



# Gold King Mine Spill **Diné Exposure Project**

**TÓ'ÉITSO**, THE WATER IS YELLOW:  
WATER QUALITY RESULTS OF THE SAN JUAN  
RIVER ON THE NAVAJO NATION ONE YEAR  
AFTER THE GOLD KING MINE SPILL

**6/21/17**

**KARLETTA CHIEF, PALOMA I. BEAMER, ELMIRA  
TORABZADEHKHORASANI, NATHAN LOTHROP, DEAN BILLHEIMER,  
YOSHIRA ORNELAS VAN HORNE, AND JANI INGRAM**

Partnerships:



Funded By:



National Institute of  
Environmental Health Sciences



**Agnese Nelms Haury Program**  
in Environment and Social Justice

# WHO WE ARE



## UNIVERSITY OF AZ



- Karletta Chief
  - Hydrology Professor



- Paloma Beamer
  - Environmental Health Professor



- Nicolette Teufel-Shone
  - Health Promotion Professor



- Dean Billheimer
  - Biostatistics Professor



## NORTHERN ARIZONA

- Jani Ingram
  - Chemistry Professor
- Manley Begay
  - Indigenous Studies Professor



## NAVAJO CHR

- Mae-Gilene Begay
  - CHR Director



## DINÉ COLLEGE

- Perry Charley
  - Director, Diné Environmental Institute



## FORT LEWIS COLLEGE

- Becky Clausen
  - Sociology Professor

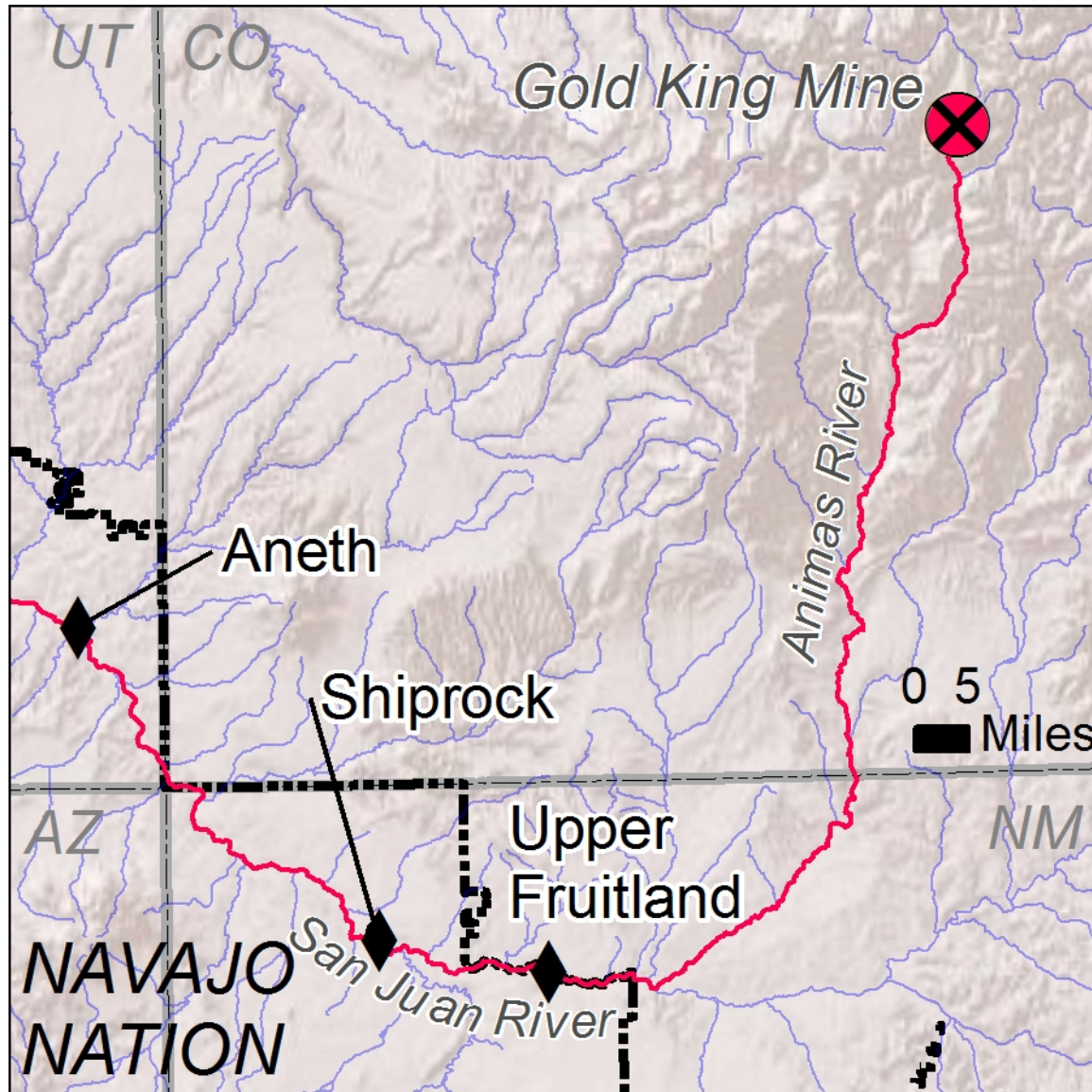


## TÓ BEE NIHI DZIIL

- Janene Yazzie
  - Community Organizer



# PROJECT AREA



Gold King Mine Spill Dine' Exposure Project

# PROJECT GOALS

1. Find out levels of Arsenic, Lead, and Manganese in Environmental Samples from 3 Chapters for one year
2. Understand Human Exposure to the Spill
  - Household Environmental Samples for Arsenic and Lead
  - Personal Samples of Urine for Arsenic and Blood Lead tests
  - Sheep and Corn Samples for Arsenic and Lead
3. Survey what people think about risk from the Spill and report back measured risks



# GOAL 1: ENVIRONMENTAL SAMPLES

## 20 SAMPLES AT EACH CHAPTER

- River Water
- River Sediment Core
- Agricultural Soil
  - Grab & Core
- Irrigation Water
- Irrigation Sediment Core



# ENVIRONMENTAL SAMPLES COLLECTED

## 1. Nov 2015

- 162 soil/sediment
- 62 water



## 2. March 2016

- 183 soil/sediment
- 37 water



## 3. June 2016

- 213 soil/sediment
- 201 water

- UA, NAU, & Diné College
- 858 samples total



# WATER STATUS

- Total of **288** water samples collected

	<i>Number of samples by month</i>		
<i>Sample Type</i>	<b>Nov.</b>	<b>March</b>	<b>June</b>
Irrigation canal water	17	10	59
River water	38	31	109
Well water	12	0	12
<b>Total by Month</b>	<b>67</b>	<b>41</b>	<b>180</b>



# WATER GUIDELINES: DRINKING WATER FOR PEOPLE

- US EPA Primary Maximum Contaminant Level (MCL)
  - The maximum amount of a contaminant allowed in drinking water so that it is still safe for people to drink over many years
- US EPA *Secondary* MCL
  - The *suggested* maximum amount of a contaminant in drinking water so the water does not have bad taste, smell, or color
  - **Not related to human health or safety**
- Both set by the US Environmental Protection Agency





# WATER GUIDELINES: PLANTS AND ANIMALS IN WATER

- NOAA SQuiRTs (Screening Quick Reference Tables)
  - The maximum amount of a contaminant allowed in water so it is safe for plants and animals to live in over many years
  - Used by the National Oceanic and Atmospheric Administration (NOAA)
  - Based on levels set by the US EPA and other organizations

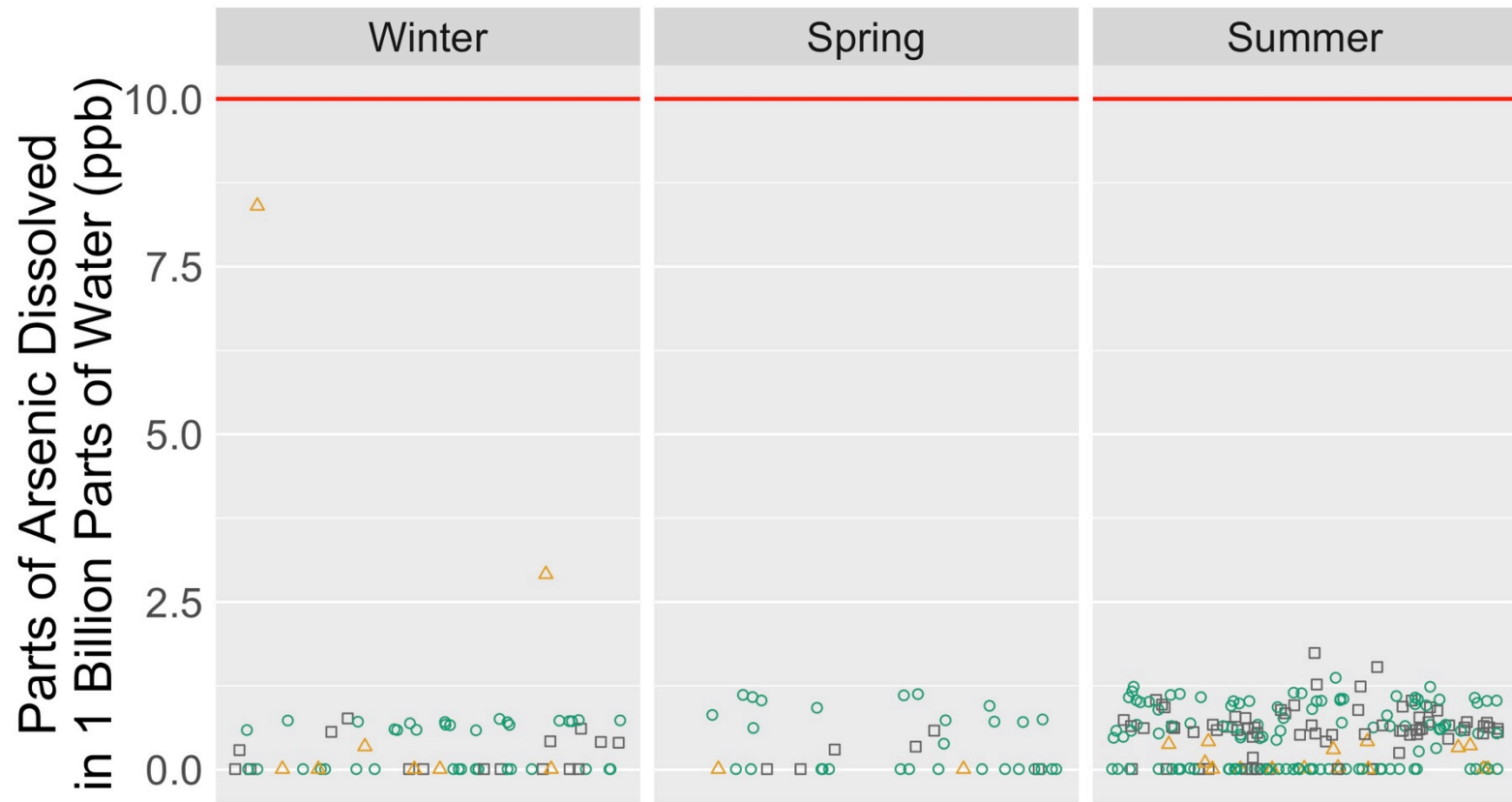


# OUR MAIN FINDINGS

- Amounts of **arsenic** in water were below the guidelines for drinking water for people and for plants and animals living in water
- Amount of **lead** in 4 river samples was above the water guideline for plants and animals living in water in Spring 2016
- Amounts of **manganese** were above both guidelines in Spring 2016 more than Winter 2015 and Summer 2016
- Amounts of metals in the San Juan River and canal water were generally higher in Spring 2016 compared to Winter 2015 and Summer 2016



# AMOUNT OF ARSENIC IN WATER



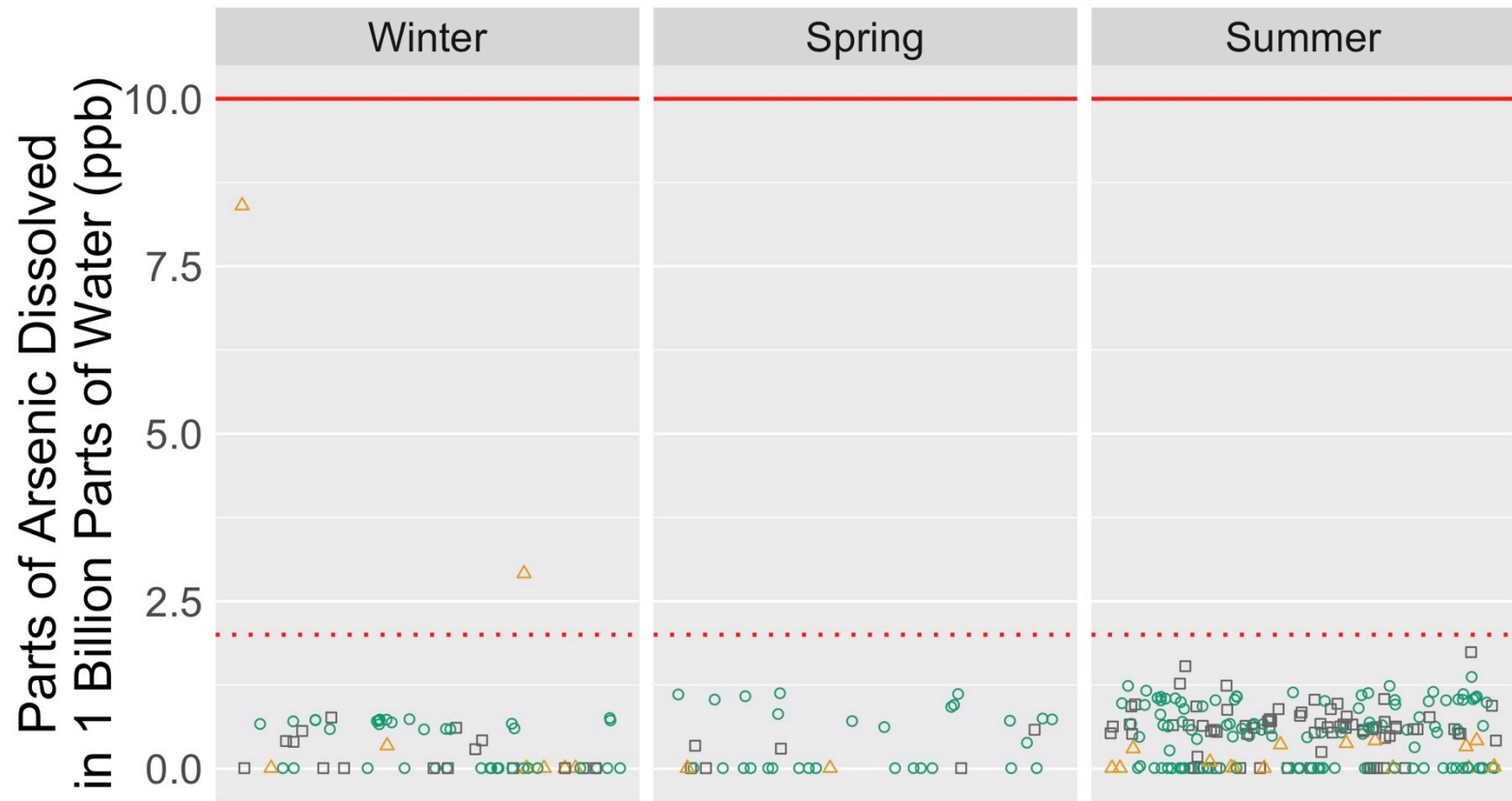
Guidelines: — US EPA Primary MCL

Where sample was taken: □ Canal ○ River △ Well



Gold King Mine Spill Dine' Exposure Project

# AMOUNT OF ARSENIC IN WATER



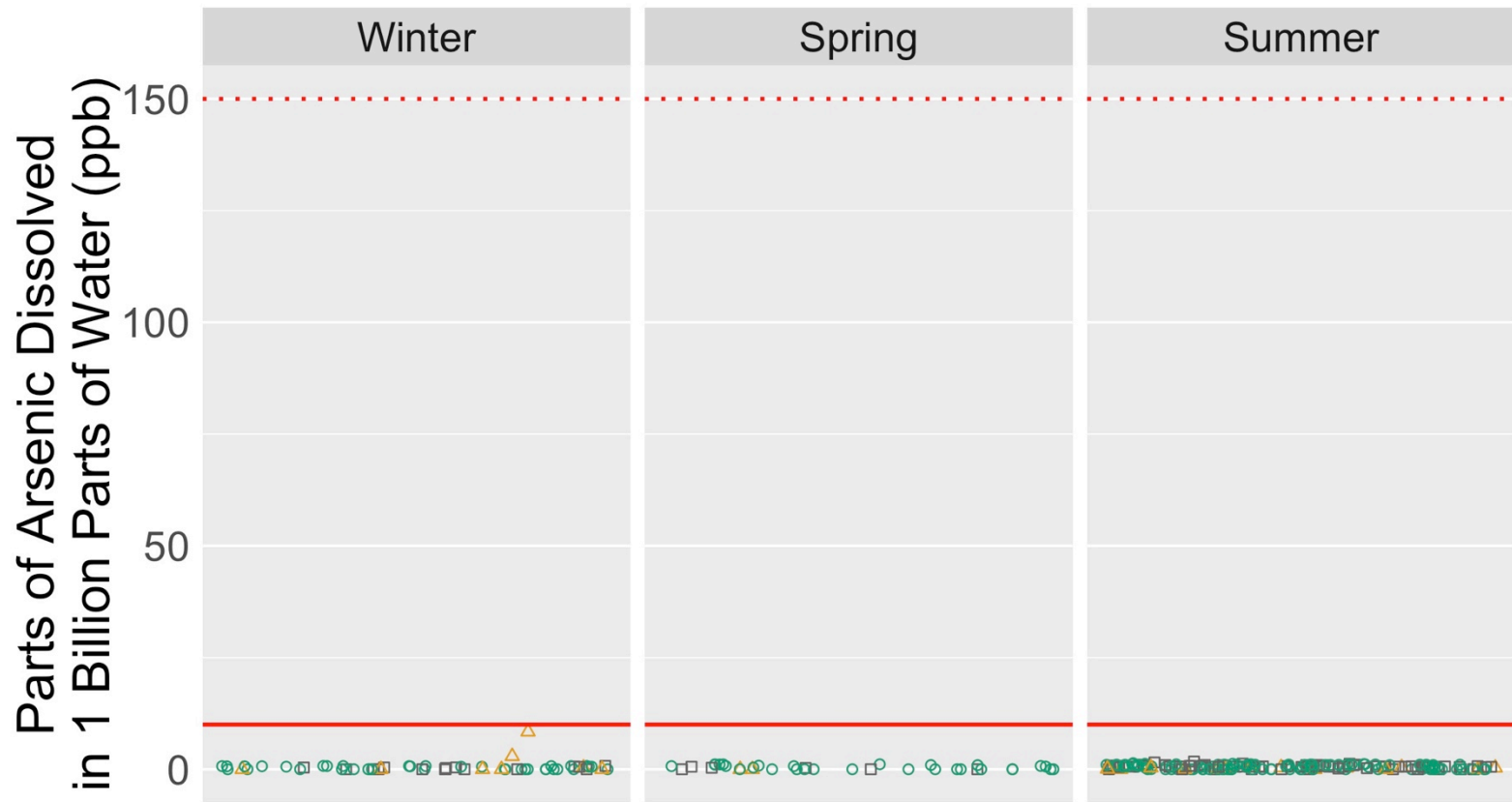
Guidelines: Tucson City Minimum US EPA Primary MCL

