THE UNIVERSITY OF ARIZONA Cooperative Extension

ARIZONA project WET WATER EDUCATION TODAY

Final Report
June 22, 2025

Prepared for: Arizona Department of Water Resources
Tucson AMA Water Management Assistance Program

The purpose of this project is to provide support for the expansion of Arizona Project WET training, materials, and festivals in the Tucson Active Management Area (AMA).

I. Introduction

The purpose of this program is to educate K-12 students about their interconnected water resources and their importance to Arizona's future in support of Tucson AMA's statutory goal of safe yield. Project goals are to work towards an understanding of:

- Surface water in terms of a watershed's components, its dynamics, and its role in the hydrologic cycle.
- The groundwater system in terms of its components, composition, and its role in the hydrologic cycle.
- The effect of snowpack on water flow in a watershed
- The movement of water through diverse substrates
- Surface water and groundwater rights in the Arizona
- Surface water management through containment and distribution
- Colorado River system allocations and uses.
- The Central Arizona Project and the Shortage Sharing Agreements on the Colorado River
- Groundwater recharge and the Arizona water bank
- Water reuse and augmentation
- Water Conservation Technology
- The Engineering Design Process

Funds granted by this contract will be used to develop and conduct curriculum components, STEM lessons, water saving and professional development for teachers. This funding will also expand existing programs within the Tucson AMA region.

II. Scope of Work (per Amendment No. 1)

Task 1: Educator One-Day Workshop
APW shall conduct a one-day workshop, potentially reaching 20 educators from the Tucson AMA. Educators will improve upon their skills in engaging students in real-world and relevant science, technology, engineering, and math learning that focuses on systems thinking and creative problem-solving. Participants will leave this workshop with practical applications for instruction regarding STEM concepts and will receive classroom implementation resources from APW.

Deliverable: The Annual report shall include a description of the workshop, including location, syllabus, marketing efforts, attendance, and survey results. (Appendix A & NEW Appendix D)

Task 2: The Groundwater System

The groundwater system is one of Arizona's most important water reserves. Increasingly, in many areas of the state, we are even managing water storage using the groundwater system. Arizona students need to understand this system as a crucial part of the water cycle to ensure that, as decision makers, we manage this resource for future prosperity.

- APW will conduct no fewer than 30 groundwater presentations for students in the Tucson AMA.
- APW will also deliver TWO (2) full-day and up to FOUR (4) half-day Water Festivals for 4th grade students within the Tucson AMA.

Deliverable: The semi-annual report will include the number of students, student assessment, and evaluation data from each teacher.

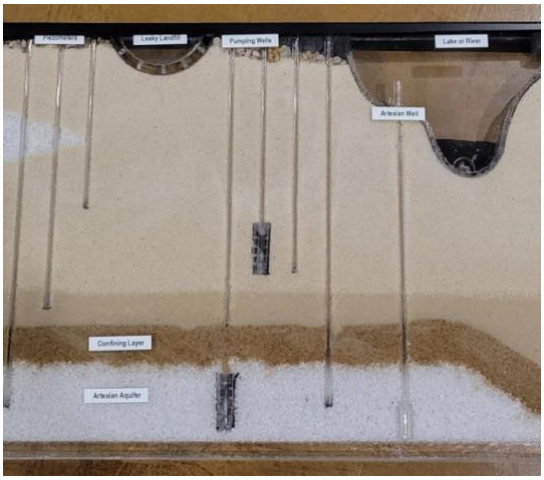
- Groundwater (UPDATED Appendix B)
- Arizona Water Festival (UPDATED Appendix C)

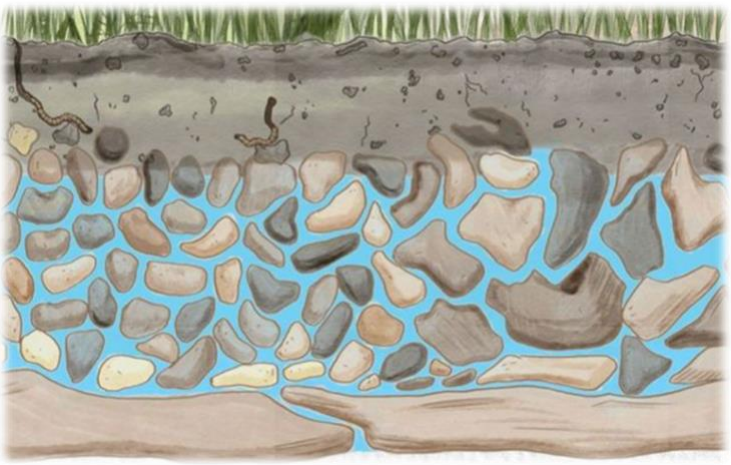
III. Models and Materials

A. Groundwater Flow Model purchased from CD Custom Workshop – delivered July 2024

Concepts a groundwater flow model demonstrates include:

- Flow through confined and unconfined aquifers
- Effects of pumping on said aquifers
- Cone of depression
- Effects of well pumping on water table
- Rain discharge effects on contaminant depth
- Two directional river flow
- Groundwater movement through an artesian aquifer
- Contaminant dispersion/dilution in an aquifer
- Groundwater inflow/outflow in a seepage lake
- Leakage of landfills into ground water
- Water quality stratification in the aquifer





THE UNIVERSITY OF ARIZONA Cooperative Extension

ARIZONA project WET WATER EDUCATION TODAY

NEW APPENDIX A

Educator 1-Day Workshop

About WSI and the Educator Workshop:	The Water Scene Investigation (WSI) Curriculum Unit was developed by Arizona Project WET. It has been created as a case study where the students investigate and identify the cause of a calamity in the community. The students examine artifacts, documents, and anecdotal evidence to draw conclusions that answer the question, "what is in the WATER?"
	The Unit of Study is designed to help teachers meet the 6th-8th grade science standards using student-centered, 3-dimensional learning. This focuses on doing science: asking questions and defining problems, developing and using models, planning and carrying out investigations, analyzing and interpreting data and constructing explanations and designing solutions. Emphasis also falls on recognizing relationships that connect all sciences and other fields of study. Specifically, the Arizona Water Scene Investigation (WSI) Curriculum Unit puts students at the center of their own water case, observing the phenomena that relate to the environment in which they live. Launching the unit, an interactive case file leads into the processes driving possible water contaminants and builds clear relationships between this and the water cycle, watershed, groundwater and the importance of sustainability.
Time Commitment:	2 hour PD led by APW… held on District Wednesday 2/26
	Approximately 6 class periods
	-Five facilitated by the teacher
	-One facilitated by APW staff
	-Pre and Post assessments
Timeline:	3 days of Teacher facilitated lessons (including pre-survey)
	1 day of APW staff facilitated lesson
	2 days of Teacher facilitated wrap up
	Post-survey (administered within 4 weeks of unit completion)
Resources:	WSI Curriculum Unit Guide

School	Atended PD	Teacher	Students
Apollo MS	*YES*	Heaton, Ruth	119
	YES	Pompa, Juan	114
	YES	Paz, Tammye	117
Challenger MS	*YES*	Hernandez, Airamzul	128
	YES	Price, Nancy	121
	YES	Tomollilo, Ashley	110
Gallego Intermediate	*YES*	Shaffer, Sarah	172
	YES	Uomoto, James	155
Sierra K-8	*YES*	Dong, Daniel	65
	YES	Hall, Toni	106
	YES	Raines, Michael	76

Full WSI - Water Scene Investigation Workshop presentation is included at the end of report: Attachment D.

CONTRACT NO: 2024-3180 ISA

THE UNIVERSITY OF ARIZONA Cooperative Extension

ARIZONA project WET WATER EDUCATION TODAY

Water Scene Investigation Teacher Professional Development Workshop

Facilitators: Kirstyn Kay

February 26, 2025 – Sunnyside School District

Objectives:

- Prepare teachers for the WSI Unit of Study.
- Spark interest in and demonstrate how fun and engaging science can be to teach while also meeting required state standards.
- Be a catalyst for environmental stewardship, by inspiring teachers to encourage water conservation and share sustainability solutions with their students.

2:15pm **WSI Unit overview** & **Anchor Phenomena – Introduction**

- Explain how the case study will work
- Introduce file and layout of the unit
- Unit guiding question

2:30pm

- **Lesson 1 – A Plume Problem**, CCC Connections
  - Background an exploration of what is groundwater and why it is relevant to Arizona students
  - If groundwater is contaminated, how does pollutants move?
  - Wells, pumps, overdraft and consequences of over pumping
  - 1980 groundwater act and recharge
  - Provide Lead #1 & #2 for Case file after lesson

2:50pm

- **Lesson 2 - Watersheds Work**, CCC Connections
  - Define watershed and do color map activity
  - Urban environments & contaminants
  - Flow, runoff, permeable, impermeable surfaces
  - Urban Heat Island Effect and heat dome
  - Scavenger hunt activity - homework for stipend
  - Provide Lead #3 after this lesson

CITY OF TUCSON | TUCSON WATER

Online Resources:

WSI – Curriculum Unit Folder: https://drive.google.com/drive/folders/1cdwX8jBpPf84iM9icKECk7NktFe5WloU

Textbook Portal (be sure to register your book for electronic copy pages): http://portal.projectwet.org/

For more information or questions about **Arizona Project WET** contact:

Kirstyn Kay
kkay@arizona.edu

Alexia Smith
alexiasmith@arizona.edu

SUNNYSIDE Unified School District

ARIZONA DEPARTMENT OF WATER RESOURCES EST. 1980

THE UNIVERSITY OF ARIZONA
Cooperative Extension

ARIZONA
project WET
WATER EDUCATION TODAY

3:15pm

- **Lesson 3 – CSI: Water & Diseases**, CCC Connections
  - Role of water in transmitting diseases
  - Characteristics of environments that promote transmission of diseases change with climate change
  - Student activity
  - Provide Lead #4 after lesson

3:30pm

- **APW Staff Visit to School**
  - Groundwater activity
  - Watershed activity

3:40pm

- **Solve the Case & Sustainability**
  - Student debate and then present final test results
  - Final case synopsis
  - Discuss sustainability and stewardship (water footprint)
  - Direct vs. indirect water use

3:45pm

- **Wrap-up & Thank you**
  - Share any connections discovered and review overarching questions
  - Certificates, Books & Heat guns

Thanks for attending … !

CITY OF TUCSON | TUCSON WATER

SUNNYSIDE Unified School District

Class Visits:
March – May 2025

For more information or questions about **Arizona Project WET** contact:

Kirstyn Kay
kkay@arizona.edu

Alexia Smith
alexiasmith@arizona.edu

ARIZONA DEPARTMENT OF WATER RESOURCES EST. 1980

THE UNIVERSITY OF ARIZONA Cooperative Extension

ARIZONA project WET WATER EDUCATION TODAY

UPDATED APPENDIX B

Groundwater Presentations

Classroom groundwater presentation uses systems thinking and the hands-on groundwater flow models, materials, and activities. Students from 3rd-12th grade are challenged to discover for themselves how the system works and why it matters to them as Tucson AMA water users. The program is designed to construct new knowledge, deconstruct misconceptions, and teach about the local groundwater system.

DATE	SCHOOLS	# of CLASSES	# of STUDENTS	GRADE
9/12/24	Sonoran Science Academy-Tucson K-12	4	78	6 & 7
9/19/24	Catalina Magnet HS	4	53	9 – 11
9/24/24	Sierra 2-8	3	63	5
9/25/24	Desert Christian	1	5	10
9/27/24	Immaculate Heart Academy	1	12	4
10/2/24	ASDB	4	11	9
10/10/24	Coyote Trail Elementary School	2	55	5
10/16/24	ASDB	5	22	6
10/18/24	Montessori Schoolhouse	1	31	6 – 8
10/22/24	Robison Elementary School	2	36	4
10/29/24	Pueblo High School	3	77	12
10/30/24	Catalina Foothills High School	3	69	11
10/31/24	Manzo Elementary School	1	19	4
11/1/24	Borton Magnet Elementary School	2	28	3
11/4/24	Sierra 2-8	3	52	7
11/6/24	Leman Academy Of Excellence-Marana	5	120	6
11/8/24	Adventure Schools	3	35	3 – 5
11/13/24	Borton Magnet Elementary School	3	29	1 – 4
11/15/24	Sonoran Science Academy East K-8	2	48	5
11/25/24	Adventure Schools	3	39	6 – 8
1/9/25	Gallego Primary Fine Arts Magnet School	3	60	3
1/10/25	Gallego Primary Fine Arts Magnet School	3	67	3
1/15/25	Sunrise Drive Elementary School	8	137	4 & 5
2/18/25	Sonoran Science Academy East K-8	6	150	7
3/6/25	Sonoran Science Academy-Tucson K-12	4	88	3 & 4
1/7/25	Dodge Traditional Magnet School	5	132	7
3/5/25	Gale Elementary School	2	36	4
4/17/25	Rincon High School	5	110	9 & 10
		Total	**Total**	
		91*	1662	

*91Classes represents a combined total toward a goal of 80 classes between two agencies, ADWR: GUAC Tucson AMA *and* Tucson Water.

CONTRACT NO: 2024-3180 ISA

THE UNIVERSITY OF ARIZONA
Cooperative Extension

ARIZONA
project WET
WATER EDUCATION TODAY

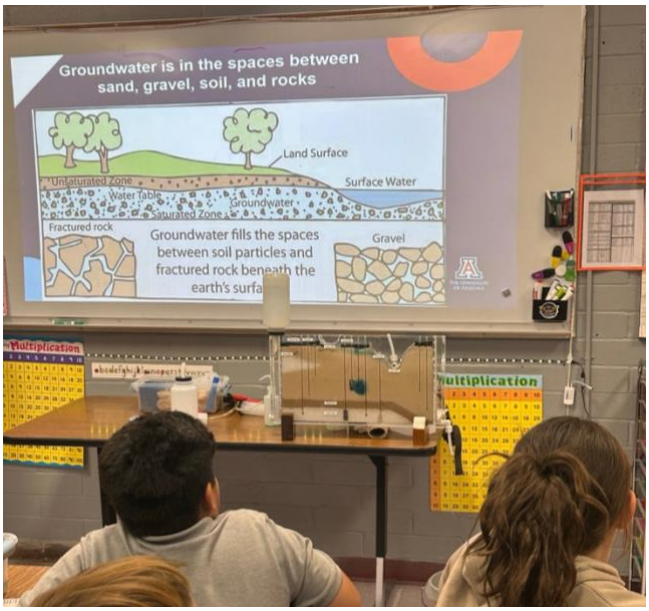
Groundwater NOW…

Summary:
All hydrological elements in our Arizona landscape impact available groundwater. Participants in the *Groundwater Classroom Program* explore the Arizona water cycle and unearth their watershed's surface to groundwater connection to deepen their understanding of how this intricate system works. Students recognize the human impacts on this system and are empowered to act as groundwater stewards in their communities.

Guiding Question:
What is our relationship with groundwater?
Is the relationship built to last?

Learning Objectives:

Model parts of the groundwater system within the watershed.
Understand the relationship between surface water and ground water.
Identify impacts of human activity on aquifers.
Recognize the importance of groundwater health and advocate for sustainability.



Groundwater Basics: 3rd – 5th
Cracking the Code of Arizona's Water Cycle
Groundwater Guardians: 6th – 8th
Defending Arizona's Aquifers from Pollution
Groundwater Connections: 9th – 12th
Mapping Arizona's Water Journey from CAP to Tap

Thank you once again for providing our students with an incredible hands-on experience. The students not only gained knowledge about the importance of water and filtration methods but also gained an understanding of the Arizona water system.

