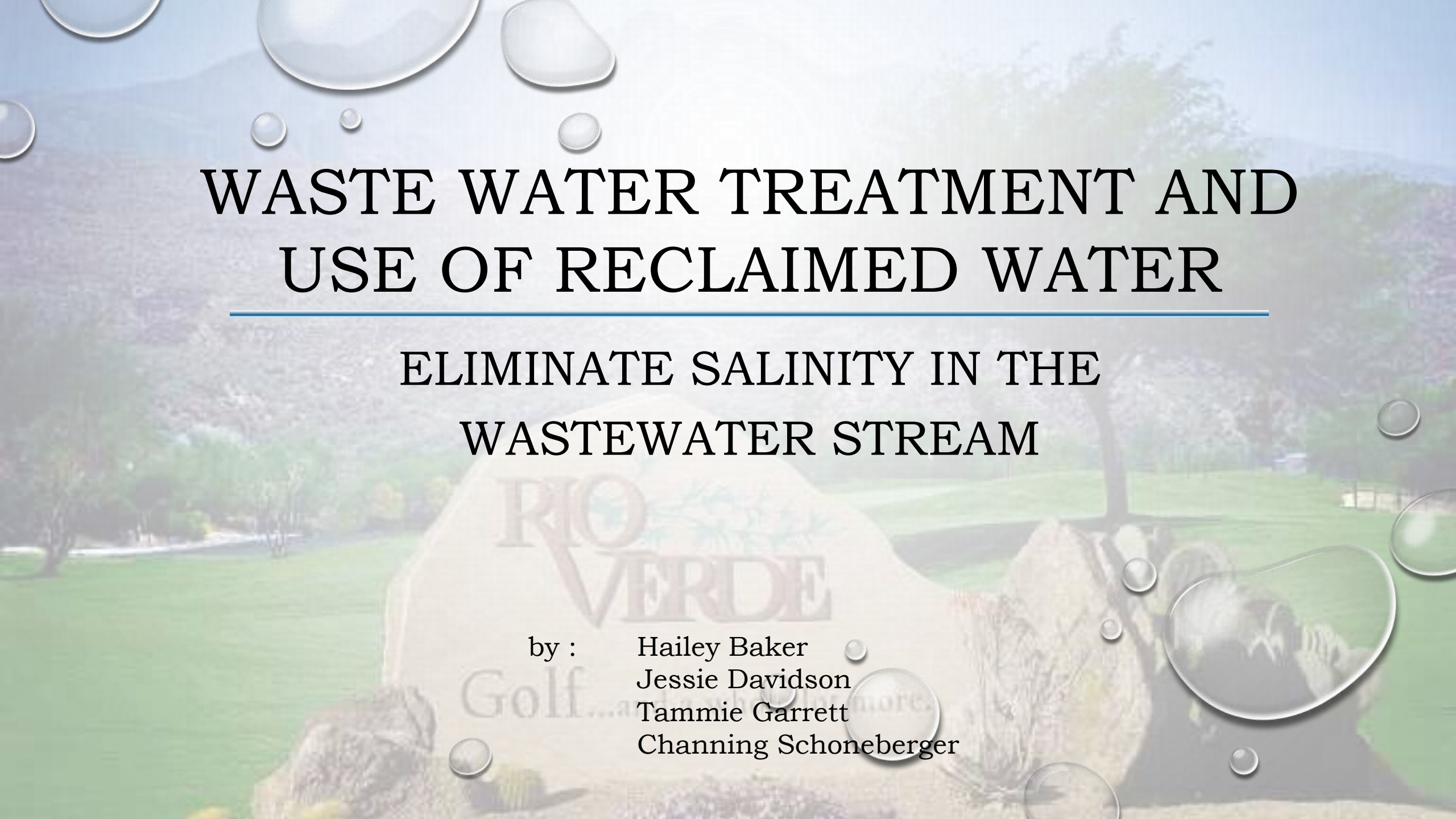


A large, light-colored rock sign sits on a gravel bed with small desert plants. The sign features the text "RIO VERDE" in a stylized font with a green vine graphic. Below it is the slogan "Golf...and a whole lot more." The background shows a lush green golf course, a large tree, and a rugged mountain range under a clear blue sky.

# RIO VERDE

Golf...and a whole lot more.





