world's water needs in the future, but it largely depends on consumers' acceptance of this water for potable and non-potable uses. Branding of reclaimed water can be an effective policy tool to destigmatize reclaimed water in addition to other strategies such as educating the public through optimal messengers (Schmidt et al., 2017) and using the least stigmatized sources of reclaimed water (Ellis et al., 2018). Thus, it is important for policymakers and those in the food and agricultural industries to understand how the various types of branding of reclaimed water can aid in mitigating the negative consumer reaction associated with it.

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Using a large data set collected in two studies involving 1212 adult participants from the Mid-Atlantic region of the United States, this paper[1] examines consumers' perceptions of a set of potential brand names for reclaimed drinking water. To our knowledge, this is the first study to test consumers' responses to branding names for reclaimed water and investigate whether having an opportunity to taste reclaimed water affects consumers' preferences for the names. Our study design involves two steps. First, we compare consumers' preferences for twenty-one potential brand names for reclaimed water using survey responses from 305 adult respondents to identify the top six most-favored names. Then, in a second study involving 907 adult participants, we use A/B testing to compare consumers' responses to the top six names selected from the first study and examine the effect of having an opportunity to taste treated and safe version of reclaimed potable water[2] on consumer perceptions of the names. Prior studies have tested only a few brand names used interchangeably by scientists, agricultural producers, and water utilities (Menegaki et al., 2009; Rock et al., 2012); we test those brand names in addition to the names currently being used to market reclaimed drinking water to consumers, the names suggested by leading researchers in the field, and variations of the names commonly found on food labels—the most exhaustive analysis of brand names for reclaimed water to date.

1.1. Background

Worldwide, more than four billion people suffer from water shortages in at least one month per year and 40% of the U.S. population is affected by insufficient water supplies annually (Mekonnen and Hoekstra, 2016). The scarcity of drinking water supplies is exacerbated by the agricultural sector's vast share of fresh water consumption, averaging over 70% globally (World Water Assessment Programme, 2016) and as much as 90% in most western U.S. states (U.S. Department of Agriculture (USDA) Economic Research Service (ERS), 2017). Demand for fresh water is increasing because of population growth and economic development, which are expected to lead to a doubling of agricultural production by 2050. Meanwhile, existing fresh water supplies are dwindling because of over-use and shifts in precipitation and temperature related to climate change (World Bank, 2014). In 2018, the stark urgency of this issue was seen in Cape Town, South Africa, when the city nearly ran out of drinking water for its residents (Mahr, 2018). Reclaimed water has the potential to become a reliable and safe source of drinking water in places such as South Africa, Australia, western parts of the U.S. and others that experience severe droughts, but only if the public accepts it. Improved branding of reclaimed water can be an important strategy in building consumers' acceptance of reclaimed water. Therefore, understanding how consumers respond to different reclaimed water names can provide policymakers with critical insights that can enhance their efforts in promoting acceptance of potable reclaimed water.

Reclaimed water—wastewater that is treated to state-specific standards to make it safe to use for potable and non-potable needs—has proven to be a cost-effective, reliable, and safe solution to inadequate water supplies on a large scale in Israel, Singapore, and Australia and on a much smaller scale in the United States (Chen et al., 2013; Dery et al., 2018; WateReuse, 2018). There are also considerable environmental benefits from water reclamation, including reducing stress on vulnerable local ecosystems (Environmental Protection Agency (EPA) (EPA), 2018). However, when consumers become aware that reclaimed water has been or will be added to their drinking water or used to irrigate the produce they buy, they typically either require a significant reduction in price to purchase and consume such products or they outright reject them (Menegakiet al., 2007; Bakopoulou et al., 2008; Menegaki et al., 2009; Morgan and Grant-Smith 2015; Hui and Cain 2017; Schmidt et al., 2017; Ellis et al., 2018; Li et al., 2018; Savchenko et al., 2018a, 2018b). This overreaction to the potential risk associated with consuming reclaimed water, stems from the "toilet to tap" perception.

Several studies have shown that stigma attached to water "contaminated" by municipal waste, lead, or sterilized cockroaches was reduced or overcome by making consumers aware of the number of barriers between the water they consume and the source of the contagion (Rozin et al., 2015; Kecinski et al., 2016; Hui and Cain, 2017; Kecinski and Messer, 2018). Showing or even just telling consumers that the water had been filtered reduced their stigmatization of it. Introducing intermediate steps such as putting treated wastewater into a surface body of water for a period of time or using it to recharge an aquifer before sending it to consumers' taps had the same effect (Rozin et al., 2015; Hui and Cain, 2017). These processes seem to be perceived by consumers as having returned the water to a more natural, fresh, or pure state.

Companies that produce bottled drinking water have tended to emphasize the waters' natural state, freshness, and purity to market it. Most brands reference places of origin, such as glaciers, springs, and islands, to maintain the connection between the water and a natural, fresh source, even though several brands are simply filtered tap water (Wilk, 2006; Hawkins, 2009). Consumers often are not aware of the true source of the water because of relaxed regulations regarding food labeling and perceive bottled water as purer, safer, and healthier than tap water, which is not necessarily the case (Wanctin, Dalmeny, and Longfield, 2006; Clarke, 2007; Hawkins, 2009; Hu, Morton and Mahler, 2011). Even consumer claims that they can taste the difference between bottled and tap water have proven unreliable in blind taste tests (Wilk, 2006). Still, producers of bottled water continue to promote their products as healthier by advertising that they naturally contain nutritious minerals or promote the water as "purified" because something has been removed from it (Wilk, 2006; Hawkins, 2009; Smith, 2013).