Where sample was taken: Canal River Well



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# AMOUNT OF ARSENIC IN WATER

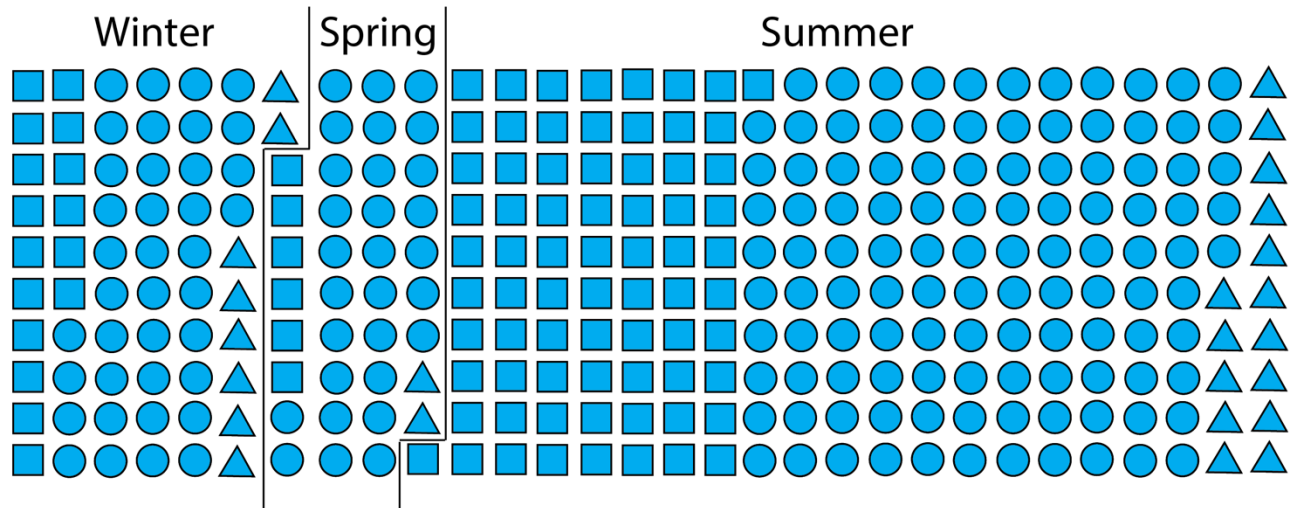


Where sample was taken: □ Canal ○ River △ Well

Guidelines: - - - NOAA SQuiRTs — US EPA Primary MCL



# COMPARING AMOUNTS OF ARSENIC IN WATER TO GUIDELINES



## Legend

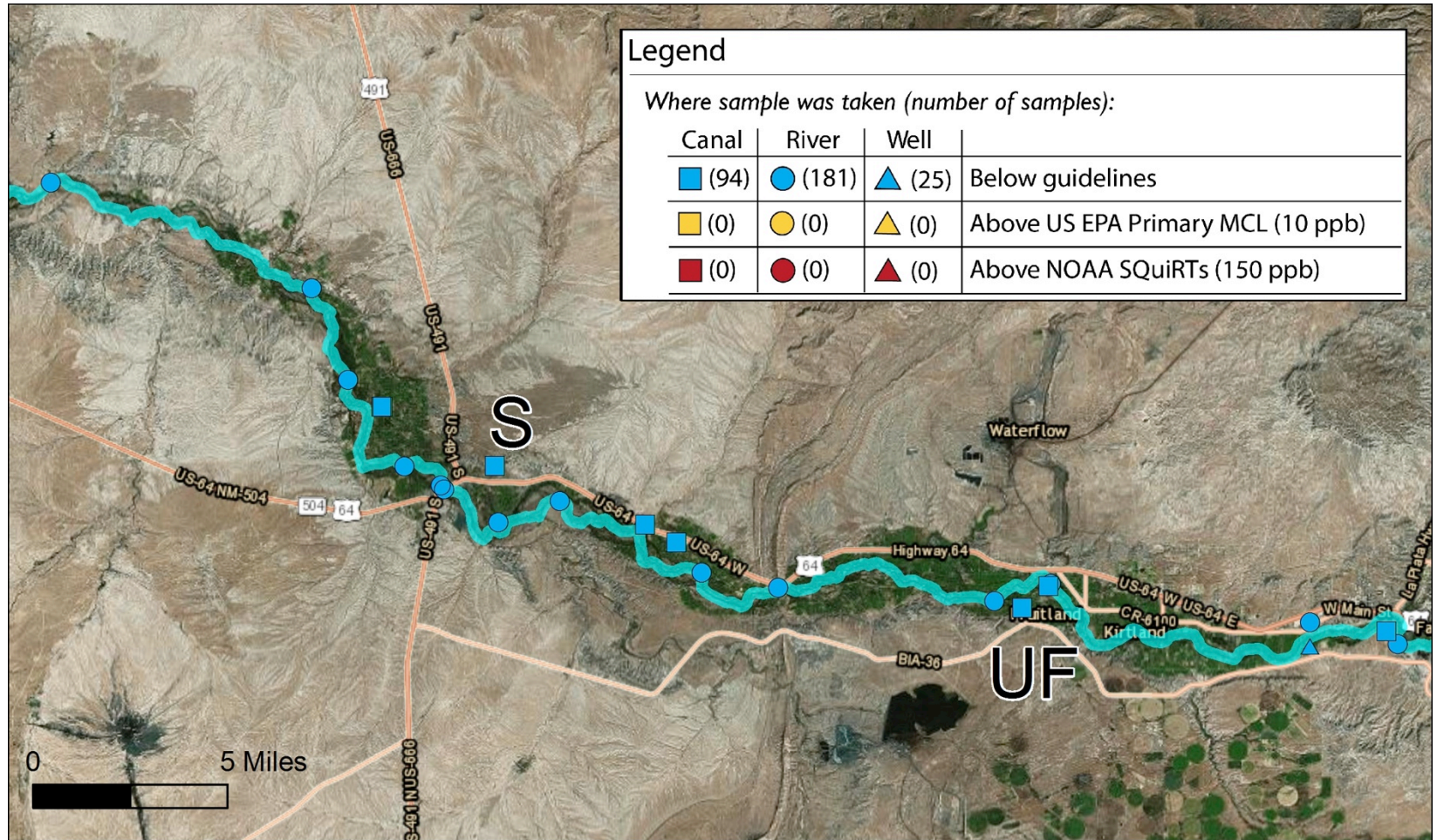
Where sample was taken (number of samples):

Canal	River	Well	
■ (94)	● (181)	▲ (25)	Below guidelines
■ (0)	● (0)	▲ (0)	Above NOAA SQuiRTs (2.5 ppb)
■ (0)	● (0)	▲ (0)	Above US EPA Primary MCL (15 ppb)



# COMPARING AMOUNTS OF ARSENIC IN WATER TO GUIDELINES

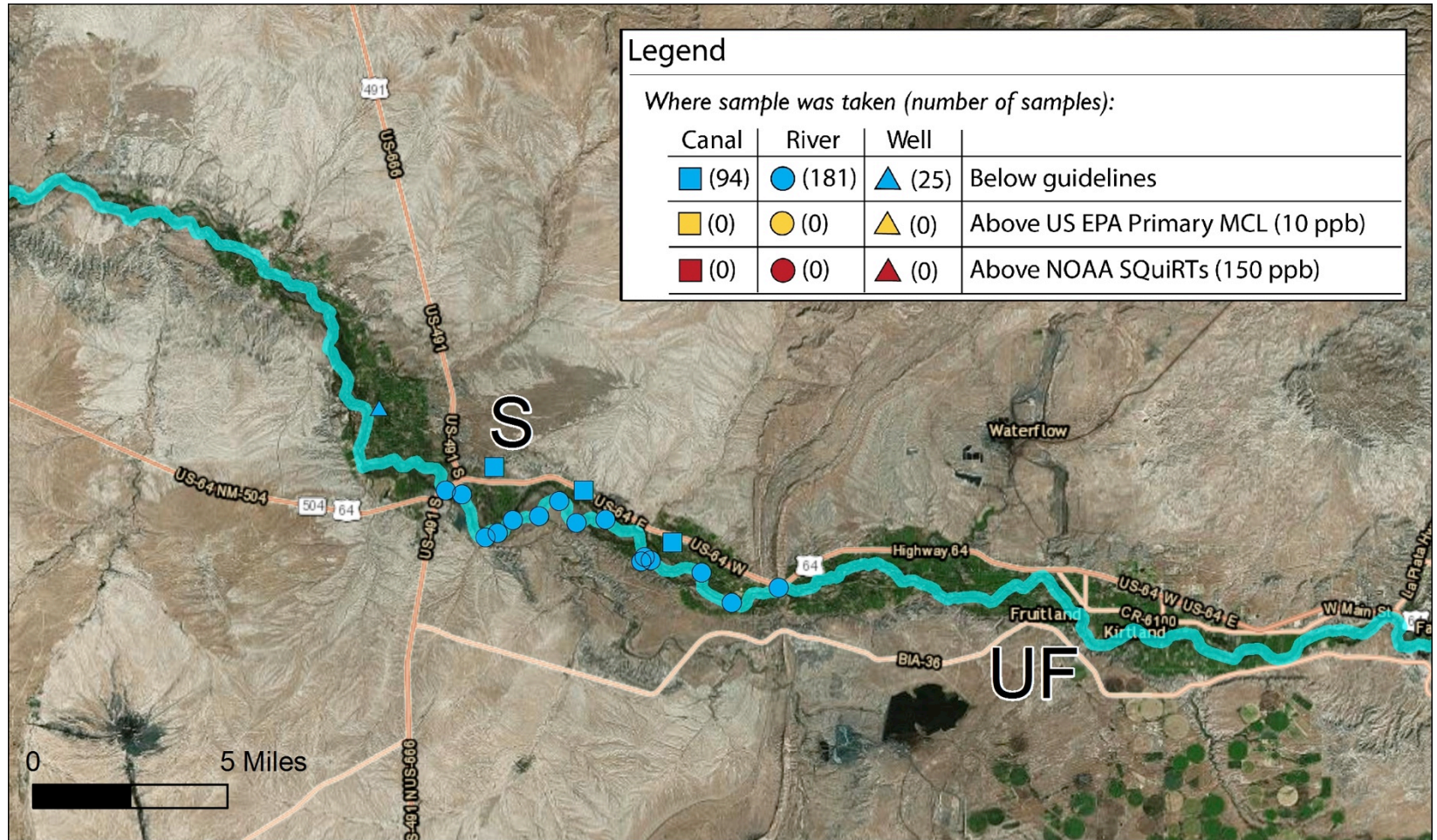
# UPPER FRUITLAND & SHIPROCK WINTER 2015



Gold King Mine Spill Dine' Exposure Project

# COMPARING AMOUNTS OF ARSENIC IN WATER TO GUIDELINES

# UPPER FRUITLAND & SHIPROCK SPRING 2016

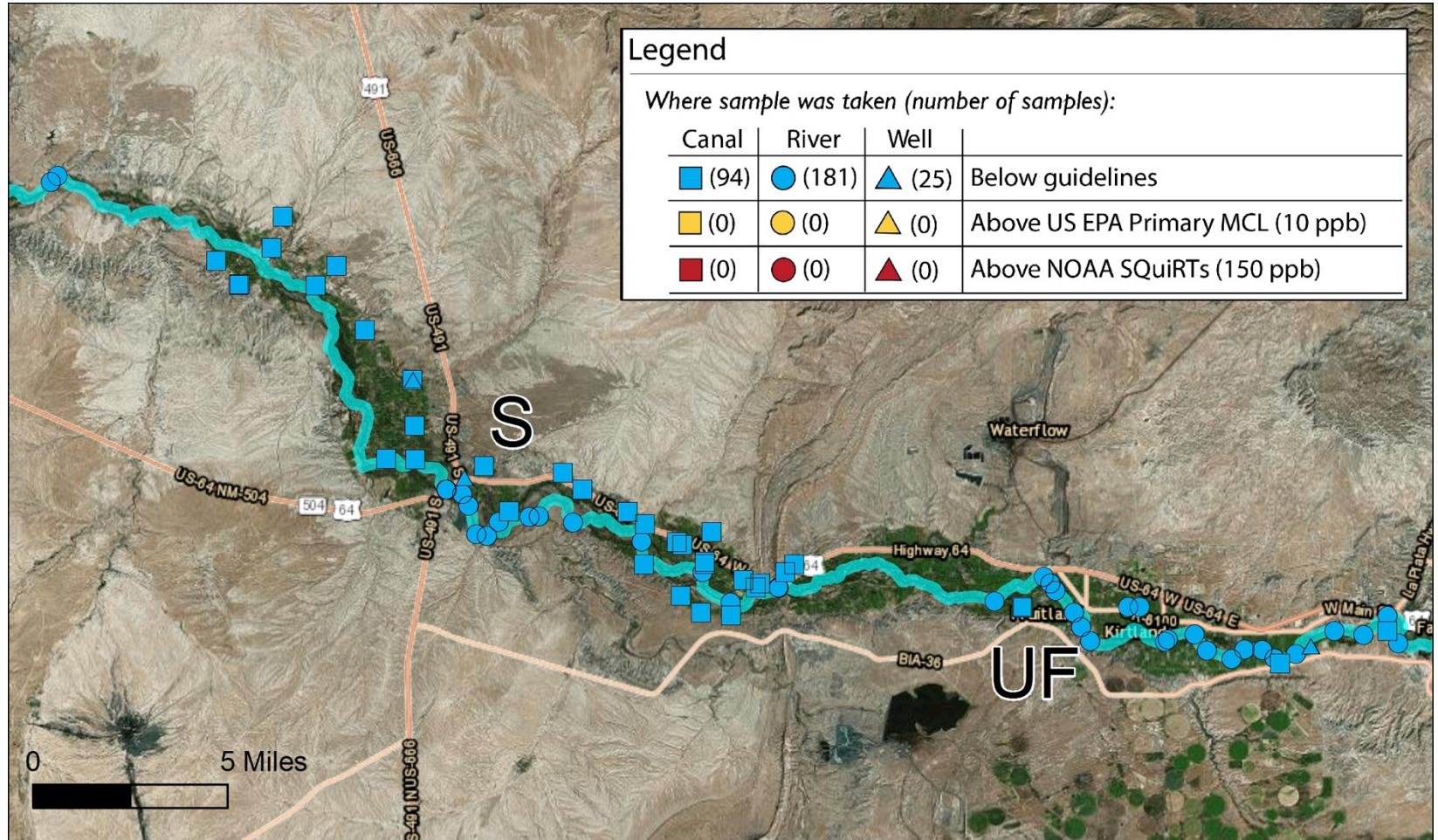


Gold King Mine Spill Dine' Exposure Project



# COMPARING AMOUNTS OF ARSENIC IN WATER TO GUIDELINES

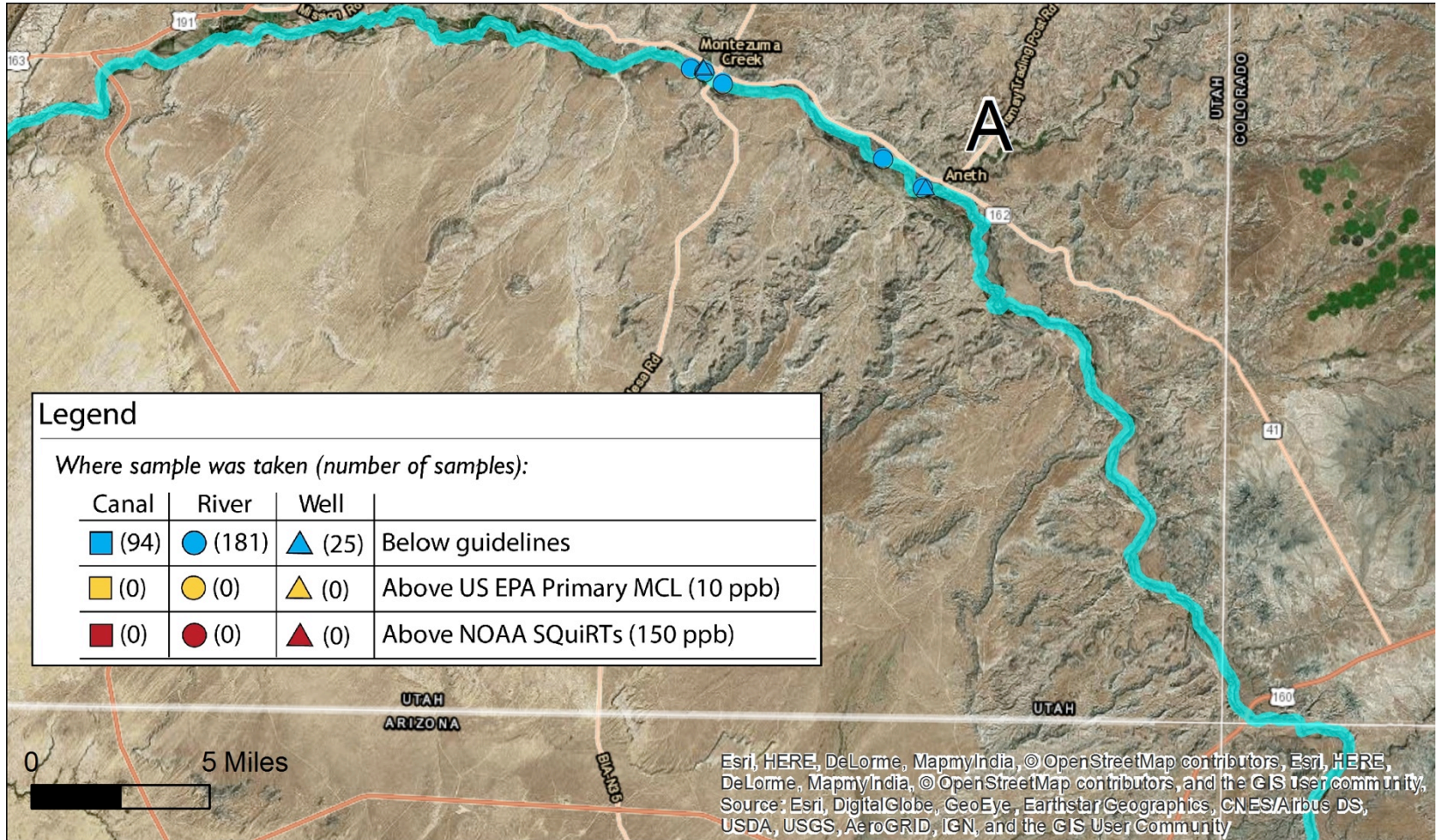
# UPPER FRUITLAND & SHIPROCK SUMMER 2016