# WASTE WATER TREATMENT AND USE OF RECLAIMED WATER

---

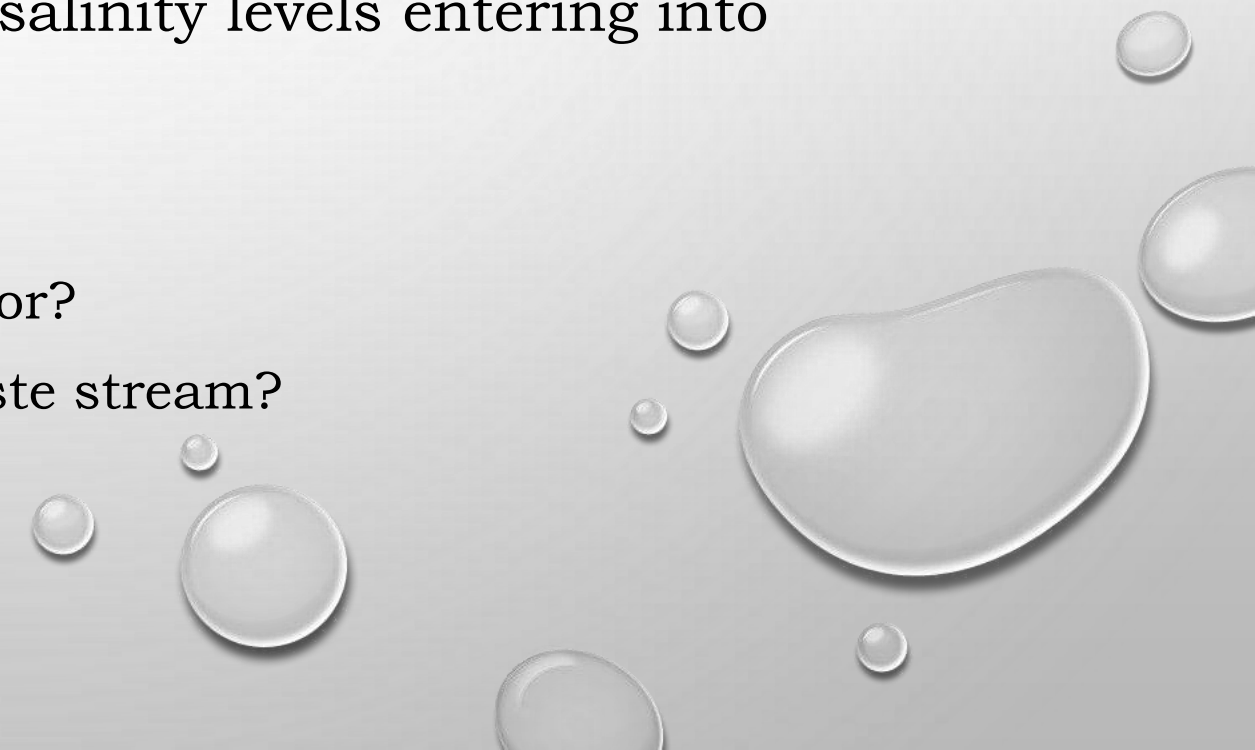
## ELIMINATE SALINITY IN THE WASTEWATER STREAM

by : Hailey Baker  
Jessie Davidson  
Tammie Garrett  
Channing Schoneberger





# PROJECT PARAMETERS

- Community partnership with the Rio Verde Community
  - The Challenge Area: Waste Water Treatment and the Use of Reclaimed Water
  - Our Objective: To reduce the salinity levels entering into the waster water stream
  - Questions
    - What is the salt being used for?
    - How is it getting into the waste stream?
    - How do we stop it?
- 



