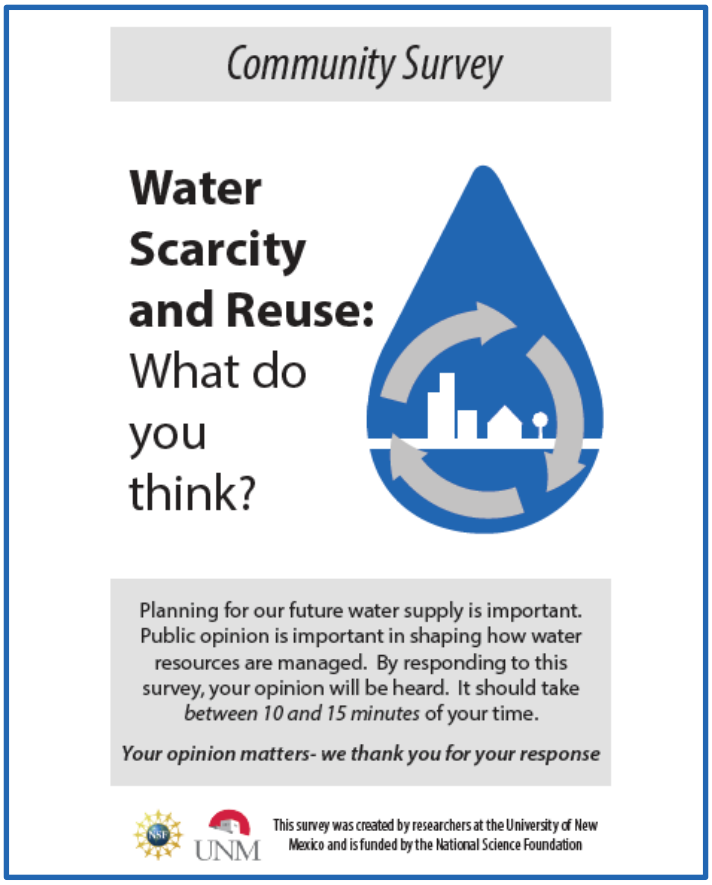
October 2022

UNDERSTANDING THE PUBLIC'S QUESTIONS AND CONCERNS ABOUT POTABLE WATER REUSE: AN ANALYSIS OF SURVEY WRITE-IN RESPONSES FROM RESIDENTS OF ALBUQUERQUE, NEW MEXICO

NM WRRI Technical Completion Report No. 402

Caroline E. Scruggs
Catherine M. Heyne



New Mexico Water Resources Research Institute
New Mexico State University
MSC 3167, P.O. Box 30001
Las Cruces, New Mexico 88003-0001
(575) 646-4337 email: nmwrri@nmsu.edu

UNDERSTANDING THE PUBLIC'S QUESTIONS AND CONCERNS ABOUT POTABLE WATER REUSE: AN ANALYSIS OF SURVEY WRITE-IN RESPONSES FROM RESIDENTS OF ALBUQUERQUE, NEW MEXICO

By

Caroline E. Scruggs, Associate Professor
Catherine M. Heyne, Graduate Assistant

Department of Community & Regional Planning
University of New Mexico

TECHNICAL COMPLETION REPORT
Account Number Q02306
Technical Completion Report #402

October 2022

New Mexico Water Resources Research Institute
in cooperation with the
Department of Community & Regional Planning
University of New Mexico

The research on which this report is based was financed in part by the U.S. Department of the Interior, Geological Survey, through the New Mexico Water Resources Research Institute. This material is based upon work supported by the U.S. Geological Survey under Grant/Cooperative Agreement No. (G16AP00072).

Page Intentionally Left Blank

DISCLAIMER

The purpose of the NM Water Resources Research Institute (NM WRRI) technical reports is to provide a timely outlet for research results obtained on projects supported in whole or in part by the institute. Through these reports the NM WRRI promotes the free exchange of information and ideas and hopes to stimulate thoughtful discussions and actions that may lead to resolution of water problems. The NM WRRI, through peer review of draft reports, attempts to substantiate the accuracy of information contained within its reports, but the views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the U.S. Geological Survey. Mention of trade names or commercial products does not constitute their endorsement by the U.S. Geological Survey.

ACKNOWLEDGEMENTS

The authors thank the numerous people who gave their time to participate in the focus groups and survey that formed the basis of the research described herein. The survey portion of this work was supported by the National Science Foundation (Grant Nos. 1345169 and 1914490), and the write-in response analysis portion was support by the New Mexico Water Resources Research Foundation (Grant No. Q02306). Funders were not involved in the study design, data collection or analysis, writing up the results, or in the decision to publish or disseminate the results.

ABSTRACT

Urban centers around the world are grappling with the challenges associated with population increases, drought, and projected water shortages. Potable water reuse (PWR, i.e., purification of domestic wastewater for reuse as drinking water) is emerging as an option for supplementing existing water supplies. Research on public perceptions of PWR has been conducted, mostly using surveys with multiple choice questions that constrain survey respondents to describing their concerns by choosing from a few response options. The approach has not achieved the objective of gathering meaningful data about the public's actual questions and concerns related to PWR to allow design of effective programming for public education, outreach, and communication.

This research fills the knowledge gap by providing the first detailed analysis of public questions and concerns about water resources and PWR based on hundreds of write-in responses to a large (n=4,000) survey conducted in Albuquerque, New Mexico. Findings demonstrate that including opportunities for survey respondents to voice their questions and concerns in their own words adds richness and nuance that cannot be obtained from multiple-choice questions alone. Especially in the case of controversial resource considerations, planners would benefit from a full and nuanced understanding of a problem before engaging with the community.

Keywords: water recycling, community survey, public perceptions, education, trust, resource planning

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION AND PROBLEM STATEMENT

Communities around the world, including those in the southwestern United States (US), are grappling with challenges related to water shortages associated with population increases and impacts of climate change (World Economic Forum 2014). In water-scarce parts of the industrialized world, commonplace strategies such as water conservation and non-potable water reuse will not be sufficient to adequately stretch water supplies. Potable water reuse (i.e., purification of domestic wastewater for reuse as drinking water) is emerging as an option that would allow communities to supplement existing water supplies without requiring substantial changes to behavior, lifestyle, or infrastructure. Potable water reuse also offers a reliable and sustainable water supply option, a benefit in areas experiencing drought and water scarcity (Tchobanoglous et al. 2011).

A number of potable reuse facilities are in operation throughout the US and globally (USEPA 2012; 2017), and existing technologies demonstrate that the practice can be implemented safely (Tchobanoglous et al. 2011). Potable reuse can be either indirect or direct (IPR or DPR), where IPR incorporates an environmental buffer (e.g., a reservoir or aquifer) between the advanced wastewater treatment facility discharge and the drinking water treatment plant intake, while DPR does not include such a buffer. Many IPR facilities have been implemented since the 1960s, mostly in the US (USEPA 2017; National Research Council 2012). Far fewer DPR facilities have been built, with the first recorded in Namibia in 1968 and a few more recently, including in Texas in the US (USEPA 2017, National Research Council 2012). The US Environmental Protection Agency (USEPA) and Congress have introduced action plans to address the climate crisis. These plans include investment in water reuse and water infrastructure (USEPA 2020; House Select Committee 2020), with the rate of potable reuse proposals expected to increase 61% by 2025 (USEPA 2017).

Public opposition has become viewed by potable reuse proponents as the critical barrier to adoption of potable reuse projects, primarily based on experiences in California and Australia (e.g., Trussell et al. 2002, Hurlimann and Dolnicar 2010). For this reason, much research has been conducted on public perceptions of potable water reuse, as summarized by various scholars (Fielding, Dolnicar, and Schultz 2019; Scruggs, Pratesi, and Fleck 2019), to better understand how to communicate and engage with the public and design effective educational materials on the topic.

While important qualitative research has been conducted (e.g., Stenekes et al. 2006; Macpherson and Snyder 2013; Morgan and Grant-Smith 2015; Scruggs, Pratesi, and Fleck 2019; Wester and Broad 2021), surveying has been the primary method used to understand public perceptions of potable water reuse.

Surveys are preferred to community meetings as an initial step toward understanding public opinion because they allow residents to consider the survey's topic(s) at their own pace and in the privacy of their own homes (Daniels et al. 2007). Surveys also allow researchers to gather large amounts of data about a particular topic from a wide range of people (Chevalier and Buckles 2013). However, because "survey questions are often simple and responses may be given out of context and without discussion, results can be superficial [and] difficult to explain" (Chevalier and Buckles 2013, 184-185). This problem of oversimplification can be avoided by including open-ended questions that require participants to provide a written response rather than select from multiple choice response options, which allows for unexpected responses outside the researcher's frame of reference and permits participants to voice their real concerns in their own words. Nevertheless, allowing for write-in responses adds time and complexity to the data analysis, decreases the chances of getting results that are analytically interesting, and increases the chances of getting irrelevant responses (Babbie 1990, 127; Fowler 2009, 101; Schuman and Presser 1996, 8). Despite the possible advantages of including open-ended questions in a survey, few studies have been conducted that compare the results of open- versus closed-ended survey questions on the same topic to understand the tradeoffs (Schuman and Presser 1996). It has been suggested that open-ended questions represent the best format when asking about complex issues, but there is debate in the literature about which form of question is superior (Schuman and Presser 1996).

Arguably, a shortcoming of the survey work on public perceptions of potable water reuse is that, like many social surveys (Schuman and Presser 1996, 79), most of the data have been collected using "closed or fixed-choice" questions. These questions constrain survey respondents to describing their concerns about potable reuse by choosing from a set of multiple-choice response options selected by the researcher. This approach is inadequate because a respondent's preferred answer on such a complex issue might not be listed among the options available, and an opportunity is missed for respondents to voice their actual questions and concerns about potable reuse. Thus, researchers might not achieve the goal of collecting meaningful data about the public's questions and concerns on potable reuse. As a result, utilities and/or municipalities could be working with incomplete information when determining how to communicate with the public and designing meaningful education and outreach programming that helps residents make informed opinions about potable reuse.

