

The San Juan Watershed Group: A Legacy of Microbial Source Tracking and Watershed Planning in the San Juan Watershed of New Mexico

June 6th, 2022

“WHO POOPED IN THE RIVER?”

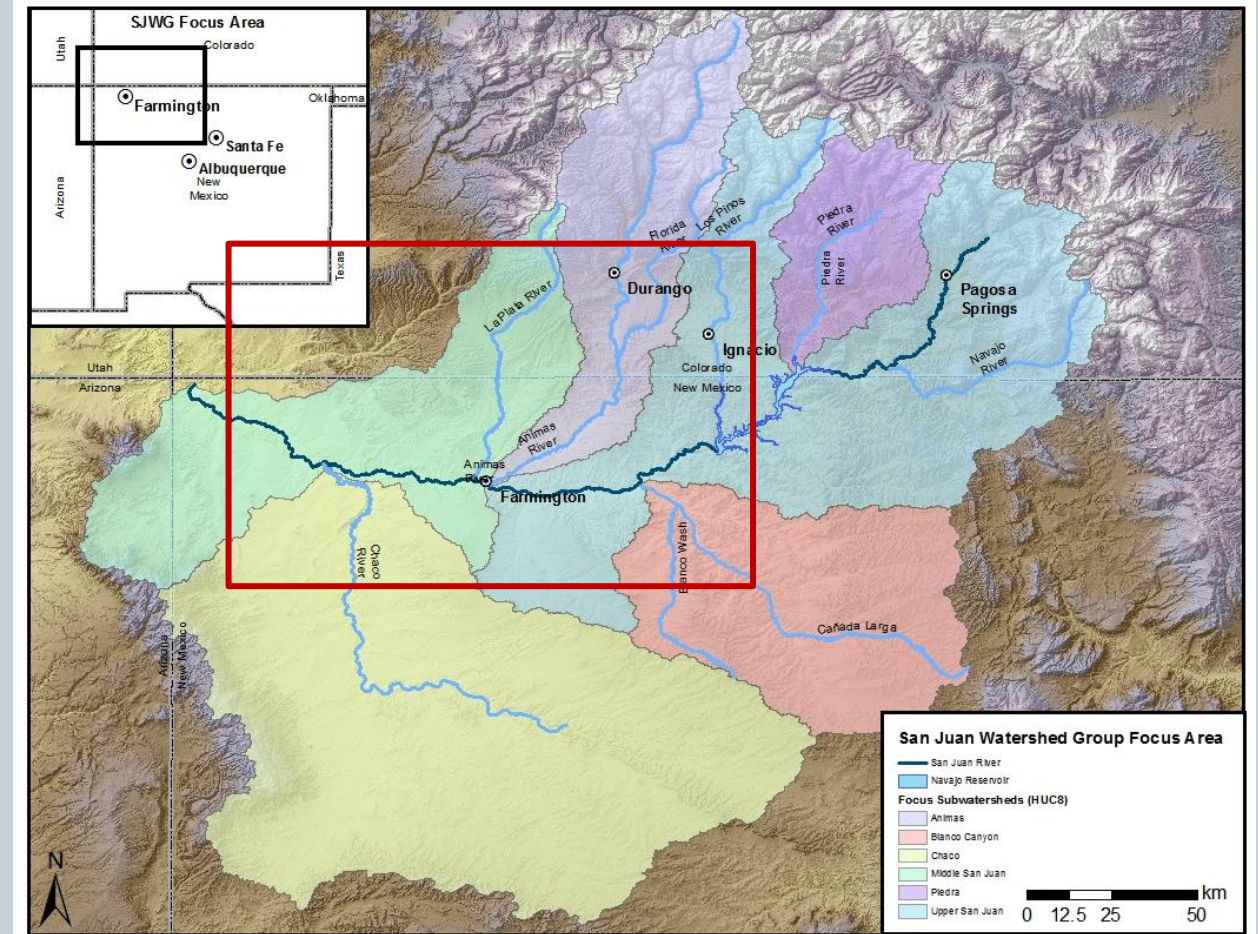


Image courtesy of LuminUltra Inc. Laboratory

Who is the San Juan Watershed Group?

- A group of citizens and local agencies working to improve water quality in the San Juan River and its tributaries so that they meet national water quality standards
 - Water Quality Research
 - Watershed Planning
 - Projects that address Non-Point Source Pollution
 - Community Outreach and Education

Mission: Find collaborative solutions to protect and restore water quality in the San Juan River Watershed for current and future generations



Water Quality Impairments in the New Mexico Portion of the San Juan Watershed



Clean Water Act 303(d) List of Water Quality Impairments for 2016-2018



2016-2018

Water Quality Impairments in the New Mexico Portion of the San Juan Watershed



Clean Water Act 303(d) Proposed List of Water Quality Impairments for 2020-2022



2020-2022

Research questions

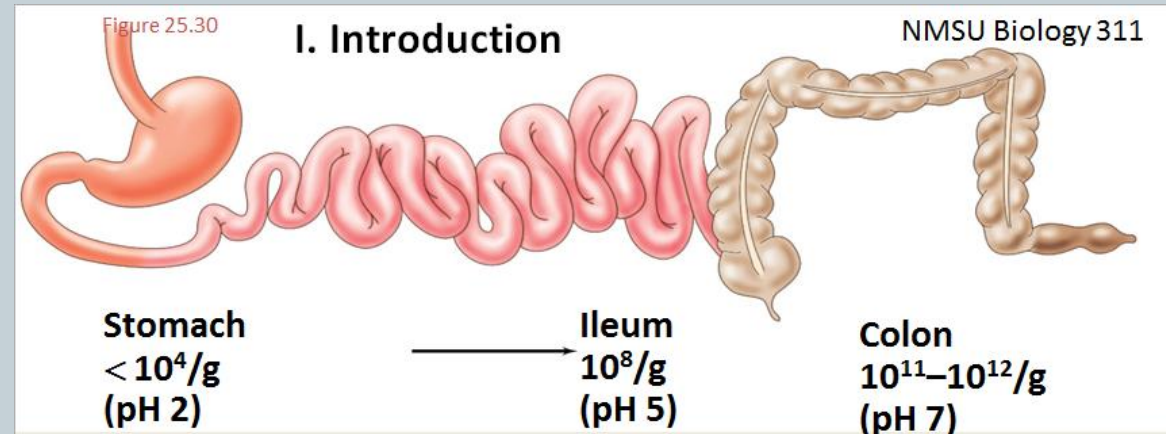
2013-14

- Who pooped in the river?
 - (which host sources are contributing to the bacteria impairment)
- Are you SURE that's who pooped?
 - (Quality assurance & control)
- When, where and how much?
 - (Temporal and spatial trends in concentrations and loads)
 - (Do trends point to specific sources or pathways for pollutants reaching the river?)

2021 (& 2016)

- Are humans still pooping in the river?
 - (presence/absence of human source bacteria)
- Where and how much?
 - (Do spatial trends in concentrations point to any hotspot sources?)
 - (Does human source bacteria drive the E.coli concentrations?)
- Are you sure its not WWTPs?
 - (QAQC data gap of treated sewage)

Fecal Indicator Bacteria



Bacteroides:

Makes up to 20% of the mass in fecal material (E. coli less than 1%). Bacteroides are strict anaerobes so less likely to grow once they exit the intestinal tract. Specific DNA markers used to ID host sources using PCR.

E. coli:

The most widely used fecal indicator bacteria. Infamous O157:H7 strain is virulent, but most strains are harmless. Samples directly comparable with standards used to determine bacteria impairment. E.coli cultured in lab – only live cells measured.

Why Microbial Source Tracking?