# PROJECT OVERVIEW

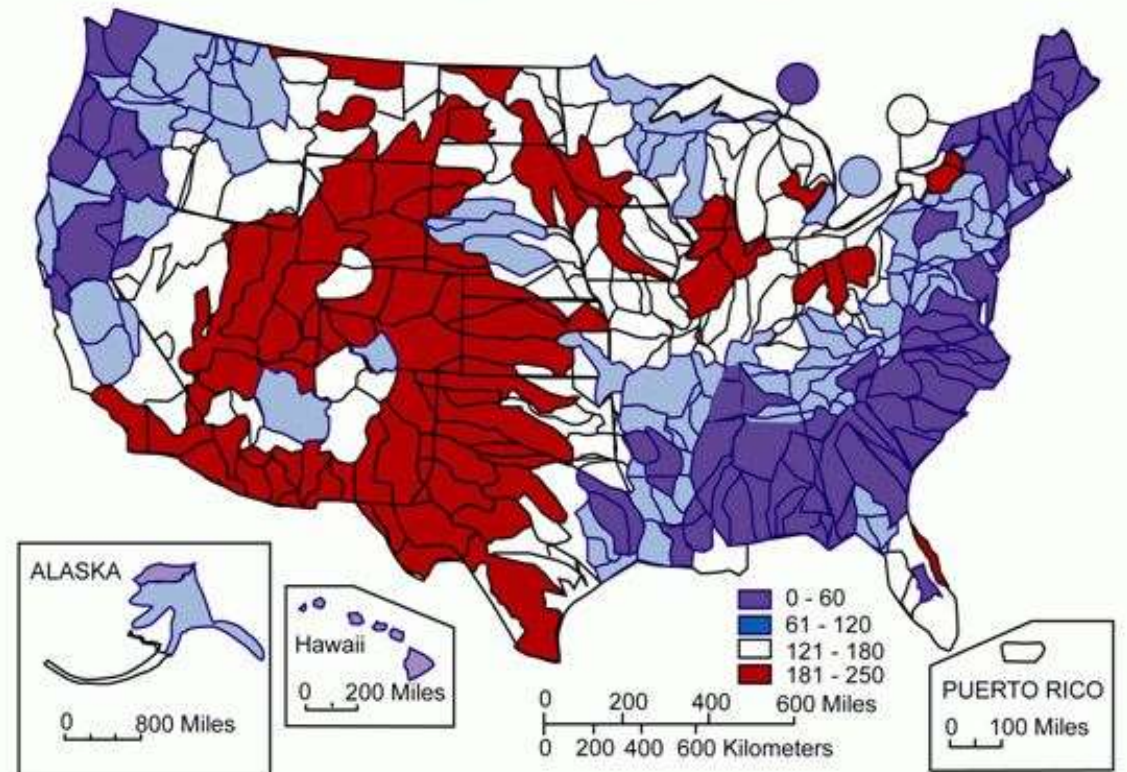
## WHAT IS THE SALT BE USE FOR?

### HARD WATER

- Water hardness is measured by the amount of dissolved calcium and magnesium.

Classification	mg/l or ppm	grains/gal
Soft	0 – 17.1	0 - 1
Slightly Hard	17.1 - 60	1 - 3.5
Moderately Hard	60 - 120	3.5 - 7.0
Hard	120 – 180	7.0 10.5
Very Hard	180 & Over	10.5 & Over

CONCENTRATION OF HARDNESS AS CALCIUM CARBONATE,  
IN MILLIGRAMS PER LITER



Mean hardness as calcium carbonate at NASQAN water-monitoring sites during 1975 water year.


Colors represent site data representing streamflow from the hydrologic-unit rea.

(Map edited by USEPA, 2005)





# IS HARD WATER A PROBLEM? MAYBE NOT

- Natural hard water :
    - Contains Calcium, Magnesium, and Iron
    - Helps to fight and prevent certain heart and cardiovascular diseases
    - Part of a healthy diet
- 