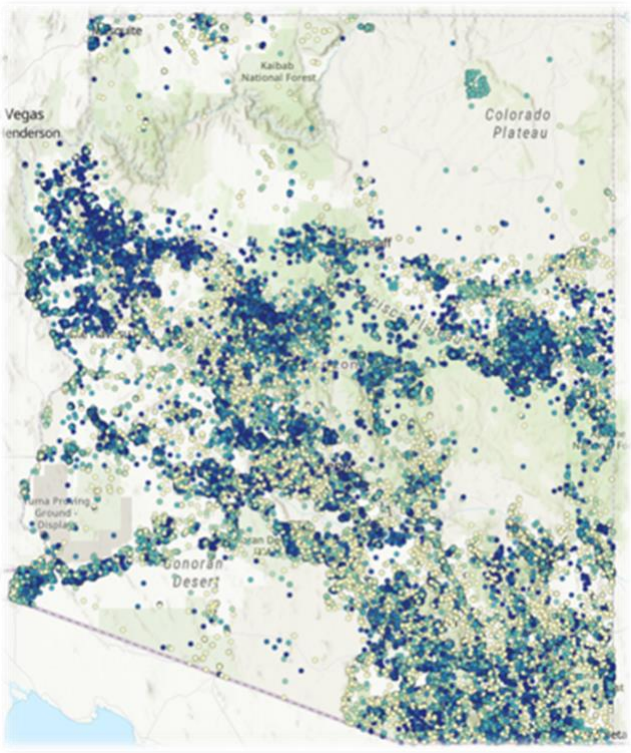
Thanks & Regards,

Rashmitha Pallath

CONTRACT NO: 2024-3180 ISA

THE UNIVERSITY OF ARIZONA
Cooperative Extension

ARIZONA
project WET
WATER EDUCATION TODAY



Alexia,

I thought you both did an outstanding job today, and I wanted you both to know.

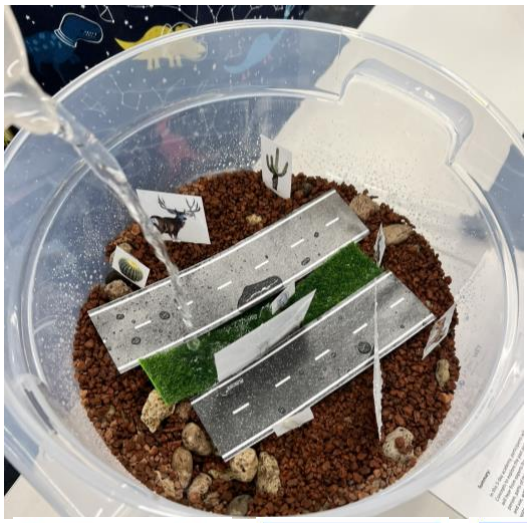
I intend to build on some of the concepts, vocabulary and environmental cornerstones you both touched upon. I have a simple assessment I plan on using for both my 6th graders and 7th graders. Ms. Pallath is welcome to use it as well.

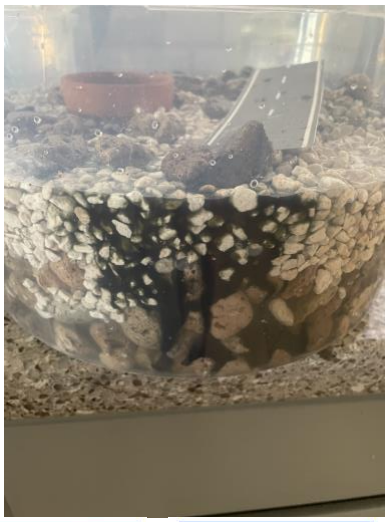
I remain ready, willing and able to help both of you in your tremendous outreach efforts in any way possible. This subject matter is dear to me, and I so appreciate your help to not only educate our students, but do so in such a cutting edge and hands on manner.

Continued success.

Cordially,

Sam Giallanza
Middle School Science Teacher

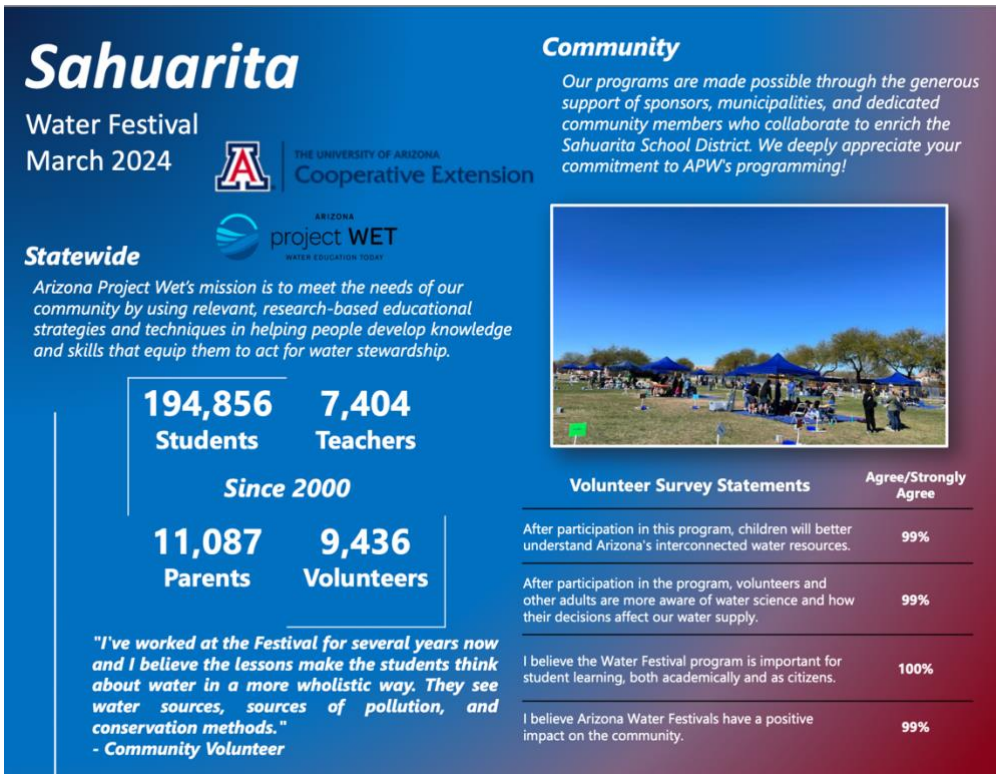


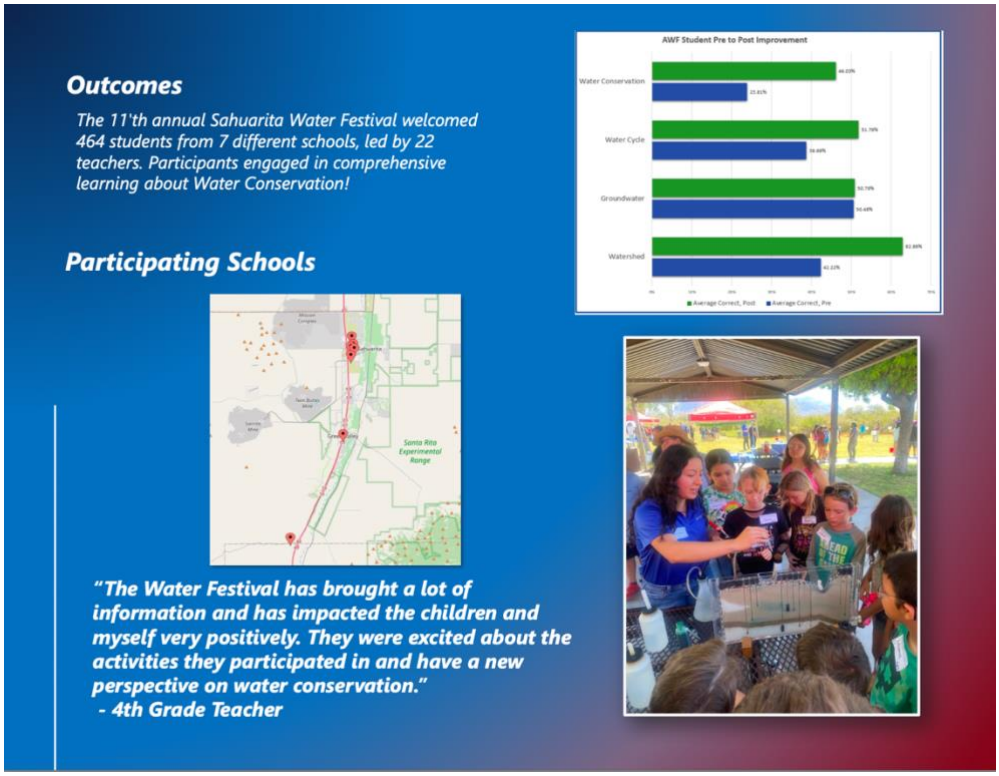


CONTRACT NO: 2024-3180 ISA

UPDATED APPENDIX C

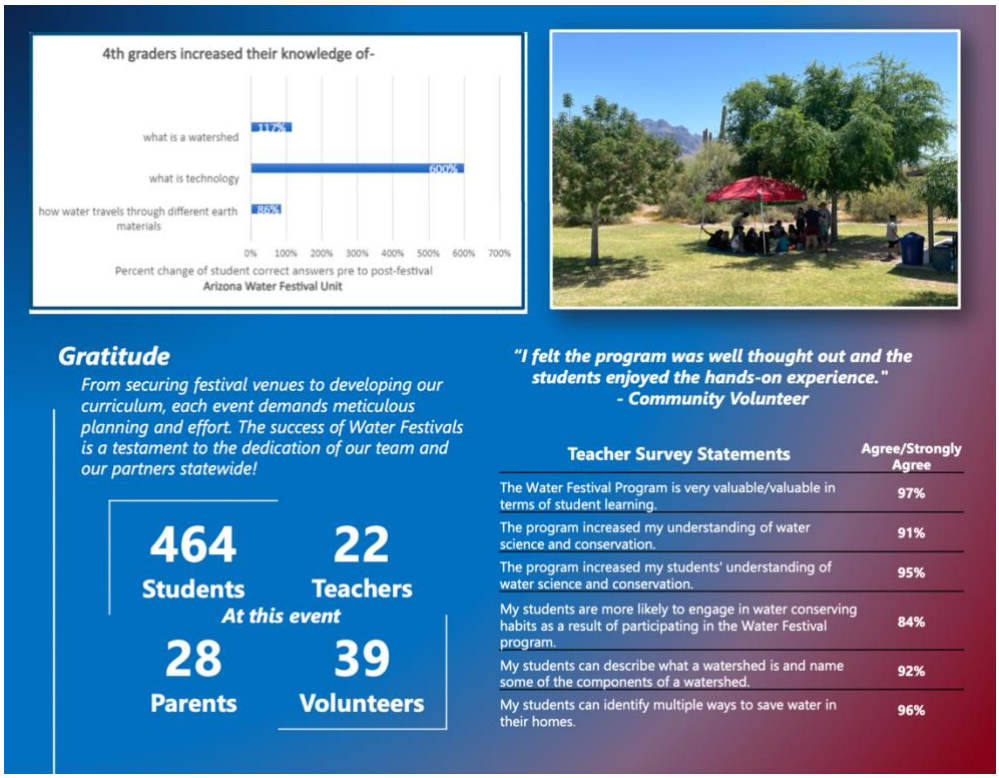
March 1, 2024, Sahuarita Water Festival





CONTRACT NO: 2024-3180 ISA

March 1, 2024, Sahuarita Water Festival continued



CONTRACT NO: 2024-3180 ISA

April 25, 2024, Tucson-Amphitheater USD

Amphitheater

Water Festival
April 2024

THE UNIVERSITY OF ARIZONA Cooperative Extension

ARIZONA project WET WATER EDUCATION TODAY

Statewide

Arizona Project Wet's mission is to meet the needs of our community by using relevant, research-based educational strategies and techniques in helping people develop knowledge and skills that equip them to act for water stewardship.

194,856 Students
7,404 Teachers

Since 2000

11,087 Parents
9,436 Volunteers

"I've worked at the Festival for several years now and I believe the lessons make the students think about water in a more wholistic way. They see water sources, sources of pollution, and conservation methods."
- Community Volunteer

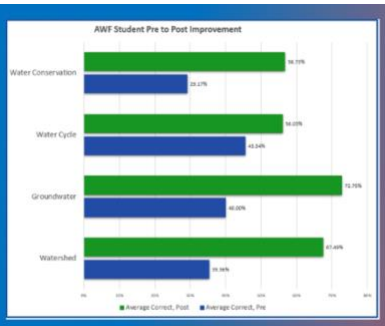
Community

Our programs are made possible through the generous support of sponsors, municipalities, and dedicated community members who collaborate to enrich the Amphitheater School District. We deeply appreciate your commitment to APW's programming!

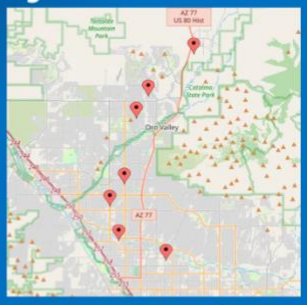
Volunteer Survey Statements	Agree/Strongly Agree
After participation in this program, children will better understand Arizona's interconnected water resources.	99%
After participation in the program, volunteers and other adults are more aware of water science and how their decisions affect our water supply.	99%
I believe the Water Festival program is important for student learning, both academically and as citizens.	100%
I believe Arizona Water Festivals have a positive impact on the community.	99%

Outcomes

The 15'th annual Amphi Water Festival welcomed 412 students from 7 different schools, led by 15 teachers. Participants engaged in comprehensive learning about Water Conservation!

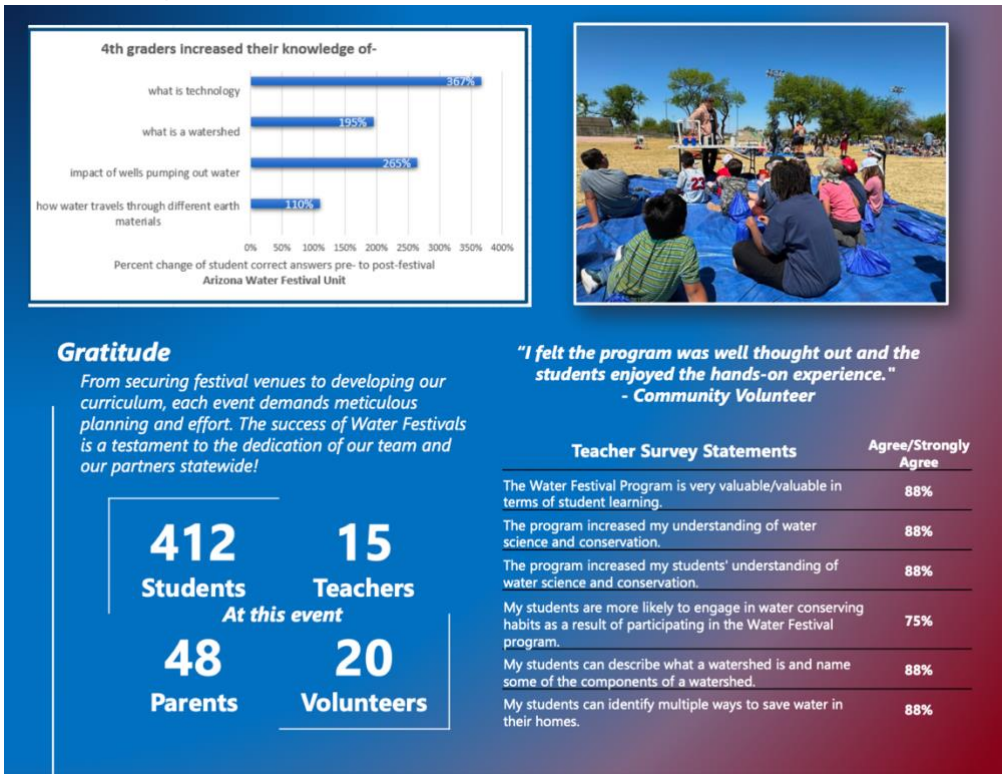


Participating Schools



"The Water Festival has brought a lot of information and has impacted the children and myself very positively. They were excited about the activities they participated in and have a new perspective on water conservation."
- 4th Grade Teacher

