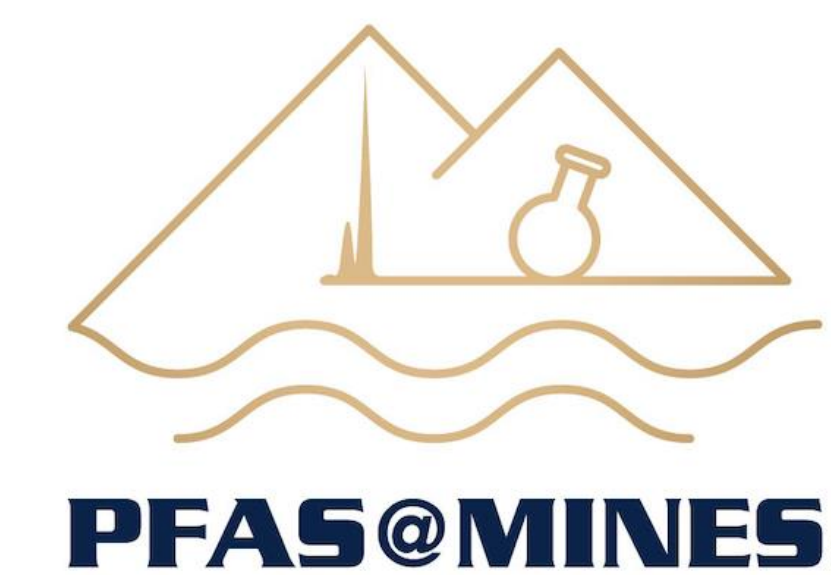




Field Sampling and Analysis for Per-and Polyfluoroalkyl Substances (PFASs) in the State of Colorado

Grace Mills, Carson Cheney, Stefanie Shea, PhD, Conrad Pritchard, Christopher Higgins, PhD
Department of Civil and Environmental Engineering, Colorado School of Mines, Golden, CO



Objective

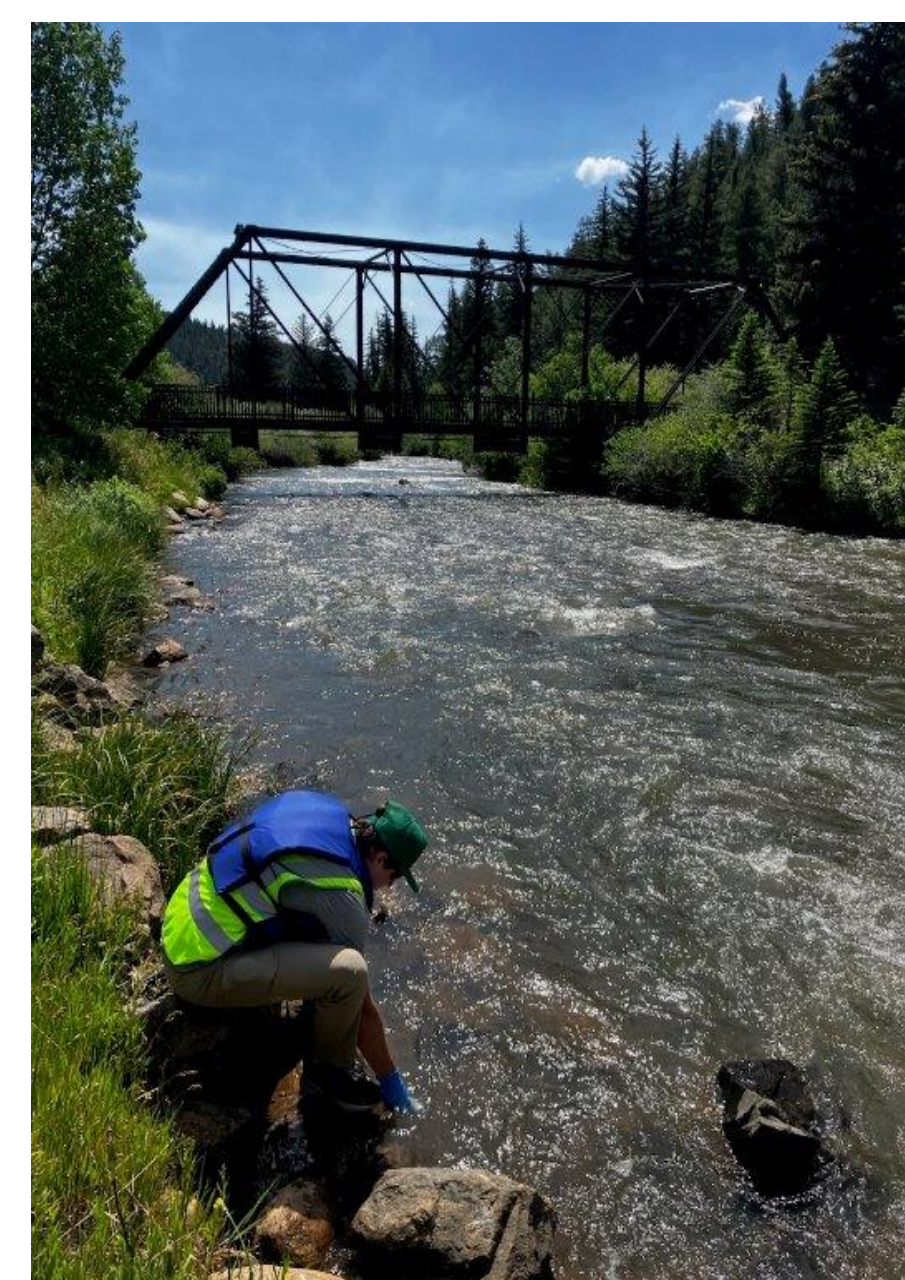
Evaluate the impact that septic tank leachate has on PFAS concentrations in surface water, groundwater, and soil through field sampling and laboratory analysis.

