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Status of Cleanup at Twin Cities Army Ammunition Plant (TCAAP)

RAB Meeting

9-16-2025

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AGENDA – September 16, 2025 at 7 P.M.

- Old Business
- Cleanup Status Update
  - Round Lake
  - Groundwater Remediation
  - Per- and poly-fluoroalkyl substances (PFAS)
  - U.S. Geological Survey (USGS) Groundwater Model
- New Business
- Next Meeting Agenda
- Public Comments

Old Business

- Vote to accept the minutes from previous meeting.
- Round Lake Technical Working Group met on February 25th , February 28th, and March 27th.
- Army held groundwater stakeholder meeting on 16 September 2025.

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What has the Army done since February 2025?

- Draft Final FY23 Annual Performance Report (APR) in regulatory review. Draft Final FY24 APR in regulatory review.
- TGRS Operating Strategy Revision in process
- FY25 Annual groundwater sampling and land use control inspections completed.
- Sixth Five-Year Review under final signoff by regulators.

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Round Lake
Remedial Design / Remedial Action Update

Twin Cities Army Ammunition Plant: Round Lake

Arden Hills, Minnesota

Contract No. W9128F22D0002

Agenda

- Round Lake Remedial Action Overview
- Additional Sediment Volume
- MOD for Dredging Areas, Design, and Schedule
- Project Schedule

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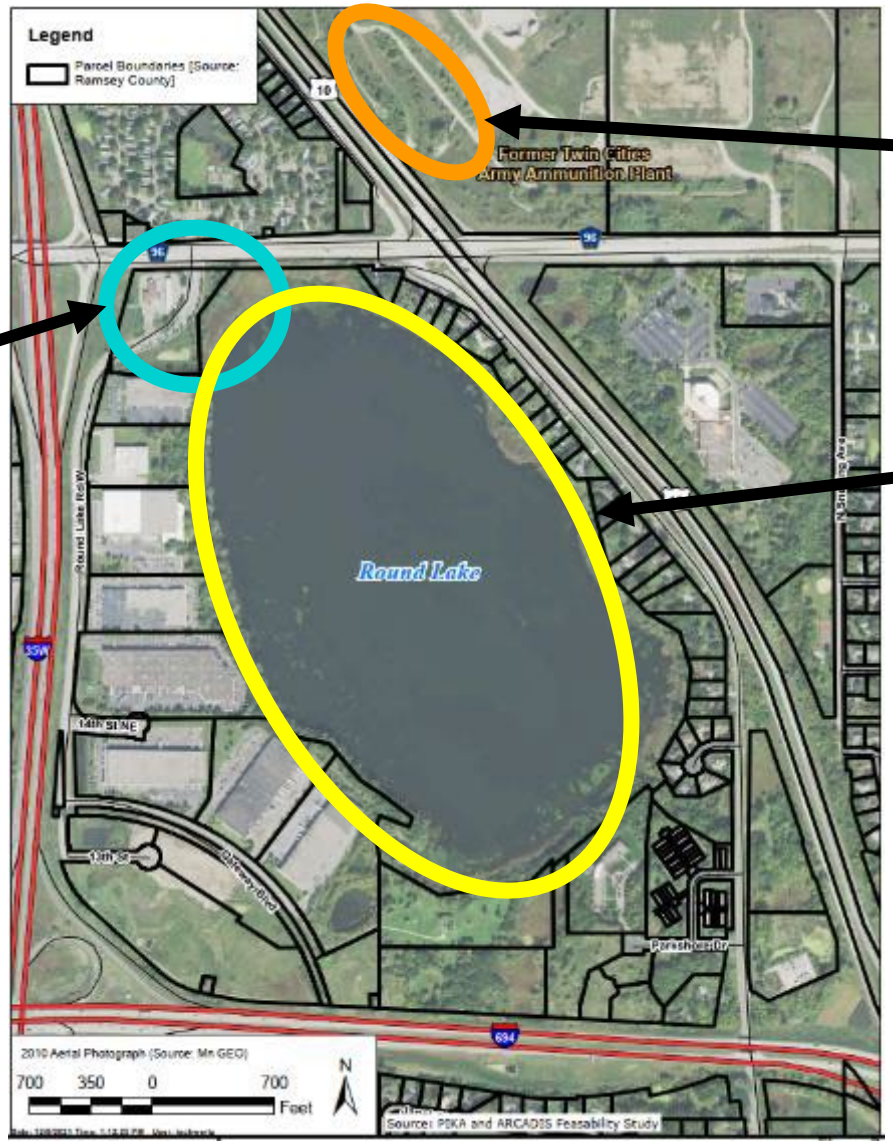
Round Lake Remedial Action



Sediment Processing

Lake Access

Dredging

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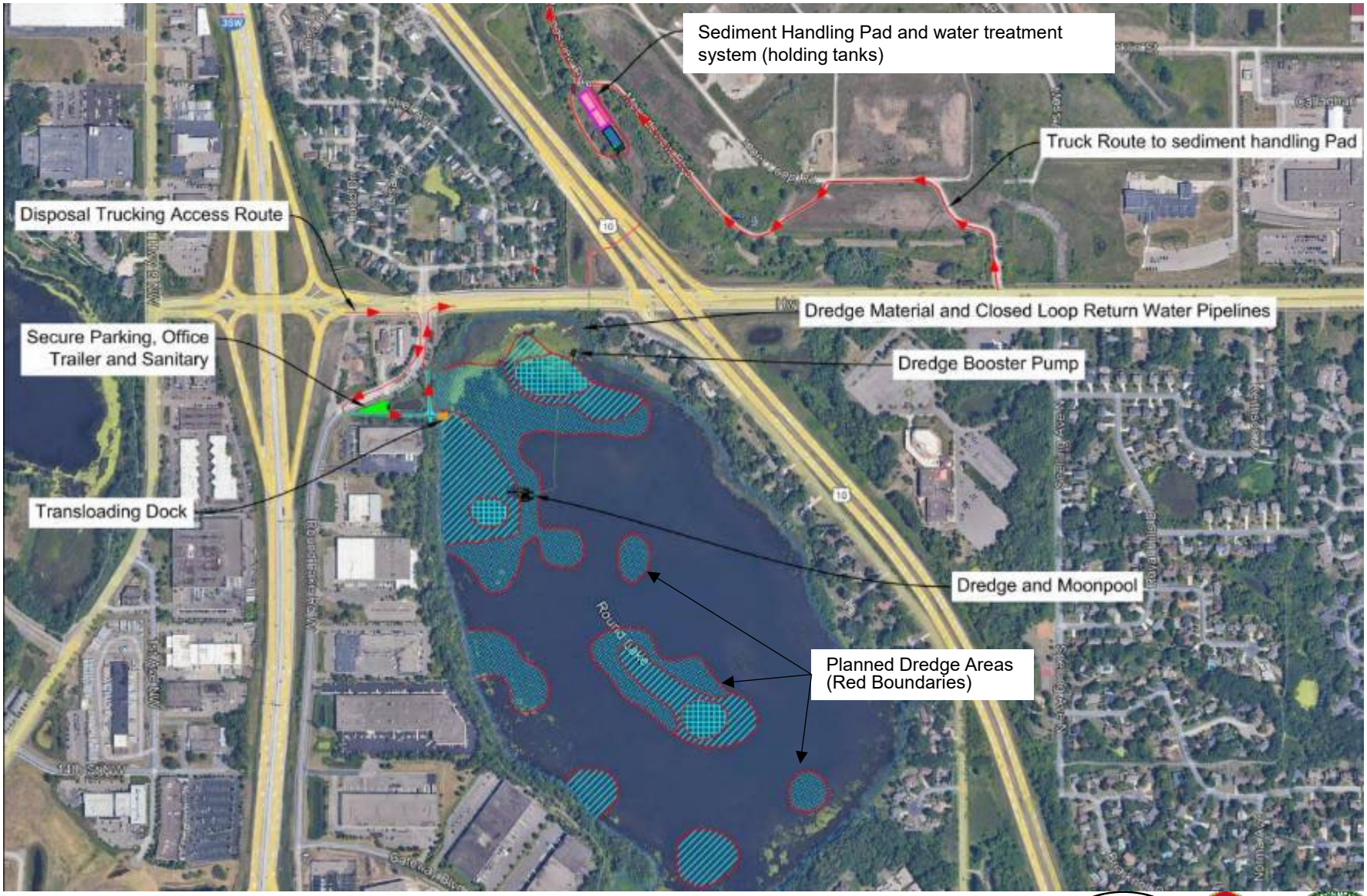
Round Lake Remedial Action



POC Information (Thomas Toudouze, U.S. AEC, 520-674-1984, thomas.p.toudouze2.civ@army.mil)

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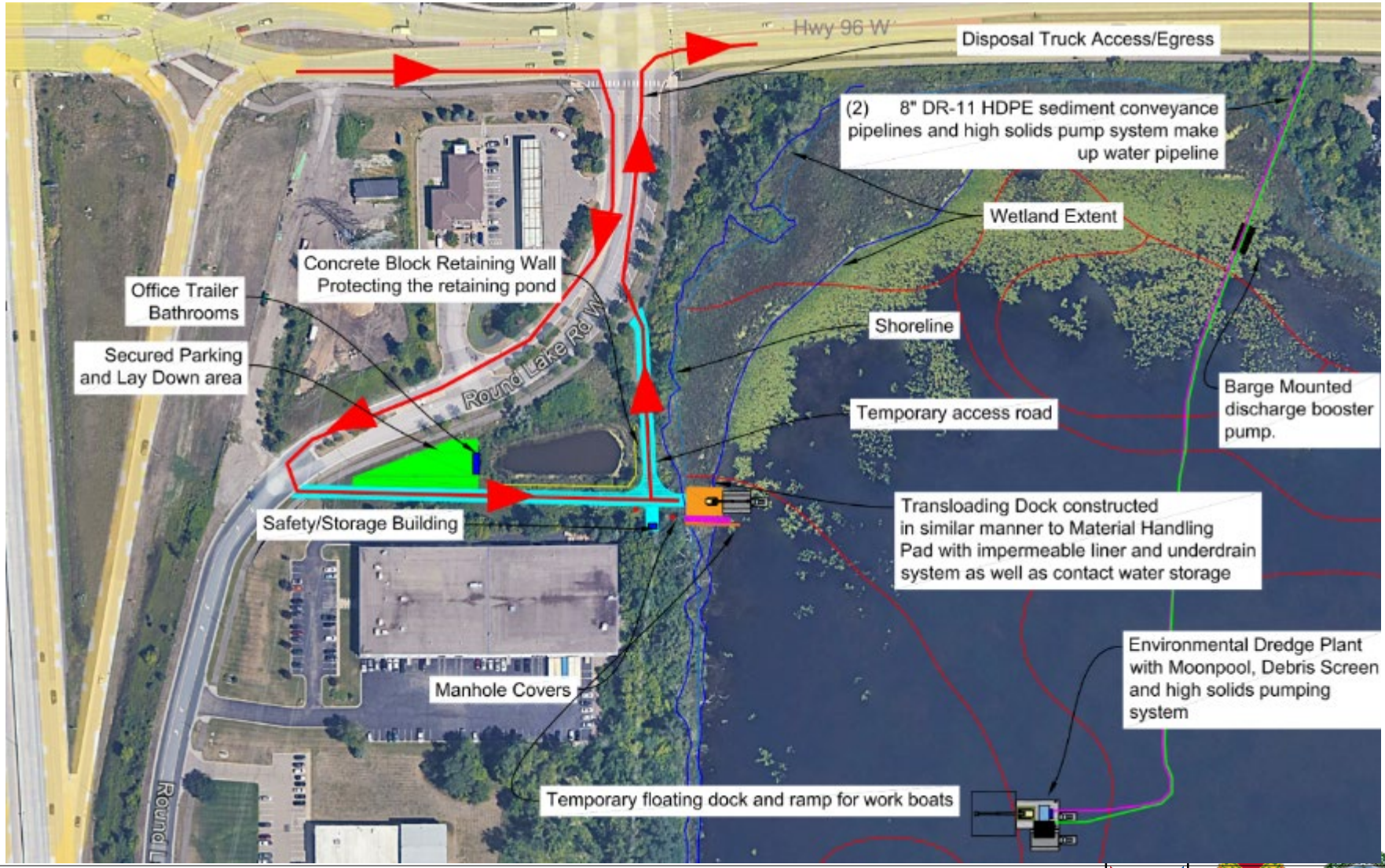
Round Lake Cleanup
Lake Access



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Storm Sewer Orientation

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Round Lake Cleanup
Sediment Processing

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Increased Sediment Volume

- Last year, the Pre-design investigation indicated a significant difference in the amount of sediment in the removal areas.
- The total estimated volume of sediment within the areas identified in the Record of Decision (ROD) is 156,000 Cubic Yards (cy), this is 74,000 cy more than the volume of 82,000 cy specified in the ROD and that this contract was scoped and funded for.
- No additional funds are available to remove the excess sediment. There is also insufficient time left in this contract to remove it.
- USAEC held a series of Technical Working Group (TWG) meetings with the stakeholders of Round Lake taking place on the 12th, 25th, and 28th of February, and on the 27th of March.
- TWG Members included: The U.S. Environmental Protection Agency, U.S. Fish and Wildlife, Minnesota Pollution Control Agency, Minnesota Department of Natural Resources, Ramsey County, Rice Creek, The City of Arden Hills, and the chair of the TCAAP Restoration Advisory Board.

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Proposed Contract Modification

- Initially four main potential paths forward were identified:

1. Continue this contract but only dredge up to the originally scoped 82,000 cy and remove the rest in a follow-on contract.

2. Remove the dredging portion of this contract and use it only for the design phase, then award a follow-on contract with sufficient funds and time to remove the entire volume in one action.

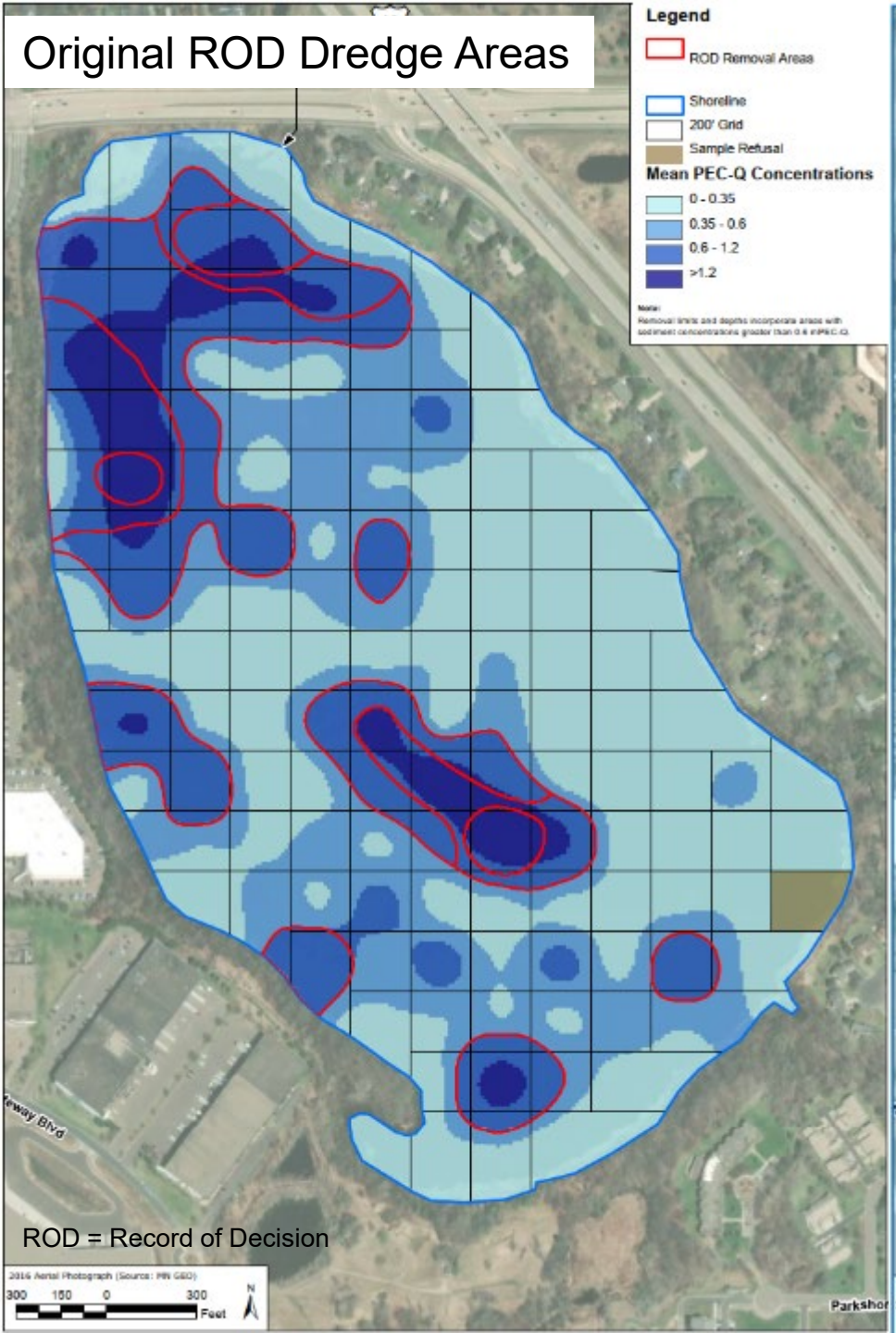
3. Stop this contract, award a contract to perform an Ecological Risk Assessment to determine if the additional sediment acts as a sufficient cap on the contamination to be protective of the environment.

4. Modify the contract to conduct additional sampling to more accurately determine the extent and volume of the contamination. This may result in a lower volume requiring removal, following that perform the design of the removal and then dredge as much as is possible before the end of the contract. Remaining sediment will be removed in a follow-on contract.

