



U.S. DEPARTMENT OF  
**ENERGY**

Legacy  
Management

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Grand Junction, Colorado

## 2018 Long-Term Stewardship Conference

# Surface Water-Groundwater Interactions as a Critical Component of Uranium Plume Persistence

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Session 2.1 – Groundwater Compliance Challenge

# Key Contributors

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Navarro, Inc.

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Dr. Roelof Versteeg  
Subsurface Insights, LLC



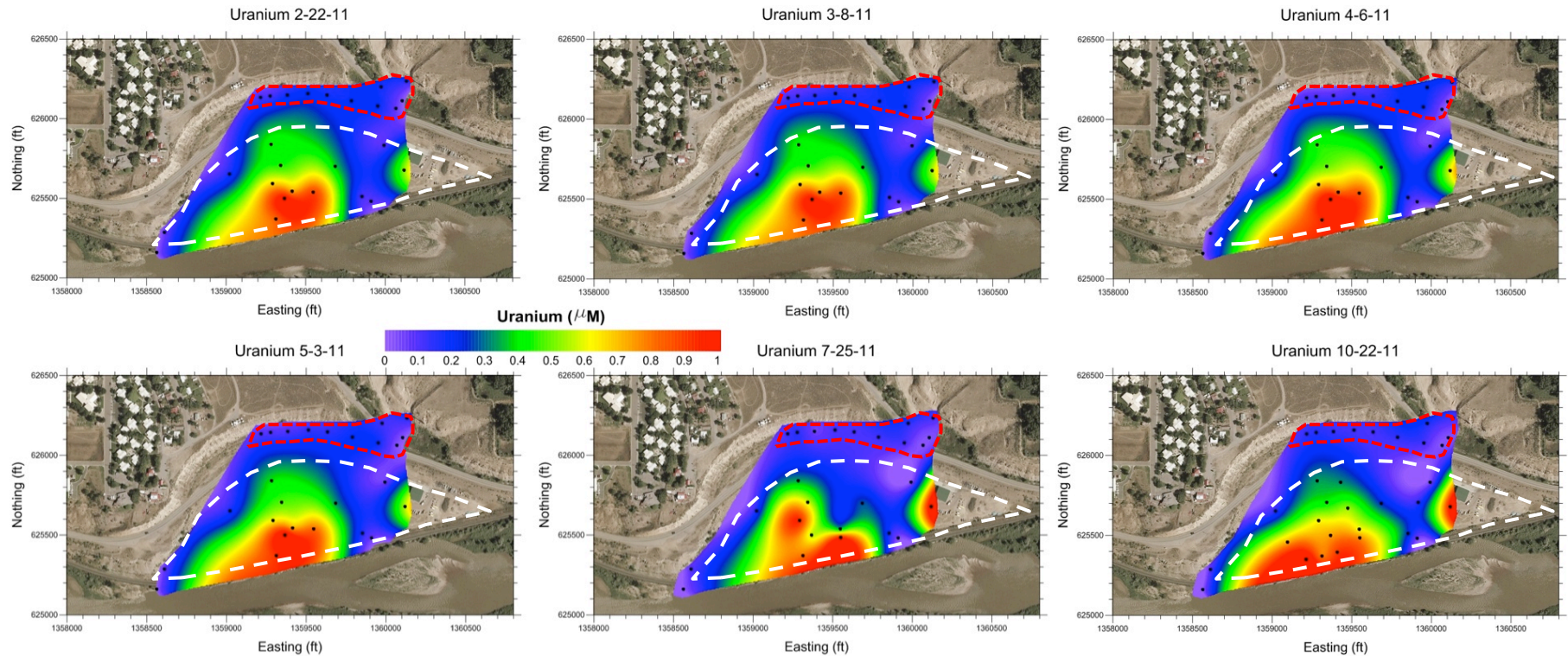
"How does a mill site's history relate to surface water-groundwater interactions? Can it contribute to U plume persistence?"



Courtesy: Alan Yoder; Story City, IA



# Mill legacy and residual U contamination



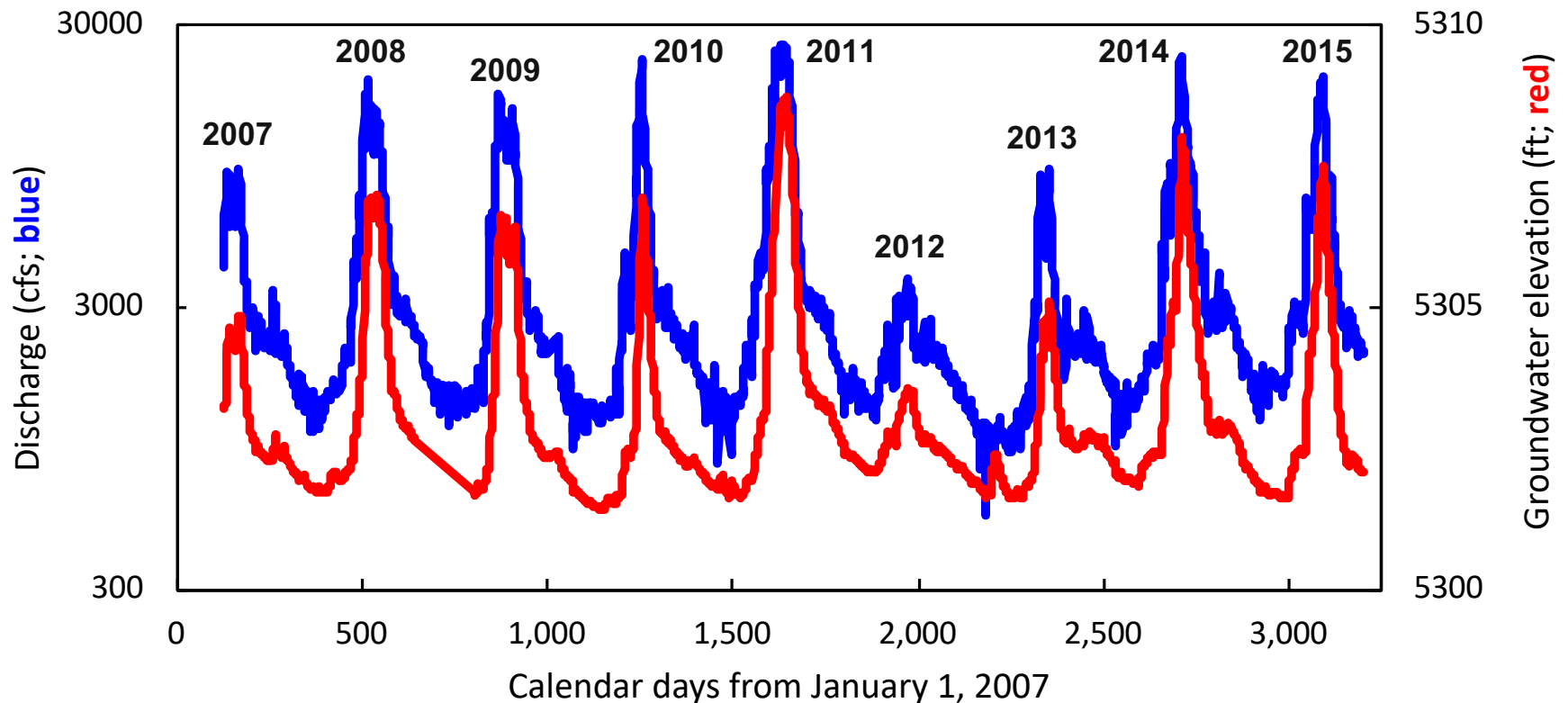
- 8-month snapshot (2011) emblematic of past 20 years → *largely persistent plume*
- Do certain components of the system have outsized impact on U persistence?