Image courtesy of LuminUltra Inc. Laboratory

Sampling Sites 2013-14



Two-Year Averages: Percent of Samples that are Positive

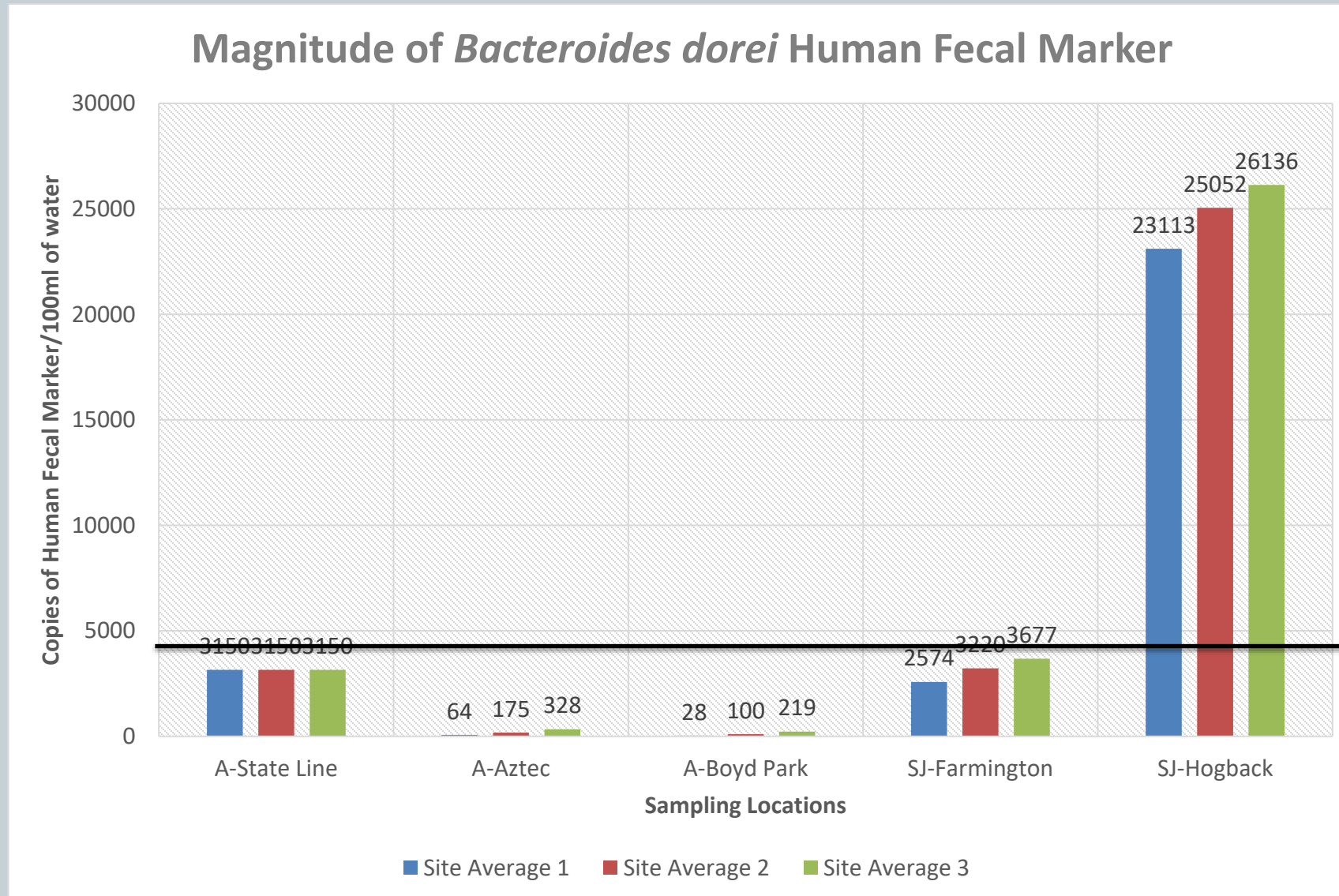
(n = 78-80 samples for Human and Bird, n=54-56 for Ruminant)

2013+2014



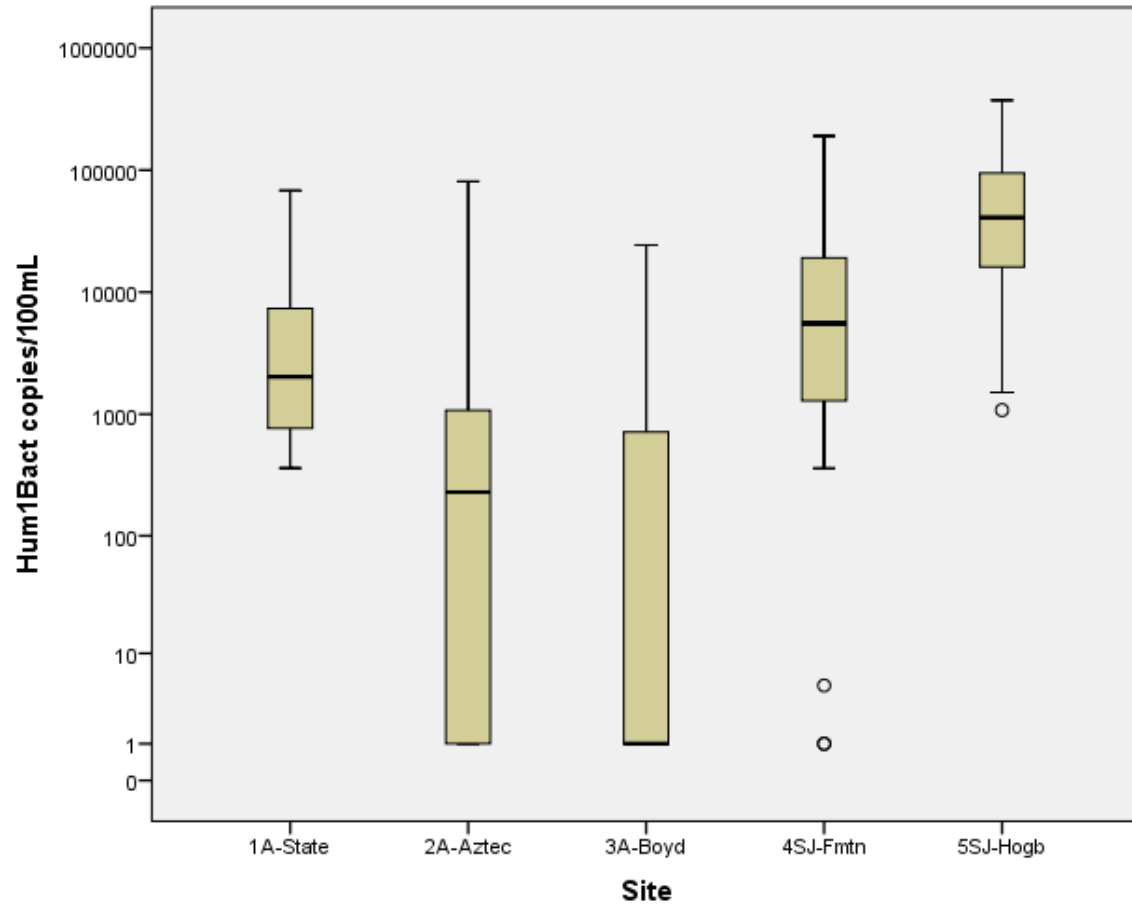
Bird and Ruminant contamination is fairly constant.
Human contamination: San Juan River > Animas River

So human contamination is present, but HOW MUCH?