Contract Modification

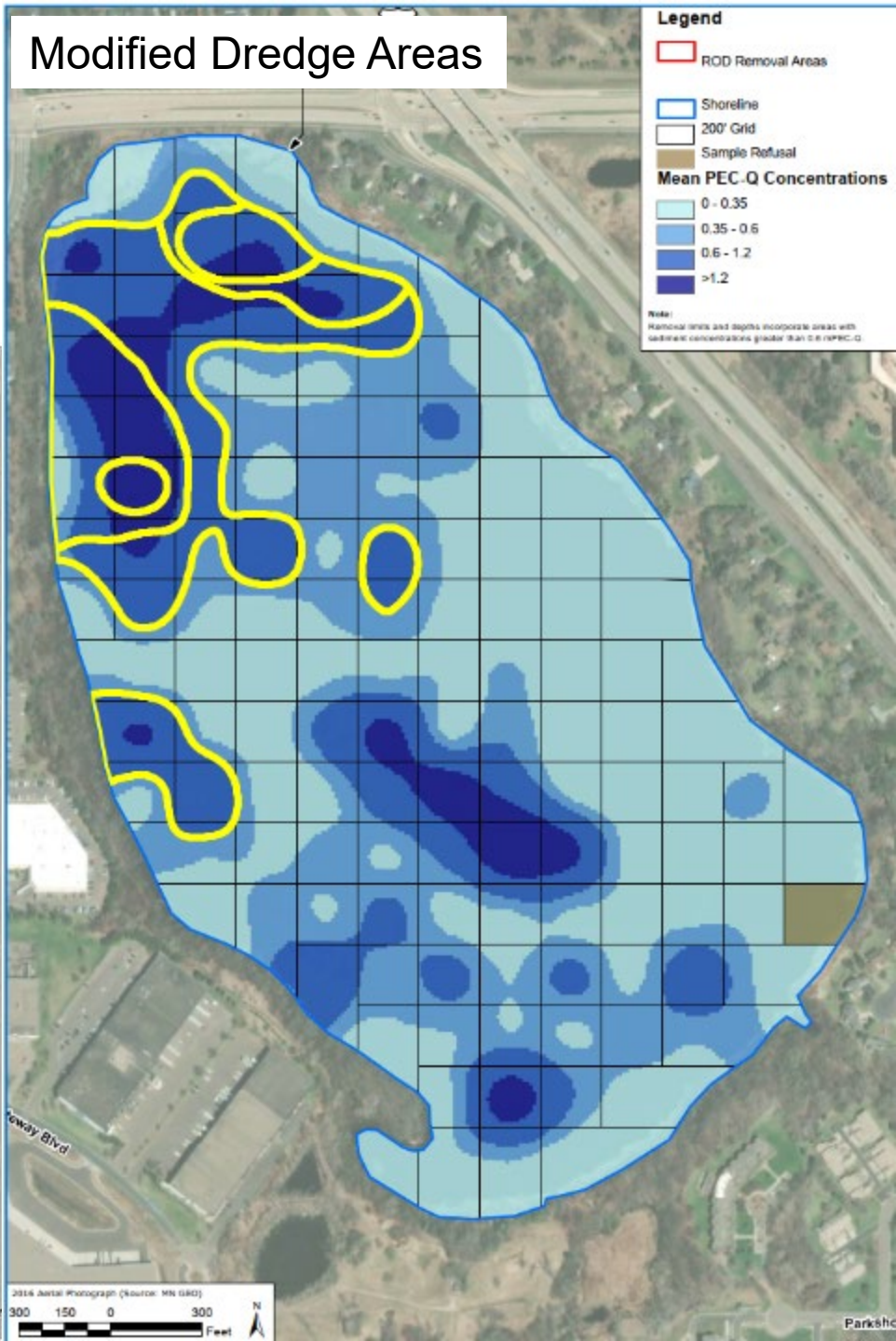
- After several discussions with the TWG, it was decided the best course of action was to dredge up to the originally scoped 82,000 cy and remove the rest in a follow-on contract.
- The Army identified three selected dredge areas that total closest to the contracted removal volume of 82,000 cy. The TWG approved the selection.

Original ROD Dredge Areas



ROD = Record of Decision

Modified Dredge Areas



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Other aspects of Modification

- The modification changes the design phase to only design for three areas to be removed, the remaining areas design phase will be included either separately or as part of the follow-on removal contract.
- The modification increased regulatory review time allowances to follow the Federal Facilities Agreement (FAA).
- No change made to the period of performance however remediation will now be conducted over two construction seasons (2026 – 2027),

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Round Lake Cleanup Schedule Recent Activity

- 30% Remedial Design Report
  - Aug 2024 Draft Submitted
  - Sept 2024 Comments Received / Addressed
  - Nov 2024 Draft Final Submitted
  - Jan 2025 Comments Received / Addressed
  - April 2025 Final Submitted
  - July 2025 Final Accepted by Regulators

- 60% Remedial Design Report
  - Draft Currently in Progress
  - October 2025 Anticipated Submittal to Regulators

- UFP-QAPP
  - September 2025 Submitted to Regulators

- Technical Meetings
  - Feb 2025 Quality Assurance Project Planning Scoping Meeting
  - Feb and Mar 2025 Technical Workgroup Meetings
  - June 2025 Coordination with Ramsey County

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Round Lake Cleanup Schedule
Upcoming Activities

- Remedial Design
  - Quality Assurance Project Plan: late 2025
  - 60%, 90%, Final Design Reports: late 2025 / early 2026

- Remedial Action
  - Vegetation Clearing (late 2025 / early 2026)
  - Sediment Removal Activities (mid 2026 – 2027)

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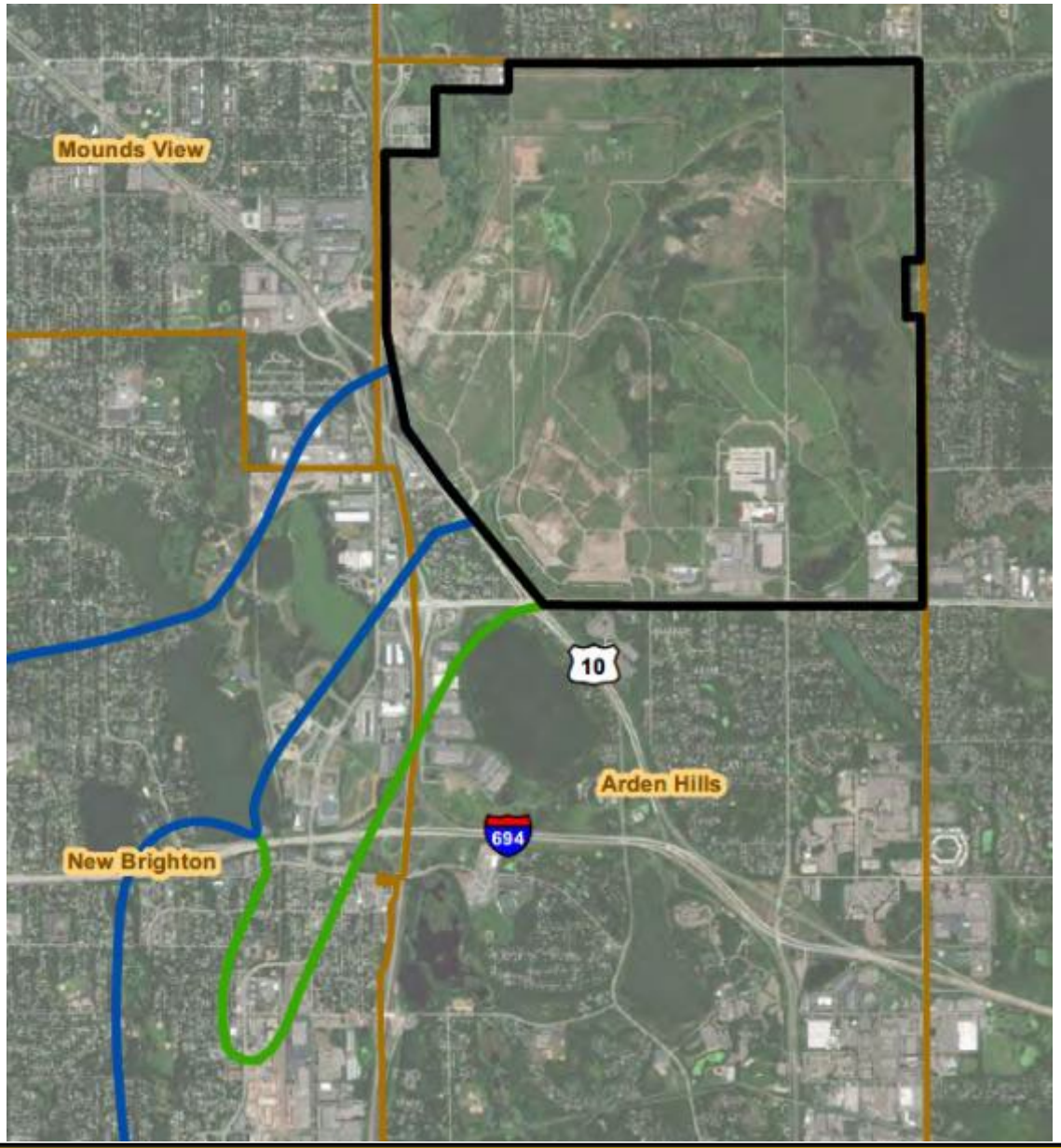
TCAAP Cleanup Status Update



LEGEND:

- Operable Unit 1 (North Plume)
- Operable Unit 2 of the New Brighton/ Arden Hills Superfund Site (the same area occupied by the Twin Cities Army Ammunition Plant in 1983, when the Site was placed on the NPL.)
- Operable Unit 3 (South Plume)
- Municipal Boundaries

POC Information (Thomas Toudouze, U.S. AEC, 520-674-1984, thomas.p.toudouze2.civ@army.mil)

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OU1 Groundwater Sampling Update

- Draft Final FY23 and FY24 APRs under regulatory review. Comments will be incorporated and Final reports distributed as soon as possible.
- Completed annual groundwater sampling (minor year) of OU1 monitoring wells in Summer 2025.
- Groundwater data will be validated and will be incorporated into the Draft Final FY25 APR.
- Annual plume maps are available in the respective APRs, most recently updated in the Draft Final FY24 APR. Final revisions underway and will be reflected in Final FY24 APR.
- Statistical evaluation of monitoring well network currently in progress. Results will be shared when available.
- Groundwater sampling allows the Army to monitor the plumes, assess remedy performance, and update the maps.

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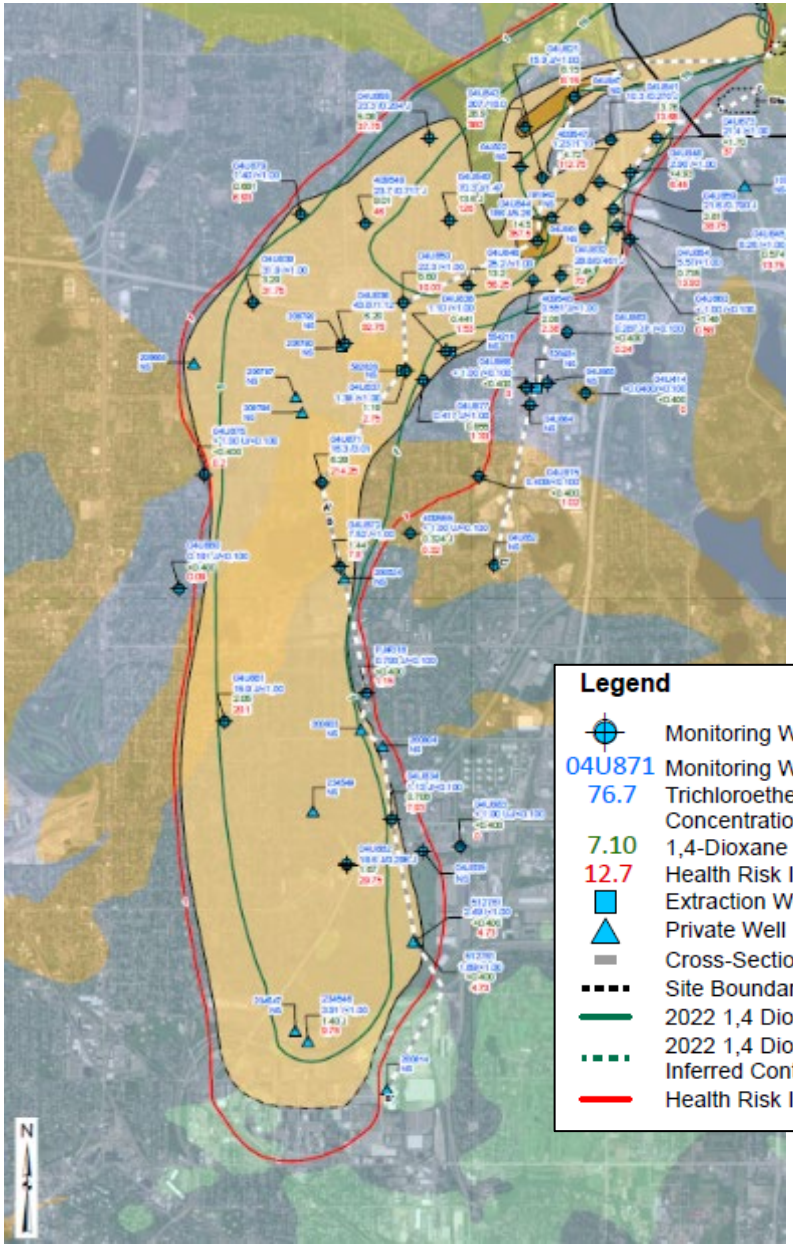
FY24 – Prairie du Chien Plume Map



- Plume remains relatively stable compared to FY23 results.
- Some minor fluctuations (both increases and decreases) spread throughout the plume.
- Higher concentration area (>100ug/L) remains as two distinct lobes (shown on next slide), consistent with FY23 results.

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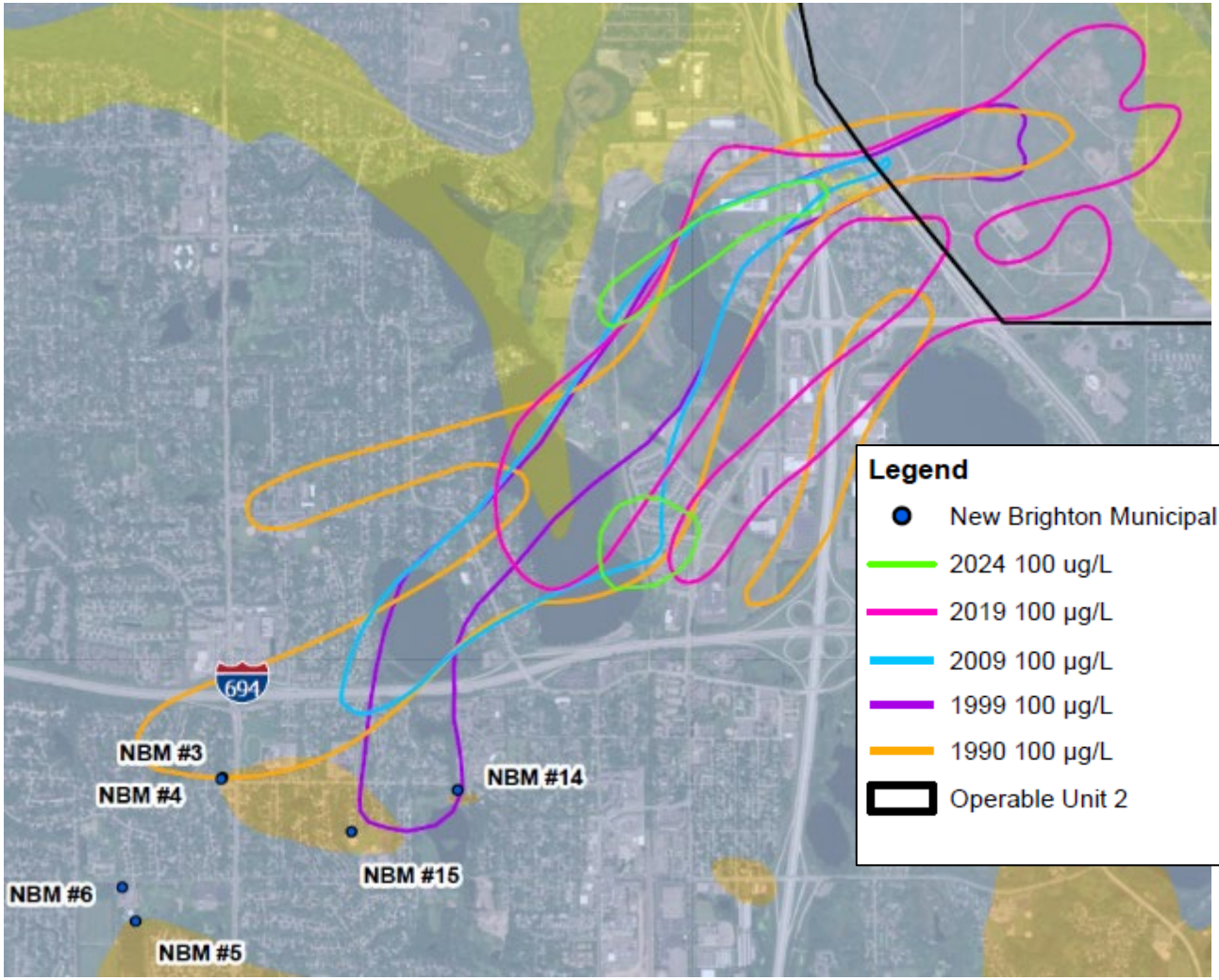
FY24 – Prairie du Chien Plume Map Over Time



Legend

- New Brighton Municipal Wells
- 2024 100 ug/L
- 2019 100 µg/L
- 2009 100 µg/L
- 1999 100 µg/L
- 1990 100 µg/L
- Operable Unit 2

Bedrock Geology

- Decorah Shale, Galena Group
- Platteville and Glenwood Fms
- St. Peter Sandstone
- Prairie du Chien Group
- Jordan Sandstone
- St. Lawrence Formation
- Tunnel City Group

POC Information (Thomas Toudouze, U.S. AEC, 520-674-1984, thomas.p.toudouze2.civ@army.mil)

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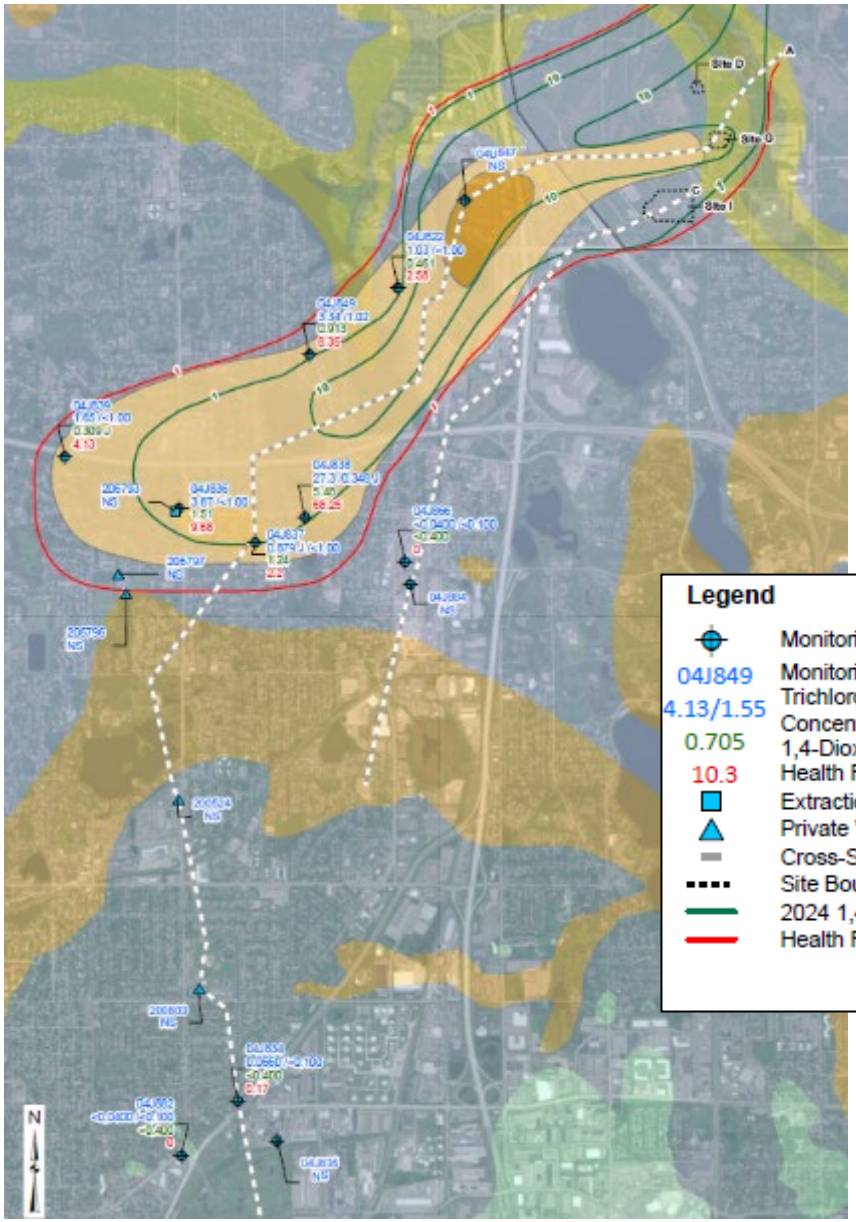
FY24 – Jordan Plume Map



- Main plume remains relatively stable compared to FY23 results.
- Downgradient wells non-detect in FY24 (most not sampled in FY23).
- Higher concentration area not sampled in FY24.