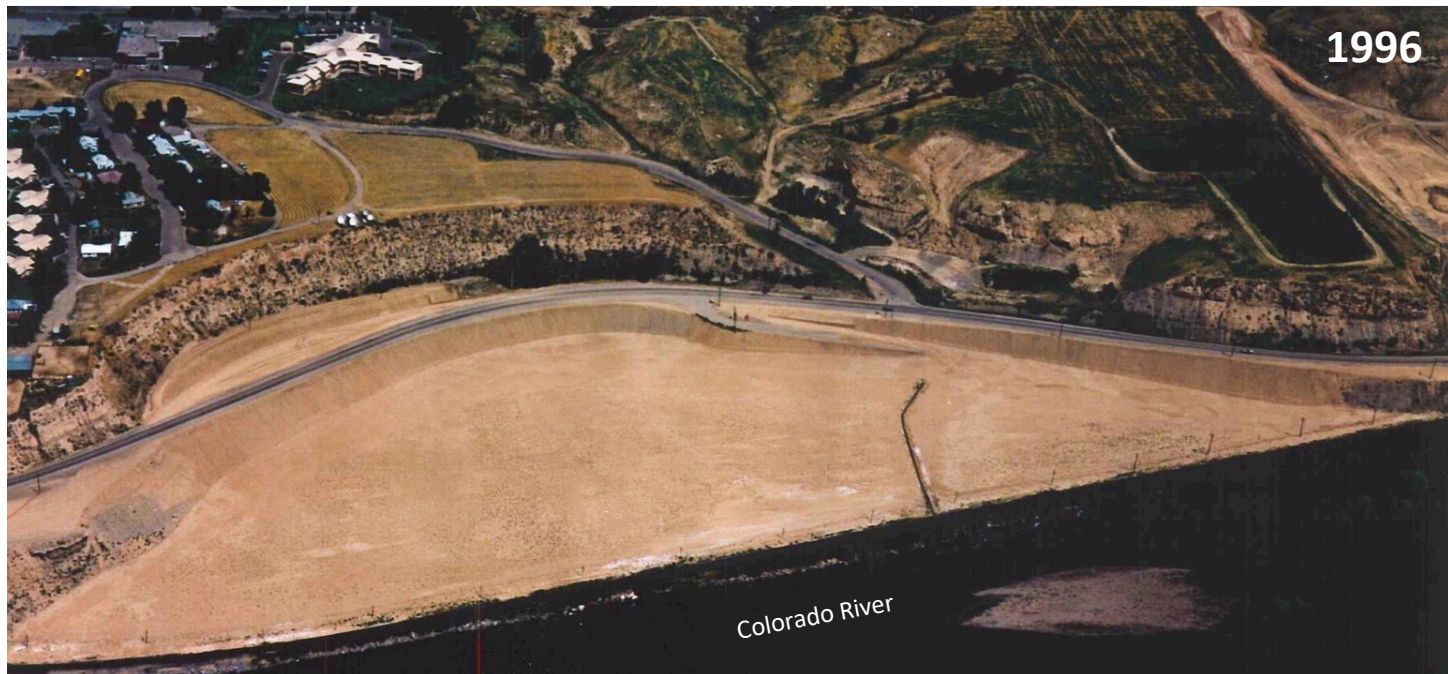
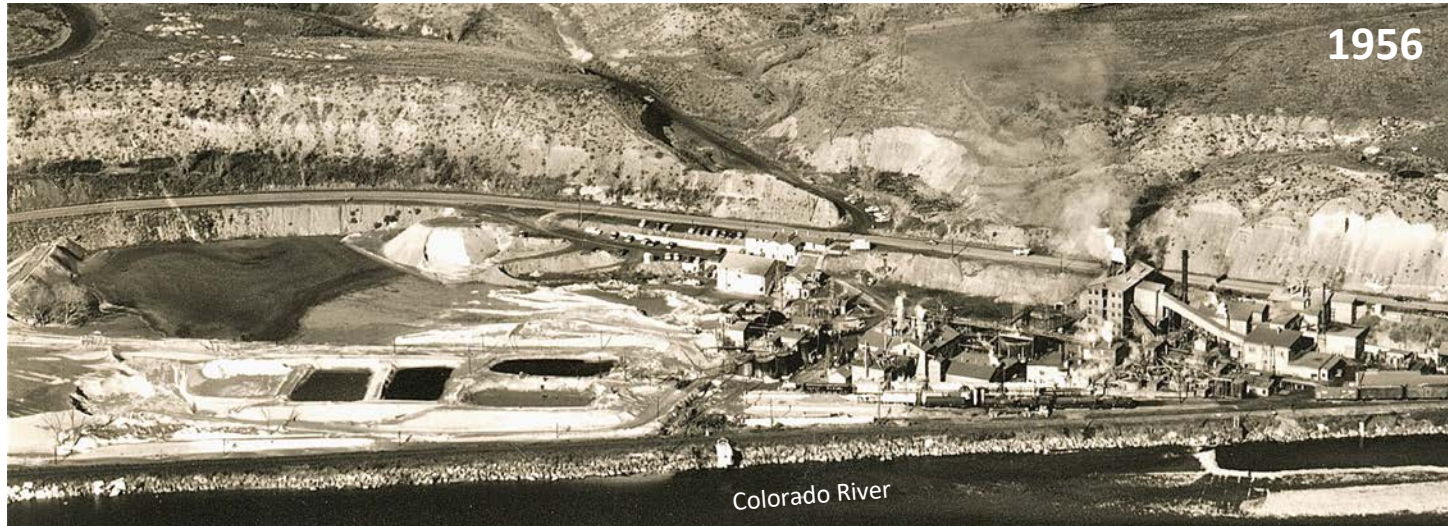
# Surface Water-Groundwater Interactions

"A key component?"