Portraying a product as more natural and healthier than competing products is a common marketing tactic by the food industry. As consumers seek greater transparency in how foods are made, producers are responding with "clean-labeling", a trend in which product ingredients are worded to appear natural and easily understandable (Aschemann-Witzel, Varela, and Peschel, 2018). Some clean-labeled foods are new products, but others have simply had an ingredient removed or replaced and their label information rephrased (Katz and Williams, 2011). Consider, for example, foods labeled as certified organic and "free from" ingredients such as preservatives. Consumers tend to view these products as more natural, healthy, and friendlier to the environment than alternatives such as genetically modified (GMO) foods and additives such as the synthetically produced growth hormone rBST, even though there is no scientific proof of such benefits (Kanter et al., 2009; Lusk et al., 2014; Messer et al., 2017; Asioli et al., 2017). Likewise, for locally grown food. Consumers may view it as better for the environment, however, local production can require greater amounts of energy-intensive greenhouses or fertilizer inputs and thus be worse for the environment than growing the same food elsewhere and transporting it long distances (Costanigro et al., 2015).

Certain foods, such as prunes and rapeseed oil, have used rebranding to change their marketing trajectory and shed their undesirable associations, becoming dried plums and canola oil, respectively. Other products, like lean finely textured beef (LFTB), used a technical industry name because it was not actively marketed to the public, allowing it to be monikered "pink slime" and cast as an example of the

[1] Funding for this study is part of larger efforts of the CONSERVE project (a Center of Excellence designated by the U.S. Department of Agriculture at the nexus of sustainable water reuse, food, and health) to fund research investigating consumer perceptions of the use of reclaimed water in agricultural production.

[2] The potable reclaimed water was obtained from the Prima County Regional Wastewater Reclamation Department in Tuscon, Arizona through collaborators on the CONSERVE project.

Table 1
Research Questions and Results.

Question	Hypothesis statement	Results
1. What names for reclaimed water are most favorably and least favorably perceived by consumers?	For each branding name a and all other branding names b $H_0 : Favorability_a = Favorability_b$ $H_A : Favorability_a \neq Favorability_b$	Reject H_0 (Tables 3 and 5). The three most favorable names are Pure, Eco-Friendly, and Advanced Purified. The least favorable were Recycled, Reclaimed, Nontraditional, Treated Wastewater, and Reused.
2. Does the opportunity to taste reclaimed water affect how consumers view various potential names for it?	For each branding name a, control c, and treatment d $H_0 : Favorability_a^c = Favorability_a^d$ $H_A : Favorability_a^c \neq Favorability_a^d$	Reject H_0 (Tables 5 and 6). The opportunity to taste reclaimed water clarifies consumer preferences and increases favorability for Eco-Friendly.
3. Does the type of water consumers typically drink affect how they perceive potential brand names for reclaimed water?	For each branding name a, water type e, and all other water types f $H_0 : Favorability_a^e = Favorability_a^f$ $H_A : Favorability_a^e \neq Favorability_a^f$	Reject H_0 (Tables 5 and 6). Participants favorability of certain names was significantly different if they typically drink bottled water instead of tap water.

lack of transparency in the food industry when its presence in food was brought to the public's attention by news reports (Greene, 2012). The term pink slime elicited the meat's "yuck" factor and suggested to consumers that it posed a food safety risk, causing the price of LFTB to plunge 42% between March and April 2012 (Detre and Gunderson, 2012; Greene, 2012; McKendree, Widmar, and Widmar, 2014).

Currently, most references to reclaimed water use scientific and industry terms such as reused, reclaimed, recycled, and treated wastewater interchangeably because little research has been done on how best to market reclaimed water to the public. Studies have examined consumers' preferences for these terms and found that terms emphasizing the treatment processes the water went through were more effective than ones that focused on the wastewater source. Menegaki et al., (2009), for example, found that Greek consumers preferred the term recycled water to treated wastewater. Rock et al., (2012) found that consumers in Arizona responded more positively to water reuse, recycled water, repurified water, and reclaimed water than to effluent, tertiary treated wastewater, and toilet-to-tap.

Informational campaigns that focus on positively framing reclaimed water instead of conjuring its stigma-inducing aspects have had considerable success. NEWater in Singapore, for example, has used this approach, enabling Signapore to obtain approximately 40% of its water from water reclamation (Lee and Tan, 2016; PUB Singapore's National Water Agency, 2018). In addition to changing the terminology, NEWater's strategy to gain broad public acceptance included bottling the water and handing it out at community events to allow people to taste it (Lee and Tan, 2016). Still, key questions remain about how reclaimed water should be branded in the United States and elsewhere.

This study addresses three key questions:

1. What names for reclaimed water are most favorably and least favorably perceived by consumers?
2. Does an opportunity to taste reclaimed water affect how consumers view various potential names for it?
3. Does the type of water consumers typically drink affect how they perceive potential brand names for reclaimed water?

Table 1 summarizes the hypotheses associated with these questions and the results of the two studies. Strikingly, the names often used to refer to this water, such as Reused, Treated, Nontraditional, Reclaimed, and Recycled, all score quite low. We find that names that invoke desirable characteristics of the water—pure, fresh, and natural—are preferred; Pure, Eco-Friendly, and Advanced Purified were viewed as most favorable among the options tested. Having an opportunity to taste reclaimed water seems to clarify people's preferences as it increases the degree of difference in their preferences for various labels. Consumers who typically drink bottled water show a significant preference for the name All Fresh, 100% Fresh, and All Natural and decreased favorability for the name Eco-Friendly.

