Channing Schoneberger
Hailey Baker
Jessie Davidson
Tammie Garrett
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Assignment 4

Rio Verde Policy Brief

This policy brief will look at 4 different key elements when trying to propose different solutions for Rio Verde's salinity levels in its waste water. The first perspective will look at Environmental aspects and give proposed policy suggestions. The next Perspective will be the economic perspective and also give a proposed policy solution. The third perspective will look at the social issues, while also giving a policy suggestions to counter such issues. Lastly this policy brief will look at general policy that can be implemented throughout Rio Verde to help with their current waste water salinity levels problems.

The Environmental Perspective

After several meetings with the community leaders of the Rio Verde Community, we were asked to focus on one specific problem, salinity levels in the effluent water. This issue is of a significant problem for the community due to the closed system waste water processing and use the community is set up with. The goals and objectives of this section are to discuss the environmental impacts and possible police implementation that may reduce or eliminate the use of water softeners that use a brine medium to create an ion exchange.

Goals and Objectives

According to Mike Kleminski, General Manager of the Rio Verde Utilities, Inc., approximately 291 million gallons of water is used inside residential and commercial buildings. Of that use, it is estimated that only 42 million gallons, or 5.8%, is used in the interior of the structure. This use would include but is not limited to; flushing toilets, taking showers, doing

laundry, washing dishes, cleaning the house, etc. Basically, any use that would lead to water exiting the structure through the sewer system. This would also include the regeneration cycle of any water softeners installed in the community. It would be reasonable to conclude that approximately 42 million gallons of effluent water is therefore process by the utility company as well.

As we have learned throughout the course of this project, a standard water softener can use between 25 and 200 gallons of water and between 8 and 15 pounds of salt during a recharge cycle and this recharge takes place approximately once a month. If we were to take an average of these numbers and apply them to the community statistics, each water softener would use approximately 112 gallons of water and displace 11.5 pounds of salt. If we also assume that one third of the residents use water softeners that would result in an approximate 52,200 gallons of water used each month for recharging water softeners. That also means that 5,313 pounds of salt is being used in the recharge cycle of a water softeners each month and eventually finding its way into the reclamation process at the water utility company. Although our research has also found that most reclaimed water processed from effluent discharge is usually a high standard and cleaner than water taken directly from the community wells, the only problem is the salinity.

Salt has an extremely high solubility rate. This means that sodium will breakdown to extremely fine particles in high concentrations making it both extremely hard to capture in a filtration process and high quantities can be transferred in a solvent (water) at any given time. Most utility companies are not equipped or able to afford the desalinization equipment necessary to remove salt from water. As discussed in our meetings with both Mike Kleminski and Sal Celona, the community of Rio Verde captures and processes 100% of the effluent water and uses it exclusively on the two golf course. From this we can reasonably conclude that most if not all

of the salt found in the effluent water is finding its way on to the golf courses. That's approximately 177 pounds of salt daily. Unfortunately, this has created two problems for the community; the requirement of additional chemicals to mitigate the effects of the salinity on the golf courses and the implementation of current policy to use portable exchange units (P.E. units) in place of traditional water softeners.

The use of water containing high salinity on the golf courses has a cumulative effect. This means that each time the reclaimed water is used to irrigate the golf course, additional salt is added to the previous irrigation. Although the salinity of the water allows the salt to migrate into the ground, this has a cumulative effect and is creating damage to the grass and vegetation. To mitigate this problem, additional fertilizers are used to counter the effects of the salt. As salt levels increase, so too does the use of additional fertilizers.

While the use of Portable Exchange units allow the community to stop the recharge process and discharge of salt into the effluent water system within the community, this creates an externality. Meaning, the community of Rio Verde is creating a waste product, shipping it off site, and requiring someone else to take care of it. Portable exchange units are still water softeners that use salt for the primary ion exchange process. The only difference is the recharge cycle takes place at a location outside the community of Rio Verde. This means a community or region is taking the responsibility of allowing the recharge to take place in their community and they are left to handle or mitigate the increase in salinity in their effluent or waste water system. As history has shown, most externalities create additional problems for the community or region accepting the waste product.

Policy and Recommendation:

Currently, the community of Rio Verde is discussing four possible policy options; 1) No water softeners, 2) Replacement of existing water softeners, 3) High efficiency “Smart” water softening units, and 4) Use of Portable Exchange Units.

A policy of “No water softeners” will most likely have the unintended consequence of detouring future residents from purchasing in the community. As an active retirement community, a considerable number of residents come to the community during the winter months. During the summer months, those same residents may travel back to a region where hard water is not an issue making water softeners preferred for their stay in Rio Verde. Others may not like the possible higher maintenance and upkeep of household appliances and other deleterious effects of hard water.

