Moab UMTRA Project Field Investigations Status Update

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Groundwater Manager
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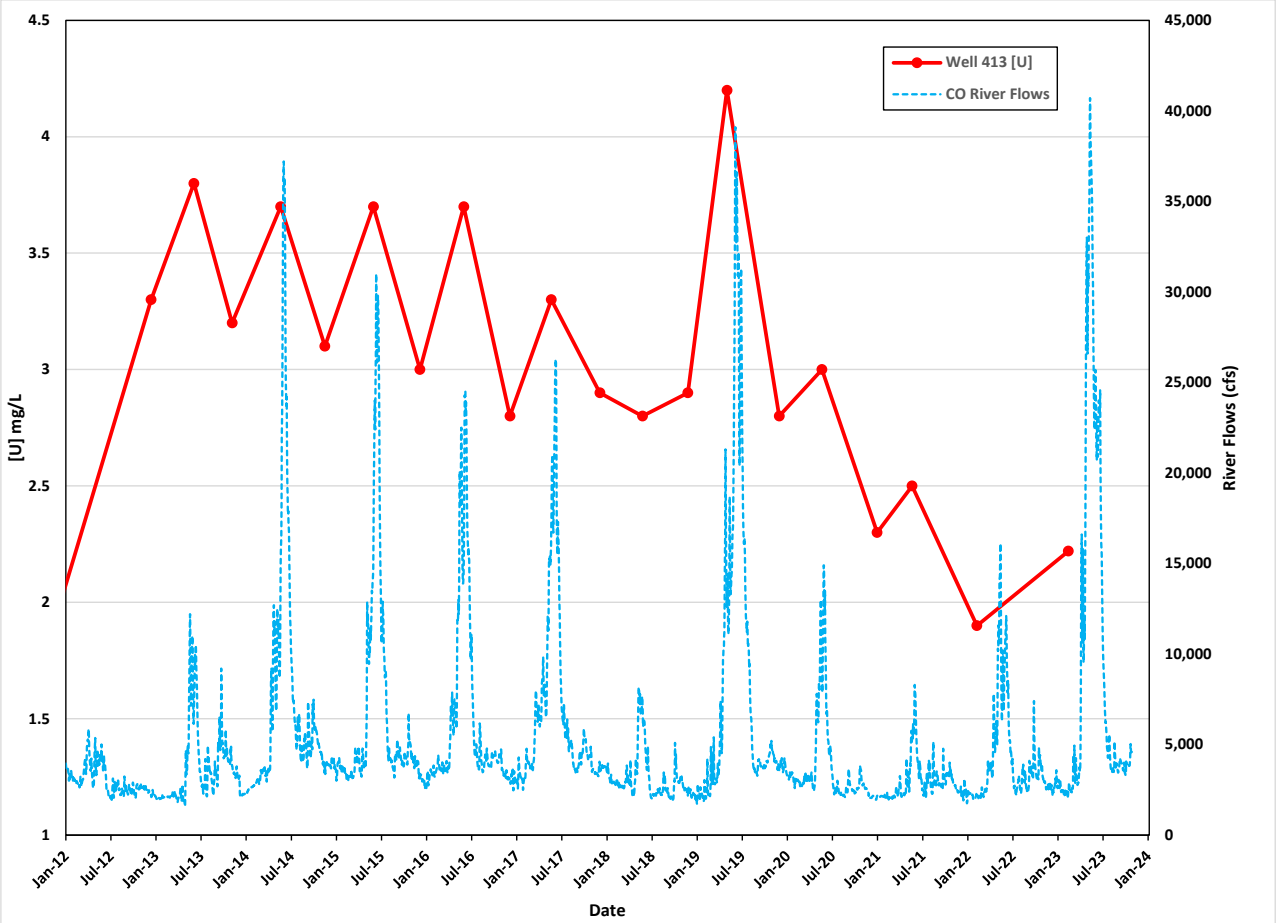
MOAB UMTRA PROJECT CRESCENT JUNCTION

Upcoming Investigations

- Based on NNLEMS meetings Sept – Dec 2022
- All identified to address data gaps for a defensible GCAP
  - Hydroxyapatite: Ken Williams, LBNL
  - Secondary Source: Keaton Belli and Jennifer Nyman, Geosyntec
  - Soil Gas: Brian Looney, SRNL
  - Electrical Resistivity Tomography (ERT): Tim Johnson, PNNL
  - Streambed Sampling Investigation: Fred Day-Lewis, PNNL