Gold King Mine Spill Dine' Exposure Project

# COMPARING AMOUNTS OF ARSENIC IN WATER TO GUIDELINES

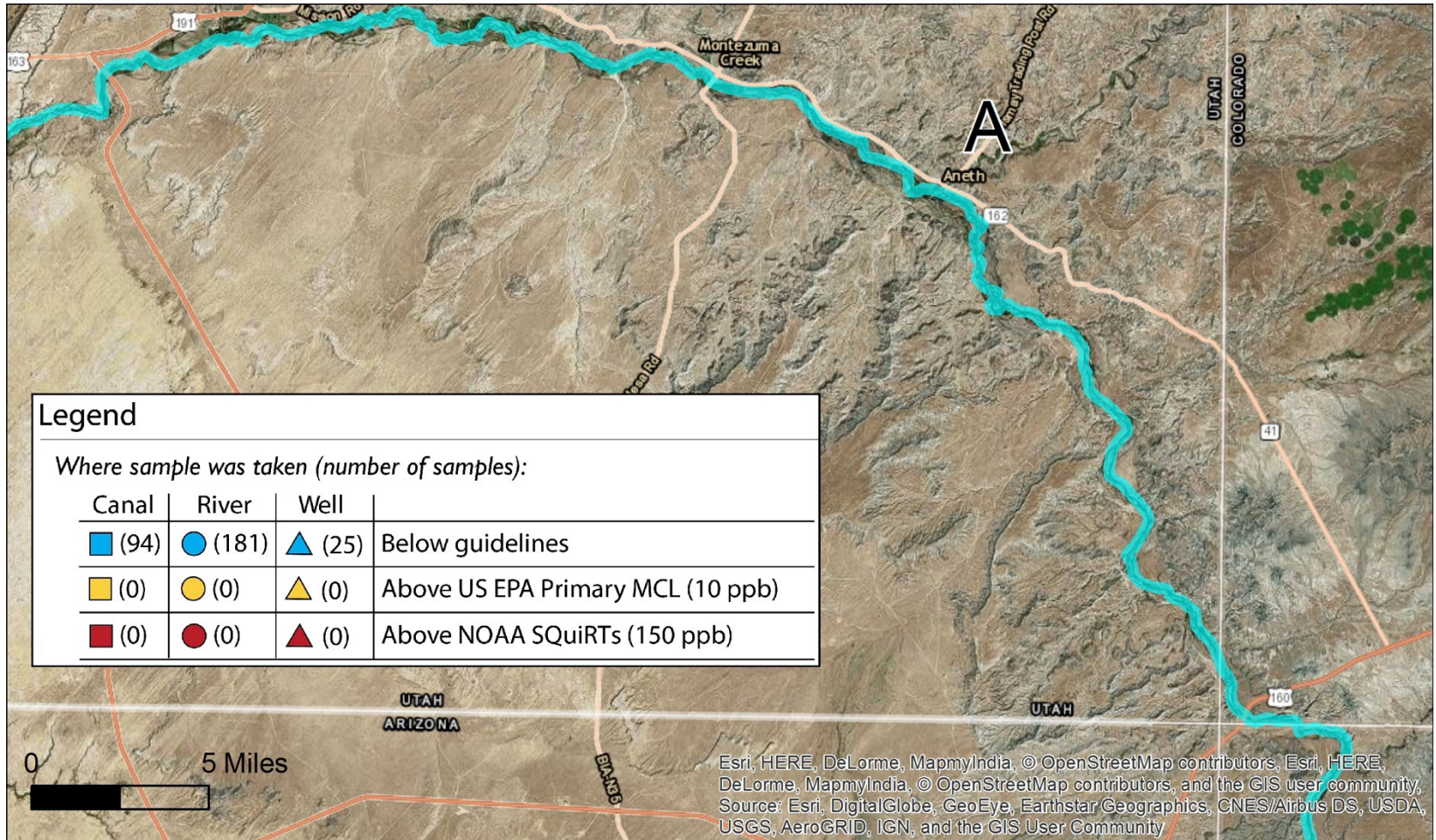
# ANETH WINTER 2015



# COMPARING AMOUNTS OF ARSENIC IN WATER TO GUIDELINES

## ANETH

## SPRING 2016

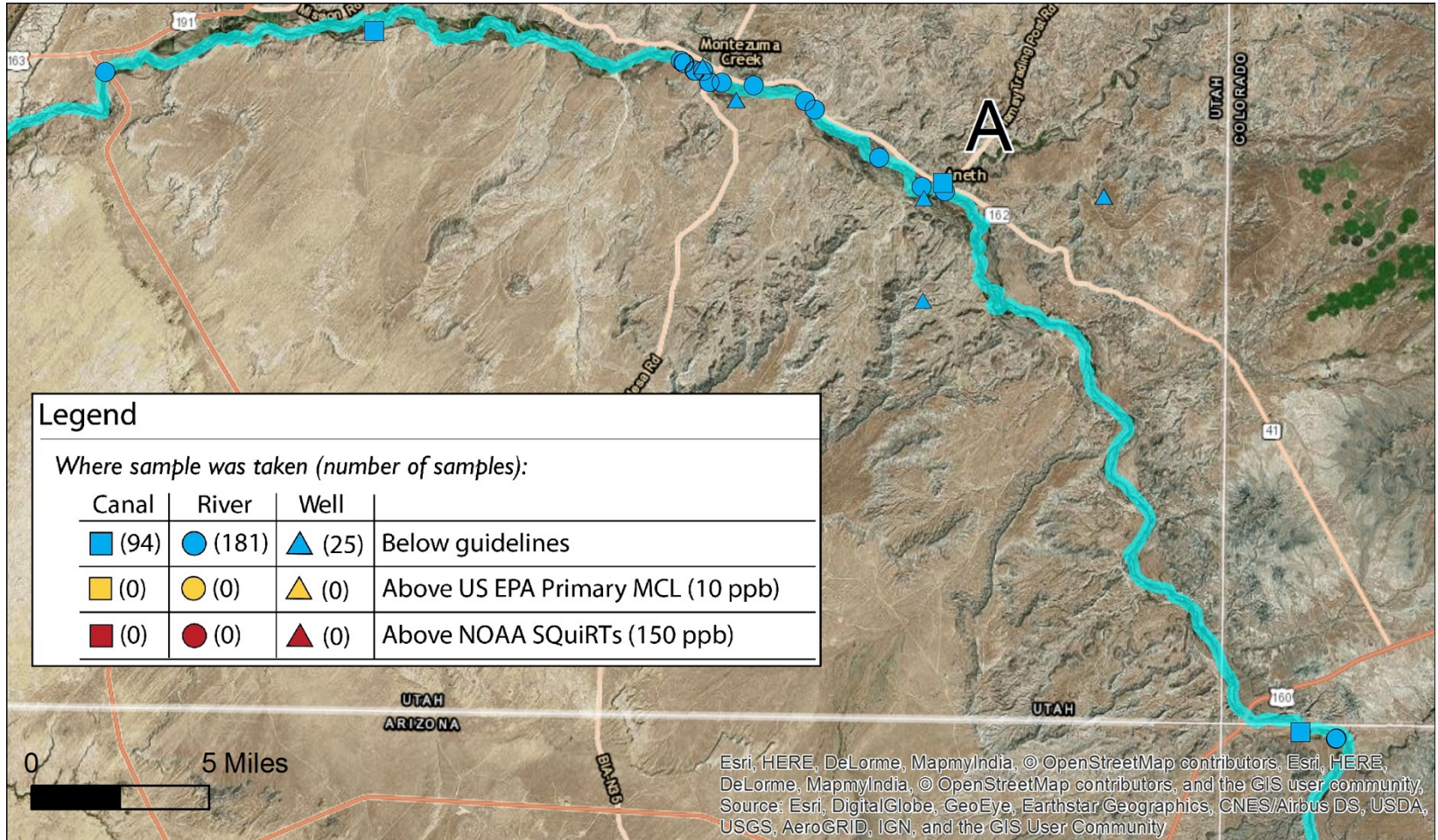


Gold King Mine Spill Dine' Exposure Project

# COMPARING AMOUNTS OF ARSENIC IN WATER TO GUIDELINES

## ANETH

## SUMMER 2016



Gold King Mine Spill Dine' Exposure Project

# AMOUNT OF LEAD IN WATER



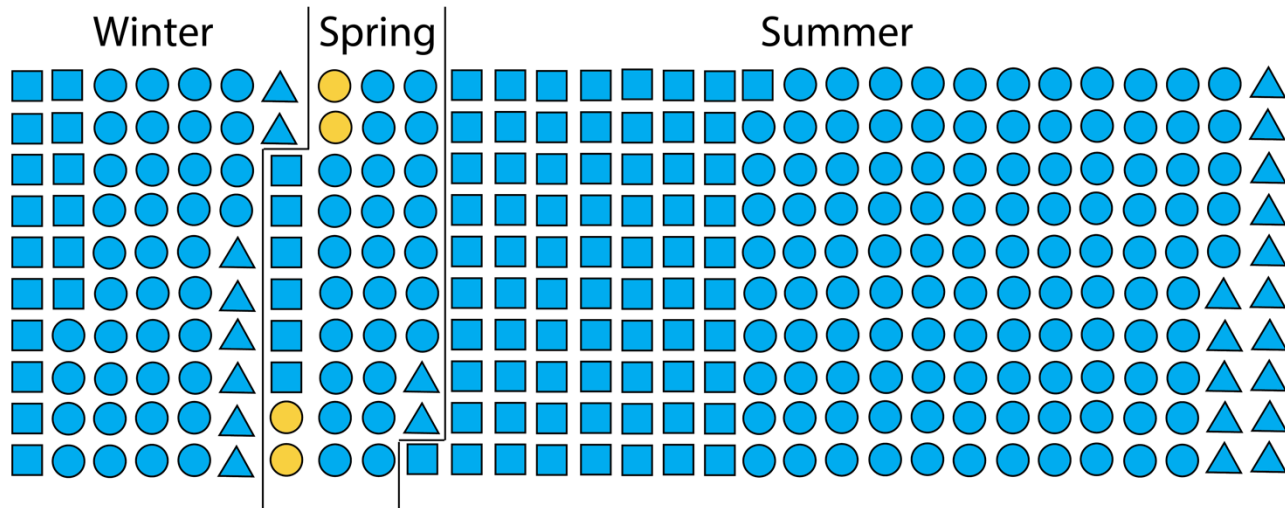
Where sample was taken: □ Canal ○ River △ Well

Guidelines: ··· NOAA SQuiRTs — US EPA Primary MCL



# COMPARING AMOUNTS OF LEAD IN WATER TO GUIDELINES

**4 of 29 (14%) Spring river samples**  
 above the NOAA SQuIRTs guideline (plants and animals living in the water)



Legend

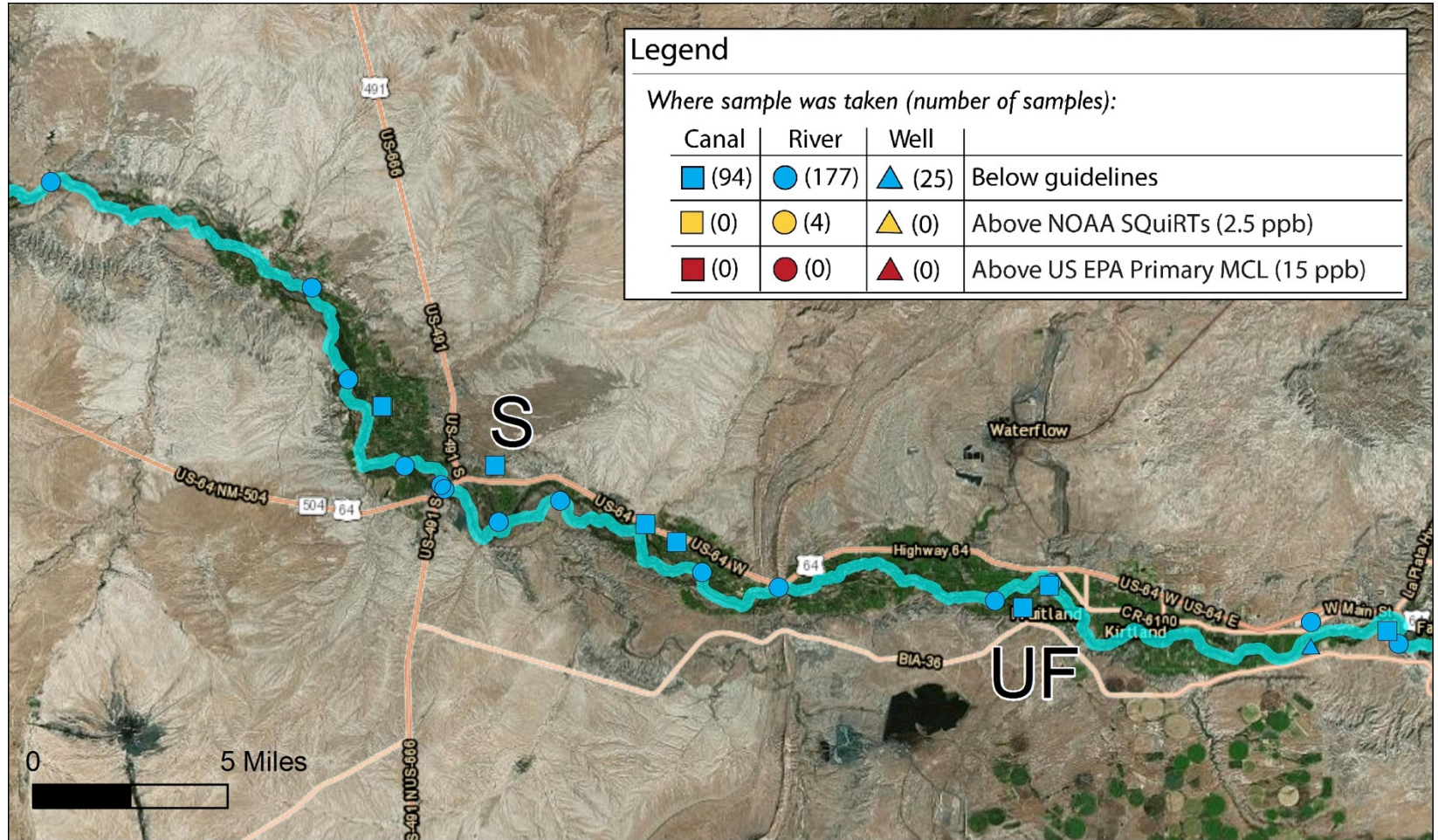
Where sample was taken (number of samples):

Canal	River	Well	
■ (94)	● (177)	▲ (25)	Below guidelines
■ (0)	● (4)	▲ (0)	Above NOAA SQuIRTs (2.5 ppb)
■ (0)	● (0)	▲ (0)	Above US EPA Primary MCL (15 ppb)



# COMPARING AMOUNTS OF LEAD IN WATER TO GUIDELINES

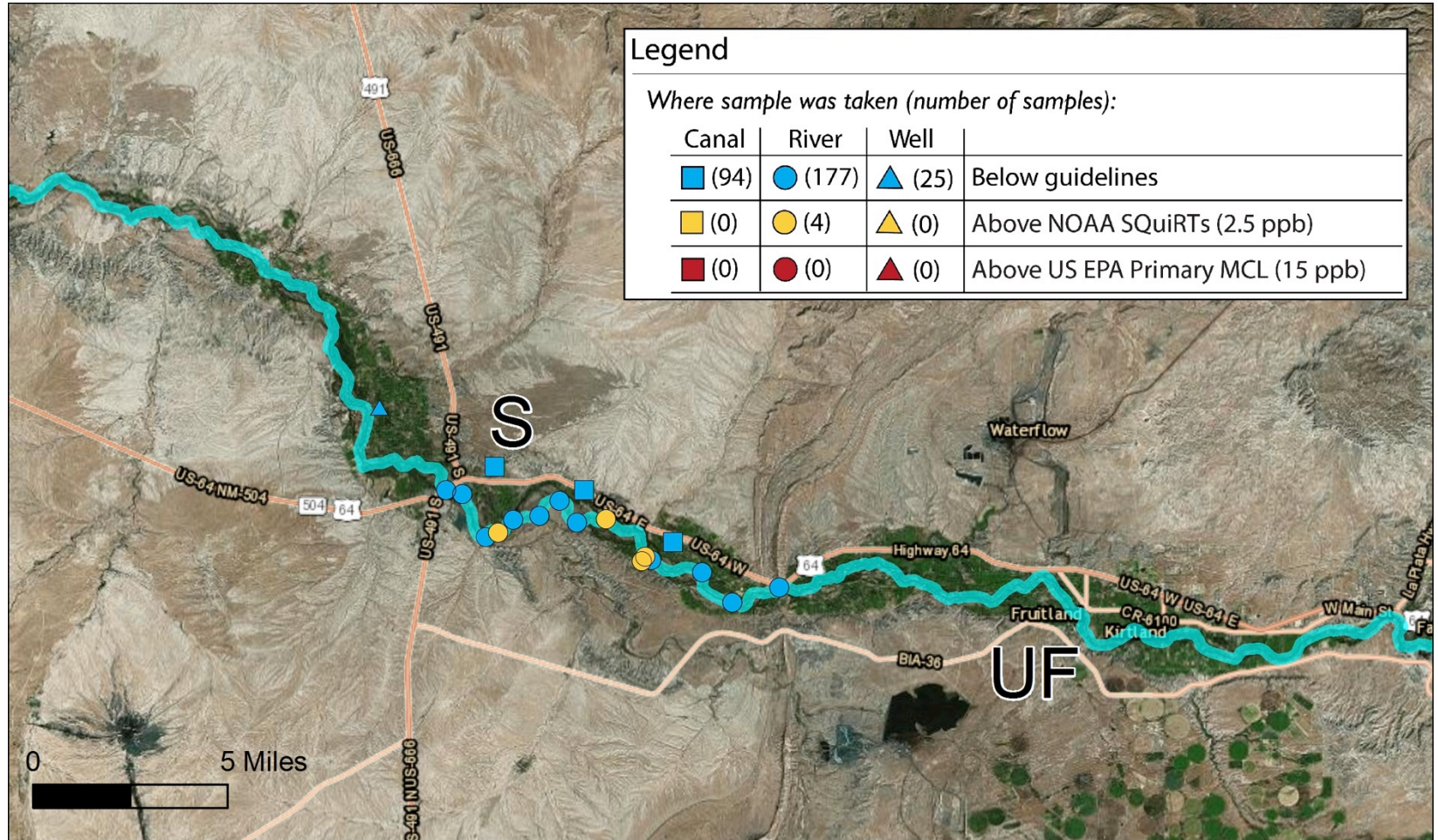
# UPPER FRUITLAND & SHIPROCK WINTER 2015



