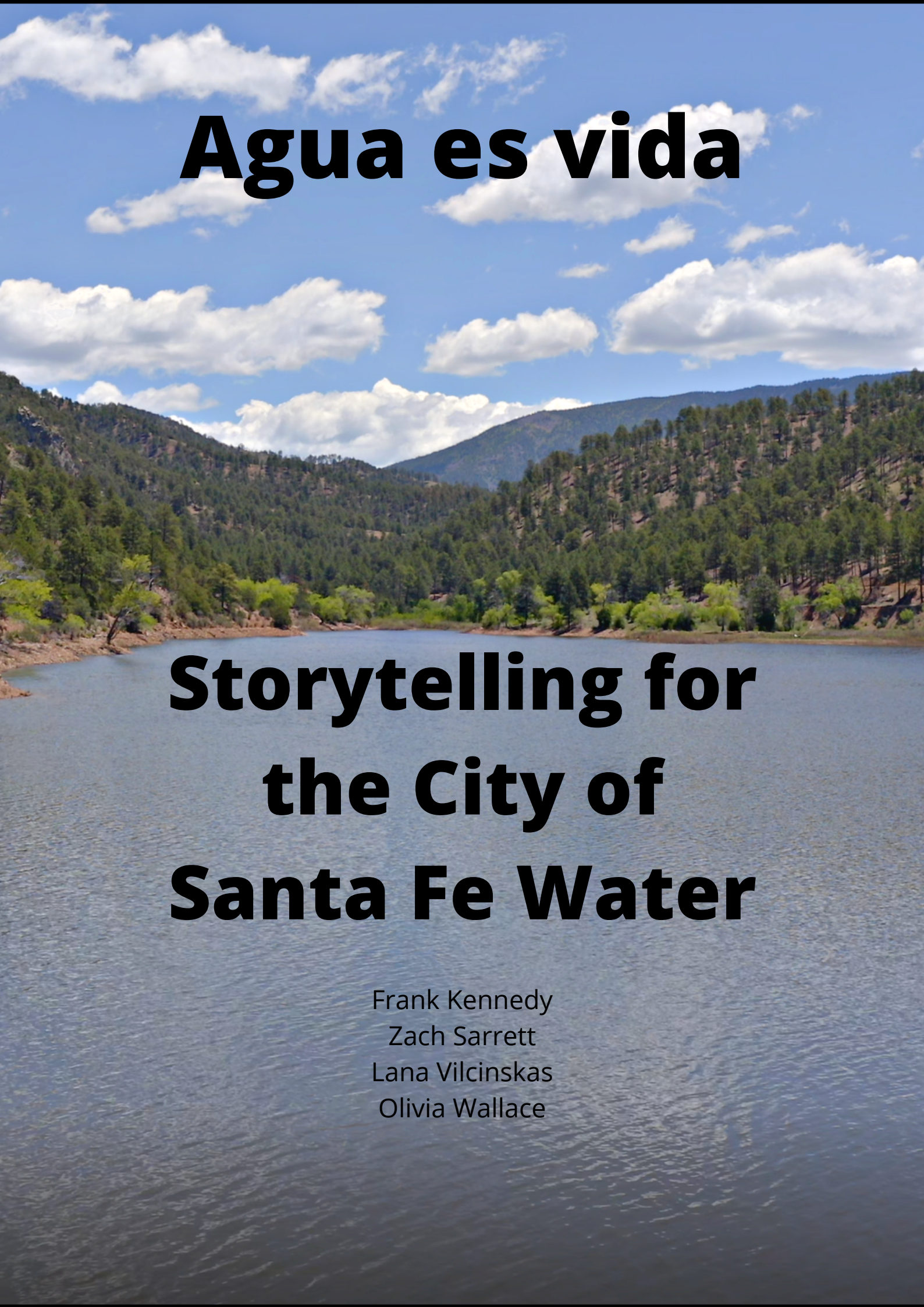

Agua es vida

Storytelling for the City of Santa Fe Water

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An Interactive Qualifying Project
submitted to the faculty of
Worcester Polytechnic Institute in
partial fulfillment of the
requirements for the degree of
Bachelor of Science

WPI

By
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Paper Submitted to:

Sponsor:
Dr. Jesse Roach
Santa Fe Water Department

Professor Thomas Balistreri and
Professor Zoe Antionette Eddy

Abstract

In collaboration with the Santa Fe Water Department, we developed educational multimedia informing civilians on their water. There is a disconnect between the city and the citizens, resulting in concerns over proper water treatment. By participating in tours of treatment plants, meetings, archival research, and semi-structured interviews with water officials, we collected information on treatment processes and the history of the water in the city. This information will be used in the videos given to the Santa Fe Water Department.

Acknowlegdements

Our team would like to thank our sponsor, Dr. Jesse Roach, as well as the City of Santa Fe Water Department. Dr. Roach was integral to our success, organizing tours of the city's water facilities and inviting us into the department's weekly meetings. We also want to thank Jonathan Montoya, the Source of Supply Manager for the Water Division, for taking the time to meet with us for an interview, and share both his extensive knowledge of the water system, as well as many archival photographs he had.

We would also like to thank our advisors, Professor Zoe Antionette Eddy and Professor Thomas Balistrieri for all the help and guidance they have given us during our time in Santa Fe. Their willingness to assist and enthusiasm during our meetings helped recharge and motivate the team, allowing us to complete our project.

Finally, we would like to thank Worcester Polytechnic Institute for making this project and our collaboration with the City of Santa Fe Water Department possible. Any photos not credited were taken by the Storytelling Team.

Executive Summary

There is a disconnect in communication between the City of Santa Fe Water and its citizens regarding where their water comes from, where and how it is treated, and whether the water is treated properly. While there is a variety of information regarding Santa Fe's water available to the public, that information is not easily accessible. The purpose of the project is to educate the general public and garner interest in the history and current status of City of Santa Fe Water through a series of videos explaining water operations and the history of water in Santa Fe. This is a big issue in Santa Fe, as water plays an essential part in the culture and ecosystem of Santa Fe. The next step after these videos would be to continue producing more videos covering a wider set of topics, such as conservation efforts and future plans for the city. Additionally, the official Santa Fe Water Website needs to be reorganized and made more user friendly for those seeking more information. Our solution is to create educational media, specifically videos, to educate and inform Santa Feans on where their water comes from, where it has come from in the past, where it is treated and how it is treated. These videos will be made accessible to the public and easy to understand for those without any preexisting knowledge on the topic.

Our solution has value as we designed these videos with the intention of them being "timeless", meaning that they will be applicable for decades to come, not just for the next year or two. If these videos generate enough public interest in the water, similar videos will continue to be created, and the general public will be integrated into future decisions on the water. Additionally, these videos are designed to answer questions the public has for the city but cannot be found easily on official sites.

Contributions

Together, the team recorded audio and drafted storyboards for our deliverables. The team also completed research for the project prior to our time in Santa Fe, as seen in the introduction and background sections of the paper, providing necessary corrections as more was learned during the IQP experience. Finally, the team worked together to collect media to be used in the videos.

During the IQP, Frank Kennedy was the main videographer for the interviews and tours the team participated in. Frank also developed scripts for the videos requested by our sponsor, and created presentations for the cohort and sponsors. Frank was also an author and editor for the final paper. Additionally, Frank found copyright free music to be used in the videos. Frank worked with Zach to produce the canva.

Zach Sarrett was one of the main interviewers for our project. He also assisted Frank in the recording of interviews and tours, allowing for different angles to be explored when reviewing media. Zach also developed scripts for the videos and created presentations alongside Frank. Zach was the other author and editor for the paper, working alongside Frank to produce the final paper and the canva.

Lana Vilcinskas was the editor and producer for the series of videos produced by the team. She also managed schedules for the team and took behind the scenes and background media for the project. Lana was also the primary creator of storyboards for the videos. Additionally, Lana reached out to various organizations while looking for archival research.

Olivia Wallace, like Zach, was one of the main interviewers during our time in Santa Fe. Olivia also transcribed answers received from the interviewees and the information obtained during the tours. Olivia provided behind the scenes media and created visual storyboards for the videos and topics covered by the team. Additionally, for this project, Olivia worked remotely.

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Introduction

Our third day in Santa Fe, we took a trip with our sponsor to the Buckman Wellfields, home of 13 city wells. From the moment we arrived, the contrast was perfectly clear. Seen in Figure 1, to our right, we were looking at one of the wells, which was actively pumping water into the city. To our left, all we saw was dry desert. As far as we could see, it was just sand and mountains, not a drop of water in sight. The climate and location of Santa Fe leads to this popular misconception that Santa Fe is struggling for water. However, this is far from the truth. Seeing this contrast, it became apparent to us that the story of the City of Santa Fe's water needed to be told.

Figure 1

Image of one of the wells in the Buckman Wellfield

Localized Water Issues

The Santa Fe River is located in Northern New Mexico. It descends from the Sangre de Cristo Mountains and flows west towards the Rio Grande, seen in Figure 2. This river is stored in two reservoirs, the McClure and Nichols Reservoirs, which provide the city with one-third of its water supply. In the past, the river and human made shallow wells were the two sources of Santa Fe water. The increasing demand for water due to population growth has led to the use of deep wells and a pipeline from the San Juan Chama to the Rio Grande with the purpose of obtaining more water (Groenfeldt, 2013). Today, the city of Santa Fe relies on surface water and groundwater from the city itself, as well as water imported from outside the local watershed.

Figure 2

Photo of the Rio Grande

There are various issues surrounding the water resources of Santa Fe. The first is in regard to effluent water. There have been multiple instances where the water treatment facilities have not met the necessary requirements for safe drinking water quality (City of Santa Fe Water Staff, 2020). This includes the release of effluent water from Santa Fe's wastewater treatment into the Rio Grande. This raises concerns for the health and safety of the community, such as the consumption of contaminated water and the effects it may have on agriculture.

What is Effluent Water?

As defined by Water and Waste Digest, effluent water is "sewage that has been treated in a septic tank or sewage treatment plant (Tuser, 2020). In Figure 3, the processing and uses of effluent water are highlighted.

Figure 3

Effluent Water and its Uses

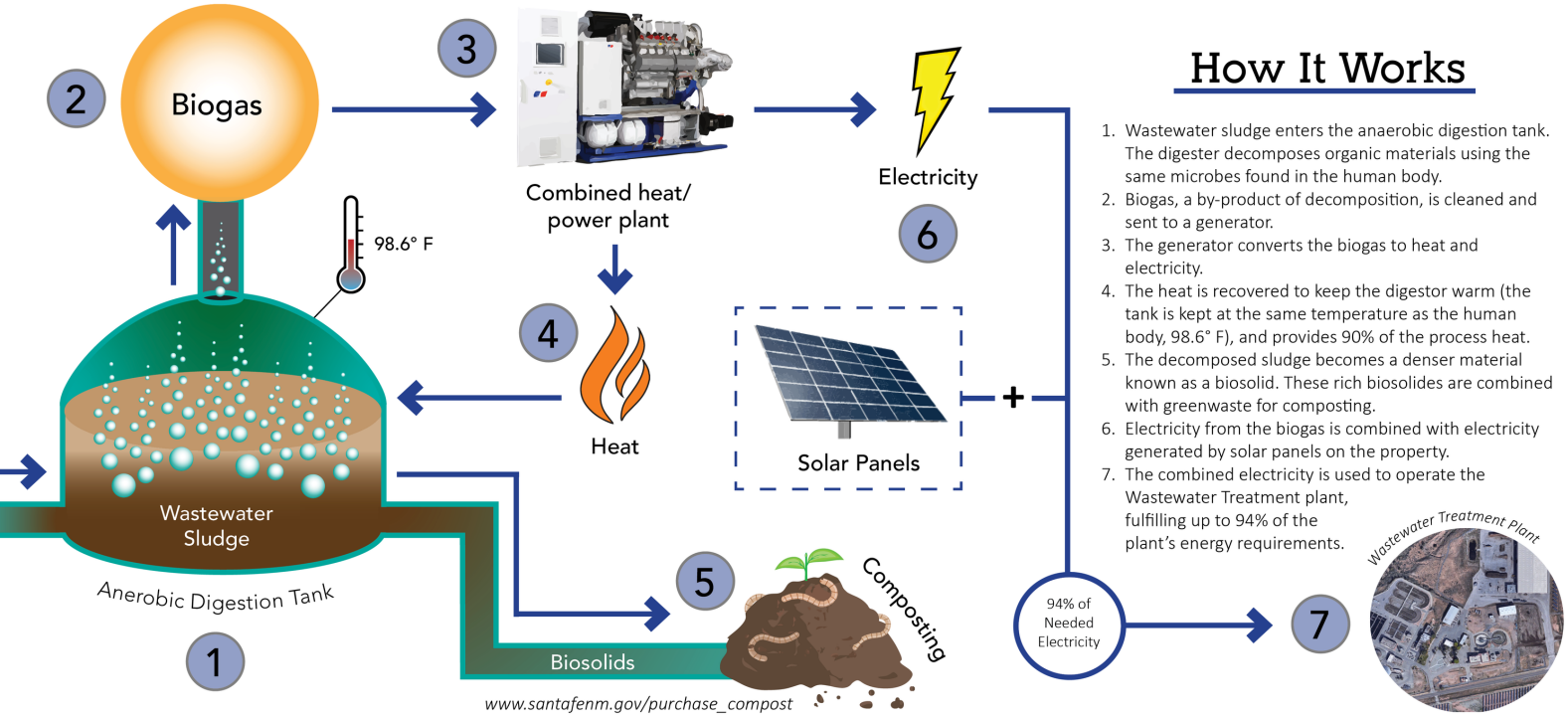


Photo courtesy of the City of Santa Fe Water Department

Additionally, there is a lack of communication between these government-run facilities and the citizens of Santa Fe. The city does not offer citizens enough opportunities to express their thoughts and opinions relative to Santa Fe water operations. In a recent public meeting regarding the city's plan for a new pipeline, the San Juan Chama Project, citizens were able to ask questions and voice their concerns regarding the future pipeline. While given this opportunity, they were limited to two minute sessions and told that an official response would be given at a later date. The final major concern, regards the global climate crisis. Climate change has led to massive droughts, and in recent years Santa Fe has experienced severe weather patterns (Rippey, 2021). Santa Fe is already plagued by droughts, and experienced massive droughts in the 1950's and 1970's. Because of these past droughts, Santa Fe has taken measurements to prepare for these challenges. However, there will be water shortages in the near future if these droughts are to continue. Due to the increasing concern of water supply and safety, there is an urgent need to tell the story of the Santa Fe Water District.