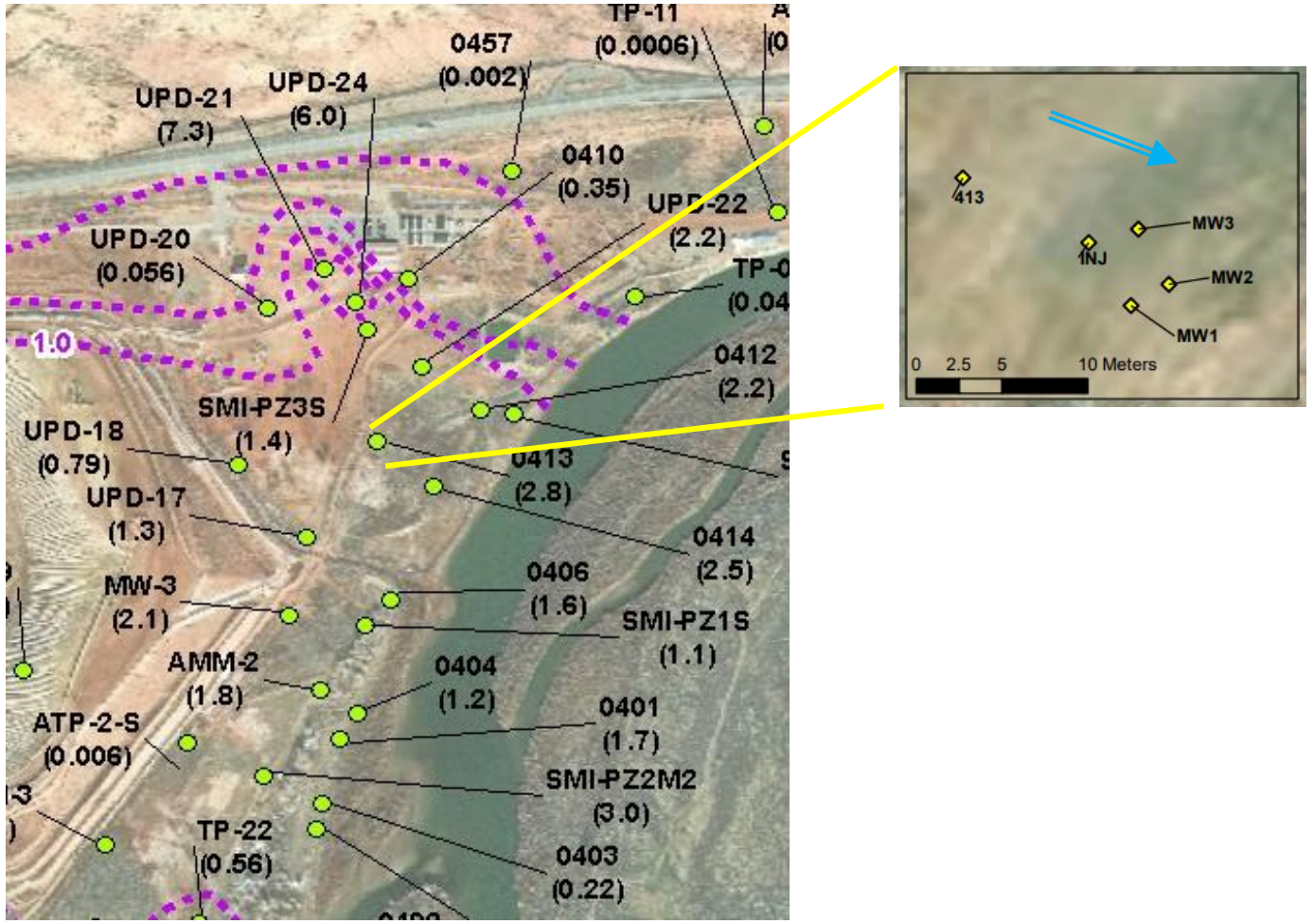
Hydroxyapatite Investigation

- Proof of principal developed based on Old Rifle Investigation (2017)
- Initiated work in Nov 2021
  - Well 413
  - NE U Plume
  - Outside of active remediation