RESEARCH QUESTION AND RELEVANCE TO PLANNERS

The present research attempts to answer the question: Do write-in responses add value to surveys on public perceptions of complex health or environmental issues, and if so, how? The study looks at this question in the context of potable water reuse. It provides the first detailed analysis of public questions and concerns about potable water reuse based on hundreds of write-in responses to a large survey conducted in Albuquerque, New Mexico, and compares those results to multiple-choice responses from the same survey. The results are valuable for designing more effective surveys and public education, outreach, and communication programming on the topic of potable water reuse. The new knowledge benefits Albuquerque and other areas that are interested in the possibility of implementing potable reuse. The results are relevant to planning in general by providing a better understanding of how inclusion of write-in responses can impact output and conclusions from community surveys. This is particularly important as professionals strive to design public input tools that effectively capture community questions and concerns.

This report begins with a description of the previous survey work that was performed in Albuquerque, along with details about how the present research expands on that effort. Then, the methods used to analyze the survey write-in response data are explained. Next, we discuss our findings before finally making recommendations for future research and practice.

EXPANDING ON PREVIOUS SURVEY RESEARCH IN ALBUQUERQUE, NEW MEXICO

In New Mexico, as in other drought-prone areas, water planners and climate change experts warn of a new reality characterized by higher temperatures and less precipitation. This future requires new thinking for water resources management (Chamberlain 2020), such as incorporation of underutilized water sources that have the potential to expand a community's water supply portfolio. In Albuquerque, IPR and DPR were included in the Albuquerque Bernalillo County Water Utility Authority's (ABCWUA) 100-year water plan (ABCWUA 2016) as potential "new" sources, and the utility is interested in better understanding how to communicate and engage with the community on potable reuse.

In a 2016-2017 collaboration with the ABCWUA, the research team conducted the first large-scale community survey on perceptions and knowledge related to potable reuse and water resources in an arid inland area (i.e., Albuquerque/Bernalillo County). The research methods, which included a literature review, focus groups, debriefing sessions, and a pre-test before the administration of the full 27-question survey, are described in detail in Distler and Scruggs (2020a) and Distler, Scruggs, and Rumsey (2020). The survey was sent to 4,000 randomly selected residents who were ABCWUA customers. A total of 1,831 completed surveys were returned for a response rate of 46%. These results demonstrated how residents of the ABCWUA service area compared to other populations that have been surveyed on similar topics, created the first model to predict potable reuse acceptance based on demographic characteristics, and demonstrated a new approach for mapping survey data to understand the kinds of education, outreach, and trust-building needed in different parts of the ABCWUA service area (Cruz, Scruggs, and Distler 2020; Distler and Scruggs 2020a; Distler and Scruggs 2020b; Distler, Scruggs, and Rumsey 2020). The high return rate also suggests that water and water reuse are important topics for area residents.

Importantly, the 27-question survey included five opportunities for write-in responses that gave our respondents the opportunity to voice their unique questions and concerns about potable water reuse. Analysis of these write-in responses was not included in the previous publications and is the focus of the present study. The five survey questions that allowed for write-in responses, along with the number of write-in responses received for each, are shown in Table 1.

The first two questions about DPR (i.e., questions I and II in Table 1), were placed mid-way through the survey following questions about general water resource topics and a description of DPR, including a diagram showing how DPR would be incorporated into existing water treatment and distribution systems. The next two questions about IPR (i.e., questions III and IV in Table 1) immediately followed the questions on DPR with a description of IPR. As recommended by Babbie (1990), Questions I-IV

attempted to be exhaustive with the response options, which were based on extensive focus group input, but also included a write-in option to capture unexpected responses. With this addition, we kept in mind Babbie's (1990, 128) caution that "respondents will attempt to fit their personal answers into one of the categories provided even though the fit might not be perfect." Question V from Table 1 was the final question of the survey and attempted to capture all remaining questions and concerns related to potable water reuse. The full survey instrument is available in two of the open-access publications from the initial survey research (see Distler and Scruggs 2020a and Distler and Scruggs 2020b).

The present study fills a remaining knowledge gap related to the public's specific questions and concerns about potable reuse by analyzing the hundreds of write-in responses received. Examining survey respondents' questions and concerns about potable reuse—written in their own words—in addition to the data from multiple choice questions, has the potential to improve the design of educational and engagement materials to make them more meaningful. It also contributes to the literature on design of surveys that aim to capture public perceptions about complex issues. A comparison of the two sets of data is provided in the Results and Discussion section.

Table 1. Survey questions with write-in response options and number of responses received.

Survey Question[a]	**No. Responses**
I. For what reason(s) would you be willing to drink the city tap water in Community A[b]? Check all that apply. (*Note: originally question 11 in survey*.) Response options: • Not applicable–I would *not* be willing to drink the water • Water shortage, drought, and limited supply • Reduces waste; efficient use of resources • Purified water is safe to drink and is safely consumed in other US cities • I trust the purification technologies • Other: _____	97
II. What concern(s) might you have about drinking the city tap water in Community A[b]? Check all that apply. (*Note: originally question 12 in survey.*) Response options: • No concerns • I don't trust the purification technologies • I'm not confident the water is safe; health concerns • I don't trust the government or water utility • I would expect a bad taste/smell or discoloration of the water • Other: _____	222
III. For what reason(s) would you be willing to drink the city tap water in Community B[c]? Check all that apply. (*Note: originally question 14 in survey.*) Response options: • Not applicable—I would *not* be willing to drink the water • Water shortage, drought, and limited supply • Reduces waste; efficient use of resources • Purified water is safe to drink and is safely consumed in other US cities • I trust the purification technologies • The water passes through the environment before it is treated and used again • Other: _____	64
IV. What concern(s) might you have about drinking the city tap water in Community B[c]? Check all that apply. (*Note: originally question 15 in survey.*) Response options: • No concerns • I don't trust the purification technologies • I'm not confident the water is safe; health concerns • I don't trust the government or water utility • I would expect a bad taste/smell or discoloration of the water • Other: _____	190
V. Do you have any concerns about drinking water reuse[d] that have not been discussed here? If so, please describe them below. (*Note: originally question 27 in survey.*)	341

[a]The actual numbers of the survey questions were changed to Roman numerals I-V for ease of discussion.
[b]Community A was a hypothetical community practicing DPR.
[c]Community B was a hypothetical community practicing IPR.
[d]The survey was designed with input from community focus group participants, and those participants found the term "drinking water reuse" to be more understandable than the term "potable water reuse".

METHODS

The survey write-in response data were entered and organized in Microsoft Excel. From here, the authors used an approach similar to analyzing interview data to analyze the write-in response data. The first author created codes, while systematically studying the data, to categorize the write-in responses into groups of similar responses. Once the first round of coding was completed, related codes were grouped and other codes were refined into more descriptive codes. As the iterative process continued, codes were created, modified, and consolidated. The second author then examined the data and proposed codes and suggested modifications and additions to the set of codes, which were discussed in depth by the authors. Finally, a minimum number of codes was retained that adequately represented all responses. The codes were applied to the data by the second author in consultation with the first author when any questions arose. The first author then reviewed the coding as a reliability check and any questions about code application were discussed by the authors and resolved (Charmaz 1995; Creswell 1998; Jiang and Bansal 2003; Neuendorf 2017).

The finalized list of 47 codes is presented in Table 2; the codes are not strictly in order because they are arranged by theme, as discussed in the next paragraph. Write-in responses that contained more than one idea, question, or concern, were assigned multiple codes, as appropriate. For example, the response: "I don't trust the water utility to do reuse safely, and if we limit growth, we won't need reuse," would receive two codes, 19 and 34. Because some responses contained multiple ideas, the number of codes assigned to the write-in responses to questions I through IV was 10%-27% greater than the number of responses to each question. For question V, not surprisingly, the number of codes assigned was 69% greater than the number of responses received since many responses contained more than one idea. One code was used to capture comments that were seemingly unrelated to the study topic, such as, "We need more water fountains around town." Example responses captured by each code can be found in Appendix A. As will be discussed later, the set of codes demonstrates that participants often used their write-in responses to elaborate or provide emphasis on the multiple-choice answers they selected.

Broader themes related to the public's questions and concerns about potable reuse were created by grouping the codes so that the data could be considered and discussed more generally. The 47 codes were categorized into 10 broad themes, with an eleventh theme designated Other to capture the codes that seemed unrelated or not as pertinent to the study topic. The themes are listed in Table 2, which is organized to show how codes were grouped to create the various themes. The full description of each theme is shown in the first column of Table 2, and the abbreviated descriptions are as follows: *(A) Existing quality/safety concerns, (B) Reuse quality/safety concerns, (C) Don't trust system, (D) Trust*

system, (E) Limit growth/better management, (F) Public education, (G) Not sure, (H) Cost concerns, (I) Environment/aquifer concerns, and *(J) Don't drink tap water*. The code and theme data were analyzed and graphically displayed using Microsoft Excel.

Table 2. Finalized codes and themes describing the survey write-in responses.