2. Research design

2.1. Study I

To assess consumers' preferences for different names for reclaimed water, we first compiled a list of all the names used in the literature and currently used to market reclaimed water to consumers throughout the world. We then shared that list with colleagues on the CONSERVE project[3] and asked them to edit and add to it. This process was intended to explore a wide array of names and it generated a final list of twenty-one names that were used in a survey that employed a five-point Likert scale (see Table 2 for the complete list of names). The survey was administered to 305 adult respondents using convenience sampling. Participants were randomly recruited at a local farmers' market and at a shopping mall in Delaware, locations that typically attract a diverse population from nearby states such as New Jersey, Maryland, Pennsylvania, New York, and Virginia. Convenience sampling in field locations was used, as opposed to undergraduate students in the laboratory, to obtain a more representative sample. However, due to financial and time constraints, we were unable to obtain a perfectly representative sample. To avoid forcing each participant to provide responses for all twenty-one names, each was shown a randomly selected group of six names on their tablet screen when asked to respond to the following question (see Appendix A-1):

> "Being able to drink treated wastewater is a possibility available to consumers. This drinking water has been referred to by several different names. On a scale of 1 (least favorable) to 5 (most favorable), **please indicate how favorable you consider** each of following names for this water."

Each participant i has a true favorability score y^* for each name j. We cannot directly observe y^* but can observe the categories of response, y (1 = least favorable to 5 = most favorable), which can be formalized as

[3] CONSERVE is comprised of bioscientists, engineers, economists, social-behavioral scientists, law and policy experts, extension specialists, educational media developers, and computer scientists (http://conservewaterforfood.org/).

$$y_{ij} = \begin{cases} 1 & if y_{ij}^* \leq \mu_1, \\ 2 & if \mu_1 < y_{ij}^* \leq \mu_2, \\ 3 & if \mu_2 < y_{ij}^* \leq \mu_3, \\ 4 & if \mu_3 < y_{ij}^* \leq \mu_4, \\ 5 & if \mu_4 < y_{ij}^*. \end{cases} \quad (1)$$

The parameter μ_n ($n = 1, 2, 3, 4, 5$) is the externally imposed endpoints of the observable categories. Participants choose the integer that is closest to their true favorability score y_{ij}^*.

2.2. Study II

In the second study, we used A/B testing and the same stated-preference, five-point Likert scale question described above for Study I to elicit participants' perceptions and to determine if tasting a treated and safe version of reclaimed potable water affected their preferences. Specifically, based on the analysis of the data from Study I, we were able to identify the six most-favored potential brand names for reclaimed water and showed participants in Study II each of these names. Tablet computers presented 907 adult participants with the six names on a single screen (see Appendix A-2): Pure, All Natural, 100% Fresh, All Fresh, Eco-Friendly, and Advanced Purified. Presentation of the names on the screen was randomized to eliminate ordering effects. To avoid the potential bias associated with the discovered preference hypothesis (Plott, 1996), participants could go back and change their ratings after considering all six names.

Recruitment for Study II took place at a large agricultural community event held on campus of a large public university in Delaware that attracts approximately 8000 people from at least eighteen states each year. As with Study I, we used convenience sampling in a field location to obtain a sample more representative of the general population than undergraduate students but were unable to obtain a perfectly representative sample. Given the differences in the recruitment locations, variations were observed between the populations of the two studies, as shown in Tables 2 and 4. Interestingly, despite these differences in populations, the overall ratings for the top names were similar, suggesting that these names may have broad appeal. Appendix C presents summary statistics for the demographics of Study I and Study II alongside those for the United States population.

Participants in Study II were randomly assigned to a treatment and a control group. The treatment group was given an opportunity to drink potable reclaimed water,[4] provided in a three-ounce cup, at the beginning of the study. Their compensation for participating in the study was the same, regardless of if they tried the water. The water was dispensed from a clear glass jug located on a table on the treatment group's side of the room. Of the 453 treatment-group participants, 355 (78%) tried the water and were asked to rate its taste and overall quality compared to the water they typically drink on a scale from 1 (worse) to 5 (better) with 3 indicating that it was the same (see Appendix A-3). Participants who chose not to drink the water were asked to dispose of the cup when they finished the survey. The 454 participants in the control group were not given the opportunity to taste the reclaimed water and could not observe the treatment group.

After rating the favorability of the six potential names for reclaimed water, participants completed a survey that collected information on their demographic characteristics, political views, and opinions on relevant topics (see Appendix B for the complete survey). Before leaving, each participant received a gift certificate for a free ice cream cone, worth approximately $3, to a local creamery within walking distance as compensation for their time.

[4] The potable reclaimed water was obtained from the Prima County Regional Wastewater Reclamation Department in Tucson, Arizona, through collaborators on the CONSERVE project.