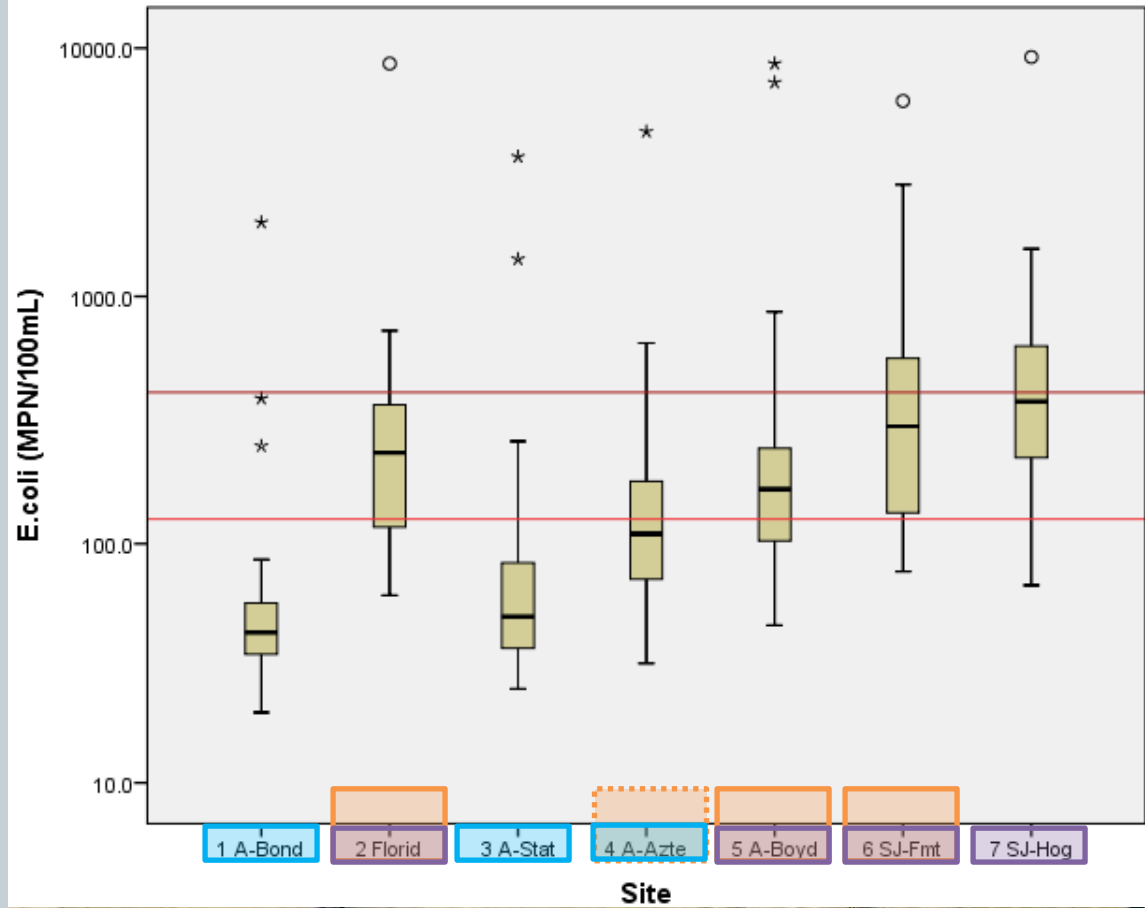


4200 copies/100ml is a benchmark illness rate of 30 illnesses per 1000 swimmers

Human1Bacteria Quantification 2014



E.coli Quantification 2014



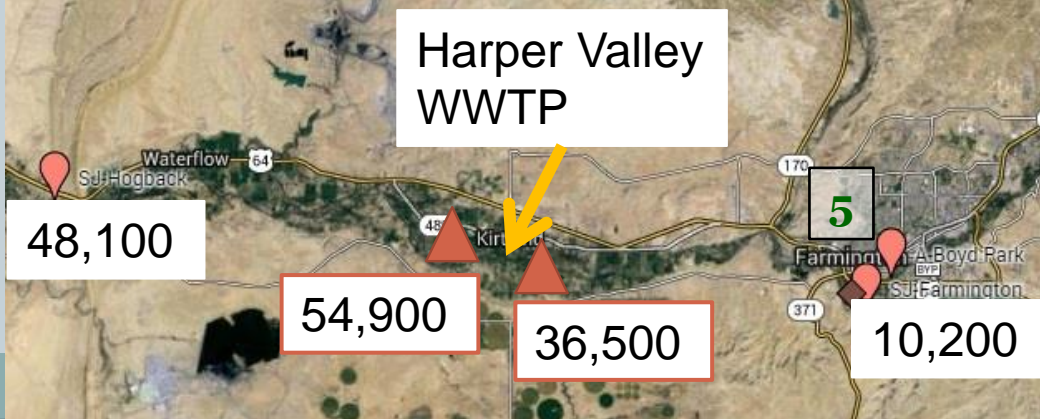
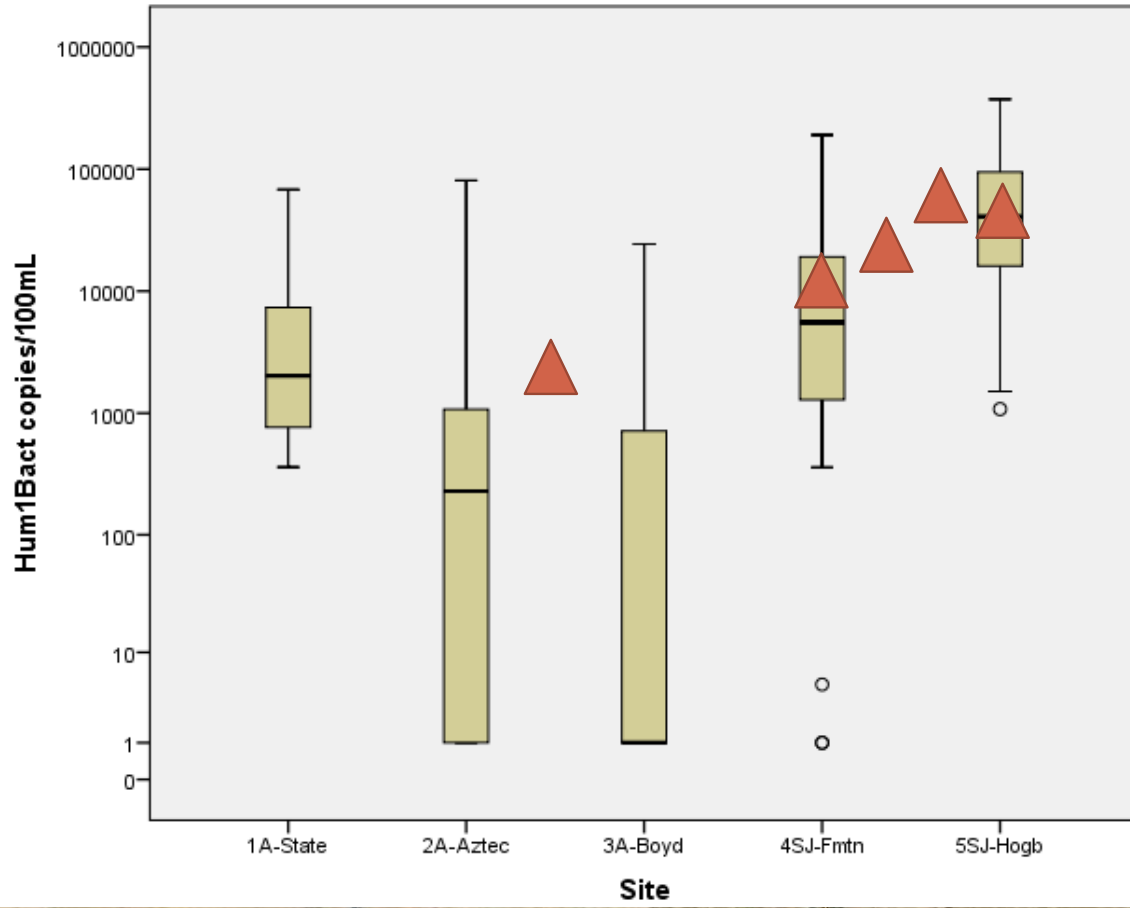
Answers (and MORE questions!) from the original study

- Who pooped in the river?
 - Ruminants (95-100% positive)
 - Human (60-97% positive)
 - Birds (30-50% positive), NO horses or dogs detected
- Are you SURE that's who pooped in the river? YES
- When, where, and how much?
 - Greater concentration of B.dorei and E.coli on the San Juan River, greatest increase between Farmington and the Hogback. Lots of exceedances during monsoon season.
- Are any of our other pollution problems tied to the poop problem?
 - Positive correlation between E.coli and storm events (flow, turbidity, nutrients)
- Can we tell from the data how the poop is getting to the river?
- Do the data point to or rule out any specific sources?
- Could WWTPs be contributing?