Theme & Description	Code	Code Description
A: I have questions and/or concerns about the existing water safety or quality	**1**	Concerns/complaints about existing Albuquerque (ABQ) water quality, taste
	2	Concerns about existing or potential sources of water contamination/pollution in/near ABQ
	3	Desire for more information about current local water resources or water quality
	4	Concerns and comments related to fluoride addition to drinking water
B: I have questions and/or concerns about the safety or quality of potable reuse water	**7**	Questions and concerns about chemicals and pharmaceuticals remaining in finished reuse water
	8	Water reuse is not safe, don't want to drink
	9	Concerns about safety of reuse in general, but not necessarily against reuse
	10	Concerns/ desire for more information about quality and aesthetics of potable reuse water
	15	Concern/ desire for more information about reuse processes and technologies to purify water
	16	Desire for more information about other places doing reuse and their experiences
	17	If we implement reuse in ABQ, how will information about safety of the reuse water be communicated to the public?
	37	Concerns about reuse leading to problems like in Flint, MI
C: I am not sure I trust the government or utility to adequately regulate potable reuse or ensure its safe operation	**12**	Concerns related to water reuse regulations or New Mexico Environment Department (NMED)/EPA's ability to adequately regulate
	13	Concerns about long-term commitment and adequate funding for an excellent reuse facility
	14	Concerns/desire for more information about reuse water monitoring, back-up systems, operators, security, reliability, external threats, terrorism
	19	Concerns/ distrust of utility related to reuse
	20	Concerns/ distrust of the government and/or processes that would lead to reuse implementation
	21	I don't trust tap water/technology/science
D: I trust the government, utility, and/or technology to safely implement potable reuse	**18**	Respondent trusts utility, will do reuse safely
	23	Support potable reuse/survey, reuse sounds like a good idea
	25	Water reuse ok/going to happen anyway and will add extra filtration at home
	43	Trusts the technology
	44	Efficient, fine if it's easily available/free
E: I have concerns about water scarcity; if we better manage water resources and/or limit growth, we won't need potable reuse	**5**	Questions and concerns about water quantity or aquifer depletion in ABQ or downstream
	6	Concerns about current water waste in ABQ/NM
	28	Appropriate ways of reusing water instead of potable water reuse (PWR)
	29	Ways to curb water usage to avoid the need for PWR
	30	Unrelated to PWR, recommendations related to local water resource management
	34	Growth will stress ABQ's water resources; may not need reuse if limit growth
F: I am interested in more public education on water treatment, conservation, resources, and reuse	**26**	Need more public education about environmental pollution and water conservation/resources/reuse
	27	Desire for more information about other forms of reuse/desalination/water purification besides what's discussed in survey
	45	Want to see results of survey
G: I am not sure if I would accept potable reuse/think it's safe	**39**	Don't know/ undecided/ not sure
H: I have concerns about water costs/rates, for reuse and/or in general	**32**	Questions and concerns about the cost of reuse
	33	Complaints about current water rates and fees, unrelated to PWR specifically
I: I have preferences related to potable reuse based on concerns about the environment or aquifer	**11**	Concerns related to positive or negative effects on the environment or aquifer from practicing water reuse
	24	Reuse methods that minimize evaporation are best
	47	IPR is preferable to DPR because of taste and natural treatment processes
J: Potable reuse won't affect me - I don't drink tap water	**22**	Won't affect me - I only drink filtered/distilled/RO/bottled water
O: Other (Random, less pertinent to research question, etc.)	**31**	Recommendations for successful implementation of potable reuse in ABQ
	35	There's not a problem with water shortage; climate change isn't happening
	36	Critical of survey
	38	Seemingly unrelated
	40	Believes already drinks DPR/IPR water
	41	Have no other option but to drink it
	42	Worried what others will think
	46	Thank you/good luck/appreciate it

RESULTS AND DISCUSSION

General observations about survey write-in responses

When examining the survey write-in responses, it was clear that issues related to safety and trust were priorities for our survey respondents, although other issues were also important. Figure 1 shows the total response counts grouped by theme for all five write-in response questions. Responses describing questions and concerns related to Theme B and Theme C were most prevalent. Theme B included concerns about the safety of reuse water and the chemicals or pharmaceuticals that might remain in the treated water. It also included the expressed desire for more information about the quality of the reuse water, the treatment technologies that would be used to purify the water, the experiences of other communities that have implemented potable reuse, and how safety information about the reuse water would be communicated to the public. In addition, respondents wondered if implementation of potable reuse would lead to problems similar to those experienced by residents of Flint, Michigan, during that community's 2014-2016 water quality crisis. Theme C broadly covered concerns related to lack of trust: trust in state and federal regulators to regulate potable reuse adequately, trust in the water utility and its operators to always operate the treatment systems competently and reliably, trust in the treatment and monitoring technologies used, and trust in the decision-making processes that could lead to implementation of potable reuse. Theme C also included concerns about whether adequate funding would be dedicated long-term to operation of the potable reuse system. Theme A came in third place for questions and concerns related to existing water quality. Survey questions about perceptions related to a potential alternative water source clearly brought up concerns about respondents' experiences with the current source. While less frequently mentioned, the other seven themes displayed the depth and breadth of the questions and concerns of Albuquerque residents related to their drinking water and local water resources, most of which were outside the bounds of the multiple-choice response options. Even though relatively few respondents raised these other questions and concerns, they seem reasonable for a population considering potable water reuse, and water planners who are interested in engaging with the community on the topic would benefit by being prepared to respond to questions and concerns surrounding these issues. Once public discussion of a potential reuse project is initiated, similar questions and concerns might become more common among community members.

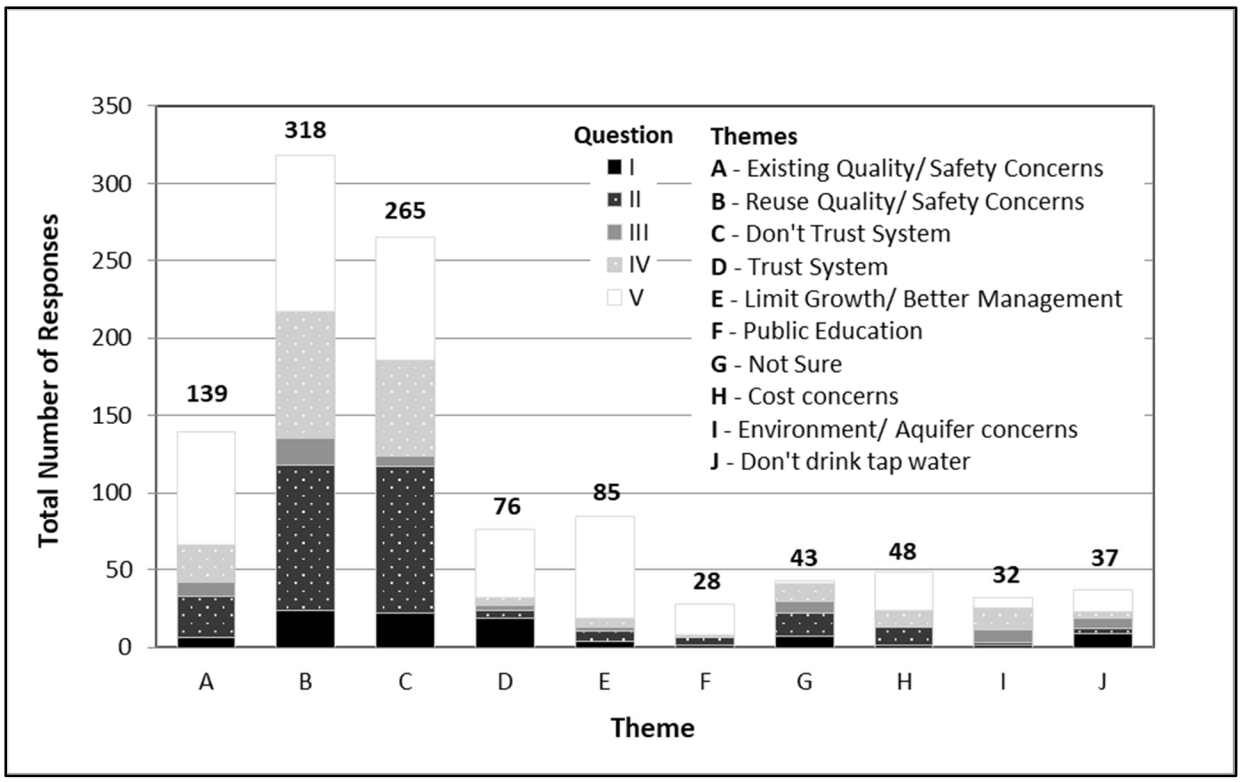


Figure 1. Survey write-in response counts by theme to questions I-V.

Looking at either data set—from the write-in or the multiple-choice responses—in isolation could lead a water planner to different conclusions. For example, only 6% of respondents, or about 110 people, indicated in the multiple-choice responses that they would "refuse to drink" DPR water. This percentage decreased to 4%, or about 73 people, when asked about IPR water (Distler and Scruggs 2020a). On the surface, these numbers—from a total of 1831 respondents—seemed to indicate limited overall resistance to potable reuse among residents; they certainly represented one of the lowest "refuse to drink" percentages of respondents from similar studies found in the literature. However, the write-in response results seemed to suggest more concern about the safety of potable reuse than did the multiple-choice response results.

Questions about trust were another place where the multiple-choice response results seemed inadequate for decision making and design of public outreach programming. The survey asked respondents to indicate the level of trust they would have in a variety of people and entities to provide them with accurate information about potable reuse. Respondents were asked to indicate their level of trust by choosing among five categories ranging from "mostly distrust" to "mostly trust" (Distler and Scruggs 2020a). A question like this one is common on surveys that examine public perceptions of

potable reuse because the results can help those interested in possibly implementing the practice determine which persons or entities might best engage with the public on reuse-related topics.

The multiple-choice responses to this set of questions about trust indicated very low trust in local elected officials (only 16% mostly or somewhat trusted them) and moderate trust in state and federal regulators and the local water agency (43% and 47%, respectively, mostly or somewhat trusted these entities) (Distler and Scruggs 2020a). These results are important because it is typically these persons and entities who would introduce a potential potable reuse project and provide education and outreach programming in the community. While the trust levels in these persons and entities might suggest that they are not the ideal candidates to communicate with Albuquerque residents about water reuse, the numbers do not begin to provide the rich story about trust that is provided by the write-in response results. The write-in responses tell us not only the specific people and entities that respondents do not trust, but also *why* they do not trust them to produce safe drinking water reliably and consistently or to make good decisions in the public interest. Without these details, we can only assume the reasons that these entities are not well trusted.