Past Solutions

The City of Santa Fe Water Department has recently created a strategic plan for the years 2021-2023. The last strategic plan was created in 2010, and it is labeled as the “Santa Fe Municipal Watershed Plan”. When this plan was created, the City of Santa Fe was struggling with climate change, specifically with an increase in wildfires. The plan was created to span a total of 19 years, and the overall goal was to implement long-term management, funding, and outreach for the Santa Fe Municipal Watershed. There are four areas of focus for this plan, all of which are vital to the maintenance of the municipal watershed. These four categories are vegetation management and fire use, water management, public awareness and outreach, and financial management (Lyons, 2010). The plan focuses on the financial aspect of maintaining the watershed. Additionally, there were plans implemented to educate the youth of Santa Fe on water use and supply. While this plan has been effective in maintaining the upkeep of the municipal watershed, the City of Santa Fe is still experiencing water-related issues, as well as problems related to the global climate crisis.

Additionally, as seen in Figure 4, to remedy the lack of communication between the city and the citizens, the water department created infographics designed to explain their missions and goals for water projects throughout the city. From these previously attempted solutions, shortcomings of the plans can be identified and further developed. These changes, as well as the re-utilization of the current strengths, can be used to better educate the Santa Fe public.

Figure 4

City of Santa Fe Water Infographic Depicting the Visions and Goals of the Department

Photo courtesy of the City of Santa Fe Water Department

Our Vision

The main purpose of our project was to raise awareness in the general population and educate them about their water. This included where the water has come from in the past, where it currently comes from, where it will continue to come from, and the quality of the drinking water. To achieve this, we created educational videos that will be posted online in an easily accessible location for the citizens to see.

These videos will provide factual, unbiased information on where Santa Fe's water comes from, how and where it is treated, and how much water Santa Fe has. These videos will each convey a different aspect of the story. Topics for the videos will include the path the water takes, the history of water in Santa Fe, water conservation in Santa Fe, and the future of water in Santa Fe.

Background

The History of Santa Fe and its Culture

Santa Fe is the fourth-largest city in the state of New Mexico, with an estimated population over eighty thousand people (United States Census Bureau, 2019). Previously inhabited by Indigenous populations, Santa Fe was established by Spanish colonists between the years of 1607 and 1610. This makes Santa Fe the second-oldest city in the United States with a long and rich cultural history. It was the first US city chosen by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as a Creative City, acknowledging the vast cultural influence of the city (City of Santa Fe, 2020).

As of 2019, the population within Santa Fe identified as 88.0% of the population identified as White, 2.9% as American Indian and Alaska Native, 1.8% as Asian, and 1.6% as Black, with 2.7% of the population identifying as two or more races. Additionally, 55.2% of the population identifies as Hispanic or Latinx. Understanding the cultural makeup of the city, and the influences the population has on the culture, can change the way strategies are developed to educate or interact with these populations.

The City of Santa Fe Water Department

The City of Santa Fe Water Department's main task is to maintain and upkeep the quality of water found in the area. The water department became a municipal responsibility in 1995 and has since implemented various policies and projects in order to ensure that the water is safe, potable, and sustainable. This includes the replacement of wells located around the city, such as the St. Michael's Well, and the reparation of twenty-two water service lines and twenty-five water main breaks (City of Santa Fe Water Staff, 2021). Additionally, the department has launched programs such as EyeOnWater to better involve the community in their work. The EyeOnWater project's main objective is to educate the public on water conservation and highlight their own water usage in the community. This allows them to make smarter decisions to reduce unnecessary water consumption and waste (City of Santa Fe Water Conservation, 2016).

Today, the City of Santa Fe Water department primarily uses the Source Water Protection approach to identify contaminated sources of water and keep pre-existing sources clean. The main belief of this approach is that contamination prevention is the best way to guarantee long-term drinking water. The Source Water Protection plan, as seen in Figure 5, contains two major phases, starting with the assessment phase. The assessment phase is primarily used to determine what areas are utilized for drinking water and the possible risks of pollution that could threaten this status. Once the risks are assessed, they are then ranked in terms of impact, from low impact to high impact. The second phase of the plan is then initiated: the protection phase. During this phase, the city develops a series of strategies to address the risks, such as litter removal and tank management, which are then distributed to the public. This distribution ultimately provides the public with an understanding of what is happening to their water sources, giving them an opportunity to assist if possible (City of Santa Fe Water Staff, 2021).

Figure 5

The Source Water Protection Plan

Photo courtesy of the City of Santa Fe Water Department

The Present

Although the city has taken steps towards public inclusion in water conservation, there is often still a disconnect in communication regarding incidents of effluent water. The long history of miscommunication is evident as Santa Fe's water treatment facility has not been in compliance four times in under one year. This has resulted in waste and sewage being allowed to flow down the Santa Fe River. As seen in Figure 6, the Santa Fe River is a popular swimming location for families, and a source of water for farmers. This presents numerous health concerns for those in the area. This also produces economic concerns for the farmers as their farms are negatively impacted by the use of sewage water.

Figure 6
Santa Fe River Through the City

Another part of the disconnect is the lack of communication between the general public and the government. In December of 2019, the city voted on a plan to build a pipeline that would send the treated water from the waste treatment facility back to the Rio Grande River, in exchange for return flow credits. While this does help the city plan for future water shortages, they did not take into consideration how their own citizens would be impacted in the present. There are people who depend on the water from the river for food and money, as well as for recreation. Additionally, there was a huge lack of public input, as noted by the two council members who voted against the plan (Cantor, 2019).

The final major problem facing the Santa Fe water supply is in regard to climate change. New Mexico as a whole has been experiencing extreme droughts. According to Santa Fe's 2020 water report, the annual precipitation decreased from 17.4" to only 8". This was the lowest annual precipitation recorded since the gauge was installed in 2006. The lack of rainfall led to an increase in demand for outdoor watering. Although there was a significant decrease in rainfall, the water consumption increased from 87 gallons per capita per day to 93 in 2019 (City of Santa Fe Water Staff, 2020).

Despite this being the lowest recorded rainfall in years, the city was successful in supplying its citizens with enough water. Surface water, sourced from the Santa Fe River and San Juan River watersheds, was the largest supplier, providing 87% of the total water used throughout the year. Although the City of Santa Fe was able to keep up with the lack of rainfall this past year, it is predicted that they will struggle in the coming years if the precipitation patterns continue. This will result in a heavier reliance on groundwater usage in the upcoming years, as seen in Figure 7 through the use of city and Buckman wells (City of Santa Fe Water Staff, 2020).

Figure 7

Water Production and Use in Santa Fe in August 2021

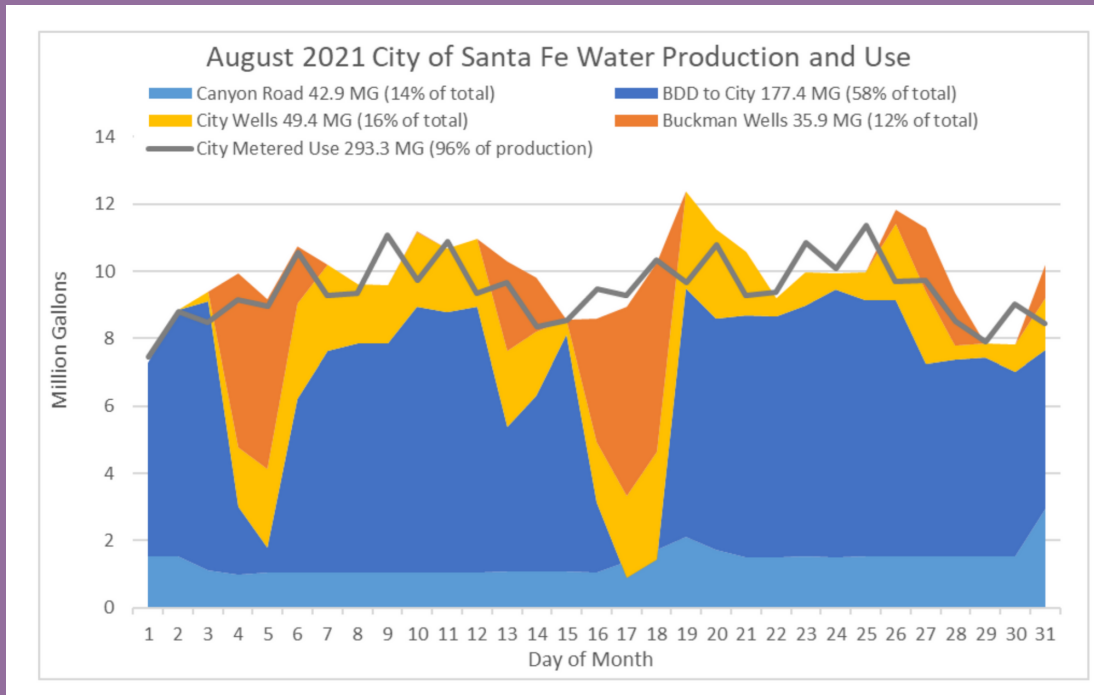


Photo courtesy of the City of Santa Fe Water Department

Summary of Background

In Santa Fe, there is widespread concern regarding the quality and availability of water. Additionally, there is a clear disconnect between the citizens and the municipal facilities responsible for the upkeep and maintenance of water. The urgency of Santa Fe's current situation has incentivized the need to educate the citizens on their water. By addressing the public and easing communication between citizens and the municipal government, information regarding water will be made more accessible to the community.

Methodology

To complete this project, the team utilized the following methods to gain knowledge on the water in Santa Fe: archival research, non-participant and participant observation, and semi-structured interviews. This also included exploring the city to gather media, as seen in Figure 8. The knowledge we learned from these methods proved to be essential in the formation of our videos. We were able to cite information from a wide variety of sources, allowing for a more unbiased result. Additionally, from these methods, we were able to glean a better understanding of what Santa Fe is truly like, which gave us further insight into how the city will develop in the future. We recommend that future groups build on what was accomplished and subsequently expand the methods to further what was completed.

Figure 8

Arroyo Mascaras

Archival Research

Our first form of methodology was archival research. Through extensive research at a public library seen in Figure 9, we found old newspaper clippings, photos and microfilms ranging from the 1970s to the 2000s. This information was primarily used to create our video regarding the history of water in Santa Fe, as well as giving us a good background of Santa Fe from which to work off of. Additionally, we gained historical knowledge on Santa Fe that was not provided in our conducted interviews, giving a much broader understanding of developments and changes in the city.

Figure 9

Work at the Public Library

Non-Participant Observation

To gain more information on the water systems in the city, we participated in weekly water operations meetings at the City of Santa Fe Water Department, which can be seen in Figure 10. Through these meetings the team was able to establish water quality standards in the facilities, which facilities required repairs and renovations, and weekly demands of water in the city. The meetings also provided insight as to which facilities needed upkeep, which projects were being officialized, and any concerns over water production.

Figure 10

Reviewing Media at the Office

We also participated in meetings outside of the water department, such as meetings regarding a prescribed burn at Nichols Reservoir and the San Juan Chama Project, which explained the city's plan on developing a new source of water. Participation in these meetings were done not only to gain a better understanding of future developments and current goals that the city wants to complete, but to establish how the public viewed each development. Despite the prescribed burn occurring near the city, this was a private meeting consisting of the water department, firefighters, and weather officials. The San Juan Chama Project meetings were public and occurred over the span of two days, allowing anyone unable to attend one day to participate in the next meeting. While the water department did speak on planned developments, the meetings were used primarily to note questions and concerns that citizens had. These meetings allowed us to gain new insights into concerns that the citizens held that we were not aware of before, as we had only learned about the water from the government's point of view.

Participant Observation

To gain a better understanding of the treatment processes in Santa Fe, we participated in tours of the preexisting water treatment plants and reservoirs, as seen in Figure 11. Through tours of each treatment plant, Canyon Road, Buckman Direct Diversion, and the Waste Water Treatment Plant (PRWRF), we learned how the water reaches the plant, the types of chemicals used in treatment such as aluminum sulfate and ferric chloride as coagulant, the stages of water treatment, and how the water is stored in various tanks in the city before distribution. For each tour, videos of the plants were taken to provide the team with background knowledge as we explored more of the system. These videos were transcribed to make it easier to reference specific material in the tours. The information from the tours was used to create scripts for the educational videos in conjunction with replies from our interviewees.

Figure 11

Nichols Reservoir

Semi-Structured Interview

We interviewed Jonathan Montoya, the Source of Supply Manager for the water division. Mr. Montoya has worked for the city since 2012, and has extensive knowledge on the Canyon Road Treatment Plant, and the inner workings of water throughout the city. Through our interview with Mr. Montoya, seen in Figure 12, we gained copious amounts of knowledge on how Canyon Road works, what the treatment process entails, and where the water goes from after Canyon Road. We also learned about the usage of wells throughout the city and any concerns or issues regarding water supply and quality in the future. This interview was transcribed and coded, and the information provided was used in the creation of the Path the Water Takes video. This interview was completed in accordance with IRB regulations, under the record IRB-22-0072.

Figure 12

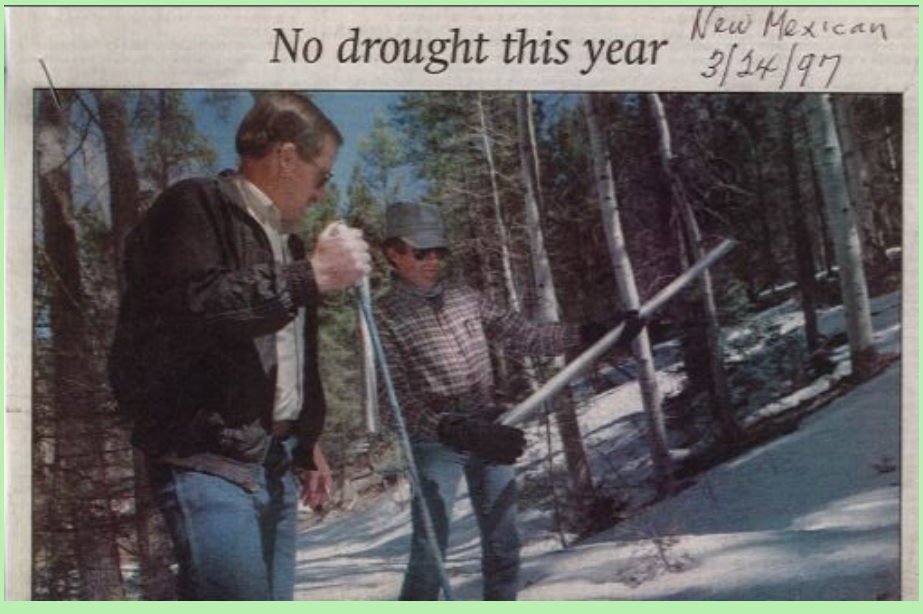
Screenshot of Zoom Interview

What We Learned

From our time spent in the library, the team learned about the development of Santa Fe water, starting with the droughts in the 1970's and finishing with the creation of the Buckman Wellfield. Additionally, we were able to learn about water conflicts, such as the debate over whether places like Las Campanas should use treated water to care for their golf course or if that water should primarily be allocated to the citizens who utilize this water for basic needs, such as drinking. Through this archival research, we were granted another view into the history of Santa Fe through newspaper clippings highlighted in Figure 13, allowing us to gain a more unbiased look into the history of Santa Fe's water.