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# COMPARING AMOUNTS OF LEAD IN WATER TO GUIDELINES

# UPPER FRUITLAND & SHIPROCK SPRING 2016

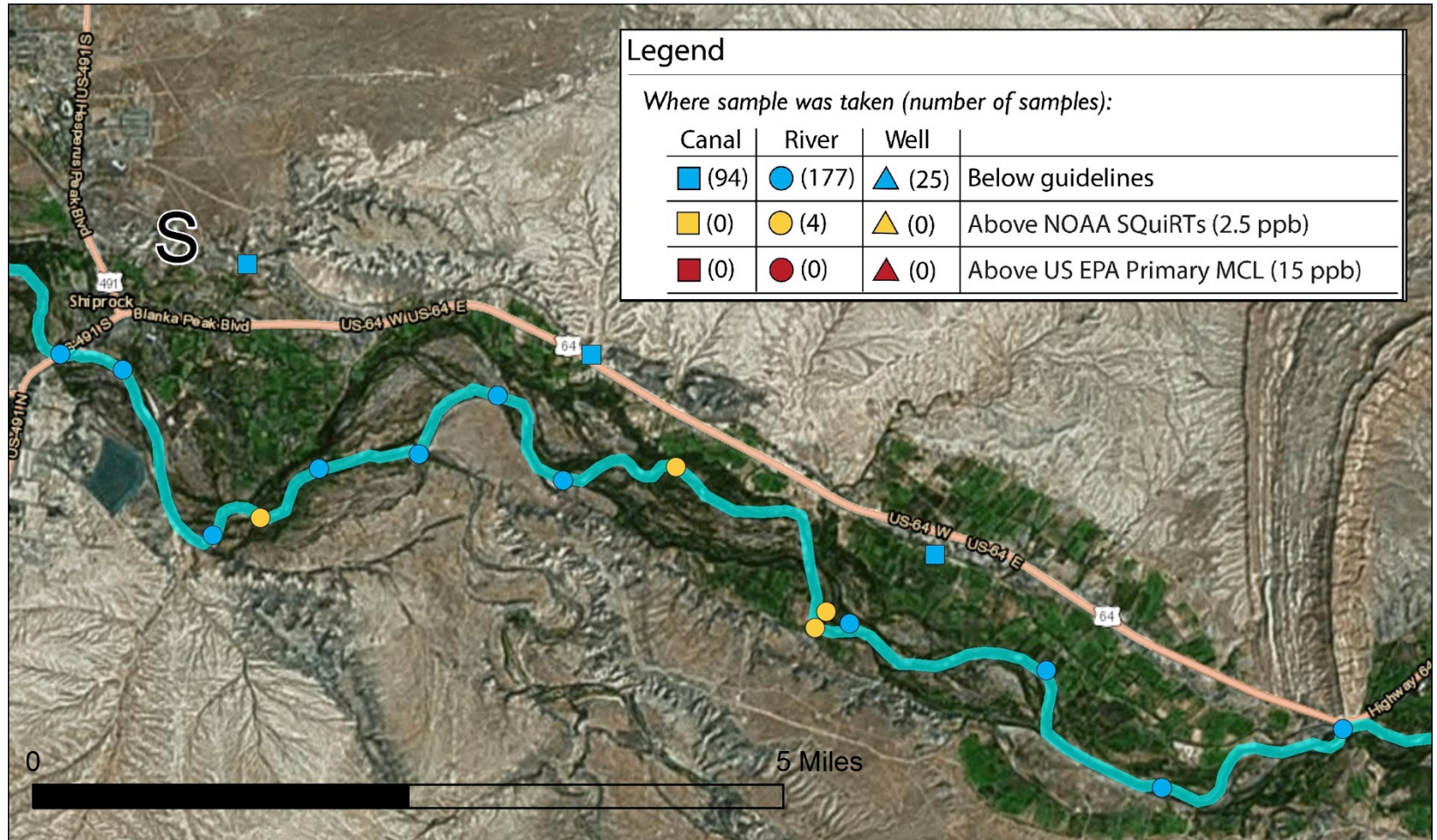


Gold King Mine Spill Dine' Exposure Project



# COMPARING AMOUNTS OF LEAD IN WATER TO GUIDELINES

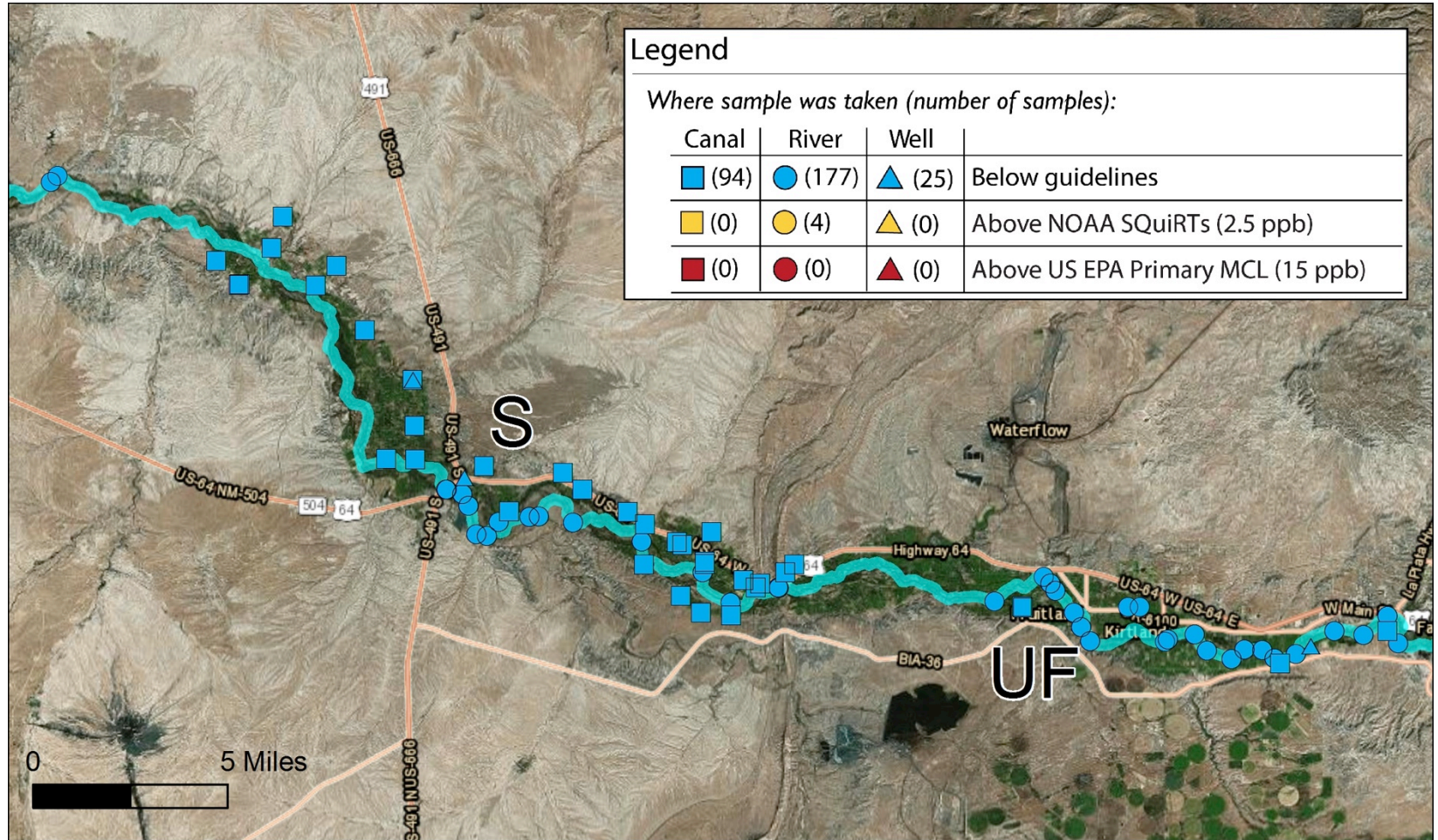
# UPPER FRUITLAND & SHIPROCK SPRING 2016



Gold King Mine Spill Dine' Exposure Project

# COMPARING AMOUNTS OF LEAD IN WATER TO GUIDELINES

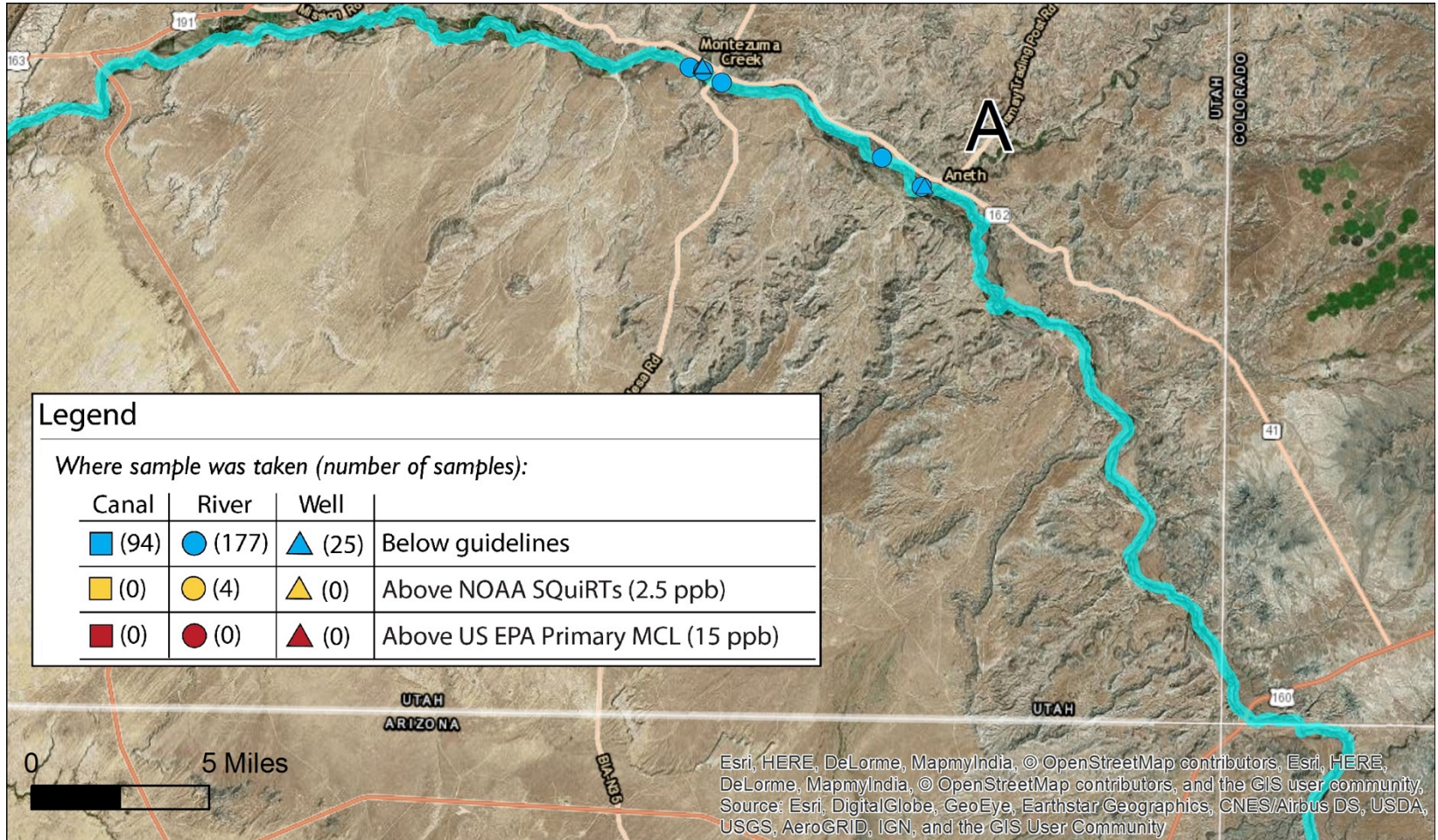
# UPPER FRUITLAND & SHIPROCK SUMMER 2016



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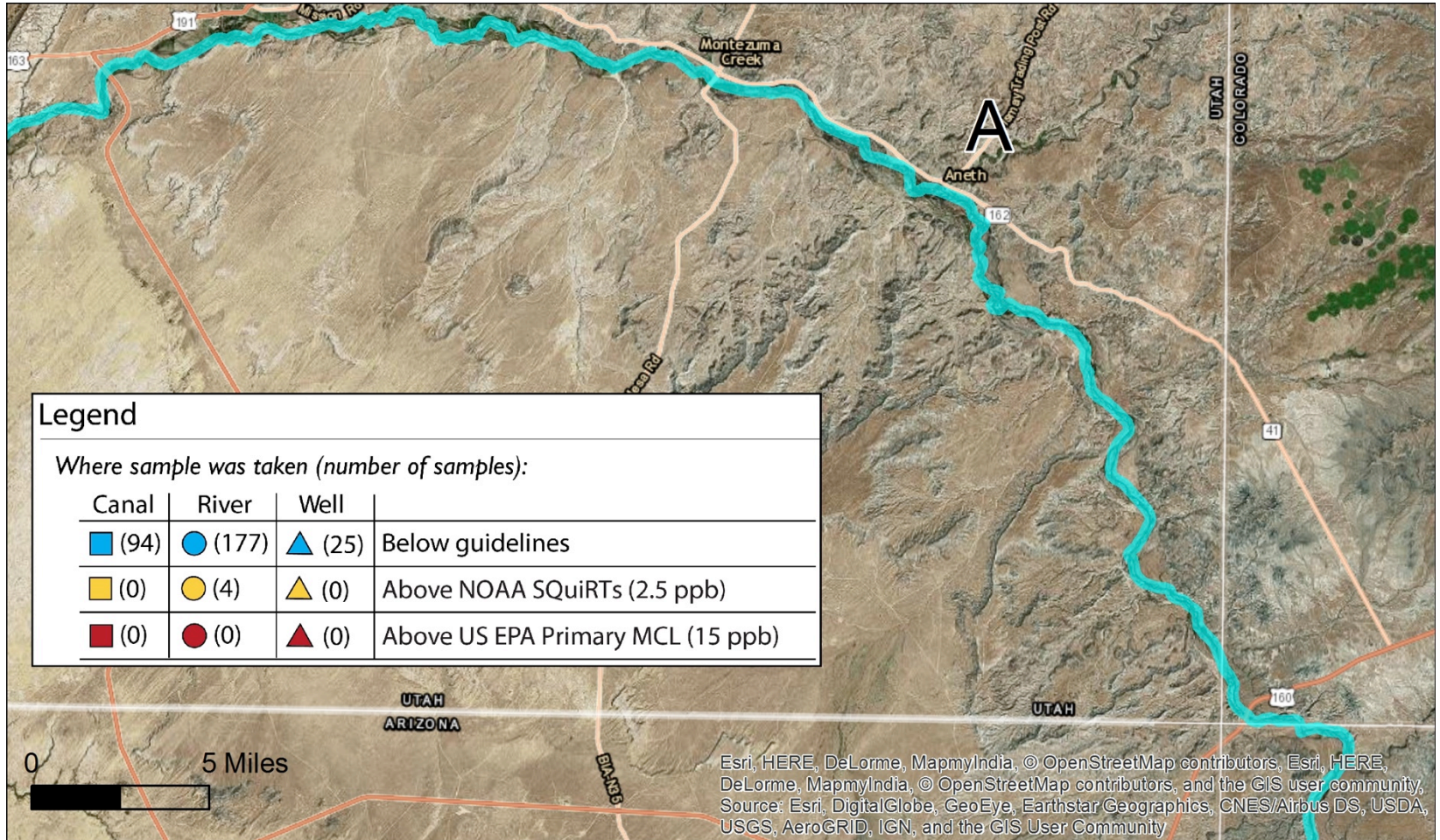
# ANETH WINTER 2015