For example, respondents indicated in the multiple-choice questions that they had only moderate trust in the water utility. This is important information that suggests the utility should work to build trust with the community. More specifically, in the write-in responses numerous survey participants also expressed doubt whether water utility operators would have sufficient training on potable reuse technologies and whether water quality monitoring would be adequate to always produce safe drinking water. These questions related to operator training and water quality monitoring could be specifically addressed in public education and outreach programming on potable water reuse.

In questions II, IV, and V (Table 1), respondents had the ability to describe additional concerns about drinking DPR and IPR water that were not covered by the multiple-choice response options. Many of respondents' questions and concerns were outside the bounds of the multiple-choice options (e.g., related to water rates and project costs, impacts on aquifer health, limiting growth or better management of existing water resources, and a need for better public education on water resources). The questions and concerns described by respondents suggested that public perceptions of reuse were more nuanced and complicated than could be captured by our multiple-choice options. The differences between the multiple-choice and write-in data sets are discussed in more detail in the next subsection.

Analysis of survey write-in responses to Questions I-IV

We performed a comparative examination of the multiple-choice and write-in responses for each of the questions I-IV. By looking at the number of write-in responses to the questions in Table 1, we can assume that the reasons for *accepting* reuse were captured relatively well by the multiple-choice response options when compared to the reasons for *concern*: questions I and III received far fewer write-in responses than did questions II and IV, the latter of which asked about additional concerns beyond the choices provided. A summary of the multiple-choice response results for questions I-IV is shown in Figure 2 and a summary of the write-in response results for those questions is shown in Figure 3; see Table 1 for the exact wording of each question and response option as some phrasing is shortened in Figures 2 and 3.

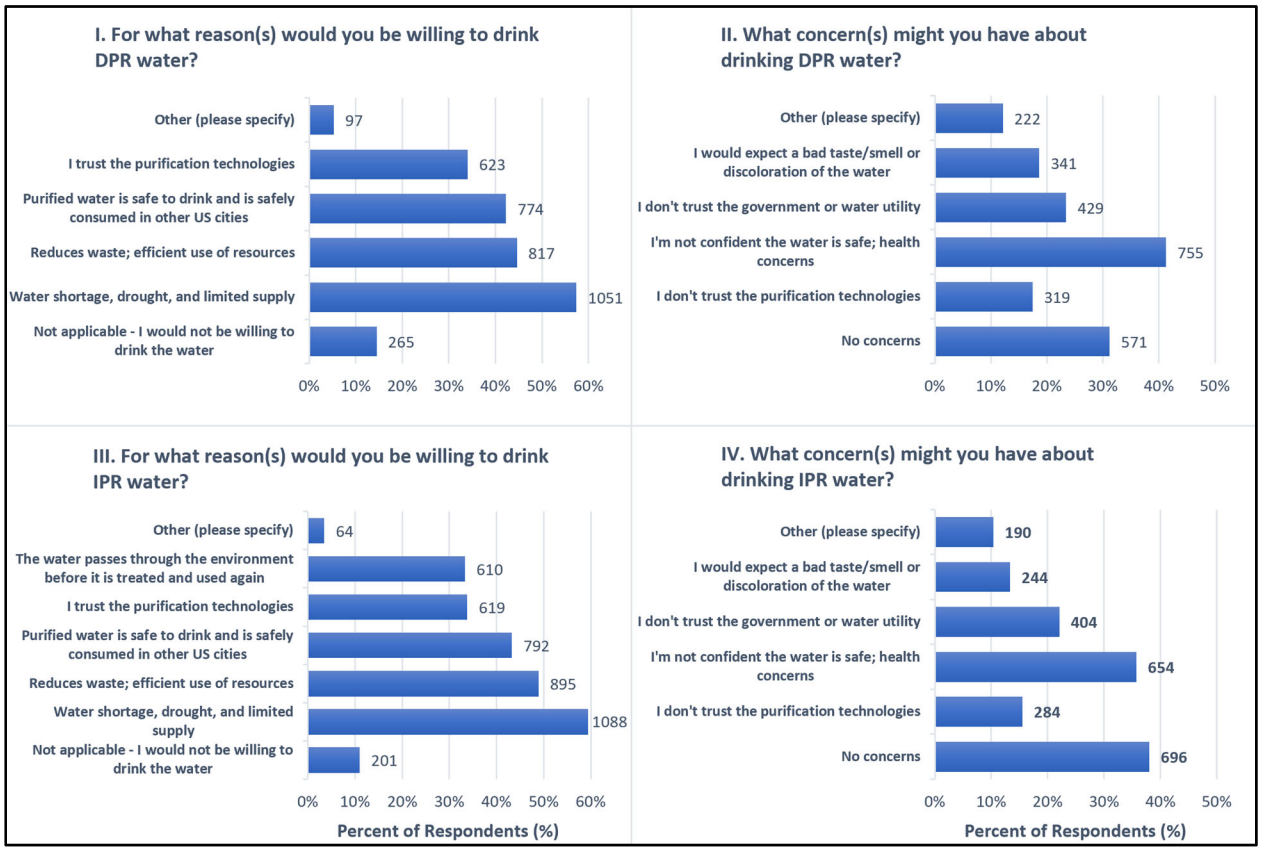


Figure 2. Multiple choice selections made in response to questions I-IV (previously analyzed data, see Distler and Scruggs 2020a). Responses are shown by percent of responses along with frequency counts for each question.

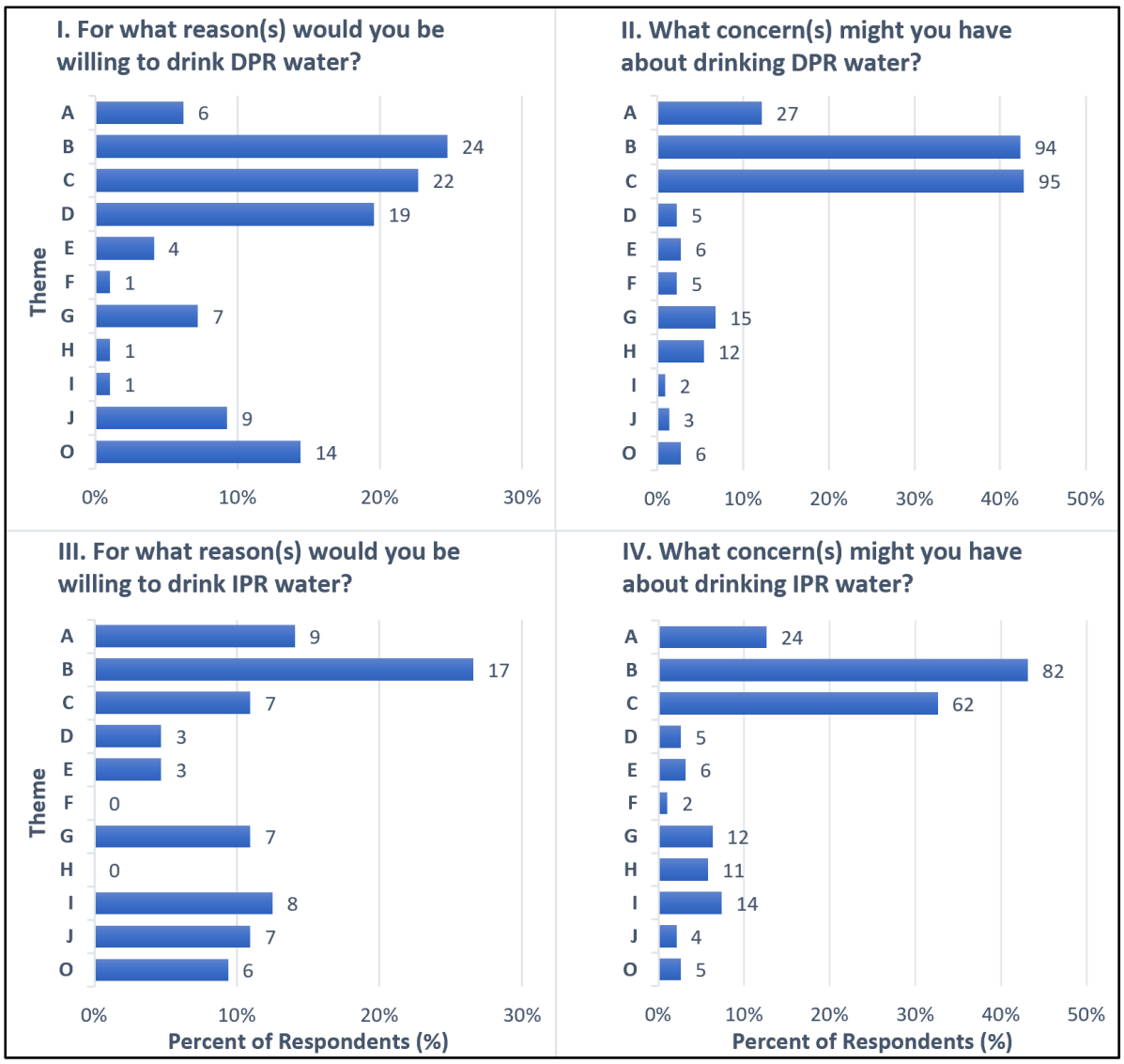


Figure 3. Write-in responses to questions I-IV. Responses are categorized by theme and shown by percent of responses and frequency counts for each question. (Themes: A-Existing Quality/ Safety Concerns; B-Reuse Quality/ Safety Concerns; C-Don't Trust System; D-Trust System; E-Limit Growth/Better Management; F-Public Education; G-Not Sure; H-Cost concerns; I-Environment/ Aquifer concerns; J-Don't drink tap water; O-Other.