CO River Discharge vs. GW Elevation

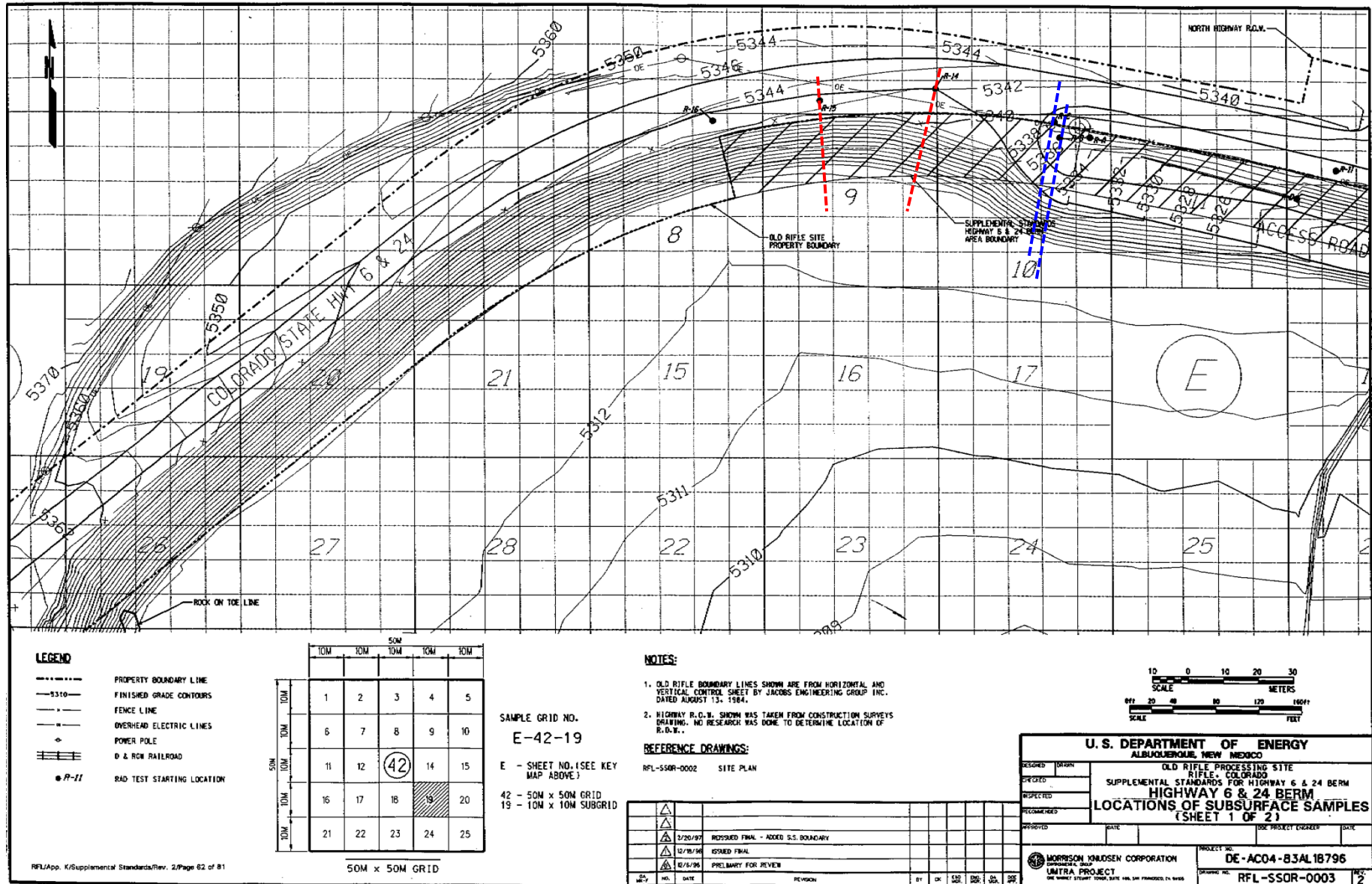


# Reclamation: Supplemental Standards





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# Reclamation: Supplemental Standards

This Supplemental Standards Application pertains to the mill tailings contamination contained in the road berm at the north side of the Old Rifle Processing site. Supplemental Standards Drawings RFL-SSOR-0002 through RFL-SSOR-0008, located at the back of this application, depict the assessed deposits of tailings in the areas for which Supplemental Standards are being considered. Remediation of the tailings deposits adjacent to the road berm was performed to the maximum extent possible. The excavation was stopped as close to the edge of the road as possible without endangering workers by de-stabilizing the slope.

## B.2.1 Location Description

The Supplemental Standards Application is within Garfield County, Colorado. A portion of the State Highway 6 and 24 berm is located within the Old Rifle processing site boundary. The berm is adjacent and parallel to the site's north boundary. The site's north boundary is also the limit of the Highway 6 and 24 right-of-way (Figure RFL-SSOR-0009). A portion of the berm, about 1600 ft long, contains contaminated material buried under clean fill, which is the area proposed for application of supplemental standards.



Application for  
Supplemental Standards  
Old Rifle Site Steep Slopes  
Along State Highway 6 / 24

30  
METERS  
1600'  
FEET  
ENERGY  
SITE  
HIGHWAY 6 & 24 BERM  
FACE SAMPLES  
(SHEET 1 OF 2)

21	22	23	24	25
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50M x 50M GRID

RFL/Apo. K/Supplemental Standards/Rev. 2/2008/2 of 81

2/20/97	REVISED FINAL - ADDED S.S. BOUNDARY	PROPOSED	DATE	DATE	DATE
12/18/96	REVISED FINAL	PROPOSED	DATE	DATE	DATE
12/18/96	PRELIMINARY FOR REVIEW	PROPOSED	DATE	DATE	DATE
NO.	DATE	REVISION	BY	CHK	DATE

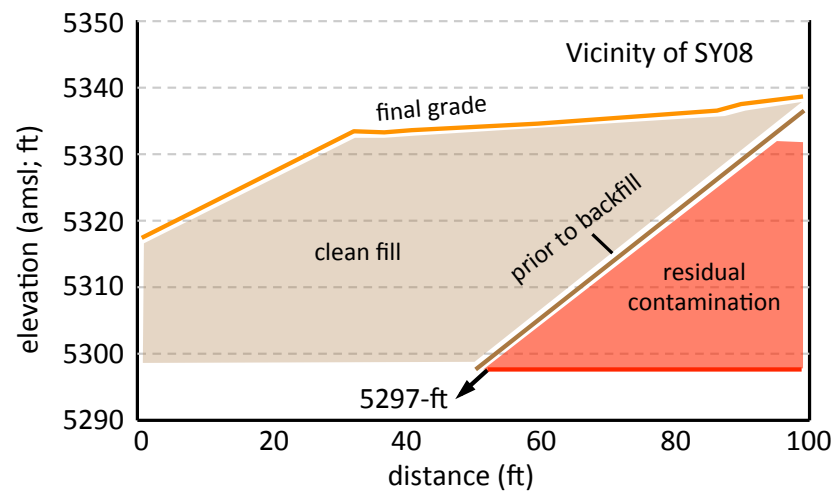
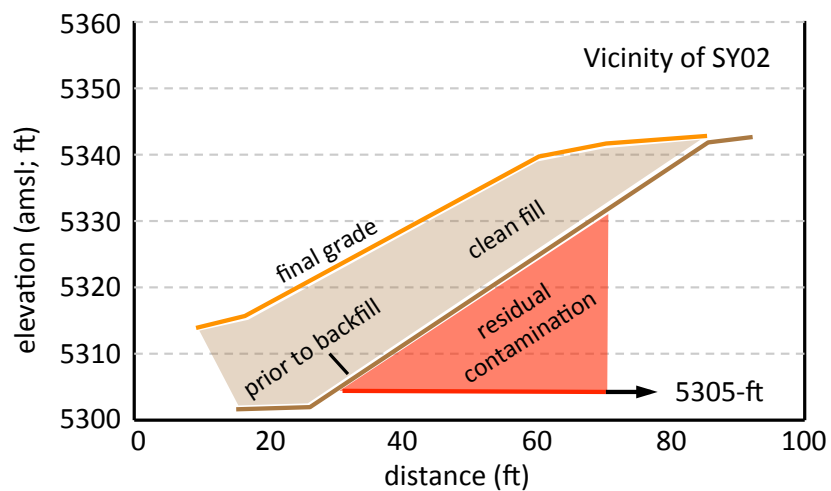
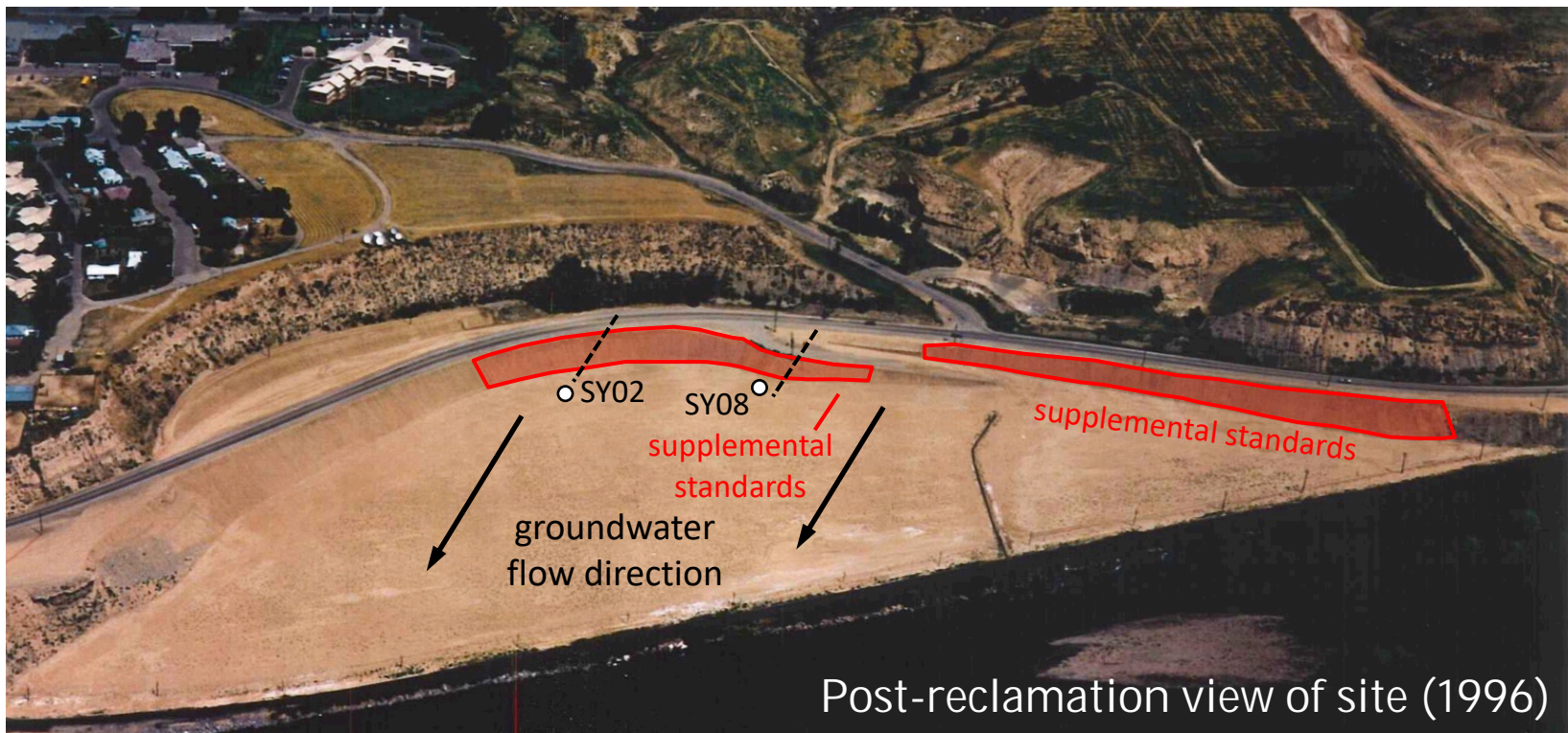
MORRISON KNUDSEN CORPORATION  
ENVIRONMENTAL GROUP  
ULTRA PROJECT  
ONE MARKET STREET, THIRD FLOOR, SAN FRANCISCO, CA 94104