Introduction

- Per- and Polyfluoroalkyl Substances (PFASs) were first manufactured in the 1940s¹
- Used in food packaging, nonstick cookware, and cosmetics²
- Chronic exposure can cause cancers, endocrine disorders, and kidney problems³
- Due to the use of products in the home, PFASs can be rinsed down the drain and appear in septic tank effluent^{4,5}
- Septic tank effluent can then percolate into and contaminate groundwater⁶

Site Selection

- We identified towns with high septic tank density
- Used the Colorado DWR database to look at drinking well density
- Assumed anywhere with a well has a septic tank



Methods

Field Sampling

- In-field testing for pH, conductivity, and turbidity
- Surface water: collected samples by fully submerging a 250 mL HDPE bottle underwater and uncapping
- Well water: Collected samples from well owner's tap
- Soil: Collected a small quantity of soil from the septic tank leach field

Laboratory Analysis

- Samples prepared via Solid Phase Extraction (SPE) for
- Liquid Chromatography-Mass Spectrometry (LCMS) Analysis
- Derivative of EPA Method 1633

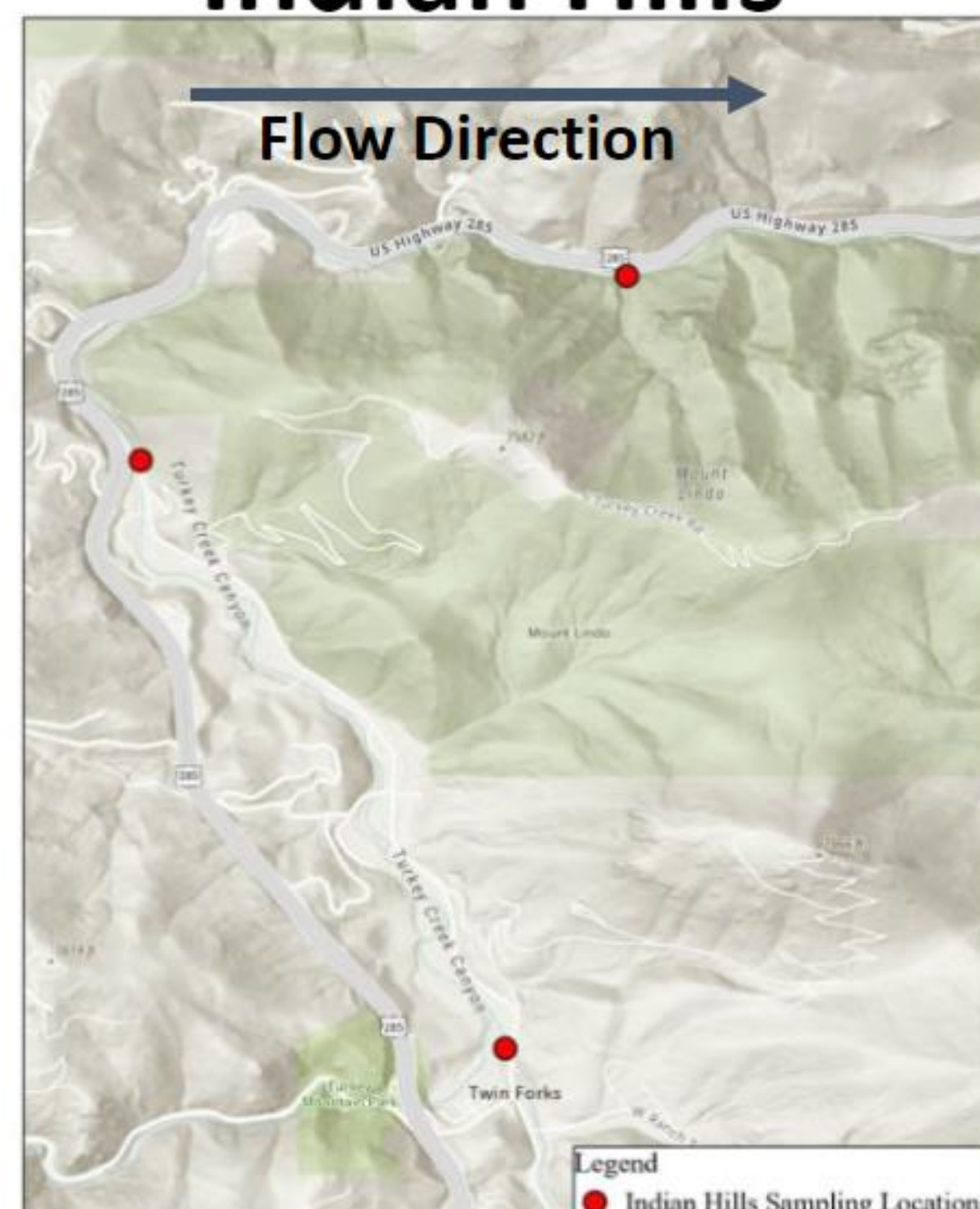


Current Progress/Results

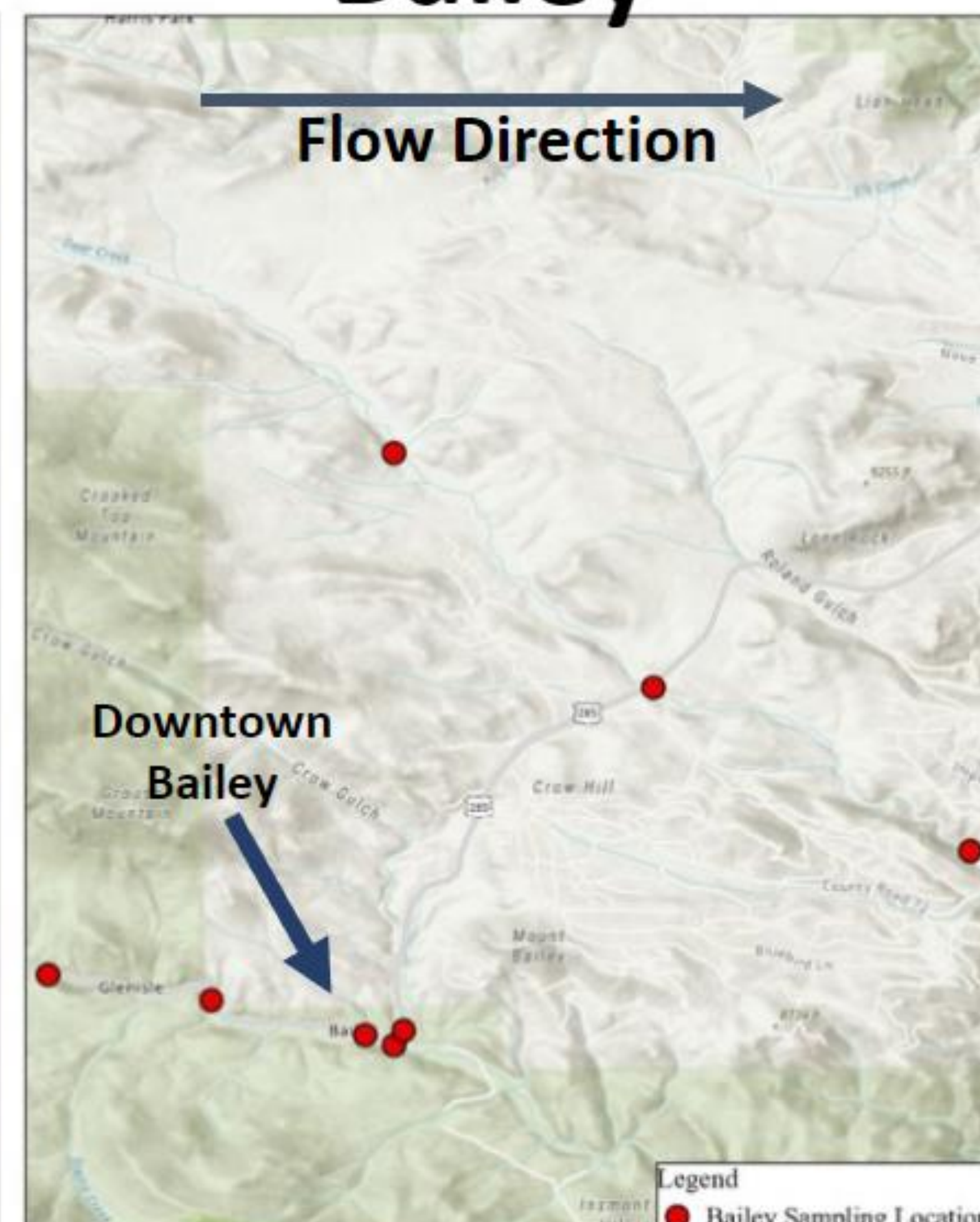
- 11 well water samples collected
- 5 soil samples collected
- 8 surface water samples collected
 - 3 from Indian Hills
 - 8 from Bailey
- All soil samples have been extracted and are ready for LCMS
- Water samples still need SPE processing for LCMS analysis

Surface Water Sampling

Indian Hills



Bailey



Conclusions/Next Steps

- Complete SPE/LCMS on all samples already collected
- Plan sampling events for:
 - Indian Hills, CO
 - Nederland, CO
 - Gunnison, CO

References/Acknowledgements

(1) Glüge et al. An Overview of the Uses of Per- and Polyfluoroalkyl Substances (PFAS). *Environ. Sci. Process. Impacts* **2020**, *22* (12), 2345–2373. <https://doi.org/10.1039/D0EM00291G>.
 (2) Abunada et al. An Overview of Per- and Polyfluoroalkyl Substances (PFAS) in the Environment: Source, Fate, Risk and Regulations. *Water* **2020**, *12* (12), 3590. <https://doi.org/10.3390/w12123590>.
 (3) Garg et al. A Review on the Sources, Occurrence and Health Risks of per-/Poly-Fluoroalkyl Substances (PFAS) Arising from the Manufacture and Disposal of Electric and Electronic Products. *J. Water Process Eng.* **2020**, *38*, 101683. <https://doi.org/10.1016/j.jwpe.2020.101683>.
 (4) Harris et al. Targeted and Suspect Screening of Per- and Polyfluoroalkyl Substances in Cosmetics and Personal Care Products. *Environ. Sci. Technol.* **2022**, *56* (20), 14594–14604. <https://doi.org/10.1021/acs.est.2c02660>.
 (5) Adegoke et al. Septic Systems. In *Water and Sanitation for the 21st Century: Health and Microbiological Aspects of Excreta and Wastewater Management (Global Water Pathogen Project)*; Michigan State University, 2019. <https://doi.org/10.14321/waterpathogens.59>.
 (6) Schaidter et al. Septic Systems as Sources of Organic Wastewater Compounds in Domestic Drinking Water Wells in a Shallow Sand and Gravel Aquifer. *Sci. Total Environ.* **2016**, *547*, 470–481.

This work was funded by the Colorado Department of Public Health and Environment