From the upper left corner of Figure 2, we see that respondents selected all four of the available reasons for willingness to drink DPR water, with "water shortage, drought, and limited supply" being the most popular reason. The lower left corner of Figure 2 shows that respondents had very similar reasons for being willing to drink IPR water, with even higher numbers of selections for most response options as compared to DPR. The additional response option that was included for IPR but not DPR (i.e., the water passes through the environment before it is treated and used again) was selected with the least frequency. This is interesting because the literature suggests that it is specifically the existence of the environmental

buffer that results in higher acceptance of IPR as compared to DPR. For our survey participants, this reason does not appear to be as compelling as some of the other multiple-choice response options.

Based on the results of the multiple-choice responses, which are similar to those from other studies in the literature (Macpherson and Snyder 2013; Millan et al. 2015), a water planner might assume that they had a clear understanding of the reasons community members would accept potable reuse. However, we see that 5.3% (97) and 3.5% (64) of respondents provided write-in response reasons for their willingness to drink DPR and IPR water, respectively—reasons that presumably were not adequately covered by the multiple-choice response options. These reasons are summarized by theme and shown in the upper and lower left corners of Figure 3 for DPR and IPR, respectively. In some cases, respondents elaborated on the multiple-choice answers they selected, while in others, they provided reasons that were not included in the multiple-choice answer set, often with embedded concerns. Example write-in responses include: "I would have to trust agency and process," "Probably already downstream of someone else's waste input," "It is used in space," "[If] purification methods and routine analysis would be available to public," "[It would] prevent contamination of the river," "If I could apply additional purification myself [at home] as well," or "This seems safe as long as politicians aren't allowed to f*** us over like they did in Flint". The counts by theme are not large when we look at the reasons voiced by respondents about willingness to drink DPR and IPR water, but the reasons provided are revealing of general community questions and concerns expressed in many write-in responses.

From the upper right corner of Figure 2, we see that respondents selected all four of the available multiple-choice concerns about drinking DPR water, with "I'm not confident the water is safe; health concerns" being the most frequently selected concern. Not surprisingly, respondents' selections regarding concern for IPR water followed the same pattern. Of note, the upper right corner of Figure 2 shows that 31% (571) of respondents indicated "no concerns" about DPR, and this was the second most frequently chosen option. The lower right corner shows that 38% (696) of respondents had "no concerns" about IPR water, making this the most frequently chosen option for IPR. It is possible that question order influenced these results; IPR might have seemed like a less threatening approach when asked about after DPR.

As mentioned, when compared to reasons to accept potable reuse, respondents provided more write-in responses about causes for concern. Twelve percent of respondents (222) provided write-in responses about concerns for DPR and 10% (190) provided responses for IPR. While these numbers might seem small based on the limited survey sample, they become quite relevant if 10%-12% of the population has these same concerns and questions. It is therefore important to consider these replies since they might

become prominent in community discussions about the acceptability of potable reuse. Again, in some cases, respondents were elaborating on the multiple-choice answers they selected, and in others they were describing concerns that were not included in the multiple-choice answer set. Regardless, the alignment of primary concerns expressed in the multiple-choice and write-in responses is evident by comparing the right-hand plots of Figures 2 and 3. For both multiple-choice and write-in responses, the top concerns for DPR and IPR were related to safety/health and trust.

Importantly, respondents provided water planners with excellent information about the issues they wanted to be addressed before feeling confident in forming opinions about potable reuse. Respondents wanted to know more about the current water quality in the community and how the reuse water quality, safety, taste, and other aesthetics would compare. They wanted to know specifically about potential hazardous chemicals and pharmaceuticals that would remain in the reuse water following treatment, and which chemicals would be added during treatment. Additionally, respondents were interested in the treatment technologies that would be used, the experiences of other communities that have implemented potable reuse, and how a water crisis such as the one experienced by Flint residents would be avoided. Some questions and concerns were related to adequacy of funding and security for the reuse facility, while others were focused on water reuse regulations, water quality monitoring and communication, and operator training. Several respondents expressed concern for health of the aquifer when responding about IPR. There were also questions about the cost of potable reuse and how it might affect water rates, and others commented that Albuquerque would not need to pursue potable reuse if it better managed existing water resources and growth. Example responses included: “I am concerned about what may not get filtered out (chemicals from household cleaning products and medications)”, “Very fearful of drugs that are flushed in toilet by many families—not sure of purification capabilities and government desire to ‘make it work’ and foist it on us”, “Concerned about the chemicals used in purification as well”, “Purification technologies are appropriately implemented and monitored”, “Fear of: human error, mechanical breakdown, terrorism (biological)”, “Human error or disaster/accident at plant, power failure”, “The water authority hiring the right personnel to properly operate and manage the system”, “Potential undetected failure of the purification system”, “Safety process and backup systems, safeguard information needed”, “1) High cost of installation, certification, and maintenance, 2) community overplanning resulting in untenable population growth, climate change a factor to be considered”, “Long-term concern for adequate funding to maintain quality of reuse infrastructure”, “It would taste different—most water consumption is nonresidential, so focus on reuse for agriculture!”, “Don’t trust US EPA or NM EPA to properly regulate (Flint, MI)”, “Concerns about Flint-like infrastructure safety issues”, “I would want the results of independent evaluations of drinking water quality made available to the public”,

"Possible long-term effects, 20+ years", "Just not familiar enough with the process—community needs education about this purification process".

Water planners would need to be fully prepared to engage with the concerns described above at any public education and outreach event on potable reuse. Importantly, many of these concerns cannot be extracted from the multiple-choice results of this study. Further, it is likely that many of the write-in questions, such as those about chemical constituents and operator training, are ones that most residents would have; not all respondents had considered them while completing the survey. Even in a community like Albuquerque where DPR and IPR are included as possible future water supply options (ABCWUA 2016), community outreach regarding the above write-in questions and concerns has not yet occurred.

Regarding survey design more generally, scholars have suggested that an optimal approach would involve asking a sample of the population open-ended questions about the research topics, and then using those responses to construct the multiple-choice response options to the closed-ended questions that are included in the survey (Schuman and Presser 1996). We approached this recommendation to constructing the multiple-choice response options by (1) conducting eight 90-minute focus groups with members of our target population, and (2) reviewing the results of similar previous studies. Still, we received additional clusters of write-in responses that were outside the bounds of the results from our focus groups and other surveys. Thus, for complex issues such as potable water reuse, our findings suggest that the inclusion of at least a few write-in response options throughout the survey is important to understand the full suite of common concerns and questions, as well as the nuance that likely exists. If for no other reason, Fowler (2009) emphasizes that survey respondents can feel frustrated if they are never given the opportunity to express their ideas or concerns in their own words. Despite the additional time and resources required for analysis of write-in responses, write-in results would allow a planner to be far more prepared for engagement with the community on complex topics.

Analysis of survey write-in responses to question V

Figure 4 displays the results by theme of the write-in responses to question V, which gave survey participants a final chance to describe any remaining concerns about potable reuse that were not addressed in the survey. Here, in addition to the primary concerns related to safety and trust that were given for questions I-IV, we see emphasized the idea of limiting growth and/or better management of existing water resources to avoid needing potable reuse. Concerns about the cost of reuse and the effect on water rates as well as calls for improved public education on water resources and reuse were expressed. Again, these appear to be reasonable concerns that likely would become part of the public

discourse in a community considering potable reuse, and water planners should be prepared for them. Also, it was clear from the responses to this question—many were long and full of underlined words, exclamation points, and other forms of emphasis—that participants appreciated the opportunity to vent and be heard about water-related community concerns.

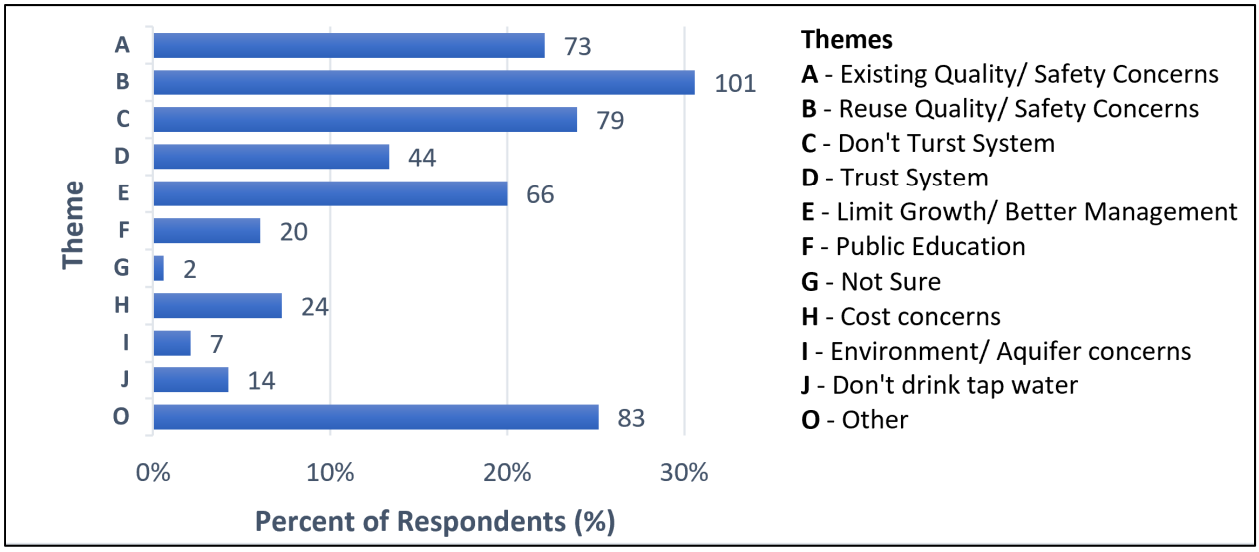


Figure 4. Write-in responses to question V (Do you have any concerns about drinking water reuse that have not been discussed in the survey?) categorized by theme and shown by percent of responses and frequency counts for each question.