PROJECT NO.  
DE-AC04-83AL18796

DRAWING NO.  
RFL-SSOR-0003

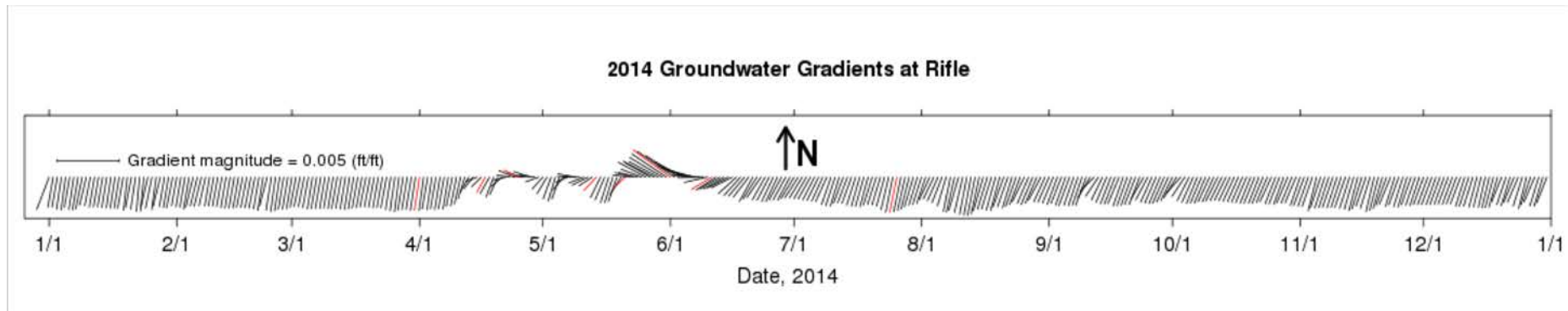
SHEET 2





# Supplemental Standards and GW

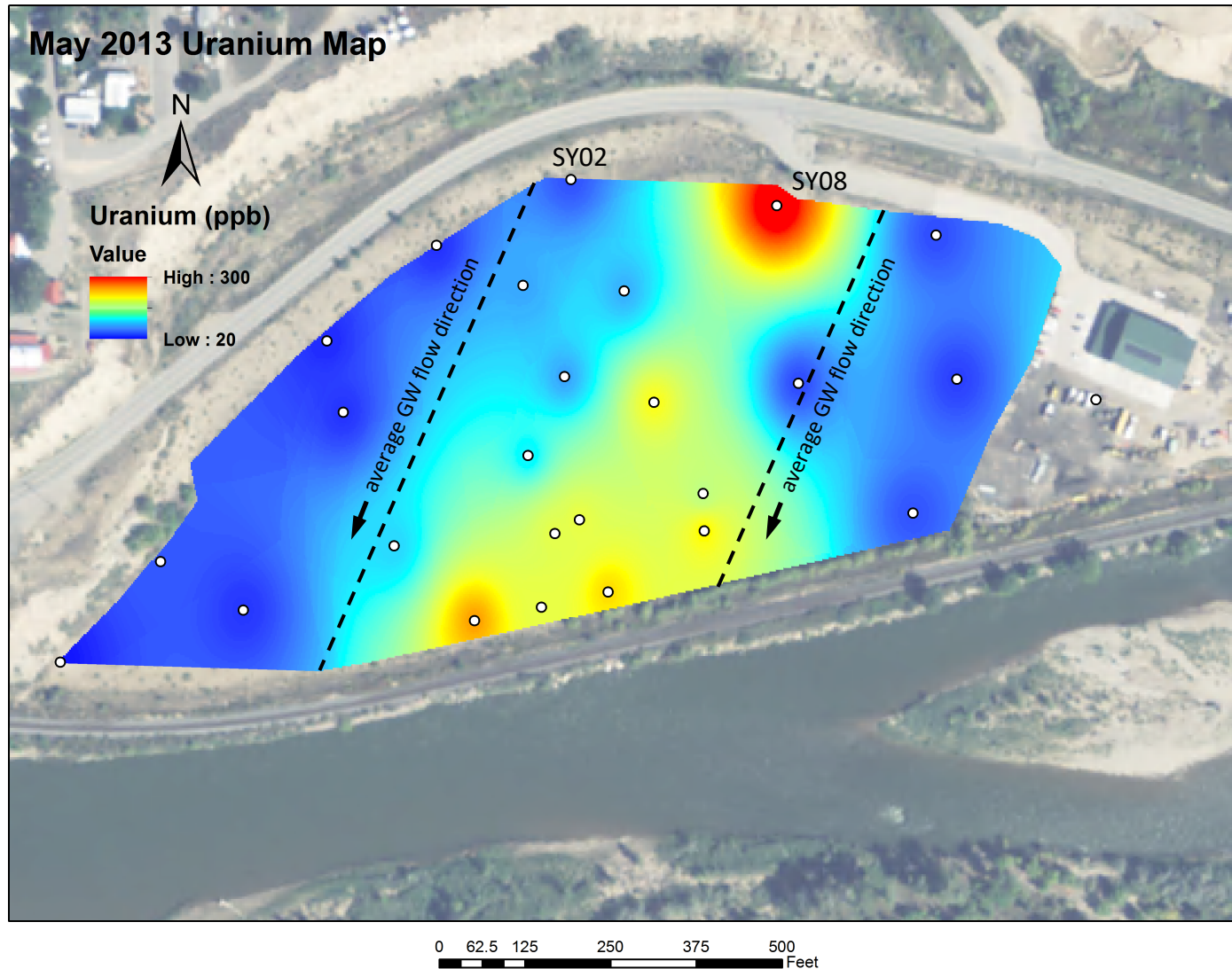
## Site wide groundwater gradient and flow direction [2014]