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# COMPARING AMOUNTS OF LEAD IN WATER TO GUIDELINES

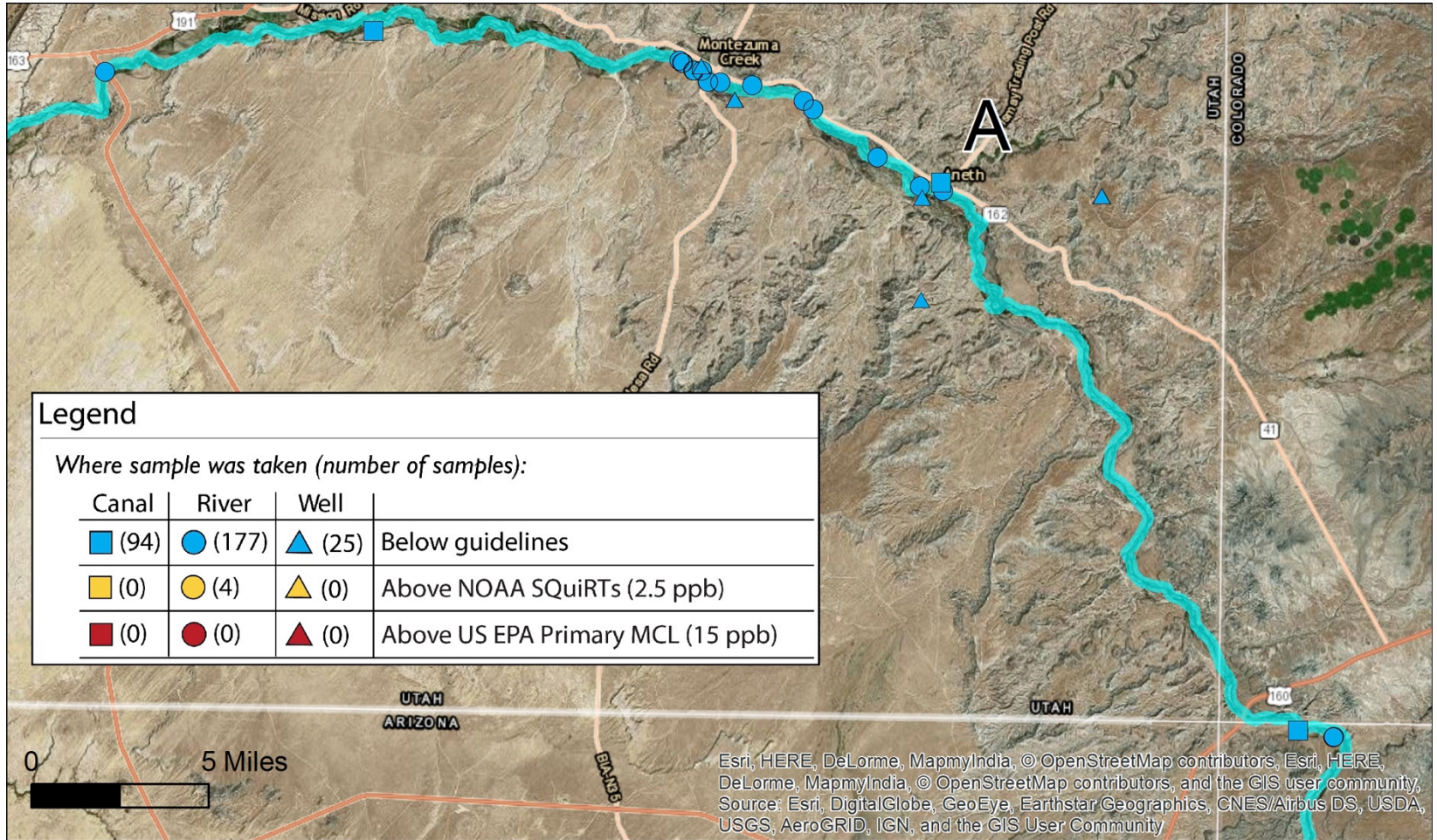
# ANETH SPRING 2016



Gold King Mine Spill Dine' Exposure Project

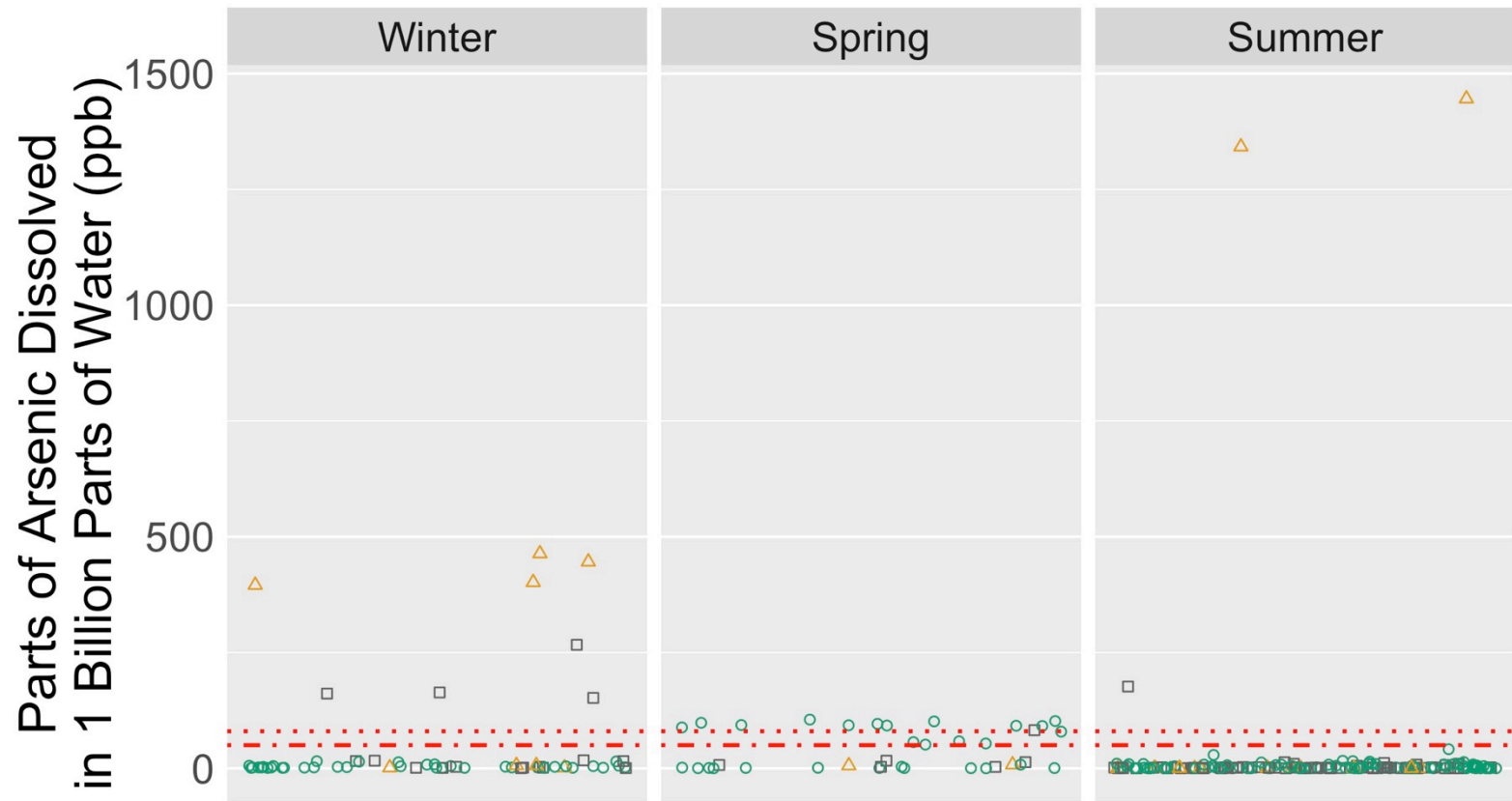
# COMPARING AMOUNTS OF LEAD IN WATER TO GUIDELINES

# ANETH SUMMER 2016



Gold King Mine Spill Dine' Exposure Project

# AMOUNT OF MANGANESE IN WATER



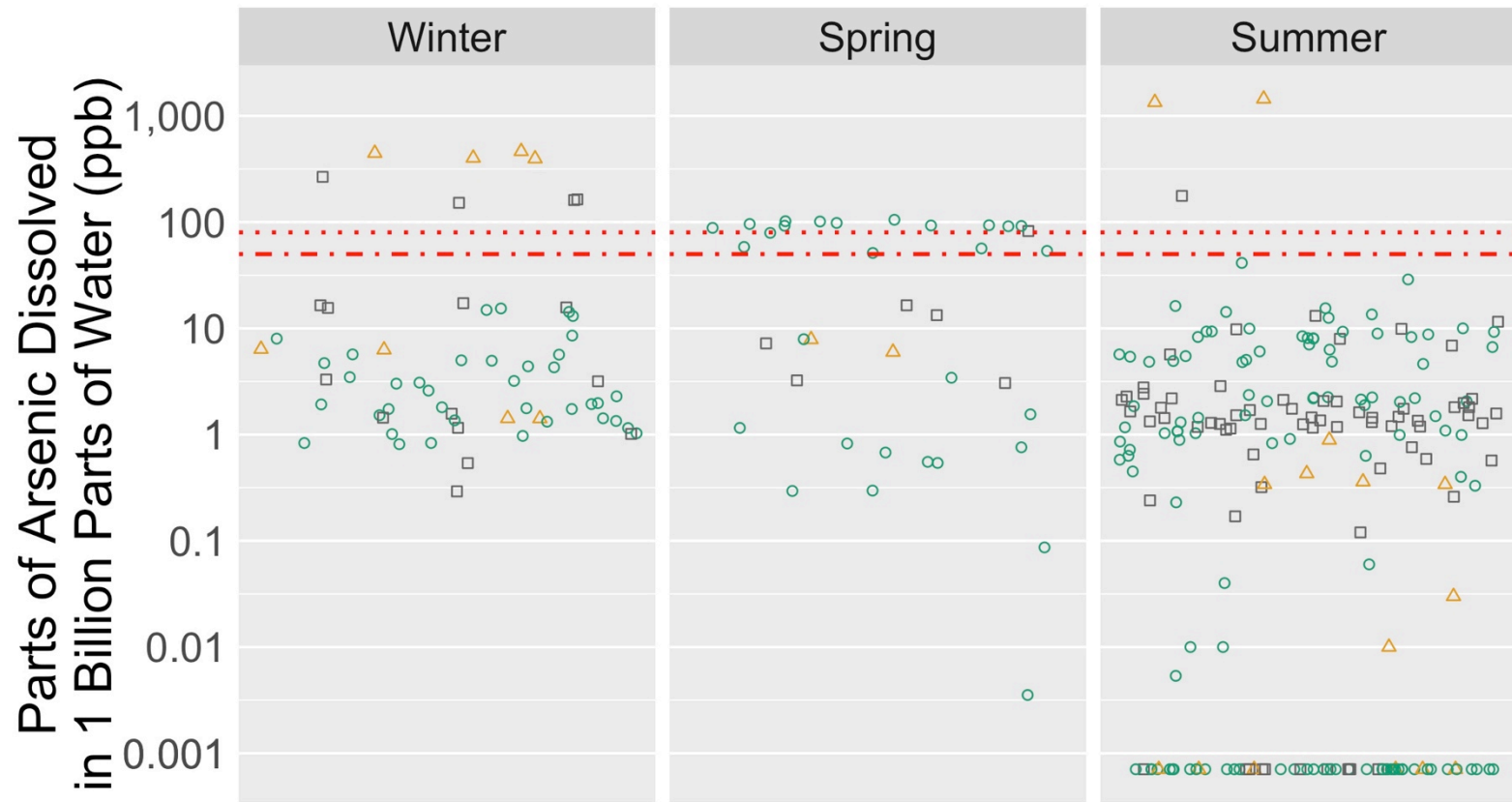
Guidelines: NOAA SQuIRTS US EPA Secondary MCL

Where sample was taken: Canal River Well



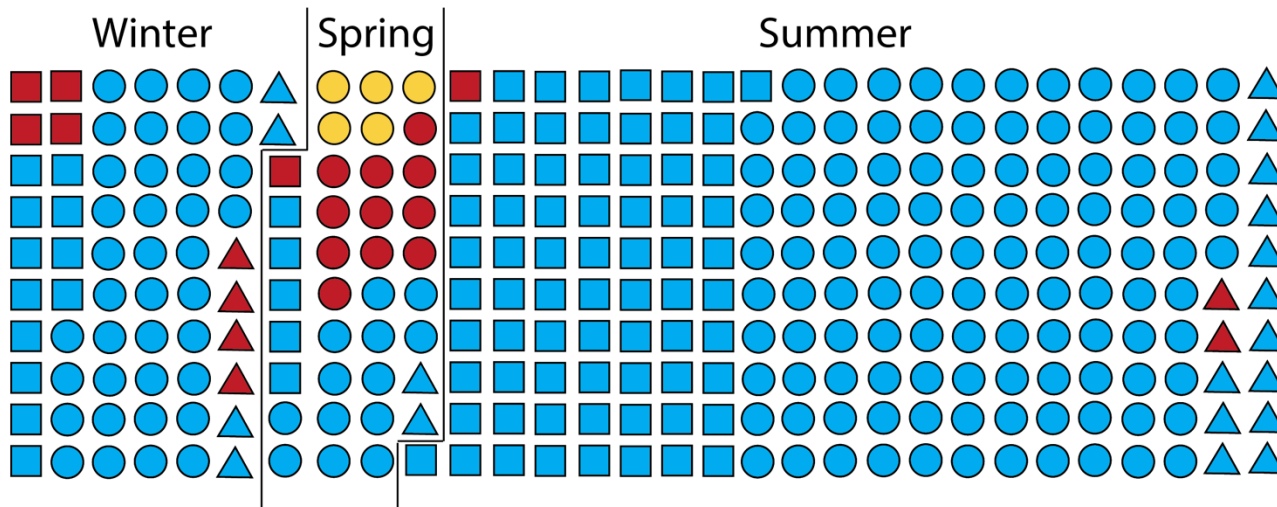
Gold King Mine Spill Dine' Exposure Project

# AMOUNT OF MANGANESE IN WATER



# COMPARING AMOUNTS OF MANGANESE IN WATER TO GUIDELINES

**4 of 16 (25%) Winter canal samples**  
 above the NOAA SQuiRTs guideline (plants and animals living in the water)



Legend

Where sample was taken (number of samples):

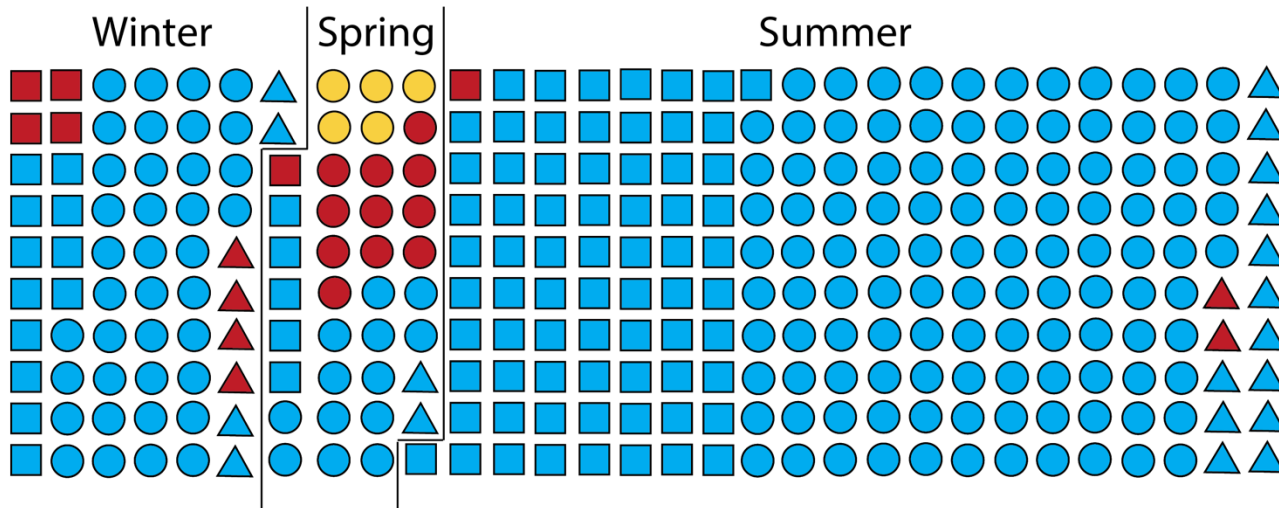
Canal	River	Well	
■ (88)	● (164)	▲ (19)	Below guidelines
■ (0)	● (5)	▲ (0)	Above US EPA Secondary MCL (50 ppb)
■ (6)	● (11)	▲ (6)	Above NOAA SQuiRTs (80 ppb)





# COMPARING AMOUNTS OF MANGANESE IN WATER TO GUIDELINES

**4 of 8 (50%) Winter well samples**  
 above the NOAA SQuiRTs guideline (plants and animals living in the water)



Legend

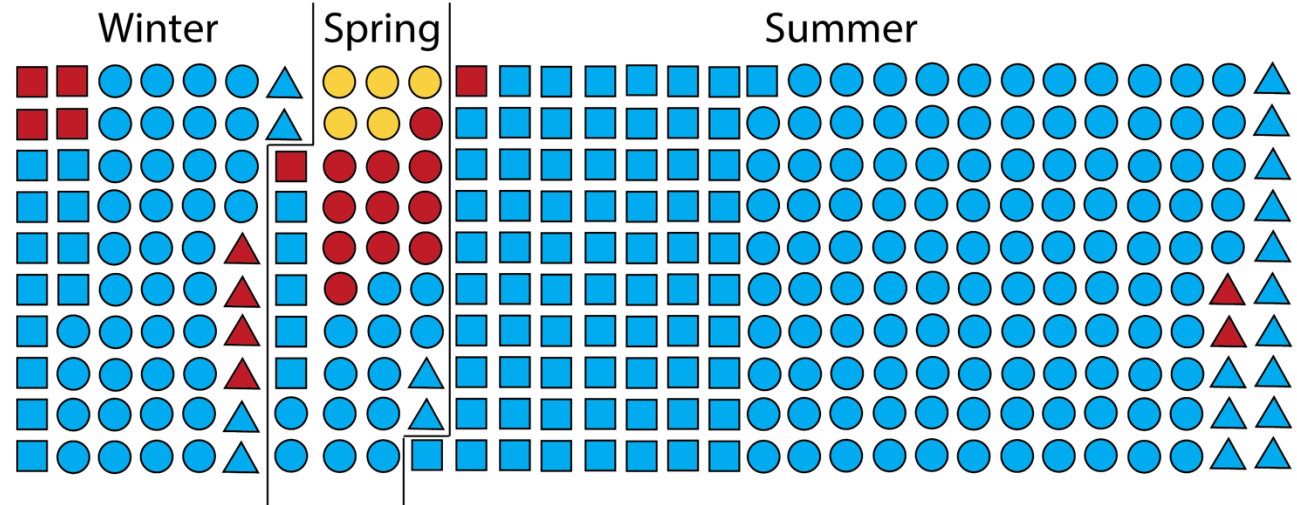
Where sample was taken (number of samples):

Canal	River	Well	
■ (88)	● (164)	▲ (19)	Below guidelines
■ (0)	● (5)	▲ (0)	Above US EPA Secondary MCL (50 ppb)
■ (6)	● (11)	▲ (6)	Above NOAA SQuiRTs (80 ppb)



# COMPARING AMOUNTS OF MANGANESE IN WATER TO GUIDELINES

**1 of 6 (17%) Spring canal samples**  
 above the NOAA SQuiRTs guideline (plants and animals living in the water)



Legend

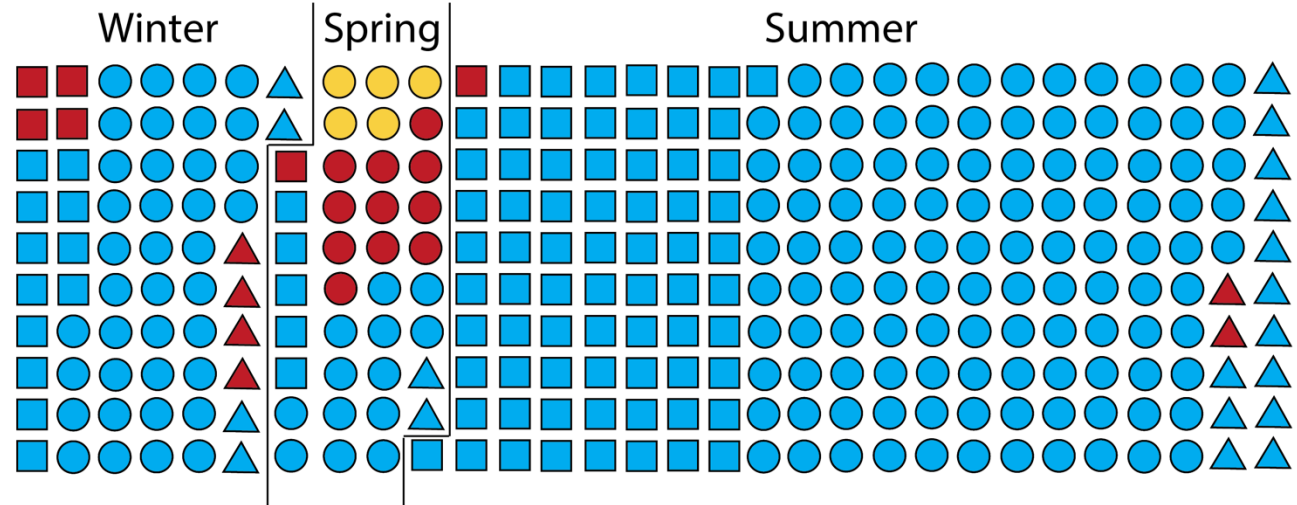
Where sample was taken (number of samples):