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

The write-in response data described herein build on the existing potable water reuse literature, and provide a more complete and nuanced understanding of Albuquerque residents' specific questions and concerns about potable water reuse compared to responses from answers to multiple-choice survey questions. In contrast to what survey design scholars have suggested, many of our participants did not merely force fit their responses to one of the multiple-choice options provided; rather, we were surprised by the number of participants who provided write-in responses when the opportunity was available to them. While the write-in responses required additional time and resources to analyze, they provided richer and more complete data compared to the multiple-choice response data alone. This is relevant to water planning because of the critical need to design meaningful education and outreach programming on water resources and reuse. Especially in the case of controversial resource considerations, planners would benefit from a full and nuanced understanding of a problem before trying to engage with the community. The advance knowledge of residents' questions and concerns allows planners to collect data, educate themselves on important aspects of the problem, and create presentations or handouts that could help address and discuss questions and concerns. Further, given that residents seemed aware of and concerned about several high-profile and well-publicized drinking water-related failures, it is worth considering that water management entities could do a more intentional and proactive job of publicizing their important successes in bringing safe drinking water to the community. This could help the local water utility and related entities to build trust with the community and build support for future water projects that address water scarcity.

More generally, this research looks at how adequately multiple-choice surveys capture public concerns about complex health and environmental issues, such as potable water reuse, and confirms a need for inclusion of write-in response options. Our findings suggest that inclusion of at least a few write-in response opportunities is important to understand the full suite of concerns and questions, as well as the nuance that exists. Despite the additional resources for analysis required by this approach, the results would allow planners to be far more prepared for engagement with the community.

For future research on planning related to water resources and reuse, we recommend that researchers follow up on some of the topics raised in the write-in responses that are not well-represented in the literature. For example, studies that examine how costs, perceptions of community growth and resource management, and environment and aquifer concerns influence acceptance of water reuse would be beneficial. More generally, additional research is needed to better understand the differences between the results from multiple-choice and write-in survey questions on the same topic.

REFERENCES

Albuquerque Bernalillo County Water Utility Authority (ABCWUA). 2016. *Water 2120: Securing our Water Future*.

Babbie, Earl R. 1990. *Survey Research Methods*. 2nd ed. Belmont, CA: Wadsworth Publishing.

Chamberlain, Kendra. 2020. Water reckoning looms in New Mexico's future: "We're not prepared for what's ahead of us". *The NM Political Report*. September 19, 2020. https://nmpoliticalreport.com/2020/09/19/water-reckoning-looms-in-new-mexicos-future-were- not-prepared-for-whats-ahead-of-us/. Accessed 9/24/2021.

Charmaz, Kathy. 1995. Grounded Theory. In: Smith, Jonathan A., Rom Harré, and Luk van Langenhove, Eds., *Rethinking Methods in Psychology*, 27-48. London: Sage Publications. https://dx.doi.org/10.4135/9781446221792.n3.

Chevalier, Jacques M. and Daniel J. Buckles. (2013) *Participatory Action Research: Theory and Methods for Engaged Inquiry*. New York, NY: Routledge, Taylor & Francis Group.

Creswell, John W. 1998. *Qualitative Inquiry and Research Design: Choosing Among Five Traditions*, 55-58. Thousand Oaks, CA: Sage Publications.

Cruz, Maurice P., Caroline E. Scruggs, and Lauren N. Distler. 2020. Mapping Potable Reuse Survey Data Using Spatial Statistics to Inform Tailored Education and Outreach. *American Water Works Association Water Science*. https://doi.org/10.1002/aws2.1197.

Daniels, Thomas L., John W. Keller, Mark B. Lapping, Katherine Daniels, and James Segedy. 2007. *The Small Town Planning Handbook*. 3rd ed. Chicago, IL: Planners Press, American Planning Association.

Distler, Lauren N. and Caroline E. Scruggs. 2020a. Arid Inland Community Survey on Water Knowledge, Trust, and Potable Reuse. I: Description of Findings. *Journal of Water Resources Planning and Management* 146 (7):4020045.

———. 2020b. Survey Data on Perceptions of Water Scarcity and Potable Reuse from Water Utility Customers in Albuquerque, New Mexico. *Data in Brief* 29:105289.

Distler, Lauren N., Caroline E. Scruggs, and Kellin N. Rumsey. 2020. Arid Inland Community Survey on Water Knowledge, Trust, and Potable Reuse. II: Predictive Modeling. *Journal of Water Resources Planning and Management* 146 (7):4020046.

Fielding, Kelly, Sara Dolnicar, and Tracy Schultz. 2019. Public acceptance of recycled water. *International Journal of Water Resources Development* 35:551-586. https://doi.org/10.1080/07900627.2017.1419125.

Fowler, Floyd J. 2009. *Survey Research Methods*. 4th ed. Thousand Oaks, CA: Sage Publications. https://doi.org/10.4135/9781452230184.

House Select Committee on the Climate Crisis. 2020. *Solving the Climate Crisis: The Congressional Action Plan for a Clean Energy Economy and a Healthy, Resilient, and Just America*. Staff Report.

Hurlimann, Anna and Sara Dolnicar. 2010. When Public Opposition Defeats Alternative Water Projects - The Case of Toowoomba Australia. *Water Research* 44 (1):287-297. https://doi.org/10.1016/j.watres.2009.09.020.

Jiang, Ruihua Joy and Pratima Bansal. 2003. Seeing the Need for ISO 14001. *Journal of Management Studies* 40:1048-1067. https://doi.org/10.1111/1467-6486.00370.

Macpherson, Linda, and Shane A. Snyder. 2013. *Downstream: Context, understanding, acceptance: Effect of prior knowledge of unplanned potable reuse on the acceptance of planned potable reuse.* Alexandria, VA: WateReuse Research Foundation.

Millan, Mark, Patricia. A. Tennyson, and Shane A. Snyder. 2015. *Model communication plans for increasing awareness and fostering acceptance of direct potable reuse*. Alexandria, VA: WateReuse Research Foundation.

Morgan, Edward A., and Deanna C. C. Grant-Smith. 2015. Tales of science and defiance: the case for co-learning and collaboration in bridging the science/emotion divide in water recycling debates. *Journal of Environmental Planning and Management* 58:1770-1788. http://dx.doi.org/10.1080/09640568.2014.954691.

National Research Council. 2012. *Water Reuse: Potential for Expanding the Nation's Water Supply Through Reuse of Municipal Wastewater*, 1-262. Washington, DC: National Academy of Sciences.

Neuendorf, Kimberly A. 2017. Reliability. In: *SAGE Research Methods: The Content Analysis Guidebook,* 165-200. Thousand Oaks, CA: Sage Publications. https://dx.doi.org/10.4135/9781071802878.n6

Schuman, Howard and Stanley Presser. 1996. *Questions & Answers in Attitude Surveys: Experiments on Question Form, Wording, and Context.* Thousand Oaks, CA: Sage Publications.

Scruggs, Caroline E., Claudia B. Pratesi, and John R. Fleck. 2019. Direct potable water reuse in five arid inland communities: an analysis of factors influencing public acceptance. *Journal of Environmental Planning and Management* 63:1-30. https://doi.org/10.1080/09640568.2019.1671815.

Stenekes, Nyree, Hal K. Colebatch, T. David Waite, and Nick J. Ashbolt. 2006. Risk and governance in water recycling: Public acceptance revisited. Sci. Technol. Hum. Values 31 (2): 107–134. https://doi.org/10.1177/0162243905283636.

Tchobanoglous, George, Harold Leverenz, Margaret H. Nellor, and James Crook. 2011. *Direct Potable Reuse: A Path Forward*. WateReuse Research Foundation and Water Reuse. Alexandria, VA: California.

Trussell, Rhodes R., Paul Gagliardo, Samer Adham, and P. Tennison. 2002. The San Diego potable reuse project: an overview. *Proceedings of the International Conference on Wastewater Management and Technology for Highly Urbanized Coastal Cities*. Hong Kong: Hong Kong Polytechnical University.

United States Environmental Protection Agency (USEPA). 2012. *Guidelines for Water Reuse*. EPA/600/R-12/618. Washington, DC: EPA. https://www3.epa.gov/region1/npdes/merrimackstation/pdfs/ar/AR-1530.pdf.

United States Environmental Protection Agency (USEPA). 2017. *Potable Reuse Compendium.* EPA/810/R-17/002. Washington, DC: EPA. https://www.epa.gov/ground-water-and-drinking-water/2017-potable-reuse-compendium.

United States Environmental Protection Agency (USEPA). 2020. *National Water Reuse Action Plan (WRAP)*. Washington, DC: EPA.

Wester, Julia, and Kenneth Broad. 2021. Direct potable water recycling in Texas: case studies and policy implications. *Journal of Environmental Policy & Planning* 23:1, 66-83. DOI: 10.1080/1523908X.2020.1798749.