3. Results

3.1. Study I

In Study I, 305 adult participants rated the favorability of six potential names for reclaimed water, generating 1814 observations (some participants did not rate all the names presented). Table 2 presents summary statistics for the demographic characteristics of this sample and the number of participants who saw and rated each branding name. Since the six names shown to each participant were determined randomly, there was some variation in how many times each of the twenty-one names was rated. For instance, All Natural and Fresh2O were presented to the largest number of participants (99). Fig. 1 displays the mean favorability rating for each name and its associated 95% confidence interval. The figure shows that the top six names—Pure, All Natural, 100% Fresh, All Fresh, Eco-Friendly, and Advanced Purified—stood out strongly for participants since their means and the lower bounds of the confidence intervals were all greater than 3.00, the middle value of the Likert scale. Interestingly, five of the six least favorable names were the terms most commonly used by scientists, agricultural producers, and water utilities (Recycled, Reclaimed, Non-traditional, Treated Wastewater, Reused). Also striking is how adding "Pure" to "Recycled" moved the favorability ranking from sixteenth (2.39) to seventh (3.11).

Given the ordered nature of the data (1 = least favorable and 5 = most favorable), we used an ordered logit model to test for significance between the names. To account for the within-subject comparisons, we implemented a random-effects specification and estimated the coefficients using clustered standard errors. The model is formalized as:

$$Pr(y_{ij} > n | \mu, x_{ij}, d_i, v_i) = H(\beta_1 x_{ij} + \beta_2 d_i + v_i - \mu_n), \quad (2)$$

where $v_i \sim N(0, \sigma_v^2)$, and $H(\bullet)$ is the logistic cumulative distribution function with a mean zero and variance of $(\frac{\pi}{\sqrt{3}})^2$. In this specification, y_{ij} is the categorical favorability score for participant i for branding name j, μ_n is a set of externally imposed endpoints of the observable categories ($n = 1, 2, 3, 4, 5$), x_{ij} is a vector of dummy variables for participant i and branding name j with Reused (the least favored of the twenty-one names) as the omitted variable, d_i is a vector of demographic variables for participant i, v_i includes panel-level random effects.

The estimated coefficients from Eq. (2) and the results of the Wald tests of whether there are significant differences between the coefficients of the branding names are presented in Table 3. Those values show that the top three names (Pure, All Natural, 100% Fresh) are significantly different, at a 5% level, from names seven through twenty-one. The fourth, fifth and sixth ranked names (All Fresh, Eco-Friendly, Advanced Purified) are significantly different, at a 5% level from names nine through twenty-one. To trim the number of names tested in the second study, a line was drawn between the sixth ranked name (Advanced Purified) and the seventh ranked name (Pure Recycled) because the seventh ranked name is significantly different, at the 5% level, from the top three names whereas the sixth name is not. The highest ranked names predominantly invoke physical characteristics of the water (pure, fresh, natural) rather than the processes used (recycled, reclaimed, treated, reused), which aligns with the characteristics typically used to market bottled water. It was the names that emphasized the processes the water had gone through that had the smallest coefficients. In contrast to previous studies, there are no significant differences between any of these names (Menegaki et al., 2009; Rock et al., 2012). Demographic variables, such as gender, level of education, annual household income, and political beliefs have no significant effect on participants' favorability ratings of the names. However, the older someone is and if they typically drink bottled water, relative to tap water, the less favorably they rank the names.

Table 2
Summary Statistics for Study I.

			Branding name	Observations
	Total Participants	305	*Pure Water*	97
			All Natural Water	99
Demographics	*Mean Age*	38	*100% Fresh Water*	75
	Median Age	35	*All Fresh Water*	82
	Mean Annual Household Income	$35,000-$49,000	*Eco-Friendly Water*	82
	Median Annual Household Income	$35,000-$49,000	*Advanced Purified Water*	82
	Female	52%	*Pure Recycled Water*	93
			EcoWater	88
Educational Attainment	*High School or Less*	32%	*ReNew Water*	90
	Some College or Associate Degree	41%	*Sustainable Water*	90
	Bachelor's Degree	14%	*Advanced Purified Recycled Water*	87
	Graduate Degree	13%	*NEWater*	84
			EnviroWater	88
Employment	*Unemployed*	10%	*Fresh2O*	99
	Employed	70%	*Green Water*	81
	Retired	6%	*Recycled Water*	84
	Disabled	3%	*Reclaimed Water*	75
	Student	11%	*Nontraditional Water*	84
			Treated Wastewater	86
Political Affiliation	*Liberal*	28%	*Low Footprint Water*	85
	Moderate	31%	*Reused Water*	83
	Conservative	27%		
	Other	13%		
Drink Most Often	*Bottled*	83%		
	Filtered Tap	0%		
	Tap	16%		
	Other	1%		