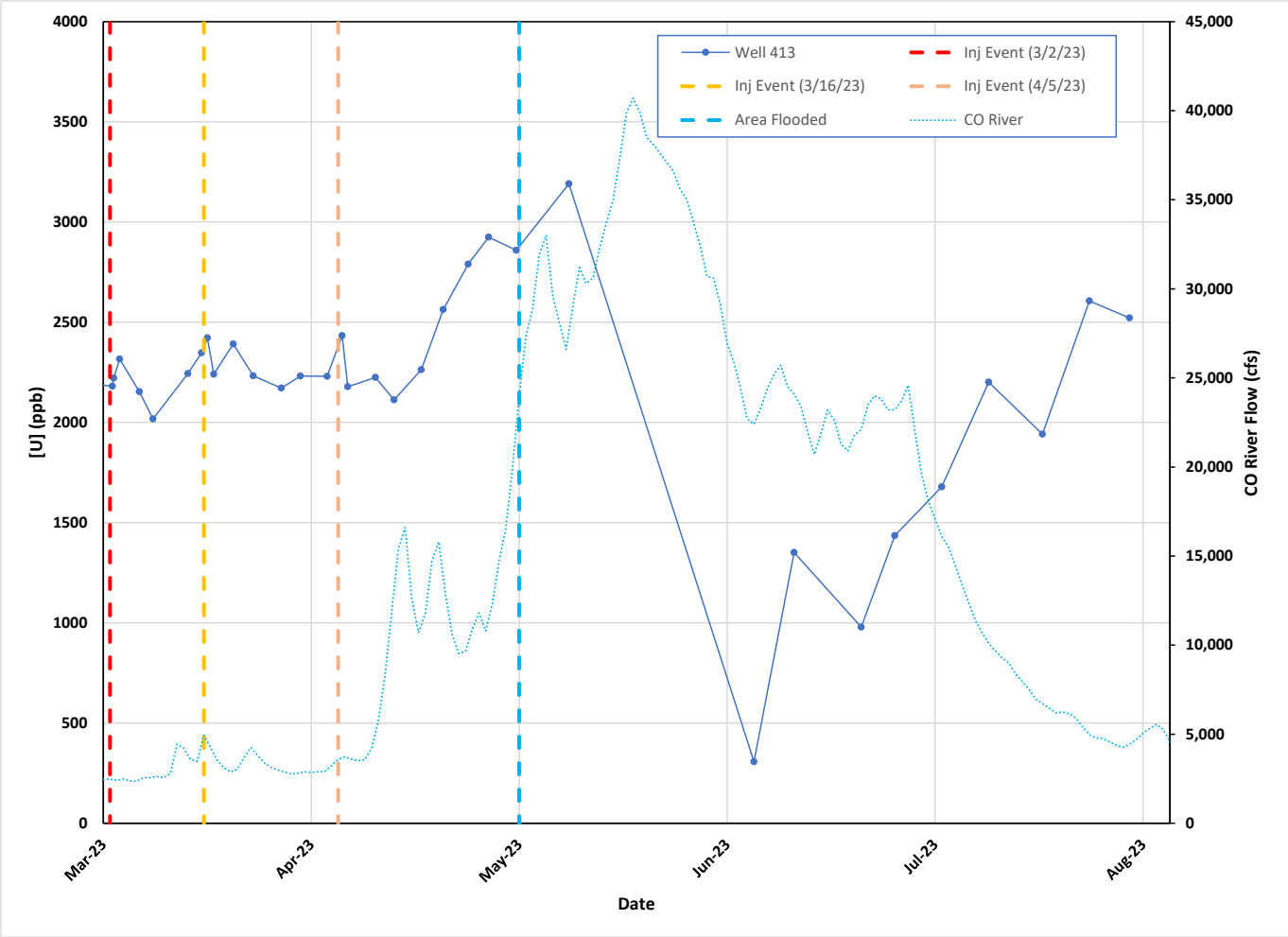


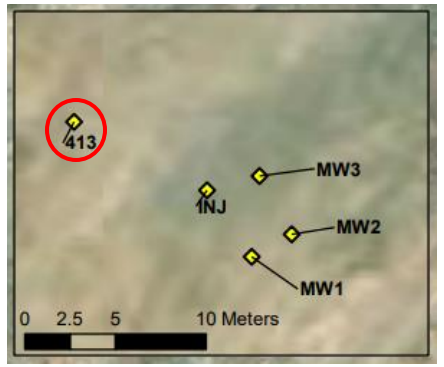
Hydroxyapatite Investigation

- Initiated work in Nov 2021
  - Tracer Tests (Br, 2 tests)
  - NMR Monitoring (14 events)
    - Dave Walsh (Vista Clara Presentation on Tuesday)
  - Chemical Injection (3 events)
  - Results



Hydroxyapatite Investigation Results





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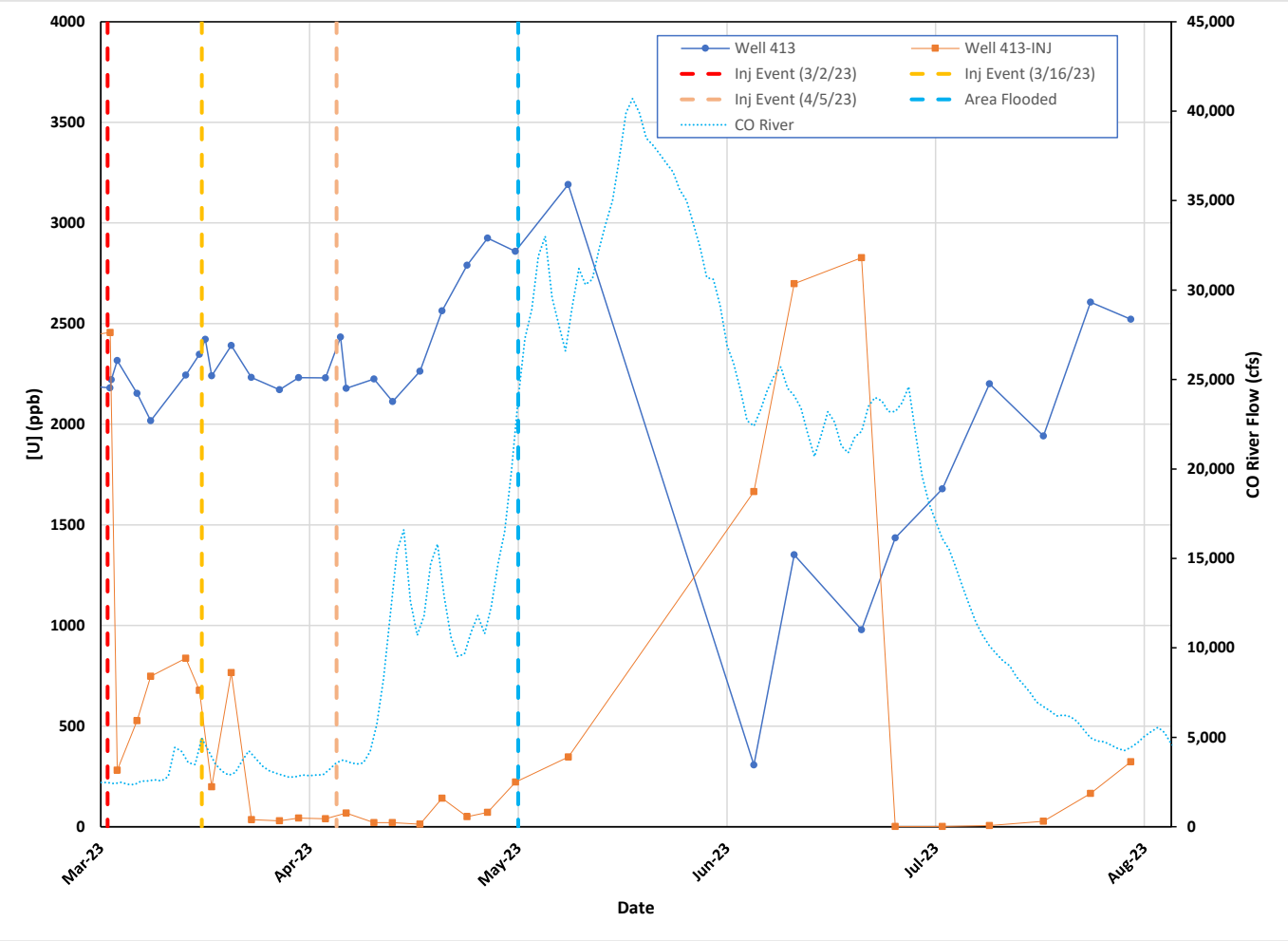