Legend

- Monitoring Well
- 04J849 — Monitoring Well ID
- 4.13/1.55 — Trichloroethene/1,1,1-Trichloroethane Concentration (µg/L)
- 0.705 — 1,4-Dioxane Concentration (µg/L)
- 10.3 — Health Risk Index
- Extraction Well
- Private Well
- Cross-Section Line
- Site Boundary
- 2024 1,4 Dioxane Concentration Contour (µg/L)
- Health Risk Index = 1

2024 Trichloroethene Concentrations (µg/L)

- > 100 µg/L
- > 0.4 µg/L
- Operable Unit 2

Bedrock Geology

- Decorah Shale, Galena Group
- Platteville and Glenwood Fms
- St. Peter Sandstone
- Prairie du Chien Group
- Jordan Sandstone
- St. Lawrence Formation
- Tunnel City Group

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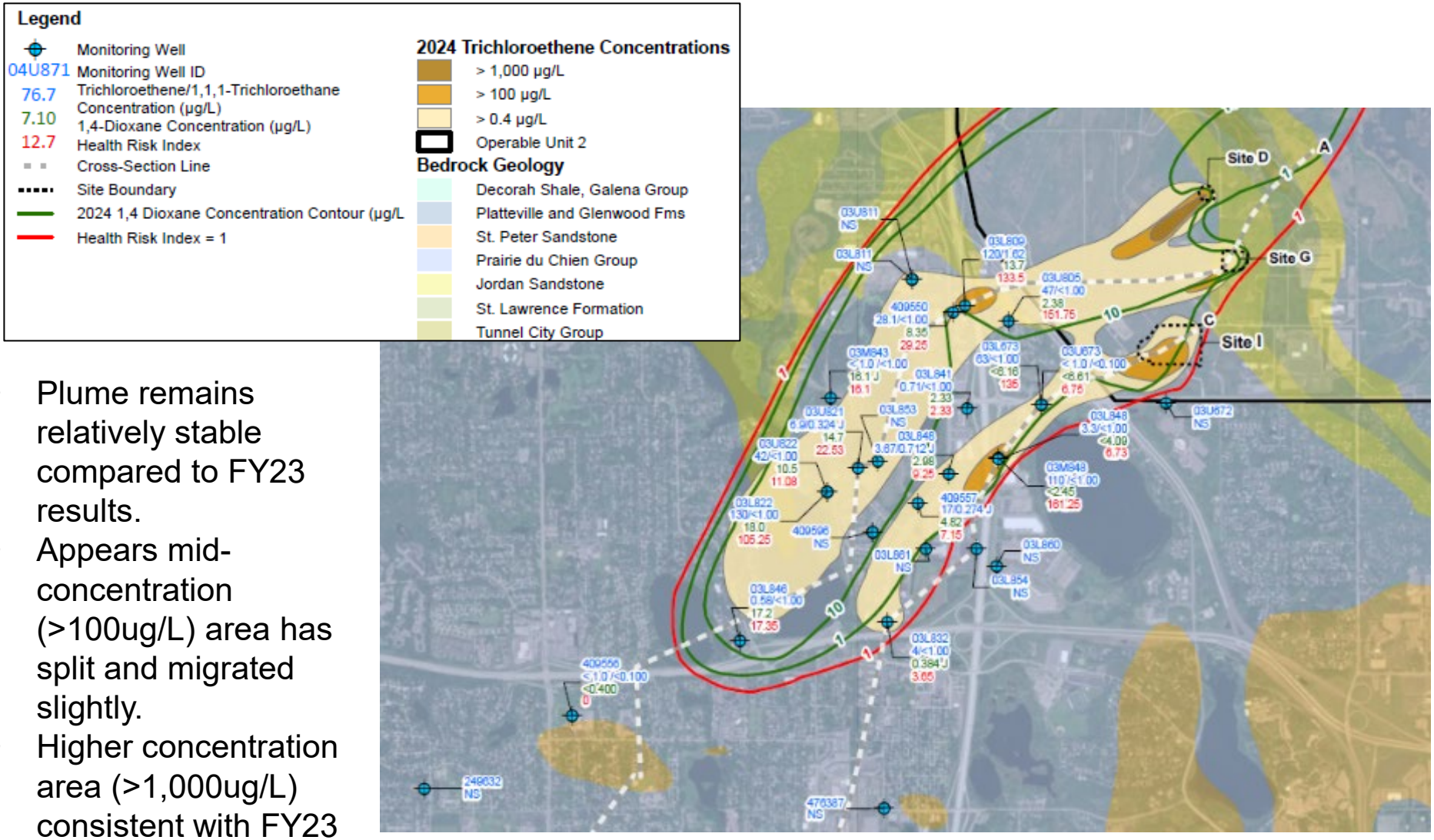
FY24 – OU2 Unconsolidated Sediments Plume Map



- Plume remains relatively stable compared to FY23 results.
- Appears mid-concentration (>100ug/L) area has split and migrated slightly.
- Higher concentration area (>1,000ug/L) consistent with FY23 results.

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Twin Cities Army Ammunition Plant Cleanup

LEGEND:

- Operable Unit 1 (North Plume)
- Operable Unit 2 of the New Brighton/ Arden Hills Superfund Site (the same area occupied by the Twin Cities Army Ammunition Plant in 1983, when the Site was placed on the NPL.)
- Operable Unit 3 (South Plume)
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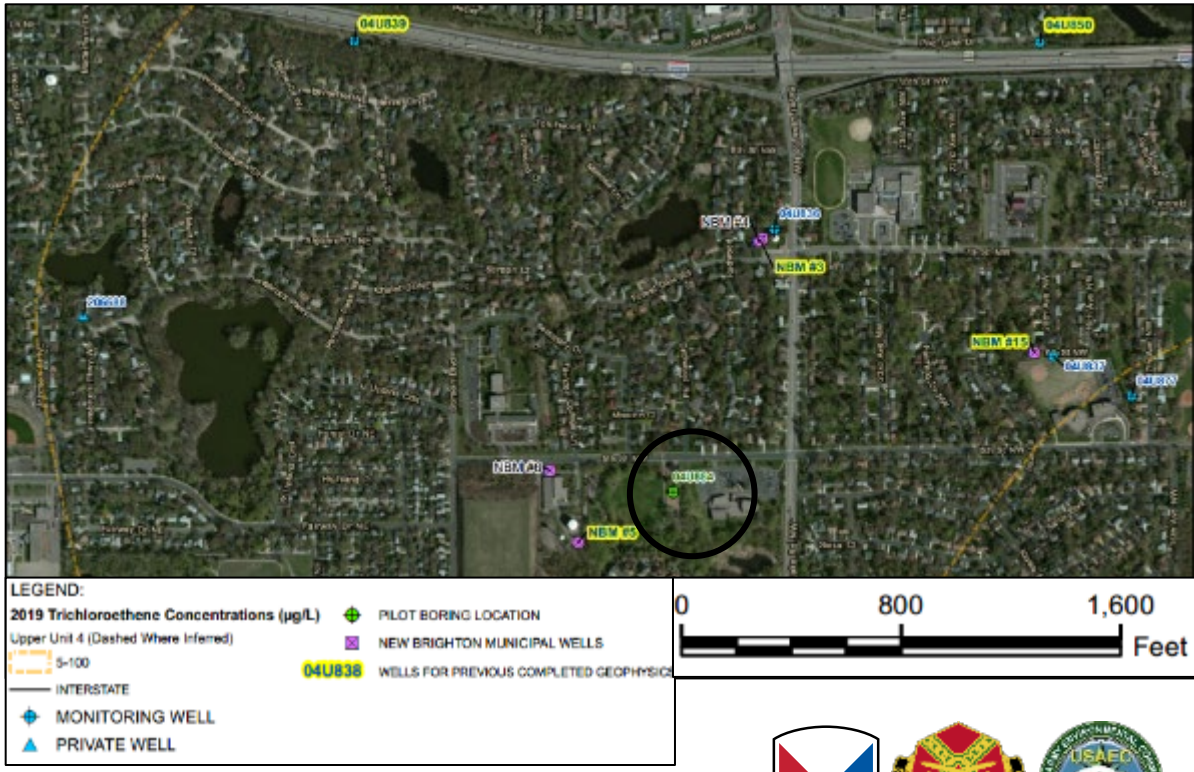
OU1 Optimization Objectives

- Generate data to support siting and design of a potential New Brighton (NB) recovery well:
  - Optimize plume control and mass recovery.
  - Meet NB requirements for production volume and integration with existing drinking water system.

- Identify potential refinements to NB operation to optimize plume control and mass recovery.
- City has awarded a contract to Traut to install new well, drilling planned for Spring 2026, expected to be operational by end of 2026.



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Twin Cities Army Ammunition Plant Cleanup

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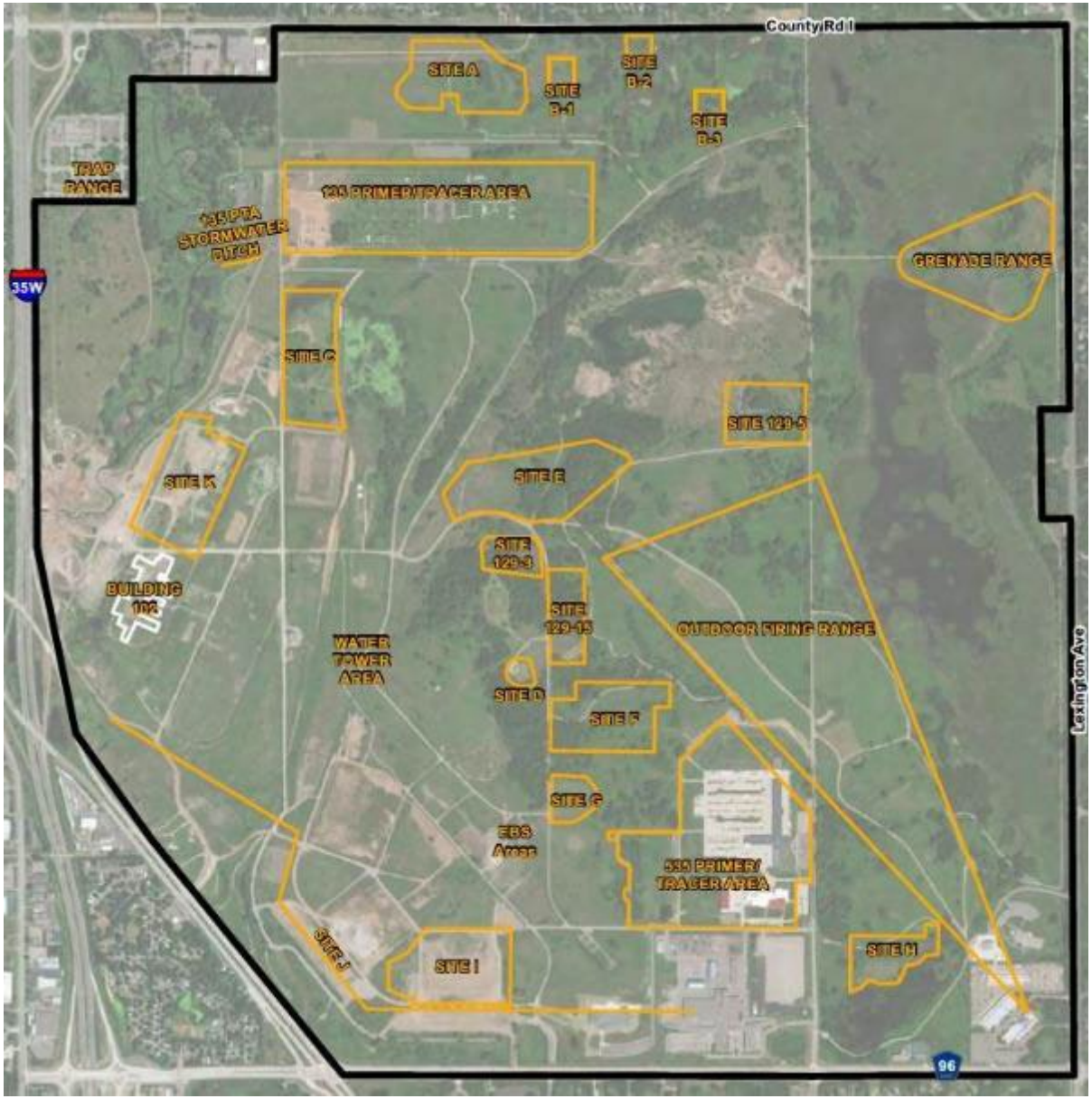
OU2


County Rd I
SITE A
SITE B-1
SITE B-2
SITE B-3
TRAP RANGE
125 PTA STORMWATER DITCH
124 PRIMER/TRACER AREA
GRENADE RANGE
35W
SITE C
SITE 124-5
SITE K
SITE E
SITE 129-3
BUILDING 102
SITE 129-15
OUTDOOR FIRING RANGE
WATER TOWER AREA
SITE D
SITE F
SITE G
EBS Area
539 PRIMER/ TRACER AREA
SITE J
SITE I
SITE H
Lexington Ave
96

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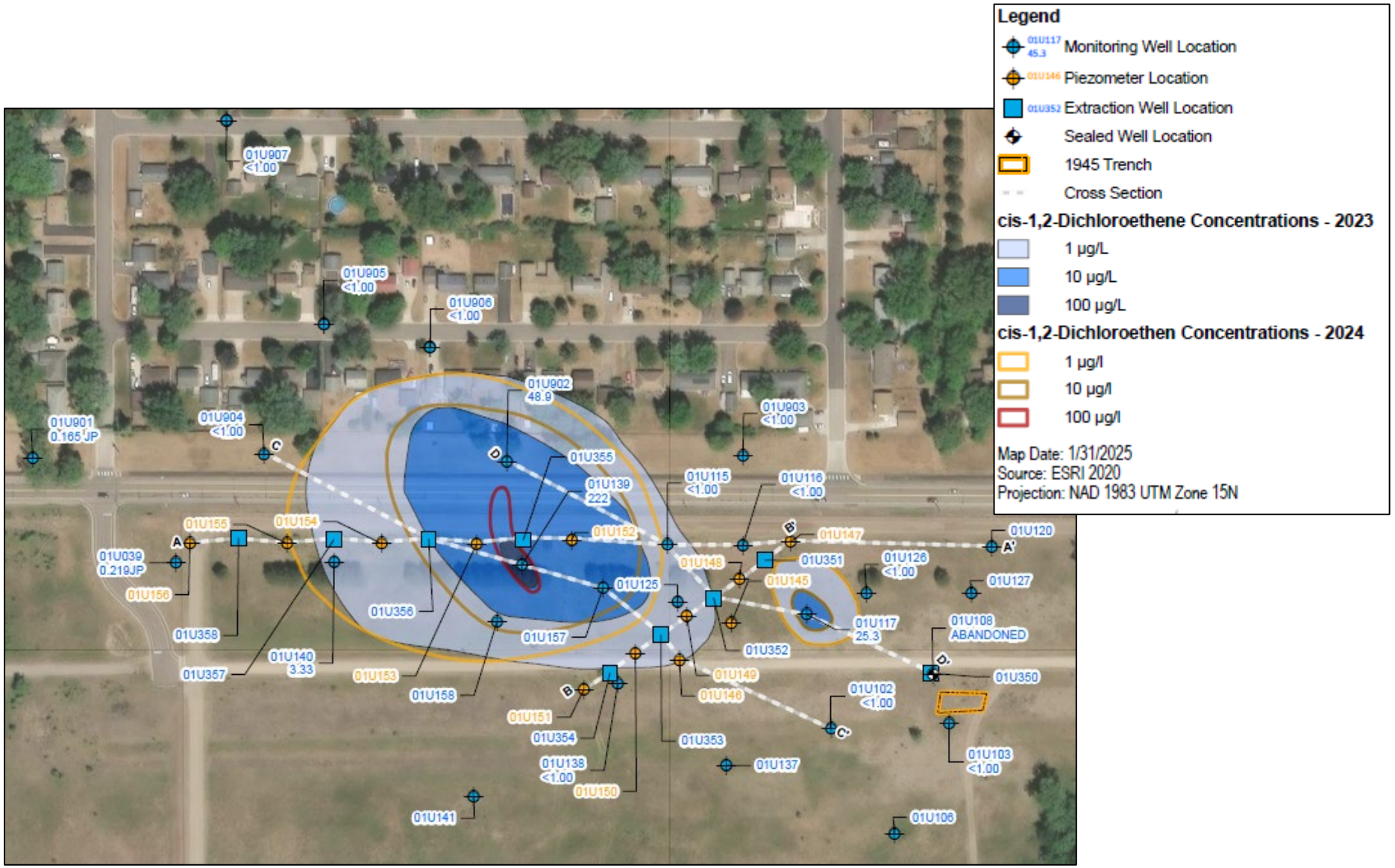
OU2 – Site A Monitored Natural Attenuation



OU2 – Site A Monitored Natural Attenuation

- Main plume (FY24) relatively stable compared to FY23.
- Concentrations within the heart of the smaller plume have decreased from FY23.

OU2 – Site C Monitored Natural Attenuation

- One location exceeds cleanup level compared to three locations in FY23.
- Plume shrank back to FY22 levels.
- Continue monitored natural attenuation.