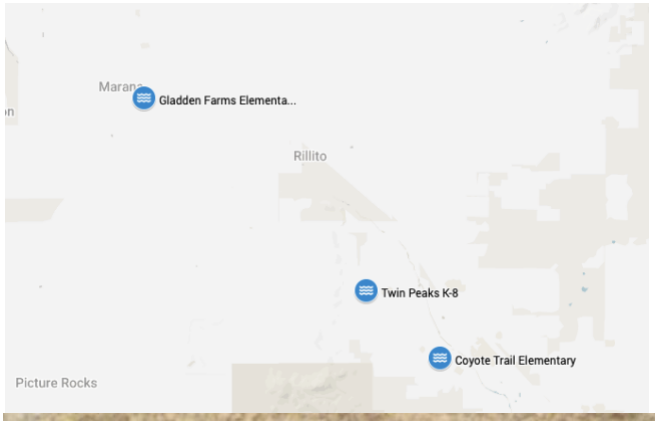
April 25, 2024, Tucson-Amphitheater USD continued



THE UNIVERSITY OF ARIZONA Cooperative Extension

ARIZONA project WET WATER EDUCATION TODAY

Festival Date	Water Festival	Schools	Sponsors	Students	Teachers	Volunteers
11/12/24	Marana	Twin Peaks K-8, Coyote Trail, Gladden Farms	ADWR, Tucson Water	270	11	31

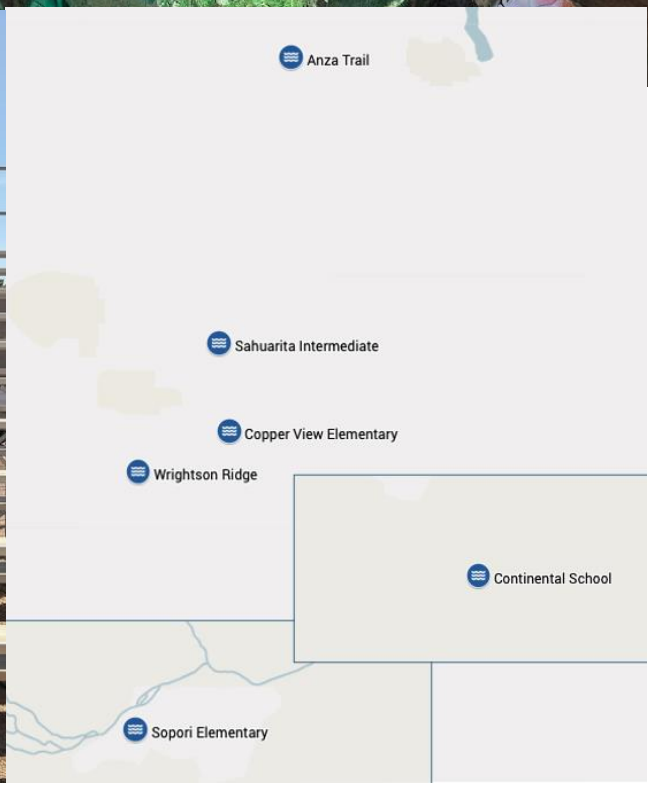


CONTRACT NO: 2024-3180 ISA

THE UNIVERSITY OF ARIZONA Cooperative Extension

ARIZONA project WET WATER EDUCATION TODAY

Festival Date	Water Festival	Schools	Sponsors	Students	Teachers	Volunteers
2/28/25	Sahuarita Green Valley	Anza Trail, Wrightson Ridge, Continental School District, Sopori Elem, Sahuarita Intermediate, Copper View	ADWR, Freeport-McMoRan, Sierrita Operations	450	20	48

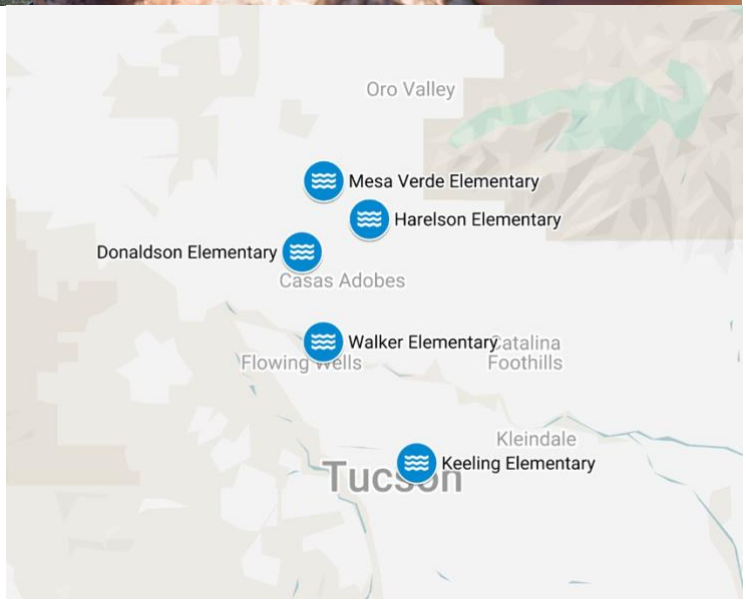


THE UNIVERSITY OF ARIZONA Cooperative Extension

ARIZONA project WET WATER EDUCATION TODAY

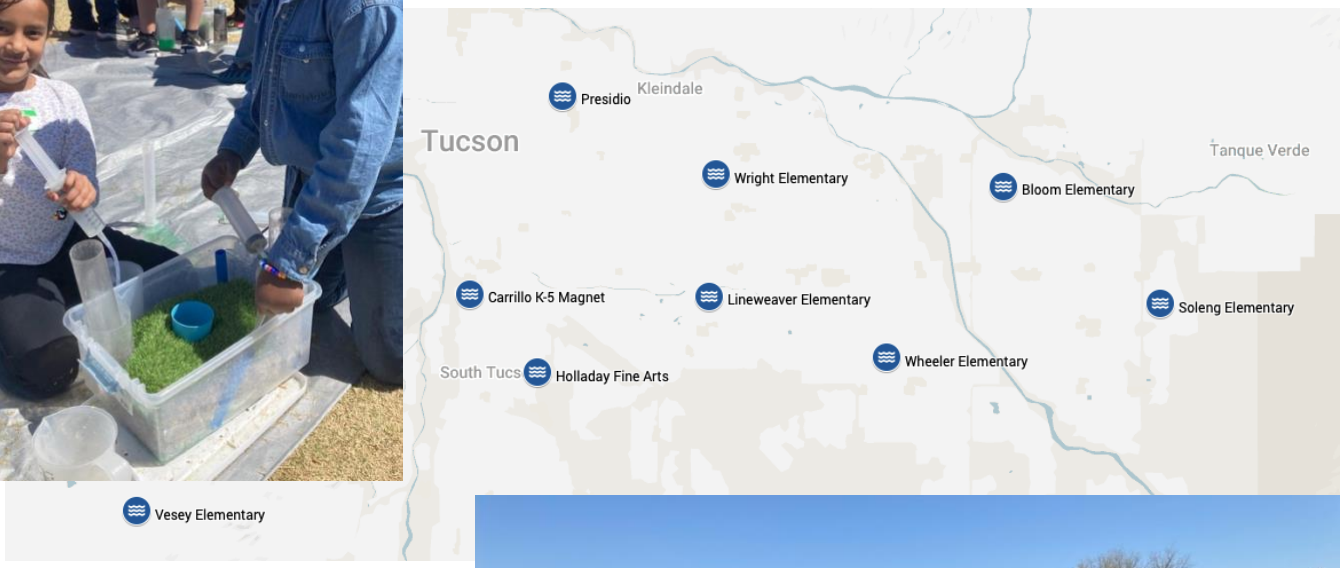
Festival Date	Water Festival	Schools	Sponsors	Students	Teachers	Volunteers
3/11/25	Amphi USD, Tucson, Oro Valley	Helen Keeling, Lulu Walker, Harelson, Mesa Verde, Donaldson	ADWR, Tucson Water, Rainbird	202	10	18

AMPHITHEATER Public Schools

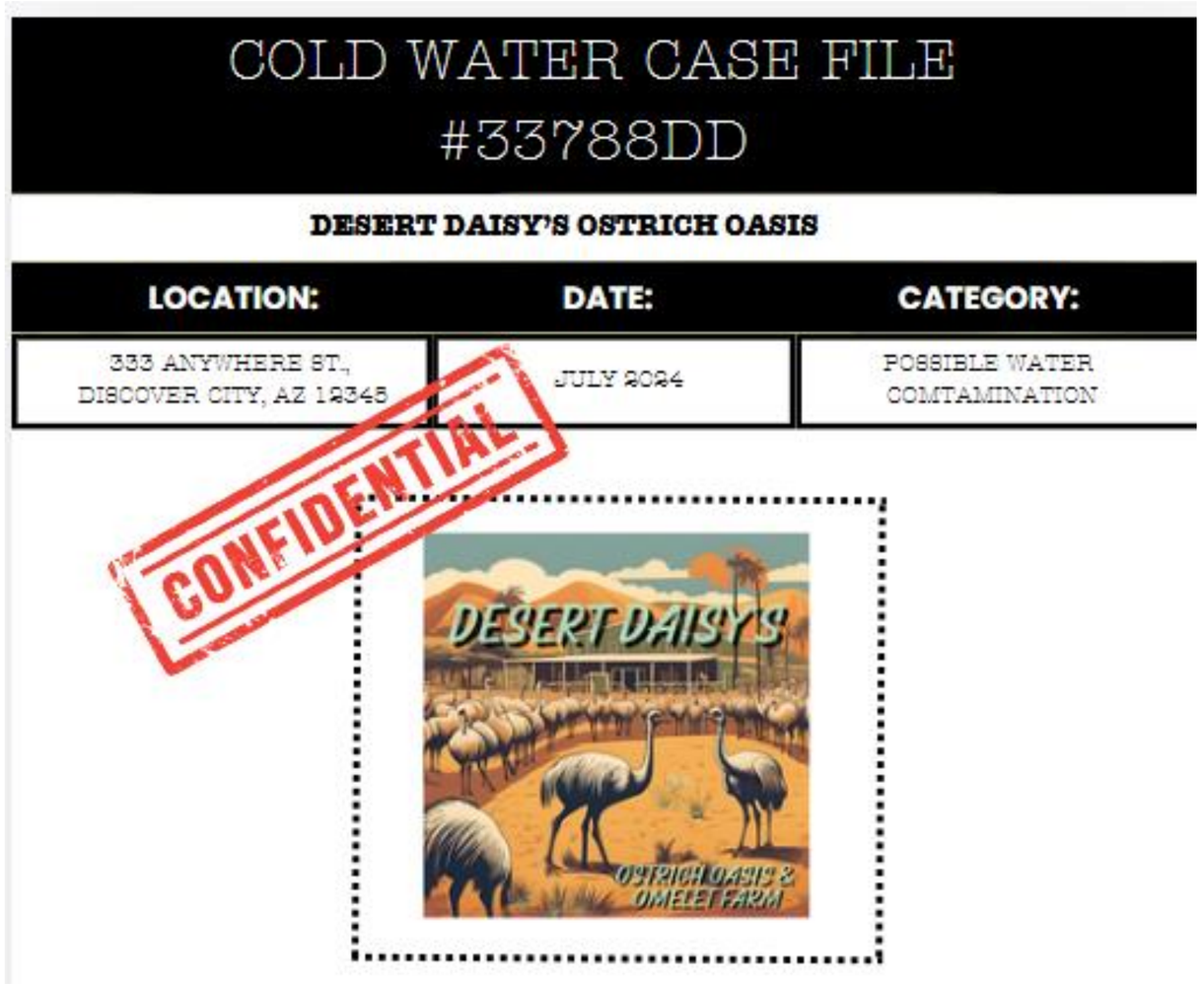


CONTRACT NO: 2024-3180 ISA

Festival Date	Water Festival	Schools	Sponsors	Students	Teachers	Volunteers
3/20/25	TUSD	Presidio, Vesey , Carillo, John B, Wright, Bloom, Soleng, Lineweaver, Wheeler	ADWR, Tucson Water	315	15	14



CONTRACT NO: 2024-3180 ISA



Arizona Project WET
Water Scene Investigation (WSI) Teacher Workshop

THE UNIVERSITY OF ARIZONA
Cooperative Extension

ARIZONA
project WET
WATER EDUCATION TODAY

2024-2025

We respectfully acknowledge the University of Arizona is on the land and territories of Indigenous peoples. Today, Arizona is home to 22 federally recognized tribes, with Tucson being home to the O'odham and the Yaqui. Committed to diversity and inclusion, the University strives to build sustainable relationships with sovereign Native Nations and Indigenous communities through education offerings, partnerships, and community service.

Arizona Project WET is committed to the advancement of diversity, equity, and inclusion in all aspects of our work. A wide array of perspectives enables us to be more effective, creative, and relevant to people's lives. We strive to respect the beliefs, languages, interpersonal styles, and values of all individuals. APW's goal is to create an environment that is inclusive, supportive, equitable, and utilizes the talents of underrepresented groups as drivers of change. Diverse experiences and perspectives are integral to the accomplishment of our mission.

THE UNIVERSITY OF ARIZONA

About Arizona Project WET (APW)

Our Vision

Arizona Project WET will set the standard for water-related education programming and resources in the state. We will build a population that is knowledgeable and empowered to take action for water sustainability to support Arizona's diverse communities and ecosystems.

Our Mission

To meet the needs of our community by using relevant, research-based educational strategies and techniques in helping people develop knowledge and skills that equip them to take action for water stewardship.

THE UNIVERSITY OF ARIZONA

What We Do

Outreach

Delivering direct student and community outreach that inspires students through relevant, water-focused experiences.

Education

Developing and providing teacher professional development that deepens water-related content knowledge and impacts educational practice.

Connection

Using our expertise as educators to connect community water stewards and the k-12 education system.

THE UNIVERSITY OF ARIZONA

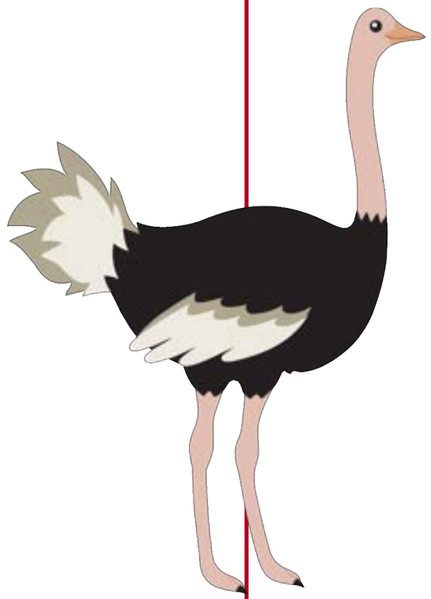
Workshop Objectives

- Prepare teachers for the WSI Unit of study.
- Spark interest in and demonstrate how fun and engaging science can be to teach while also meeting required state standards.
- Be a catalyst for environmental stewardship, by inspiring teachers to encourage water conservation and share sustainability solutions with their students.

THE UNIVERSITY OF ARIZONA

Student Pre and Post Survey

https://projectwet.arizona.edu/WSI_student_survey



BEFORE

Please administer the survey before students start the case or any of the lessons. This is not a test. Please feel free to facilitate reading the questions as a class.

AFTER

Please administer the same survey again after completing the unit, ideally no more than two weeks after you close the case.

THE UNIVERSITY OF ARIZONA

WSI Unit of Study

Summary:

You're on the scene with WSI. In this campy but complex Unit of Study, juvenile detectives of the Cold-Water Case Squad investigate and identify the cause of a calamity in the community. Student sleuths work together, finding the clues that protect lives and livelihood; solving the question, "What's in the WATER?" before time runs out!

THE UNIVERSITY OF ARIZONA

WSI UNIT GUIDING QUESTIONS:

How is water polluted and how can we keep human activity from compromising the viability of our watershed/water cycle systems?

THE UNIVERSITY OF ARIZONA

WATER CYCLE

Identify the role of water in human/ animal wellness and connect environmental health challenges to threats associated with a changing climate.

GROUNDWATER

Analyze data to solve a mystery and identify potential groundwater pollutants. Conclude that past solutions, developed with the best intentions, may create contemporary problems.

WATERSHED

Identify surface forms of pollution and consider ways to reduce urban runoff and the flow of contaminants in water throughout a watershed.

SUSTAINABILITY

Act as environmental stewards, conserving and keeping water clean through both behaviors and available technologies, supporting resilient solutions that benefit the (biodiverse) community.