Dec 2016 Targeted Sampling



Human1Bacteria Quantification 2014 + Dec 2016

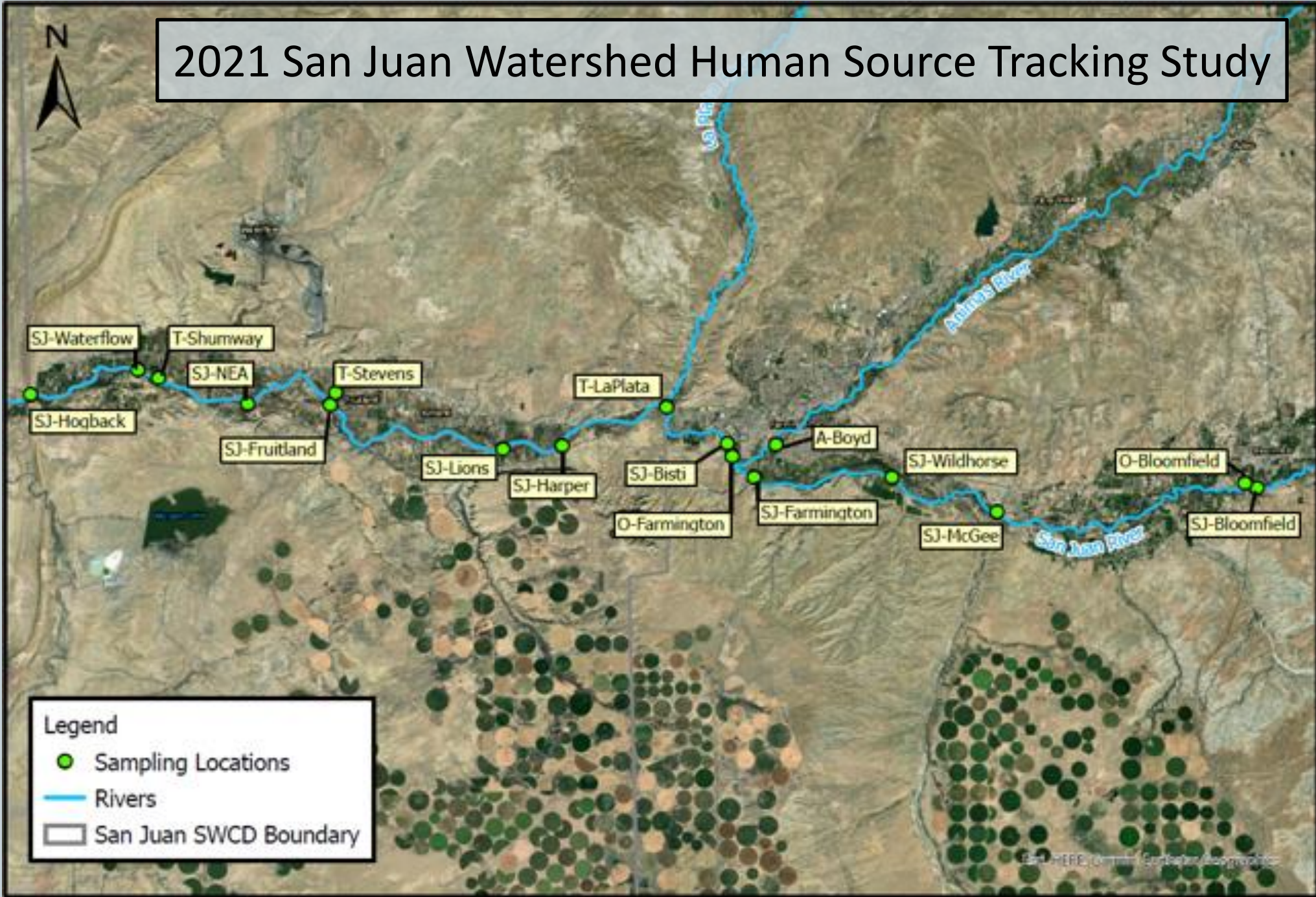


HOW could the Bacteria be Getting to the River?

Biological Source	Source Activity	Pathway to River:	Ground water	Direct Discharge	Irrigation Returns	Storm water
Human	Faulty septic tanks		X			
	Illegal septic (straight pipes, cess pits, etc.)		X	X	X	X
	Leaking sewer pipes		X	X		
	Illegal dumping – waste disposal companies			X		X
	Illegal dumping – recreational vehicles			X		X
	Wastewater treatment plants			X		
	Outdoor defecation					X

Community meetings – identify known or suspected sources, bracket sampling sites

2021 San Juan Watershed Human Source Tracking Study



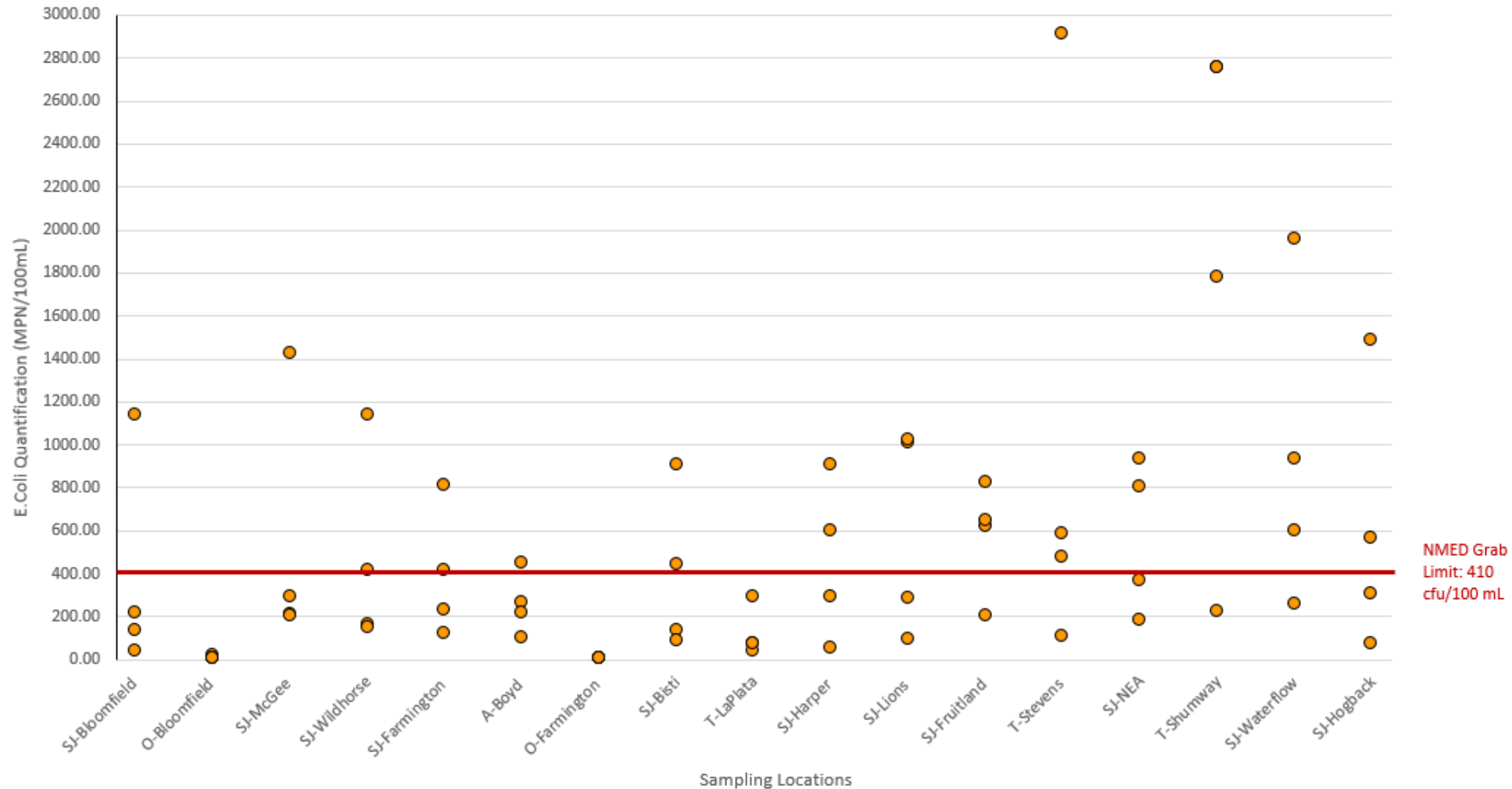
Sampling Dates	Mode of Travel
August 4th	Raft
August 5th	Vehicle
August 25th	Raft
August 26th	Vehicle
September 29th	Vehicle
September 30th	Raft
October 27th	Raft
October 28th	Vehicle

The \$40,000 Question(s)

- Have *E.coli* and human source *B.dorei* levels changed since 2016?
- If humans DID poop in the river, where, (when), and how much?
- Are Wastewater Treatment Plant outflows contributing to human source levels in the river?
- Do the data point to or rule out any specific source hotspots?

E.coli is still indicating too much bacteria ...