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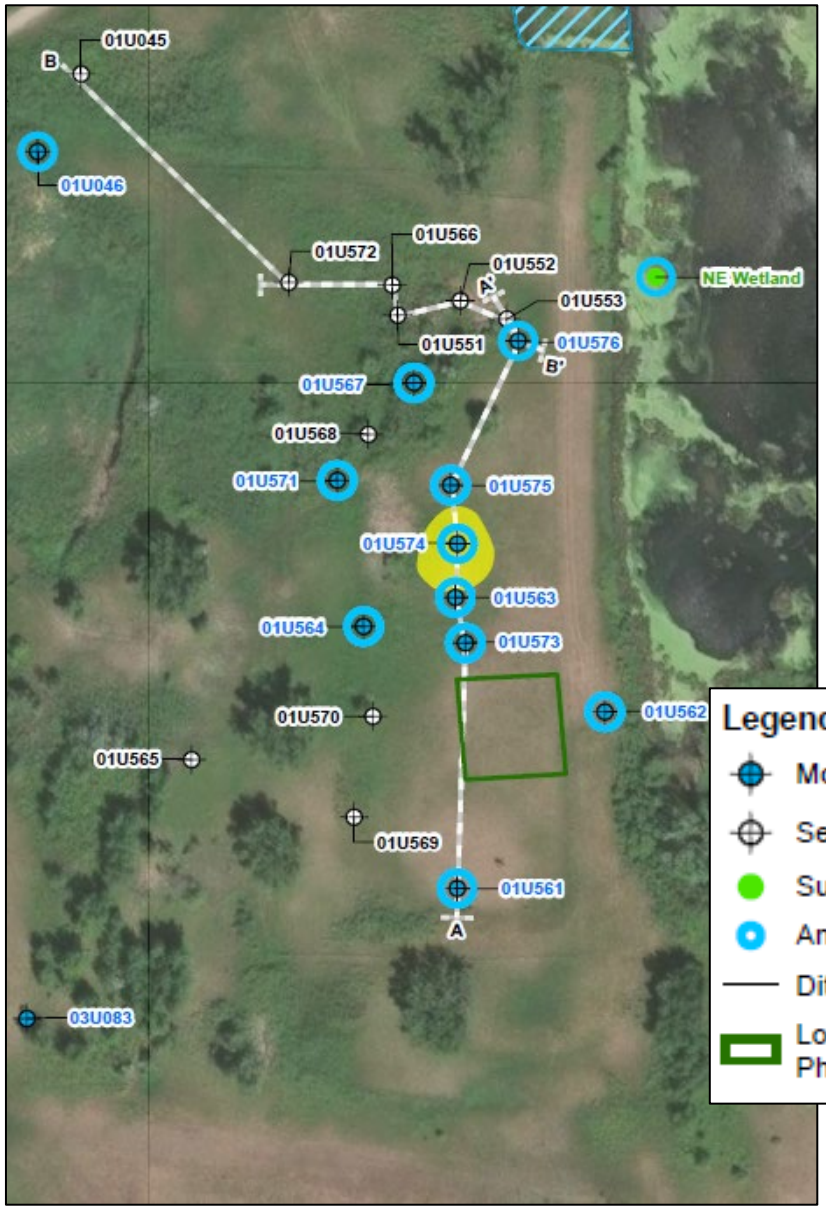
OU2 – Site C Monitored Natural Attenuation



Legend

- Monitoring Well Location
- Sealed Well Location
- Surface Water Sampling Locations
- Annual Monitoring Locations
- Ditch
- Location of Plot for Phytoremediation Demonstration
- Approximate Boundary of Wetland Constructed in 2007
- Cross Section
- 15 µg/L Lead Contour (2024)

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OU2 – Site K Pump and Treat

- Groundwater collection system continues to provide containment of the horizontal and vertical extent of the TCE plume.

- Annual groundwater sampling for FY25 completed in June 2025.

- June 2024 groundwater sample results confirmed trend of stable or decreasing TCE over 20+ years.

- FY25 quarterly treatment system samples met applicable discharge limits.

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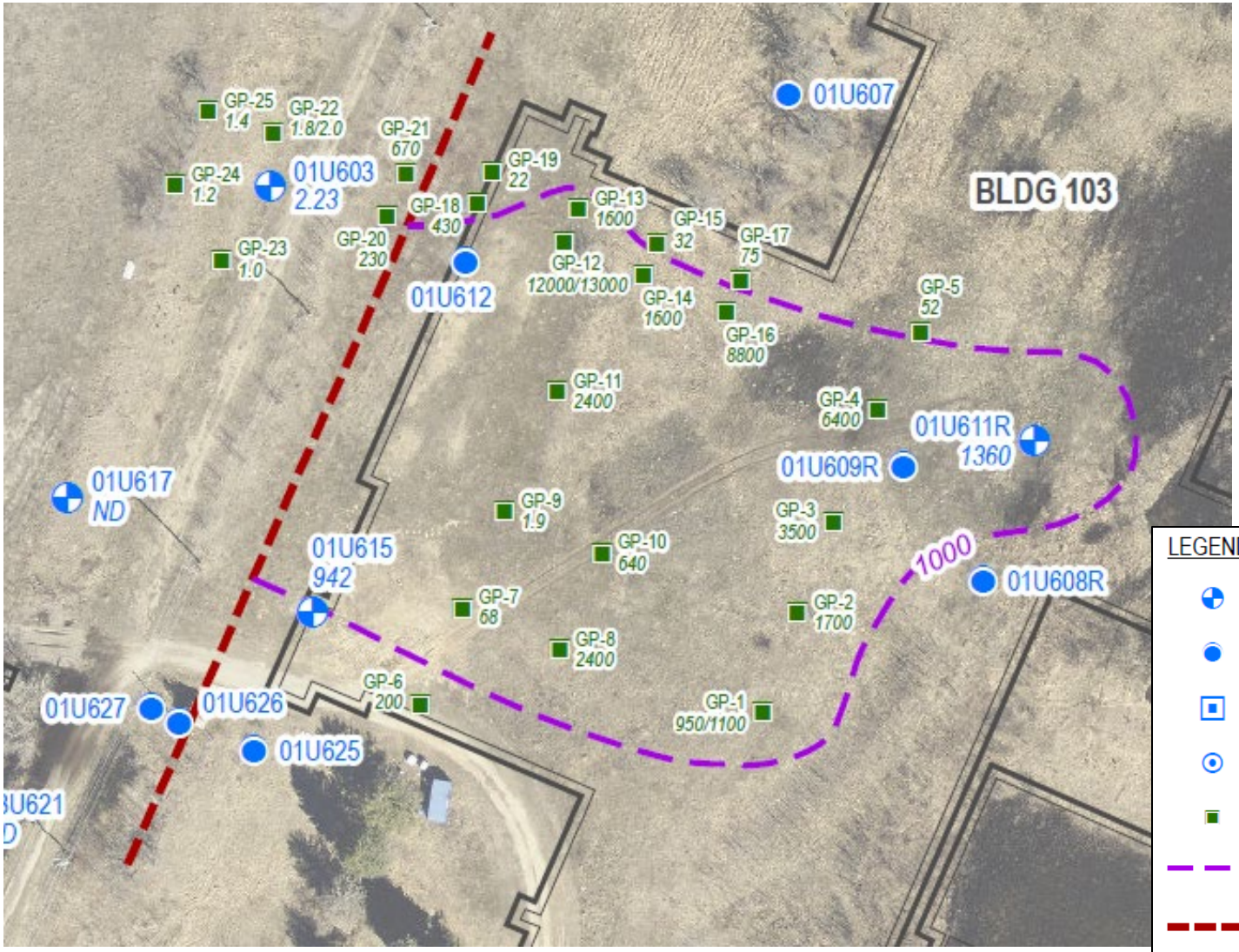
OU2 – Site K Pump and Treat



LEGEND

- ANNUAL UNIT 1 WATER QUALITY MONITORING WELL LOCATION
- ANNUAL UNIT 1 WATER LEVEL MONITORING WELL LOCATION
- UNIT 3 SENTINAL WELL LOCATION
- BUILDING 102 MONITORING WELL (SAMPLED IN MAY 2024)
- GEOPROBE BORING LOCATION FROM 2014 INVESTIGATION
- 1000 µg/L TCE PLUME LIMIT (ESTIMATED BASED ON 2014 DATA)
- SITE K COLLECTION TRENCH LOCATION
- HISTORICAL BUILDING / STRUCTURE

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OU1/OU2 Well Abandonment and Reinstallation

- Abandonment of three industrial wells in OU1 and 42 monitoring wells in OU2.
- Reinstallation of four monitoring wells in OU1 and one monitoring well in OU2.
- Monitoring well reinstallation in OU1 pending successful right-of-entry negotiations.
- All activities planned for FY26.

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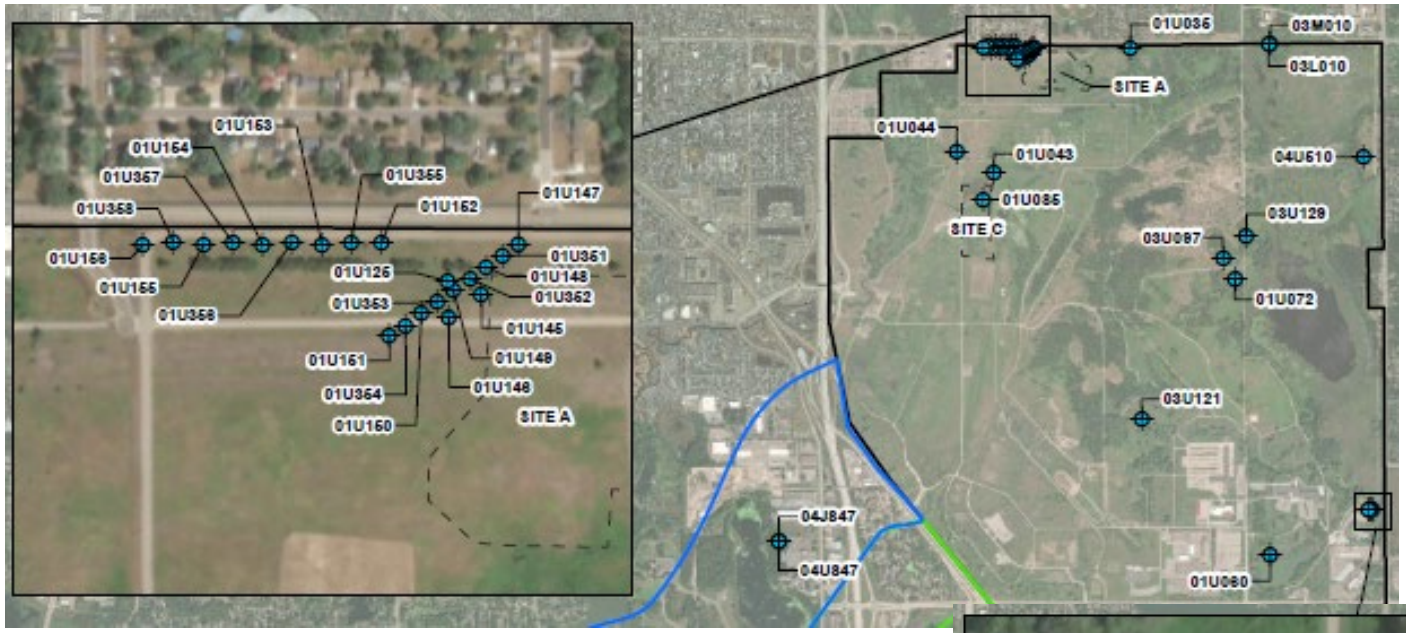
OU1/OU2 Well Abandonment and Reinstallation



Legend

- Monitoring Well Proposed for Abandonment
- Operable Unit 2
- Operable Unit 3 (South Plume)
- Operable Unit 1 (North Plume)
- Site Boundaries

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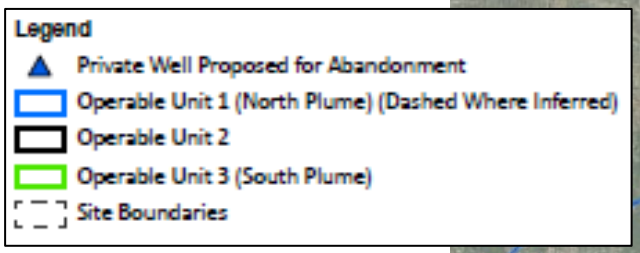
OU1/OU2 Well Abandonment and Reinstallation



POC Information (Thomas Toudouze, U.S. AEC, 520-674-1984, thomas.p.toudouze2.civ@army.mil)

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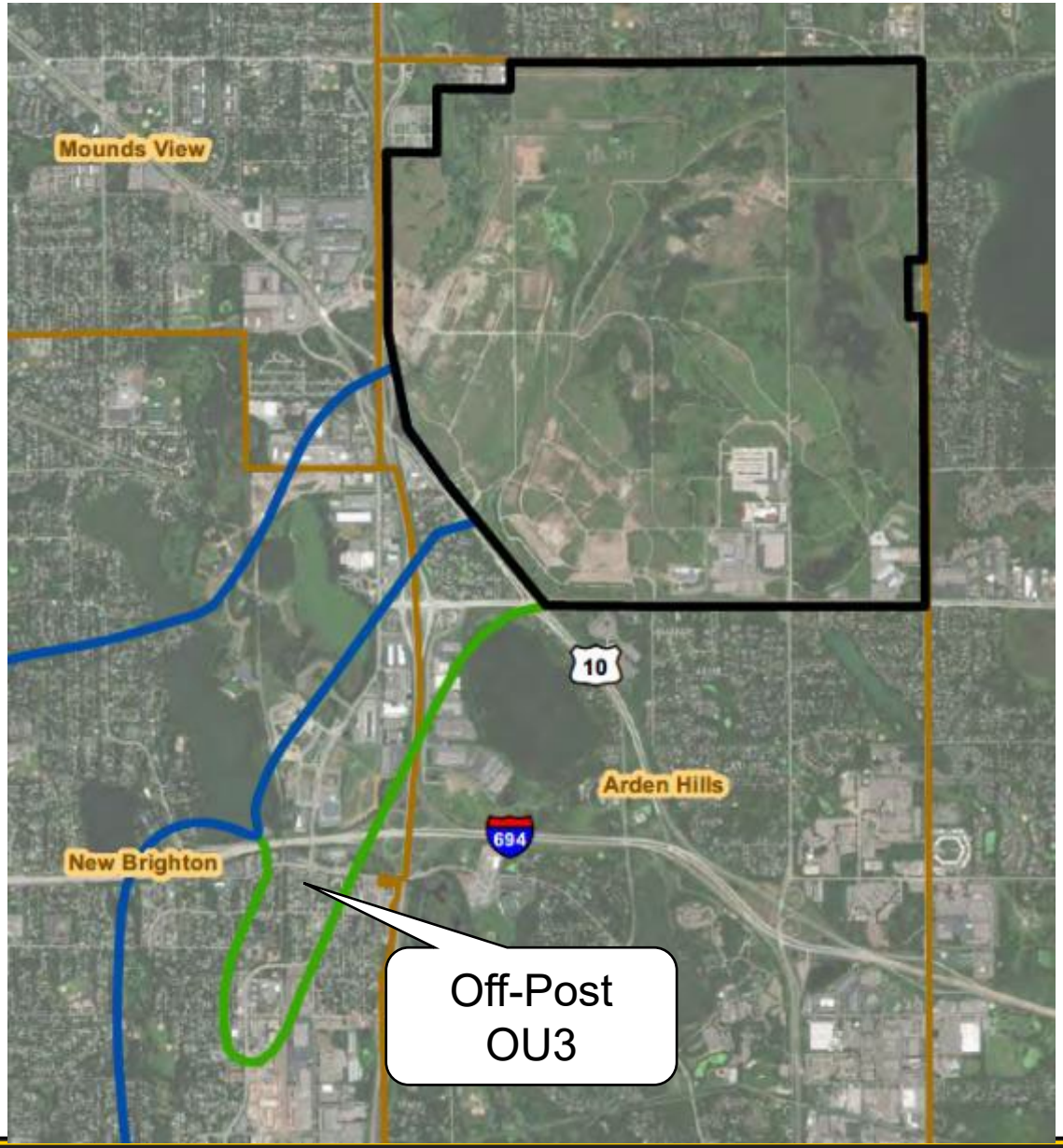
Twin Cities Army Ammunition Plant Cleanup



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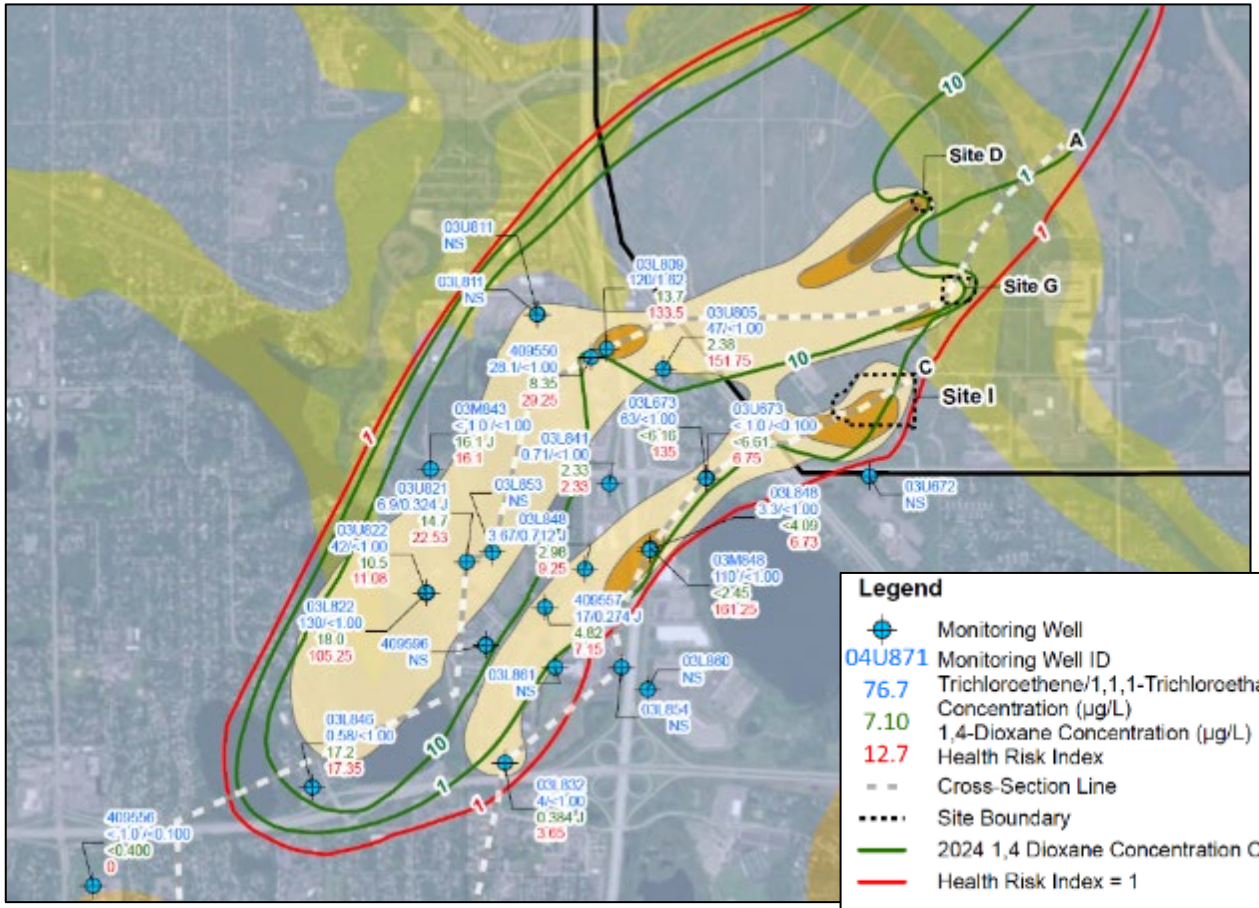
OU3 Plume

- OU3 plume remains relatively stable – results consistent with FY23.
- Continued monitored natural attenuation.
- Annual groundwater sampling completed in Summer 2025.