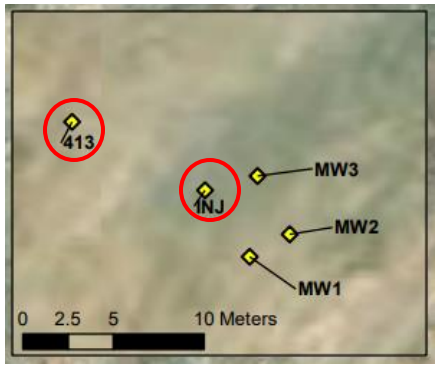

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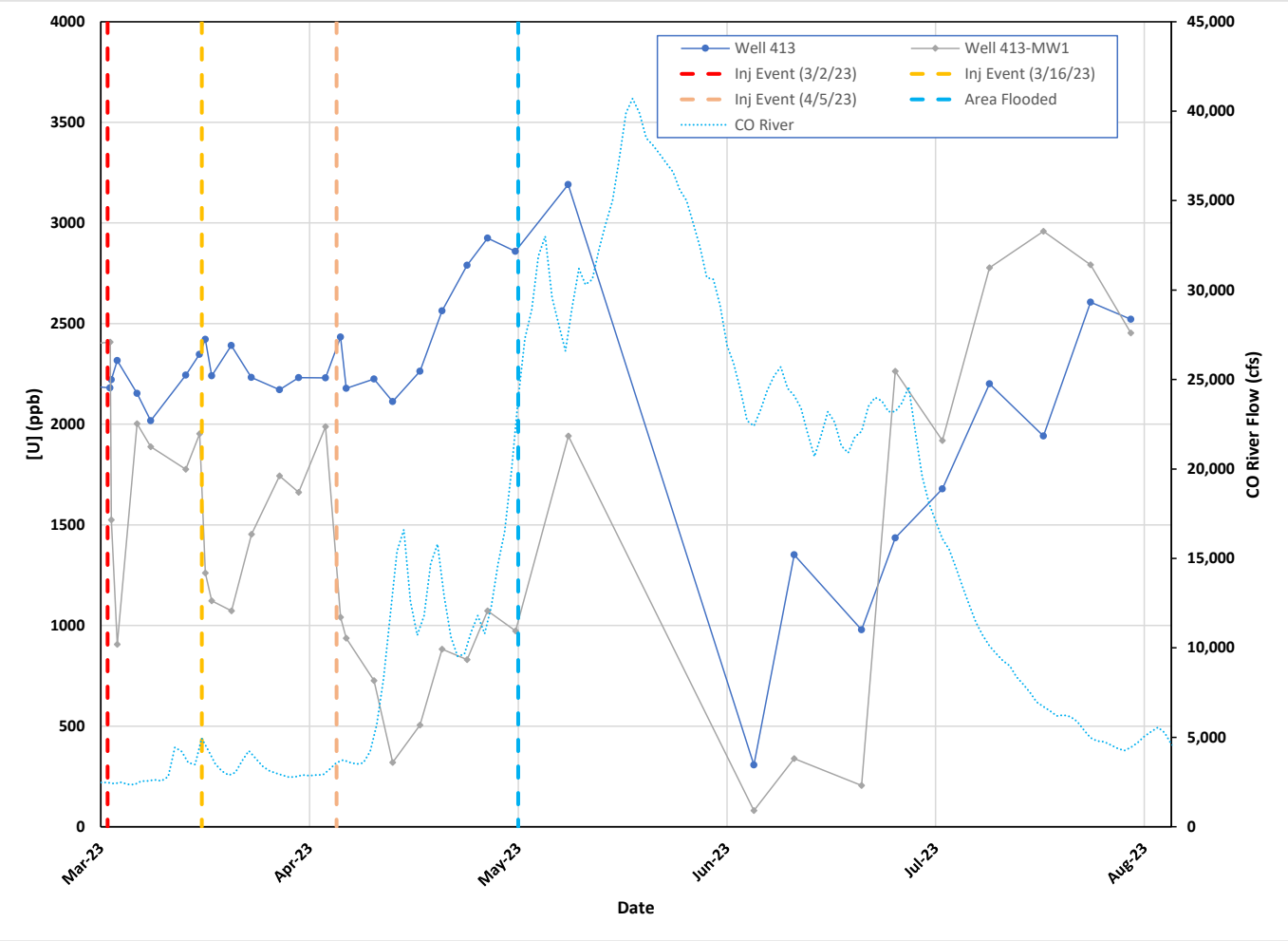