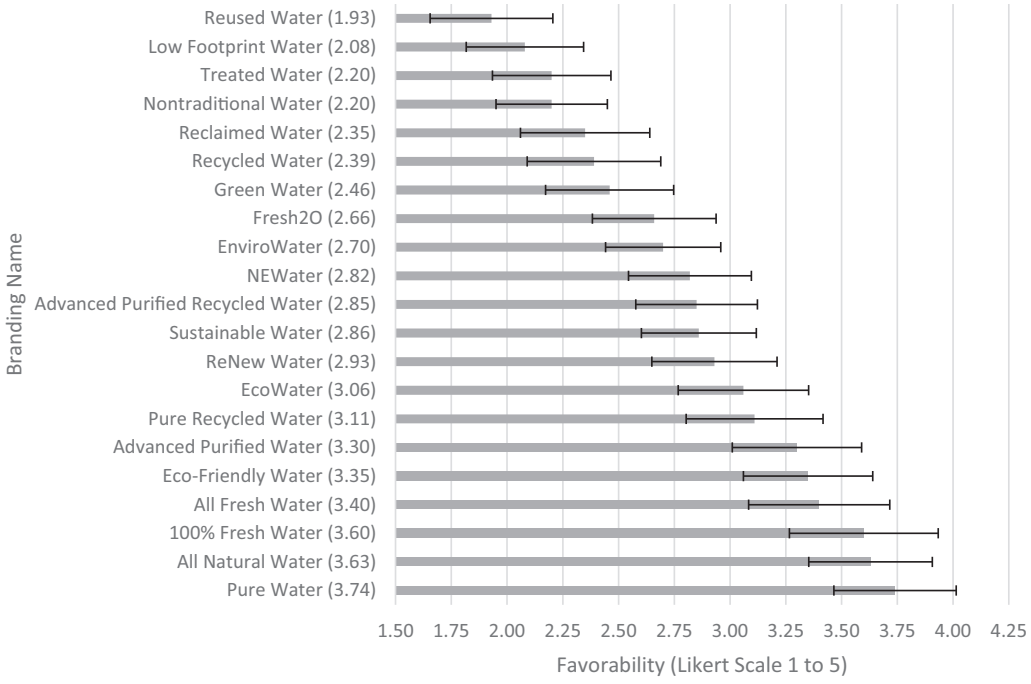

Fig. 1. Mean favorability and 95% confidence intervals of Study I names. Note: Respondents rated their preferences for branding names using a Likert scale, where 1 indicated "Least Favorable" and 5 indicated "Most Favorable". Dashed bars represent 95% confidence intervals.

Table 3
Results from Ordered Logit for Study I.

	Coef.	S.E.	Branding names that are sig. dif. at the 5% level
Branding Name			
1. Pure Water	3.549***	0.370	4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
2. All Natural Water	3.201***	0.354	5 7 8 9 10 11 12 13 14 15 16 17 18 19 20
3. 100% Fresh Water	3.358***	0.431	5 7 8 9 10 11 12 13 14 15 16 17 18 19 20
4. All Fresh Water	2.875***	0.366	1 9 10 11 12 13 14 15 16 17 18 19 20
5. Eco-Friendly Water	2.632***	0.321	1 2 3 9 10 11 12 13 14 15 16 17 18 19 20
6. Advanced Purified Water	2.675***	0.346	1 9 10 11 12 13 14 15 16 17 18 19 20
7. Pure Recycled Water	2.338***	0.358	1 2 3 13 14 15 16 17 18 19 20
8. EcoWater	2.259***	0.317	1 2 3 4 13 14 15 16 17 18 19 20
9. ReNew Water	1.892***	0.327	1 2 3 4 5 6 15 16 17 18 19 20
10. Sustainable Water	1.929***	0.302	1 2 3 4 5 6 15 16 17 18 19 20
11. Advanced Purified Recycled Water	2.037***	0.309	1 2 3 4 5 6 15 16 17 18 19 20
12. NEWater	1.919***	0.328	1 2 3 4 5 6 15 16 17 18 19 20
13. EnviroWater	1.606***	0.315	1 2 3 4 5 6 7 8 16 17 18 19 20
14. Fresh2O	1.715***	0.335	1 2 3 4 5 6 7 8 16 17 18 19 20
15. Green Water	1.214***	0.307	1 2 3 4 5 6 7 8 9 10 11 12
16. Recycled Water	0.980***	0.293	1 2 3 4 5 6 7 8 9 10 11 12 13 14
17. Reclaimed Water	1.047***	0.291	1 2 3 4 5 6 7 8 9 10 11 12 13 14
18. Nontraditional Water	0.782***	0.297	1 2 3 4 5 6 7 8 9 10 11 12 13 14
19. Treated Wastewater	0.763***	0.281	1 2 3 4 5 6 7 8 9 10 11 12 13 14
20. Low Footprint Water	0.668**	0.317	1 2 3 4 5 6 7 8 9 10 11 12 13 14
Age	− 0.011**	0.006	
Typically Drink			
Bottled	− 0.582***	0.227	
Other	− 1.790	1.180	
Cut 1	− 0.550	0.382	
Cut 2	0.544	0.378	
Cut 3	1.914***	0.382	
Cut 4	3.239***	0.400	
Total N	1796		
Total Participants	302		

* Significant at the 10% level.
Note: Names are ranked by mean favorability score, with Pure Water having the highest and Reused Water, the omitted variable, the lowest. A branding name was determined to be significantly different from the other branding names using Wald Tests. Three participants were dropped from the regression because they did not report their age.
*** Significant at the 1% level.
** Significant at the 5% level.

3.2. Study II

The 907 adult participants in the second study rated each of the top six branding names identified in Study I, yielding 5442 observations. Table 4 presents summary statistics for the treatment-specific variables and the demographic characteristics of the sample. Of the 453 participants in the treatment group, 78% tried the water, and on average they rated the water as having the same taste and quality as the water they typically drink. This is higher than the findings reported in other studies, such as Hui and Cain (2017). We believe this is a result of participants having the opportunity to try the water, and therefore see and smell it. In the design by Hui and Cain (2017), participants answered a hypothetical question that perhaps instinctively evoked a more negative image since the water could not be seen or smelled.

Table 4
Summary Statistics for Study II.