Legend

- Monitoring Well
- 04U871 Monitoring Well ID
- 76.7 Trichloroethene/1,1,1-Trichloroethane Concentration (µg/L)
- 7.10 1,4-Dioxane Concentration (µg/L)
- 12.7 Health Risk Index
- Cross-Section Line
- Site Boundary
- 2024 1,4 Dioxane Concentration Contour (µg/L
- Health Risk Index = 1

2024 Trichloroethene Concentrations

- > 1,000 µg/L
- > 100 µg/L
- > 0.4 µg/L
- Operable Unit 2

Bedrock Geology

- Decorah Shale, Galena Group
- Platteville and Glenwood Fms
- St. Peter Sandstone
- Prairie du Chien Group
- Jordan Sandstone
- St. Lawrence Formation
- Tunnel City Group

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Update on the Deep Groundwater TCAAP Groundwater Recovery System (TGRS)

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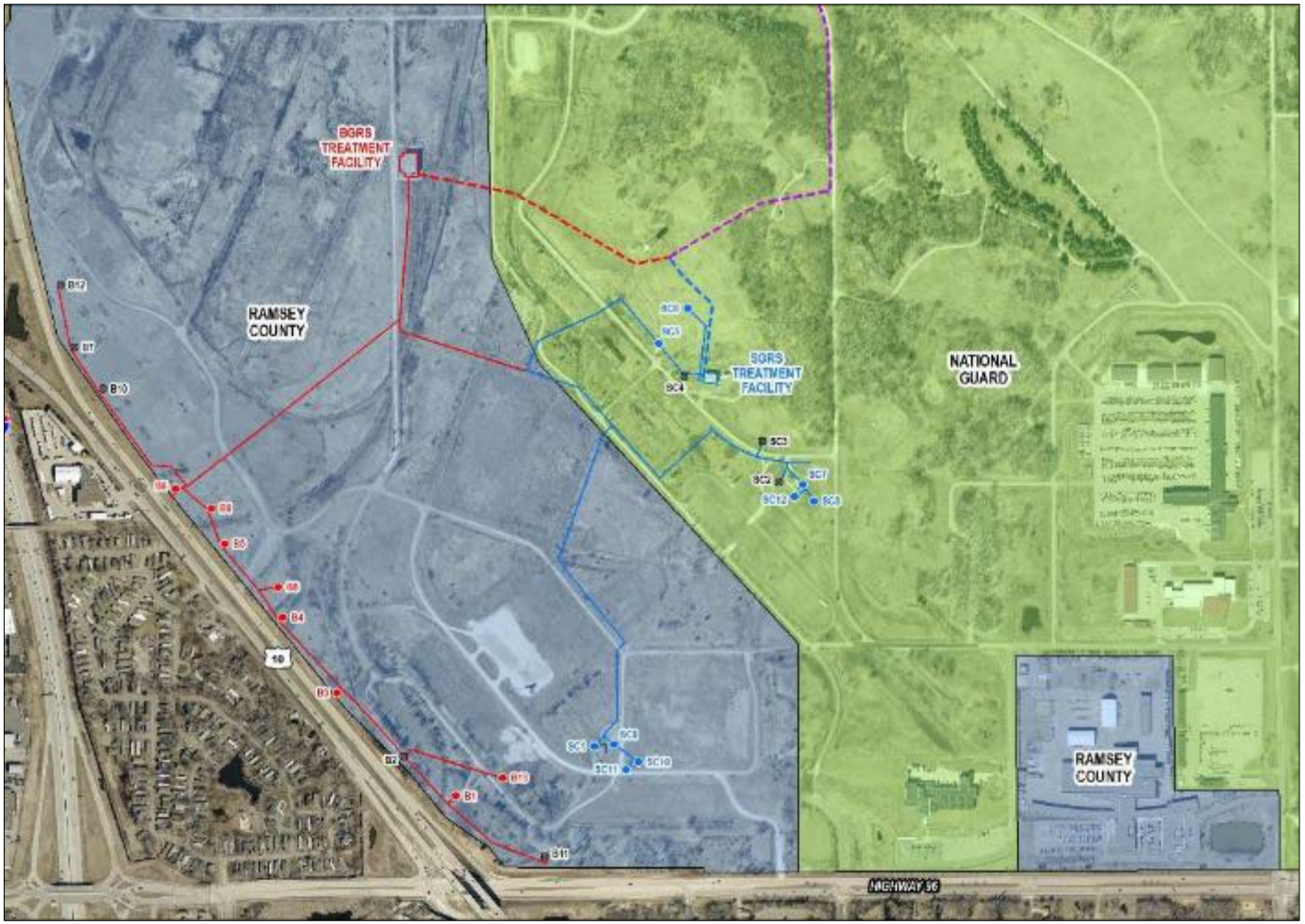
OU2 Optimization – TGRS Layout

Boundary Groundwater Recovery System (BGRS)

Source Area Groundwater Recovery System (SGRS)

BGRS + SGRS = TGRS



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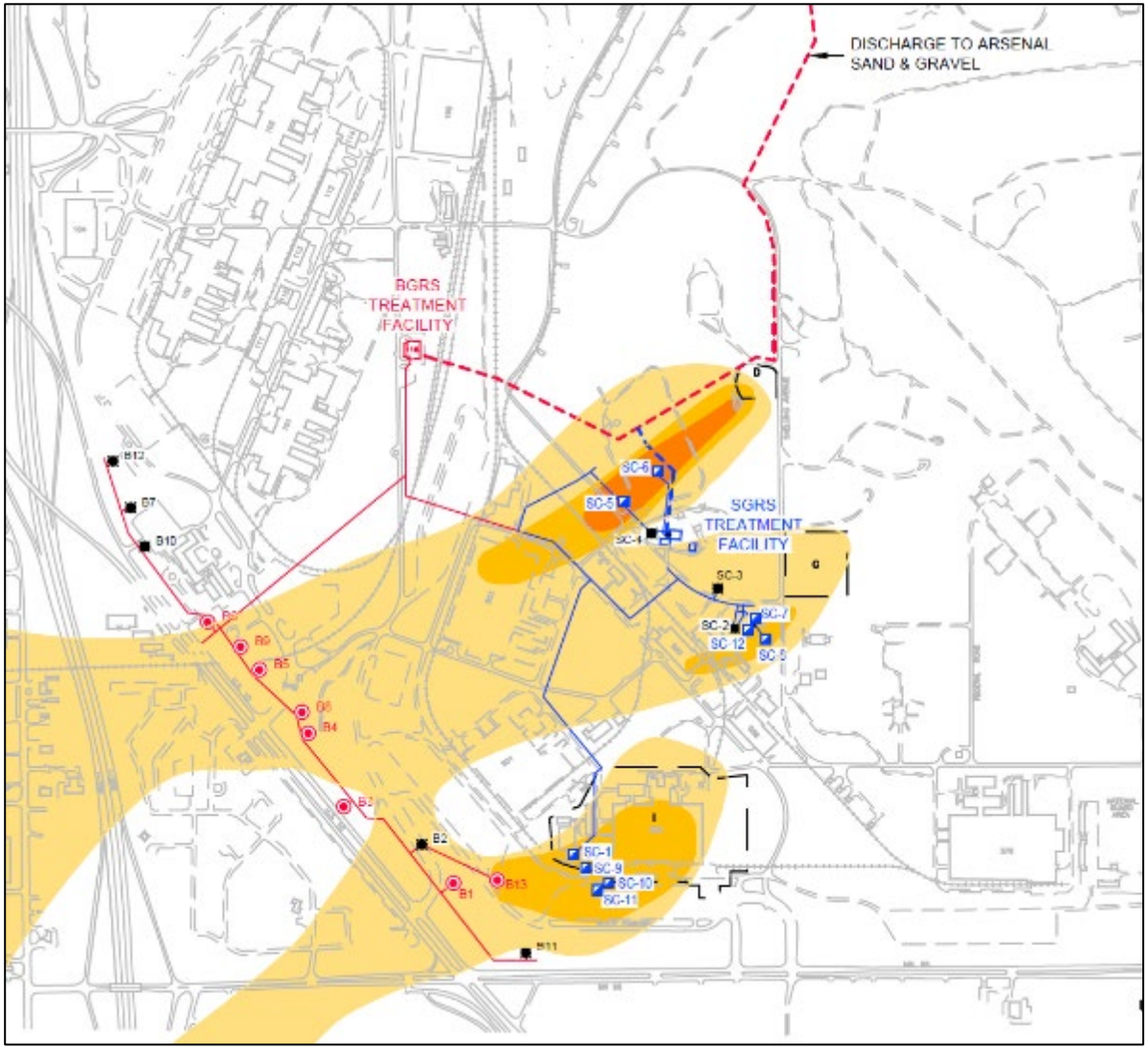
OU2 Optimization – TGRS Layout – TCE

Boundary Groundwater Recovery System (BGRS)

Source Area Groundwater Recovery System (SGRS)

BGRS + SGRS = TGRS

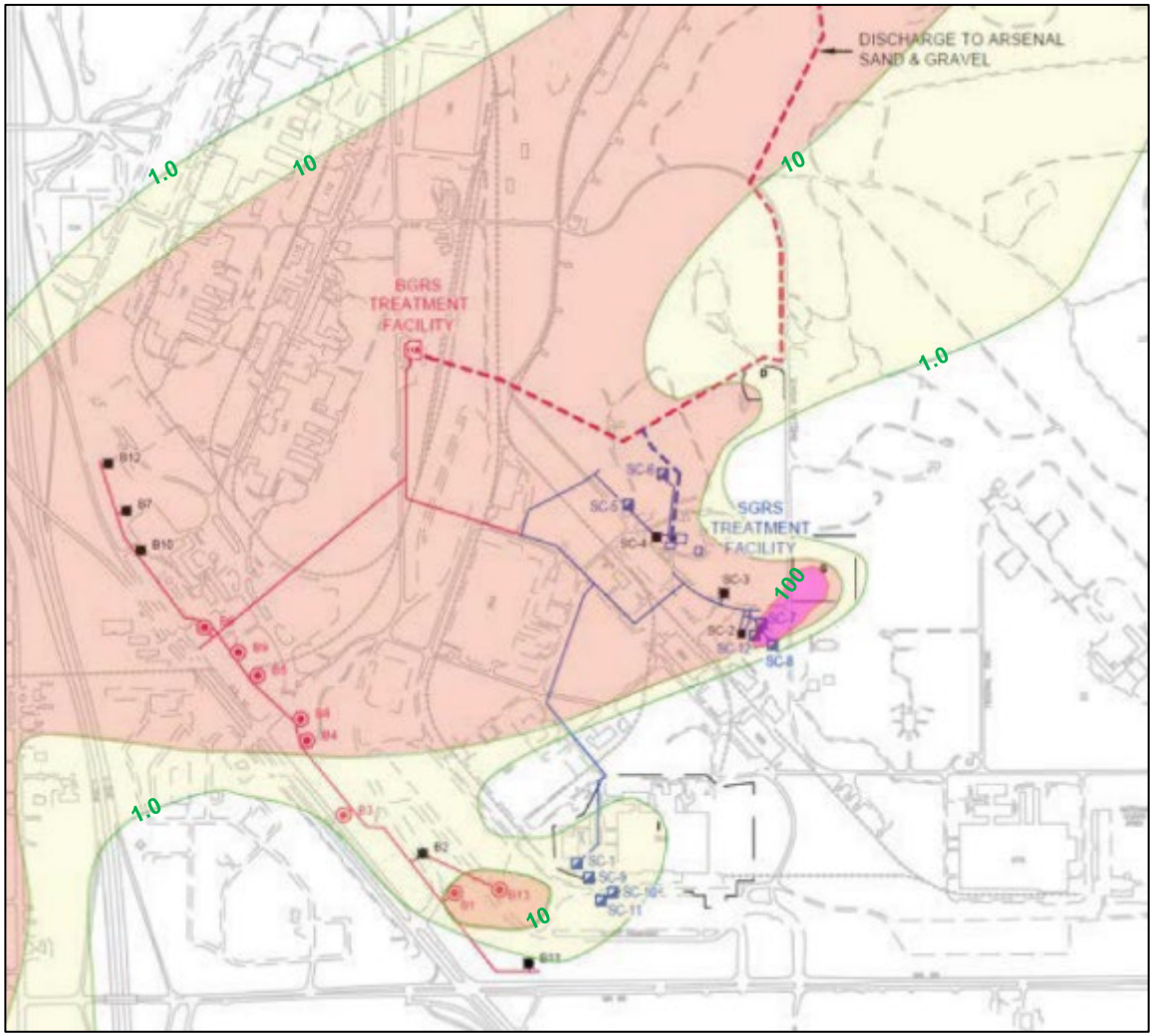


OU2 Optimization – TGRS Layout – 1,4-Dioxane

Boundary Groundwater Recovery System (BGRS)

Source Area Groundwater Recovery System (SGRS)

BGRS + SGRS = TGRS



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OU2 Deep Groundwater Remediation – FY25
Total TGRS Operation Update

- The FY25 annual average extraction rate (BGRS + SGRS) is approximately 1,927 gal per minute (gpm) through August 2025, **well above** the Global Operating Strategy (GOS) Operational Minimum of 1,745 gpm.
- GOS is based on the 2001 TCE plume concentrations
- FY24 TCE plume width is ~17% narrower than the FY01 plume. TCE contained by TGRS during FY24.
- Through August 2025, the BGRS has pumped 765,610,800 gallons and removed 258 lbs of VOCs; and the SGRS has pumped 163,745,880 gallons and removed 1,155 lbs of VOCs.
- TGRS Operating Strategy Revision is being prepared to optimize contaminant removal & more efficiently sustain hydraulic containment of the source areas.

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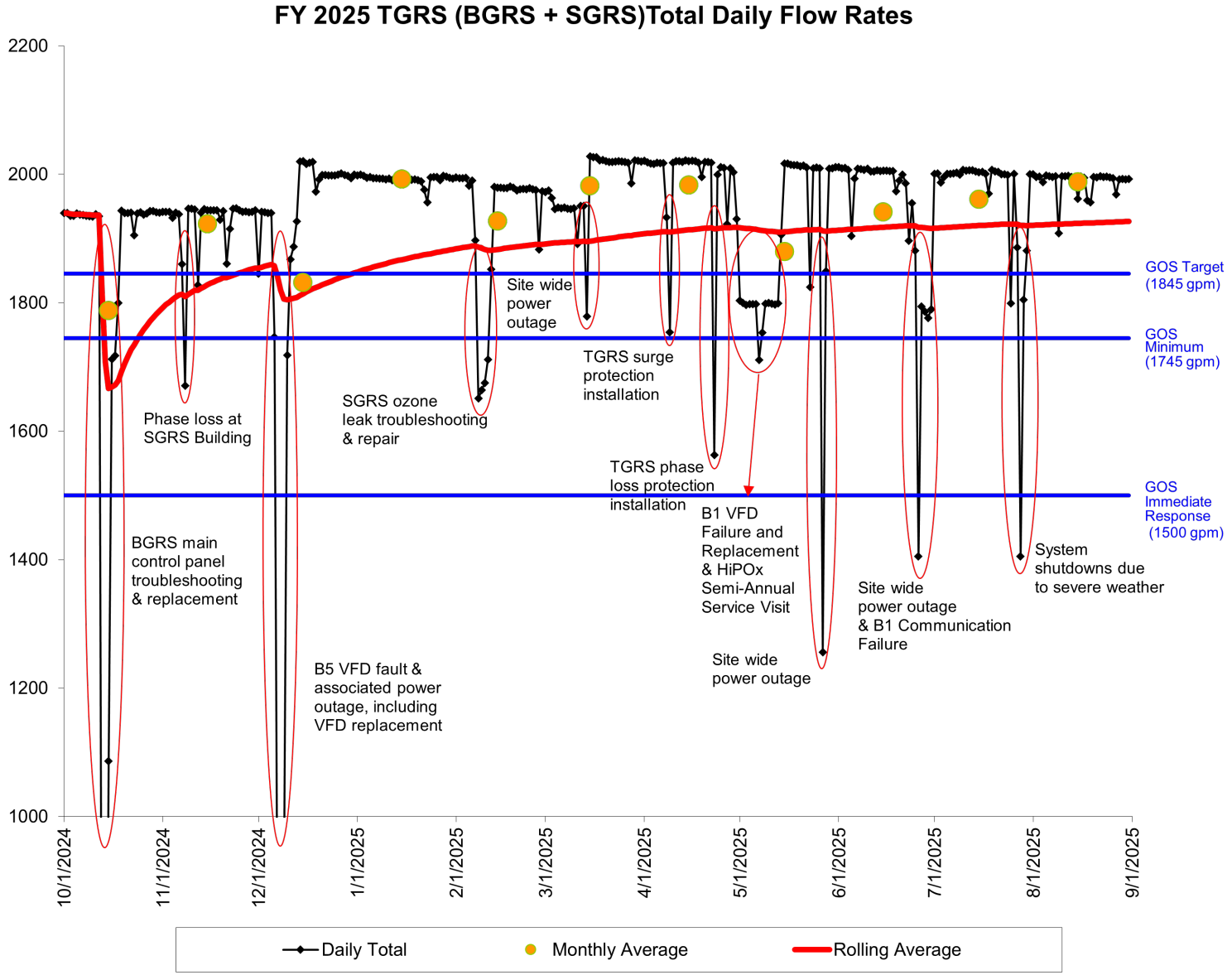
FY25 Daily Flow Rates



POC Information (Thomas Toudouze, U.S. AEC, 520-674-1984, thomas.p.toudouze2.civ@army.mil)