Figure 13

Portion of a Newspaper Photocopied at the Public Library



No drought this year (1997), March 24th. *New Mexican.*

Participation in the weekly water operations meetings at the office provided us with a view of how facilities and water supplies in Santa Fe were managed and developed. This included what repairs needed to be completed, what water production was like in the treatment plants for the current week, and any concerns officials had over specified projects or projections. The meetings also offered insight into what the upcoming weeks would look like, such as how much water each treatment plant would provide for weeks thereafter. In addition to these meetings, we also participated in public meetings to gauge public opinion over water related plans. From this we learned that in general, the public was often critical towards the local government and upset about the lack of public input. This included the lack of regard for how the citizens would be impacted by the potential changes. In these meetings, many stated how they required the water for their farms and businesses, and that large scale changes could prove detrimental to their lives if the city was to go through with these plans.

The most beneficial aspect of our time in Santa Fe was touring the water facilities, treatment plants and wells around the city. On our first day in Santa Fe, our sponsor, Dr. Jesse Roach, took us on a tour of the McClure and Nichols Reservoirs and Canyon Road Water Treatment Plant, which is highlighted in Figure 14. We learned that from the reservoirs, the water is transferred through the use of gravity powered pipes to the treatment plant located close by, where it undergoes proper treatment before being stored in tanks for future distribution. We then toured the Wastewater Treatment Plant, where we learned about the process of taking effluent water and going through a series of treatments, so that it is potable and can be sent back down the Santa Fe River. Any water that is unable to be properly treated is used for irrigation at nearby golf courses.

Figure 14

Sangre de Cristo Water Treatment Plant

Two days later, we participated in another tour that focused on the Buckman Wellfield and the Buckman Direct Diversion Treatment Plant. A portion of this facility can be seen in Figure 15 Through this session, the team learned about the current 13 wells that were developed to assist the city through the many droughts that plagued Santa Fe in the past two decades. Here, while all of the wells do produce water, the city primarily relies on wells 10 to 13. Additionally, the water produced here, which only requires chlorine to be potable, is mainly used in the event of an emergency. To end the tour, we were taken to the Buckman Direct Diversion Treatment Plant (BDD) to see how water is treated there. Unlike the Canyon Road Treatment Plant, BDD primarily sources its water from the Rio Grande. Canyon Road and BDD are the two main sources of water for the City of Santa Fe.

Figure 15

Buckman Direct Diversion Water Treatment Plant

Finally, to supplement the information learned through the tours, we conducted an interview with Jonathan Montoya, the Source of Supply Manager at the Canyon Road Treatment plant. Through this interview, we learned more about the city's wells, potential issues regarding the water in the future, and how water is properly treated at Canyon Road. After talking to Mr. Montoya, we learned that as of now, the city has enough water to provide for the citizens. However, if the population continues to increase at its current rate, demands would grow higher and more water would be required. Additionally, while the treatment plants are currently well equipped to treat the water that enters each facility, repairs and updates will be needed to ensure that the plants run properly. While repairs can be achieved now, eventually the replacement of machinery will be necessary in the future, which Mr. Montoya believes will be difficult for older treatment plants.

Overall, the information obtained during our time in Santa Fe proved to be essential in the development of our deliverables. With this information, we were able to develop videos explaining the path of the water in Santa Fe and the history of water in the city. Furthermore, for future groups and our sponsor, we developed a set of visual storyboards regarding conservation efforts in Santa Fe and the future of the water in the city.

Video One: Path of the Water

The first video we produced was about the path that the water takes, starting with snowmelt and precipitation and ending with the cycle eventually beginning anew. The video is split into Four main sections, with each section going into detail about a certain path. The first path we introduced was about the Canyon Road Water Treatment Plant (CRWTP), highlighted in Figure 16. This path starts at the McClure Reservoir up in the mountains. From here, the water leads down to Nichols Reservoir, which is a smaller reservoir than McClure. From Nichols, the water is transported down to CRTP, where it goes through the treatment process to make it safe and potable. Once the water is drinkable, it is sent to a storage tank, where it can then be distributed throughout the city.

Figure 16
Aerial View of CRWTP

Photo courtesy of the City of Santa Fe Water Department

The second section of the video is about wells. The city has 20 wells, 13 Buckman wells and 7 city wells. These wells were all built in the past in response to varying droughts. Nowadays, these wells function primarily as emergency wells, in times of need. The water from the wells is treated as well, although not as heavily as at the treatment plants, as all it needs is a small quantity of chlorine to be potable. The third section of the video focused on The Buckman Direct Diversion (BDD). Along with CRTP, Buckman is a main treatment plant that the city uses. However, unlike CRTP, the water treated here comes primarily from the Rio Grande River. The water is treated and similarly sent off to storage tanks, before being spread throughout the city. The final section of the video describes what happens after the water is sent out to the city. Once the water is used, it is sent to the Wastewater Treatment Plant, where it is once again purified and treated. Once the water is safe for use again, it is released downstream into the Santa Fe River. Eventually, this water will evaporate, and then when it comes down as rain or snow, the cycle starts again.

Video Two: History of Santa Fe's Water

The second video we created was about the history of water in Santa Fe. The contents of this video helped explain the development of water in the city, starting from the creation of the Old Stone Dam in 1881. The video then shifts its focus forward to the 1950's, when the city was hit by massive droughts. 20 years later, in the 1970's, Santa Fe once again was plagued by droughts. After both of these extended periods of droughts, the city built more wells to combat future droughts. In 1995, the city acquired the water company, making water a municipal responsibility. Once again, in 2002, droughts tormented Santa Fe. Finally, in 2011, the city developed the Buckman Direct Diversion Plant.

This video was especially hard to make because of the lack of media. We had an exceptionally difficult time finding usable photos from before the 1970's. We reached out to the Smithsonian, the Santa Fe National Archives and multiple local research centers before a local library was finally able to provide us with old newspaper clippings that we could use. Everywhere else either did not have any information for us, could not give it to us because we could not get the proper authorization, or charged an exorbitant amount.

Storyboards

For future groups, we created a storyboard about conservation for the water department to eventually turn into a video. For this video, we obtained most of our information through the City of Santa Fe Website alongside the SaveOurWater website, seen in Figure 17. This storyboard can be seen in Appendix A.

In addition to the storyboard about conservation, we developed a storyboard detailing the future of water in Santa Fe. The video will focus on the San Juan Chama Return Flow Pipeline, which is scheduled to be constructed in upcoming years. Along with the pipeline, we also provided information on Santa Fe 2100, the city's plan for water resource management. This storyboard is seen in Appendix B.

Figure 17

SaveOurWater Logo

Photo courtesy of the City of Santa Fe Water Department

Recommendations

During our time in Santa Fe, we have learned through trial and error what has worked and what needs improving. From our experience, we have created the following recommendations for the City of Santa Fe Water Department, Dr. Jesse Roach, and whoever continues this project after us.

Printing Out and Creating Infographics

While infographics from the city were used in the production of our videos, because the videos will be used on the water department website, a steady internet connection must be utilized to view the content. This ultimately limits who can see the videos or not. Therefore, to make the videos more accessible to a wider audience, we recommend the printing and distribution of these infographics in common public areas around Santa Fe, such as restaurants and grocery stores.

Figure 18

View of Nichols Reservoir

Captioning Videos

As of now, the videos are only recorded in English with no subtitles. In Santa Fe, 55.2% of the population identifies as Hispanic or Latinx. To make the videos more accessible, we recommend providing captions (similar to the figure below) in different languages, which would allow the city to reach and educate more people who are not comfortable or as skilled in English as others are. Additionally, these captions would allow those with hearing impairments or disabilities to learn the same information as those viewing the videos normally.

Figure 19

Captioned Video Screenshot

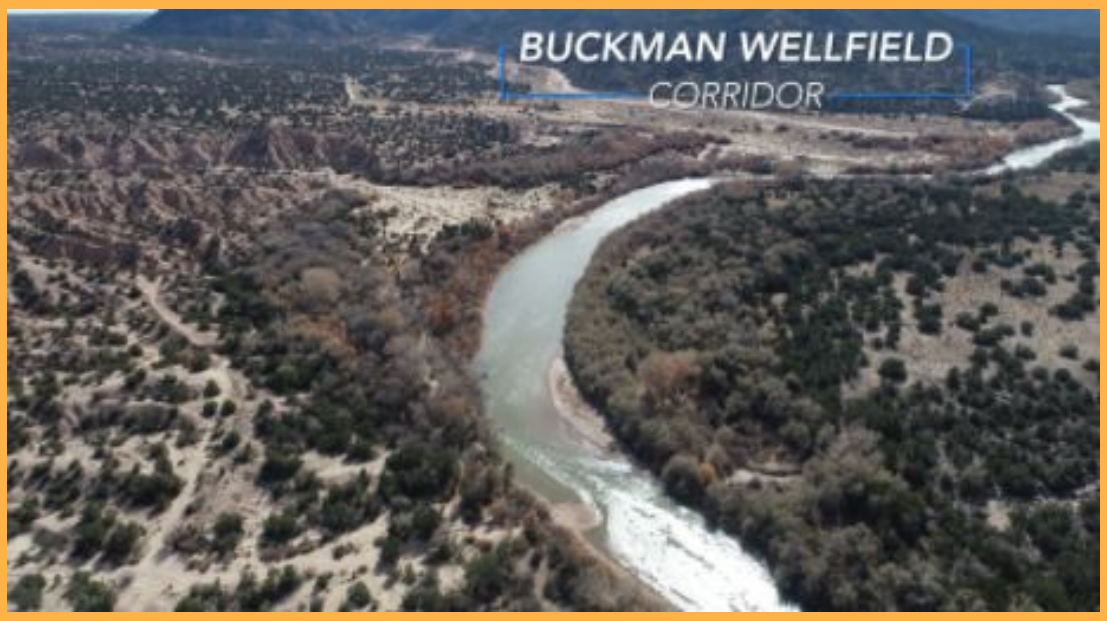


Photo courtesy of the City of Santa Fe Water Department

Public Outreach

As outsiders to the Santa Fe treatment process, and water treatment in general, our team came into this experience with little knowledge on the inner workings of water treatment and facilities. Therefore, the videos were produced so that they could be viewed by anybody, regardless of how much knowledge they possessed on Santa Fe water. We recommend that future groups create surveys or focus groups consisting of citizens to establish what they do not know, what is known, and what they want the videos given to consist of. This may prove to be difficult since not all the information provided to the group from the city can be distributed due to legal reasons, but this would ultimately provide a better learning experience for the citizens of Santa Fe.

Figure 20

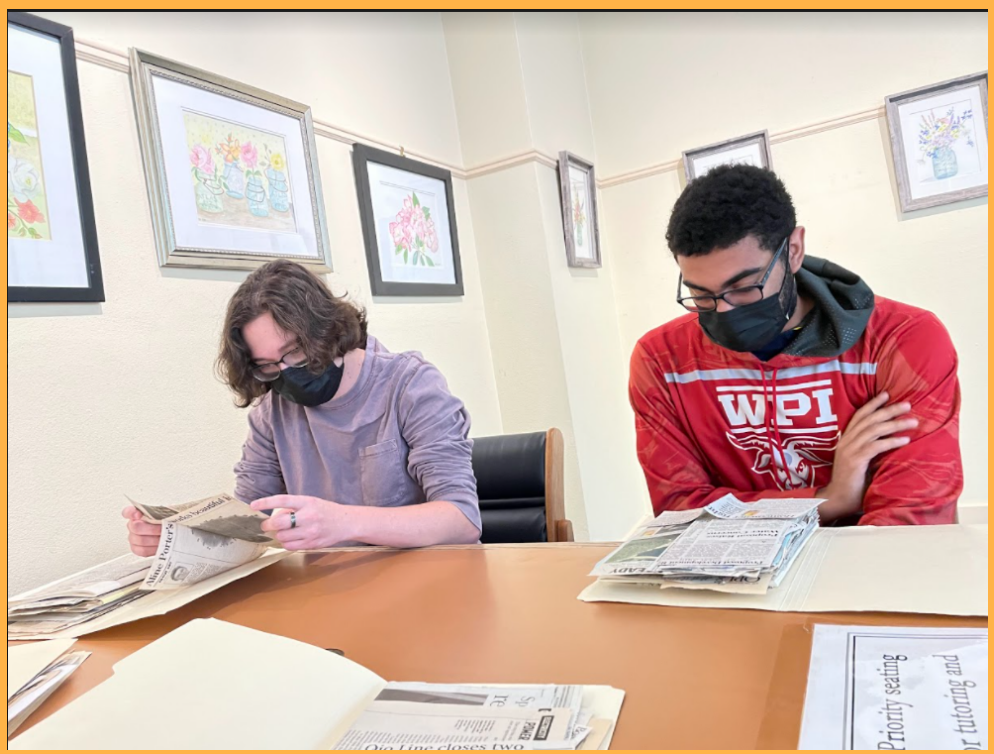
View of Santa Fe at Sunset

Obtaining Copyrights

While media could be found for videos, acquiring copyrights to use the media was difficult. We recommend establishing what footage and media would be used in the deliverables sooner during the term, allowing the team to reach out to organizations for permission.