Canal	River	Well	
■ (88)	● (164)	▲ (19)	Below guidelines
■ (0)	● (5)	▲ (0)	Above US EPA Secondary MCL (50 ppb)
■ (6)	● (11)	▲ (6)	Above NOAA SQuiRTs (80 ppb)



# COMPARING AMOUNTS OF MANGANESE IN WATER TO GUIDELINES

**11 of 29 (38%) Spring river samples**  
 above the NOAA SQuiRTs guideline (plants and animals living in the water)



Legend

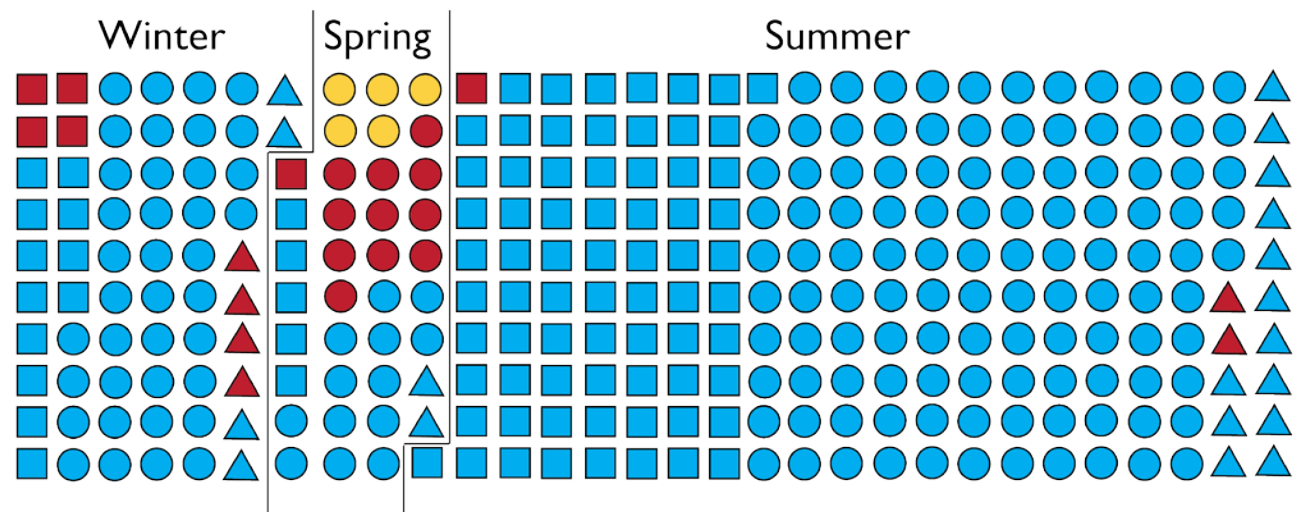
Where sample was taken (number of samples):

Canal	River	Well	
■ (88)	● (164)	▲ (19)	Below guidelines
■ (0)	● (5)	▲ (0)	Above US EPA Secondary MCL (50 ppb)
■ (6)	● (11)	▲ (6)	Above NOAA SQuiRTs (80 ppb)



# COMPARING AMOUNTS OF MANGANESE IN WATER TO GUIDELINES

**5 of 29 (17%) Spring river samples**  
 above the US EPA Secondary MCL guideline (drinking water for people)



Legend

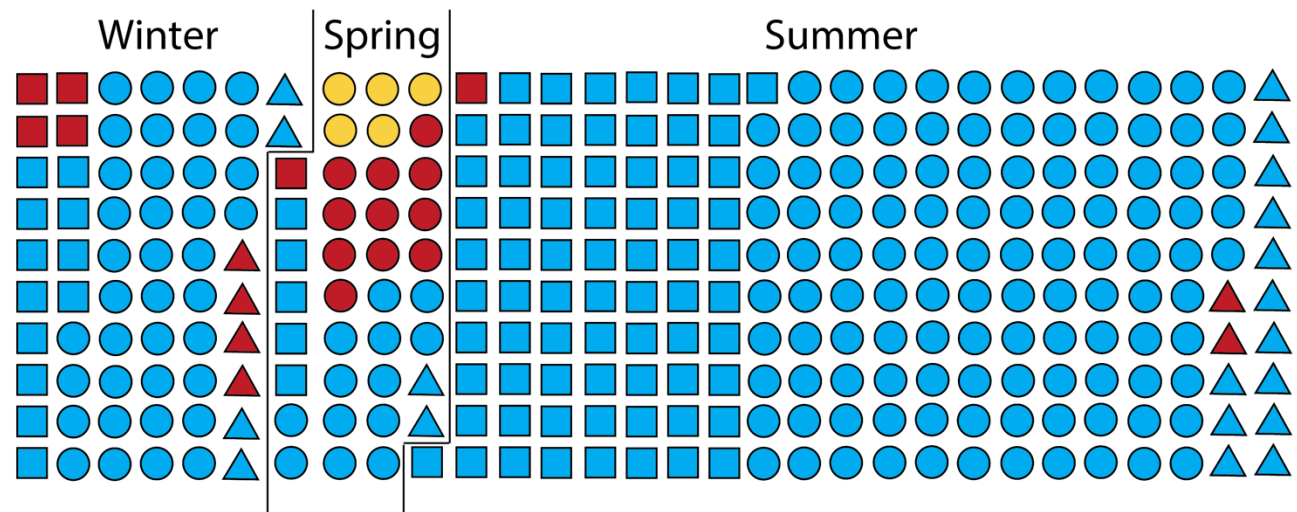
Where sample was taken (number of samples):

Canal	River	Well	
■ (88)	● (164)	▲ (19)	Below guidelines
■ (0)	● (5)	▲ (0)	Above US EPA Secondary MCL (50 ppb)
■ (6)	● (11)	▲ (6)	Above NOAA SQuRTs (80 ppb)



# COMPARING AMOUNTS OF MANGANESE IN WATER TO GUIDELINES

**1 of 72 (1%) Summer canal samples**  
 above the NOAA SQuiRTs guideline (plants and animals living in water)



Legend

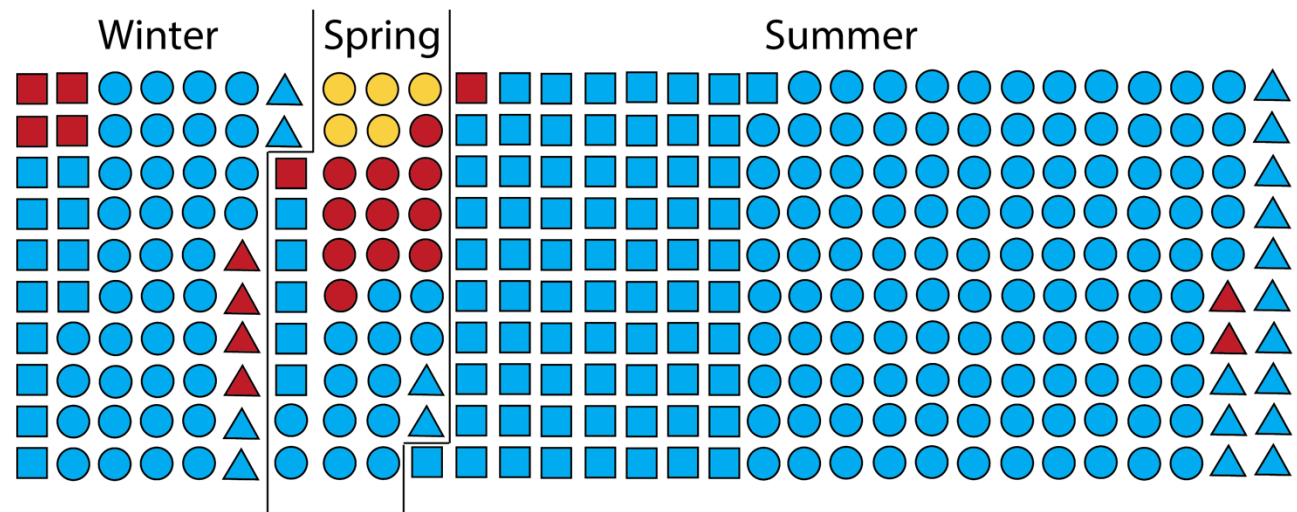
Where sample was taken (number of samples):

Canal	River	Well	
■ (88)	● (164)	▲ (19)	Below guidelines
■ (0)	● (5)	▲ (0)	Above US EPA Secondary MCL (50 ppb)
■ (6)	● (11)	▲ (6)	Above NOAA SQuiRTs (80 ppb)



# COMPARING AMOUNTS OF MANGANESE IN WATER TO GUIDELINES

**2 of 15 (13%) Summer well samples**  
 above the NOAA SQuiRTs guideline (plants and animals living in water)



Legend

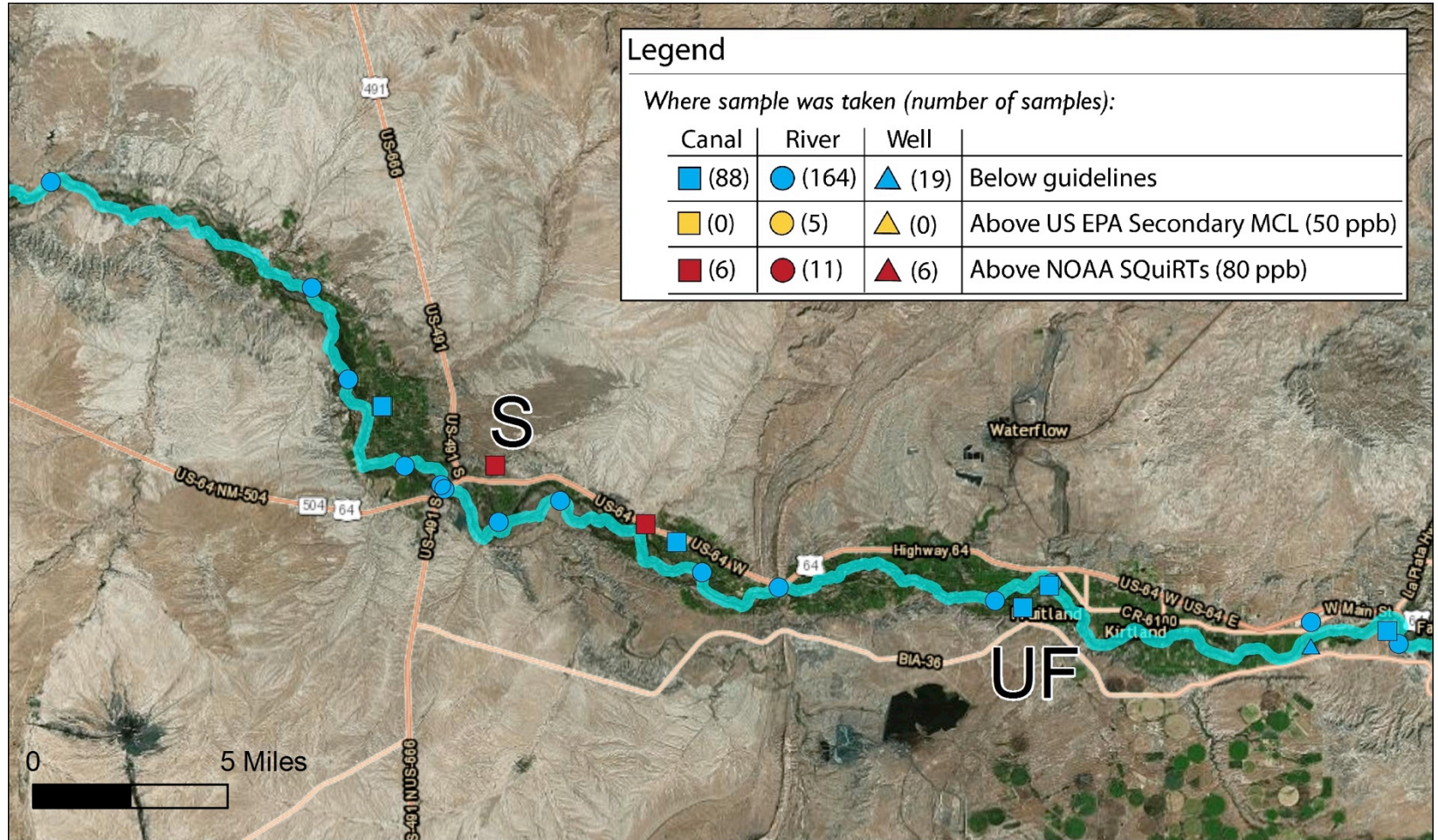
Where sample was taken (number of samples):

Canal	River	Well	
■ (88)	● (164)	▲ (19)	Below guidelines
■ (0)	● (5)	▲ (0)	Above US EPA Secondary MCL (50 ppb)
■ (6)	● (11)	▲ (6)	Above NOAA SQuiRTs (80 ppb)