WSI UNIT OF STUDY AT-A-GLANCE:

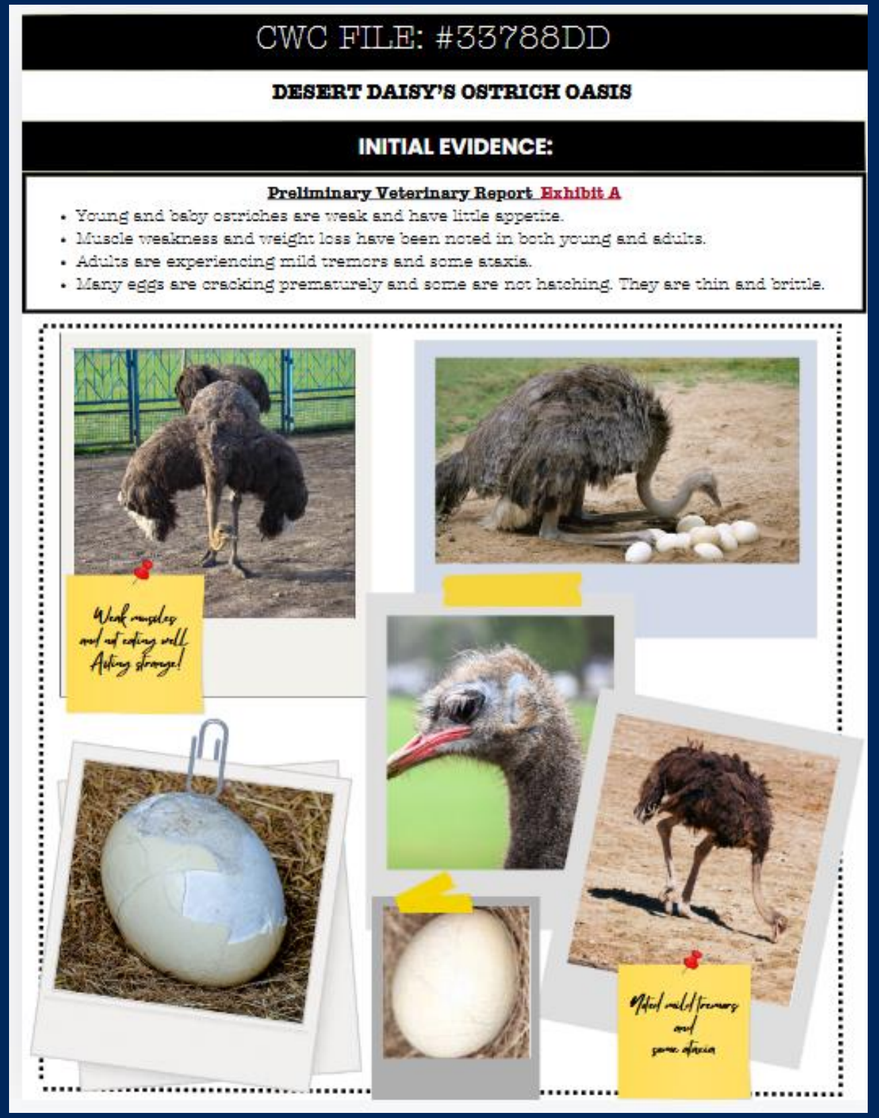
How is water polluted and how can we keep human activity from compromising the viability of our watershed/water cycle systems?	
Teacher Professional Development Workshop • 1.5-hour workshop led by APW staff	
Pre-visit Lessons for teachers to do: • A Plume Problem/ A Grave Mistake • A-maze-ing Water • CSI: Water and Diseases/ Super Sleuths	**Post-visit Lessons for teachers to do:** • Class discussion to solve the case study • Water Sustainability Worksheets • Additional optional Lessons
Site event at school by APW staff: Groundwater Pollution	**Site event at school by APW staff:** Watershed Contaminants and runoff prevention

THE UNIVERSITY OF ARIZONA

Intro & Layout of WSI Unit

Set the scene:

- Give out Case File
- Have class/group discussions with driving question board…
- Create 3 groups and begin notes for argument of culprit



THE UNIVERSITY OF ARIZONA

Have students begin and continue to do map worksheet throughout the unit.

DIRECTIONS

Use the info given in the case file to figure out and label each letter from the map with a word from the **Place Vocabulary** Column. Then using the details in the case file place the vocabulary from the **culprit/pollutants/scenario vocabulary column** under the correlating place you might find it. The second column words may be used more than once under different places.

Place Vocabulary:

- Alfalfa Farm
- Stream
- Mister Cabanas
- Barn/Garage
- Farm Bathrooms/Strawberry Crop
- Daisy's Home
- Well

Culprit/Pollutants/Scenario Vocabulary:

- City Water
- Battery Pollution
- Paint Pollution
- Stomachache
- Not Feeling Well / ill
- Fertilizer
- Pesticides
- Mosquitoes
- Drought
- Surface Runoff
- Septic Tank Pollution
- Groundwater contamination

For example:

A. ___Alfalfa Farm_____
___Fertilizer_____
_____
_____

MISCELLANEOUS NOTES / FEEDBACK

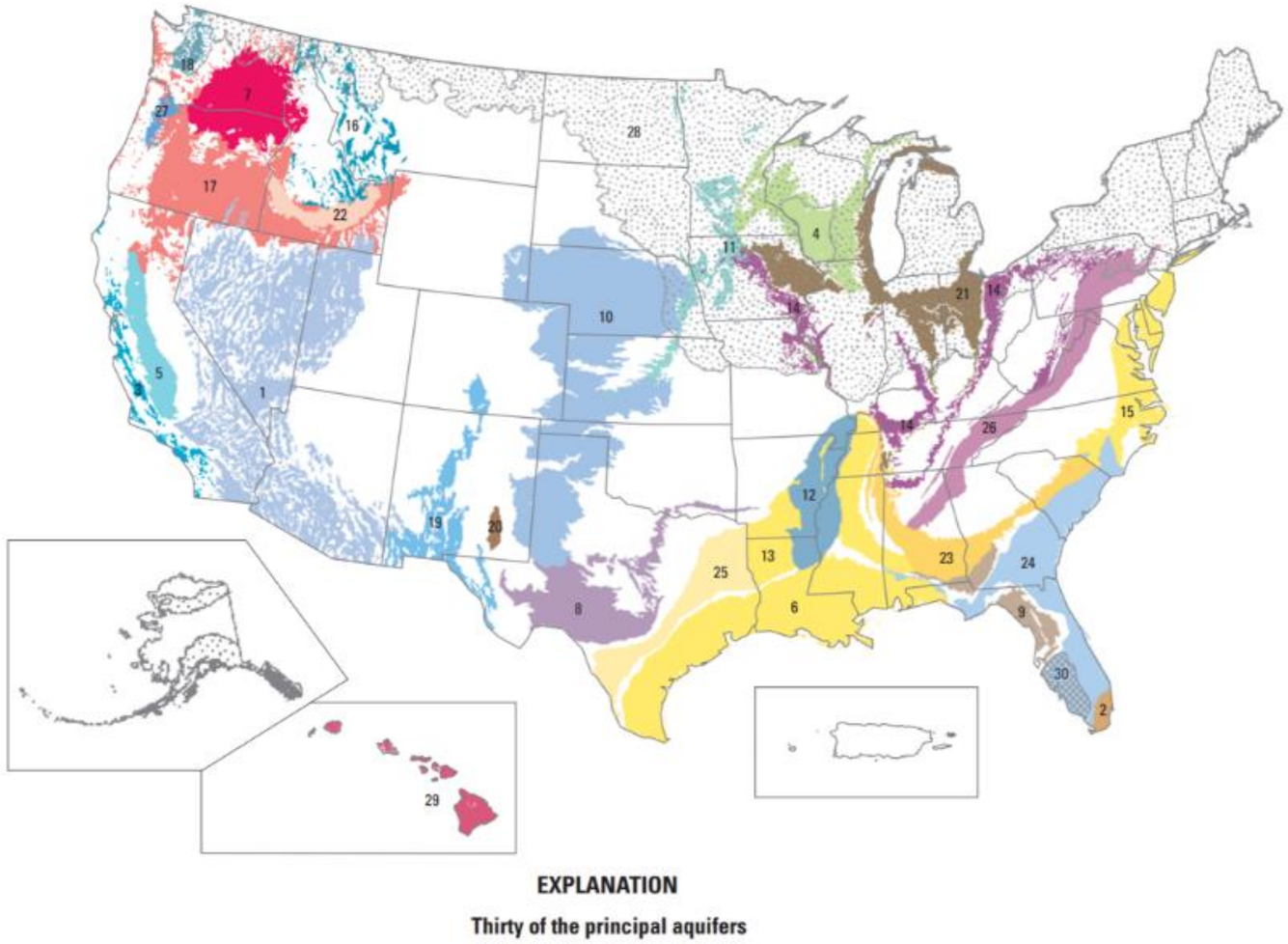
Detective Name: _____

Topic: _____

THE UNIVERSITY OF ARIZONA

GROUNDWATER & ARIZONA: Pre Lesson 1

Unearthing Groundwater:

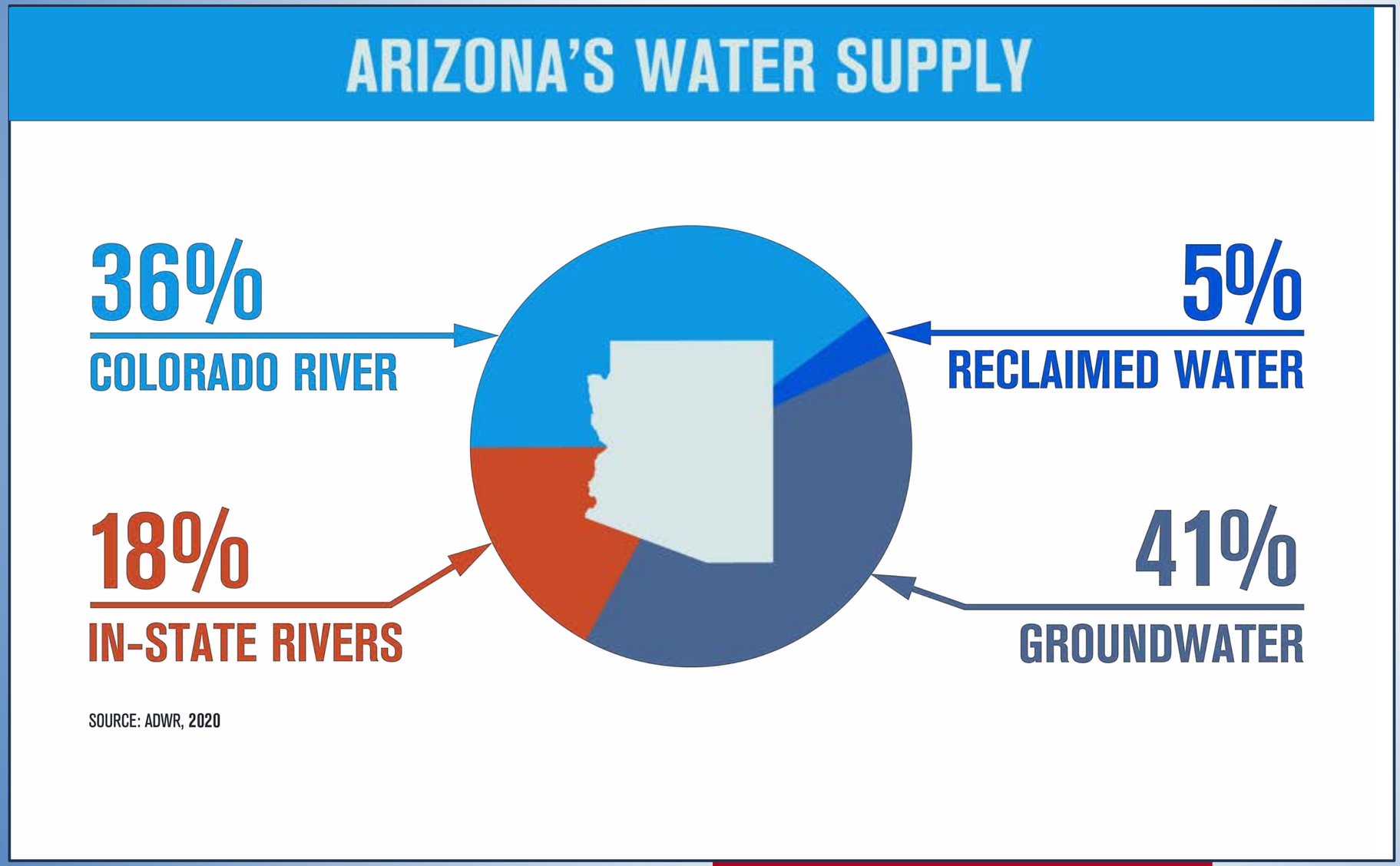


Groundwater Use in the U.S.

- The National Ground Water Association has determined that 38% of the U.S. population, depends on groundwater for its drinking water supply.

THE UNIVERSITY OF ARIZONA

GROUNDWATER & ARIZONA: Pre Lesson 1



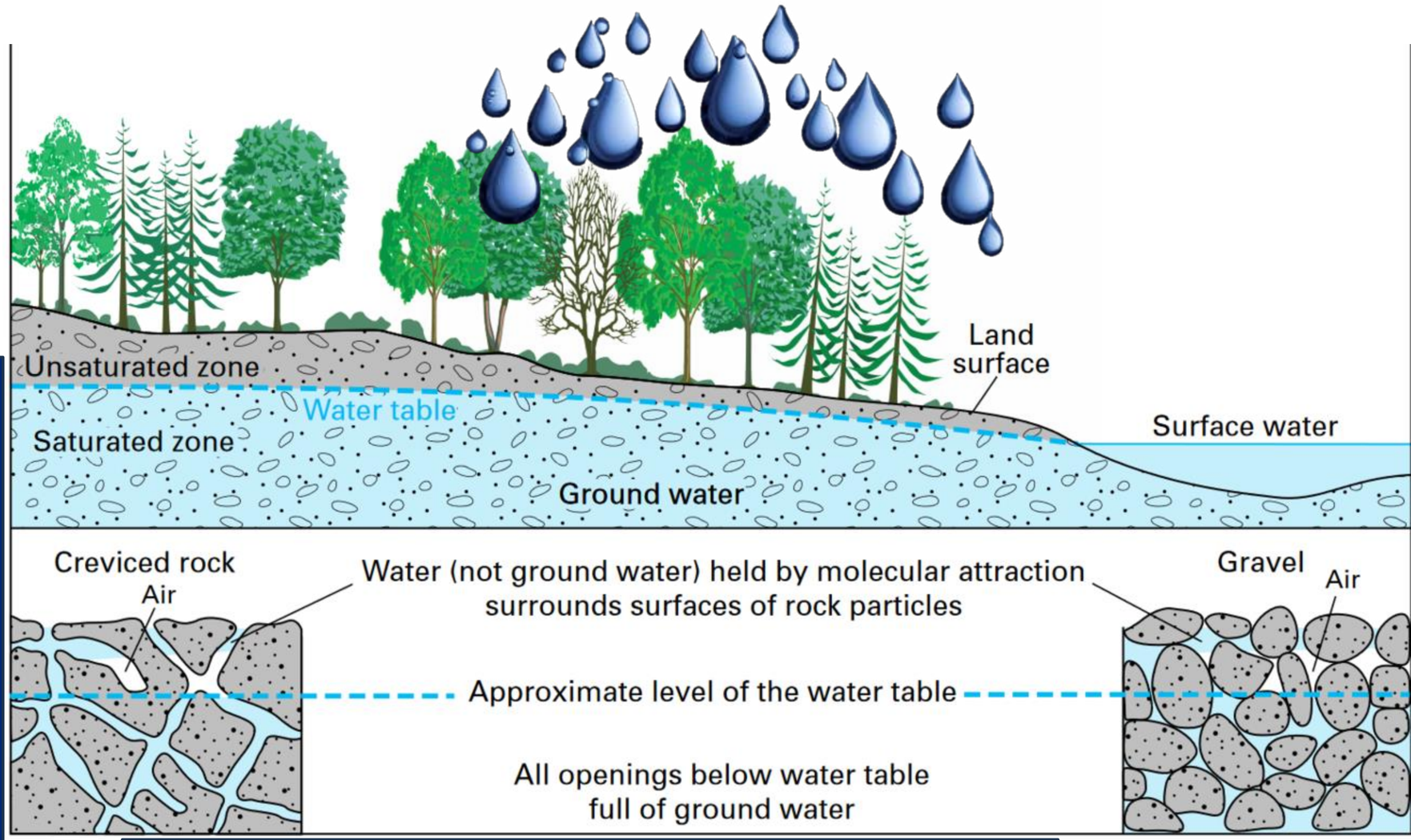
How important is groundwater to Arizona?