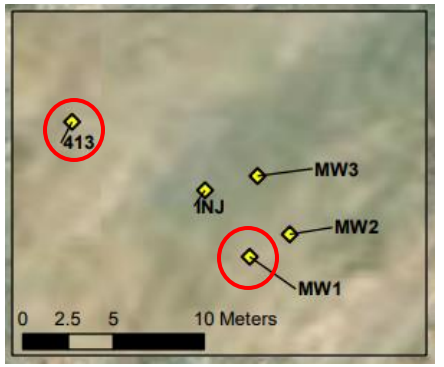

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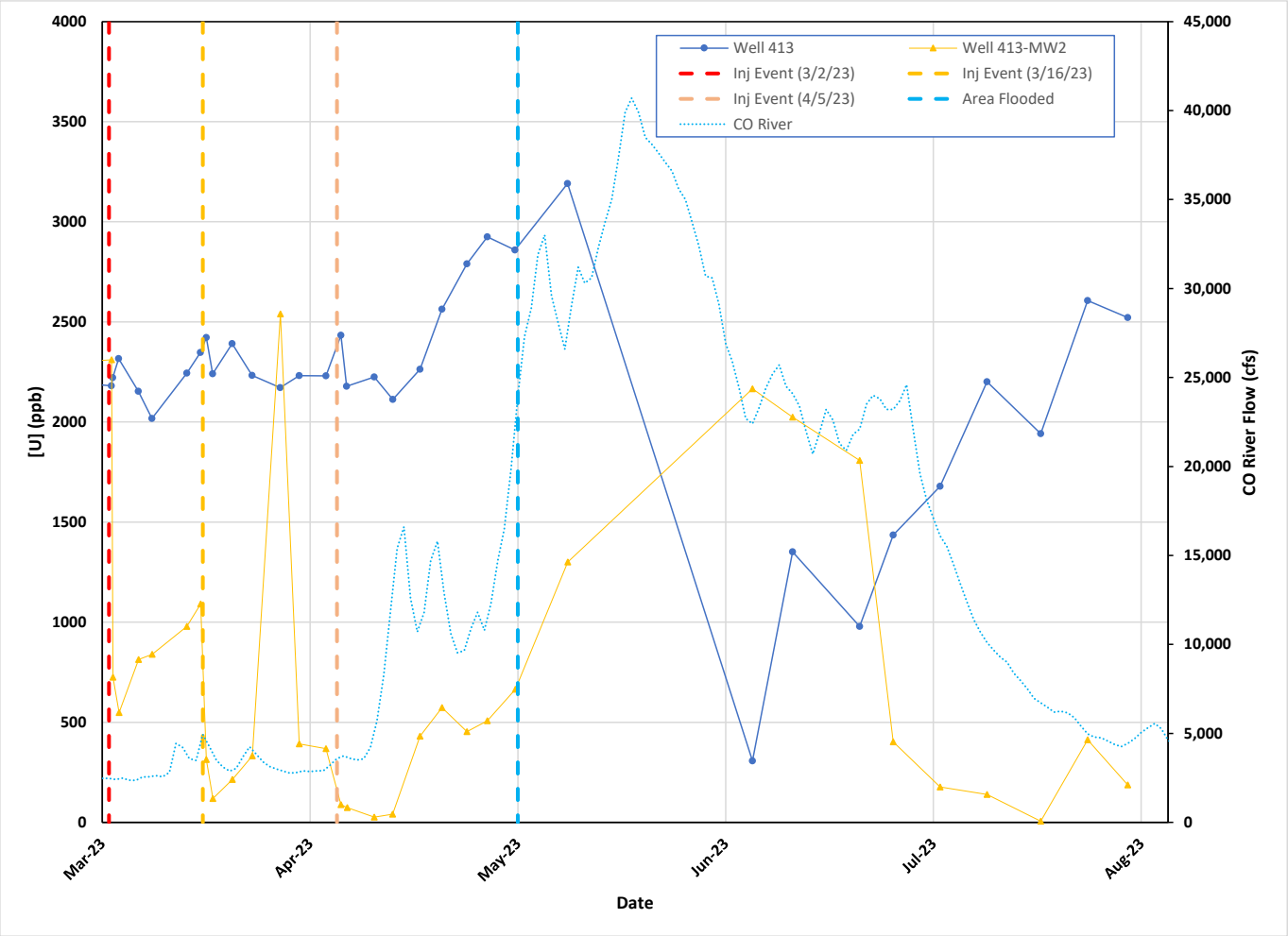