Both the second and third policy options, replacement of existing water softeners or use of high efficiency “Smart” water softening units do lesson the amount of salt, but salt is still being use. While the replacement of older, less efficient systems will always increase efficiency and performance, even new systems still use salt as the primary catalyst for ion exchange. Research has shown that potassium can also be used for excellent ion exchange but, the problem is cost. Most suppliers of potassium charge on average four times the cost of salt.

The last policy, Use of Portable Exchange Units, will remove the salinity problem from the Rio Verde Community. However, as previously discussed, this creates an externality. As a community that is trying to promote sustainability, the creation of an externality is not a sustainable solution. That will require a solution that takes care of the current problem without creating one or increasing a problem for a different community.

Our recommendation is a policy that will remove the salinity from the waste water system and not create an externality. Our policy is to use the technology of the Nuvo System.

This system use chelation technology to soften the water. This system does not use salt, electricity, or water to recharge the system. Our research has also found the monthly cost comparison has negligible higher cost then standard water softeners including the cost of salt. For this, we recommend a policy that provides an incentive to residents to convert to a chelation technology driven water softener.

The Economics Perspective

The Problem

At the beginning of this project, the economics of the current state of the Rio Verde waste water system was based largely on the costs of its environmental impact. The main issue involves the salinity in the reclaimed water that is used for irrigation on the community's golf courses is also an economic issue, as the added salt slows down growth of the grass, which incurs additional watering (and pumping of that water). The cost of pumping wastewater for that irrigation purpose is highly expensive (Middel, Quay & White 2013), making the additional pumping to offset the salinity even more costly. In addition, the salt from the reclaimed water can cause buildup in water infrastructure (pipes, valves, etc.) (Middel, Quay & White 2013), and fixing or replacing these affected parts to keep the system working can get expensive as well. Common solutions such as desalination of the already salt-filled reclaimed water are too cost-prohibitive for this community to consider, and since the community operates in a closed system (served by privately-owned Rio Verde Utilities for both water input and output needs), it requires a solution that uses systems already in place. With this constraint, it is important to note that part of the treatment process that costs the most to the community is the operation and management stage (Muga & Mihelcic 2008), as opposed to the water softening stage, but the operations and management functions are largely engrained in Rio Verde's closed system, and so is less

available for intervention. Intervening in the water softening stage results is more for the goal of achieving a truly sustainable system.

The Solution

To solve the problem of high salinity on the golf courses, the Rio Verde community has decided to switch to portable exchange water softeners. In this scenario, a home uses a water softener pod that can be exchanged for a fully recharged one after sufficient use; the company controls the portable exchange units, and charges the residents (or community) a monthly fee for the exchange service. A water softener tank itself (which the company would be replacing every month) costs around $600 (according to top retailers such as Lowes and Home Depot), and the monthly fee paid by the customer comes in around $30 or $40 (nuvoh2o.com). However, since the units themselves are owned and controlled by the water softener company, the cost of those units is not seen by the residents of the community. The Rio Verde chose to move in this direction because it removes the threat of salt from the recharge process from the actual community grounds, since the recharge process is conducted off-site at a facility owned by the water softener company (in this case Rayne Water, a privately owned company operating in Arizona). The problem with this process is that while it removes the externality from the community itself, it does not address the root cause of the problem (using water softeners as a way to reuse reclaimed water) and instead simply outsources the externality to another location. From a sustainability perspective, this does not solve the problem; rather, it moves the problem to another place for someone else to deal with, meaning that there is still salt contaminating an environment somewhere.

To counter this externality, our group came up with the proposed solution to switch the Rio Verde community to a salt-less water softener system (an example would be NuVo H2O, a

private company) that uses more environment-friendly materials in its pod construction and softening process. The units use a process called “citra-charge”, which uses a form of citric acid to bind to the unwanted minerals in hard water (nuvoh2o.com). The units are installed directly in the home, and cost around $600 (similar to the cost of a portable exchange unit) (nuvoh2o.com). They then require a filter replacement every three to six months, with those filters costing around $80 (nuvoh2o.com)

The social Perspective

The Problem

The Rio Verde community has asked us to develop a system that will solve the salinity issues associated with their current use of reclaimed water to irrigate their golf courses and help them monitor their current sustainability initiatives and help them make adjustments in the future. However the use of reclaimed water has received a largely negative response from the public and as a result has been a difficult practice for which communities can effectively advocate. The largely adverse public attitude towards the practice has been the hardest challenge for reclaimed water to overcome, so changing this attitude is now one of the most urgent tasks communities like Rio Verde are currently facing. Many people doubt the safety of reclaimed water and think it should not be used in any instance where there is a risk that humans may come in direct or indirect contact with it. People do not believe the water is as sterile as it should be for its intended purposes. Middel et al state that, “A big misconception among the general public is that reclaimed water comes straight from a waste facility to their homes as the phrase “from toilet to tap” suggests.” Many studies have also shown that people believe that the institutions in charge of monitoring and treating the water will not be able to prevent the huge perceived risk of contamination. Establishing and maintaining a trust in authorities to manage these risk factors is

critical in public perception of reclaimed water use (Ross 2014). Without this trust a community cannot hope to move forward with such a controversial practice as reclaimed water use.