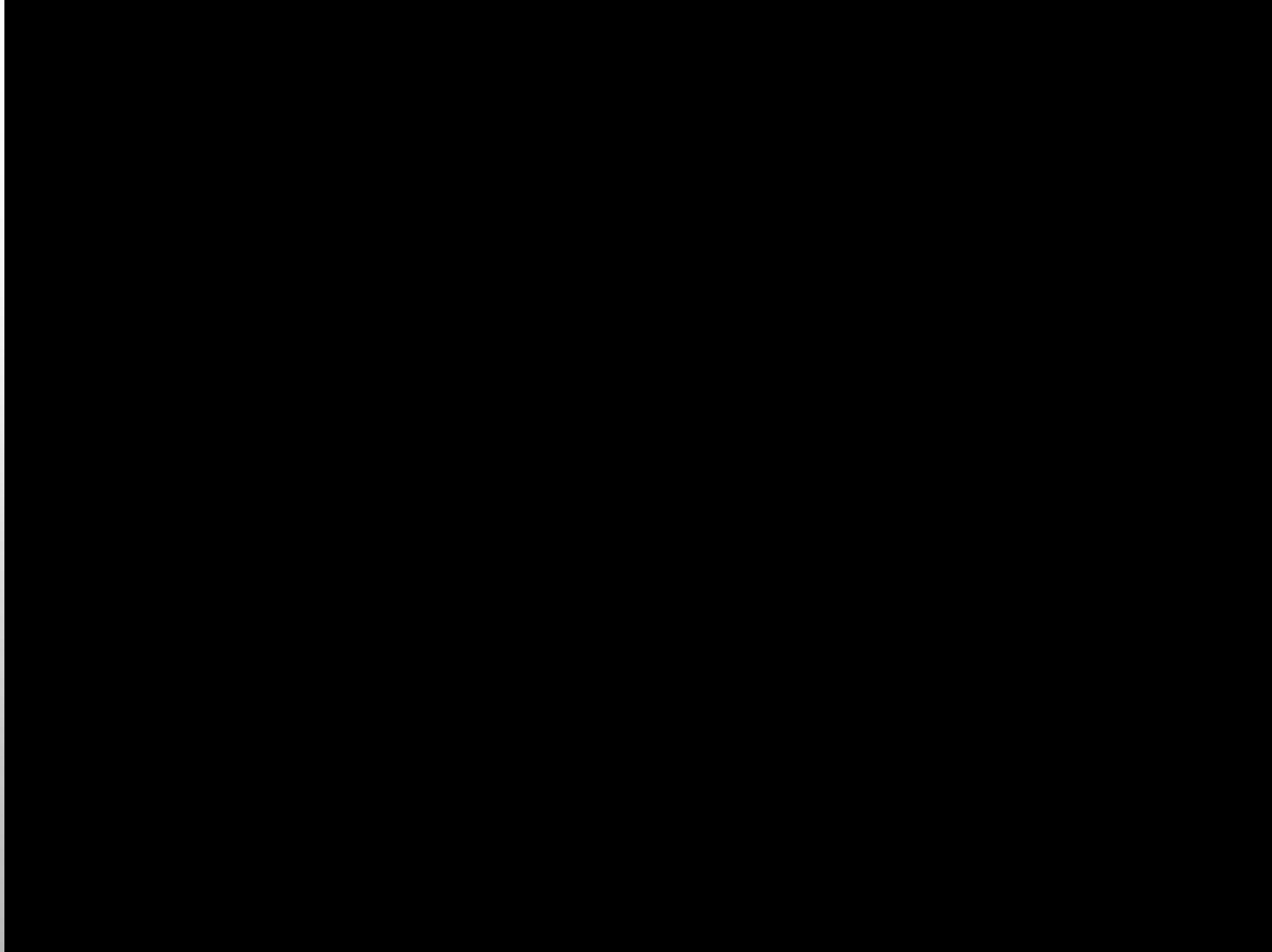


# IS HARD WATER A PROBLEM? MAYBE NOT OR, MAYBE IT IS!

- Pro's of Natural Hard Water :
  - Contains Calcium, Magnesium, and Iron
  - Helps to fight and prevent certain heart and cardiovascular diseases
  - Part of a healthy diet
- Con's of Natural Hard Water:
  - Correlation with eczema
  - Dry sticky feeling left on the skin and dull hair (scum build up)
  - Taste
  - Reduces the efficiency and life expectancy of household appliances and clothes
- Softened Water
  - Greatly reduced or no scum build up
  - Mostly void of Calcium, Magnesium, and Iron
  - Maintains the efficiency and life expectancy of household appliances and clothes



# HOW DOES THE WATER SOFTENER WORK?





# HOW DOES THE WATER SOFTENER WORK?

*TexasWaterSoftener.com*



**1st**



# SALTLESS WATER SOFTENER






# HOW HAS THE PROJECT PROGRESSED?







# RESULTS AND FINDINGS

- THE PORTABLE EXCHANGE WATER SOFTENING SYSTEM DOES MORE HARM THAN GOOD, AND MOVES THE PROBLEM OF WASTEWATER ELSEWHERE (DOES NOT TRULY TAKE CARE OF THE PROBLEM)
  - SALT-LESS WATER SOFTENING IS A MORE ENVIRONMENTALLY-FRIENDLY OPTION
  - POLICY CHANGE IN THE CURRENT SUSTAINABILITY MARKERS: TRACK SALINITY IN WATER AS A WAY TO TRACK IMPACT OF THE CHOSEN WATER SOFTENER
- 