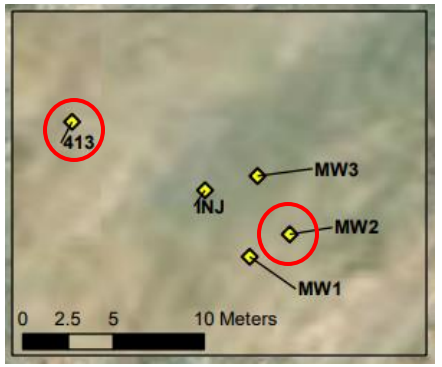

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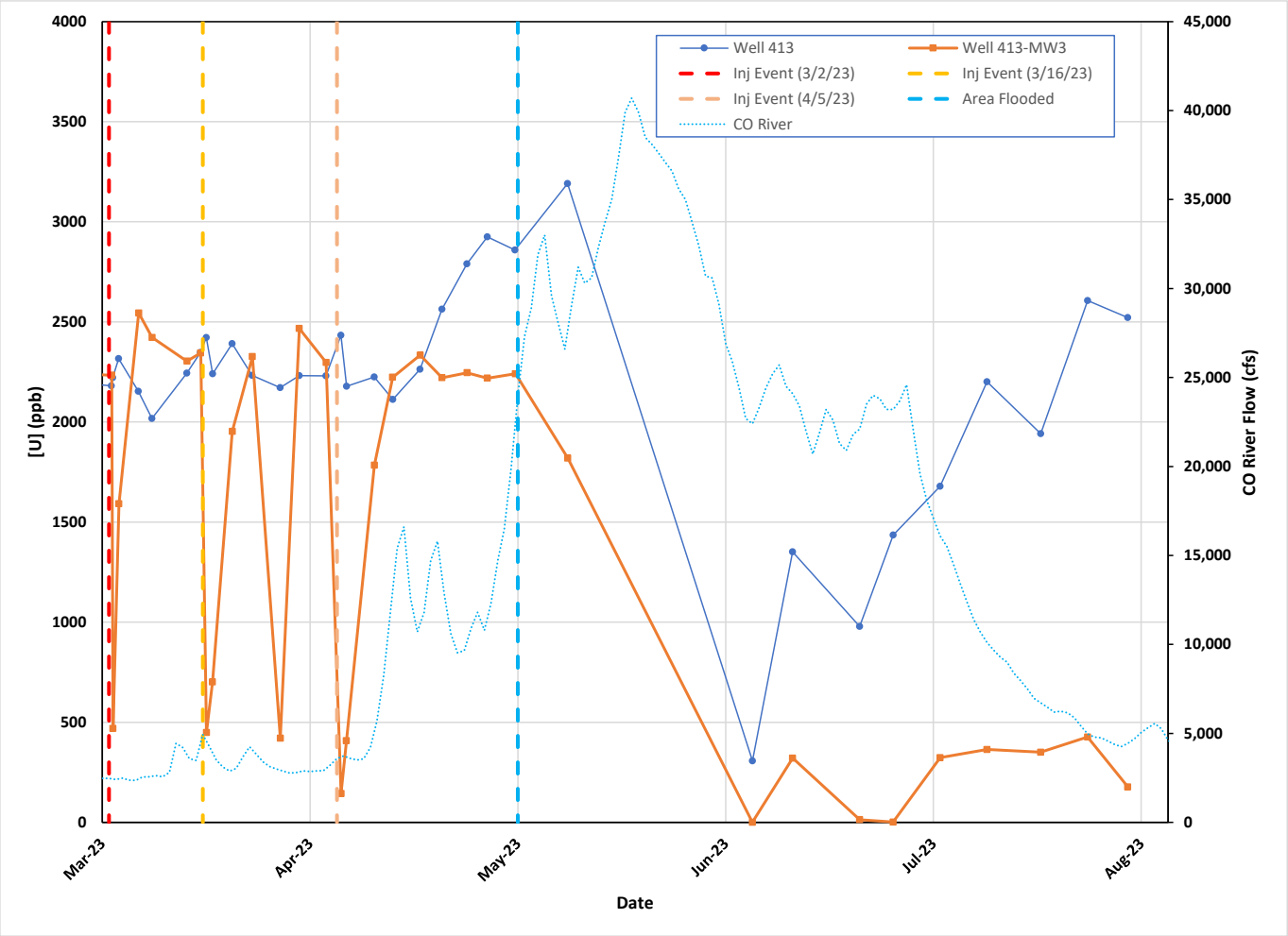
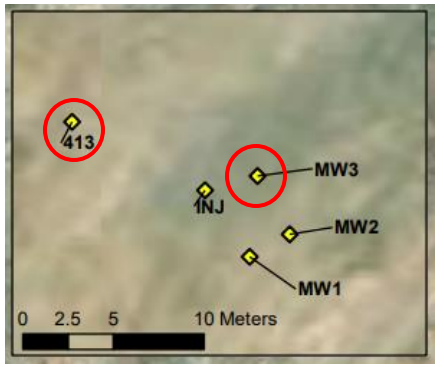


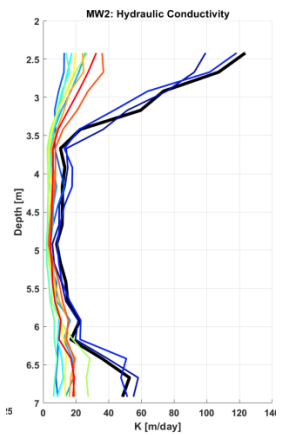


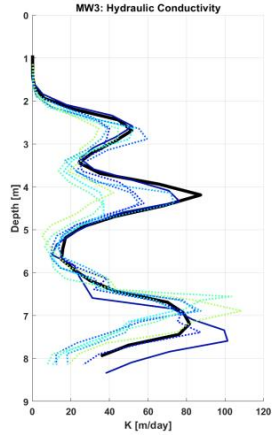
Hydroxyapatite Investigation - Continuation

- Two Proposals Submitted to Continue
  - Hydroxyapatite Extension
    - Impacts of flooding event
    - Ammonia removal through struvite precipitation
  - Geochemical Tracers
    - Groundwater age dating
    - Recharge sources
  - Funding