E.Coli Quantification Results for All Sampling Sites and Events

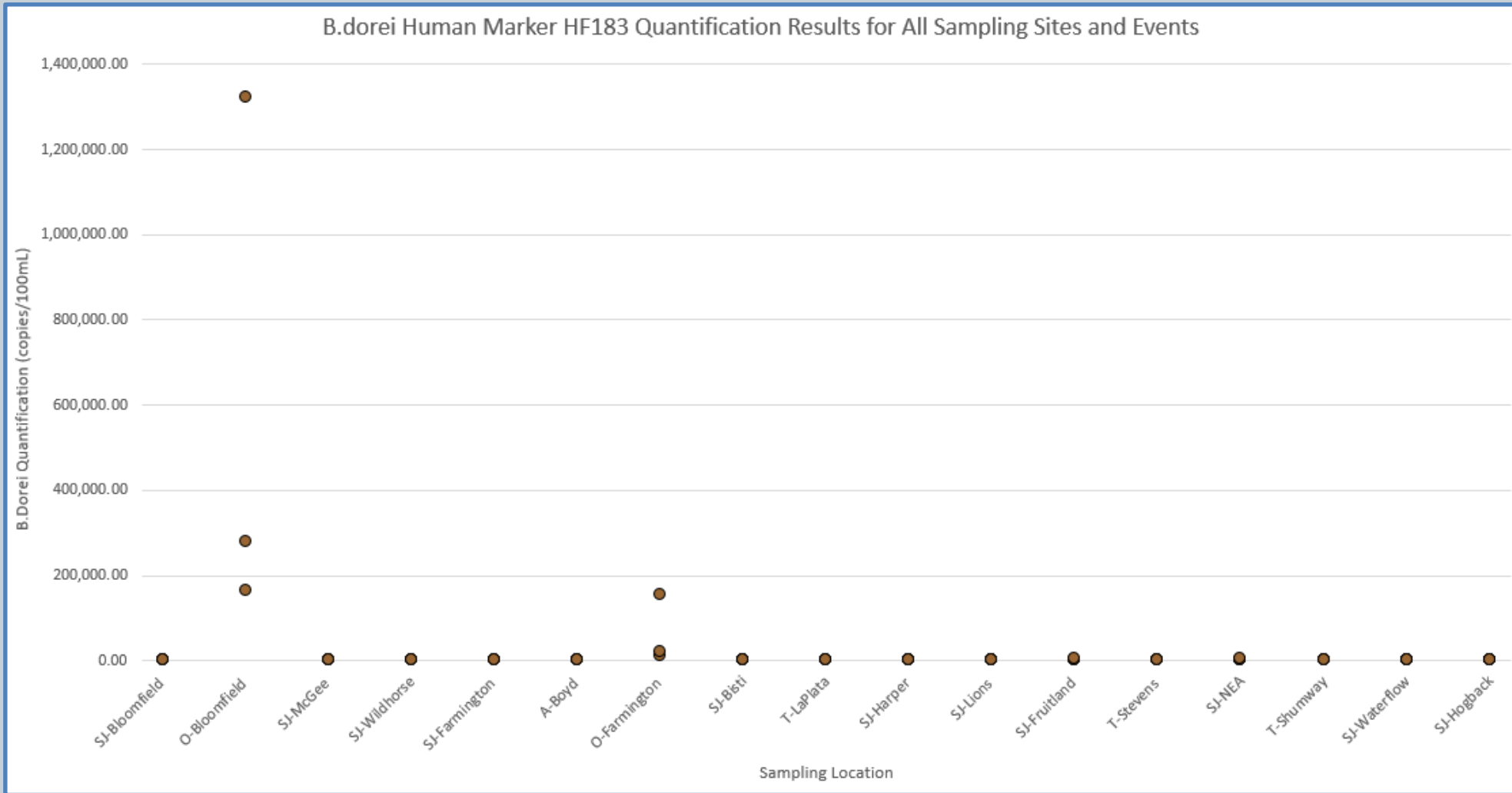


NMED Grab
Limit: 410
cfu/100 mL

**48% of samples
over the single grab
exceedance limit**

Number of Single Grab <i>E.coli</i> Exceedances Over 410 cfu/100mL
SJ-Bloomfield: 1/4
SJ-McGee: 1/4
SJ-Wildhorse: 2/4
SJ-Farmington: 2/4
A-Boyd: 1/4
SJ-Bisti: 2/4
T-LaPlata: 0/4
SJ-Harper: 2/4
SJ-Lions: 2/4
SJ-Fruitland: 3/4
T-Stevens: 3/4
SJ-NEA: 2/4
T-Shumway: 3/4
SJ-Waterflow: 3/4
SJ-Hogback: 2/4

What's the Latest Scoop on Human Poop?

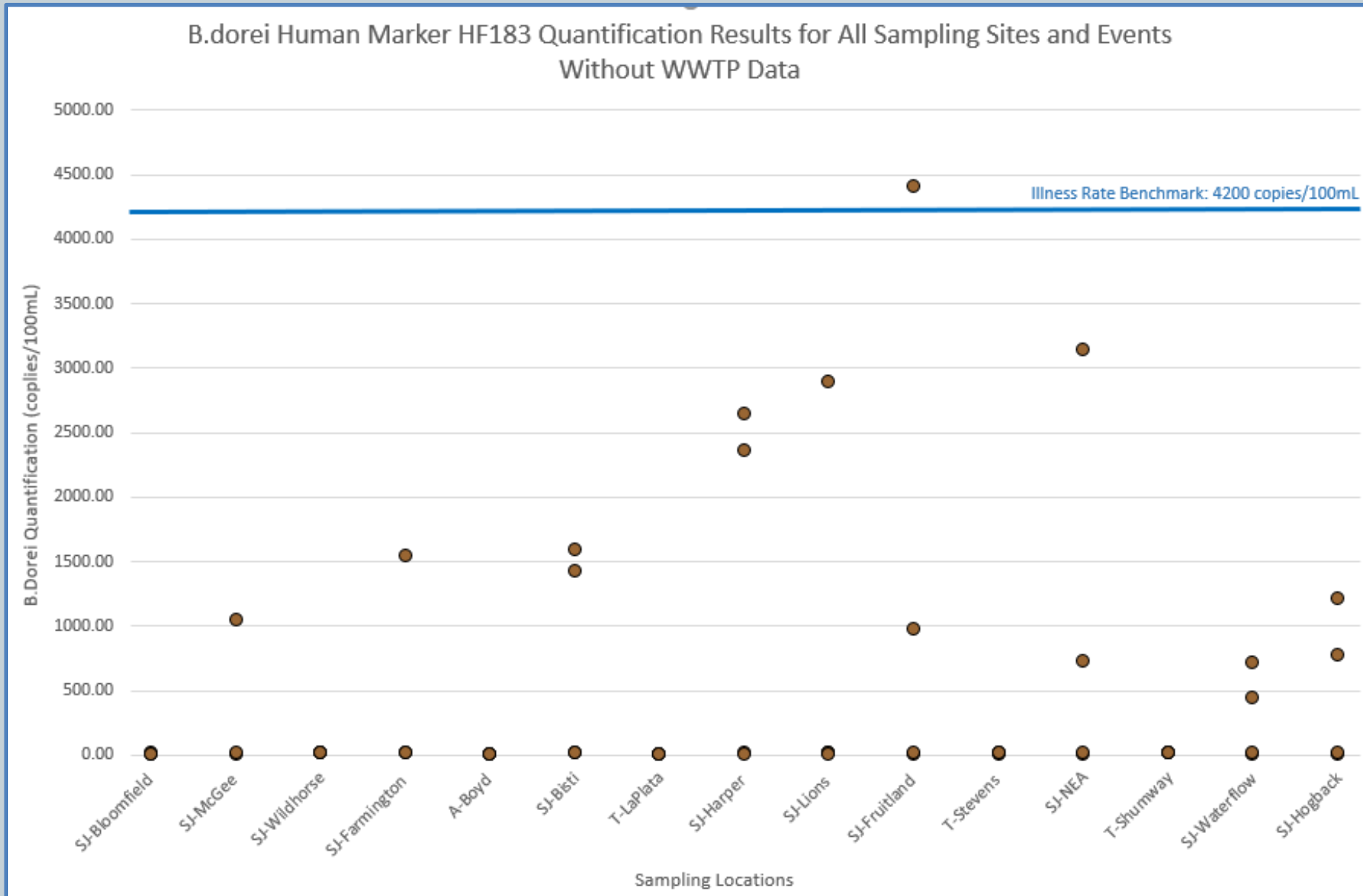


29% of results were quantifiable for human source bacteria

Only 1 sample over Illness Rate Benchmark

Tributaries had no detected contributions of human source bacteria

What's the Latest Scoop on Human Poop?