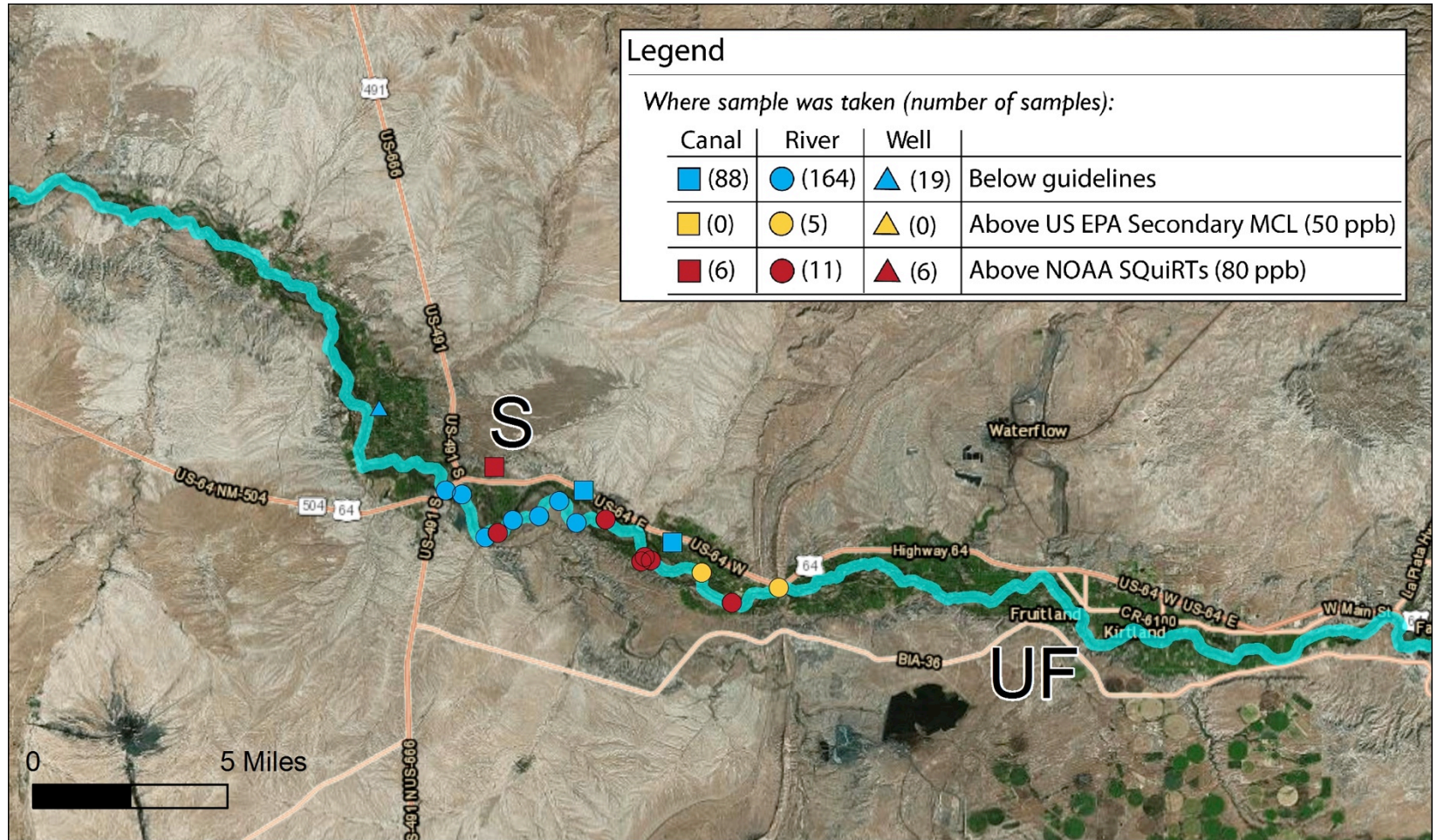
# COMPARING AMOUNTS OF MANGANESE IN WATER TO GUIDELINES

# UPPER FRUITLAND & SHIPROCK WINTER 2015



# COMPARING AMOUNTS OF MANGANESE IN WATER TO GUIDELINES

# UPPER FRUITLAND & SHIPROCK SPRING 2016

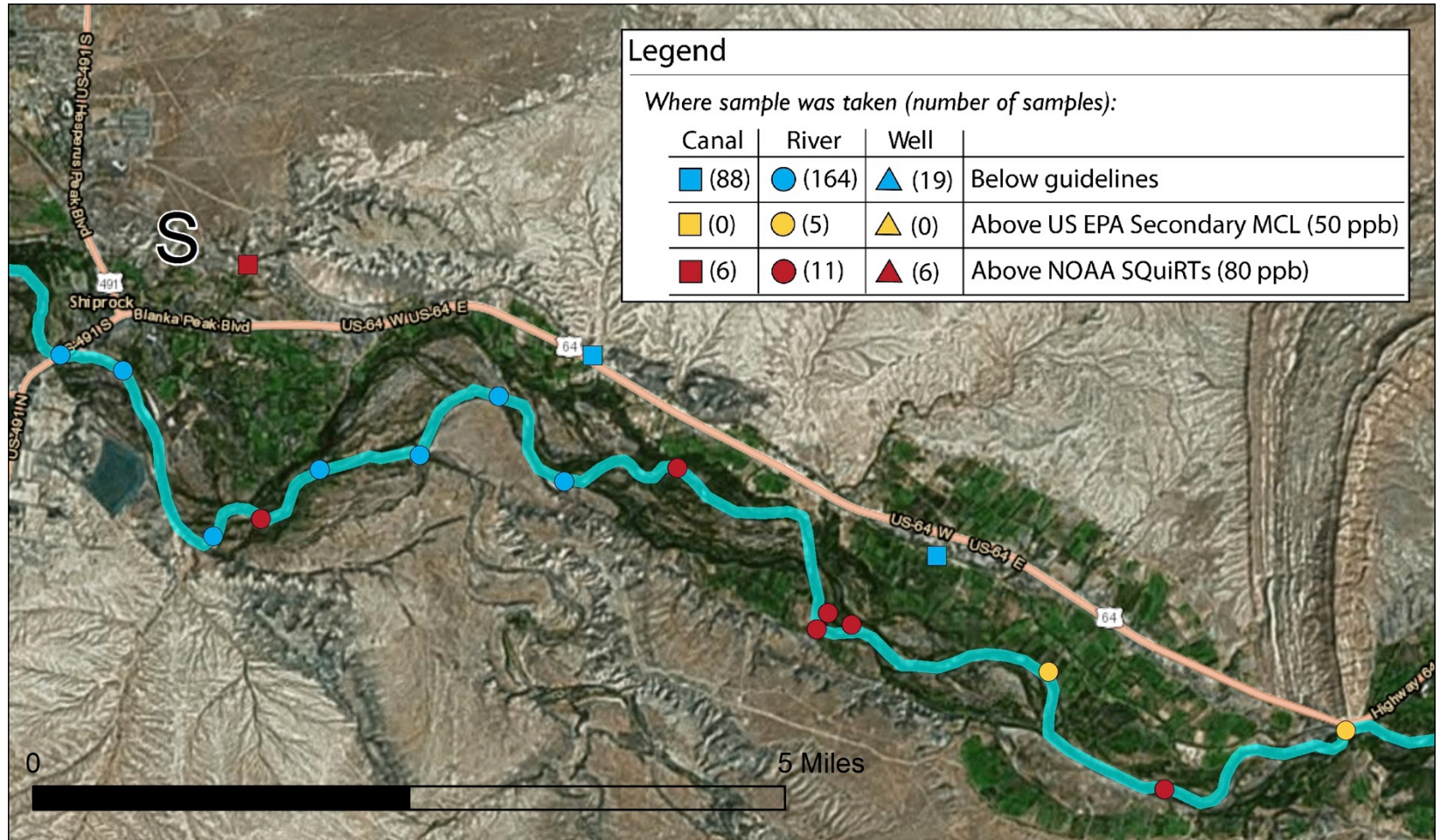


Gold King Mine Spill Dine' Exposure Project



# COMPARING AMOUNTS OF MANGANESE IN WATER TO GUIDELINES

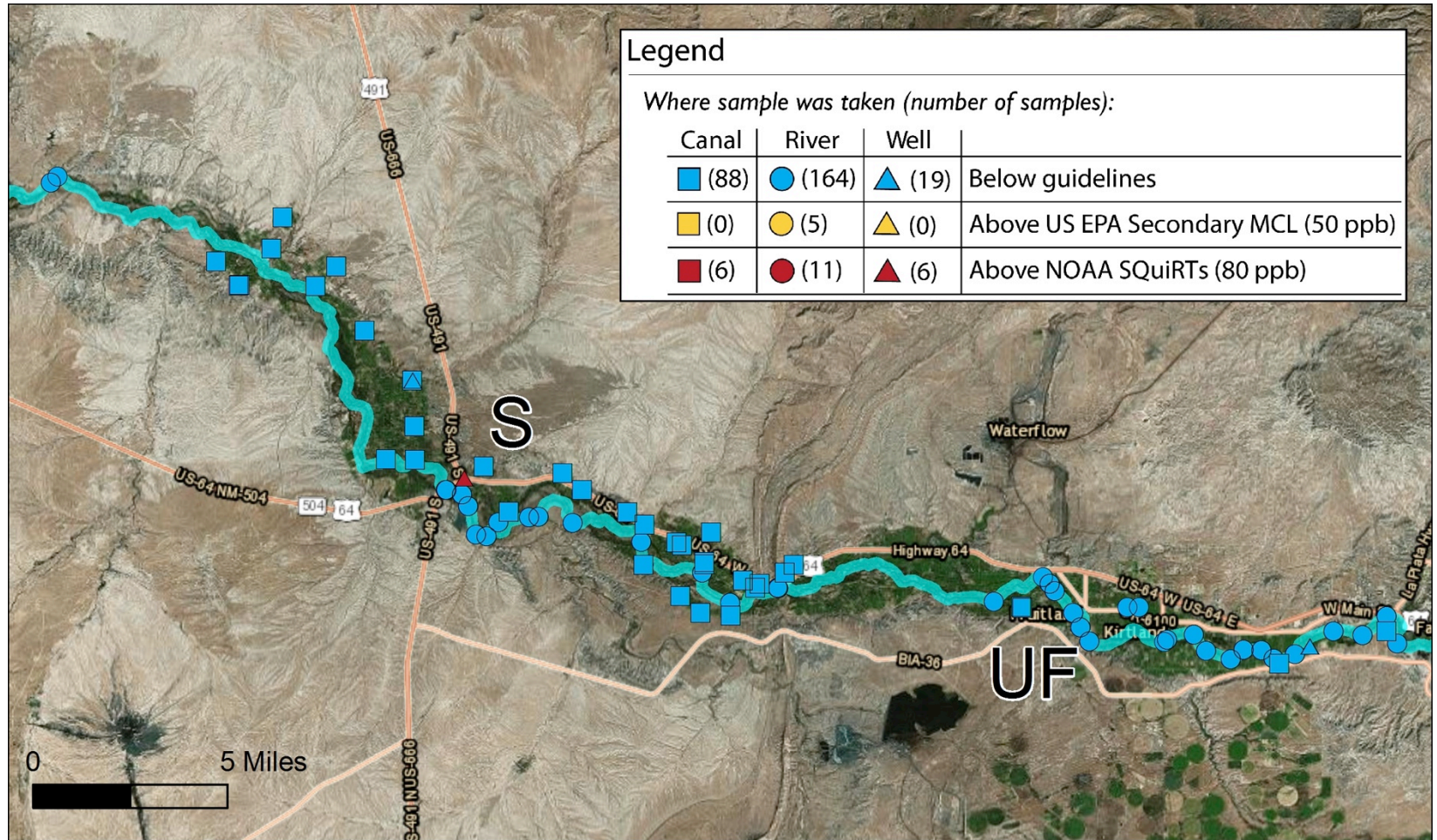
# UPPER FRUITLAND & SHIPROCK SPRING 2016



Gold King Mine Spill Dine' Exposure Project

# COMPARING AMOUNTS OF MANGANESE IN WATER TO GUIDELINES

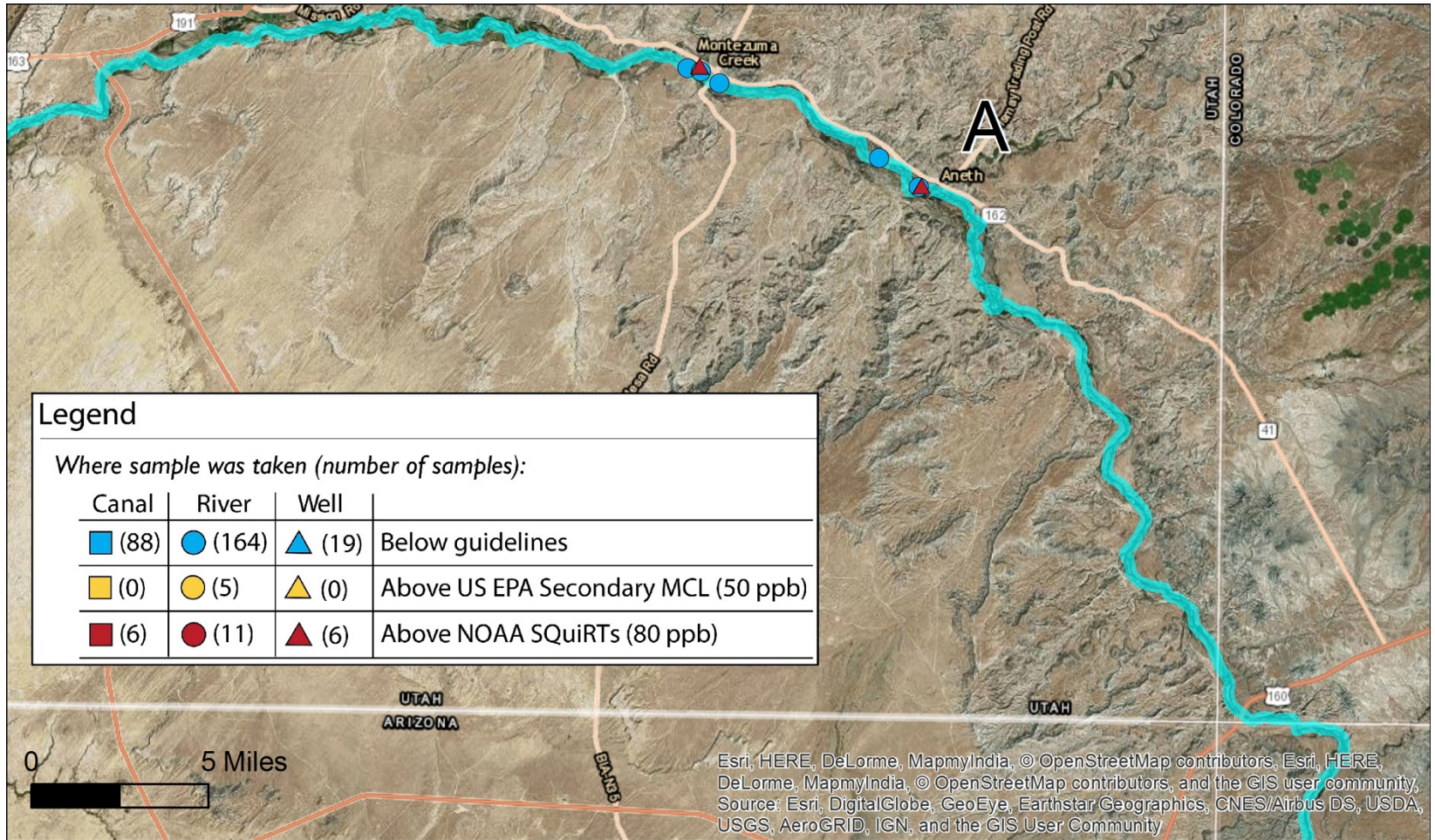
# UPPER FRUITLAND & SHIPROCK SUMMER 2016



Gold King Mine Spill Dine' Exposure Project

# COMPARING AMOUNTS OF MANGANESE IN WATER TO GUIDELINES

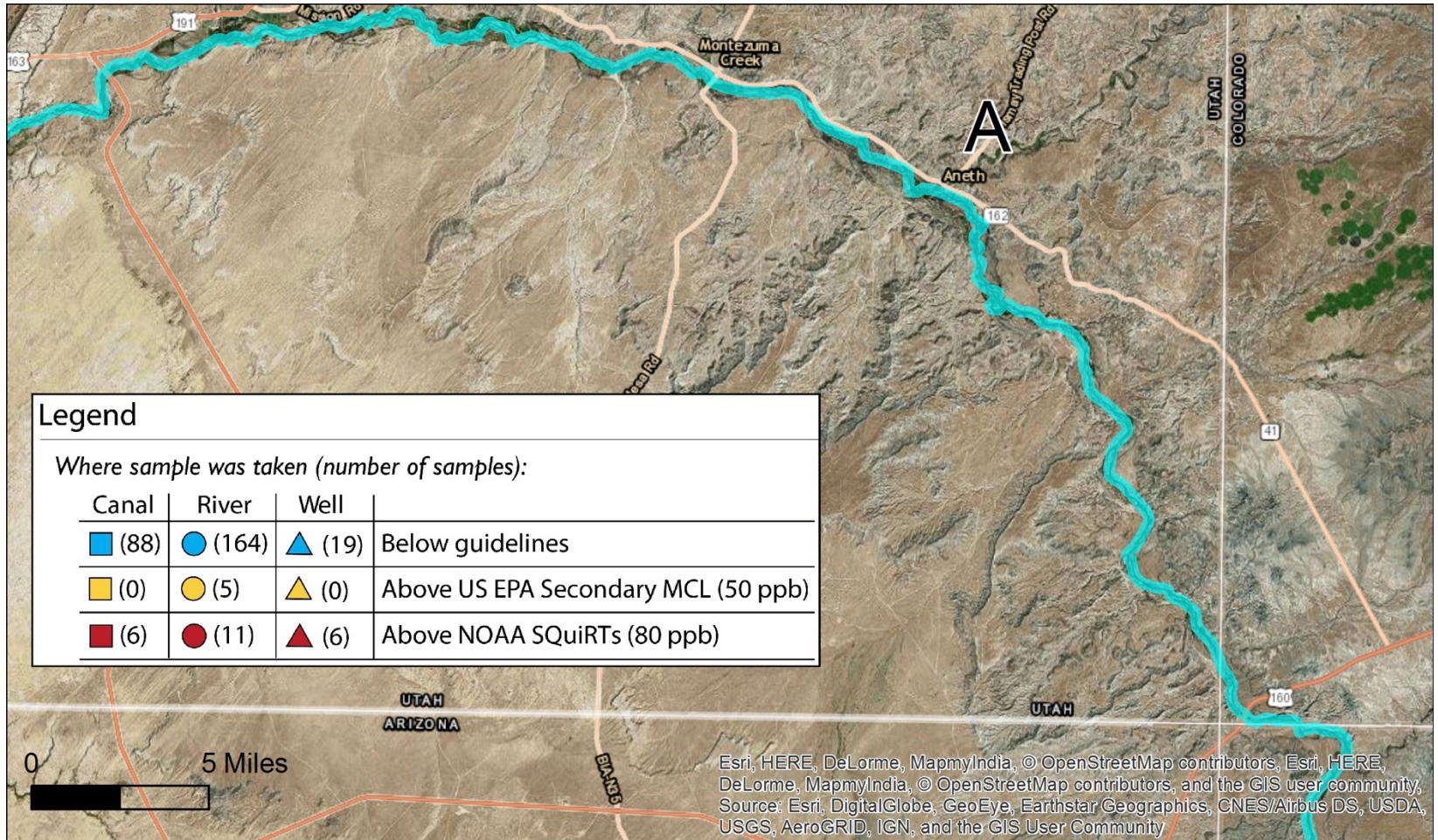
# ANETH WINTER 2015



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# COMPARING AMOUNTS OF MANGANESE IN WATER TO GUIDELINES

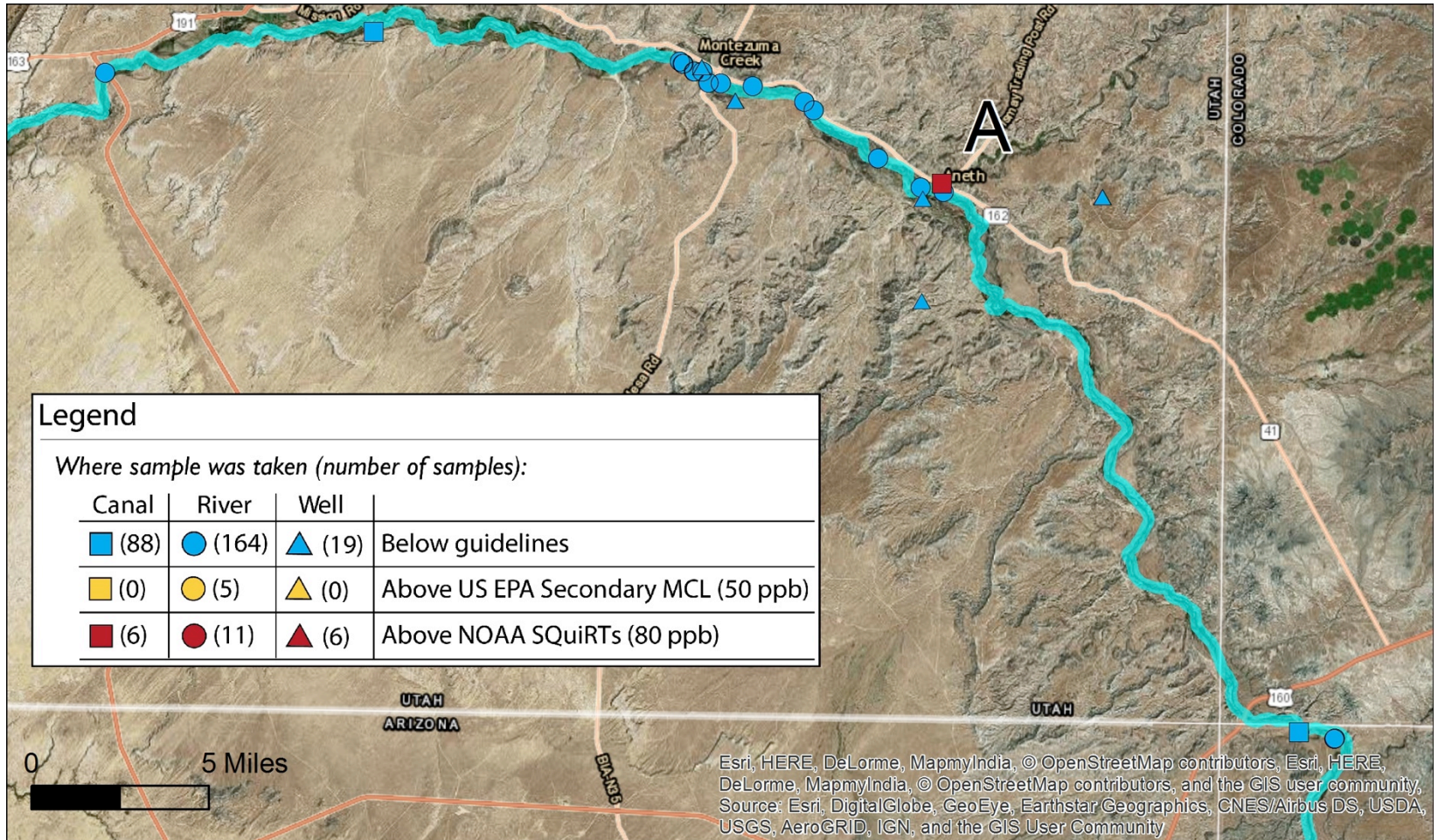
# ANETH SPRING 2016



Gold King Mine Spill Dine' Exposure Project

# COMPARING AMOUNTS OF MANGANESE IN WATER TO GUIDELINES

# ANETH SUMMER 2016



Gold King Mine Spill Dine' Exposure Project

# GOAL 2: HOUSEHOLD SAMPLING

Aug 8-12, 2016

- ✓ Worked with Navajo CHRS
- ✓ Took drinking water, dust wipe and soil samples
- ✓ Collected urine samples
- ✓ Measured lead levels in blood using a portable machine and a finger stick
- ✓ Administered questionnaire and food recall survey
- ✓ Story in Navajo Times
- Will deliver results in Summer 2017 to participants, then community