THE UNIVERSITY OF ARIZONA

Let's Review!

Pore Spaces

Groundwater moves between the spaces and pores and is pulled down due to gravity. The bigger the spaces between the materials, the faster or easier the water can move around it.

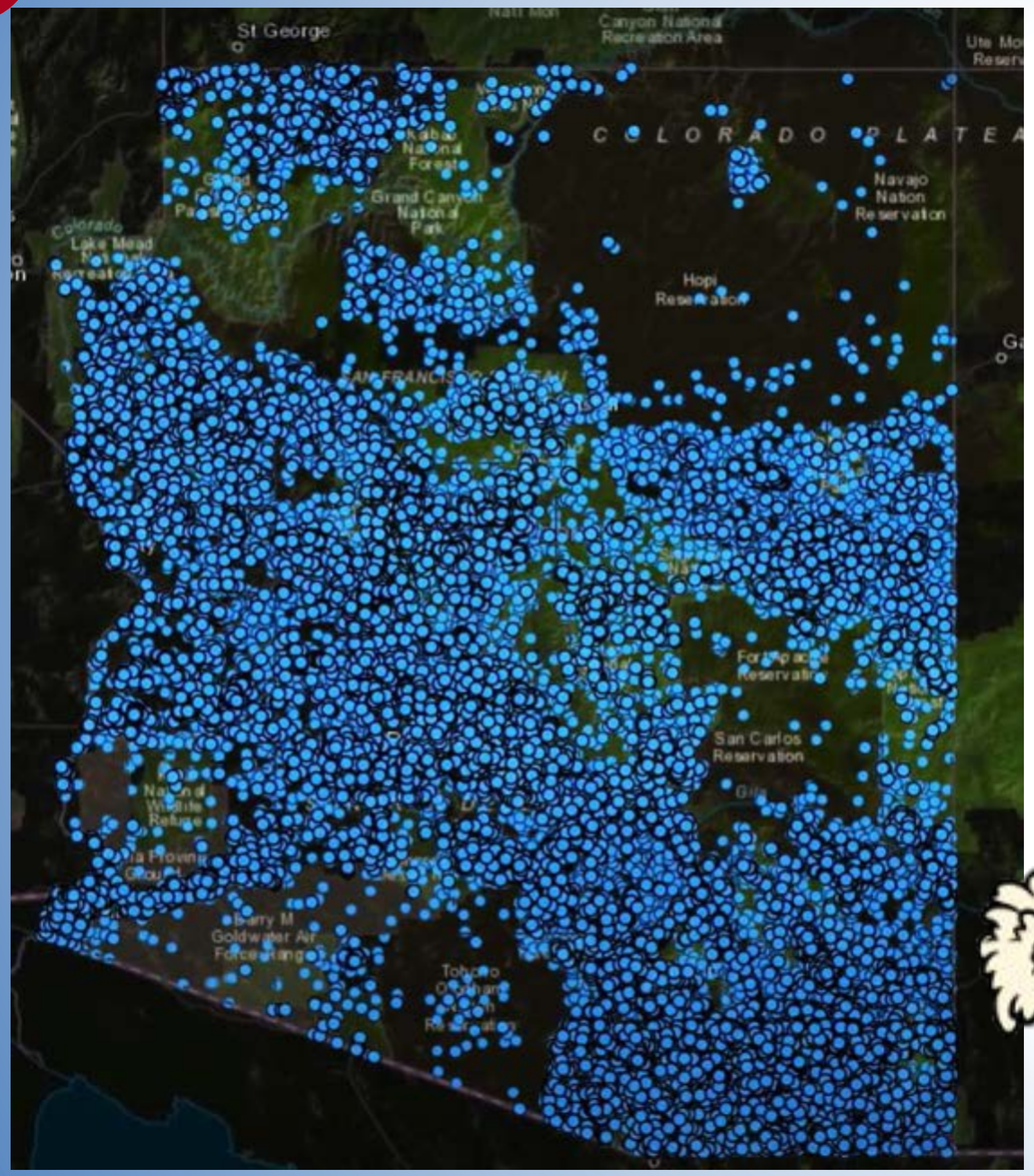


Aquifer:

An area where significant groundwater is present. Groundwater flows between layers of earth materials.

THE UNIVERSITY OF ARIZONA

GROUNDWATER & ARIZONA: Pre Lesson 1



Well, well, well, what do we have here?

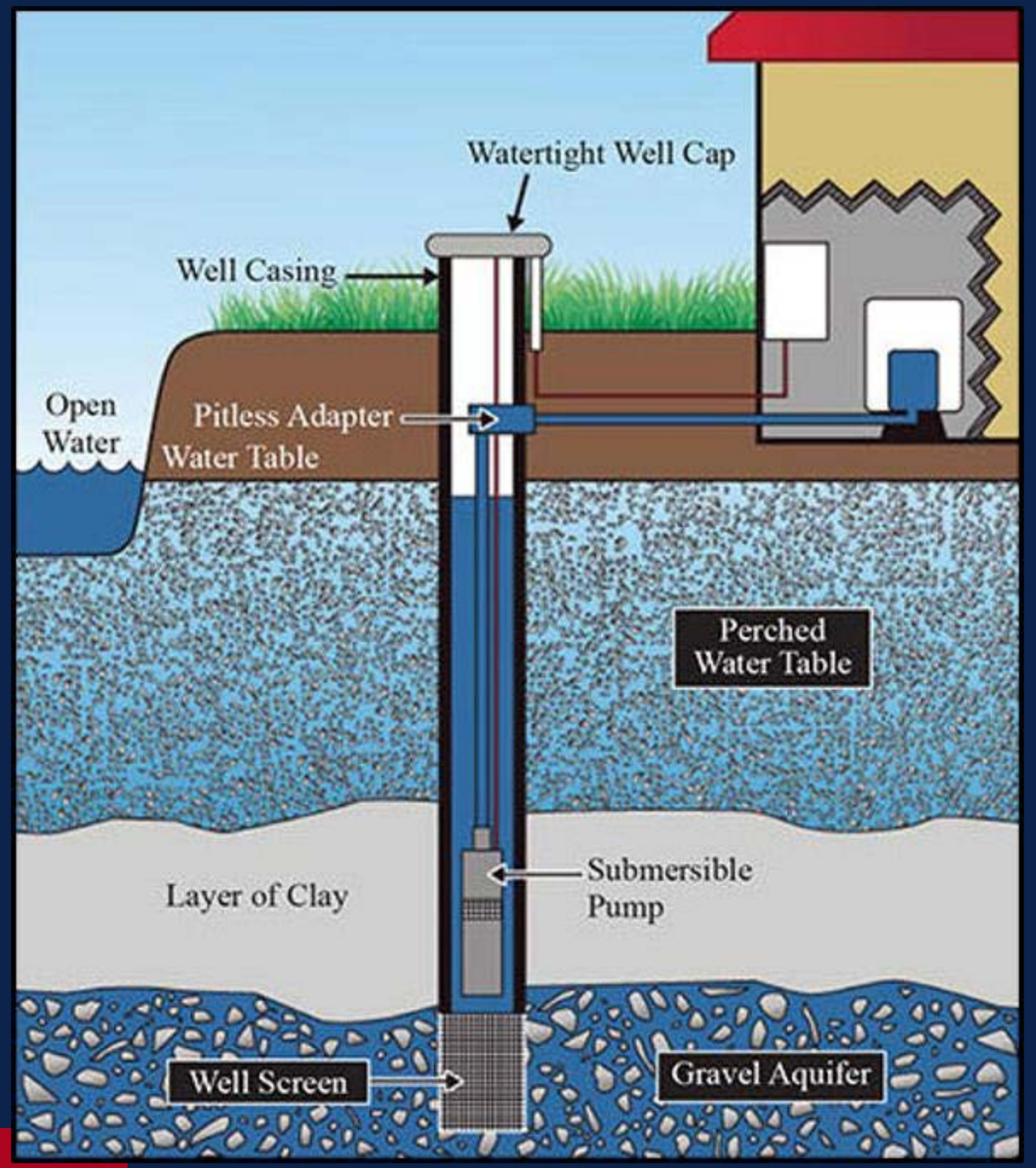
- How do we access and use groundwater?
- Both individual landowners and city municipalities drill wells to access groundwater.

THE UNIVERSITY OF ARIZONA

GROUNDWATER & ARIZONA: Pre Lesson 1

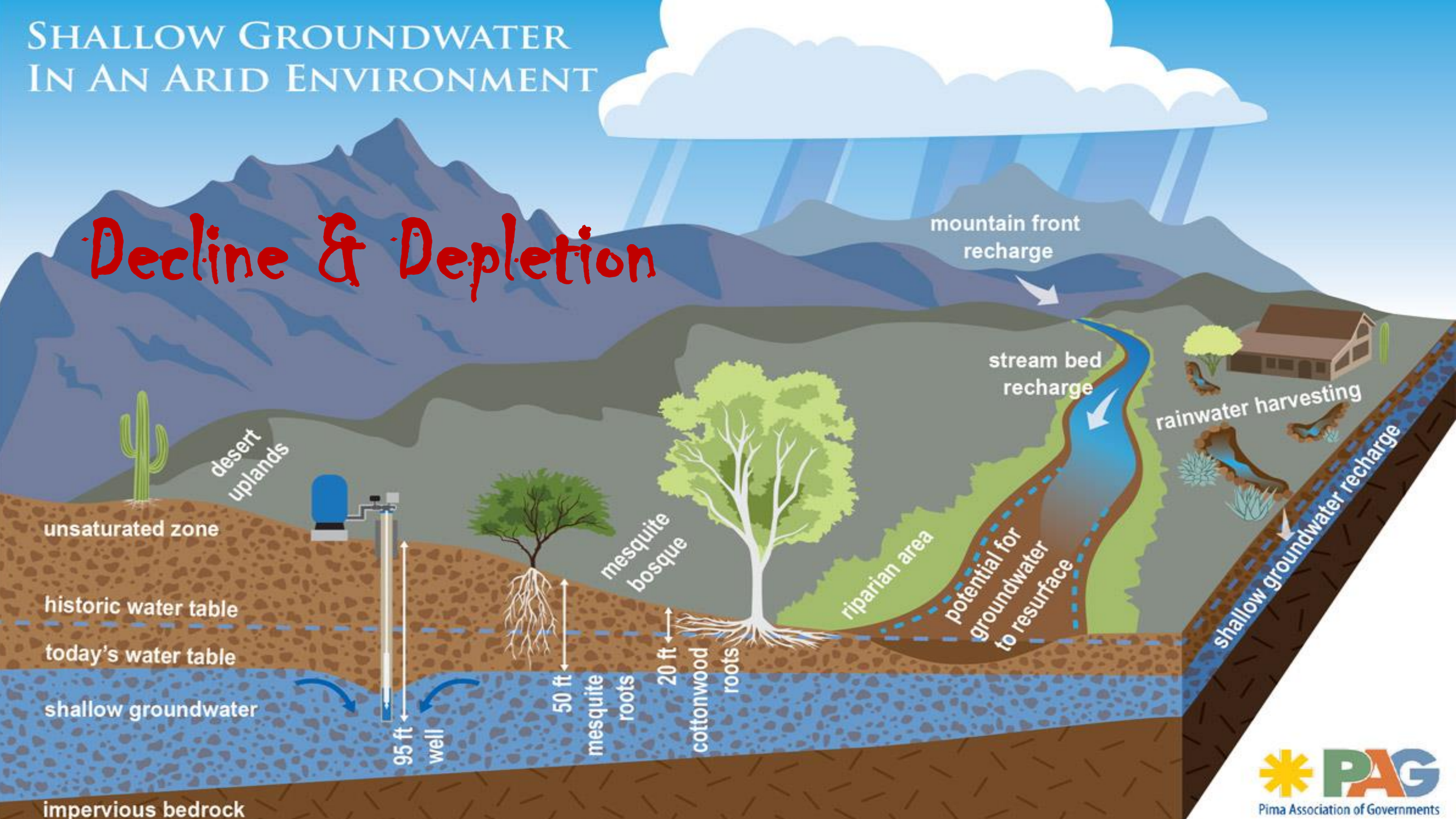
How do we pump it up and why?

- We use it for drinking water, agriculture, and for pretty much everything else.
- Do different places have different amounts of groundwater? Do you think it is evenly distributed under Arizona?



Shallow Groundwater In An Arid Environment

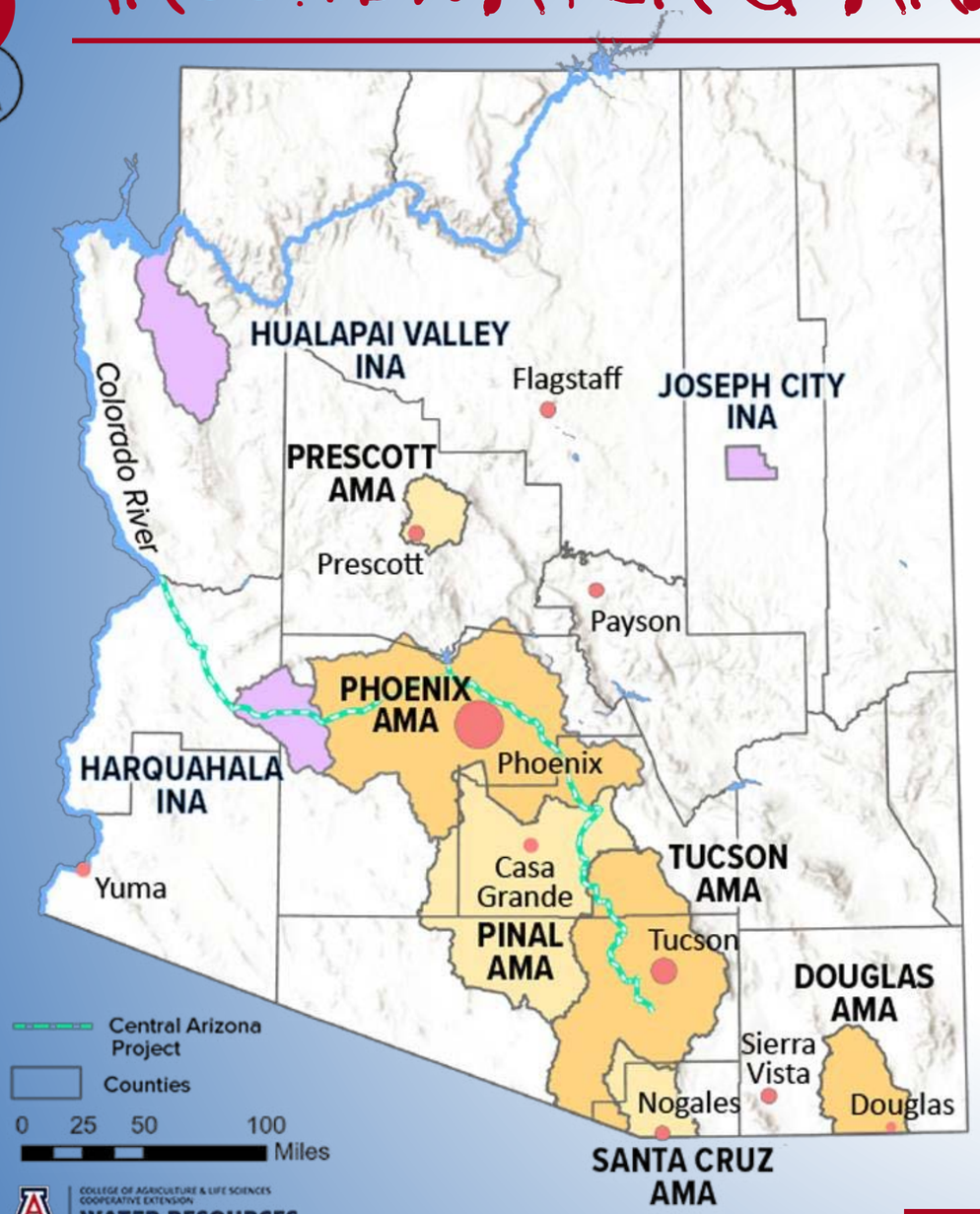
Decline & Depletion



Pima Association of Governments

Sink Holes, Fissures & Land Subsidence, Oh My!