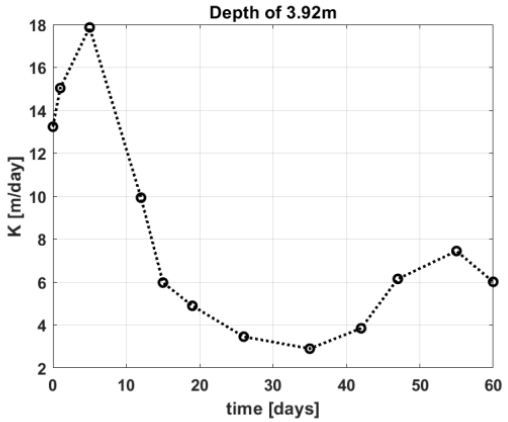
NMR Results

- Completed on 2 of 3 MWs
  - MW2 K response (3.9 m)
    - Decrease in free water content in response to precipitation in pores
    - Decrease in K detected
  - MW3 K response (3.6 m)
    - Some change in K between 4 and 5 m bgs

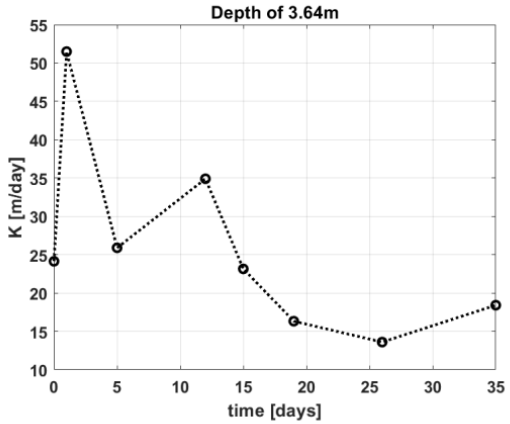




MW2



MW3



Secondary Source Investigation

- Based on recommendation from 2021 Moab Groundwater Summit for GCAP Preparation
  - Batch pore flushing and batch pore flushing model refinements
    - Column studies and batch reactor tests
  - Numerical modeling
    - Remedial time frame prediction under various groundwater remedies
  - Field investigation completed in October 2023

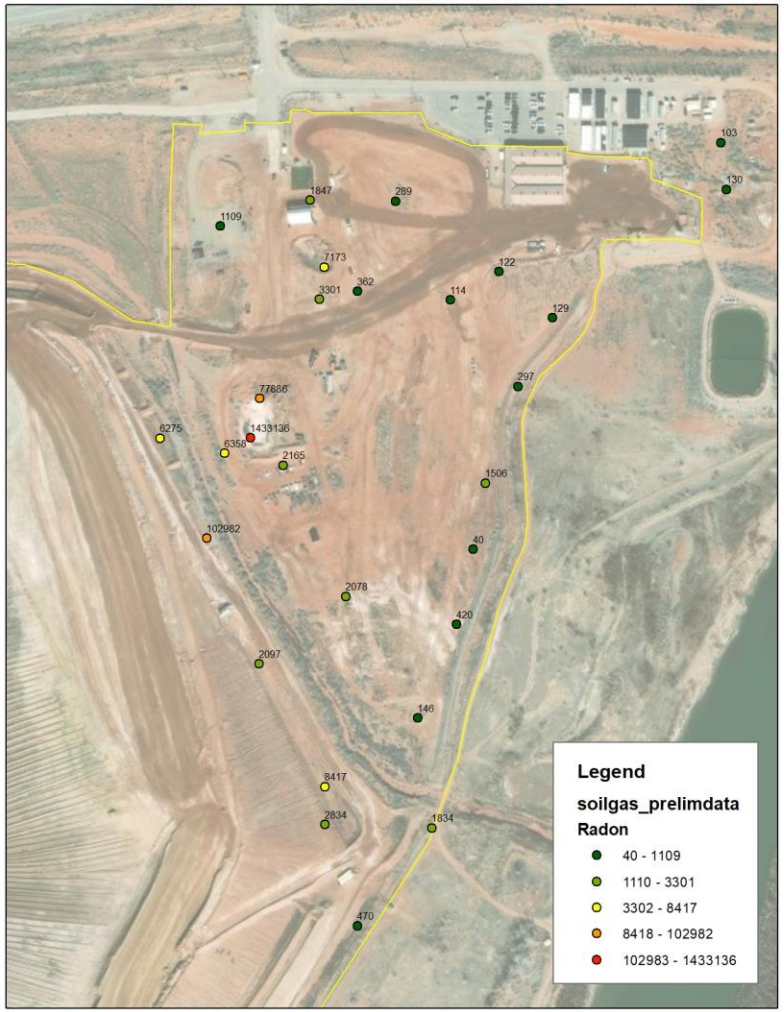
Secondary Source Investigation

- Preliminary data currently received from lab
- Keaton Belli, Jennifer Nyman, and Lisa Burgess (Geosyntec)