Figure 21

Reviewing Newspaper Articles at the Public Library



Creation of Additional Videos

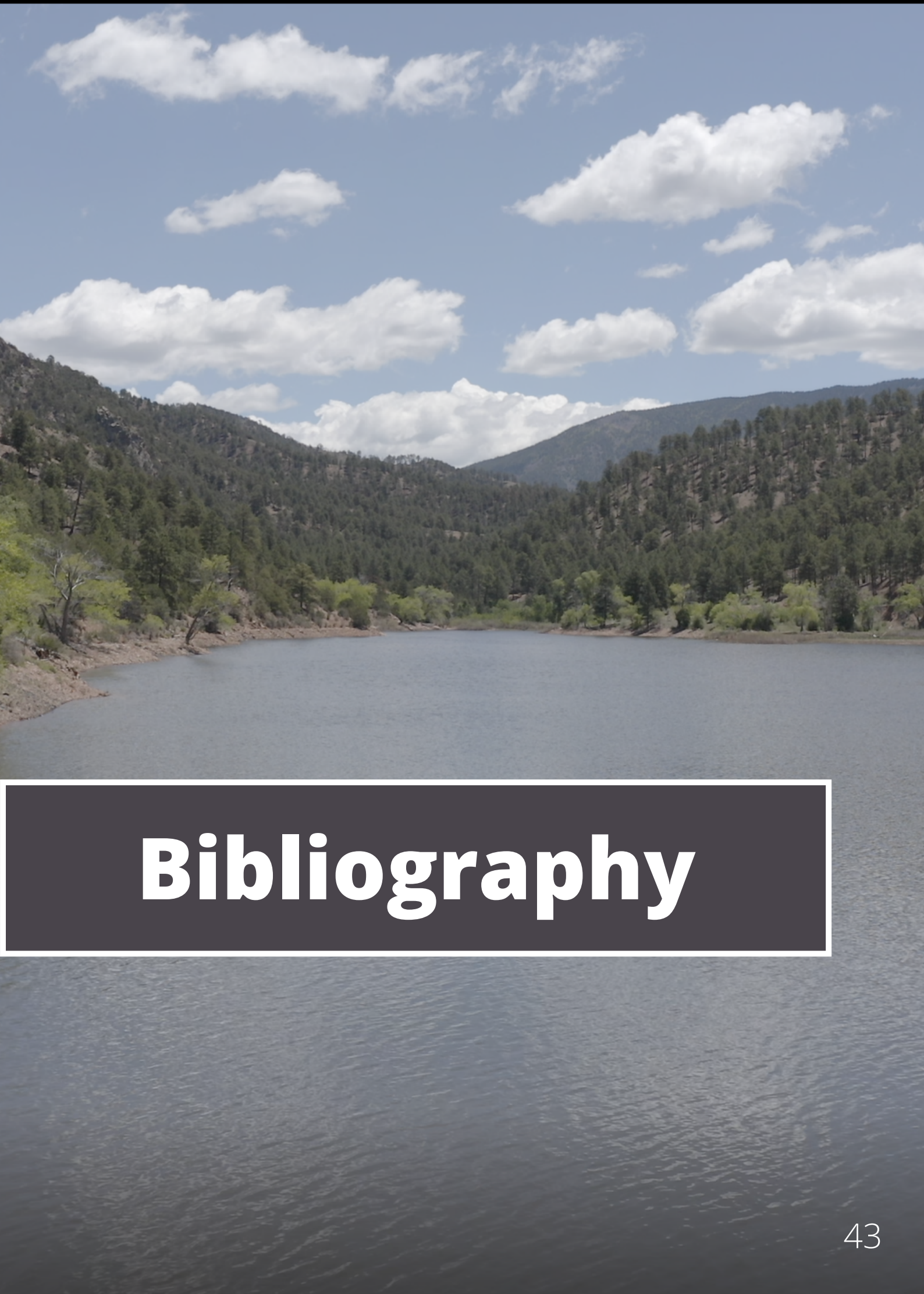
In addition to producing videos based on the storyboards that the team provided, we recommend developing more videos that cover more topics on Santa Fe's water. Through the creation of these extra videos, future groups would be able to further engage and educate the public.

Figure 22

Downtown Santa Fe

Conclusion

When we arrived in Santa Fe, our knowledge on the intricacies of the Santa Fe Water system was lacking. From our time with Dr. Roach, we were able to learn about the complexities of running a city, and all the minute details that are required to ensure that the water system runs properly. Through this guidance and more research, we set out to develop videos designed to educate the public on the city's water system. While a clear goal was established, we faced challenges along the way. One such challenge was the acquisition of copyrights and media. To address this problem, we reached out to various organizations and local archives. While many of these conversations resulted in empty leads, we connected with a local library that provided us with stacks of old newspaper clippings that we scavenged through, looking for useful information. Having resolved our problems, we are leaving Santa Fe with ways to remedy their problems, in the form of engaging videos, visual storyboards, and a set of recommendations for the future.



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Appendicies

Appendix A - Conservation Visual Storyboard

WATER *for the* FUTURE

As drought looms, Santa Fe is better off thanks to drilling and conservation. But rising demand on a wavering source puts Eldorado on shaky ground.

Stories by BEN NEARY ♦ *The New Mexican*

1/31/99

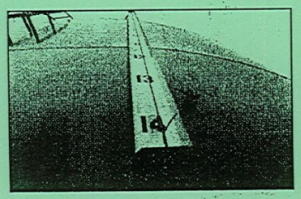
▶ *Dry summer of 1996 taught Santa Fe a lesson in the importance of water planning and conservation*

Santa Fe is better prepared today for drought conditions than in 1996, when limits on its ability to deliver water forced the city to restrict outdoor watering and impose stiff fines on heavy water consumption.

The water-saving habits learned by residents and businesses during that dry spell could be a factor in helping the community cope with another one.

More importantly, the city has beefed up its system of groundwater wells since that dry summer three years ago.

"We're going to be able to produce up to 1 billion gallons more than we were before, which is about 25 percent of annual demand," said Mike Hamman, director of the city's Sangre de Cristo Water Co.



A water-level indicator hangs on the side of a 250,000-gallon tank in Eldorado. Five tanks in the subdivision can hold a combined 2.5 million gallons of water.

In addition to Santa Fe Canyon reservoirs and wells near the Rio Grande, Santa Fe has relied on a series of wells in the city. Some older wells have been retrofitted and put back into service.

The city also drilled some new wells to add to the system's production capacity,

Please see **SANTA FE,** Page A-4

Water for the Future

Santa Fe: Conservation awareness, planning boost supply

Continued from Page A-1

which is especially important during periods of peak demand:

■ The Baca Street Well, also called the Santa Fe Well, can produce 370 gallons per minute. During the dry 1996 summer, the well was not in production because of water pollution in the area.

■ The Torreon Well, which wasn't available for use three years ago, recently was redrilled and is producing 500 gallons per minute.

■ Two other wells that are back online, the Alto Well and the Furguson Well, are producing 600 gallons per minute, Hamman said.

■ In addition, Hamman said the city has drilled two new exploratory wells that together can produce about 1,000 gallons a minute. One of the new wells is off Camino La Tierra, near the city's 10 million-gallon water-storage tank. The other of the new wells was being drilled last week near the intersection of Paseo de Peralta and Guadalupe Street near the rail yard.

The Santa Fe water situation is still benefiting from a 1996 public-education effort on water conservation, when residents cut back their water use significantly. A city water-conservation ordinance limiting outdoor watering to alternating days in the city remains in effect during summer months, Hamman said.

Richard Moore, spokesman for the city's Parks and Recreation Department, said the city still hasn't determined whether it will water its parks and playing fields this summer. He said watering ceased last October and normally would resume in March depending on the water supply and its condition.

Because of conservation efforts, Hamman said he doesn't expect the city's total water consumption will reach the 1995 level of 13,000 acre feet until the year 2005. An acre foot is the amount of water that covers an acre to a depth of 1 foot, roughly 325,000 gallons.

On top of increased well production and conservation savings, Hamman said the city also anticipates good storage levels in the city's three reservoirs.

For the week ending Jan. 24, reservoir storage ranged from 51 percent to 68 percent. Hamman expects levels to rise as snow on the mountains upstream continues to melt.

"If we get a significant level of precipitation this spring and summer, we'll be in real great shape," Hamman said. "Our reservoirs are at 65 percent right now and growing slowly."

Hamman expects the city reservoir system to have 70 percent to 75 percent of its capacity by the start of summer. Coupled with the additional groundwater production, he said, "We anticipate being able to meet summer demands."

Meanwhile, Hamman said the city continues to take steps to meet increased demand in the future.

The city's 40-year water plan calls for reaching the point where it can produce three-quarters of the water it needs from underground wells in dry years, and take three-quarters of demand from surface-water supplies when the flow is available.

Mike Hamman

Santa Fe County, which has limited water rights, serves customers on its own water system essentially by extending lines connected to the city's system. Although it's a 50 percent partner in a river-diversion project, the county is dependent on the city for water production and distribution.

To meet the long-range plan, the city is working with Santa Fe County and San Ildefonso Pueblo to build a diversion project on the Rio Grande. A series of deep shafts with perforated pipes extending under the river will collect water.

Hamman said plans call for having the first of the shafts, called a Raney Gallery, in operation for testing by October. He said it will pump steadily until the spring of 2000 to provide information about water quality. Officials hope it won't need further filtration.

It will cost $8 million to $15 million to build the test gallery system, Hamman said.

The river-diversion project is intended to take advantage of rights that both the Santa Fe city and county governments have to water that comes into New Mexico from Colorado through the federal San Juan/Chama project.

Aside from the relatively small portion of the water supply that the city draws from its existing Buckman well field near the river, neither the city nor the county uses much of the water from the federal project.

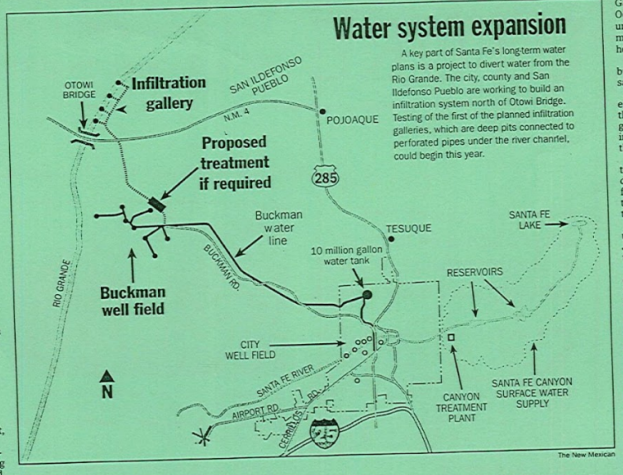
"This whole program won't work unless we can get access to our San Juan/Chama water," Hamman said of the city's 40-year water plan.

The city hopes to build a pipeline to carry purified water from its sewage-treatment plant, off the end of Airport Road, back upstream for release into the Santa Fe River channel. About 60 percent of the water used in the city of Santa Fe reaches the treatment plant and is available for purification and reuse for irrigation and other purposes. While such treated water is not put back into the drinking-water supply, placing it back into the river channel would allow some recharge of the aquifer that would benefit the city well system.

State water laws would allow the city to claim a credit for the water placed back into the river channel, which in turn would allow it to pump more water from the Rio Grande, Hamman said.

The cost of building the pipeline hasn't been determined, Hamman said. He said technical analysis of the project will take place during the next two years. While city and county officials continue to take steps to meet the long-term demand for water, Hamman thinks the dry summer of 1996 has changed residents' attitudes about water permanently.

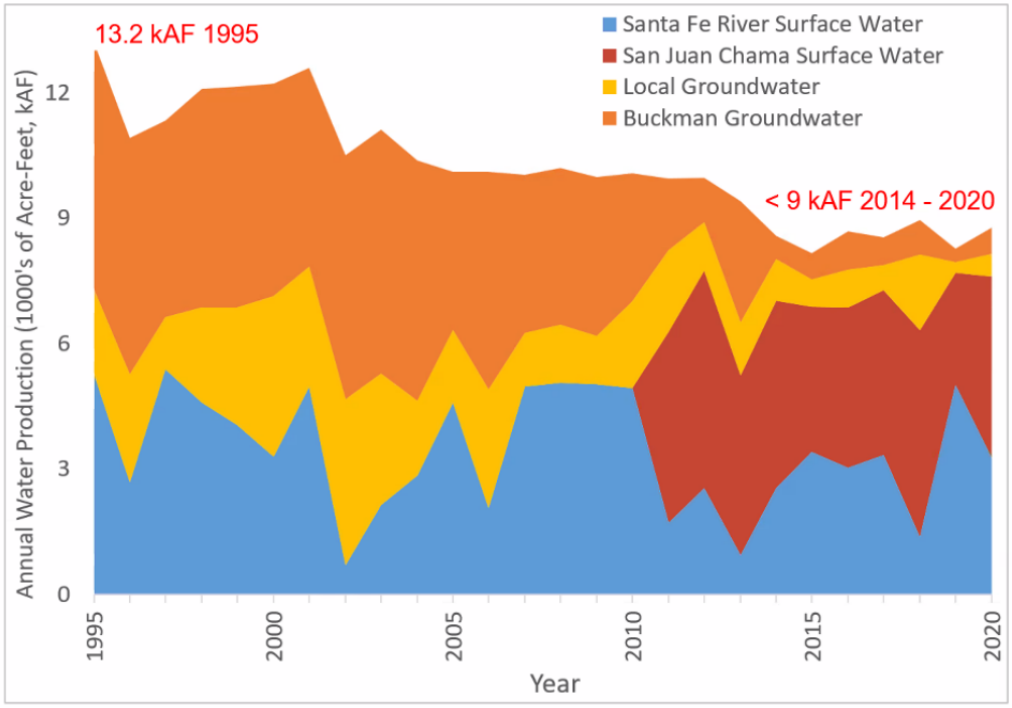
"We're definitely situated better from a water-production perspective," Hamman said. "And given people's experience with watching their own water use, if we did experience some shortfall later in the summer, I anticipate that we could get people to cut back significantly."



Conservation Success: 1999, Water Conservation Program

Save Water Santa Fe: Youtube channel - “Save Water Santa Fe” - include video clips

City of Santa Fe Water Supply by Source 1995 - 2020



SJC Water:

Direct access to SJC water from BDD starting 2011

Successful Conservation:

13.2 kAF in 1995 (68,000 served)

<9 kAF since 2014

33% reduction in demand (>80,000 served)

25% increase in population

Effluent for affluent

Photos by Steve Babuljak/The New Mexican

Las Campanas executives show a meter vault that is part of the development's new system that taps Santa Fe's treated effluent. From left are Jim Taylor, vice president of marketing; Mike Sanderson, vice president of engineering and construction; and Taber Anderson, president of Lyle Anderson Companies, which own Las Campanas and similar golf/housing developments in Arizona, Hawaii and Scotland.