Fortunately for the Rio Verde community most of these issues have already been addressed. The community already uses reclaimed water to irrigate their golf courses and it currently has a monitoring system that monitors the concentration of other organic materials and keeps track of salinity levels in the reclaimed water they use. They have also clearly established trust between the community members because they have all been extremely supportive of the program. The main problem that the community will actually face is gaining community support for a change from their current system to one that is better for their golf courses. Often people become comfortable with how things currently are and are resistant to change when they don't directly see what is wrong.

The Solution

The intense opposition of the use of reclaimed water stems from the severe lack of information available to the public. In order to remedy this, information about reclaimed water must be made easily accessible to community members and comprehensive enough that everyone can actually understand what is happening. The Rio Verde community has already conducted workshops in the past and continuing to get its residents involved and keeping them updated about what is going on within the community will make them feel like they have a hand in the changes happening around them. Providing information to the residents about why the change is being made and how exactly this change will benefit the community will perpetuate support for the project and make its implementation much easier. Another way to make sure trust is maintained both throughout the project and after its completion would be to set up an interactive monitor in a high traffic area such as the front lobby area that will display the current

status of the reclaimed water being used to water the golf courses. By having up to date information easily accessible community members can have real-time knowledge about what keeps their facilities up and running. Some effective indicators that could be displayed are salinity levels, concentrations of certain organic materials, how much water using reclaimed water is saving and where the water is being used within the community.

General Policy Perspective

This section will examine the use of reclaimed wastewater in Rio Verde, AZ through a policy perspective. It should be stated that although water as an overall theme has many concerns to Rio Verde, wastewater specifically, does not have nearly as many agenda items as the topic of water supply. As a result there was a lack of information in the provided materials regarding anything with respect to wastewater. That said there is significant room for cross-collaboration between the water supply policy agenda and the reclaimed wastewater agenda to solve some of Rio Verde's overarching water goals, one such example would be using excess reclaimed wastewater to recharge the community's water aquifers as water in Rio Verde is either by well or potable source (www.rioverdeissues.com), but those will not be examined in this report. Given the limited information given about Rio Verde's policy involving wastewater management only three issues will be presented for analysis. The issues will be examined using very basic program evaluation because "Evaluation must be purposeful and not done just for its own sake. Evaluation should contribute to the present program or to further and future programs." (Steele, 1970) In this case the first case being evaluated will be the promotion supported by Rio Verde offered through Rayne Water Conditioning for special pricing on a portable exchange (PE) water softening system (Roadrunner Newsletter). The next topic for evaluation will touch on Rio Verde's goal to reduce issues with the water treatment system. Finally, the policy regarding the

use of reclaimed wastewater on the golf course will be evaluated. The goal here is to take a nonbiased view towards the current policies to determine a course of action to more efficiently meet the needs and overall goals Rio Verde is looking to achieve with reclaimed wastewater while taking in the considerations of all stakeholders involved.

One unique aspect to take into consideration is the level of governance that Rio Verde provides as it does have its own mailing ZIP code the community is not a traditional municipality. As a result its residents pay no school or town; the only taxes taken are from county (www.rioverdearizona.com). This began to raise questions regarding how utilities were handled specifically wastewater after some digging through Maricopa County's archive an article titled Rio Verde Foothills Area Plan (2013) revealed that a company called Rio Verde Services maintains water treatment services for the community. Armed with a better understanding of the community's governance, via homeowners association, a more direct approach to policy implementation can be considered. It should be noted that the process for how proposed polices become finalized by the association is unclear as it can be through community member vote or direct order of the association. However, the following evaluation if considered can be implemented under either style of governance.