World Economic Forum. 2014. *Global risks 2014*. 9th edition. https://reports.weforum.org/global-risks-2014/

APPENDIX A

Code and Description	Example Responses (unedited except for clarity)
1: Concerns or complaints about existing ABQ water quality, taste	• The water already tastes bad sometimes and sometimes its fine? • Out of my tap there is too much calcium or whatever that make it taste funny • General high iron content of our water. • Do not like the taste. • The river water has increased calcium in our tap water multi-fold. Doesn't taste as good/clean as water from the aquifer. • The water already does not smell good or taste good. It also leaves a chemical smell in the large glass jar I put it in to cool it in the refrigerator, in summer, before putting it in the filtered pitcher. • Taste is bad and water scale around fixtures (white). • Currently has bad odor, taste, and sometime discolored. • Hard water
2: Concerns about existing or potential sources of water contamination/pollution in/near Albuquerque	• Probably already downstream of someone else's waste input. • Gold mine contaminates! • old pipes • contamination from los alamos • Chemicals from Sandia Labs and Kirtland AFB [Air Force Base] • Oil Spill has contaminated the aquifer • Fracking, drilling, pollution of the aquifer. • People who dump chemicals in the water • Haven't forgotten about the jet fuel in the aquifer. Very concerned about chemical contamination of the water supply • City waste, agricultural waste pesticides etc. oil and gas fracking impact on water quality safety will definitely have consequences.
3: Desire for more	• What are we using?

information about current local water resources or water quality	• Where is the treated water coming from? • Can't that [hard water] be made better? • How much of the city's water reuse currently goes to watering city parks, balloon park and any other projects? • I myself am pretty misinformed with where exactly your tap water comes from and how scarce it is here in Albuquerque. • How much lead in drinking water? • check water at rio bravo and south of it all that area bad most of the people that live there are always sick. • My main concern is what is being "added" to the drinking water. Since it is mainly all I drink I want to be sure that I'm not putting bad "stuff" in me. • We would like to know if we already consuming/drinking reused water.
4: Concerns and comments related to fluoride addition to drinking water	• just sense tap water is not good anymore, even just because of FLUORIDE, etc. • We are adamantly opposed to fluoride in the drinking water, please don't add it in. • Fluoride is so readily available in other areas (toothpaste) and adding it to drinking water is creating over exposure. • Yes - we don't need fluoride in our water. • I would like to know if the drinking water that is reused would be fluoridated • I am very against adding fluoride to our water systems • The water should have supplemental fluoride added to reduce dental disease. The amount present naturally is not adequate.
5: Questions and concerns about water quantity or aquifer depletion in ABQ or downstream	• our ground water is almost completely depleted • Loss from evaporation • I don't know where the water will continue to come from for all of the development that the city of Albuquerque continues to build, and it is a concern to me. • don't plan to live in Albuquerque for the rest of my life, and one of the reasons is because I don't think there will be enough water here to sustain life for the long haul.

	• How will Albuquerque reuse affect downstream communities depending on that water? • Will we be breaking interstate water laws by shorting down stream communities? • agriculture sucking the Rio Grand dry before it reaches the ocean. • the residents that have put in wells in the last 10 years to water their lawns as often as they want...is it taking from the aquifer? • In the future, will we run out of water? • Policy makers must recognize and make the effort to the long-term planning without degrading the current level of service afforded to the existing community.
6: Concerns about current water waste in Albuquerque/NM	• infrastructure is old so water loss through water line breaks is a concern to me as well! • Farmers in NM use most of the states water and mostly using inefficient methods. • NM does not do enough to save/reduce water usage. Wasteful. • not enough enforcement of folks who waste water both commercial and private • water waste in large lawns, etc. • I think it is a waste of water to have to clean recycling items before putting them into bin. • I know for a fact that Sandia Golf Course uses 1 million gallons a day to water the course, add that times all golf courses and you can talk about waste
7: Questions and concerns about chemicals and pharmaceuticals remaining in finished reuse water	• Concerned also about pharmaceutical input. • I would be concerned about the chemicals used for purification • People who dump chemicals in the water, and the treatment plant might not detect those chemicals • Heavy metals and hydrocarbons in my drinking water. • If there is too much chlorine, lead • naturally occurring contaminants? • What minerals or byproducts remain/differ from the original treatment once

	re-used? • Are there chemicals or organic objects not filtered or tested for?
8: Water reuse is not safe, don't want to drink	• this option is not viable for me. • Just the concept of drinking toilet water is disgusting. • I'm afraid that "good enough" for some isn't good enough for my children's life-long health. • I would not drink it might have to use it but will not drink it. • I've seen what gray water has done to a community. Devastation of vegetation and many people with cancer. • Not Safe :(• you will kill every man, woman, and child with your mystery poison H20! • Reuse can spread diseases • With increases in cancers and autoimmune diseases it would take a lot of work for me to feel that recommendations and approvals of drinking water use weren't biased and bought.
9: Concerns about safety of reuse in general, but not necessarily against reuse	• Long testing period first • After researching I would be willing to drink it if its safe. • If it truly is purified and safe, I don't see an issue with it. • I don't necessarily think it's "pure" but I doubt it's much better/worse than bottled water. • I might have concerns but willing to try. • As long as water purification standards are regularly tested for and met it should be fine. • psychological like if you only knew what was in the hot dog or chorizo... • It's not that I totally distrust these technologies and agencies, it's just the unknown and that the concept is foreign to me. • must be almost 0% chance of cross contamination.
10: Concerns/ desire for more information about quality and	• I would need to do a lot of research • At the very least I'd like more information on the process of purification.

aesthetics of potable reuse water	• I would want the results of independent evaluations of drinking water quality • An issue would be sustaining quality during times of high usage. • Would expect slight taste or smell depending on level of oxidation? • Want to see technical comparison of tap water and commercial bottled water. • Question: How does it compare to river or lake water now used? • How much chlorine would be used?
11: Concerns related to positive or negative effects on environment or aquifer from practicing water reuse	• Lower impact on the environment, sustainable for my children. • climate change a factor to be considered. • Even water lost to absorption by surrounding ground would benefit water supply if it goes back into the aquifer. • Injecting into the aquifer pollutes the process of the centuries and millenia of the environment doing it's job. Something like that can't be rushed. It would pollute the aquifer. • don't put wastewater in aquifer. if it is ever not clean it will poison the well • I have concerns with aquifer contamination by treated water injection • Don't like the risk to the aquifer • Infiltration and current shallow vadose recharge areas must be properly characterized and protected to avoid contamination of water being used to restore aquifer. • What [is] planned to guarantee water quality as it passes down main water tributaries and underground aquifers. • if it also provides habitat for native flora and fauna.
12: Concerns related to water reuse regulations or New Mexico Environment Department (NMED)/EPA's ability to adequately regulate	• standards too low • who determines this at what purification levels are acceptable? • Don't trust US EPA or NM EPA to properly regulate • Recycled waste water is likely to have more pharmaceuticals in it which EPA does not regulate. • lax regulations

	• Due to current changes in EPA and other agencies, I would want appropriate testing to be conducted. • Need independent testing outside government/ ABCWUA • Concerned about regulatory federal...issues compromising the outcome • The EPA already does not regulate many pollutants that are in water. (Lists of unregulated pollutants are common knowledge.)
13: Concerns about long-term commitment and adequate funding for an excellent reuse facility	• Long term concern for adequate funding to maintain quality of reuse infrastructure • Don't trust to collect enough taxes to pay for safe operation. • Need more resources, funding is important. • Budgets are being cut and we are a very poor state. Less funds to make sure our drinking water is safe. • Underestimating the cost to capitalize and run such a system could be disastrous. • the proper financial commitment at the state, city and water utility levels need to be made to ensure the best reuse technologies and staff are used • How will these treatment costs be paid for?
14: Concerns/desire for more information about reuse water monitoring, back-up systems, operators, security, reliability, external threats, terrorism.	• If the technologies are monitored and maintained (consistent, professional, ethical, scientific) • Something could go wrong. • Safety process and backup systems, safeguards info needed. • Human error, laziness lax concern of employees. • don't trust monitoring • sabotage by vandals or terrorists • How will the employees be trained, monitored and maintain education? (certification, continuing education) • It might be better to ask if the local water department is even capable of carrying out water reuse programs that don't sacrifice quality. • How easy is it to shut down the system (temporarily or permanently) in case of an emergency or failure?
15: Concern/ desire for	• I would need to do a lot of research regarding the safety of the drinking

more information about reuse processes and technologies to purify water	water reuse • I don't completely understand the process • aquifers are good filters? • More info on purification tech. • I want to know more • I will read more at the links provided. • show me the science.
16: Desire for more information about other places doing reuse and their experiences	• Need proof of success in method • Need well documented examples, good& bad, of reuse by others. • I will need to research where this has been used and see what the feedback has been. • Is there info - or access to links for those cities on your site?
17: If we implement reuse in ABQ, how will information about safety of the reuse water be communicated to the public?	• my concern is if release of noxious chemicals upstream are reported to the public (eg - Intel or los alamos or other large potential polluters) • Purification methods and routine analysis would be available to public. • Public notification of the policy and procedure that will be used if sampling of the purified water is found to be of a lesser standard than policy dictates • Will current statistics/data of the water quality be posted on a website, and/or via local media outlets - like the pollen count is "reported"? • Based on recent drinking water disasters, how can our water utility and elected/appointed officials build trust with the community that our drinking (tap) water is completely safe?
18: Respondent trusts utility, will do reuse safely	• I trust those staff monitoring • I believe the water Authority has done a marvelous job for water conservation program is one of the best in the country. • the use of river water from the San Juan Chama water project is resulting in groundwater rising. • their 100-year water planning strategy is visionary and bold. • The region is very fortunate to have this type of water leadership [in the local water utility].

19: Concerns/ distrust of utility related to reuse	• I do not trust ABCWUA to do this correctly • I trust the technology, just not the gov. employees to do a competent job • I do not trust the water authority to tell the truth. • My main concern would be the agency in charge of water treatment • Something could happen to the system and authorities would not inform the public or make any effort to correct like what happened in Flint, MI • Water agency should be independent of the city of Albuquerque
20: Concerns/ distrust of the government and/or processes that would lead to reuse implementation	• I would have to trust agency and process. • difficult to trust gov't • I don't trust ABQ Bernalillo to use high enough standards • poor management decisions made without technical review • I don't feel that anything will have any effect as our leaders will do as they want. • there is no transparency in the process • People in Flint, MI trusted their local government and look what happened to them. • Independent testing of quality outside of government?
21: I don't trust tap water/technology/science	• Do not trust purification technology. • skeptic • 100% pure drinking water, 100% of the time, will never happen! • Possible long term effects, 20+ years. • Limits of technology: Safe for limited use not the same as safe for constant use. • Technology not advanced enough • Not sure all impurities are gone, especially for people with compromised immune systems. • Not proven that it is safe! • I never know what to believe.