SF Water 5/12/04

As promised to city, Las Campanas will begin irrigating its golf courses with treated wastewater

By TOM SHARPE
The New Mexican

Las Campanas began drawing treated effluent from the Santa Fe wastewater-treatment plant this week to irrigate its golf courses in accordance with a deal the developers of the luxury development struck with city government last fall.

Under the agreement, reached two weeks before Las Campanas and the city were to go to trial, the development will cut in half its use of potable well water from the city system.

Now that Las Campanas is using mostly effluent to irrigate its two 18-hole golf courses, the city and the development can begin a new era of cooperation on water issues, said Taber Anderson, president of Lyle Anderson Companies, which owns Las Campanas.

"The City Council for so long, I think, needed Las Campanas to have something to complain about," he said "We were a lightning rod for a lot of political issues."

Prior to the settlement in September, Las Campanas and city officials were at odds over whether the development must comply with city drought-emergency restrictions. Under Stage 3, city residents can irrigate only one day a week. Under the current Stage 2, outdoor irrigation is limited to three days a week.

Anderson said Las Campanas could have reduced its irrigation by an amount comparable to the schedule, but the golfing turf would not survive unless it is irrigated more often than the city rules allow.

"Unfortunately, whoever created that (schedule) had no idea how to grow grass," he said. "We were trying to convince the city staff that we can live with these

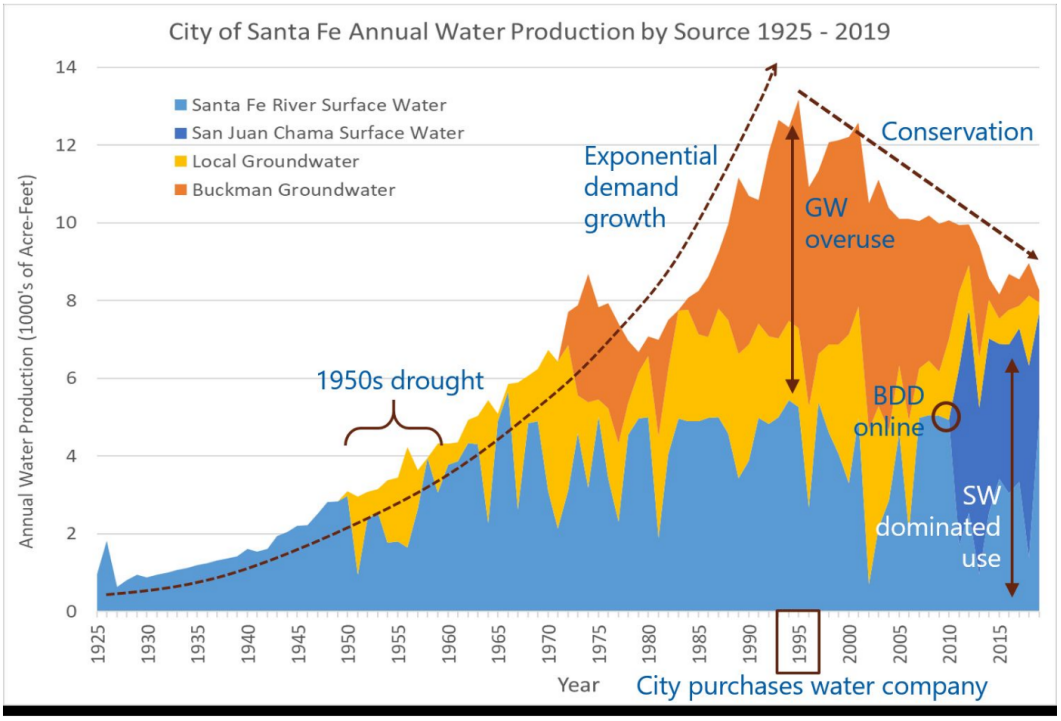
Please see **WATER,** Page B-5

Las Campanas has built a 2-million-gallon tank to hold treated effluent at the Santa Fe wastewater-treatment plant. The water is then pumped seven miles to irrigate the luxury development's golf courses, which use 450,000 to 800,000 gallons a day.

Effluent Water Use instead of Potable at parks and Golf Courses

Santa Fe golf course

Residential Rebates



Manage sources, Buckman Wellfield/City WellField/CRTP/Buckman Regional WTP

Water Emergency Stages- Orange & Red

Adopted: May 29, 1996
Amended: June 13, 1996

City of Santa Fe
EMERGENCY WATER REGULATIONS
Water Emergency Management Plan
Stage 2 Implementation Plan

PURPOSE:

The city of Santa Fe, given its location in a high altitude desert environment, may experience unseasonably hot and extremely dry weather conditions of a persistent nature. When conditions are such that a drought or other water shortage conditions can be predicted, the city will initially request water users to voluntarily reduce water consumption to meet estimated shortages relative to the projected demand. When voluntary measures are not sufficient to accomplish the desired reductions in water use, the city will implement mandatory measures. This document defines these measures for a stage 2 drought management condition.

Following are the elements of the stage 2 implementation plan:

1. **BASE LEVELS AND SURCHARGES.** The city's need for a total reduction of water use on the order of 25% to avoid periods of shortage. To accomplish this, all customers of the municipal water system will be required to reduce water use by 25% or better as measured against the water bill during the same month, as the previous year. In addition, 100% of residential water use in excess of 12,500 gallons of water per month will be subject to surcharges.

A. A base monthly water use calculated by meter size will be exempt from this requirement if customers do not exceed the following amounts:

METER SIZE (Inches)	May - August (Gallons per month)	September - April (Gallons per month)
All Residential	6,000	4,500
1 - Commercial	12,500	7,500
1½ - Commercial	25,000	15,000
2 - Commercial	40,000	24,000
3 - Commercial	78,000	46,800
4 - Commercial	125,000	75,000
6 - Commercial	250,000	150,000
8 - Commercial	400,000	240,000

B. For all customers, water use above the base water use will be subject to a surcharge of $10.00 per 1,000 gallons on water used above 75% of what the customer used during the same month, the previous year.

C. In addition to the surcharge described in B. above, Residential customers using between 12,500 gallons and 25,000 gallons per month shall pay a surcharge of $15.00 per 1,000 gallons on 100% of use above 12,500 gallons.

D. In addition to the surcharges described in B. and C. above, Residential customers using in excess of 25,000 gallons per month shall pay a surcharge of $50.00 per

1996 stage 2 implementation plan

2021 mid-year report for progress on 5-year conservation plan (2020) Goals:

- City partnerships
- Complete overhaul of education program
- Work with other city departments to distribute outreach material to children and adults
- Incorporate messaging into the art community
- Updates to rebate program that include passive rainwater capture
- Focus on reducing outdoor water use
- Continue to work closely with the Water Conservation Committee under the leadership of Councilor Romero

2021 Scorecard on Progress
U.S Drought Monitor
NM Governor's Drought Task Force Planning
Water Conservation Ordinances
What can YOU do: Fix leaks, Rebates, Obey Water Restrictions, Use EyeOnWater video of someone on laptop using website, Irrigation Water Audit (QWEL-Certified)

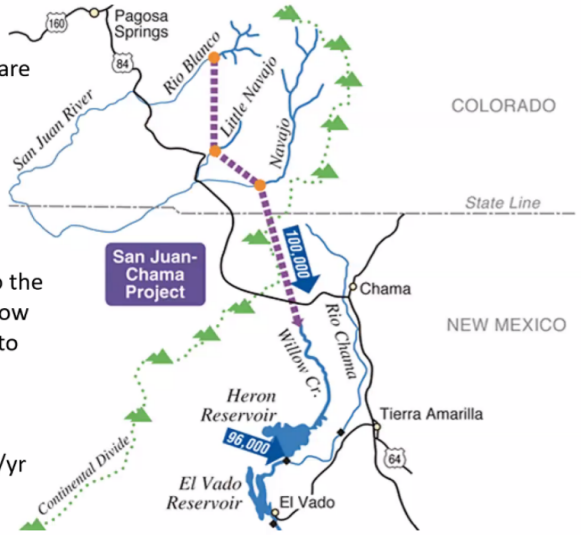
Plant water-conserving plants in your gardens

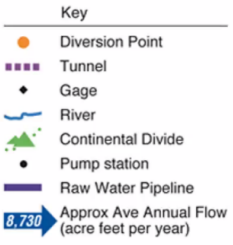
Appendix B - Future of the City (Water)

- Water Resources Planning
- History

San Juan Chama (SJC) Project Water

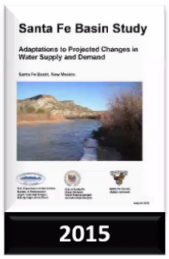
- Portion of NM's share of Colorado River water under the Upper Colorado River Compact
- Diversion from three tributaries to the San Juan, gravity flow through tunnels into Chama system.
- City & County full allocation 5605 AF/yr

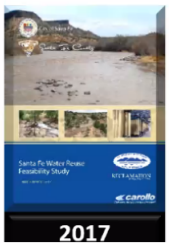




San Juan Chama Return Flow Project Purpose and Need

- Purpose is Full Utilization of San Juan Chama (SJC) Project Water
  - Allow for continued prioritization of renewable surface water
  - Allow for continued conservation of groundwater
  - Allow for reduced Rio Grande water rights acquisition
  - Increase long-term water supply and resilience
- 2015 Santa Fe Basin Study Identified the Need
  - Incorporation of potential climate change impacts to future supply
  - Water shortages by 2050s if no action taken
  - Effluent utilization identified as a key adaptation strategy
- 2017 Effluent Reuse Feasibility Study Identified the Project
  - Analyzed 7 different effluent use scenarios for technical and financial feasibility
  - Using a triple bottom line approach, the SJC Return Flow Project was the most effective way to maximize the value of effluent and supplement water supply





- San Juan Chama Return Flow Pipeline Project
- Santa Fe 2100*
- Water and Growth
  - Water rights to offset added demand
  - Jesse definitely talks about this in the tours from Week 1
- Conservation and Reuse
  - 5 year conservation plan (2020)

Appendix C - Scripts
Path of the Water Script

Exposition line:
There are four different sources of water for Santa Fe, and three main paths the water follows before reaching City homes and businesses. Like all water, the cycle begins with precipitation as rain or snow. Some of the precipitation that falls in the Santa Fe River Watershed flows down the river and is stored in local reservoirs. Some of the precipitation that falls in southwest Colorado flows down tributaries to the San Juan River and is diverted into tunnels for storage in reservoirs along the Chama system in northern New Mexico. Some precipitation soaks into the ground and reaches the groundwater table in local and regional underground aquifers.

Path #1:

1.1 The first path is that of the Santa Fe River water, and starts in the Sangre de Cristo Mountains as water that flows into McClure Reservoir. This reservoir sits at an elevation of 8,000 ft, and has been in service since 1926. When full, McClure holds almost 3000 acre feet of water, which for context is approximately one third of the City's annual use.

1.2 Water released from McClure Reservoir flows downstream to Nichols Reservoir. In service since 1943, Nichols Reservoir has a capacity of 700 acre feet. Water can be released from Nichols to the Santa Fe River, or to the Canyon Road Water Treatment Plant.

1.3 The Canyon Road Water Treatment Plant is where Santa Fe River water is treated. The first step in the treatment process is to add a coagulant and mix it thoroughly. A coagulant is a substance that allows solids in the water to bind together more easily.

1.4 Next, the water travels through a series of flocculation basins with mixers that get progressively slower. Through flocculation, particles and other solids in the water collide together and stick, forming larger clumps of material called flock.

1.5 The water is then sent to sedimentation basins where the flock settles out due to gravity and the clear water then flows to filtration rooms. The water seeps through a filter made up of a layer of carbon and a layer of sand. The carbon helps remove odor and color, while the sand removes any particles still remaining after the flocculation process. When this is completed, the pH levels of the water are adjusted, Chlorine is added, and the water is stored in a two million gallon tank for distribution to the City through an extensive network of underground pipes.

1.6 The Canyon Road Water Treatment Plant is entirely gravity powered. The water that comes in from the reservoirs essentially flows through the facility and the treatment process without the need for pumps.

Path #2:

2.1 The second path is through wells. The city utilizes 20 wells in total. 13 of the wells are part of the Buckman Wellfield, and the remaining 7 are city wells. While these wells do provide water for the city to use, these are mostly used in the event of an emergency, such as a drought. The water from these wells is naturally filtered underground, and is treated with chlorine before being sent into the distribution system.

Path #3:

3.1 The third and final path of the water is through the Buckman Direct Diversion Treatment Plant, also known as the BDD. The BDD treats the Colorado River Water delivered into the Rio Grande system by the San Juan Chama Project mentioned earlier. The river water passes through fish screens, and is spun through large pipes to remove sand and other large particles which are immediately returned to the river. The remaining water, which is still carrying quite a bit of sediment is pumped up to the BDD Water Treatment Plant. There, the water is sent to large pre-sedimentation basins where much of the larger sediment particles settle out.

3.2 Next, ozone and coagulant are added to the water to oxidize organic materials and to force the finer particles to clump together. After this, similar to the process at Canyon Road Water Treatment Plant, the water flows to flocculation chambers where the water is gently mixed, allowing the particles to collide and stick together.

3.3 Due to gravity, the larger clumps fall to the bottom of the chamber, where they are then sent to a centrifuge to remove excess water, later being sent to a landfill. Next the water is sent through filters to remove even smaller particles, and ozone is added again to kill microbes and remove bad tastes and odors.

3.4 Finally, the water is sent through a carbon medium to remove oxidized materials and excess ozone. Chlorine is then added and the water is distributed to holding tanks for distribution to the City system.

Path to consumption:

4.1 These three main paths all converge either in the city's water tanks, or directly in the distribution pipes. Water pumped to the storage tanks flows by gravity to City homes and businesses. Water used indoors then flows into the sewer collection system and again by gravity down to the Waste Water Treatment Plant near the airport.

4.2 From the wastewater treatment plant, all of the water is treated. Some of this effluent is used for irrigation purposes, mainly at nearby parks and golf courses, and the remainder is released to the lower Santa Fe River. Most of the water will eventually evaporate, and the process begins again.

History of Santa Fe Water Script

Introduction:
Water is life. For as long as humans have lived, they have relied on water to survive. That includes here in Santa Fe where for over 400 years, the Santa Fe River has met some or all of the city's water needs. For hundreds of years the natural flow of the river was sufficient to meet those needs, but by 1846, increasing immigration and population growth drove the need for a more steady supply and resulting plans to dam the river.