	Total participants	907
Treatment	*Total Participants*	453
	Tried Recycled Water	78%
	Taste Rating (compared to water you typically drink)	3.12
	Overall Quality Rating (compared to water you typically drink)	3.26
Demographics	*Mean Age*	32
	Median Age	24
	Mean Annual Household Income	$50,000-$74,999
	Median Annual Household Income	$75,000-$99,999
	Female	68%
Educational Attainment	*High School or Less*	2%
	Some College or Associate Degree	36%
	Bachelor's Degree	28%
	Graduate Degree	23%
Employment	*Unemployed*	4%
	Employed	48%
	Retired	4%
	Stay at Home Parent	3%
	Disabled	0%
	Student	40%
Political Affiliation	*Liberal*	44%
	Moderate	36%
	Conservative	15%
	Other	5%
Heard About	*Pure*	59%
	All Natural	53%
	100% Fresh	40%
	All Fresh	33%
	Eco Friendly	30%
	Advanced Purified	40%
Drink Most Often	*Bottled*	21%
	Filtered Tap	53%
	Tap	26%

The mean favorability coefficients (with 95% confidence intervals) presented in Fig. 2 and paired *t*-tests reveal that participants in the control and the treatment group liked the name All Fresh least. The most consistently preferred names in the two groups are Pure, followed by Advanced Purified. Looking at the treatment group, we see more-distinct preferences for the names than in the control group. The largest treatment effect is with the name Eco-Friendly, which moves from fourth most preferred in the control group to the most preferred in the treatment group. Overall, the names Pure, Eco-Friendly, and Advanced Purified scored significantly more favorable than All Natural and 100% Fresh, which are not significantly different from one another.

To examine the effects of the reclaimed water tasting treatment further and to determine any potential relationships between the participants' favorability ratings of the names and the type of water they typically drink, we analyzed iterations of Eq. (2) that incorporated additional independent variables and interaction terms (see Table 5). The first model in Table 5 investigates differences in the perceptions of the branding names among the participants in the treatment group based on whether they tasted reclaimed water. The second model examines the effect that the water participants typically drink has on their perceptions of the branding names.

The findings presented in Table 5 and the results of Wald tests summarized in Table 6 show that having an opportunity to try reclaimed water and tasting it increases participants' favorability of the name Eco-Friendly (*Tasted*Eco-Friendly*) relative to the control group.

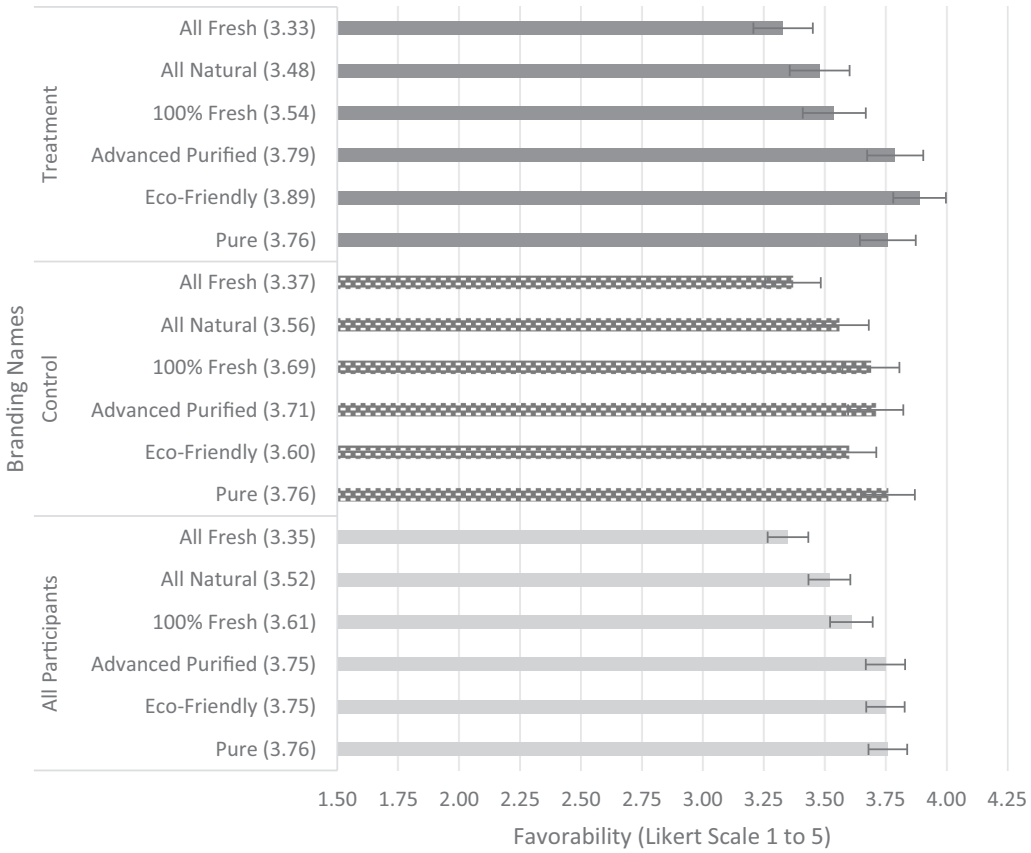

Fig. 2. Mean favorability and 95% confidence intervals of Study II names. Note: Respondents rated their preferences for branding names using a Likert scale, where 1 indicated “Least Favorable” and 5 indicated “Most Favorable”. Dashed bars represent 95% confidence intervals.