GROUNDWATER & ARIZONA: Pre Lesson 1



1980 Arizona Groundwater Management Act

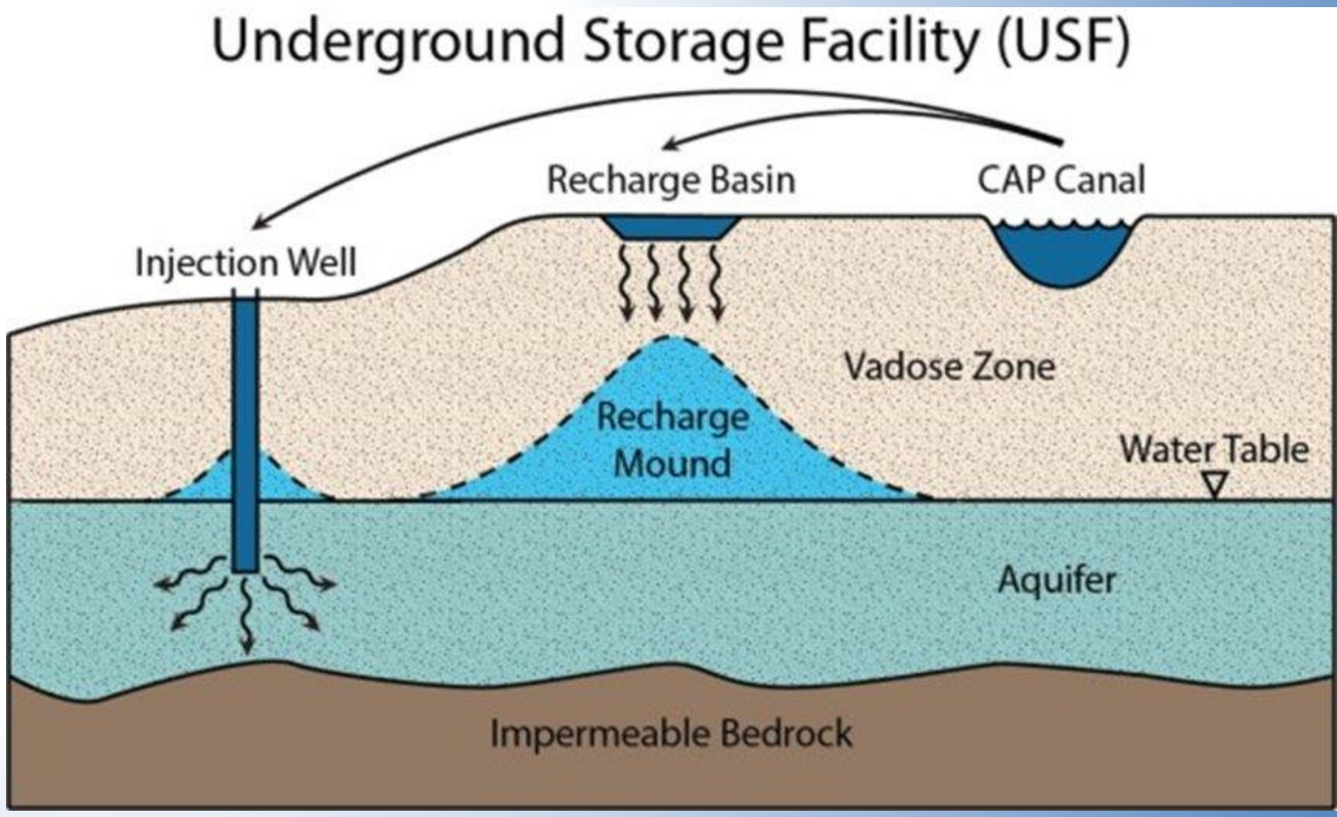
- Active Management Area and Irrigation Non-Expansion Area designations
- Groundwater pumping limitations
- Recharge

COLLEGE OF AGRICULTURE & LIFE SCIENCES COOPERATIVE EXTENSION
WATER RESOURCES RESEARCH CENTER

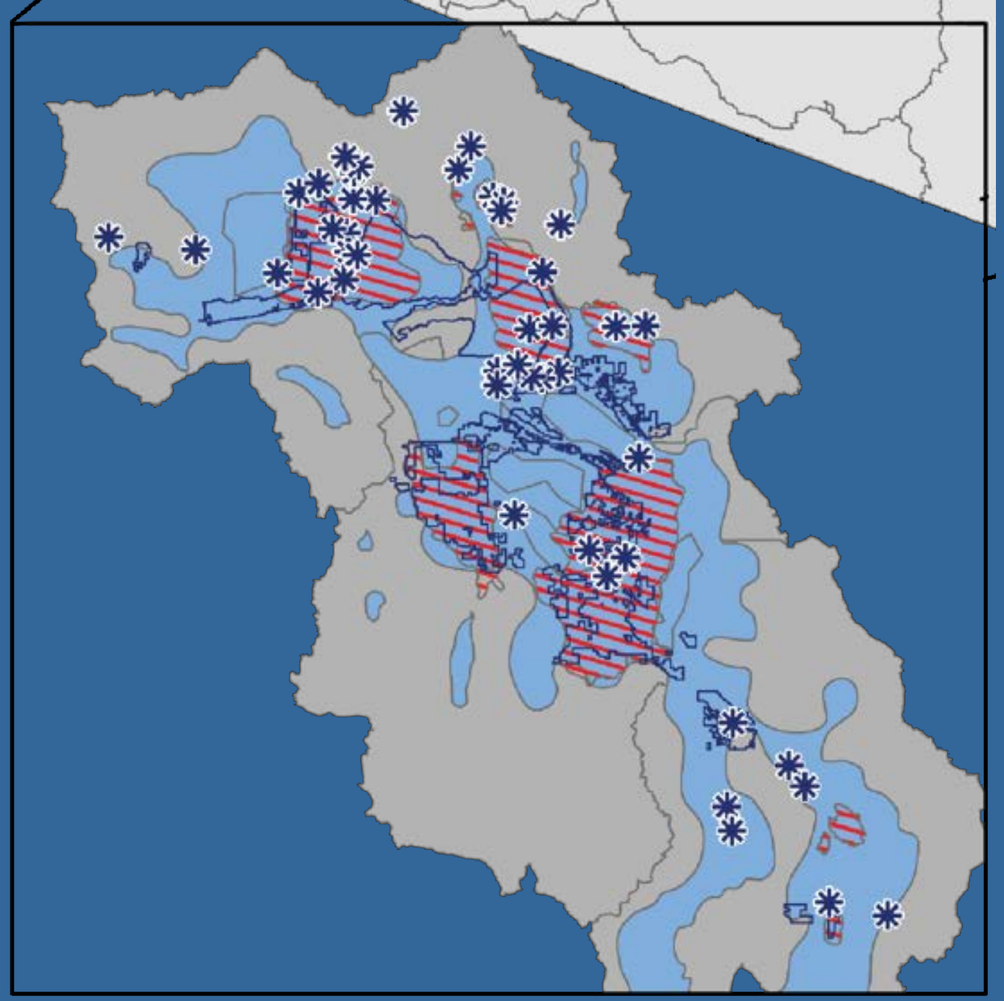
THE UNIVERSITY OF ARIZONA

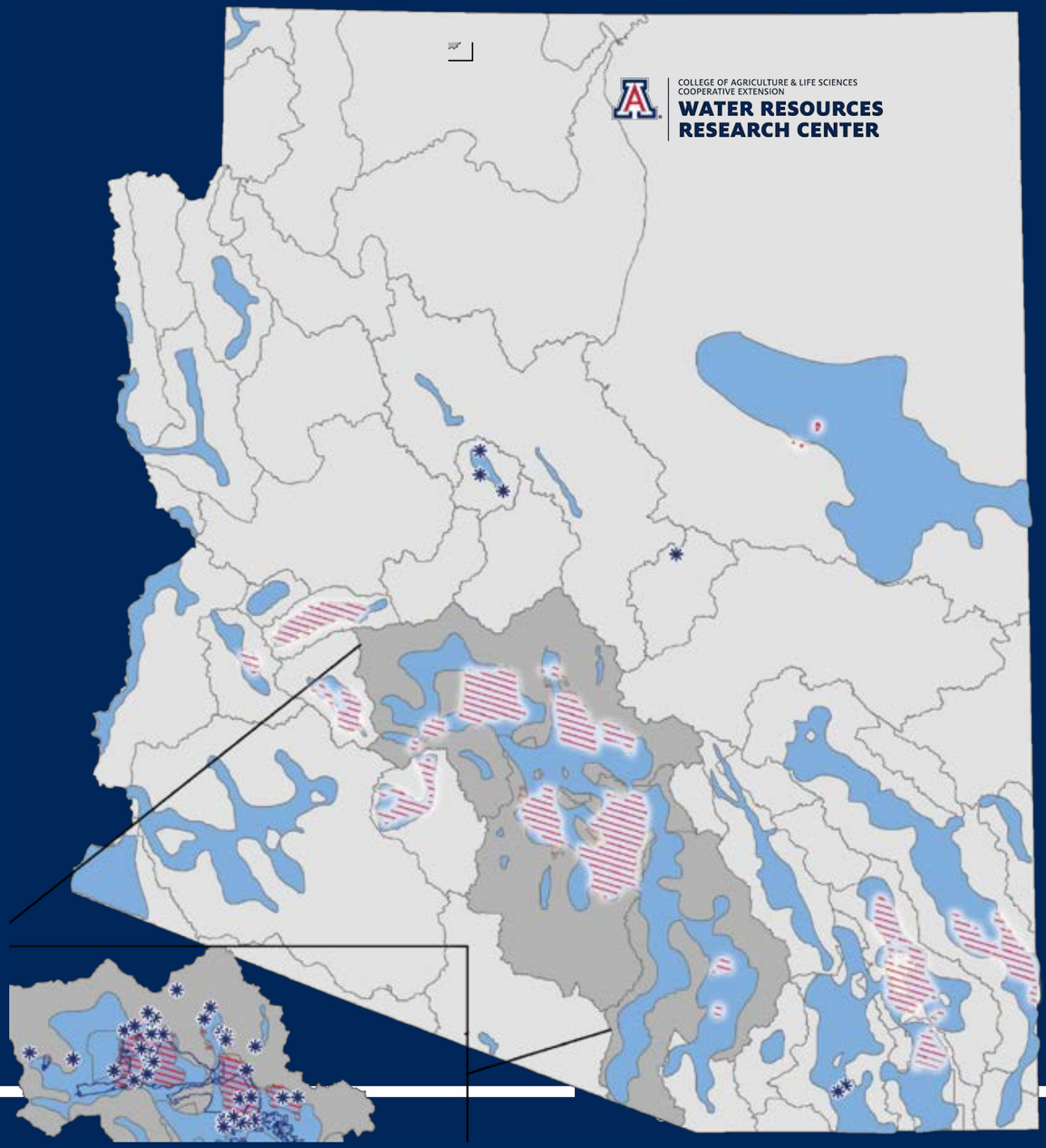
GROUNDWATER & ARIZONA: Pre Lesson 1

Recharging the Aquifer



SUBSIDENCE AND STORAGE





Source: ADWR 2014

- High Productivity Aquifers
- Land Subsidence Due to Overpumping
- Groundwater Basins
- Underground Storage Facility

GROUNDWATER & ARIZONA: Pre Lesson 1

- **Watch Series of Arizona Groundwater Videos – an APW & ADWR joint project.**

THE UNIVERSITY OF ARIZONA

Groundwater & Sustainability : Lesson 1

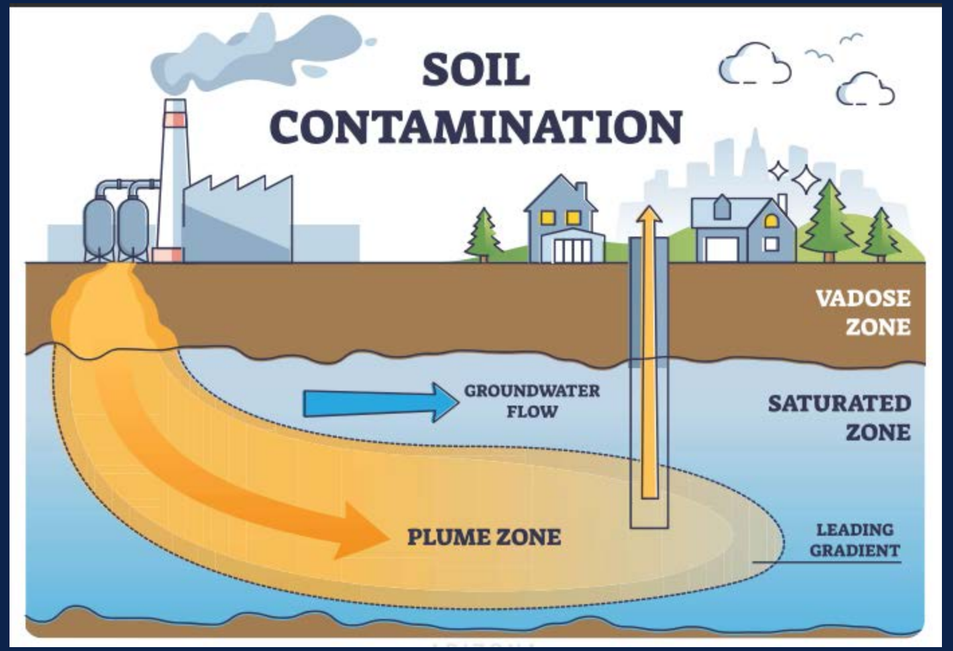
A PLUME PROBLEM

Investigative Questions

- How does water move underground?
- If groundwater is contaminated, will pollutants move to other nearby locations?

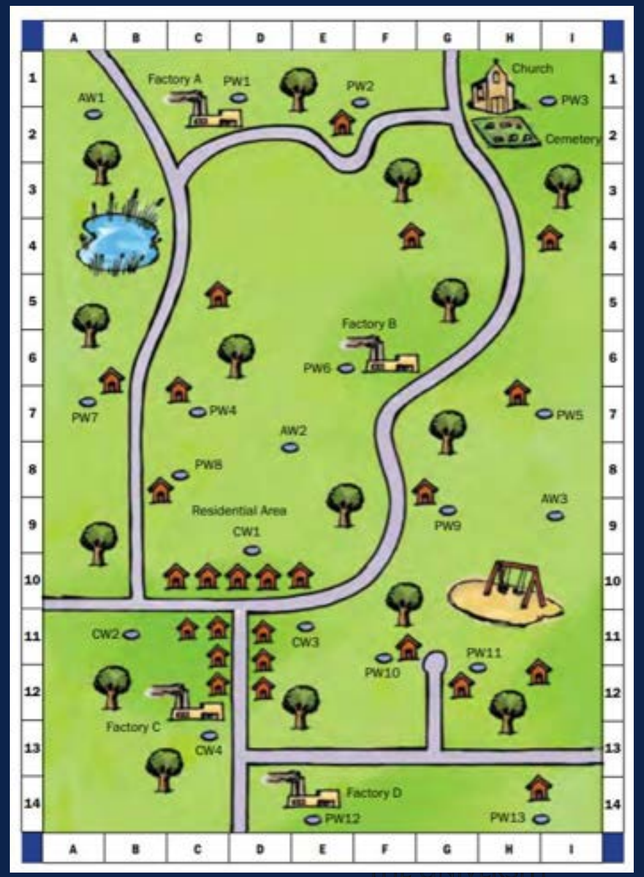
THE UNIVERSITY OF ARIZONA

GROUNDWATER: A Plume Problem



The Activity:

- Students read through a scenario and plot data on a map to discover groundwater contamination levels.
- They soon learn that with new evidence their data may not lead to only one answer.