# PORTABLE EXCHANGE VS SALT-LESS SYSTEMS



## PORTABLE EXCHANGE

- \$35 - \$48 PER MONTH; ACTUAL UNIT IS AROUND \$600 (CONTROLLED BY THE COMPANY)
- PAYING FOR SERVICE; BUSINESS COMES OUT, REPLACES USED PE UNIT WITH A NEW ONE, TAKES THE USED ONE TO THEIR FACILITY AND RECHARGE IT THERE
- EXTERNALITY OF MOVING SALTY WASTEWATER OFF-SITE


## SALT-LESS WATER SOFTENING

- EXAMPLE: NUVO H2O
- MORE ECO-FRIENDLY, LESS SALT IN THE WATER
- ~\$640 FOR INSTALLATION, NEW FILTER EVERY 3 – 6 MONTHS; \$80 FOR NEW FILTER
- COST COMES OUT TO BE VERY SIMILAR TO THE PE PROCESS, BUT MORE ECO-FRIENDLY (MADE OF RECYCLABLE PARTS, FILTRATION INCLUDED, CITRA CHARGE A MORE ENVIRONMENTALLY-FRIENDLY )






# IGNORANCE IS NOT BLISS

- BIGGEST PROBLEM WITH POPULARIZING THE USE OF RECLAIMED WATER IS PUBLIC OPINION SURROUNDING IT
  - MOST PEOPLE THINK IT IS UNSAFE, UNSANITARY/TOO HIGH OF RISKS
    - "TOILET TO TAP"
  - MOST RECLAIMED WATER IS HIGHER IN QUALITY THAN IS REQUIRED FOR MOST APPLICATIONS
  - RIO VERDE COMMUNITY ALREADY OPEN TO USING RECLAIMED WATER IS A GOOD START
- 





# POPULAR OPINION RULES THE DAY

- GAINING A COMMUNITY BACKING FOR A DIFFERENT SYSTEM WILL MAKE IT EASIER TO IMPLEMENT SOMETHING NEW
  - EDUCATE THE COMMUNITY MEMBERS
  - AGAIN ALREADY OPEN TO RECLAIMED WATER
    - SHOULDN'T BE HARD TO GAIN POPULAR SUPPORT
  - SAME BENEFITS/RISKS JUST BETTER FOR THE ENVIRONMENT
  - KEEP THE PUBLIC EDUCATED
- 





IT'S ALL ABOUT THAT GREEN



# IT'S ALL ABOUT THAT GREEN

- UP-FRONT COST APPEARS TO BE MORE FOR THE HOMEOWNER, SINCE THE UNIT IS ACTUALLY INSTALLED AND OWNED BY THE RESIDENTS (RATHER THAN BEING CONTROLLED BY COMPANY)
- OVER TIME, INVESTMENT COMES OUT TO BE VERY SIMILAR
- OVERCOME THE INITIAL INVESTMENT FOR LONG-TERM SUSTAINABLE BENEFIT



HOW DO WE KEEP SCORE?

POLICY OR POLICE



# How Do We Keep Score?

## POLICY OR POLICE

### POLICY

- INCENTIVES TO REMOVE SOFTENERS USING SALT
- POLICY THAT ONCE A SOFTENER NEEDS REPLACING, NO NEW SALT SOFTENERS
- VOLUNTARY REGISTRATION OF HOUSEHOLD SOFTENER UNITS
- INCENTIVES TO INSTALL NO-SALT SOFTENERS

### POLICE

- HOME TO HOME INSPECTION AND REGISTRATION OF SALT SOFTENER SYSTEMS
- MANDATORY SCHEDULED REPLACEMENT OF SALT SYSTEMS TO NO-SALT SYSTEMS
- MONETARY INCENTIVE TO CHANGE (FINES)