	• And, science often changes its mind - something is and then - no its not.
22: Won't affect me - I only drink filtered/distilled/RO/ bottled water	• I boil my own water to drink • Home Purification System in use. • distillation for 20 years • I do have concerns - but I don't drink tap water. • I purchase my drinking water and will ALWAYS continue to do so. • I drink bottled water and I don't know where it comes from either.
23: Support potable reuse/survey, reuse sounds like a good idea	• Developing new methods and technologies for water will continue to become more important throughout the world. • efficient • Advanced purification would increase our water quality • Common-damn-sense • Tastes great. • I don't have concerns about drinking water reuse. • Help us please :) • It's only a couple decades before we will need all this. • this type of research is very important, so thank you for spending the time doing it! :) • I hope my participation helped and that your research helps our state find alternative ways to meet our future water demands.
24: Reuse methods that minimize evaporation are best	• storage in reservoir can evaporate, less efficient so direct use or aquifer recharge probably superior
25: Water reuse ok/going to happen anyway and will add extra filtration at home	• I would still filter it before i drink it • I'd use extra purification • I'm for reuse but will add some purification of my own. • Doesn't matter it's gonna happen. Would like to be notified so I have the option of buying a secondary filter.

26: Need more public education about environmental pollution and water conservation/resources/reuse	• promote the science as well • I think it still has a certain gross factor until it is properly explained/shown so you can disassociate that feeling from the water. • LOTS of public education is necessary. • more dimensional information on water is needed, more positive propaganda. • Push and educate about river, water treatment friendly house hold cleaning products. • Get the APS science teachers involved in the presentations as a community liaison component. • Just opinion: I wish this were an issue more socially discussed.
27: Desire for more information about other forms of reuse/desalination/water purification besides what's discussed in survey	• What are other options? • I would like to also learn more about how to reuse my own grey water on lawns, etc. • I would be interested in the science behind using plants to filter water. • Why not ship in sea water and de-sal for use?
28: Appropriate ways of reusing water instead of potable water reuse (PWR)	• Why not use it to water golf course, and for construction, and everything except drinking? • I would trust it for watering plants, cars etc. • Reuse could be used for non-human consumption and agricultural use if any possibility of cross-connection eliminated • I think recycled waste water would best be put to good use for fire hydrants, construction, watering golf courses and parks, car washes, industrial and commercial uses. • Reuse water is Second best, return to the river. • water reuse is fine for all purposes except drinking water in my opinion.
29: Ways to curb water usage to avoid the need for PWR	• there are other ways to save water we use • sure are trying to find any way to eat it besides conservation • the area needs extreme measures to conserve what water we have left. • provide incentives to reduce use.

30: Unrelated to PWR, recommendations related to local water resource management	• Why not build deep reservoirs to capture our rain water like houses do with barrels. That would be easier treated. • Farmers in NM should not be favored over humans who need clean drinking water. • Water pricing should be more transparent and market based. • need for updated tech to water agriculture (drip) no more flood irrigation, need new cash crops, i.e.. hemp, Chile, grapes, and not alfalfa. • Curtail evaporation on large lakes i.e. elephant butte, golf courses should be played on native grasses. • why not consider displace water diverted to acequias, or other irrigation, aquifer recharge zones • raising the price of water will always solve the water problem • Allow grey water systems via planning and zoning department. • consider better development codes to use runoff to recharge aquifer instead of convey on hard surfaces.
31: Recommendations for successful implementation of potable reuse in Albuquerque	• Reverse osmosis better • Absolute transparency and public involvement is necessary. • replenish aquifer • needs to be designed like an oversized septic system • It should not be presented by an advocacy group of any type. • We need public health oversight and validation. • I recommend a go slow process on these issues with a pilot program if desired where no recycled water is injected into our water system but a pilot plant be continually be monitored for a period of a few years and a body of volunteers be polled on their observations due that period. • Applicable taxes should be levied to facilitate this. • Give tours of the purification facility! • Get the APS science teachers involved in the presentations as a community liaison component. • Those new developments should be the first to use purified wastewater for drinking.

	• Installation of end user quality monitors and other redundant safety features.
32: Questions and concerns about the cost of reuse	• Too expensive • concern about cost issues compromising outcome • cost, impact on low income communities • Stupid waste of money • would drinking water reuse increase my water rates? • cost of initial capital investments and long term cost of operating and maintaining infrastructure rates are already increasing. • not all the cost should be passed onto the consumer. • What is the difference in cost for direct and indirect?
33: Complaints about current water rates and fees, unrelated to potable water reuse specifically	• This is about rate increases for raises and bonuses! • I am concerned about limiting trees and grass as they give us cleaner cooler air. The higher water rates go up the fewer plants we can grow. • I am a water saver and harvester but I will never see any savings as long as I live here. • The cost of water in Albuquerque is higher than anywhere I have lived (5 different states and europe). • individuals and families who use more water than average should pay more. • There should be no franchise fee by the city which is a double tax. • this area doesn't use an income-based or residential-type of sliding scale to determine what residents will pay. • Cost seems to rise the more we conserve.
34: Growth will stress Albuquerque's water resources; may not need reuse if limit growth	• Community overplanning resulting in untenable population growth • Strategy may not be necessary if area population growth can be kept in check. • planners are willing to sacrifice quality-of-life of the residents to achieve growth. • I am afraid we will overbuild to the degree that we conserve the water.

	• If there is indeed a water shortage and impending crisis, how can the city and county justify approving the addition of 90,000 new water users in the Santolina and other developments?
35: There's not a problem with water shortage; climate change isn't happening	• ABQ is sitting on an Aquifer the size of one of the great lakes and a large portion is untapped due to political reason. • don't believe there is a water shortage • Climate change science isn't science.
36: Critical of survey	• Some questions too personal- • Your inappropriate and disingenuous use of the term "drinking water" in the diagrams and text breed even more distrust. • It's "waste water re-use" not "drinking water re-use". • I refuse to answer my ethnicity and race due to the fact that is Not relevant and find it discriminating and offensive. • Please quit dividing our demographic responses racially. • drinking water re-use is far more complex than what is discussed here. • Grants from a heavily taxed people are given for studies that don't make any sense. • These questions are out of line! • I think the way this survey is designed, asking so many questions about trusting scientific determinations, could cause doubt in some individuals. • It would be better to direct participants to skip further questions if they said they trust it.
37: Concerns about reuse leading to problems like in Flint, MI	• Something could happen to the system and authorities would not inform the public or make any effort to correct like what happened in Flint, MI • Lead in pipes and water e.g. flint michigan • I believe contaminated water is all around us-Flint just got caught. • Possible issues with lead while making changes to the current system.
38: Seemingly unrelated	• It is used in space • We need to protect water • Water is life. I blessed the water before drinking to our Heavenly father.

	• Don't like in your face. • Do not give him the due concern, which is for another city A. • Farmers would still flood irrigate with better quality water than people would have to drink. • I am concerned about the education budget. • More water fountains around town. • If I had a red button to press and kill every man, woman, or child in NM, I would. Luckily, I don't have a red button. Therefore I am hopeful that your program will be run as incompetently as I would imagine that it will be • tastes toxic filtration bottled is also probably a chemical toxin problem from plastic • air pollution • suck the back row! • the "cleaning" process of the fuel spill • I'm concerned stupid liberal policies will interfere with my God-given right outlined by our constitution to life, liberty and pursuit of happiness. • And could SOMEONE convince PNM to abandon the grid and provide customers with solar panels? • I sure hope the ABCWUA is paying attention to this! • Mayor Barry sucks look at Central. • The Water Authority's persistent campaign to restrict outdoor water use has contributed to creation of a huge heat island, adversely impacted air quality, and probably made our city less likely to attract rain. • Dumbing down landscape watering with the 12321 message fails to help educate customers with an understanding of how much their plants actually require to survive and flourish. • If this survey is confidential and will be removed and not connected to me in any way how do you intend to give out the water barrels? • the digital age makes us more vulnerable. Check it out for yourself; one large electromagnetic pulse will bring all electronic systems and the internet down.
39: Don't know/	• Not sure

undecided/ not sure	• Just don't know • undecided • just have developed opinion but not really know.... • hard to say • Not enough information to make a good judgment or form an opinion.
40: Believes already drinks DPR/IPR water	• I drink this in Europe all the time. • if there is a city upriver that is already putting their treated waste water back in the river I am already enrolled. • It's all being treated and used again. You're simply suggesting reuse immediately.
41: Have no other option but to drink it	• Only if I had to and didn't have another option • I occasionally drink tap water but this is very, very rare. • Out of necessity. • would not be my preference.
42: Worried what others will think	• I fear family, guests and visitors to my home would stop coming if they had concerns or are repulsed by the idea of drinking, cooking with, washing with recycled water. • What is suggested for dealing with divided families? :)
43: Trusts the technology	• I trust the technology • Developing new methods and technologies for water will continue to become more important throughout the world. • engineering and technology improve lifestyle • I'm very familiar with that process, and trust the process. • But with the second step of purification I would consider drinking the water with confidence. • I love this tech • if Space Station can recycle urine…
44: Efficient, fine if it's	• If it was free

easily available/ free	• It's the most convenient and accessible. • efficiency
45: Want to see results of survey	• Will we receive news from this survey • No, but will the results of the survey be published or made available online somewhere? • Would like to view results when completed.
46: Thank you/good luck/appreciate it	• Thank you! • You're welcome. • Good luck with survey!
47: IPR is preferable to DPR because of taste and natural treatment processes	• I prefer the indirect reuse method. • taste improved by time in aquifer • The environment helps us and is perfectly designed when given the chance to operate correctly. • stored water would allow settling • i would think storage would provide a time period to determine/maintain quality