Sample ID	Collect Date/Time	Matrix	Result	Unit
Nitrogen, Ammonia				
BH-01-20231002	10/02/23 15:00	GROUND WATER	0.665	MG/L
UPD-18-20231003	10/03/23 10:30	GROUND WATER	192	MG/L
MW-3-20231003	10/03/23 12:35	GROUND WATER	320	MG/L
BH-05-20230927	09/27/23 14:10	GROUND WATER	235	MG/L
BH-04-20230928	09/28/23 10:15	GROUND WATER	116	MG/L
BH-05-2-3FT	09/27/23 08:15	SOIL	32.7	MG/KG
BH-05-9-10FT	09/27/23 08:45	SOIL	8.29	MG/KG
BH-05-14-15FT	09/27/23 08:50	SOIL	22.2	MG/KG
BH-05-24-25FT	09/27/23 10:25	SOIL	118	MG/KG
BH-04-2-3FT	09/27/23 16:05	SOIL	7.14	MG/KG
BH-04-7-8FT	09/28/23 08:10	SOIL	5.48	MG/KG
BH-04-10-11FT	09/28/23 08:30	SOIL	6.30	MG/KG
BH-04-18-19FT	09/28/23 08:45	SOIL	82.5	MG/KG
Uranium				
BH-01-20231002	10/02/23 15:00	GROUND WATER	14.4	UG/L
UPD-18-20231003	10/03/23 10:30	GROUND WATER	667	UG/L
MW-3-20231003	10/03/23 12:35	GROUND WATER	2210	UG/L
BH-05-20230927	09/27/23 14:10	GROUND WATER	593	UG/L
BH-04-20230928	09/28/23 10:15	GROUND WATER	2040	UG/L
BH-05-2-3FT	09/27/23 08:15	SOIL	1870	UG/KG
BH-05-9-10FT	09/27/23 08:45	SOIL	874	UG/KG
BH-05-14-15FT	09/27/23 08:50	SOIL	1250	UG/KG
BH-05-24-25FT	09/27/23 10:25	SOIL	1570	UG/KG
BH-04-2-3FT	09/27/23 16:05	SOIL	580	UG/KG
BH-04-7-8FT	09/28/23 08:10	SOIL	849	UG/KG
BH-04-10-11FT	09/28/23 08:30	SOIL	2110	UG/KG
BH-04-18-19FT	09/28/23 08:45	SOIL	1980	UG/KG

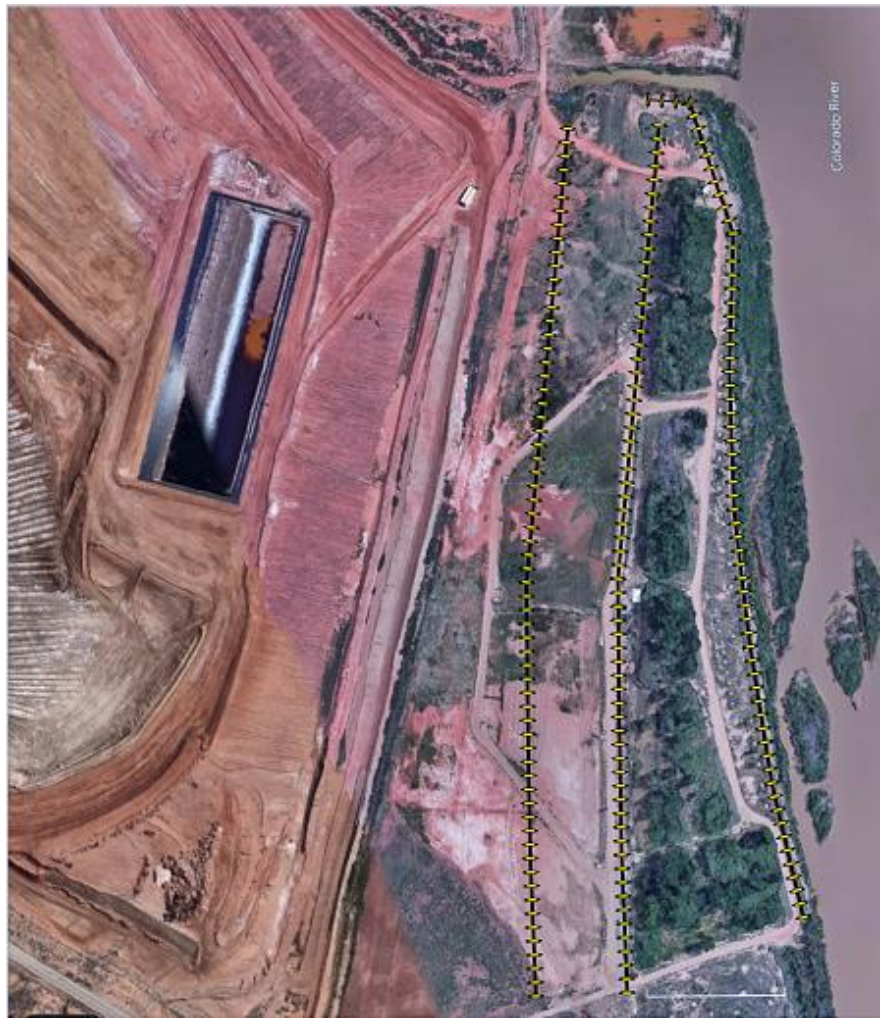
Soil Gas Survey Investigation

- Brian Looney, Holly Vermeulen, and Austin Coleman, SRNL
- Analysis of gas-phase samples to identify and refine secondary contaminant sources in vadose zone and shallow groundwater
  - Both ammonia and uranium
- Field work completed last week



ERT Investigation

- Tim Johnson, PNNL
- Use ERT to image subsurface structure and monitor stage-driven groundwater/surface water interaction
- Scheduled for March 2024



Streambed Sampling Investigation

- Fred Day-Lewis, PNNL
- Perform streambed sampling at multiple depths along one or more transects across the Colorado
  - Assess salinity in pore water
  - Potential flux of groundwater to the river
- Installation of temperature probes to record vertical temperature profiles
- Scheduled for March 2024

QUESTIONS?