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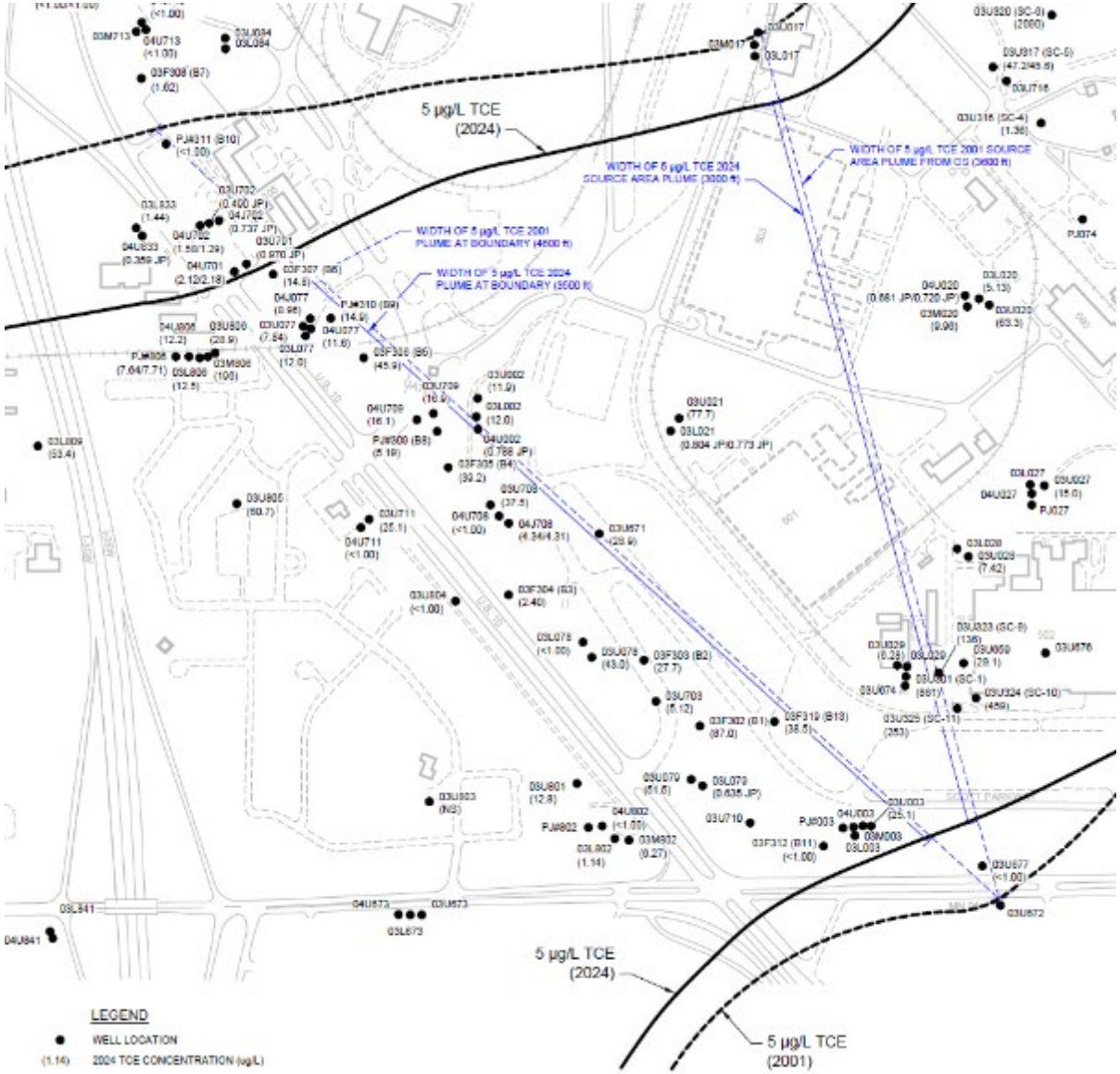
FY24 TCE Plume (3,000 feet wide)



TGRS, SGRS Update

SGRS (Source Area) System Operation – AO + Air Stripper

- System is operating and meeting all 1997 OU2 ROD and 2020 ESD #3 discharge criteria in monthly sampling since start up, including:

SGRS Discharge	Criteria
1,4-Dioxane	1.0 µg/L
TCE	5 µg/L
1,1,1-TCA	200 µg/L
Bromate	10 µg/L

- Full treatment to criteria of 1,4-dioxane and TCE in AO reactor; air stripper only needed for chlorinated alkanes
- Since the SGRS began operation, influent TCE and 1,4-Dioxane concentrations decreased by over 71% through August 2025. TCE and 1,4-Dioxane concentrations in the individual SGRS extraction wells also decreasing.

SGRS Air Emissions

SGRS startup sampling results:

- Measured contaminants were much less than those assumed/modeled in April 2021
  - No detectable ozone within the SGRS Building (previously assumed @ 0.18 lb/hr),
  - TCE into air stripper less than 5 ug/L (vs. assumed @ 32 ug/L)

- Confirmed through MPCA screening model that SGRS air emissions are below State of Minnesota inhalation risks levels for acute, subchronic, chronic, and cancer exposures for at National Guard fence line.

TGRS, BGRS Update

BGRS (Boundary) System Operation – Air Stripper

- System is operating and BGRS Effluent samples met all 1997 OU2 ROD discharge criteria in monthly sampling completed during FY25 *(through August).*
  - TCE all less than 5 µg/L limit
  - All other contaminants of concern were non-detect (<1.0 µg/L)

BGRS VOC influent concentrations decreased from FY24 to FY25 (*through August)*:

Averaging ~35 µg/L

BGRS Air Emissions

- Development activity has not begun in this area and there are currently no receptors. Modeling and sampling completed in 2020.
- 80% reduction in TCE influent concentrations at BGRS since SC-5 and SC-1 were rerouted from BGRS to SGRS. Influent TCE reduced from 201 µg/L in 2020 to less than 40 µg/L *through August 2025*.
- TCE emission rate through August 2025 = 0.0033 g/s (2020 modeled emission rate = 0.005 g/s).
- Additional air sampling and modeling will be completed for BGRS emissions *prior to receptors being in the area associated with Ramsey County development work.*

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PFAS Update

- A Preliminary Assessment and Site Inspection (PA/SI) was finalized in September of 2023.
- In July of 2024, the Army received a joint letter from EPA and MPCA disagreeing with the number of Areas of Potential Interest (AOPIs) moving forward to a Remedial Investigation and Feasibility Study (RI/FS).
- In November of 2024, a discussion between USAEC and EPA was held to discuss a path forwards, this includes a supplemental screening and sampling event to identify sites potentially missed during the PA/SI. This effort will be combined with the RI/FS contract.
- In January 2025, the Department of Defense adopted new screening levels for PFAS. Due to this two additional AOPIs have been added to the RI, the Southwest Sewer System (Site J) and the Open Burn Area/Salvage Area (Site C).
- A RI/FS contract is currently on hold due to budgetary constraints. Additional funds specifically for PFAS expected to be provided in FY27 – FY31.

PFAS Update

- Because of the timeline of the DoD PFAS investigation, Ramsey County is voluntarily performing PFAS screening activities of soils on the Rice Creek Commons parcel.
- Ramsey County has submitted a QAPP/Workplan for this PFAS work to EPA, MPCA, and the Army. Regulators have provided comments on the QAPP/Workplan.
- Next steps
  - Finalization of QAPP/Workplan
  - Sampling and analysis

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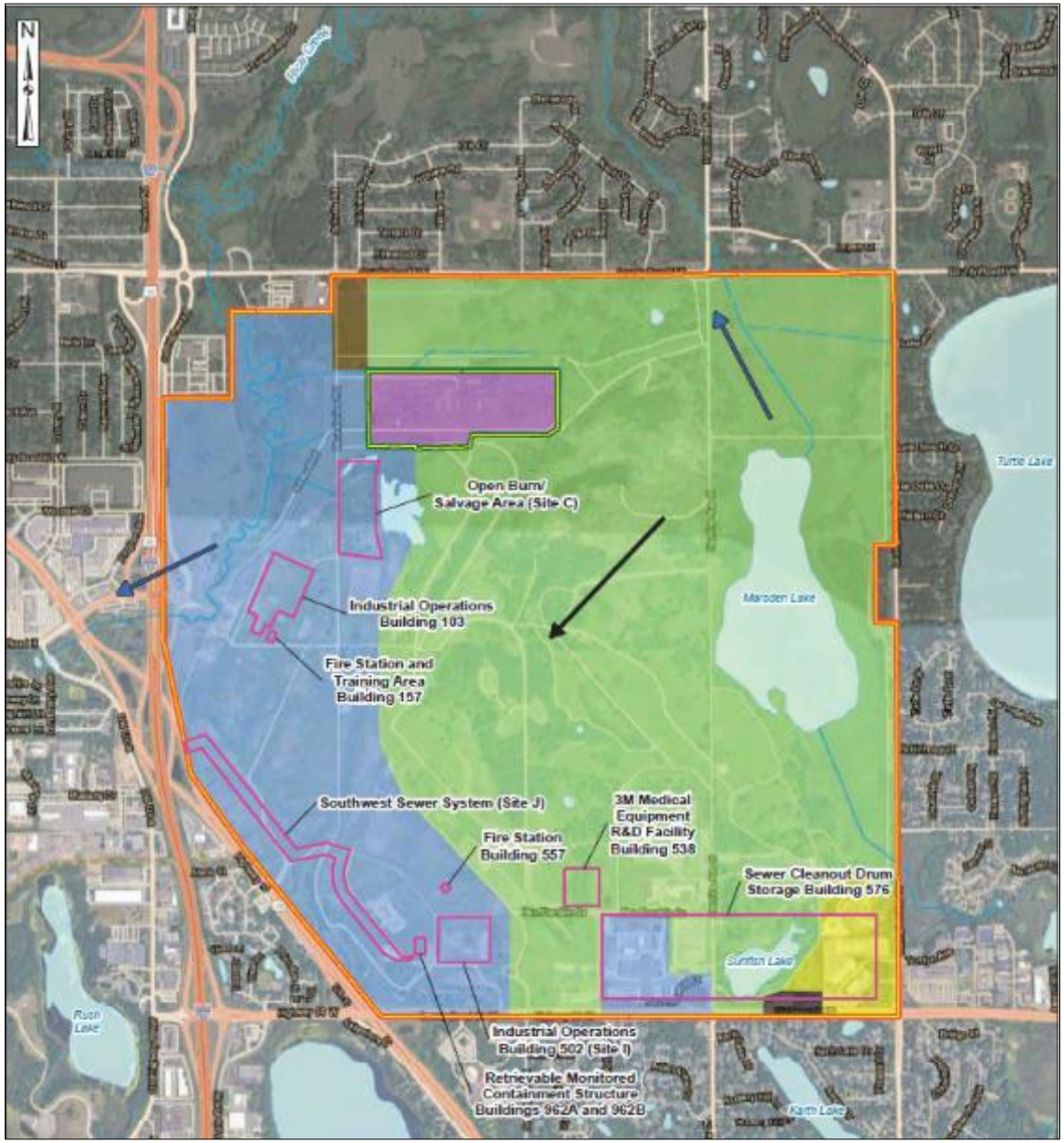
Map of AOPIs



Current PFAS AOPIs

- Building 103
- Building 157
- Building 502
- Building 576
- Site C
- Site J

Additional AOPIs are under consideration on the Rice Creek Commons parcel.

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TCAAP Community Involvement Plan

- The Army is in the process of renewing their Community Involvement Plan (CIP) for TCAAP.
- The purpose of the CIP is to gauge current community interest and best methods of communication with them. It is required to be periodically updated.
- The first phase of renewing the CIP involves short interviews members of the community around the installation.
- If you are interested in participating in these interviews please contact Carla Avery at (848) 327-4448 or cavery@contifederal.com between now and October 15th.

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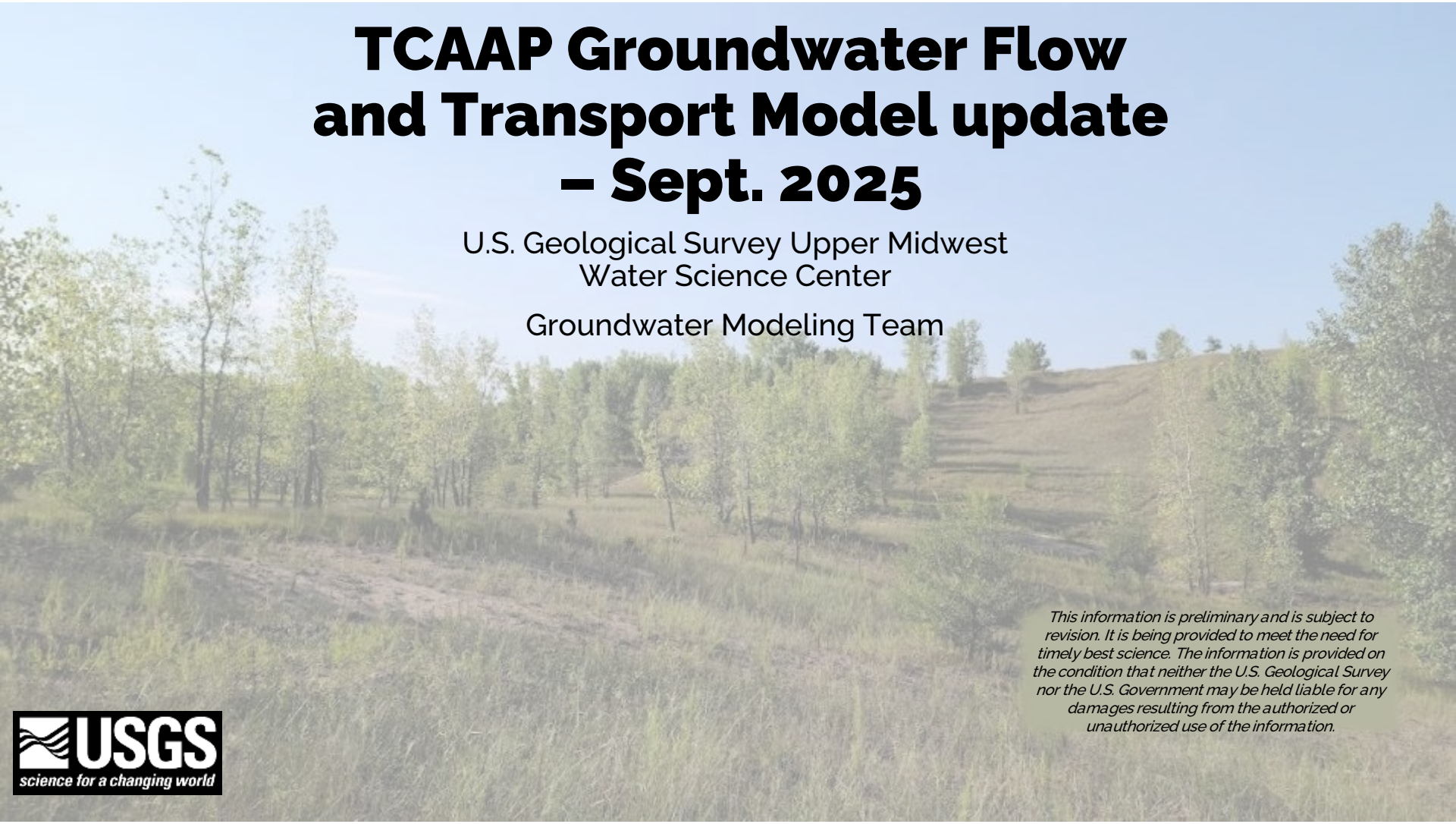
Additional Presentations

- USGS Groundwater Model Update

TCAAP Groundwater Flow and Transport Model update – Sept. 2025

U.S. Geological Survey Upper Midwest
Water Science Center

Groundwater Modeling Team



This information is preliminary and is subject to revision. It is being provided to meet the need for timely best science. The information is provided on the condition that neither the U.S. Geological Survey nor the U.S. Government may be held liable for any damages resulting from the authorized or unauthorized use of the information.

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Project Overview

- Build groundwater flow model and transport models to simulate the groundwater system near TCAAP
  - Focus on the deeper groundwater contamination that originates in OU2 and migrates offsite in OU1 and OU3
  - Contaminants
    - 1,4-dioxane
    - Trichloroethene (TCE)
- Model objectives:
  - Estimate the expected plume capture from the pumping remediation system
  - Assess future plume behavior and footprint

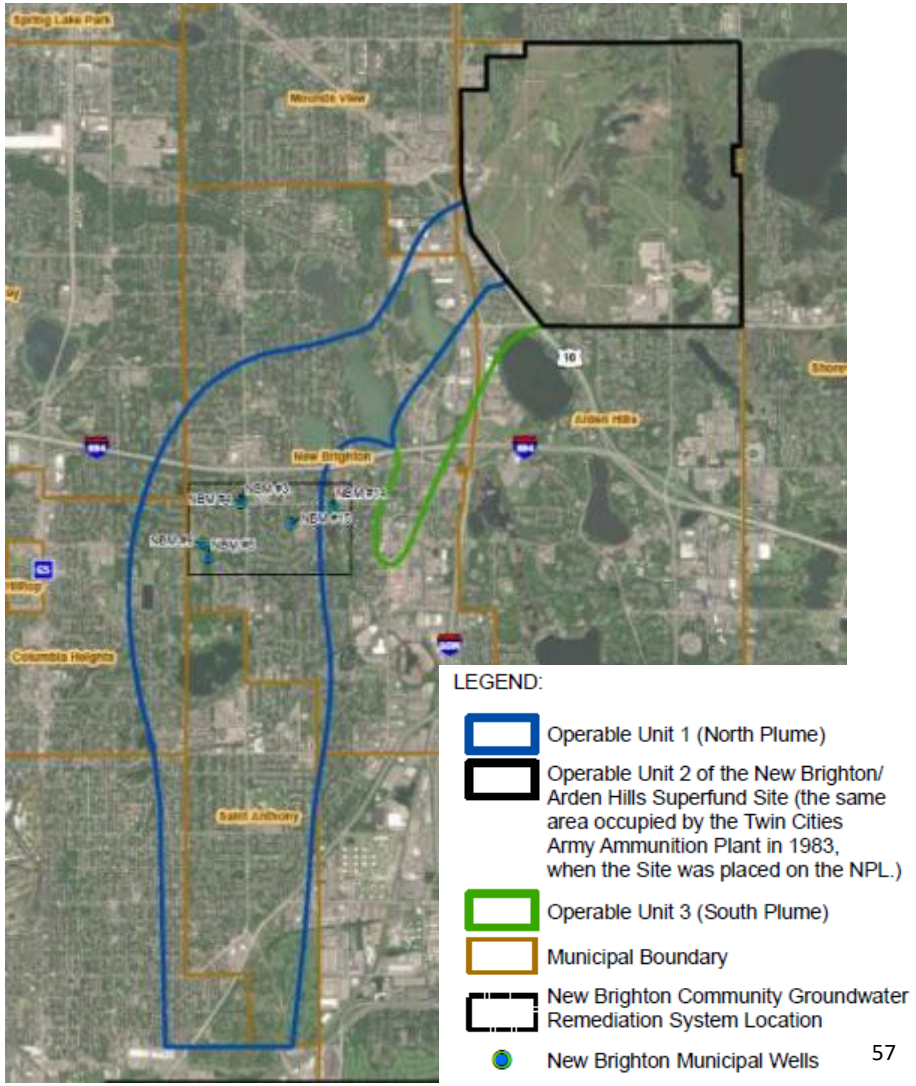

Figure modified from Figure 2-1 in the Fiscal Year 2020 *Annual Performance Report*.