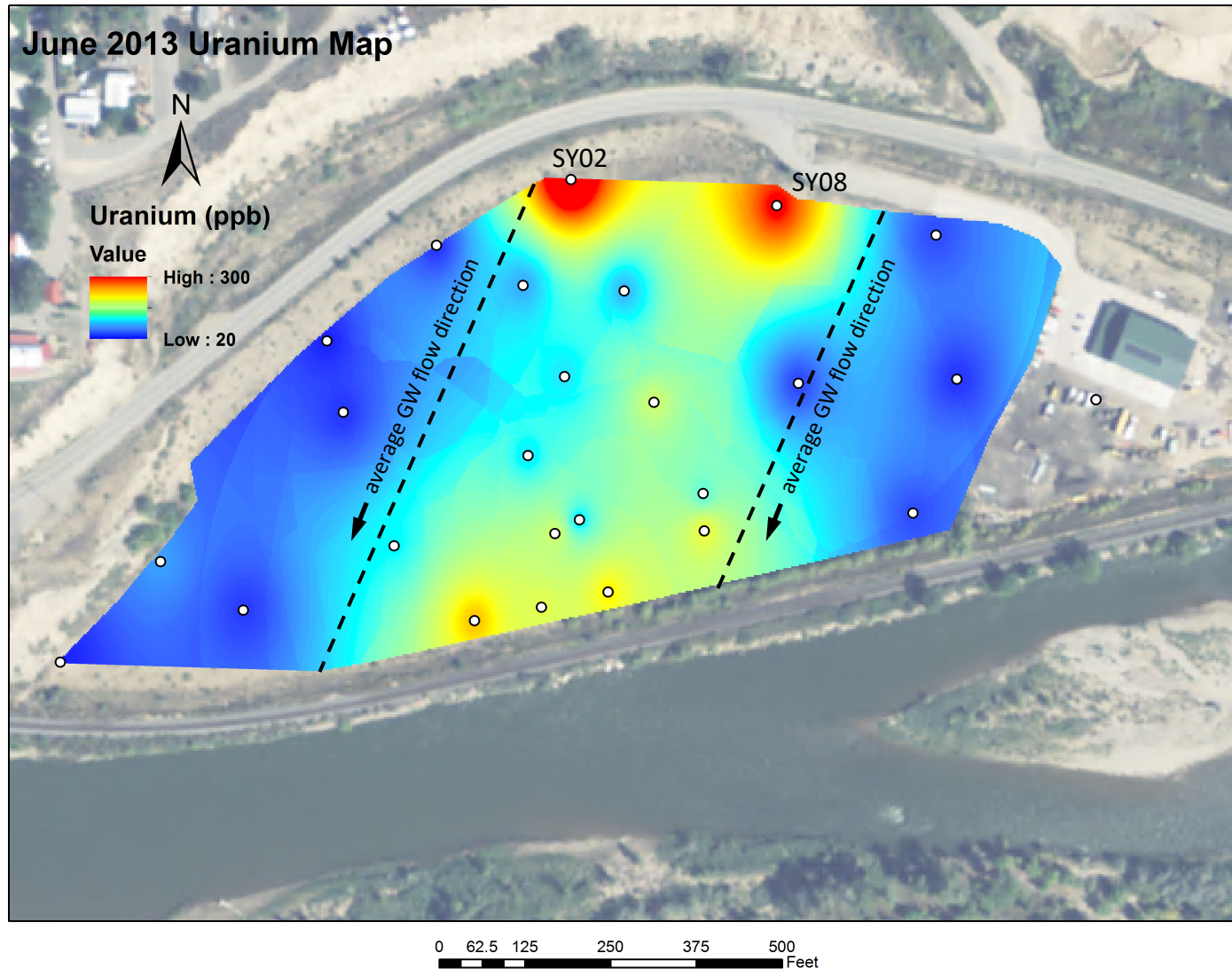
- Average annual flow direction: S-SW or ca. 185-195° azimuthal from north
- Variation in flow direction during hydrograph excursion