The Solution

The first policy to review involves the initiative for Rio Verde residents to convert their water softening systems to a portable exchange unit as to reduce the saliency of the reclaimed wastewater. Looking at the provided material only the Roadrunner Newsletter provided to the community residents had anything related to the topic and it was an advertisement from Rayne Water Conditioning featuring a special rate for Rio Verde residents. Several questions come to mind one being how effect was the incentive towards conversions to

the PE softening systems? Can Rayne Water Conditioning take a more direct marketing approach since converting to PE softening systems is community policy goal? Depending on the effectiveness of the current plan an alternative is to propose a mandate through the home owners associate for residents to switch to the PE softening system. Then issue a fee if the mandate is not complied with by a specific date but also offer an incentive to people what convert before a certain date and perhaps to those who have already converted.

The second policy topic involves Rio Verde's goal to resolve its current water treatment issues. The best way to evaluate this item is through cost benefit analysis which can be summed up as 1 it is virtually synonymous with welfare economics, that is, economics used normatively--used, that is, to provide guidance for the formation of policy, either public (the more common domain of the term) or private. 2 At the other end of the scale of generality, the term denotes the use of the Kaldor-Hicks (wealth maximization rather than utility maximization) concept of efficiency to evaluate government projects, (Posner, 2000). It has not been clearly identified what the issues surrounding the current water treatment system involve however it is known that it is contracted through a company known as Rio Verde Services. In this situation the cost benefit analysis would involve identifying the issue occurring with the current service provider and determining the cost involved with resolving the problem as well as the annual operational cost of using the current company. You would then take the sum of those two numbers and compare it to a quote from bids received by competing companies. Two companies that located here in Arizona are American Water and EPCOR Utilities. What is unique about these companies is the amount of resources each can bring to a small community such as Rio Verde. Each company runs operations at a national level which brings the benefits of scale. Now both the ability for a company to scale as well as an abundance of resources is important especially when taking

factors such as sustainability into consideration because these large companies operation at a national level will have up to date technology. After reading through each of these companies' websites they both show a commitment to innovation and infrastructure growth. It is possible that these companies have technologies within the water reclamation process that can reduce the saliency of the reclaimed wastewater at a more efficient rate than the PE softening systems which is another alternative to meeting the first policy topic. The cost benefit analysis would conclude with determining the best value based on both cost and an assessment of the community's wastewater treatment needs.

The final policy Rio Verde is serious about maintaining is the use of reclaimed wastewater for use on the golf courses within the community. This policy ties closely with understanding the issues currently occurring with the water treatment service. One question that arises, how efficiently is water transferred to the golf courses from the treatment plant? Also, does Rio Verde Services keep a percentage of the water being reclaimed? This may be a topic that arises when discussing contract terms when trying to resolve the current issues within water treatment. It should also be made clear in the contract with a new service provider that 100% of the reclaimed water belongs to Rio Verde. Additionally policies should be put in place to ensure routine maintenance to the golf courses irrigation system as a preventative measure to reduce water waste as well as keeping operational costs down.

Conclusions

Overall, the cost of both the portable exchange units and the salt-less water softening system (using information from the NuVo H2O company) are very similar. The main barrier is the up-front cost that the salt-less system requires; rather than having the cost of the softening

unit be handled by the water softening company, the community would pay for and control the units themselves, meaning that the $600 price per unit is more apparent. However, since it costs more to pump additional water onto the golf courses to make up for the damage wrought by the salt (Middel, Quay & White 2013), a reduction in that salt content would translate to less water needed for maintaining the fields, and thus result in lower costs for the community.

After presenting this information to interested stakeholders, it is evident that additional research is needed to see if there are other companies similar to NuVo H2O that may offer their units at lower prices, or to see if there is a deal to be made to make the NuVo systems more attractive to the community from an economic standpoint. Due to the urgency of the salinity problem, the focus is more on getting the brine from recharge off of Rio Verde property, rather than taking overall sustainability into account, and so the solution proposed by this group is less of a priority to community leaders. However with the lack of information about reclaimed water the processes involved in treating it has led to a lack of trust in the institutions responsible for monitoring it and, as a result, a high risk assessment surrounding its use. The Rio Verde community is already leaps and bounds beyond most communities like it because it already uses a water reclaim system to irrigate its golf courses, but its current system needs revision. In order to gain popular support for a system overhaul, the continued practice of community workshops like would give residents an opportunity to ask questions and get first-hand information about reclaimed water use within their community and explain exactly why the change is happening. Once the public is given the information about the benefits of a different system the community will have no problem gaining the support of its members.

In conclusion the narrow focus of reclaimed wastewater within the Rio Verde community accounts for the limited number of policy applications. However the primary goals and

objectives of the community's wastewater reclamation needs are identified in the above chapters. In future applications of this process it may be worthwhile to combine the two water sections into one piece as reclaimed wastewater may be able to serve a larger function for the Rio Verde community. In the interim the current policy issues should find a resolution before more innovative and sustainable solutions are jointly approached from the water perspective.

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