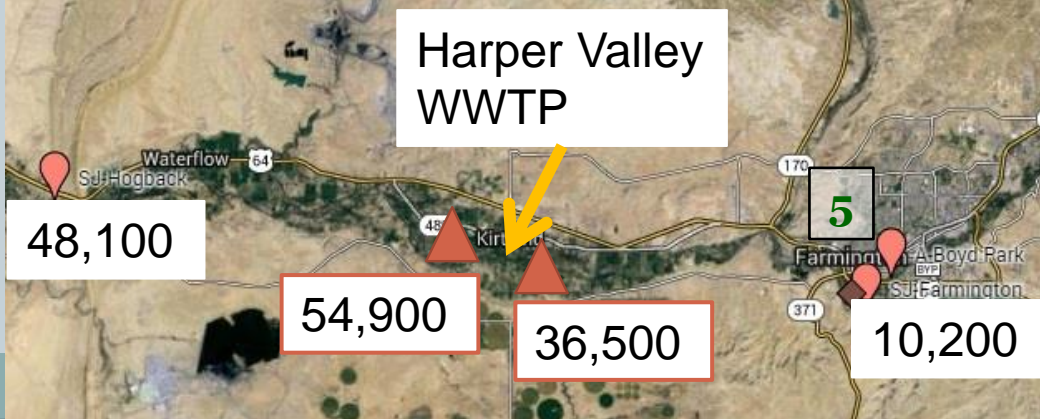
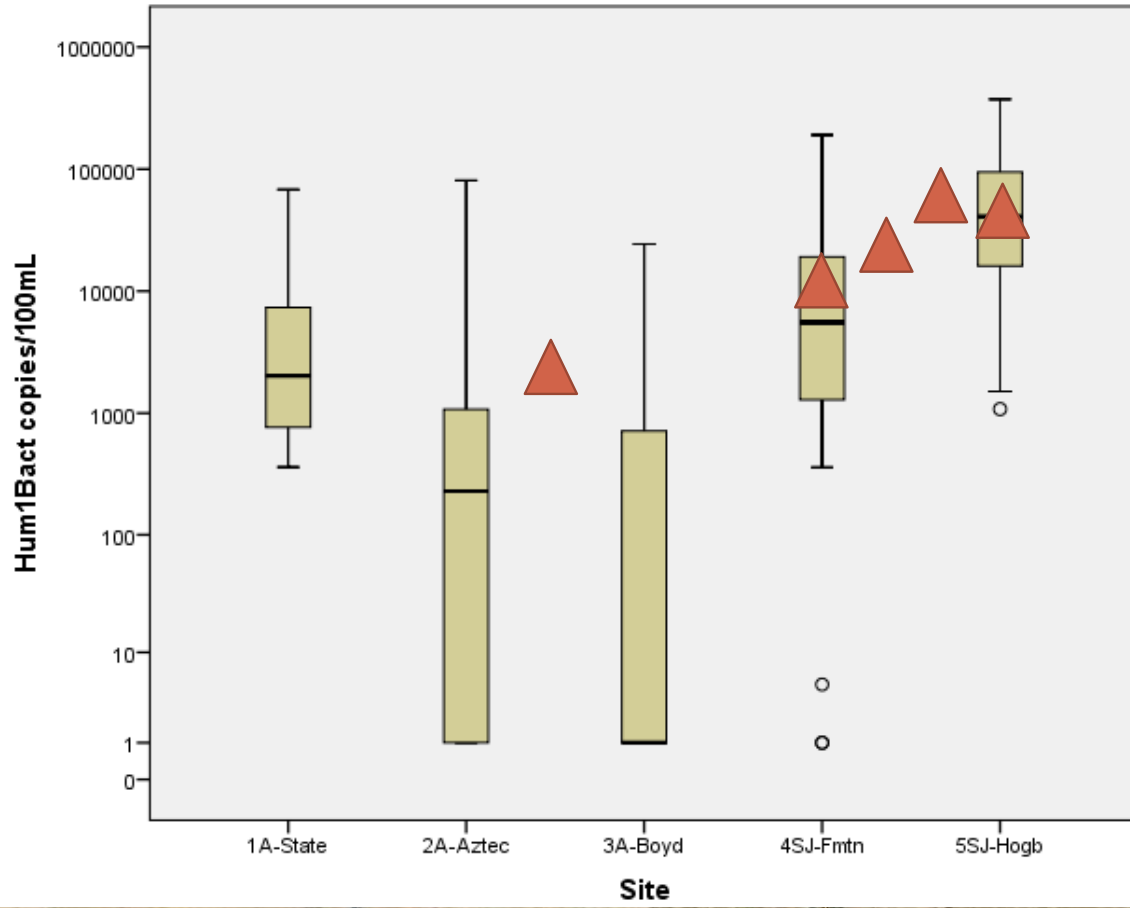


29% of 2021 results were quantifiable for human source bacteria

Only 1 sample over Illness Rate Benchmark

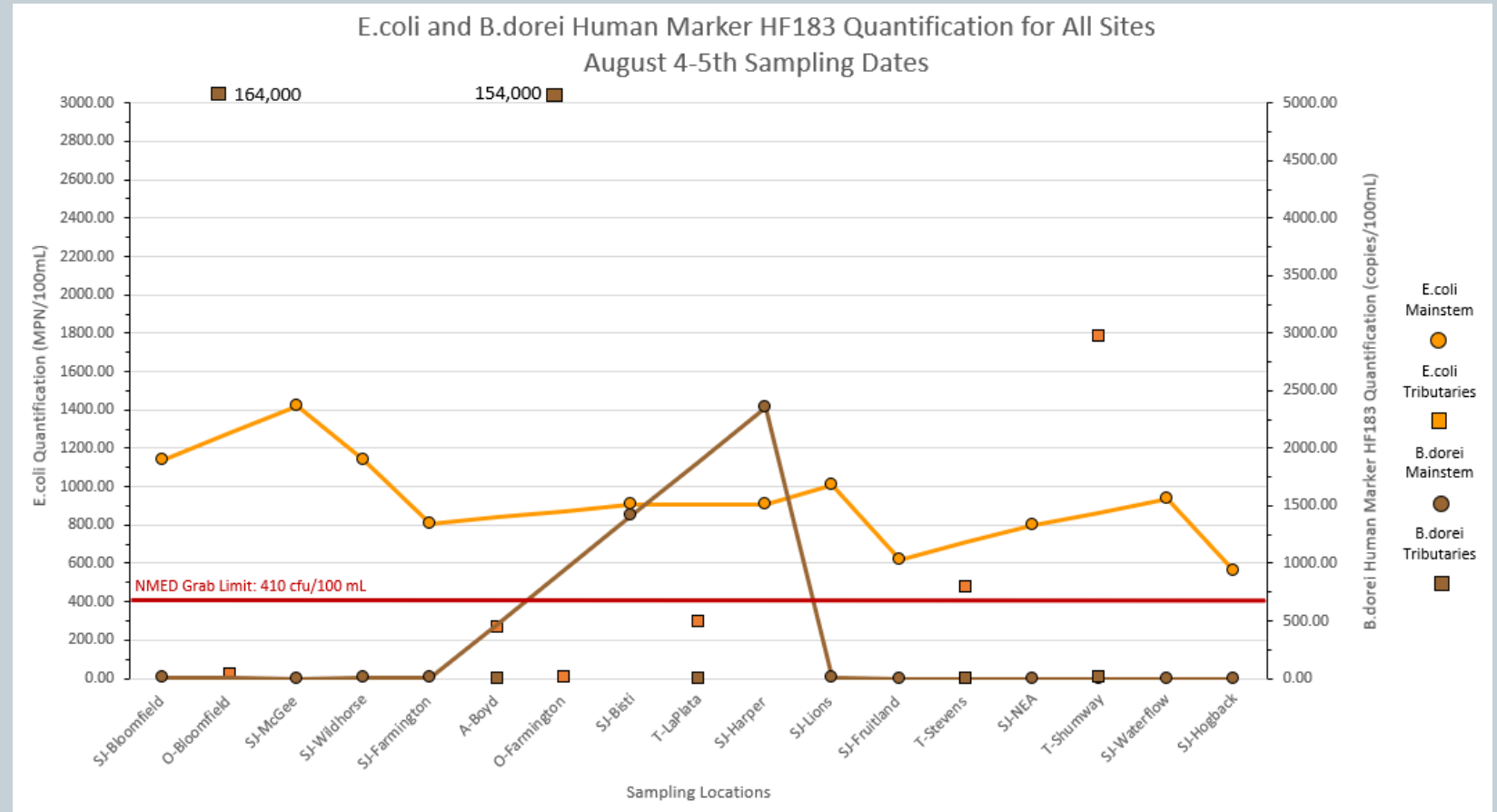
Tributaries had no detected contributions of human source bacteria

Human1Bacteria Quantification 2014 + Dec 2016



The Latest Scoop on Poop – Where oh Where...?