# How Do We Keep Score?

## POLICY OR POLICE

### POLICY

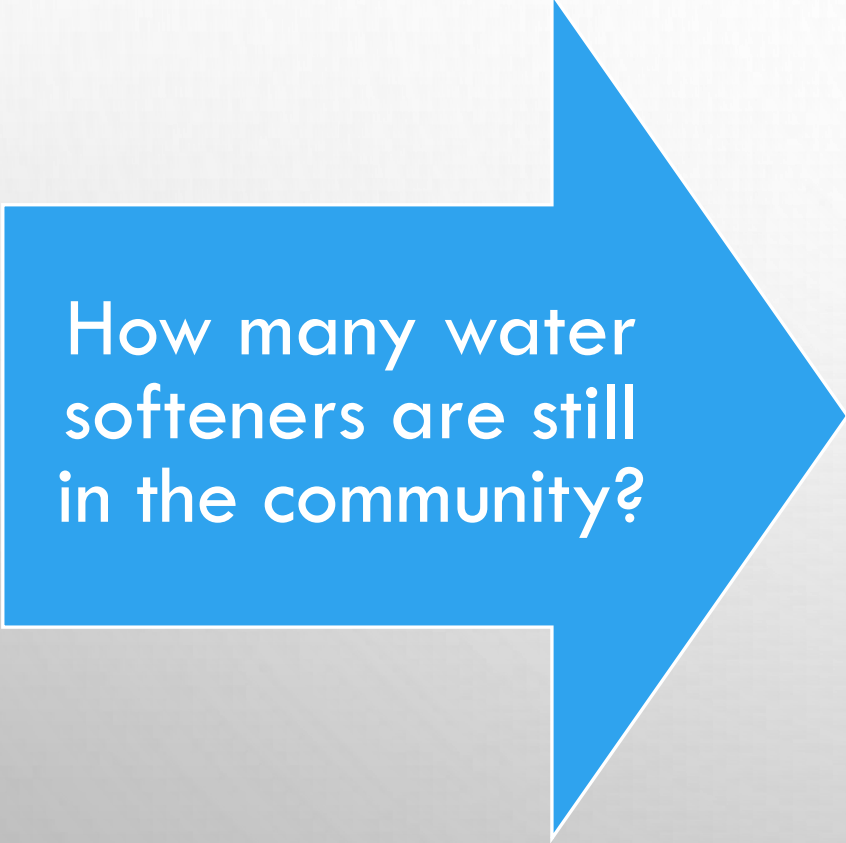
- INCENTIVES TO REMOVE SOFTENERS USING SALT
- POLICY THAT ONCE A SOFTENER NEEDS REPLACING, NO NEW SALT SOFTENERS
- VOLUNTARY REGISTRATION OF HOUSEHOLD SOFTENER UNITS
- INCENTIVES TO INSTALL NO-SALT SOFTENERS

### POLICE

- HOME TO HOME INSPECTION AND REGISTRATION OF SALT SOFTENER SYSTEMS
- MANDATORY SCHEDULED REPLACEMENT OF SALT SYSTEMS TO NO-SALT SYSTEMS
- MONETARY INCENTIVE TO CHANGE (FINES)



# CHALLENGES AND UNKNOWNNS



How many water softeners are still in the community?