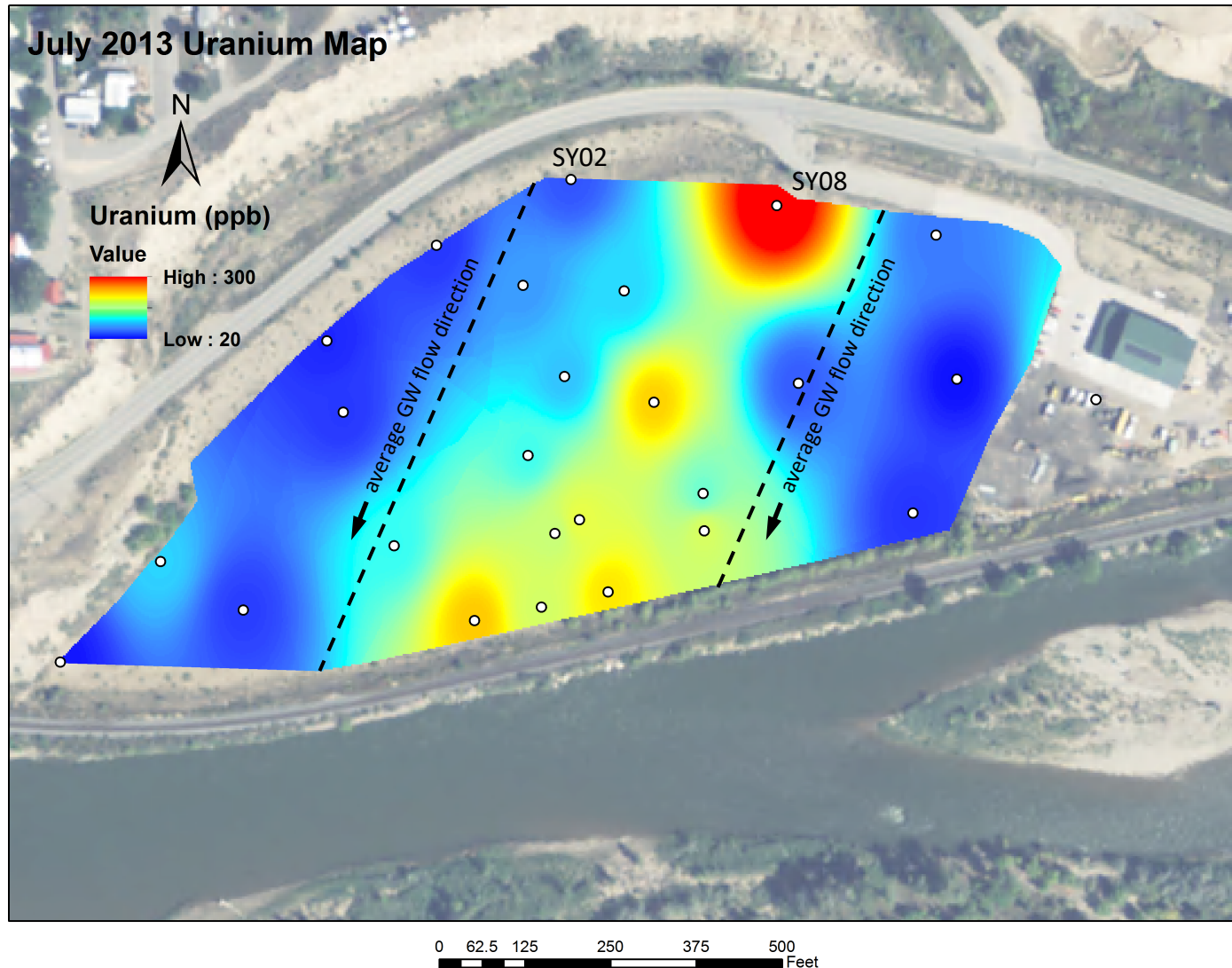
# Supplemental Standards and GW



# Supplemental Standards and GW

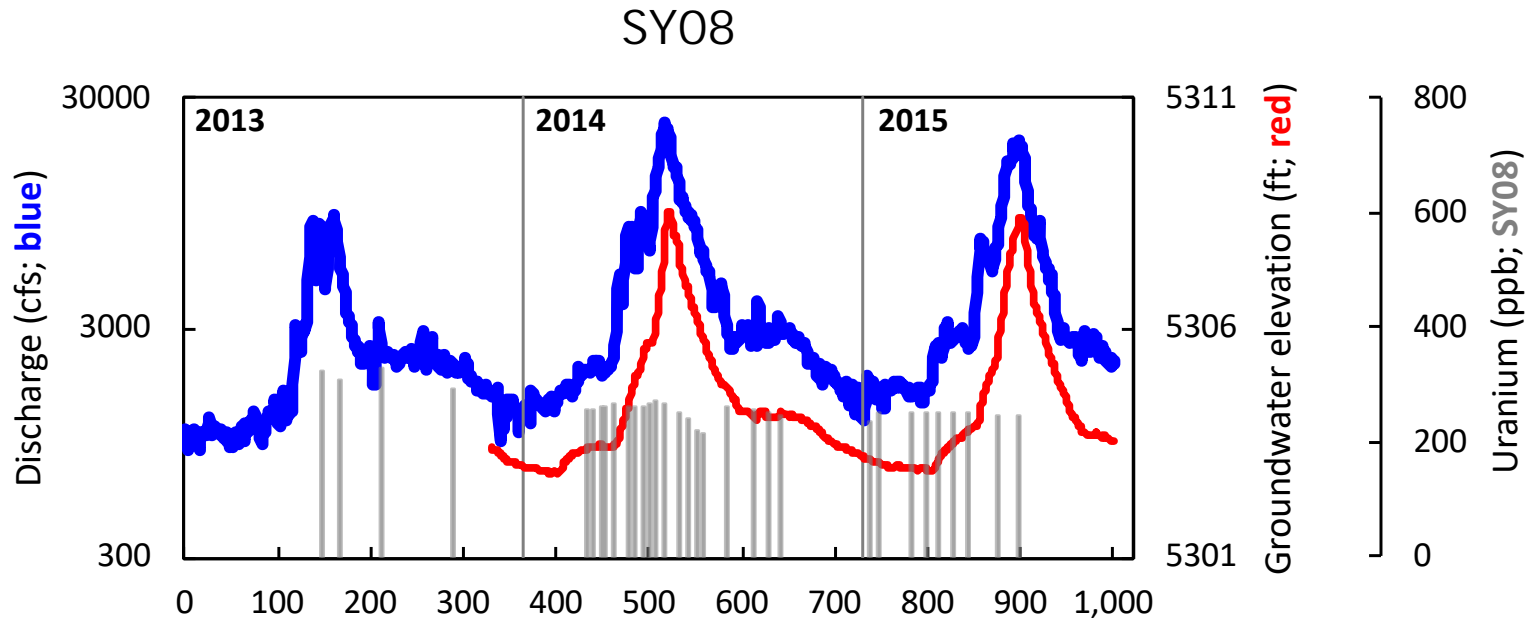


# Supplemental Standards and GW



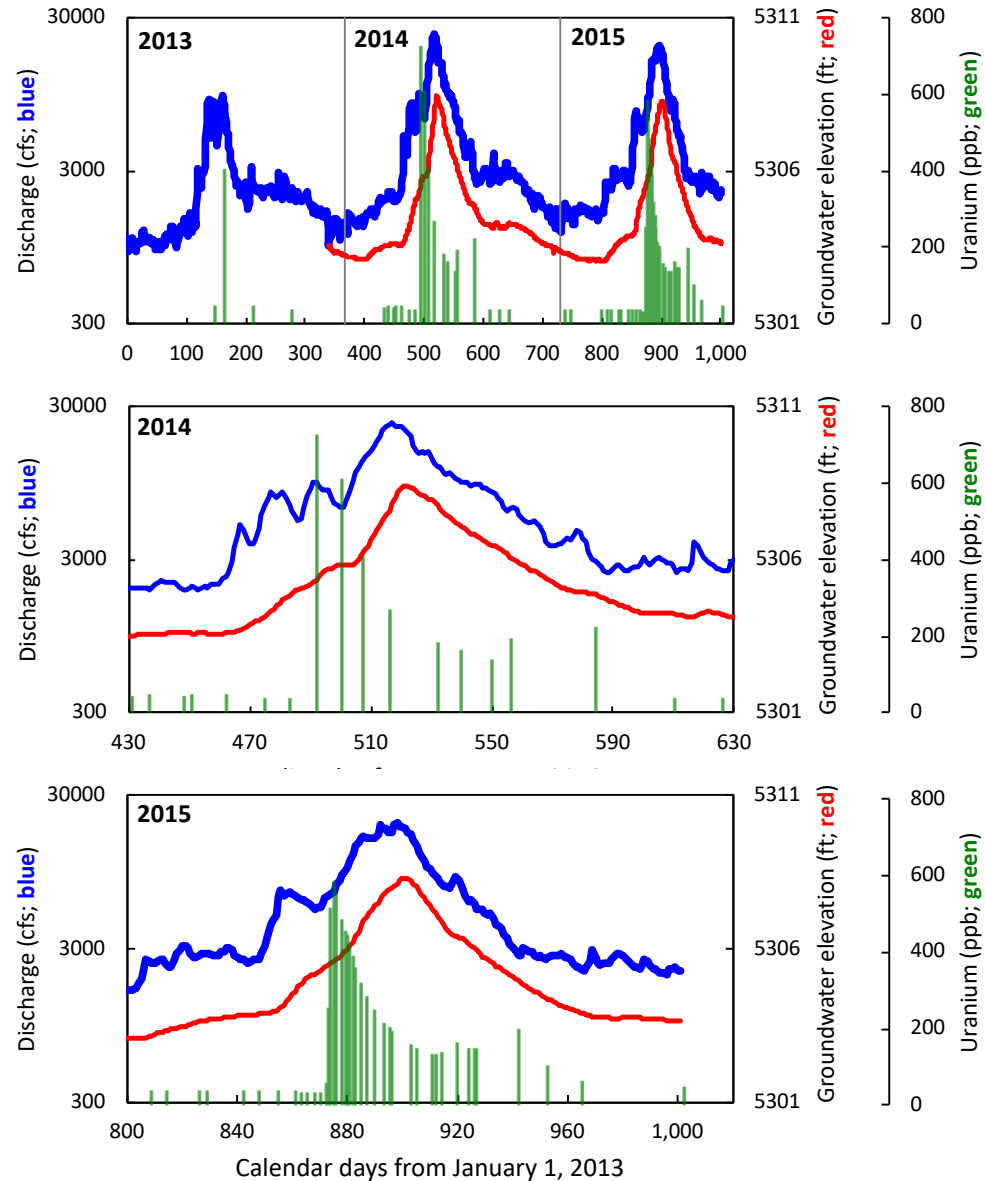