1881:
The Santa Fe River was one of the original reasons that people had settled here, and they wanted to harness as much of the river as possible. In 1881, the Santa Fe River was dammed for the first time behind the Old Stone Dam, which could store up to 25 acre feet of water. This small dam filled with debris relatively quickly leading to additional dam construction.

1893 through 1943:
Completed in 1893, Two Mile Dam was the second dam built on the Santa Fe River, with a capacity of 500 acre feet, or twenty times more than Old Stone Dam. This was followed in 1926 by Granite Point dam which would eventually be increased in size and renamed McClure, and then finally the fourth dam on the river, Nichols Dam, was completed in 1943.

1946:
In 1946, the Public Service Company of New Mexico, a New Mexican based corporation, took over control of Santa Fe's water from the Santa Fe Water and Light Company.

1950's:
In the 1950's, Santa Fe was hit with one of the worst droughts in its history. For nearly a decade, there was a lack of rainfall in Santa Fe, and the citizens and city struggled directly as a result. In response to this extensive drought, the City created a second water supply in the form of several wells near the Santa Fe River.

1970's:
Just 20 years later, continued growth in demand resulted in the need to add yet another supply. The city once again built more wells, this time the Buckman Wells. There were 8 wells installed, and this became the City's third supply and the first supply from outside of the Santa Fe River Watershed.

1995:
In 1995, the City of Santa Fe purchased the Sangre de Cristo Water Company from the Public Service Company of New Mexico, making water a municipal responsibility. This transition laid the groundwater for the creation of a conservation ethic in Santa Fe, but tough days lay ahead.

2000's:
In 2002, Santa Fe was once again hit with drought. Although conservation efforts had begun, drastic supply shortage on the Santa Fe River and years of overuse of wells left the City in a precarious Water position. Mandatory water restrictions were put in place, irrigation water was cut off to the Parks, and grass died across the City. 4 deep new wells were drilled in the Buckman wellfield and plans for the Buckman Direct Diversion were hatched.

2011:
In 2011 the Buckman Direct Diversion, also known as BDD, was brought online, becoming Santa Fe's fourth major source of water. BDD is a treatment plant that currently provides anywhere from 50% to 70% of Santa Fe's water in any given year. The inclusion of the plant has resulted in less dependence on the rest of the city's facilities and allowed for underground aquifers, that were once taxed by overuse, to recover.

Today:

That brings us to the current day. Since 1995 when the City took over the water system, total City use has dropped by 33%, even as the population served increased by 25%. The BDD and Santa Fe River together typically supply 80% of City demand, and water levels are rising in the wells as a hedge against future drought. City of Santa Fe Water is in a strong position to guarantee a safe, reliable, and resilient supply of water to meet the needs of the City today, and for many years to come.

Appendix D - Our Sponsor

Throughout the history of Santa Fe, water has been imperative to the survival of the city. The same can be said today, which is why Santa Fe now has an entire department dedicated to water, the City of Santa Fe Water Department. While our sponsor is the City of Santa Fe Water Department, we have worked primarily with our main liaison, Dr. Jesse Roach, the Santa Fe Water Department Director. As the Director of the Water Department, Dr. Roach is responsible for ensuring that water resources are available now and in the future and that reservoirs and treatment plants are able to store and treat water so that they meet quality drinking standards. Dr. Roach also works with the water department to ensure that the structures required to transfer and store water are of proper condition and are sufficient enough to deliver water to the tens of thousands of water meters throughout the city. The City of Santa Fe Water Department, while one of many municipal utilities in the state, is important in influencing water policy throughout New Mexico and provides planning for long range water resources.

Appendix E - Interview Questions

1. Would you like to introduce yourself?
2. What is your position/job title? What does that entail?
3. How long have you been working with the City of Santa Fe, Specifically the Water Department?
4. Could you explain the overall functions of both line shaft and submersible wells in the city?
5. The difference between the two?
6. Have there been any issues regarding these wells that have caused a noticeable decline in water quality?
7. Are there other wells used in times of emergency/drought?
8. Are there any flaws with the wells currently? If so, are there improvements or fixes that would solve these issues?
9. What do you think has been the biggest concern regarding water supply (quantity) for the past 5 years? 10? 25?
10. Do you think these issues will persist in future years? What do you think will be the biggest problems from a water quantity perspective going forward?
11. Do you have any other predictions for future concerns to the water supply?
12. What do you think has been the biggest water quality concern in terms of meeting water quality standards for the past 5 years? 10? 25?
13. Do you think these issues will persist in future years? What do you think will be the biggest problems from a water quality perspective going forward?
14. What impacts have droughts or other natural disasters had on the local water supply for the past 5 years? 10? 25?
15. What effects, if any, have the Covid-19 pandemic played on water demand, water supply, or water security?
16. As of now, how accessible do you believe current information on City of Santa Fe Water is to the public?
17. What is the Path from entry to exit for the plant?
18. What is the filtering & treatment process for the plant?
19. Is anything added to the water in the process?
20. What is often removed by the filtering process?
21. Of the items that are removed, what happens to them, and where do they go?
22. How much of Santa Fe's water comes from CRTP?
23. After leaving CRTP, where does the water go?
24. What is the role of the Operator's office in CRTP?

Appendix F - Jonathan Montoya Interview Transcript

13:02:48 Um, so yeah, so like Zach was saying, we just wanted to thank you.
13:02:57 Since it is easy to like accidentally kind of cut people off over zoom, especially with like this Wi Fi problems. We're going to be waiting a few seconds like after we finish talking to give you a chance to respond.
13:03:53 I'm just one last thing before we kind of begin. So we after the interviews over we're going to be processing and downloading the zoom video.
13:04:03 If there are any parts that we decided to put in our public videos we're going to send them to you first and wait for you to confirm that before we like publish any videos, that's all right with you.
13:04:13 Okay.
13:04:15 Alrighty, and do you have any questions for me again.
13:04:21 No, I think it got it.
13:04:22 Okay.
13:04:23 Alrighty, so first off, please start off by introducing yourself.
13:04:31 So my name is Jonathan Montoya.
13:04:36 What is your position or job title.
13:04:41 The source of supply manager for the water division for the City of Santa Fe.
13:04:51 How long have you been working for the City of Santa Fe.
13:04:56 I've been working for the city since 2012
13:05:01 So you've been working with the water department since 2012?
13:05:05 Correct, yeah, I started as a plant operator.
13:05:12 And then I started off actually on graveyard shift, working with the treatment plant, as a level for operator.
13:05:18 And then from there I went to the maintenance crew that takes care of the wealth, the wealth field and all the mechanical systems. And then after that I was the supervisor for the maintenance crew.

13:05:32 And then I moved up to be the source of supply operations manager.

13:05:42 Already, would you be able to explain the overall functions of both line shaft wells and submersible wells that I know both are used in the city.

13:05:54 Sure.

13:05:55 So, I mean, basically the whole idea with the well is to pump water on the ground refrain. So, with a submersible well, both the pump and the motor that drives the pump heart submerged in the water.

13:06:13 Down below the ground, could be 100 feet can be several hundred feet. The case of Santa Fe the groundwater. The water pumps settings vary from, you know, 400 feet all the way up to close to 1000 feet.

13:06:28 And the difference between a line shaft and the submersible like I said the submersible pump both the motor drives the pump and the pump are submerged in the water and lineshaft, only the pump is down under the water below the ground, and the motor

13:06:44 that drives the pump whether it's a motor or an engine like a natural gas powered engine or diesel.

13:06:51 We don't have any Diesel Power coming to Santa Fe, we have natural gas power but it's basically a big piston engine or an electric motor that has a drive shaft that goes all the way down to the pump, wherever it's, you know, wherever the pump setting is.

13:07:08 So those are the two differences.

13:07:11 Um Do you find that like one works like better than the other.

13:07:19 Know, they both work, really good.

13:07:31 Um, no, they both work, really good. Um, so, the own em expense on a submersible pump, I shouldn't even say expense I should just say, the maintenance required for submersible pump is less, but in the event that it does break you have to pull the whole

13:07:39 well out the whole, I mean not necessarily the case you know the well but you have to pull the pump.

13:07:53 You have to pull the motor, everything has got to come up. For a line shaft well, half of the mechanical portion of the well is located above ground, so you can back up the truck to it and you can work on it.
13:07:58 You know, you don't have to have a special crane and stuff to lift it out if the motor shorts out because typically when wells give problems like these.
13:08:10 It's like an electrical issue with the motor, you know, because it's all it takes a lot of power to or a lot, a lot of energy to to get it turned in and lift the water up out of the ground, so it's easier for us to maintain the wells that are above ground
13:08:27 and we have a majority of the world's we have our line chef pumps, there's only a handful that are some reasonable.
13:08:34 Yeah, that makes sense.
13:08:36 Yeah, that makes sense, um, have there been any like specific issues regarding the well so most of them are line shaft but have you noticed like for either one any like issues that have caused a decline in the water quality recently.
13:09:05 No. Stone, though, the type of well doesn't really impact water quality, so much.
13:09:00 and the groundwater. Um, it's fairly stable. There's, I mean, imagine the waters got to travel through the ground so it moves really slow. So, the quality, it doesn't change a whole lot, you know, it could change it from pump it a lot, and we draw the
13:09:20 wells way down and we create like a hydraulic gradient that makes the water flow towards the well for an extended period, then I could see you know there can be some quality changes but it's not like drastic compared to surface water supply, like Canyon
13:09:35 Road human plan for the BDD where the water quality changes, like, you know, very odd you know within the 24 hour period it could change quite a bit because the river is what's influencing the water quality there versus the ground locker for.
13:09:54 So would you say that like groundwater in the walls is more of like a reliable source when it comes to like the water quality.

13:10:03 It comes to quality. Yes.
13:10:18 And it, I would say that because of the depth of our wells, we're tapping into a water that's really deep really old.
13:10:16 And it's not really influenced me a lot of the pollution and stuff like that, of course, there's like naturally occurring contaminants uranium arsenic metals, you know, iron and things like that.
13:10:27 Those are like naturally occurring, but then there's also the external contaminants that, you know, pollution, and the way that that gets down to a well is, you know, somebody dumps it on the surface or near the surface and it's kind of percolate to the
13:10:45 soil or find a pathway to make it down to the well, and the depth of our wells is kind of like creating a big space of big barrier between any potential contamination.
13:11:07 You know some of the things we worry about is contamination near one of our wells, because since our wells are so deep that contamination if it were to make it near our wells, it can literally get to the well and if it's not correct, protected correctly
13:11:12 and can flow right down to the water supply.
13:11:15 So, the construction of the world is really important, you know, a lot of most wells.
13:11:22 When they design them, they put an annular seal around the world wealth, the column, but the actual casing. It's like a concrete grout that the pump in for several hundred feet to protect against that.
13:11:43 So,
13:11:43 let me know if you cut out too because I just got the unstable connection notification field. So, yeah, I can I can hear you perfectly fine I just saw the videos a little bit slow but it should be all good.
13:11:56 Um, so, seems like you guys have like a very like organized system with all of this, do you have any kind of like backup wells are like emergency wells in case there was like an extreme drought or like an emergency if something were to like break.

13:12:13 So, Santa Fe is unique there's for water supplies right you got to surface water supplies and two on water supplies in the city well filled in the Buckman well field.
13:12:26 And we don't normally run the Buckman well field, since we've brought sort of the Buckman diversion online so i would i would say we have the largest wealthy but the city has is a backup for an emergency for drought.
13:12:40 And we've been recovering it.
13:12:43 We haven't been using it and live in the groundwater recover. Basically since 2011 2012 when the usage of a BDD picked up.
13:12:54 So, there it's still the original we haven't drilled any new wells.
13:13:01 Since then, you know, since. Back in 2008, the city drilled for new wells down in Buckman because of a drought situation. And they, they drill Buckman wells 10 through 1310 1112 and 13.
13:13:18 And they were supplemental to the original Ninewells that were down there. And it was just because the groundwater level had gone down and declined.
13:13:28 And it was just do we were just taxing the law prefer dollar we were it was beyond it sustainable yield.
13:13:35 So since then, like, we've shift towards more surface water which is more renewable.
13:13:42 And I would say the buckman field is our backup.
13:13:52 All right. Alrighty.
13:14:04 I think so can you guys hear me. Yes. Okay, yeah. So, let me know if I need to be more specific, I can do this I could, I could chat your ears off about this stuff.
13:14:12 Um, as we keep the questions do get kind of more like specific, so I can keep going, or do you want to.
13:14:22 I can take over if you want.
13:14:28 I think, I think the next big question is, what do you think is the biggest concern regarding water supply for the next five or so years.

13:14:38 Over the next five or so years. Um, I would say contamination of our groundwater system is high on our list.
13:14:48 Um, that's not necessarily
13:14:53 like impacting the amount of water but it would impact the usable amount of water that we have, um, I would say, high on the list also is a forest fire up in the watershed low This doesn't pertain the groundwater.
13:15:08 If there's a forest fire up in the watershed, or across the Rio Grande up in the Los Alamos area that would cause a runoff heavy cash flow could potentially take out the.
13:15:24 The buckling diversion, or at least for a while.
13:15:26 It's just because you know if there's a flow like that and the cat treat the water is Ash and stuff in the river.
13:15:39 And that makes sense. And what do you think will be the biggest concerns in the next ten or twenty years?
13:15:43 Sorry.
13:15:52 Clearly the population growth would be like long term with a certain amount of water basically we know what the watershed will yield, we're limited on the amount of water that we can produce from Buckman diversion because of water rights.
13:16:09 And we are also limited from our well usage, just because it's not as sustainable as a have a water source, we may be permitted to pump.
13:16:23 You know, lots of water.
13:16:24 But you know what is it what are the effects of it to the ground water supply. And, you know, as the population. Right now we're, we're sitting Posey.
13:16:35 But let's just say, 50 years from now. You know, I think, conservation has really curved that a lot like the impacts of that you know our city has grown a whole bunch.
13:16:49 And we've actually been able to use less water, with a population increase. And that's just, you know, hats off to the conservation group because they they've really reduced the, the amount of water per person.
13:17:06 And or the demand on the system it's just it's all a conservation every all of it.