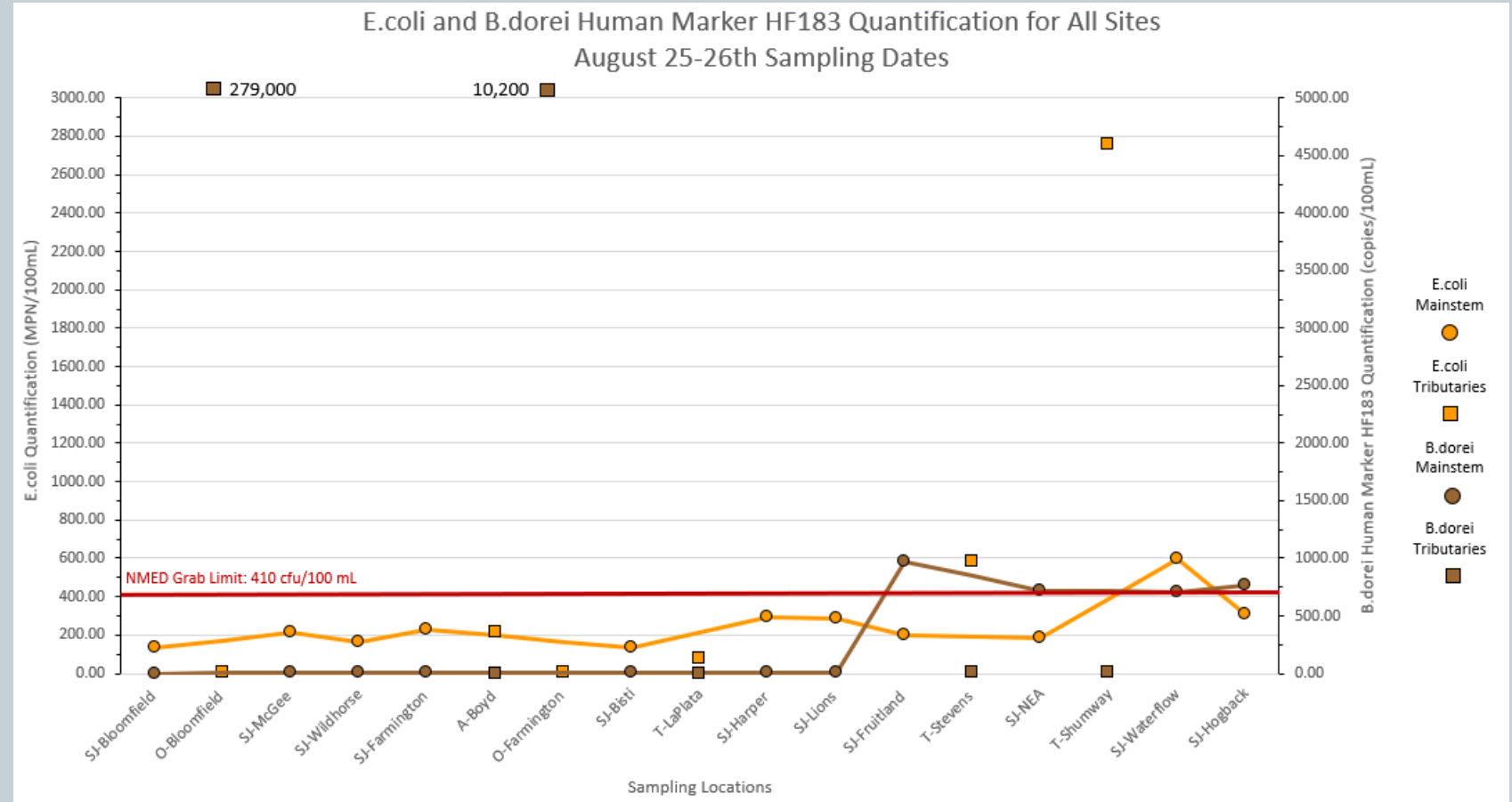
August 4th and 5th



Flow (cfs)	Navajo Dam Release (cfs)	Turbidity (fnu)	% E.coli Results over Exceedance Limit	% B.dorei HF183 Quantifiable Results
700-900	400	500-1,500	87%	13%

The Latest Scoop on Poop – Where oh Where...?

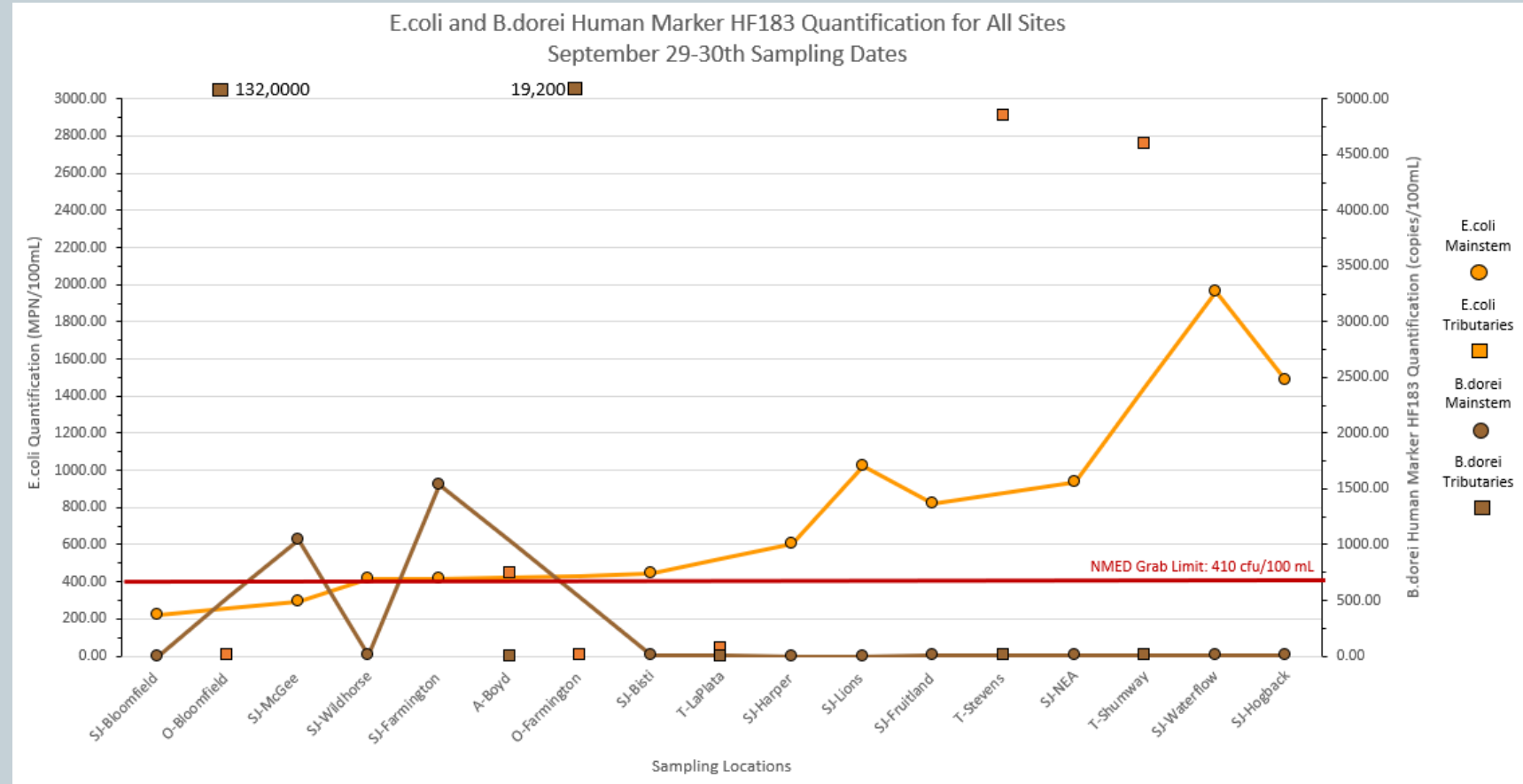
August 25th and 26th



Flow (cfs)	Navajo Dam Release (cfs)	Turbidity (fnu)	% E.coli Results over Exceedance Limit	% B.dorei HF183 Quantifiable Results
550-650	680	100-225	20%	27%

The Latest Scoop on Poop – Where oh Where...?

September 29th and 30th



Flow (cfs)	Navajo Dam Release (cfs)	Turbidity (fnu)	% E.coli Results over Exceedance Limit	% B.dorei HF183 Quantifiable Results
800	760 to 680	500-4,000	80%	13%

The Latest Scoop on Poop – Where oh Where...?