- Sometimes past solutions become current problems.

Now think about how this activity might play into the case file?

- **Provide Lead #1 & #2 after lesson:**


CWC FILE: #33788DD

DESERT DAISY'S OSTRICH OASIS

NEW LEAD: #1

Detectives were able to find and speak with a former worker from the Derby Demolition days, and he explained more details about what happened on the property before the derby was decommissioned. He also provided a few photo showing some possible concerns of mishandling of hazardous materials that could be a concern. **Exhibit D**

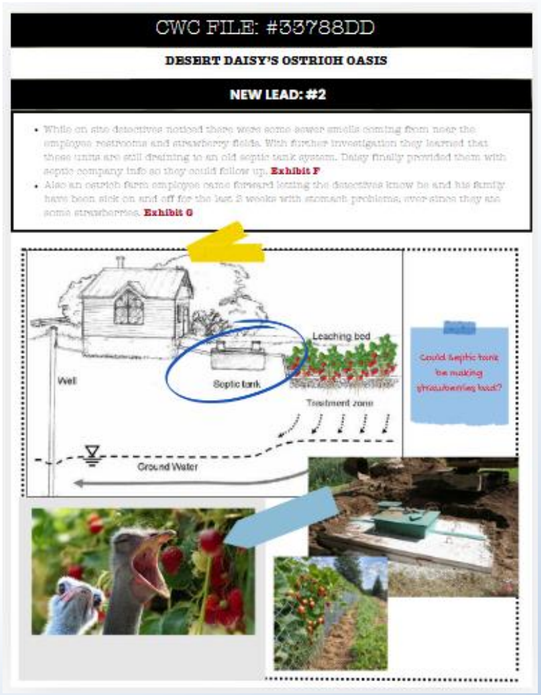

EXHIBIT D

August 2nd, 2024

"When I worked at Desert Daisy's back in the day, we had batteries and paint that we needed to get rid of. But, honestly, the people in charge didn't seem to care much about how we threw these things away.

I remember seeing batteries and paint cans piled up with other trash. There were no special bins or recycling processes for these items. We didn't get any instructions on how to handle them safely. They needed to be accessed fast and quick, since we would freshen up the paint before the derby would start. After painting we just left the materials outside on the ground, honestly it was like no one really cared."

-John Dale


CWC FILE: #33788DD

DESERT DAISY'S OSTRICH OASIS

NEW LEAD: #2

- While on site detectives noticed there were some sewer smells coming from near the employee restrooms and strawberry fields. With further investigation they learned that these units are still draining to an old septic tank system. Daisy finally provided them with septic company info so they could follow up. **Exhibit F**
- Also an ostrich farm employee came forward letting the detectives know he and his family have been sick on and off for the last 2 weeks with stomach problems, ever since they ate some strawberries. **Exhibit G**


Sunrise Septic Services
987 Everywhere Ln.
Discover City, AZ 12345
(602)-867-5309
info@sunriseseptic.com
www.sunriseseptic services.com

Cold-Water Case Squad
456 Always St., Discover City, AZ 12345

Dear Detective,

According to our records, the septic tank on Daisy's property was last serviced by our company 10 years ago. In the inspection report that was submitted with this service, there is a note about a potential leak coming from the septic tank. We recommended that Daisy follow up with our team if she had any concerns about this leak, but our records show that she never contacted us again. Please let us know if we can provide any further assistance to you. I have attached the inspection report to this letter.

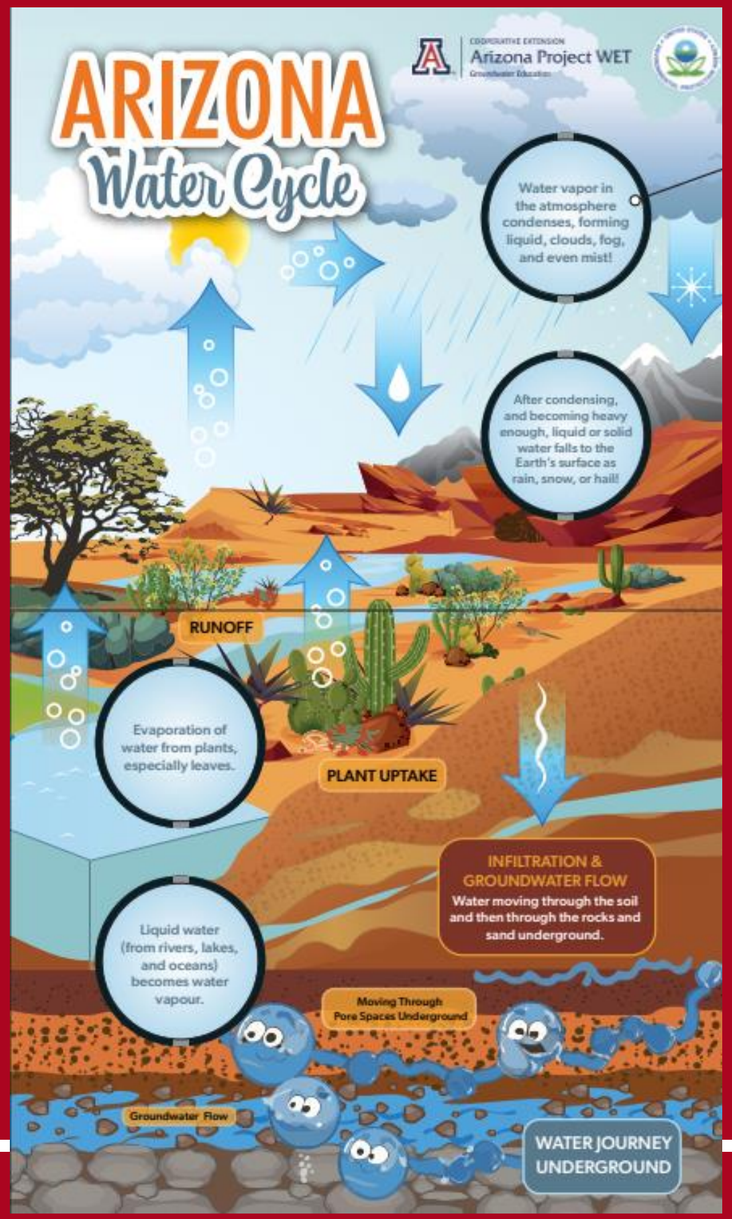
Sincerely,

John Doe
Head Septic Engineer

SUNRISE

EXHIBIT F

Wrap-Up



Stability & Change

Lesson 1

- What have you learned about how groundwater moves?
- If it is contaminated, can pollutants move to other locations?
- How does groundwater fit within the Arizona Water Cycle?
- How can you protect and conserve groundwater?

THE UNIVERSITY OF ARIZONA

WATERSHED: Lesson 2

Watershed Wonders:

1. Did you know that with every step that you take, you are always in a watershed?
2. You probably know what state and city you live in, but do you know which watershed you live in?
3. What exactly is a watershed, and why should you care about it?

THE UNIVERSITY OF ARIZONA

WATERSHED: *Watersheds Work*

What is a Watershed?

A watershed is: a land area that DRAINS to the low points.

THE UNIVERSITY OF ARIZONA

WATERSHED: Watersheds Work

The Activity:

Key/Legend:

- Ridges (along upfold) = Green
- Valleys (along downfold) = Blue

Optional:

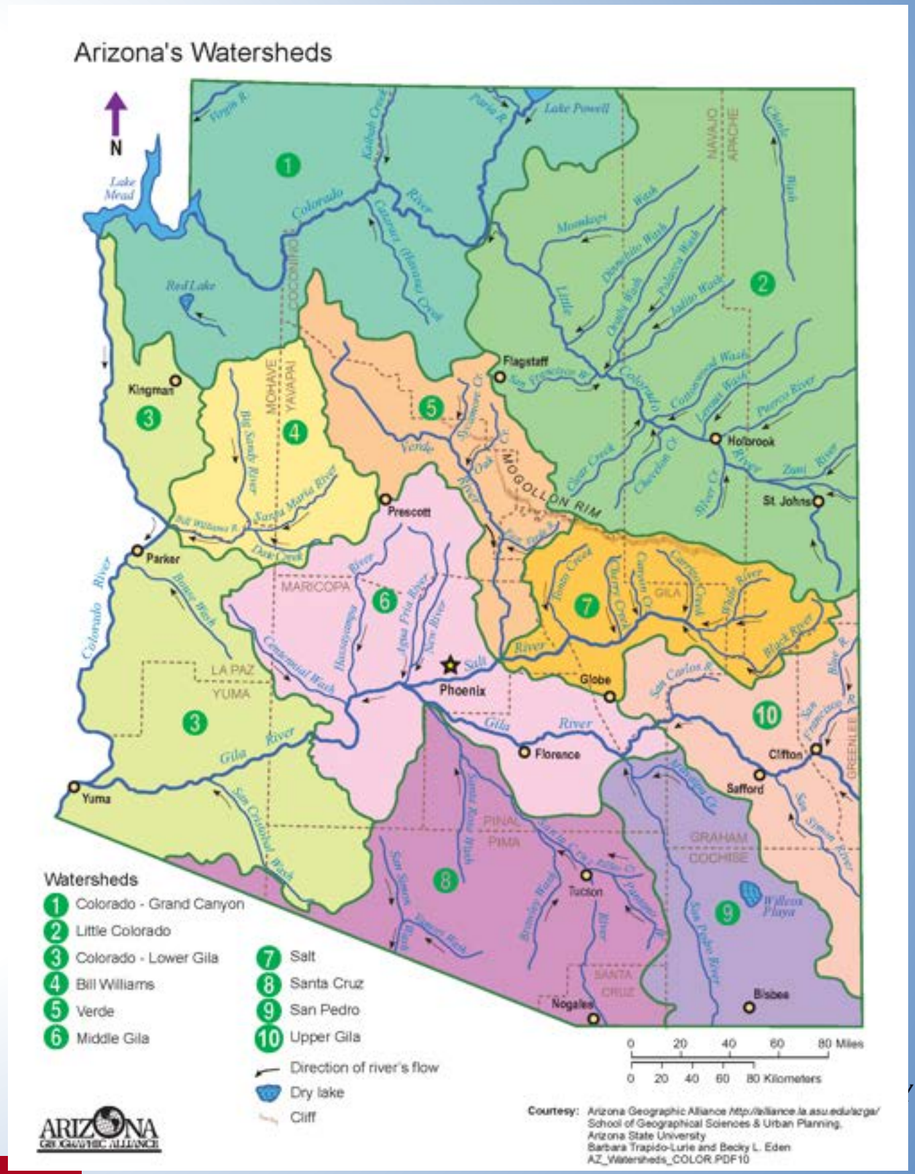
- Farms (colored area) = Brown
- Old Mines (*) = Red
- Cities (#) = Purple

THE UNIVERSITY OF ARIZONA

WATERSHED: Watershed Works

What are we managing when we talk about watershed management?

The land and water in that area.



WATERSHED: Lesson 2

Watersheds Work

Investigative Questions

- How does human impact on the land affect water and heat within a watershed?
- How can we reduce urban runoff and the flow of contaminants in water throughout a watershed?

SW-IFL
Southwest Integrated Field Laboratory

WATERSHED: Watersheds Work

Following the Flow

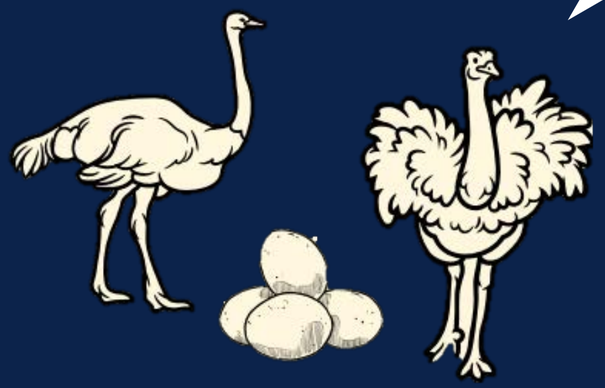
- When rain falls or when snow melts, does the water just sit there? Or does it move? Why?
- We know some of it may percolate down through earth materials into the ground, but most of it flows downhill as what?

Runoff is important as it keeps our rivers, lakes and groundwater flowing. But…?

SW-IFL
Southwest Integrated Field Laboratory

What's on the surface matters

- What happens when rain falls on:
  - fields, meadows, and pastures?
  - a forest or woodland?
  - a desert landscape or dunes?
  - the city and suburbs?



SW-IFL
Southwest Integrated Field Laboratory

PERMEABLE

Water can sink in or percolate into the earth materials, where plants can use it, or it keeps traveling further down to reach groundwater (infiltration).

IMPERMEABLE

Water cannot penetrate or percolate, but rather pools or runs off the surface. These are also called impervious surfaces.

Watershed: *Watersheds Work*

In our city centers and neighborhoods what happens to that runoff?

Rain becomes storm water!

What makes storm water a bad thing?






SOIL – SEDIMENTS – ROAD SALT – VEHICLE SPILLS – FERTILIZERS – PET WASTE – HEATED WATER – GREASE – TRASH – DETERGENT – SOLVENTS

THE UNIVERSITY OF ARIZONA

Where does storm water go?

To our rivers, lakes, and natural environment.

Check out Green Stormwater Infrastructure

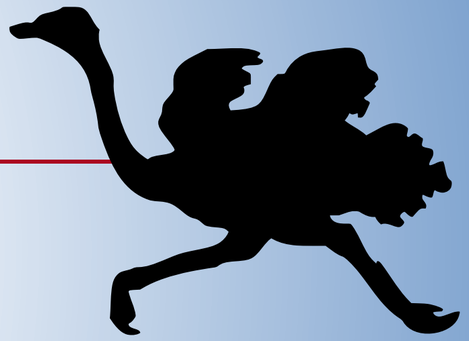
Now think about how this activity might play into the case file?

CWC FILE: #33788DD

DESERT DAISY'S OSTRICH OASIS

NEW LEAD: #3

- Another eye witness came forward. A farm worker from the alfalfa farm on the adjoining property to the ostrich farm has provided evidence that the alfalfa farm does spray with a lot of pesticides and herbicides and that her family hasn't been feeling well recently.
- Also noted was that while the stream from the alfalfa farm is drying up, there are still some deep enough areas/pools of water that some of the ostriches use to drink from.



- **Provide Lead #3 after lesson**

THE UNIVERSITY OF ARIZONA

WATERSHEDS & CLIMATE: Lesson 3

We all have a role:

- The quality of water in a river or lake is influenced by both natural factors and how people use the land around it.
- Everyone is responsible for the health of the watershed and the water systems within it.
- Our actions, good or bad, have an impact on our water supply.

THE UNIVERSITY OF ARIZONA

WATERSHEDS & CLIMATE: Lesson 3

CSI: Water & Diseases

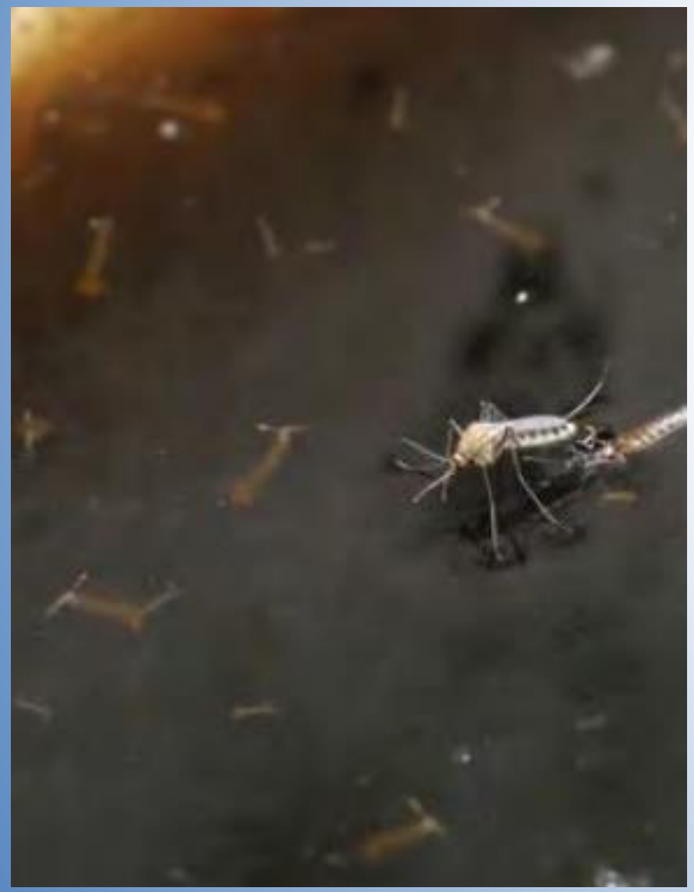
Investigative Questions

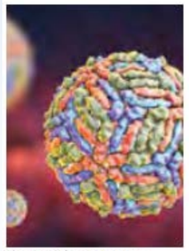
- What is the role of water in transmitting diseases and in human/animal wellness?
- How do the characteristics of environments that promote the transmission of diseases change with a changing climate?