13:17:17 Yeah, that sounds really interesting yeah that was that was my next question about terms of lung, like, in terms of long term.
13:17:24 So what do you think, obviously for now.
13:17:26 It seems like the water situation is good and for the next, you know, 10, 20 years but as the population keeps growing and eventually it'll catch up with it even with conservation.
13:17:36 What do you think the answer to that is or is there an answer to it.
13:17:43 I'm not sure, you know, I'm not sure if there's an answer I mean if the population grows the amount of water that's available in the area.
13:17:53 Either people have to use less water, or we have to figure out a way to either reuse the water.
13:18:02 You know, that's probably going to be the next big thing is, you know, not, not necessarily like so waters, kind of like a one time thing that the way we think about it now you know comes out of the tap and it goes down the toilet, it goes to the, to
13:18:19 the treatment plan, the wastewater plan. Well what other uses. Does it have beyond that, you know, we use it to water the parks and stuff. But I think as the technology evolves and it becomes a more affordable, there's going to be more reuse systems and
13:18:36 this is kind of a this is a this is a bad word to the water industry but toilet to tap type of technology or potential aquifer recharge our storage and recovery type projects where we're using treated sewer effluent to then recharge the aquifers and then
13:18:58 utilize the actual ground, and it would have to be treated to a pretty high level before you can just discharge it and then have it go back through the ground and go through the whole cycle of chemo.
13:19:16 The earth is probably like the biggest water filter, you know, imagine the the treatment plant has a five foot thick Barker while you're talking 1000 feet before it makes it to our groundwater.
13:19:23 So, things like that. I'm sure will come into play as the resource gets tapped out more.

13:19:37 Yeah, absolutely. I think it's definitely something to look at not even just here but I think just in general as the world population keeps growing. I think there's a lot of places that are going to have that issue so I think it's probably something that
13:19:52 we should all get on top of.
13:19:54 I think that that kind of ties into the next question in terms of you know water can quality, especially if you're going to like toilet to tap, like you said, there has to be a lot of chemicals or something, treatment that's done so you think of it, is
13:20:08 there any water concerns in the next 5,10, or so years.
13:20:15 In regards to quality.
13:20:18 Yeah, I would say.
13:20:21 So if we look at it from the aspect of the, of the wealth probably not so much.
13:20:26 Unless the drinking water standards got more stringent and or more strict and certain constituents got more heavily regulated, then there could potentially be an impact.
13:20:40 similarly to the surface water plants as they get older, you know they're designed for a certain efficiency and a certain amount of reduction and contaminants, and if the regulations become more strict, which seems like they always get more strict and
13:20:58 ever get less strict right.
13:21:01 You know, we may be come to a point where money will have to be appropriated or upgrades will have to be done to to retrofit our treatment plans to meet the new regulations, and I mean we've, we've experienced this already once before, but the Canyon
13:21:17 Road water treatment plant. The plant was basically built and designed and built in the early 70s right around the cusp of the Safe Drinking Water Act.

13:21:31 And as time went on, the regulation for timidity.
13:21:40 It got strict, stricter. So turbidity is the measure of how cloudy or how turbid the water is. And the reason that it's a regulation is because that can hide potential bacteria or pathogens they can hide in the in the cloudiness to where we can't see
13:21:57 them, or can get an accurate measurement.
13:22:00 So, you know, we had to do a retro fit in early 2000s.
13:22:04 Redo of the fluctuation segmentation process to make the planet more efficient.
13:22:10 And so, it's inevitable, you know, we'll have to do it again. And once those things don't last forever.
13:22:21 And did you have any sense of what do you think that's going to happen and, which treatment plan, you think we'll have to get done first.
13:22:32 I'm not sure about when it would happen, but definitely Canyon Road would be the first one that would that would. It's a, it's a, older technology.
13:22:43 So it's a conventional water treatment process versus
13:22:50 a more advanced water treatment process at the Buckland division has with membrane filtration. And, you know, basically there's not there is chemical addition at the button diversion.
13:23:03 But it's not as heavily relied on because the filtration process is so tight.
13:23:09 Not a lot of contaminants can make it through the membranes.
13:23:13 And so at the treatment plant that Canyon Road it's different. It's a dual media gravity filter. And we heavily rely on the flock elation sedimentation process, which, you know, it's basically addition of a chemical that, that creates a charge in the
13:23:33 that makes the particles stick together, they get heavy once there's a little bit of mass involved, they settle out to the bottom. And that's like the bulk of the process and the filtration portion is really like polishing, you know.

13:23:50 So, yeah, the filtration portion would probably have to be looked at. Definitely at the Canyon Road treatment plan.
13:23:57 What's different about the two is the incoming raw water quality at Canyon Road is way better there's a lot of control involved, there's two reservoirs upstream of that treatment plan, we can control the flow.
13:24:13 So, typically what quality changes when you increase or decrease the flow you know if it rains you look at the rivers and they're murky and money, you know from run off, or we don't really have that issue, because we're taking water right off of the reservoir
13:24:26 and we have, you know, 600 acre foot couldn't at Nichols, and it.
13:24:37 There's time there for durability and whatever would run off to basically settle out before we're drawing it off, off the far end of the reservoir. So we're lucky in that aspect.
13:24:56 Awesome.
13:25:00 Think wouldn't go to the next question.
13:25:03 So, what impact have, you know, especially droughts, but also other natural disasters, forest fires or anything else had on the local art supply in the past 5, 10, 25 years.
13:25:19 Well,
13:25:23 there really hasn't been any major impacts, other than. So, drought for instance you know this last year we were in pretty good drought.
13:25:34 And then, back in the early 2000s there was a major impact and that's when we were over popping the Buckman well filled.
13:25:41 And we really taxed the amount of water that we could sustainably yield out of that wealth build.
13:25:49 You know, since then that's, that's one of the main reasons why Buckman diversion and supplemental wills, which are located more close to that they were installed.

13:25:59 So we wouldn't hit that little so hard, other natural occurrences that have impacted it. There was a forest fire.
13:26:10 In Los Alamos, I believe it was in around the 2010 2013 realm.
13:26:17 I don't recall the name of the fire but definitely there was a brief period of when, after the fire, there was concern for runoff, whether they're going to be an impact or on an ash clue.
13:26:42 And, you know, there were a couple instances where we shut down the version. Not for extended periods, but it was more precautionary
13:26:48 other other natural things that have happened in the recent times, I mean we've had a couple of earthquakes, and, you know, within 60 miles of the reservoirs.
13:27:04 The two reservoirs that we have the earthen dams, and they don't like earthquakes, so it didn't impact our production, but it puts us into an emergency operation mode where we could potentially have to release water to to get pressure off of them.
13:27:21 So there is not an emergency event or a potential damn failure.
13:27:28 And I would say those are like kind of highly unlikely occurrences but I mean how do you predict that type of stuff that just happens and.
13:27:44 Yeah, absolutely nothing especially with earthquakes, it's very hard to predict.
13:27:50 You would think in the mountains, we have to worry about earthquakes for but
13:27:57 reservoirs upstream of Santa Fe on the Santa Fe server. You know there, they were designed.
13:28:04 Nichols was built in the, in the 40s and McClure was originally built in the 20s and then again raised in the 50s and then you know it's gone through several changes but it's still the original damn money.

13:28:20 And, you know, back in the days when they were designing those. I'm not sure that was too much of a consideration or maybe the knowledge at fault zones and things like that, or what just for the data wasn't there to really consider that type of stuff.
13:28:35 But let's say for example if there was an earthquake.
13:28:46 And there, there was evidence of some type of shift in the movement of the dam, or we had to release water basically we would be limited either route either have to let the stored water that we have go to prevent the failure.
13:28:55 And then once that happens, I mean, we would likely be limited to the amount of storage we would have, because you know you wouldn't want to fill the damn back up if there's damage that occurred or movement, there would have to be inspection likely repairs,
13:29:11 things of that nature because they were built so long ago you have to bring them up to code up to par. So there's a lot of stuff happen there to be an impact for sure.
13:29:25 Yeah, absolutely. I think we're I think we're all hoping that doesn't happen this
13:29:33 likely.
13:29:35 I think the next question.
13:29:37 I think it's a pretty timely one with everything that's happened is Covid.
13:29:42 Has anything like that had any impact on the water, whether it be demand water supply water security or anything else regarding the water
13:29:52 demand.
13:29:56 No.
13:29:56 No. I know a lot of the commercial demand shifted to residential demand, but the overall demand on the system didn't really change.
13:30:08 It didn't change anything on production.

13:30:12 What it did do is make it pretty interesting and difficult to, to keep the treatment plans operational there, they're staffed 24 seven and water operators are really hard to come by, it's it's a it's one of those certifications that's required by state,
13:30:34 that you have to have a certain level, based on the population.
13:30:38 And I, in our treatment plan, there's four lead operators, so it was what we were, we were working so hard to keep everybody separated.
13:30:50 Shift changes didn't take place in person. I mean, we had to come up with all kinds of different schemes and shift schemes to keep let we were trying to keep less than five people in the building at any one time.
13:31:05 workstations got rearranged like that. There was a big impact in that portion
13:31:12 protocols for cleaning the workspaces me away when when Greg everything work, but man we were learning from day to day for sure.
13:31:24 As far as impacting the water though.
13:31:35 It didn't really make a difference to the end user, we probably didn't know what was happening behind the scenes for sure and what.
13:31:35 In the event that somebody did get sick though, we could have been really, really hurting them, because you need those certified people to manage the treatment plant and operate the controls and look after the system.
13:31:48 So it was super important to us to keep everybody safe, and not sick.
13:31:59 Yeah, I think I think that's a very important thing.
13:32:04 Really for any job but especially for something like that we need such a specific person.

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13:32:09 And in terms of now impact is it.
13:32:14 It's not as strict now since the vaccinations, that rolled out.
13:32:32 But there is still lots of, you know, clearly there's so masks wearing in the building.
13:32:39 We no longer accept outside visitors unless there's an appointment.
13:32:44 All the external doors are unlocked, you know, that we we don't have a delivery driver from UPS or FedEx or some mail service, just rolling into drop off packages, you know, little things like that, caught us completely off guard and sick.
13:32:57 You don't realize we're up in the canyon behind a closed gate, how many people were actually coming in and out.
13:33:03 So we kind of had a title of that situation.
13:33:09 Yeah, so I would say it's like it's hard to tell whether we're like already used to it because we had to do it for the whole year that everybody was on lockdown.
13:33:19 And now we're just kind of already acclimated to be like that or, or if we've kind of mellowed out a little bit, not so much I would say there's, there's a limited amount of staff, some, some of the admin staff we're still working remotely part time.
13:33:42 It says that answer your question.
13:33:45 Yeah, absolutely.
13:33:49 I was kind of off script, but I'm just kind of curious as to you know what it looks like now.
13:33:56 Yeah, no, it's.
13:33:58 We have to change a lot of the, you know, it was really difficult was, you know, doing like safety, safety meetings and this zoom platform helped out a whole bunch.
13:34:07 But how do you do a hands on training with like let's say it's fall protection confined space entry or, you know any of that type of stuff. It's that was, that was kind of a trip because we migrated more to like an online based training, little training

13:34:26 courses little online webinars and things like that.
13:34:30 But the hands on aspect of it is like okay, we should do these like a tabletop exercises and that would be like functional exercises of.
13:34:39 We need to go get are confined space gear and make an entry.
13:34:44 Those were tough to do because you can only do a limited staff you couldn't we couldn't have a full on staff meeting with 20 people there.
13:34:52 You know, we had to do a little groups.
13:34:55 So,
13:34:58 yeah, I didn't think about that they can have like, you know, like it's just such a hands on job. So, to not be able to be hands on is like, then what do you do.
13:35:13 Okay.
13:35:27 I think it's really accessible.
13:35:31 I think navigating to where it is, is not so easy.
13:35:35 All the water quality stuff is available on the seat on the state's Drinking Water Watch website.
13:35:41 All of our consumer quality reports are available on the water division website.
13:35:48 But it's not very easy to navigate, if you really look and you dig in. Yeah, it's all there, everything's there.
13:35:55 You can find our weekly samples on the state website you can find out all the metals and nitrates for the wells, you can find out.
13:36:06 Pretty much everything for the water is all public knowledge, it's just it's not easy to find.
13:36:18 Yeah, I think in our I think our in our experience I think we've said the same thing.
13:36:24 You may associate even just like the Santa Fe government website, because we did a lot of research before coming here and there's, there's a ton of information there.
13:36:33 It's just not a super well setup website so yeah I think a lot of it needs to be updated to, you know, there's.

13:36:43 It seems like there's dead and links, you know,
13:36:48 you know, you can find it, but you may even get two separate forms of information.
13:36:57 You just got to find the most up to date one. It's almost easier to just use the search top of the search bar at the top and do a search for what you're looking for, versus trying to navigate through to find to find stuff, you know.
13:37:14 Yeah, I think that's, that's pretty spot on, in terms of what we've seen hands, hands on. So, yeah.
13:37:25 I wish we could fix that, but it's not exactly what we're doing, but yeah.
13:37:32 So I think that I think you'll find all know the violin but now I think a lot of Canyon Road questions.
13:37:41 If you could kind of explain from the starting point where the water comes in to the treatment plan to where it exit the plant, I could think it's like kind of like, What is that path.
13:37:53 What does the water go through in terms of going through the treatment plant.
13:37:58 Okay.
13:38:12 So, the water starts at Nichols reservoir, it actually starts in the sign of the watershed all the way the top goes from McClure reservoir to Nichols reservoir and Nichols reservoir, there's an inlet structure with a pipe.
13:38:16 It's a 24 inch pipe that feeds water and you can enroll the water treatment plant at the treatment plant and there's a, there's a modulating valve that controls the flow into the plant, and there's a meter there.
13:38:32 So, the water goes through that valve.
13:38:35 Whatever the desired flow rate that the water treatment plan operate whatever the operator or whatever the demand is calling for depending on what the city demand is we'll adjust the flow, all the way up to 10 million gallons a day.
13:38:47 That's how much water Canyon Road can produce.

13:38:53 So, once it goes through that valve.
13:38:55 It makes its way to the chemical injection room.
13:38:59 And in that area is the first step so it gets it gets chemicals added to our primary goal.
13:39:07 And we use is aluminum sulfate, a trading is album, just call it out.
13:39:14 Depending on the raw water quality we can change the the pH there.
13:39:18 We can raise the pH or lower the pH, either with the addition of lime or.
13:39:36 But we wouldn't get this out to form operation, but at times when we need to.
13:39:44 will raise the pH.
13:39:46 So we can add more coagulate, one of the side effects of adding the elements it lowers the pH, so it has a healthy wants it wants to operate in a range between, you know, 5.7 5.82 6.2, that's it's happy range that's where the regulation starts to happen.
13:40:02 So the water gets the argument.
13:40:06 And it makes its way to the rapid mix chamber.
13:40:09 Basically the rapid mix chamber is a large propeller that's driven by a pretty, pretty high horsepower motor, and it just mix up the chemicals in the water together once it leaves that chamber.
13:40:25 It goes to the population basis.
13:40:29 So, it gets quite violent at it gets mixed and goes to fluctuation. And there's three population base with his flock A flock B flock C.
13:40:41 There's another mixer, and it says a lesser speed, and then the water makes its way through a kind of a pathway that controls the flow that detention time basin is real kind of calculated, then it makes its way to Foxy.
13:40:59 And there's another mixer, that's slower, and then Foxy it's even slower. And so, this progressively Slower, slower mixing it promotes all the little particles that you can't see in the water.