# Surface Water – GW Interactions: SY08 Uranium

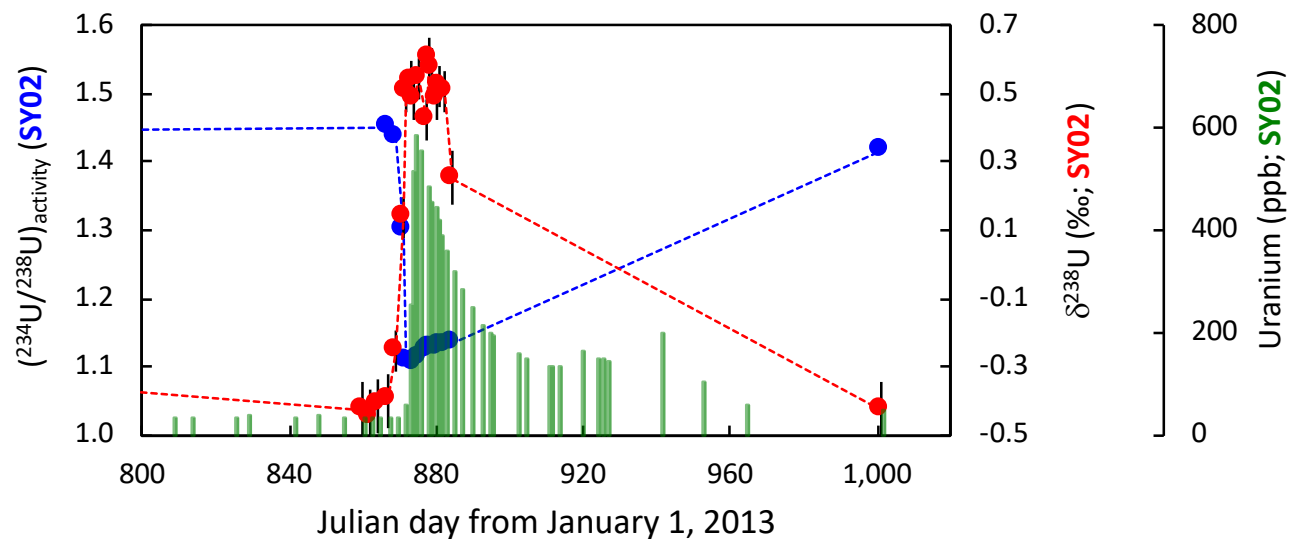
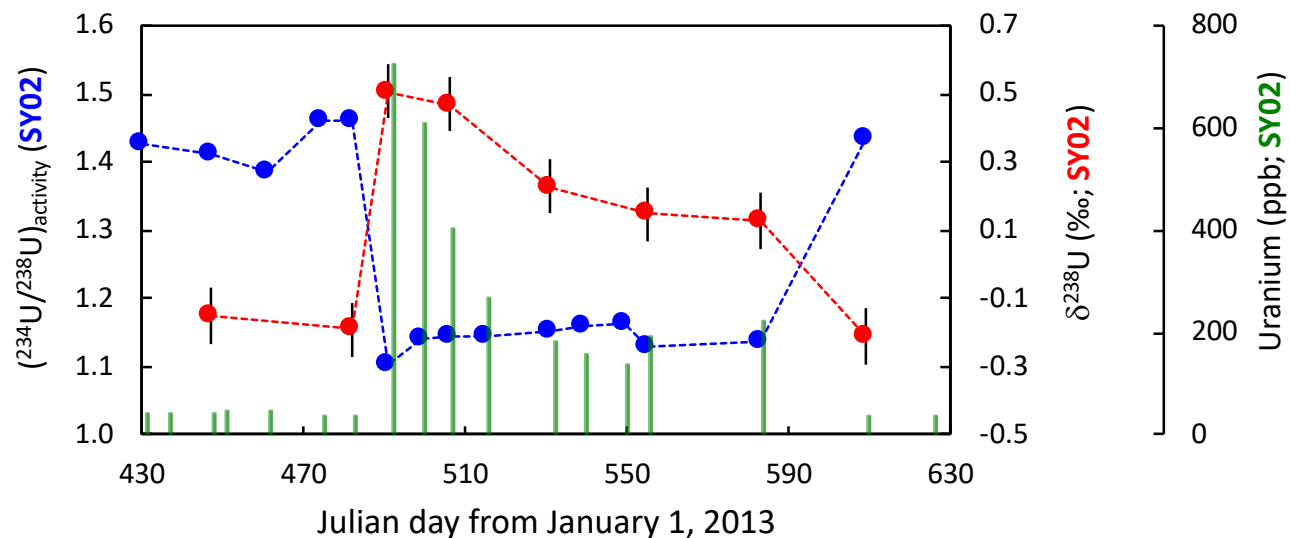


Seasonally stable U concentrations → GW elevations always higher than base of Supplemental Standards @ 5297-ft