Gold King Mine Spill Dine' Exposure Project



## Researchers measuring effects of mine spill

BY DONOVAN QUINTERO  
NAVAJO TIMES

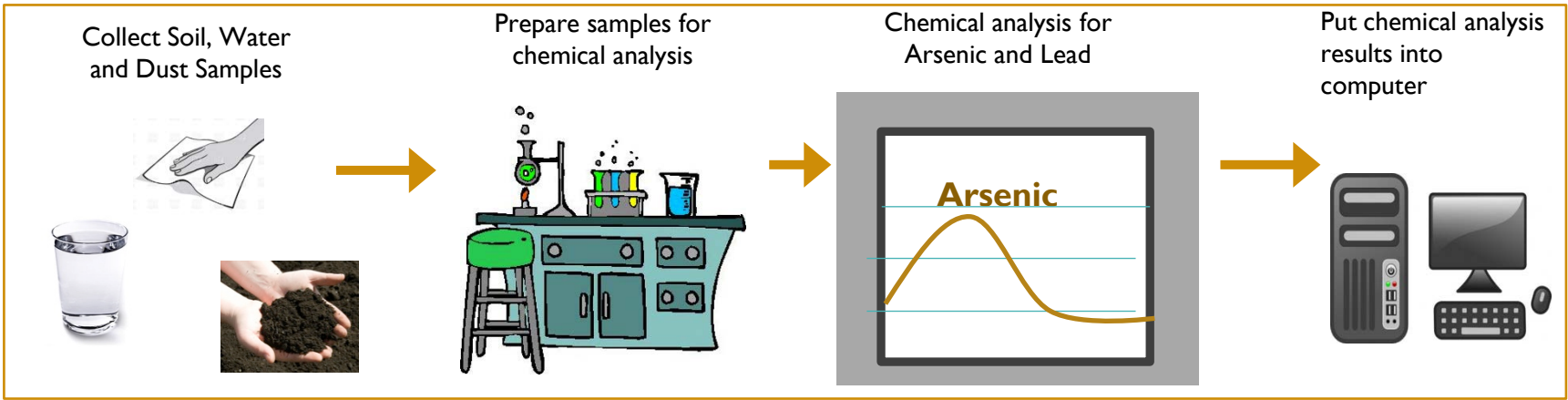
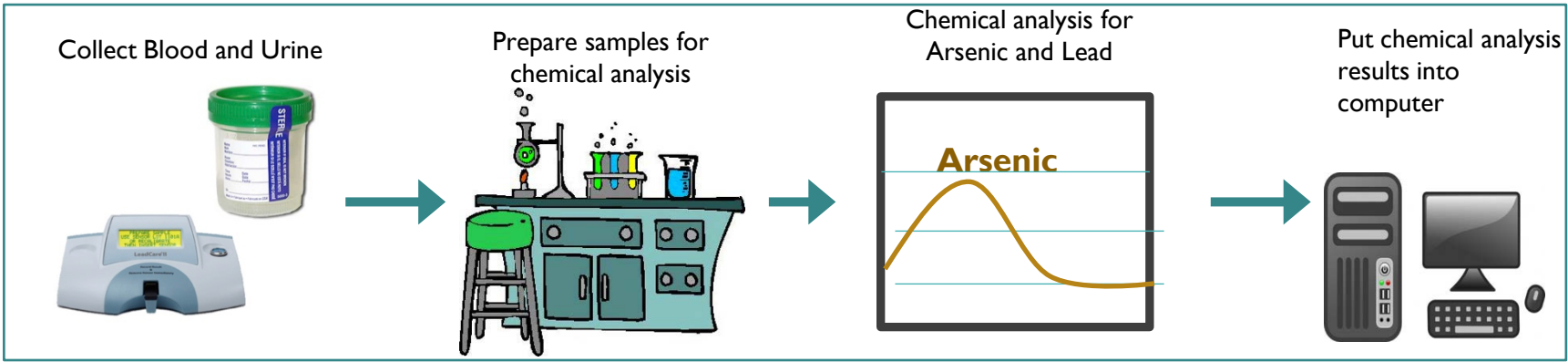
**SHIPROCK** — Community Health Representative Shirley Claco has lived by the San Juan River all her life in Hogback, New Mexico. Before the Gold King Mine spill a year ago, she says her family used the river to water their farm, water their livestock, and her grandkids played in it. After the spill, it all came to a crashing halt. Now Claco says her work, as a community health worker has become more important to her since she was given a chance to help assistant professor and extension specialist



Associate professor at the University of Arizona Paloma Bearner, right, has her blood drawn and checked by CHR Corona King with the Shiprock office (left). For any local contamination photos in Shiprock, New Mexico

have all different levels of risk." Added Pine, "As a consumer, and community member, I still believe in their planting. In their way of life, how they were raised traditionally. That's how I support them." Pine said while driving to work, she made a stop at a food stand where an elderly farmer was selling kneel down bread. She said she stopped and spoke to him about his harvest and how the spill had affected him and his selling. After she bought four pieces from him, Pine said, he was very thankful. "He told me I was one of the first persons to actually stop by, she said. "He started

# HOUSEHOLD PROCESS



# GOAL 2: HOUSEHOLD SAMPLING

	<i># of Samples by Chapter</i>			
	<b>Upper Fruitland</b>	<b>Shiprock</b>	<b>Aneth</b>	<b>TOTAL</b>
<b>Questionnaires</b>	18	20	21	59
<b>Adults</b>				
<b>Blood Lead Test</b>	18	21	22	61
<b>Urine</b>	18	21	21	60
<b>Children</b>				
<b>Blood Lead Test</b>	11	14	6	31
<b>Urine</b>	11	11	5	27
<b>Soil</b>	18	17	15	50
<b>Water</b>	18	17	15	50
<b>Dust</b>	18	17	15	50

- This does not reflect the total number of duplicate samples taken from each home, which varied from 2 to 4 water samples. Numbers only reflects individual homes.





# GOAL 3: FOCUS GROUPS

- May 13-22; June 15 & 17, 2016
- 12 Focus groups
  - Upper Fruitland, NM.....4
  - Shiprock, NM.....6
  - Aneth, UT.....2
- 123 Total Participants
- Transcription
  - All English transcribed
  - Translating from Navajo (4.5 hours total; 43% translated)
- Currently analyzing



## GOLD KING MINE SPILL EXPOSURE AND RISK PERCEPTION STUDY

### SEEKING FOCUS GROUP PARTICIPANTS

**What is a focus group?** A focus group consists of 10 individuals who have an in-depth discussion about the Gold King Mine Spill in Navajo and English.

**How many focus groups will there be?** There will be 4 focus groups of 10 people in each of the three communities.

**Who are we?** A team of professors with expertise in hydrology, exposure, health, and indigenous studies from the University of Arizona, and Northern Arizona University led by Dr. Karletta Chief.

**What we are studying?** The short-term exposure and risk perception of Navajos living in Upper Fruitland, Shiprock and Aneth on the Navajo Nation who were impacted by the Gold King Mine Spill. We would like to understand community concerns about the various exposure pathways by which an individual can be exposed to metals released by the Gold King Mine Spill.

**Who can participate?** A Navajo community member from the Aneth, Upper Fruitland, or Shiprock communities who wish to share their experience around the spill.

*Your privacy will be protected and your name and identity will not be released at any time during the study.*

**Upper Fruitland**  
Wed. June 15  
@ 6 PM

**Aneth**  
Fri. June 17  
@ 10 AM

**FOR MORE INFORMATION CONTACT**

Dr. Karletta Chief  
1 (520) 222-9801

Janene Yazzie  
1 (917) 636-2392

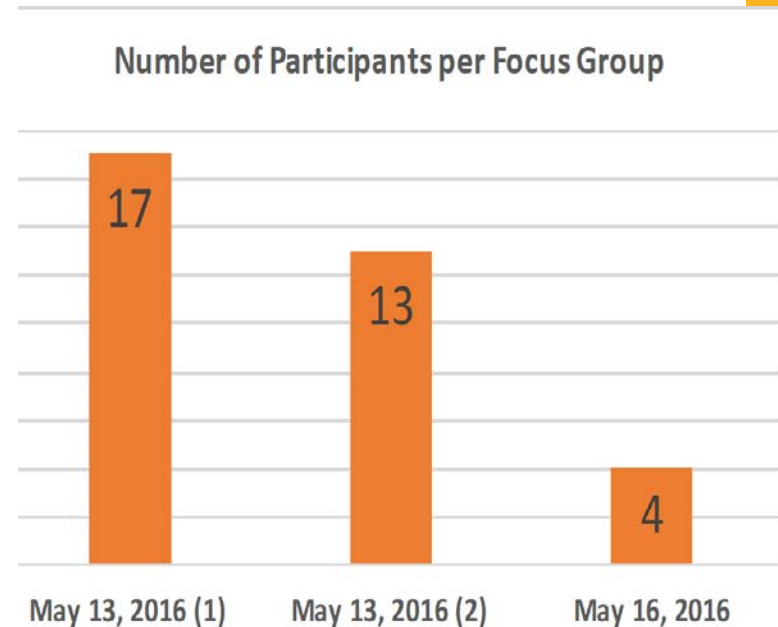


Gold King Mine Spill Dine' Exposure Project

# SHIPROCK FOCUS GROUPS

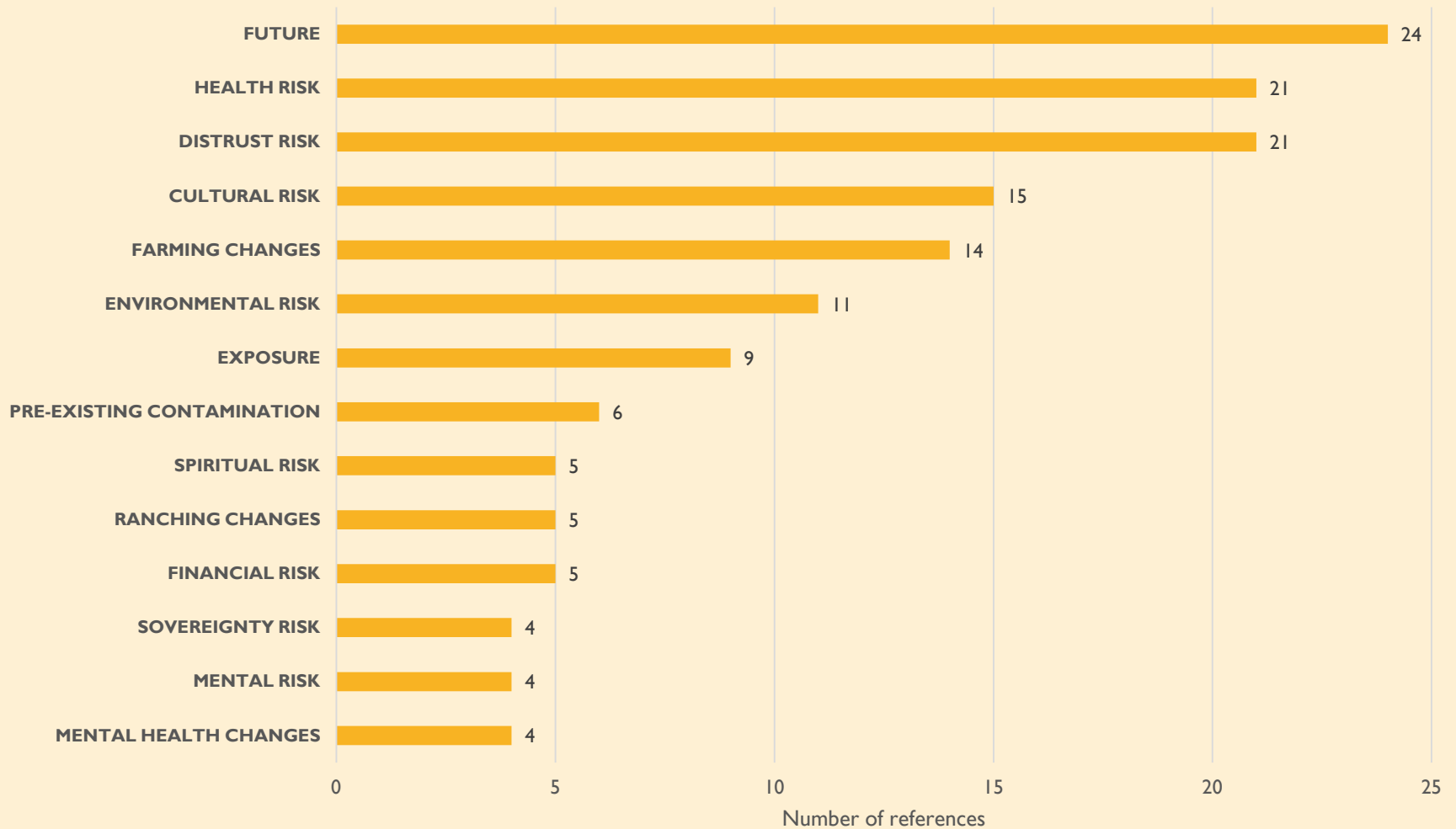
## FOCUS GROUP THEMES

Perceived Risk	Behavior Changes	Other
Environmental	Farming	Future Visions for Change
Cultural	Ranching	Sediment Exposure Pathways
Spiritual	Spiritual	Pre-existing Contamination
Mental	Cultural	
Health	Mental Health	
Financial	Recreational	
Distrust		
Historical Trauma		
Subsistence (Food Loss)		



# SHIPROCK FOCUS GROUPS

Shiprock Focus Group Top Themes



# SHIPROCK VISIONS

- Utilize the Navajo Agricultural Products Industry (NAPI) Cutter Dam water
- Pursue compensation to assist with costs to haul water or to use “drip water” temporarily
- Pursue sustainable alternatives like hydroponic farming, solar power to clean the water, and reverse osmosis or “Brita” filtering systems
- Need for a unified “voice” among the community



# SHIPROCK CONCERNS

- Personal and family health: Will eating the crops cause them health problems? Will letting their grandchildren play in the field make them ill?
- Community health: Will selling their crops “poison” others?
- Birth defects
- Cancer
- Mental health
- Animal and livestock health: Will eating their sheep make them ill?



# SHIPROCK DISTRUST

- The City of Farmington has previously dumped sewage waste in the river
- The federal government has “lied” about uranium and fertilizer safety in the past
- The Environmental Protection Agency (EPA) has not taken responsibility for the spill
- The Navajo Nation government has previously supported fossil fuel industries and has not spent money from the multimillion dollar settlement towards spill clean-up



# SHIPROCK CULTURAL CONCERNS

- Loss of community identity since they can no longer farm
- Damaged community reputation due to spill (no one will buy crops from them)
- Community is conflicted on next steps (increased tension)
- The next generation will not be able to farm (disruption to K'e and community farming culture)
- People have stopped using the river to harvest tadidiin and to wash off after sweat lodge
- Behavioral health programs have stopped taking kids to the river to discuss cultural teachings



# SHIPROCK FARMING CHANGES

- Did not farm after the spill (loss of income)
- Farmed less land (loss of income)
- Farmed for family (not to sell)
- Hauled water or used tap water





# SHIPROCK ENVIRO. CONCERNS

- Concern about heavy metals still in sediment
- EPA representative said on the news that the water is still contaminated
- ASU professor said water will “not be good for a decade”
- Concerns about long-term presence of contaminants in the sediment and the canals
- Rain brings “grey” water, is there sediment with heavy metals in there?



# PROJECTED TIMELINE FOR GIVING RESULTS TO COMMUNITY

## SPRING 2017

- **April** – Environmental Water Results

## SUMMER 2017

- **July** – Environmental Soil/Sediment Results
- **August** – Household Results (Individuals)

## FALL 2017

- **Sept.** – Household Results (Community)
- **Oct.** – Focus Group Results



# OUR MAIN FINDINGS

- Amounts of **arsenic** in water were below the guidelines for drinking water for people and for plants and animals living in water
- Amount of **lead** in 4 river samples was above the water guideline for plants and animals living in water in Spring 2016
- Amounts of **manganese** were above both guidelines in Spring 2016 more than Winter 2015 and Summer 2016
- Amounts of metals in the San Juan River and canal water were generally higher in Spring 2016 compared to Winter 2015 and Summer 2016



# CONCLUSIONS

- **Environmental Sampling** – We completed water testing for Arsenic, Lead, and Manganese. We are working on soil/sediment analysis and aim to complete by July 2017.
- **Household Sampling** – We are putting findings into a computer and will give back findings to participants in August 2017 and then to the community in September 2017.
- **Focus Groups** – We translated content from Diné'ke'jí to English and analyzing what people said. We will give back findings to the community in October 2017.



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**American Indian  
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**Center for Indigenous  
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# HOW DO I GET UPDATES?

- Subscribe to List Serve and Quarterly Newsletters by emailing: [goldkingproject@gmail.com](mailto:goldkingproject@gmail.com)
- Like Facebook Page at [Navajo Gold King Mine Spill Exposure Project](#)
- [@goldminespillproject](#)
- View updates at Website at: <https://www.superfund.arizona.edu/info-material/gold-king-mine>

- **Contact Info is:**

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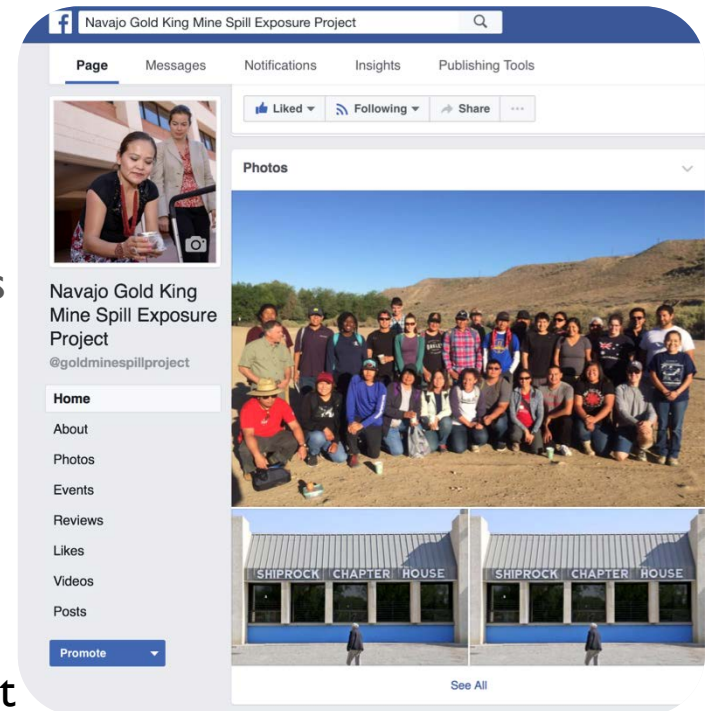
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**Questions?**