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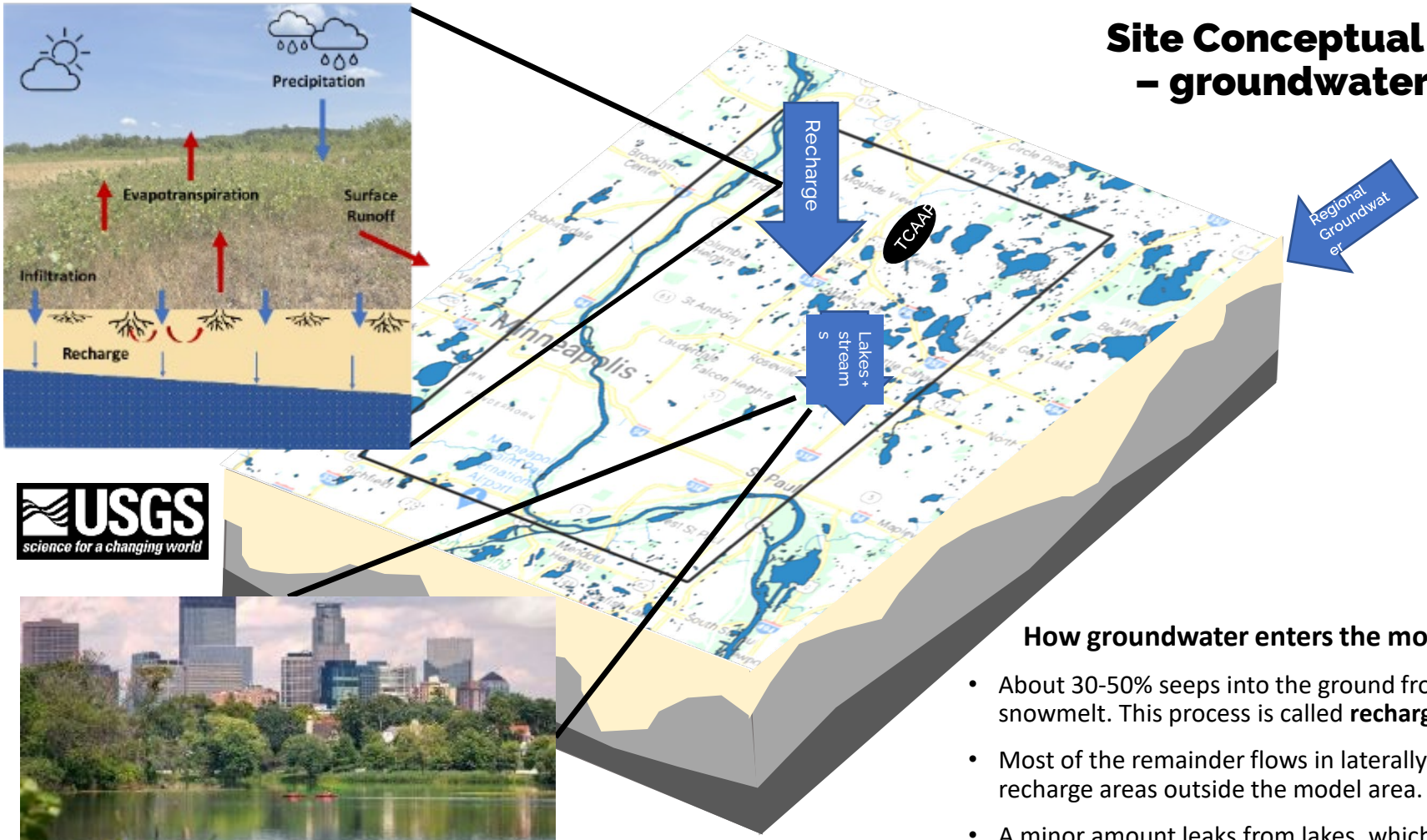
Site Conceptual Model – groundwater flow



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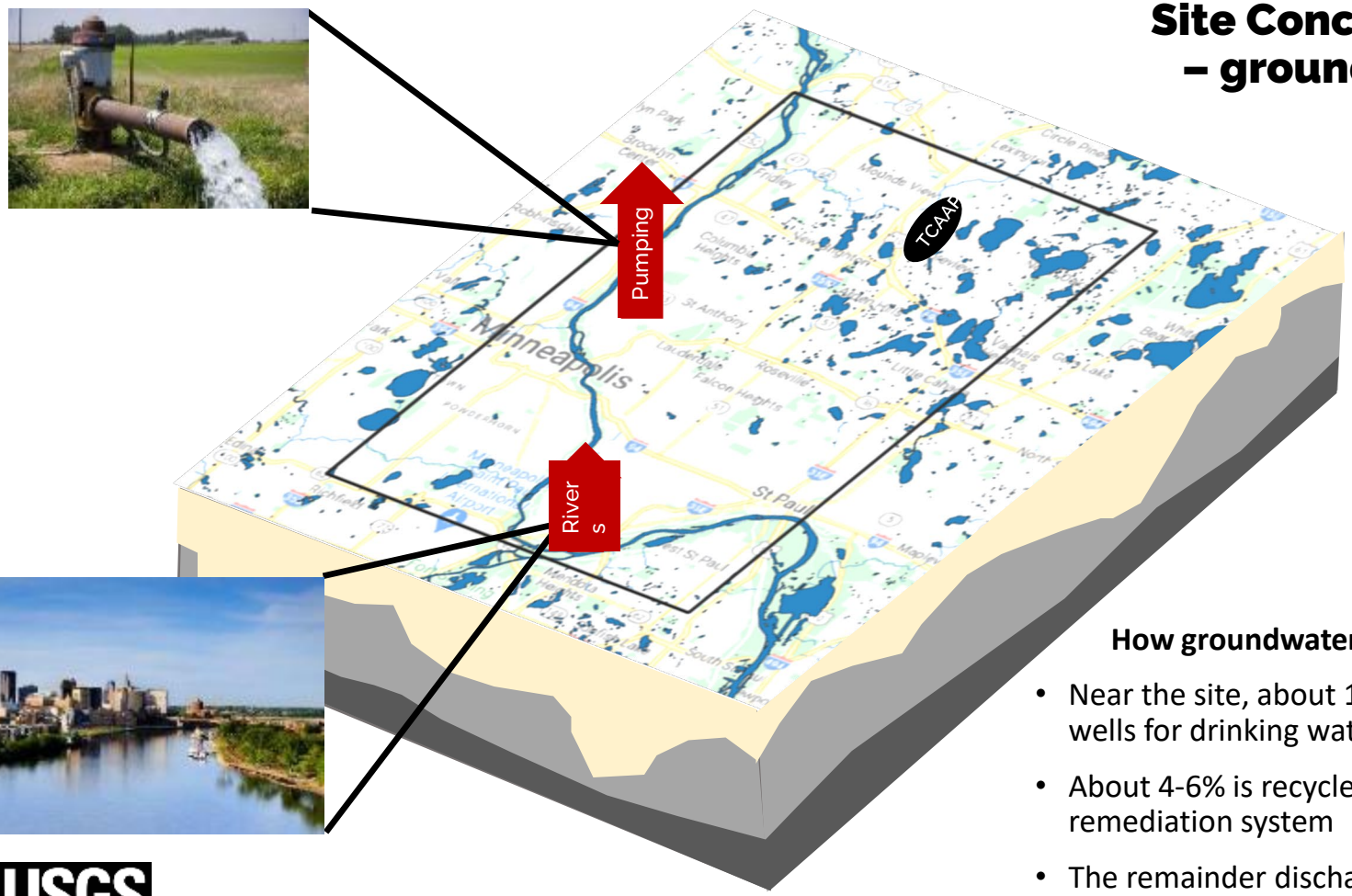
How groundwater enters the model area

- About 30-50% seeps into the ground from rain or snowmelt. This process is called **recharge**.
- Most of the remainder flows in laterally from other recharge areas outside the model area.
- A minor amount leaks from lakes, which are generally above the regional water table near the site.

Site Conceptual Model – groundwater flow



How groundwater leaves the model area

- Near the site, about 15-25% is **pumped** from wells for drinking water and other uses
- About 4-6% is recycled through the remediation system
- The remainder discharges to Rice Creek and the Mississippi River

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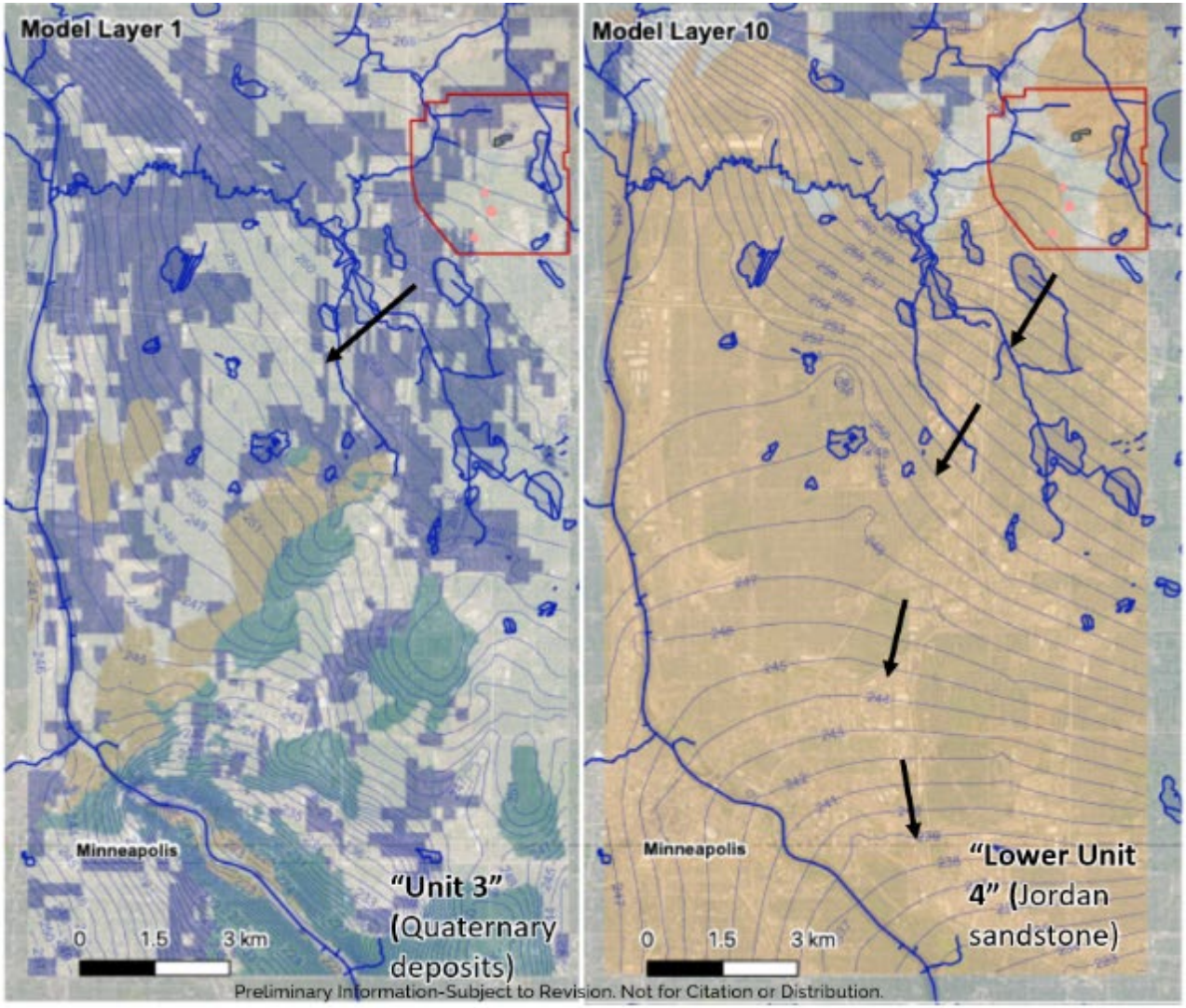
Groundwater Flow Directions

- Groundwater flow depends on the locations and strengths of sources and sinks and the aquifer geometry
- At TCAAP shallow groundwater generally flows northeast → southwest, toward the Mississippi River.
- At greater depths, flow shifts more south toward St. Paul.



TCAPP
TCE Source Areas
Groundwater flow direction
Modeled streams and lakes
Groundwater elevation, in meters

Geologic Units
Quaternary, fine
Quaternary, coarse
Decorah/Platteville/Glenwood
St. Peter
Upper Prairie du Chien (Shakopee)
Middle Prairie du Chien (high-K zone)
Lower Prairie du Chien (Oneota)
Jordan Sandstone

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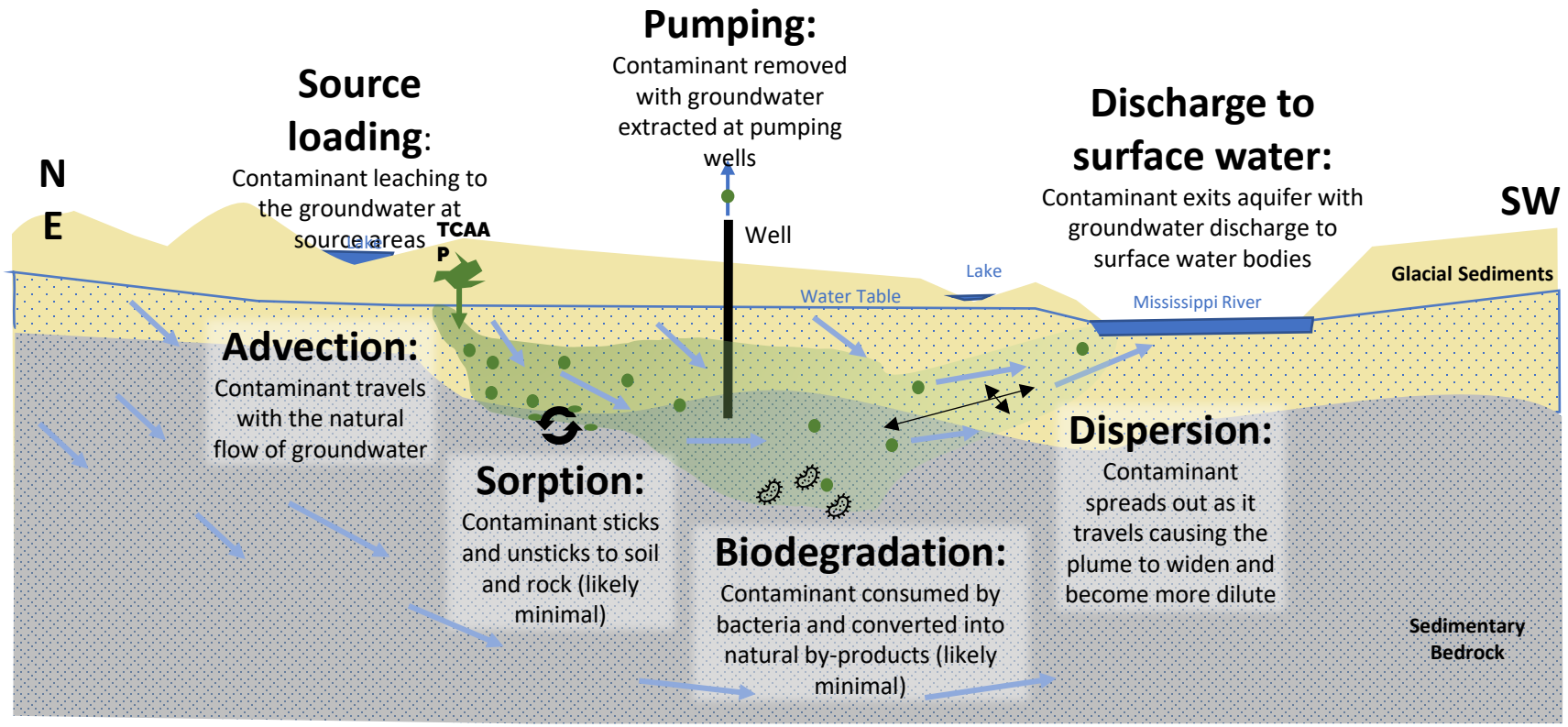
Site Conceptual Model – contaminant transport



Not to scale.

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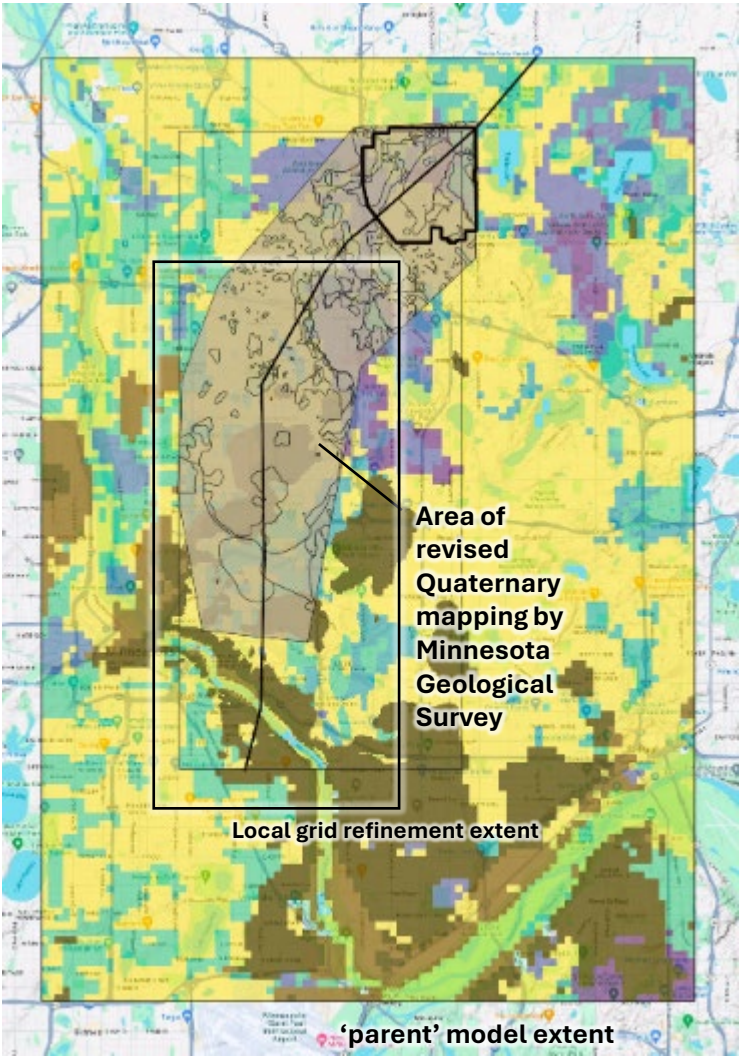

Model Area & Time Periods

Model Grid

- Area: From just north of TCAAP to the Mississippi River
- Grid:
  - Plume zone: 50 m cells, 11 layers (extending through Jordan)
  - Outside plume: 200 m cells, 16 layers
- Layers: From upper glacial deposits down to Mt. Simon Sandstone

Flow model time periods

- 2 steady-state flow periods:
  - 2000-2020: previous pump and treat system
  - Feb 2023 onward: current remediation system

Transport model time periods

- 6-month transport time steps
- TCE modeling: starts 1999
- 1,4-Dioxane modeling: starts 2017