THE UNIVERSITY OF ARIZONA

WATERSHEDS & CLIMATE: Lesson 3

Waterborne Diseases





Shutterstock_Kateryna Kon

West Nile Virus, transmitted from the *Aedes* mosquito

West Nile virus is most commonly transmitted through the bite of a mosquito. Mosquitoes become infected from feeding on infected birds then spread West Nile virus to people and other animals by biting them. The majority of people who contract West Nile Virus will not show symptoms. Mild symptoms such as a fever, rash, vomiting and/or diarrhea may last a few days although fatigue may last several weeks. One in 150 people may develop a severe illness affecting the central nervous system such as encephalitis (inflammation of the brain) or meningitis (inflammation of the membranes that surround the brain and spinal cord). These symptoms may include high fevers, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, vision loss, numbness and paralysis.

Shutterstock_Kateryna Kon

Enterotoxigenic E. coli (ETEC) gastroenteritis, caused by *E. coli bacteria*.

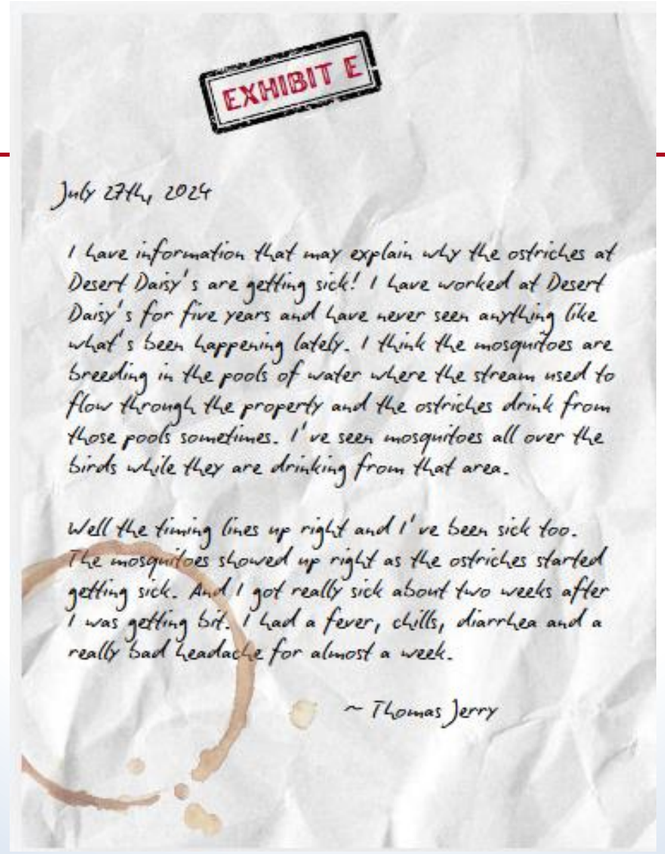
A leading cause of infant mortality worldwide, E. coli gastroenteritis is best known in the United States as an affliction common to those who visit developing countries and consume contaminated water or food. ***E. coli*** bacteria was also responsible for a wide-ranging recall of spinach and other leafy greens in 2006 after three people died and more than 200 were sickened, including 30 people who suffered a form of kidney failure. Abdominal cramping, nausea and vomiting are all common symptoms of the infection.

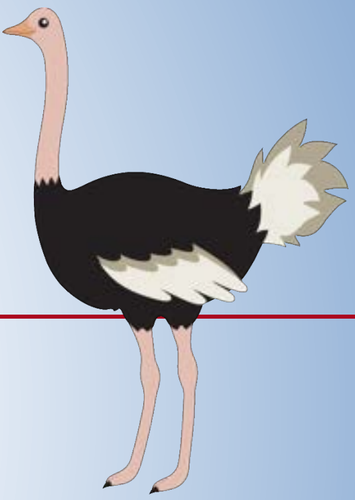
Activity:

- Students learn about how a changing climate may affect waterborne and vector diseases.
- They search for others who have been “infected” with the same disease as they have, learning and sharing about each disease.

THE UNIVERSITY OF ARIZONA

Now think about how this activity might play into the case file?





- **Provide Lead #4 after lesson**

THE UNIVERSITY OF ARIZONA

Lesson 3

Systems and System Models & Cause and Effect

Wrap-Up

- Better understanding the role of water in transmitting diseases helps us be more aware of human/animal wellness.
- So how do you think climate change and new extremes will affect disease and water quality?

THE UNIVERSITY OF ARIZONA

APW Staff Visit School

- Groundwater
- Watershed

Solve the Case

- A little more research
- Groups create and present final arguments
- Take a poll to see who believes what the culprit is…

Close the Case

- **Final Test Results**
- **Final Case Synopsis**

Lab Results

2. Blood Test Results

Animal ID: Ostrich #27
Date of Test: August 9, 2024
Lab Technician: John Martinez

Test Results:

Test Parameter	Result	Normal Range
Lead Level (ppm)	15.2	< 0.5 ppm
Hemoglobin	8.2 g/dL	10.0 - 12.5 g/dL
Hematocrit	24%	30% - 37%
White Blood Cells	6,500 /µL	5,000 - 8,000 /µL

Interpretation:

- **Elevated Lead Levels** - The lead concentration in the blood is significantly higher than the normal range, indicating chronic exposure to lead.
- **Anemia** - Lower hemoglobin and hematocrit levels are consistent with lead poisoning effects.

Summary:
The blood test confirms elevated lead levels, which are consistent with the lead poisoning observed in the necropsy. This confirms that lead contamination is the cause of the illness affecting the ostriches.

~ Dr. Featherbottom

Soil Analysis Report

Solaris Analytic Inc.
2276 Randy Johnson Way
Discover City, AZ 12345
www.solarisanalytic.com

Prepared for
Account 23324
Andy's Alfalfa Farm
351 Anywhere St
Discover City, AZ 12345

Sample description: bare soil from cropland
Sample taken: 7-23-2024
Sample received: 7-24-2024
Sample tested: 7-26-2024

Analyte	Detection Limit (mg/kg)	Result
2,4-D	160	60
Aldrin	84	ND
Chlordane	3300	ND
Chlorpyrifos	840	800
Dieldrin	160	ND
Diuron	160	100
Endosulfan	84	ND
Endosulfan sulfate	160	ND
Endrin	160	ND
Endrin aldehyde	160	ND
Heptachlor	84	ND
Heptachlor epoxide	84	ND
Hexazinone	84	52
Methoxychlor	840	ND
Simazine	160	70
Toxaphene	3000	ND

Detection Limit = minimum amount of substance testing can detect in soil
ND = Not Detected

Summary of Results
Although there are no established limits for pesticides and herbicides in soils, all pesticide levels detected are well below levels of concern for human and animal health.

Analyzed by Solaris Analytic Inc.
www.solarisanalytic.com
Report No. 135-42

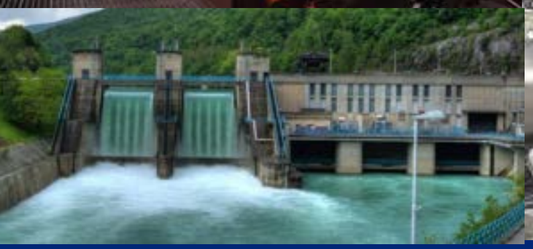
SUSTAINABILITY & STEWARDSHIP:

My Water Footprint

Investigative Questions

- How much water do I use daily?
- Why is water use called a water footprint?
- How can I be a better water steward?

THE UNIVERSITY OF ARIZONA



Indirect Water Use

The water used to produce the goods and services we all enjoy. It is the water hidden or not seen by the end-user during the process or manufacturing of a good or service.

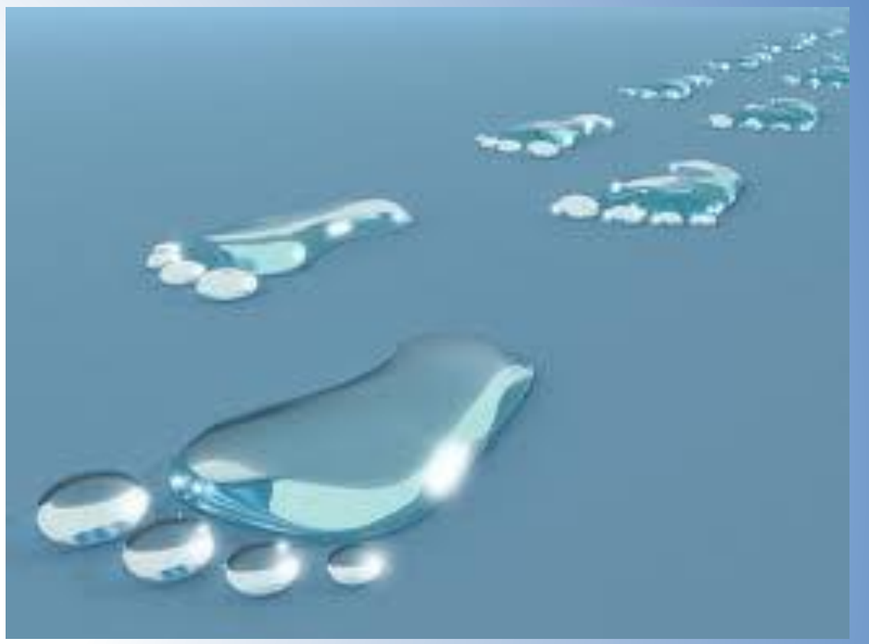
Direct Water Use

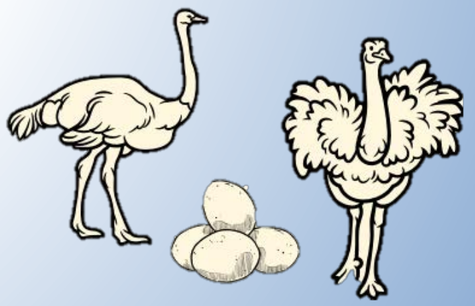
Water you use directly to do something immediately. Water that is seen, felt and used at that given time. When you turn on your faucet or hose for water.

SUSTAINABILITY & STEWARDSHIP:

What is a Water Footprint?

- It reveals water use patterns, from the individual level all the way to the national level.
- It shines a light on the water used in all the processes involved in manufacturing and producing our goods. It also accounts for water contaminated during manufacturing and production.
- A water footprint is measured in terms of the volume of water consumed, evaporated and polluted.





THE UNIVERSITY OF ARIZONA

SUSTAINABILITY & STEWARDSHIP:

BE THE TIDAL WAVE OF CHANGE!

Your daily choices and actions can add up to make a positive difference.

THE UNIVERSITY OF ARIZONA

Splashing into Solutions

You Have the Power!

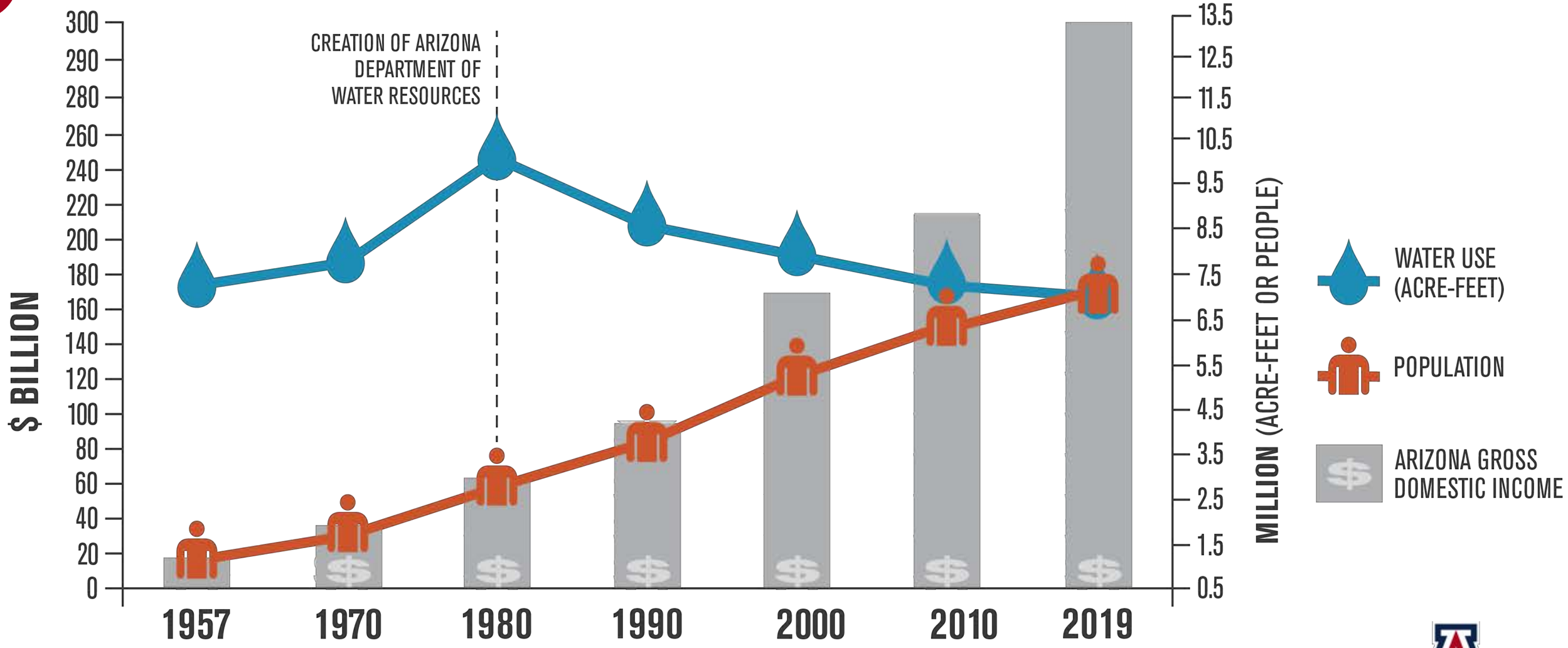
What is Water Conservation?

- Beneficial reduction in water loss, waste or use by changing behavior to use less water.

What is Water Efficiency?

- Minimize the amount of water used to accomplish a function or task. Doing more with less water. Normally relies on well-engineered products and fixtures or technology

THE UNIVERSITY OF ARIZONA



SOURCE: ADWR, 2020

THE UNIVERSITY OF ARIZONA

Take the PLEDGE:

I PLEDGE to be a water steward, to do my best to make smart choices and take actions that help conserve and keep our water supply clean.

THE UNIVERSITY OF ARIZONA

WSI UNIT GUIDING QUESTIONS:

How is water polluted and how can we keep human activity from compromising the viability of our watershed/water cycle systems?

THE UNIVERSITY OF ARIZONA

Reminders!

- Please have students complete the post student survey.
- Please provide honest feedback about how you felt this unit went (there is this workshop survey, and then a teacher after unit survey).
- Enjoy your new resources!

Survey Time!

THE UNIVERSITY OF ARIZONA

THE UNIVERSITY OF ARIZONA
Cooperative Extension

Thank you!

Kirstyn Kay – kkay@arizona.edu

Brian Valencia - bvalencia@arizona.edu

Lexi Smith - alexiasmith@arizona.edu

ARIZONA
project WET
WATER EDUCATION TODAY