13:41:14 They get mixed with that album and the album creates a small charge. Sometimes we add a little bit of polymer which polymers had some, the ones we add either a positive or negative or have both.
13:41:28 And they'll make these long strings that that the little particles can stick to.
13:41:33 And and as the as it gets progressively slower and mixing those particles get bigger, they stick together they get bigger they stick together, and they get these little flakes of flock, once it leaves the flock mixers, it goes to the clarifies that clarifies
13:41:50 is for the sedimentation portion on the process happens, the detention time is slowed way down the velocity of the water slowed way down.
13:41:58 And that's to promote the settling of the water of the particles in the, in the larger basin.
13:42:15 On the bottom of the basin is, it's a conical shaped base in its square, but the floor is shaped like a funnel, I guess. And there's a rake that slowly turns and it squeegees, the, the sludge, the particles that have already spent together and so now
13:42:24 it squeegees those towards the center, where we can pump them off, and then we'll handle a little further new water than then eventually, you know truck the dirt to the landfill.
13:42:39 So, once the water is in the, in the classifier, and the particles are certainly not the cleanest water is on the top top.
13:42:49 And so, because there's water flowing into the clarify, it's constantly wanting to fill. And it's the cleanest water is skimmed right off the top of the classifier and channeled into the treatment plan, filter room, or the filtration happens.
13:43:04 Know. Once it's in the filters, the filters are dual media. They work very similarly to like a water pitcher that you would pour water in filtered water, there's just anthracite top and send on the bottom two layers.
13:43:21 The water gets there. The anthracite help knockout and he smells.

13:43:28 The call evil the carbon absorbs smell it wants to stick to everything right. So the carbon carbon absorbs smell older can help with color for the majority of the filtration is happening on the sand.
13:43:43 Once it goes through that filter media.
13:43:48 It goes into our clear well, which is that located directly underneath our filter be.
13:43:54 That's where we add chlorine to disinfect the water. And so once we add chlorine.
13:44:03 There's a certain amount of contact time that happens in that, in that clear well and it makes its way outside to are finished water tank finished water tank is 2 million gallons and size, and
13:44:17 basically it's all gravity fit so the more water you bring into the treatment plant. The, of course we have to adjust the filter flow rates and things but basically all depending on how much water you bringing in which makes it a really efficient water
13:44:32 treatment plant, it's all gravity based there's not a lot of pumping going on. There's no pumping to go through the filters.
13:44:39 It's downhill, it's set up to where once it's in the finished water tank it's basically ready to go for distribution.
13:44:50 And that's it a little bit of pH modification at the end there, you know, when you add according to water it also lowers lowers the pH.
13:45:00 Because, you know, chlorine creates type of cloris hydrochloric acid that's what kills, that's what kills the pathogens, killing all dissolves the little outer layer of whatever the little any potential bacteria or any bugs that are in there dissolves
13:45:13 them and just burns them up so we add soda ash, to bring the water pH back up to 7.5 is our target level.
13:45:26 Before we send it up to the distribution system reason we target 7.5 is.
13:45:32 Well, clearly, we don't we don't want to have acidic water, it'll be detrimental to our pipe systems.
13:45:39 But we want to have a little bit of a softer water.
13:45:43 It's just easier for people to handle.

13:45:46 You know, most, most people's chemistry or your neutral you know seven, seven point or pH is neutral so that's the healthiest right there. You want to go too high because then I could be bad just as well but
13:46:03 that's what we target 7.5.
13:46:14 So then, for the items that are removed or whatever is removed from the water, what happens to that afterwards and where does that end up going.
13:46:24 Okay, so once the once in the sedimentation process and clarifies that sledges squeegee like I said towards the center and it's pump down to another base in order to further
13:46:41 clarify it said there's longer detention there.
13:46:44 And the sludge really good thing we call them gravity fixers. They're really deep.
13:46:51 They're much deeper than verifiers, and that's just to aid in the all the gravity that that's added and the height of the water aid and compaction of the solids bottom, and the rake further skins and takes even thicker sludge.
13:47:09 And then we will you clean this water again, it's taken off the top and recycled back to the head works of the treatment plan.
13:47:19 The one thing I didn't mention about the whole treatment plan, at the beginning was that, whereas Zero Waste plan. So, the only sewer connection that we have is basically for the kitchen and the restaurants.
13:47:31 All the floor drains, all the Analyze your water, everything in the residuals process is all based around further D watering and separating the water so we can recycle it.
13:47:46 And, and then the sludge he just gets thicker from process to process until we centrifuge it out.
13:47:52 And, and haul it off so after the gravity thickness, we pump it down and we go to bat.
13:48:05 Our centrifuge batch tanks, basically it's just a smaller volume one of sludge, and by that point, the water, it looks like really thick chocolate milk, and it's it's a small volume it's not a huge, huge volume.

13:48:17 There's controlled pumps that pump those into two centrifuges, and it's exactly what it sounds like there's a drum. It spins really fast sludge enters in one side, and the water gets slung out to the outside.
13:48:36 And the water, there's like a, there's fins inside that direct the water to one inch, and the solids out the other edge. And so, once the solids get extracted they drop onto a conveyor belt and he goes into the back of a dump truck.
13:48:50 And all it to the landfill.
13:49:00 Okay. First, I think I think it's really cool. Zero Waste plants that really gets like every possible drop of water out.
13:49:12 It's, It's quite a I think it's kind of a feather in the cap for for the city and for everybody at the time because it's an old plan. I guess it was built in the 70s and it's come to a couple retrofits, and
13:49:28 I think in the 70s if they were to know that we were zero waste and not not discharging water back to the river.
13:49:38 It would be like really how do you guys do that he played. bhu
13:49:48 I think that's incredible.
13:49:50 So then, approximately how much of Santa Fe's water comes from Canyon Road treatment plant.
13:50:01 Um, I guess it depends on the year.
13:50:05 If it's a good run off year there would be more.
13:50:09 I would say up to half.
13:50:12 I would say on average, maybe a third of the water.
13:50:18 But I'm a good year behalf so one year before last we treated 5000 5,039.8 acre feet of water, we were permitted for 5014, we almost hit our target for we actually shut it off just a shade early because we were afraid of going over.
13:50:39 But we basically hit our full permanent alignment and the total usage for the city was 9008 feet. So we actually produced more than half of the city's water that year.
13:50:59 Wow that's incredible.
13:51:01 And so then, so after its treated the treatment plan you store it in the tanks and then from there, where does it go.

13:51:10 Alright so, after it goes through the treatment plan, goes to our finished water tank and it makes its way off into the distribution system immune located in the distribution system there's various storage tanks.
13:51:25 And they're all at different elevations. And so the city's water system is is designed in a way that there's various pressure zones I mean it's not necessarily designed that way it has to be that way because it's the city is located on a slope.
13:51:42 Those roughly 1000 feet of elevation difference from our highest customers to our lowest customers.
13:51:47 So in between there there's several pressure zones with elevation comes water pressure, every foot of water column B equals about roughly half a pound point 433, pounds per square inch.
13:52:04 So, after a couple hundred feet you're you're already going to exceed the maximum allowable pressure for that's usable to people and their plumbing systems, I mean, if you had 200 psi of water pressure in your house if I not make for a fun challenge,
13:52:19 you know, so.
13:52:22 know, so. So they set it up that way and there's various pressure zones and then there's pressure reducing valves, as you go down further and further down into the system.
13:52:35 And there's storage tanks, all located along that way. And that's just to have storage to supply the demand in various areas.
13:52:41 And not all the storage is located up on the top, because then they wouldn't it wouldn't make for a very efficient system, that way either because then you have to transfer the all the city of demand from the top to the bottom.
13:52:54 So it's basically set up in stages, you know, some storage here let's say we have 10 to 15 million gallons of storage towards the top, and we have another four to 5 million and we have another you know 5 million.
13:53:10 The total storage that the city has is, excuse me, 32,500,000.

13:53:21 finished water storage.
13:53:19 So, although some peak days can exceed, you know, 1516 mg.
13:53:27 They are average demand, you know, over the throughout the years, you know, let's say 10 MTD that's that's three little over three days of finished water supply.
13:53:39 On average, and that's kind of what we target, we, we try to have three days of water storage in our system.
13:53:49 So yeah, storage tanks, then from there, it makes its way through the network of distribution pipes goes through the customers meter and then the customer drinks it or industrial users, these are commercial users use it for whatever they're doing with
13:54:06 it.
13:54:13 Perfect. And I think we have one or two more questions.
13:54:17 So, what is the role of the operators office in the cannon nurture and plants.
13:54:26 Right, so the operator. There's various levels of operator.
13:54:32 The lead operator's role, he, he or she is basically operating the entire water system.
13:54:43 He's in charge of the entire water system there, they're operating the production of the water at Canyon Road, the treatment process, making sure that that is in compliance with, with all the state and federal regulations.
13:54:58 They're making sure that there's adequate supply in the, in the storage tanks.
13:55:05 They're also monitoring the production of any of the wells, all the data collection. So all the water that we're producing is also metered.
13:55:14 And we have to we have to report whatever water we're diverting or pumping or producing we report to the state engineer so they also have to do all the compliance reporting isn't there's a lots of stuff to be done in that, in that role.
13:55:32 Now that we also have other operators that take care of all the compliance sampling.

13:55:36 We, on a routine basis we, in a one month period, we go to all the remote places of the water system and we measure for chlorine residual back.
13:55:49 We take it back to your logical sample, and we cover the whole system within a month, because of the size of the city. You know we're taking anywhere from, you know, 85, to 96 samples, a month.
13:56:07 We also have a three year basis we check for as bestest in the pipes, the samples for that. And we also check for lead and copper.
13:56:18 They're not on a routine, because the frequency required by lives not there a little bit more special have a test to test for those constituents.
13:56:31 But yeah, it's. There's a lot going on up there.
13:56:36 There's lots of.
13:56:39 They're also making calls like for, like, we try to work on all little efficiency things power consumption. Can we pump off peak.
13:56:48 Electricity is cheaper.
13:56:50 During the nighttime than it is during the day. So, you know, we try to do a little bit of forecasting, can we can we utilize our storage during the day pump at night, or will anticipate whether the demand.
13:57:03 Let's see, we know that the parks are going to irrigate on a certain day will will try to forecast the water usage so we can have more storage in our system, rather than taking a big loss.
13:57:18 Now there's a lot there's lots to it, they're regulating the irrigation flows for some of the sections and irrigation ditches.
13:57:27 The river flow is being controlled out of the control room there.
13:57:35 And I stuff, lots and lots of
13:57:46 very stressful job.
13:57:48 We can be here.

13:57:59 I'd say the ultimate. Ultimately though their role is to make sure that we have adequate safe supply of drinking water for the citizens of savvy you know that's what it boils down to know from 1000 foot perspective that's that's what they're doing they're
13:58:06 they're making sure there's plenty of water and that it's safe to drink,
13:58:14 obviously a very important job.
13:58:19 That's all of the
13:58:25 night.
13:58:25 You went on mute.
13:58:27 Oh yeah, you can hear me now.
13:58:30 Yep.
13:58:31 Alright, so that's all those kinds of questions we haven't just have one more kind of random quick random question though just just out of curiosity was the photo in your background.
13:58:42 Oh that's um that's Nichols reservoir when they were building it.
13:58:48 That's dead in 1942.
13:58:51 So, like this, let's see we can see this right here.
13:58:55 This is the inlet structure. So this is like this whole area here is the inside of the lake. That's underwater. And this is the pipe. It's about 80 feet or was, you know, we now you guys went you guys saw it, it was like it's lying down on the damn
13:59:12 face now. It used to stand out in the middle of the lake. And there's valves like there's about here, it was about here and it's about right here at the bottom.
13:59:22 I feel like a weatherman doing this.
13:59:27 But uh, so that's how we would control the flow goes through here and then there's a pipe that goes completely underneath the reservoir and that's where it comes up to the river.
13:59:40 Because he although all the old cars, you know.
13:59:44 Yeah. That's incredible.

13:59:47 What did you do where'd you get that photo from, um, I have I have a few of them. I'm not even sure where I got them but I must have about, maybe 35 photos of when they were building the dam.
14:00:02 Wow.
14:00:06 Yeah, that would be amazing if you could send that to us.
14:00:10 Now, even if we don't use it that's just amazing to see.
14:00:18 Yeah, that'd be much appreciated.
14:00:20 Have you guys heard the stories already about the old reservoir the two mile, two mile reservoir. That was that was downstream of Nichols, right around the can get in front of Canyon Road there was another reservoir there.
14:00:33 And it was even older it wasn't a very big reservoir I think it was 200 acre feet or something.
14:00:39 But when they built it.
14:00:40 They didn't really have a lot of machines that to like compact the dirt. So they use the, they had a sheep herder, and they would they flooded, they flooded the ground, and then they have the guy just take his sheep and goats back and forth across and
14:00:58 then they would add more dirt would just do it in lifts, I'm like no joke there's pictures somewhere I'll try to find them. And there's this like all these sheep on top of the dam and they're just using them to tamp down the down, I think they built it
14:01:13 in like 1912 or something like that. It's no longer in use that to come down with it took it down in 1991 that's how long it lasted.
14:01:22 Yeah.
14:01:23 If those photos that would be much appreciated. I know one of our videos, we're looking to do like kind of the past, present and future of Santa Fe water so we would definitely want to include some of those pictures and that'd be really cool.
14:01:36 Cool, so I'll send you guys what I have.
14:01:42 great story also did not know that.
14:01:47 Thank you for telling us that
14:01:51 it is too I don't want to. I don't know if you have anywhere to be we don't want to take up too much for your time.
14:01:56 I'm good. You guys have questions and shoot Oh my, I'm I my schedule is pretty free today so I have stuff I could do. I like talking.
14:02:12 I personally don't have anything else. In terms of questions, although I don't know if anybody else does or if there's anything else that you want to talk about there that you think would be good material.