# Surface Water – GW Interactions: SY02 Uranium

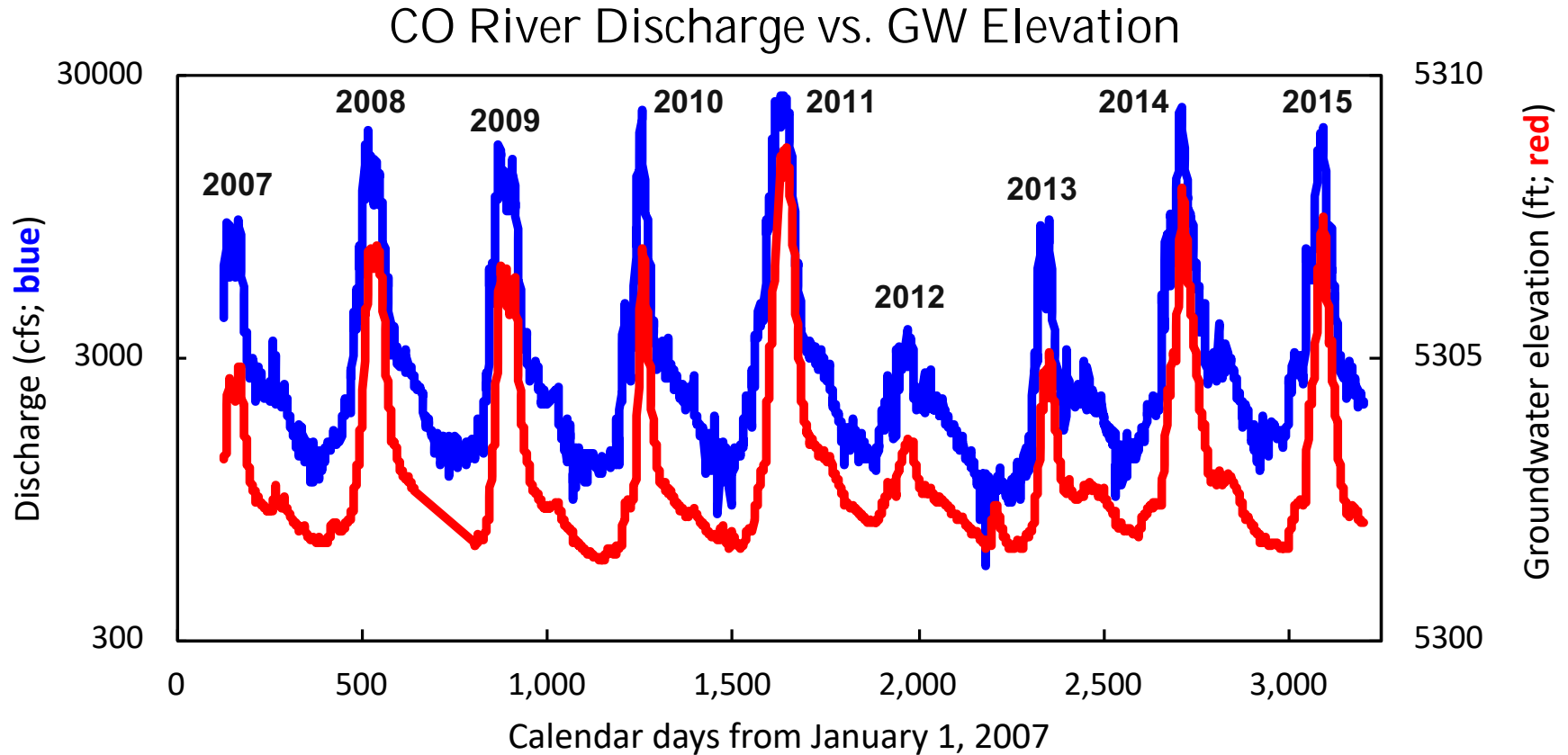


# SY02 Uranium Isotopes vs. Time



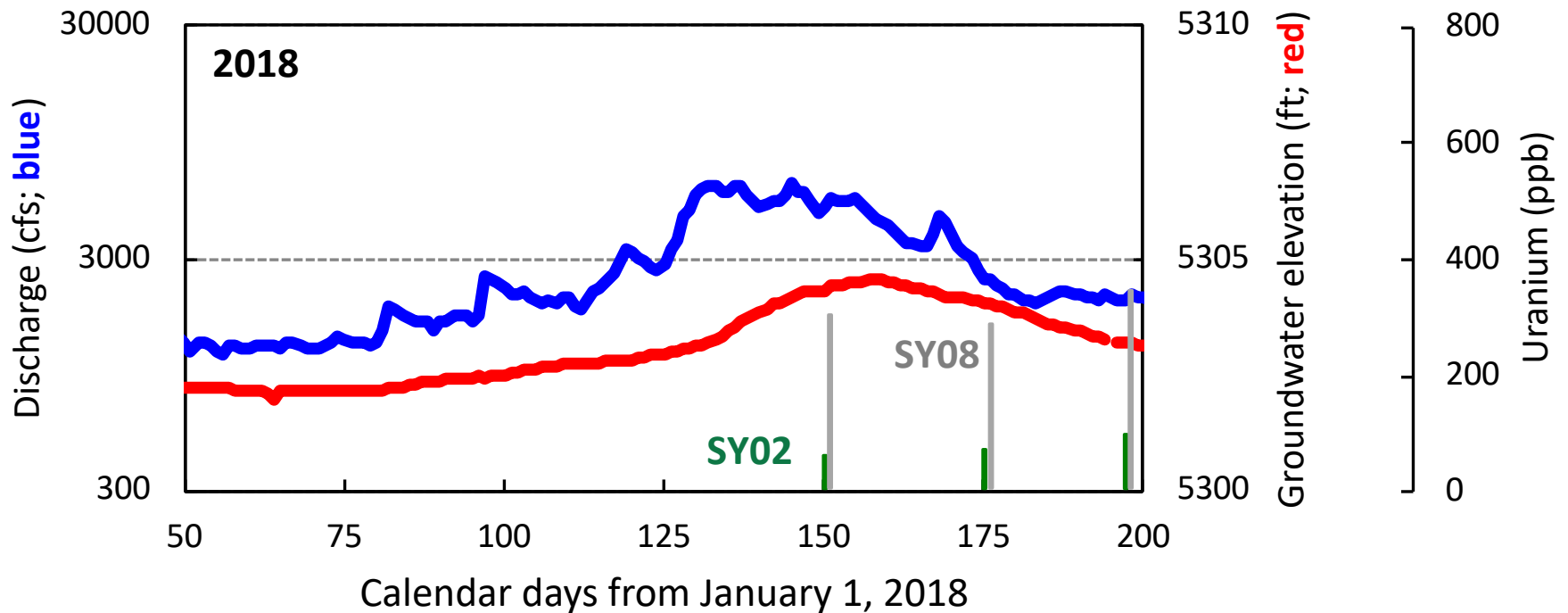


# Surface Water-Groundwater Interactions



From 2007-2015, two drought years where max. GW elevation < 5305-ft

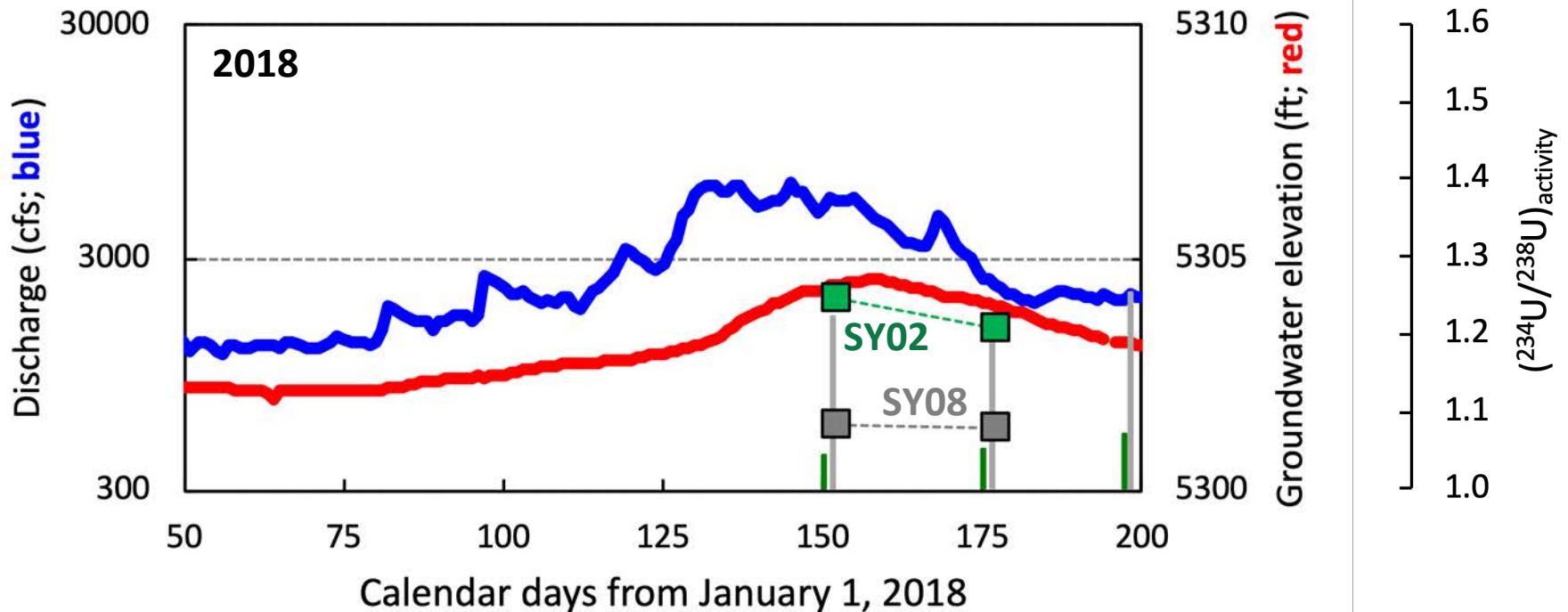
# Drought & Low Flow Year: 2018



- Minimal contact with supplemental standards at SY02 (<5305-ft)
  - Persistent contact with standards at SY08 (>5297-ft)

# Drought & Low Flow Year: 2018

## Uranium Activity Ratios



- SY02 UAR ~1.25 – 1.3 vs. ~1.1-1.15 previous years during peak [U]
  - SY08 UAR ~1.1 which is seasonally & annually stable



# Putting things in a wider DOE-LM/-EM context:

“Is Old Rifle an anomaly?”



Courtesy: Carson Coates



Courtesy: Russ McCallister





Putting things in a wider  
DOE-LM/-EM context:

“Is Old Rifle an anomaly?”

Thank you.  
Questions or comments?