However, having the opportunity to try reclaimed water, but not tasting it has no significant effect on participants’ favorability of any of the names. Demographic variables, such as gender, level of education, annual household income, and political beliefs have no significant effect on participants’ favorability ratings of the names. Similar to the findings in Study I, the older someone is the less favorably they rank the names. However, unlike in Study I, the majority of participants typically drink filtered tap water, not bottled water. Study I participants were recruited at a farmer's market and shopping mall, whereas Study II participants were recruited at a large agricultural community event held on the campus of a large public university. Thus, this difference may be reflective of participants’ higher concerns for the environment, which is typical of a university community.

We do find evidence of a relationship between several of the branding names and the participants’ preferences for drinking bottled water, rather than tap water or filtered tap water. Tables 5 and 6 show that the most-robust effects are for All Fresh, 100% Fresh, and All Natural (increased favorability). We also find a decrease in favorability for Eco-Friendly, but only when compared to tap water. This may be related to perceptions of bottled water being better, fresher than tap water (Wilk, 2006) and Eco-Friendly potentially reminding consumers that bottled water has a negative effect on the environment (Horowitz, Frago, and Mu, 2018). When comparing participants who typically drink filtered tap water to those who typically prefer tap water, we only see an increase in favorability of the name Advanced Purified, which is in line with consumers’ perceptions of filtered tap water.

Table 5
Results from Ordered Logit for Study II.

		Model I		Model II	
		Coef.	S.E.	Coef.	S.E.
Branding Name	*Pure Water*	0.668***	0.107	0.839***	0.149
	All Natural Water	0.339***	0.094	0.498***	0.131
	100% Fresh Water	0.564***	0.081	0.559***	0.126
	Eco-Friendly Water	0.390***	0.110	1.038***	0.168
	Advanced Purified Water	0.557***	0.135	0.694***	0.186
Treatment	*Tried*	0.046	0.153	0.104	0.106
	*Tried*Pure*	0.031	0.163		
	*Tried*All Natural*	− 0.176	0.152		
	Tried 100% Fresh*	− 0.281**	0.134		
	*Tried*Eco-Friendly*	0.630***	0.192		
	*Tried*Advanced Purified*	0.196	0.212		
	Did Not Try	− 0.116	0.238	0.104	0.170
	*Did Not Try*Pure*	0.173	0.279		
	*Did Not Try*All Natural*	0.217	0.246		
	Did Not Try 100% Fresh*	0.138	0.227		
	*Did Not Try*Eco-Friendly*	0.377	0.279		
	*Did Not Try*Advanced Purified*	0.464	0.327		
Typically Drink	*Bottled*	0.332**	0.155	0.748***	0.216
	*Bottled*Pure*			− 0.496**	0.230
	*Bottled*All Natural*			− 0.248	0.212
	Bottled 100% Fresh*			− 0.081	0.190
	*Bottled*Eco-Friendly*			− 1.103***	0.247
	*Bottled*Advanced Purified*			− 0.608**	0.272
	Filtered Tap	0.072	0.118	0.166	0.169
	*Filtered Tap*Pure*			− 0.073	0.183
	*Filtered Tap*All Natural*			− 0.286*	0.163
	Filtered Tap 100% Fresh*			− 0.132	0.152
	*Filtered Tap*Eco-Friendly*			− 0.272	0.207
	*Filtered Tap*Advanced Purified*			0.218	0.234
Demographics	*Age*	− 0.010**	0.005	− 0.010**	0.005
	Female	0.132	0.111	0.134	0.112
	Annual Household Income	0.000	0.019	0.000	0.019
Educational Attainment	*Some College or Associate Degree*	0.021	0.170	0.024	0.170
	Bachelor's Degree	− 0.251	0.179	− 0.246	0.179
	Graduate Degree	− 0.212	0.191	− 0.210	0.191
Politics	*Liberal*	− 0.054	0.158	− 0.052	0.158
	Moderate	− 0.121	0.159	− 0.120	0.159
	Other	− 0.051	0.286	− 0.044	0.286
	Cut 1	− 2.673***	0.288	− 2.489***	0.297
	Cut 2	− 1.642***	0.284	− 1.456***	0.293
	Cut 3	− 0.332	0.284	− 0.144	0.292
	Cut 4	1.152***	0.284	1.343***	0.292
	Total N	5442		5442	
	Total Participants	907		907	

Note: All Fresh Water is the omitted branding name variable.
*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level.

Table 6
Wald Tests for Study II Ordered Logit Models.