Lack of usable data



# From The Well Of Information

## (Works Cited)

- APPLIED ECONOMICS (2003). MARICOPA ASSOCIATION OF GOVERNMENTS REGIONAL GROWING SMARTER IMPLEMENTATION: WASTEWATER TREATMENT. WEB. [HTTP://WWW.AZMAG.GOV/DOCUMENTS/PDF/CMS.RESOURCE/WASTEWATER-TREATMENT.PDF](http://www.azmag.gov/documents/pdf/cms.resource/wastewater-treatment.pdf)
- CENTRAL ARIZONA SALINITY PROJECT (2004). "SURVEY OF WATER SOFTENER PENETRATION INTO THE RESIDENTIAL MARKET IN THE PHOENIX METROPOLITAN AREA ". INSIGHTS & SOLUTIONS INC. WEB.
- CHEN, Y.-T., & CHEN, C.-C. (2014, MARCH). THE OPTIMAL REUSE OF RECLAIMED WATER: A MATHEMATICAL MODEL ANALYSIS. WATER RESOUR MANAGE, 28, 2035-2048. DOI:10.1007/S11269-014-0595-1
- CITY OF CHANDLER PLANNING AND DEVELOPMENT. (SEPT 2008). BUILDOUT AND BEYOND: WATER, WASTEWATER, RECLAIMED WATER MASTER PLAN UPDATE & EXECUTIVE SUMMARY. CHANDLER: CITY OF CHANDLER CITY COUNCIL.
- CONKLE, J. L., WHITE, J. R., & METCALFE, C. D. (2008). REDUCTION OF PHARMACEUTICALLY ACTIVE COMPOUNDS BY A LAGOON WETLAND WASTEWATER TREATMENT SYSTEM IN SOUTHEAST LOUISIANA. CHEMOSPHERE, 73(11), 1741-1748.
- CULLIGAN OF THE RIO GRANDE VALLEY. [HTTP://WWW.CULLIGANRGV.COM/INDEX.PHP](http://www.culliganrgv.com/index.php) MOLINOS-SENANTE, M., HERNÁNDEZ-SANCHO, F., & SALA-GARRIDO, R. (2010). ECONOMIC FEASIBILITY STUDY FOR WASTEWATER TREATMENT: A COST-BENEFIT ANALYSIS. SCIENCE OF THE TOTAL ENVIRONMENT, 408(20), 4396-4402.
- FOREST, N., & WIEK, A. (2015, MAY). SUCCESS FACTORS AND STRATEGIES FOR SUSTAINABILITY TRANSITIONS OF SMALL-SCALE COMMUNITIES – EVIDENCE FROM A CROSS-CASE ANALYSIS. ENVIRONMENTAL INNOVATION AND, 22-40. DOI:DX.DOI.ORG/10.1016/J.EIST.2015.05.005
- FORREST, N., & WIEK, A. (2014, JANUARY). LEARNING FROM SUCCESS—TOWARD EVIDENCE-INFORMED SUSTAINABILITY TRANSITIONS IN. ENVIRONMENTAL INNOVATION AND SOCIETAL TRANSITIONS COMMUNITIES, 66-88. DOI:DX.DOI.ORG/10.1016/J.EIST.2014.01.003
- MARICOPA COUNTY PLANNING AND DEVELOPMENT DEPARTMENT. (2016, 02 18). RIO VERDE FOOTHILLS AREA PLAN. RETRIEVED FROM PLANNING AND DEVELOPMENT DEPARTMENT: [HTTP://WWW.MARICOPA.GOV/PLANNING/RESOURCES/PLANS/AREALANDUSEPLAN/RIOVERDEFOOTHILLSAREAPLAN.ASPX](http://www.maricopa.gov/planning/resources/plans/arealanduseplan/rioverdefoothillsareaplan.aspx)
- MCLAIN, J. E., & WILLIAMS, C. F. (2014, MARCH). SUSTAINABILITY OF WATER RECLAMATION LONG-TERM RECHARGE WITH RECLAIMED WASTEWATER DOES NOT ENHANCE ANTIBIOTIC RESISTANCE IN SEDIMENT BACTERIA. SUSTAINABILITY, 6, 1313-1327. DOI:10.3390/SU6031313
- MUGA, H. E., & MIHELICIC, J. R. (2008). SUSTAINABILITY OF WASTEWATER TREATMENT TECHNOLOGIES. JOURNAL OF ENVIRONMENTAL MANAGEMENT, 88(3), 437-447.
- PLANNING AND ZONING COMMISSION FOR THE CITY OF CHANDLER. (2008). BUILD-OUT AND BEYOND: CITY OF CHANDLER GENERAL PLAN 2008. CHANDLER: CITY OF CHANDLER CITY COUNCIL. RETRIEVED FROM [HTTP://WWW.CHANDLERAZ.GOV](http://www.chandleraz.gov)
- ROBILLARD, PAUL D. SHARPE, WILLIAM E. SWISTOCK, BRYAN R. (2016). "WATER SOFTENING". PENN STATE COLLEGE OF AGRICULTURAL SCIENCES. WEB. [HTTP://EXTENSION.PSU.EDU/NATURAL-RESOURCES/WATER/DRINKING-WATER/WATER-TESTING/WATER-TREATMENT/WATER-SOFTENING](http://extension.psu.edu/natural-resources/water/drinking-water/water-testing/water-treatment/water-softening).
- WANG, C., & GARDINALI, P. R. (2013, FEB). DETECTION AND OCCURRENCE OF MICROCONSTITUENTS IN RECLAIMED WATER USED FOR IRRIGATION – A POTENTIALLY OVERLOOKED SOURCE. ANAL BIOANAL CHEM, 405, 5925-5935. DOI:DOI 10.1007/S00216-013-6799-Z
- WANG, F.-H., QIAO, M., LV, Z.-E., GUO, G.-X., JIA, Y., SU, Y.-H., & ZHU, Y.-G. (2014, JUNE). IMPACT OF RECLAIMED WATER IRRIGATION ON ANTIBIOTIC RESISTANCE IN PUBLIC PARKS, ENVIRONMENTAL POLLUTION, 184, 247-253. DOI:HTTP://DX.DOI.ORG/10.1016/J.ENVPOL.2013.08.038

BEIJING, CHINA.