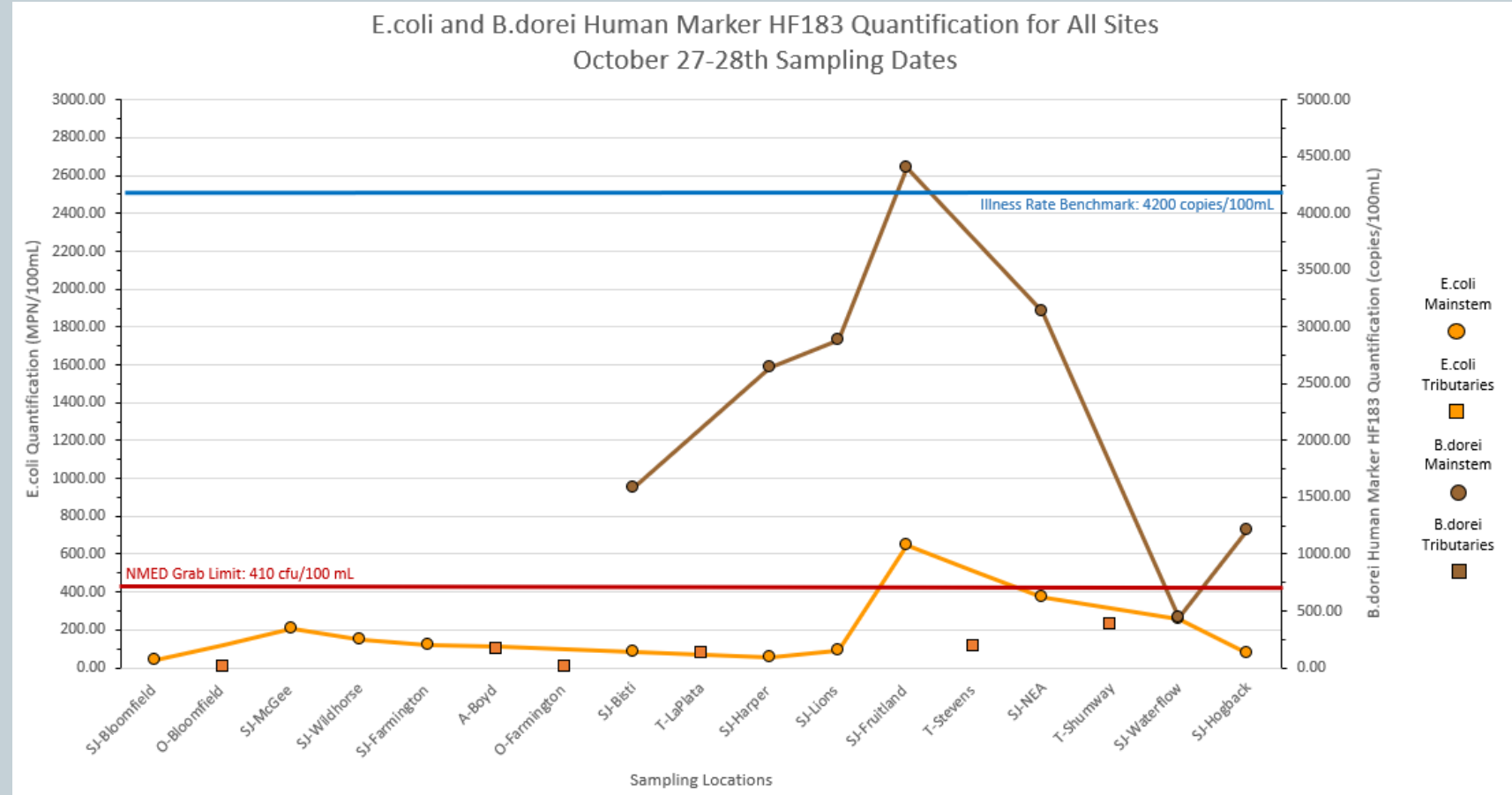
October 27th and 28th



SJ-Fruitland



SJ-NEA



Flow (cfs)	Navajo Dam Release (cfs)	Turbidity (fnu)	% E.coli Results over Exceedance Limit	% B.dorei HF183 Quantifiable Results
550-650	370	Not Available	0.07%	100%

Conclusions, and more Questions!

- Have E.coli and human source B.dorei levels changed since 2016?
 - Yes. E.coli numbers are still significant, but human source levels are much lower than 8 years ago
- Are Wastewater Treatment Plant outflows contributing to human source levels in the river?
 - No. The high numbers at WWTPs do not seem to be driving concentrations at downstream sites, and likely do not reflect a human health risk. Future sampling with a fluorescent DNA binder could quantify this (dead vs. alive cells), but it does not seem to be a priority.

Conclusions, and more Questions!

- **Where, (when), and how much?**
 - Tributaries did not have any detectable *B.dorei*, but did have high *E.coli*
 - Only 29% of samples quantifiable for human source. One incident at 4,400 copies/100mL
 - 48% of samples over the 410 cfu/100mL *E.coli* grab limit – multiple exceedances in both mainstem San Juan reaches → requalify for impairment listing
 - Highest concentration at 2,800 cfu/100mL from Stevens and Shumway Arroyos – keep on impairment list and investigate non-human sources upstream
- **Does the data point to or rule out any specific human source hotspots?**
 - Not consistently, but indications that sources still exist between Bloomfield and Farmington and Farmington and the Hogback
 - To continue to reduce human source pollution, on the ground projects and public outreach should be watershed wide
 - High *E.coli* and low human source = bacteria from other hosts

The Big Question:

What could have led to decreases in human source bacteria?

- Expansion of the Farmington WWTP
- Farmington WWTP sewer extension to Harper Valley Subdivision and Kirtland
- Decommission of Harper Valley Wastewater Treatment Plant
- Decommission of Central Consolidated Schools unlined lagoon
- Increased certification of septic haulers and pumpers
- Septic care outreach and education



Mission Accomplished?????

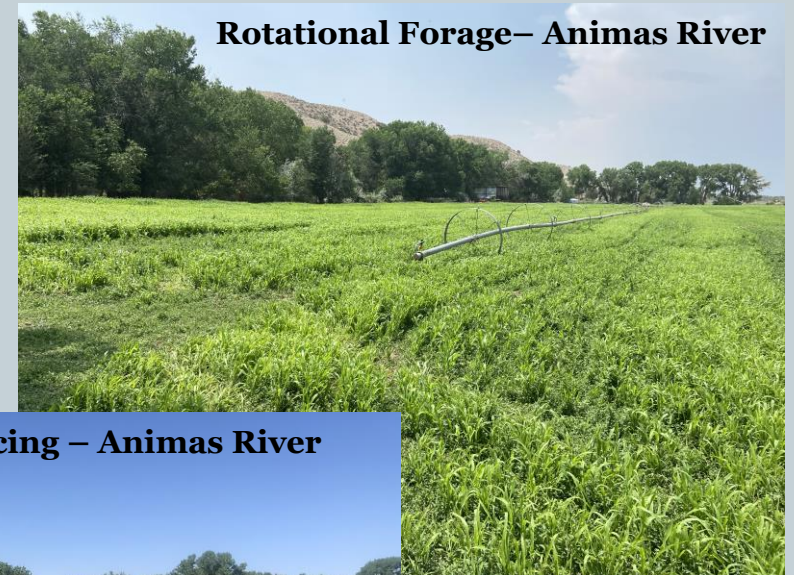
- Work concerning liquid waste has been successful but needs to continue
 - Community outreach on proper septic system care – mailed 46,000 flyers in 2020
 - RV Dump Station Signage Improvement Campaign – installed 16 roadway signs in 2021
 - NMED Liquid Waste Program Rules and Regulation Training for Septic Professionals in 2021
 - Continued Farmington sewer infrastructure expansions
 - THINKING BIG AND INTO THE FUTURE: Septic System Cost Share Program



Addressing Bacteria from Non-Human Sources



- 2013-14 MST study did detect ruminant more than human source bacteria (90-100% of the time)
 - Improving soil health and water infiltration (rotational grazing, cover crops, etc)
 - Excluding livestock from riparian areas and alternative livestock water sources
 - Plant runoff buffers from fields
 - Efficient irrigation



Thank You! Questions?

Thank You to Our Funders:

Melissa May & Alyssa Richmond
San Juan Soil & Water Conservation District
sanjuanswcd.com/watershed