Branding name	Wald test	χ2	Probability
Treatment			
Pure Water	*Control = Tasted Reclaimed Water*	0.23	0.6295
	Control = Did Not Taste Reclaimed Water	0.04	0.8424
	Tasted Reclaimed Water = Did Not Taste Reclaimed Water	0.00	0.9446
All Natural Water	*Control = Tasted Reclaimed Water*	0.63	0.4271
	Control = Did Not Taste Reclaimed Water	0.16	0.6891
	Tasted Reclaimed Water = Did Not Taste Reclaimed Water	0.78	0.3766
100% Fresh Water	*Control = Tasted Reclaimed Water*	1.94	0.1637
	Control = Did Not Taste Reclaimed Water	0.01	0.9391
	Tasted Reclaimed Water = Did Not Taste Reclaimed Water	0.72	0.3949
Eco-Friendly Water	*Control = Tasted Reclaimed Water*	17.42	0.0000
	Control = Did Not Taste Reclaimed Water	1.12	0.2904
	Tasted Reclaimed Water = Did Not Taste Reclaimed Water	2.53	0.1119
Advanced Purified Water	*Control = Tasted Reclaimed Water*	2.09	0.1486
	Control = Did Not Taste Reclaimed Water	1.68	0.1945
	Tasted Reclaimed Water = Did Not Taste Reclaimed Water	0.15	0.7032
All Fresh Water	*Control = Tasted Reclaimed Water*	0.09	0.7625
	Control = Did Not Taste Reclaimed Water	0.24	0.6260
	Tasted Reclaimed Water = Did Not Taste Reclaimed Water	0.42	0.5182
Typically Drink			
Pure Water	*Tap = Bottled*	1.20	0.2736
	Tap = Filtered Tap	0.27	0.6013
	Bottled = Filtered Tap	0.60	0.4385
All Natural Water	*Tap = Bottled*	4.61	0.0319
	Tap = Filtered Tap	0.44	0.5057
	Bottled = Filtered Tap	8.77	0.0031
100% Fresh Water	*Tap = Bottled*	7.67	0.0056
	Tap = Filtered Tap	0.03	0.8584
	Bottled = Filtered Tap	9.20	0.0024
Eco-Friendly Water	*Tap = Bottled*	2.74	0.0978
	Tap = Filtered Tap	0.36	0.5496
	Bottled = Filtered Tap	1.76	0.1851
Advanced Purified Water	*Tap = Bottled*	0.37	0.5426
	Tap = Filtered Tap	4.20	0.0403
	Bottled = Filtered Tap	1.48	0.2244
All Fresh Water	*Tap = Bottled*	12.00	0.0005
	Tap = Filtered Tap	0.97	0.3259
	Bottled = Filtered Tap	9.33	0.0023

4. Conclusions

Increasingly scarce supplies of water in the United States and across the globe have precipitated the need for new sources of potable and irrigation water. Reclaimed water has been presented as a cost-effective, reliable, and safe solution to water shortages, but consumers, upon learning that such water is or will be used for drinking or producing their food, require either a significant reduction in price to purchase or consume such products or reject them outright. Consequently, reclaimed water cannot be adopted on a large scale until ways are found

to make it acceptable to consumers. Prior studies have examined consumer perceptions of a few names used interchangeably by scientists, agricultural producers, and water utilities. However, no prior studies have compared consumers' perceptions of these names to brand names currently in use, names suggested by researchers who have addressed this problem, or variations commonly found on food labels.

Using stated-preference data collected from 305 adults, we first tested consumers' preferences for twenty-one potential branding names for reclaimed water to identify the six most-favorable names: Pure, All Natural, 100% Fresh, All Fresh, Eco-Friendly, and Advanced Purified, which invoke desirable qualities of water (pure, fresh, natural) that are commonly used to market bottled drinking water. The least favorable names—Recycled, Reclaimed, Treated, and Reused—refer to processes used on wastewater and five of the six least favorable names are the most commonly used terms by scientists and industry (Recycled, Reclaimed, Nontraditional, Treated Wastewater, Reused). The name Recycled, however, moves from sixteenth most favorable to seventh when Pure is added, an indication of the branding power of the word "pure" for reclaimed water products.

We then tested consumers' preferences for the top six names and analyzed whether an opportunity to taste reclaimed water affected participants' preferences for the names in a study using A/B testing and involving 907 adults. Overall, participants most consistently preferred Pure and then Advanced Purified. The treatment group, 78% of who tried the water, particularly favored Eco-Friendly—it moved from the fourth ranked name to the first, going from the control to the treatment group. In the first study, Pure was the highest ranked name whereas Eco-Friendly and Advanced Purified were ranked fifth and sixth.

Further, we found that typically drinking bottled water, rather than tap water, had a significant effect on participants' favorability of some of the names, particularly with All Fresh Water, 100% Fresh Water, and All Natural Water (increasing favorability) and Eco-Friendly Water (decreasing favorability). All Fresh, 100% Fresh, and All Natural may be eliciting a trait that consumers already equate with bottled water and Eco-Friendly may remind participants of the negative environmental effects of bottled water. However, further research is needed to explore this relationship.

These findings present valuable information for policymakers and members of the food industry interested in encouraging widespread acceptance of reclaimed water for various applications. As evident from our results, consumers are more likely to accept reclaimed water if its branding uses terms associated with the quality of the water (pure, fresh, natural) and suggests that terms often used by scientists and industry to describe reclaimed water (recycled, reclaimed, treated, and reused) have negative associations for consumers. This does not mean that the source of reclaimed water should be masked from consumers, but instead cast in a more favorable light. Research has suggested that food products that contain stigma inducing ingredients, such as value-added surplus products—surplus ingredients from food manufacturing that otherwise would have ended up in the trash—can gain public acceptance if they are transparent about their presence, allowing them to occupy a new category of foods (Bhatt et al., 2018). The increase in favorability of some of the branding names among the participants who had the opportunity to taste reclaimed water, as well as the large proportion of participants who actually tasted it, suggests that an important part of increasing acceptance of reclaimed water will be to allow the public to experience drinking it. This strategy was credited for the success in achieving public acceptance of reclaimed water in Singapore (Lee and Tan, 2016). Bottles of reclaimed water branded as NEWater were handed out at public events in Singapore to give the public the opportunity to taste it, a strategy that should be a part of any plan to increase acceptance of reclaimed water. Finally, if one word stood out in the results it was the word Pure, which seemed to draw the most consistently favorable response. Future research should use these results to investigate if better branding can minimize or eliminate the price reduction consumers require to purchase and consume reclaimed water or products produced with it.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.envres.2019.01.059.

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