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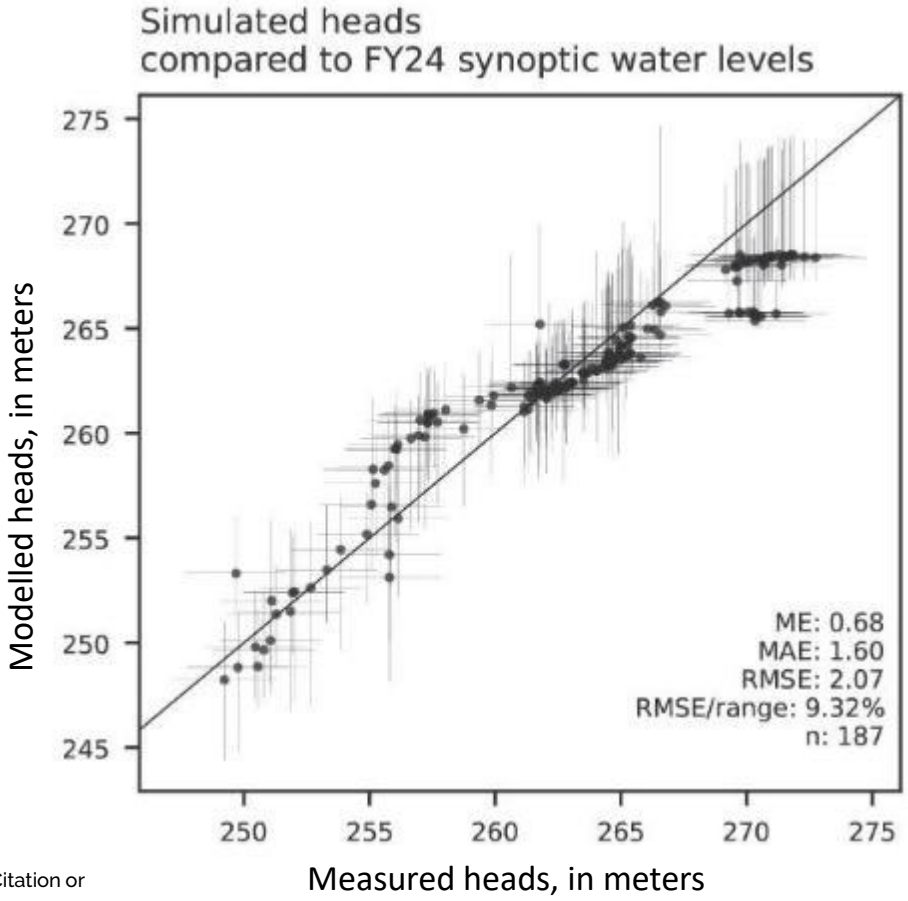
Model parameter estimation / History matching

- Goal is to improve model inputs (parameters) by matching observed data
- Ensemble approach where hundreds of plausible models are considered
- Simulated groundwater elevations, streamflows, and contaminant concentrations are compared to field observations
- Iterative process where:
  - Parameter estimation algorithm is run
  - Modeler looks at history matching results and adjusts model
  - Parameter estimation is run again…



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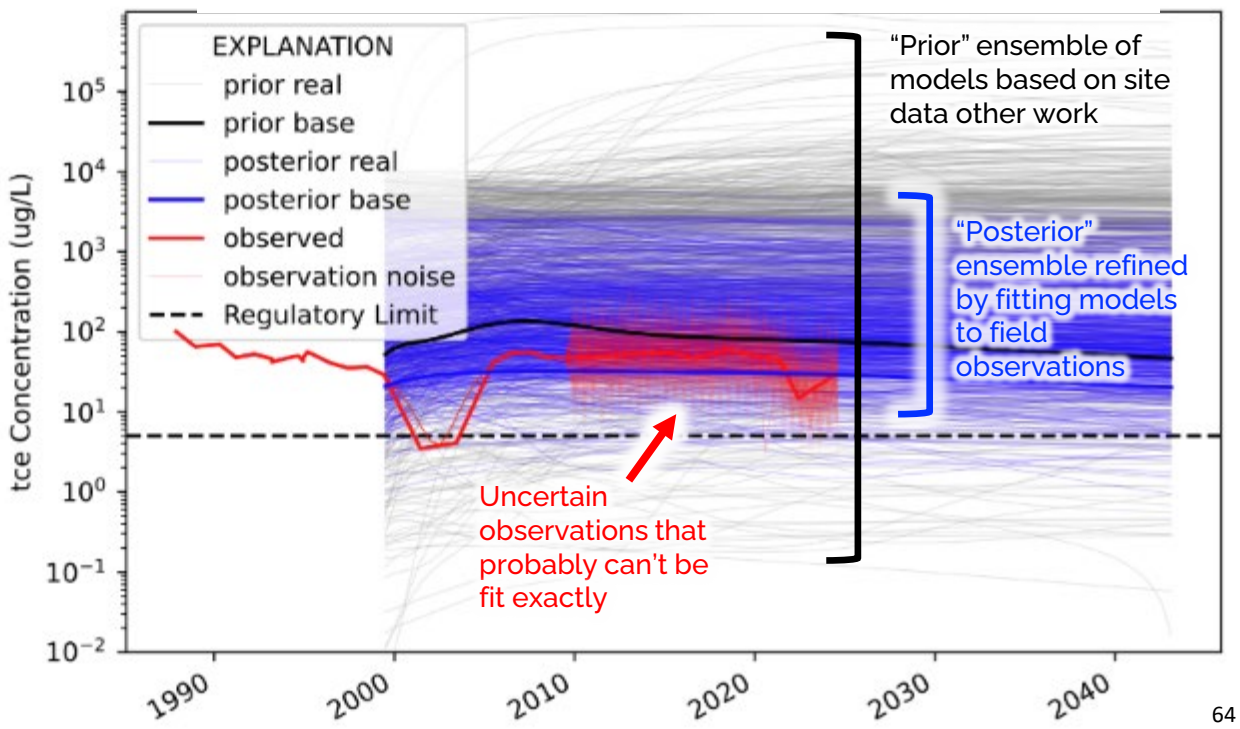
History matching: Example of concentration time series

- Goal is to reproduce recent general trends and patterns
- Challenges with conflicting observations; probably stemming from fine-scale details in source configurations, initial contaminant distribution, hydraulic gradients and geology.



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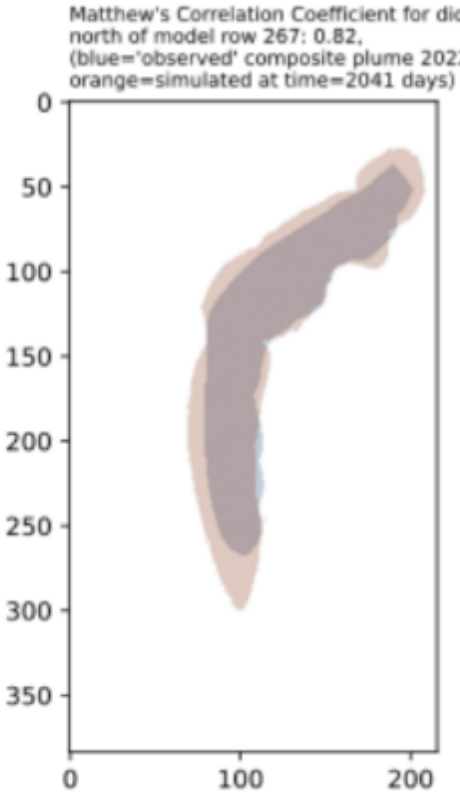
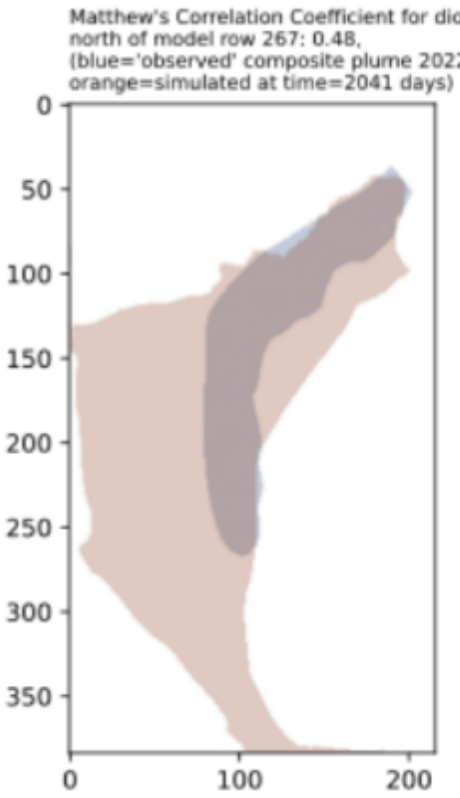
History matching: Example of evaluating plume match

- Persistent issue with plume traveling west of "interpreted" extent, especially in middle Prairie du Chien
- Plume shape may depend on complex hydrogeology that isn't fully informed by "hard" field data (groundwater levels, available concentrations, etc.)
- Need to quantify/guide parameter estimation algorithm to what we "see" as a reasonable model
- Matthew's correlation coefficient accounts for true and false positives, and true and false negatives (1 = perfect correlation, 0 = no better than random chance, -1 = inverse correlation)

Realization with a good fit



Not as good of a fit



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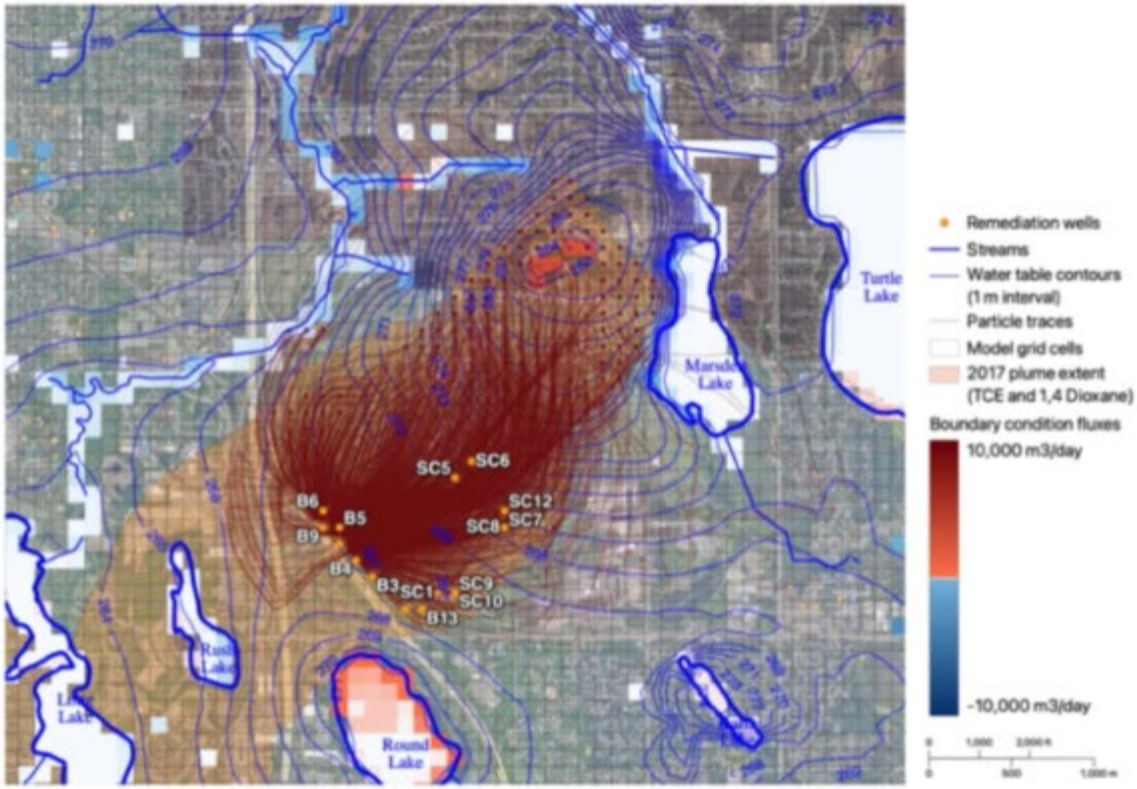
Model Forecasts: remediation system capture

- Goal is to estimate the fraction of plume volume captured by the on-site remediation system (TGRS)
  - Originating from the Site D, G & I source areas
  - Originating from within OU2 overall
- Particle tracking with MODPATH 7
- Particles released in each cell with the source area and OU2 volumes
- Forward tracking to on-site remediation wells and the New Brighton and St. Anthony municipal wells
- % capture "Forecasts" = number of particles capture / total number of particles



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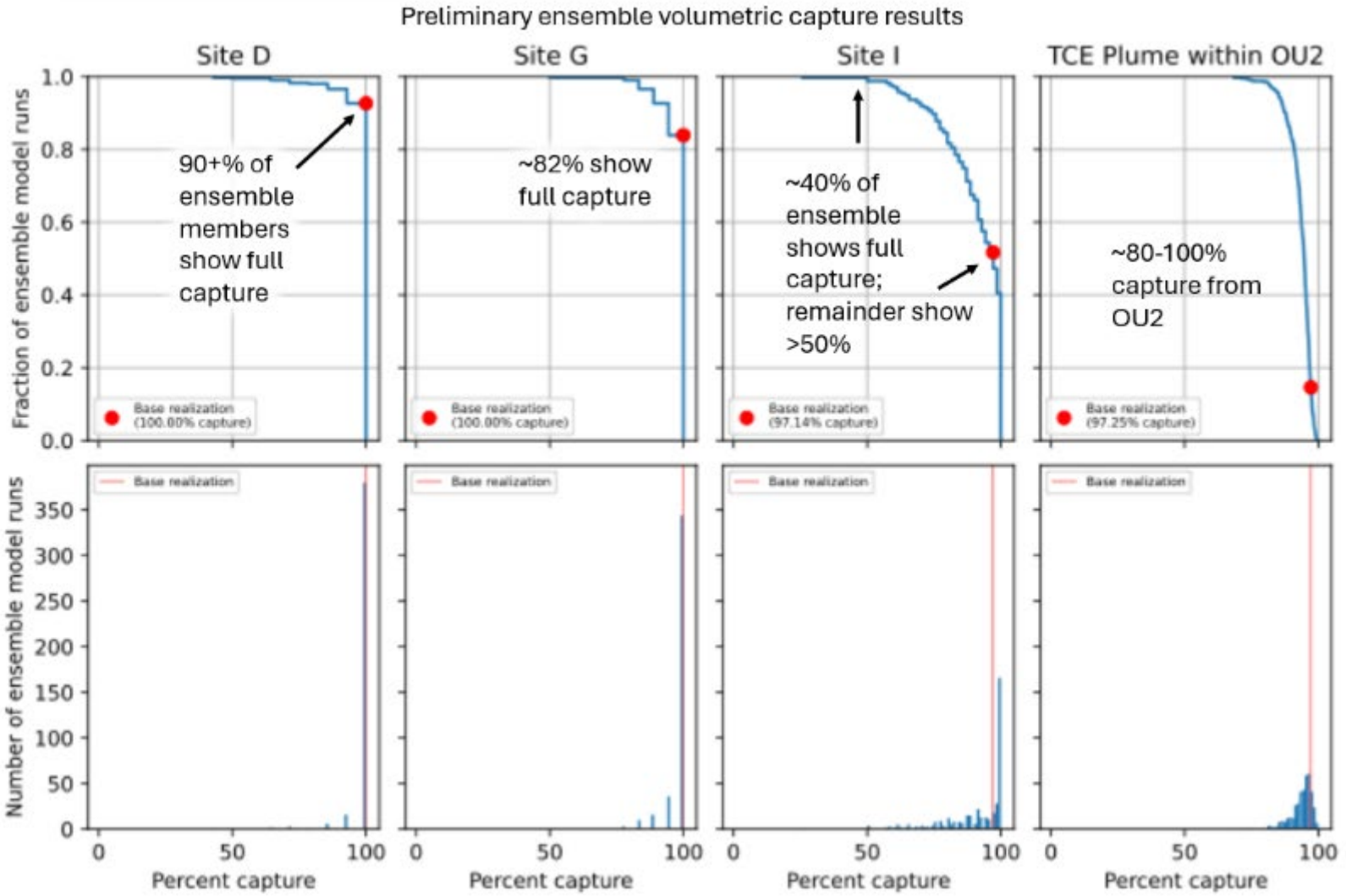
Pumping system capture results from MODPATH



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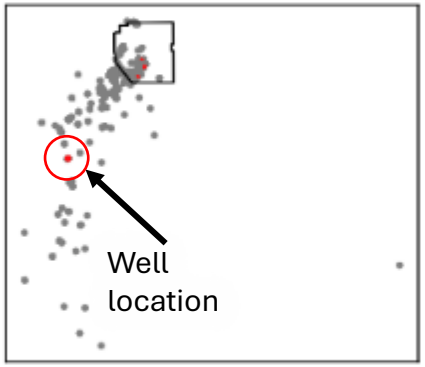
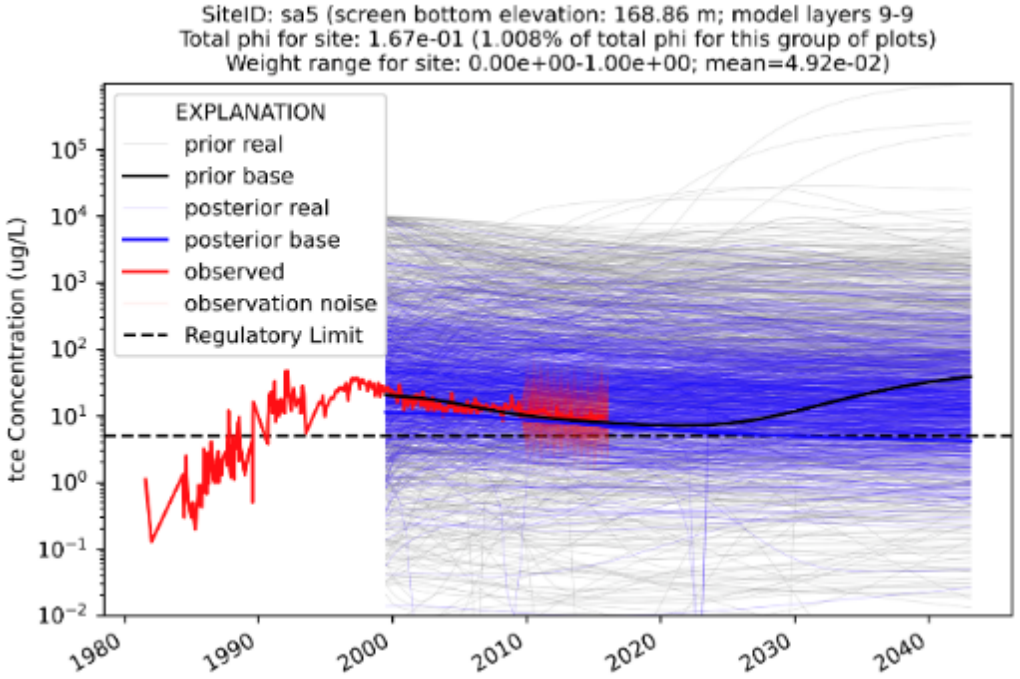
Model Forecasts: Future concentrations

- Concentrations at points of interest
- Overall shape of the plume





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Project Timeline

FY 2025

- Improve model history matching to reduce model uncertainty and better reproduce measured site data
- Built 1,4-Dioxane transport model
- Began drafting online map for users to interactively explore model results

FY 2026

- Final model adjustments and estimates of plume capture by pumping system
- Publication of model and results in USGS Series Report
- Archive model files in publicly available data release
- Publish interactive online map of model results

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Questions ?

Questions for the USGS Modeling Team that were not asked during the live presentation can be emailed to:

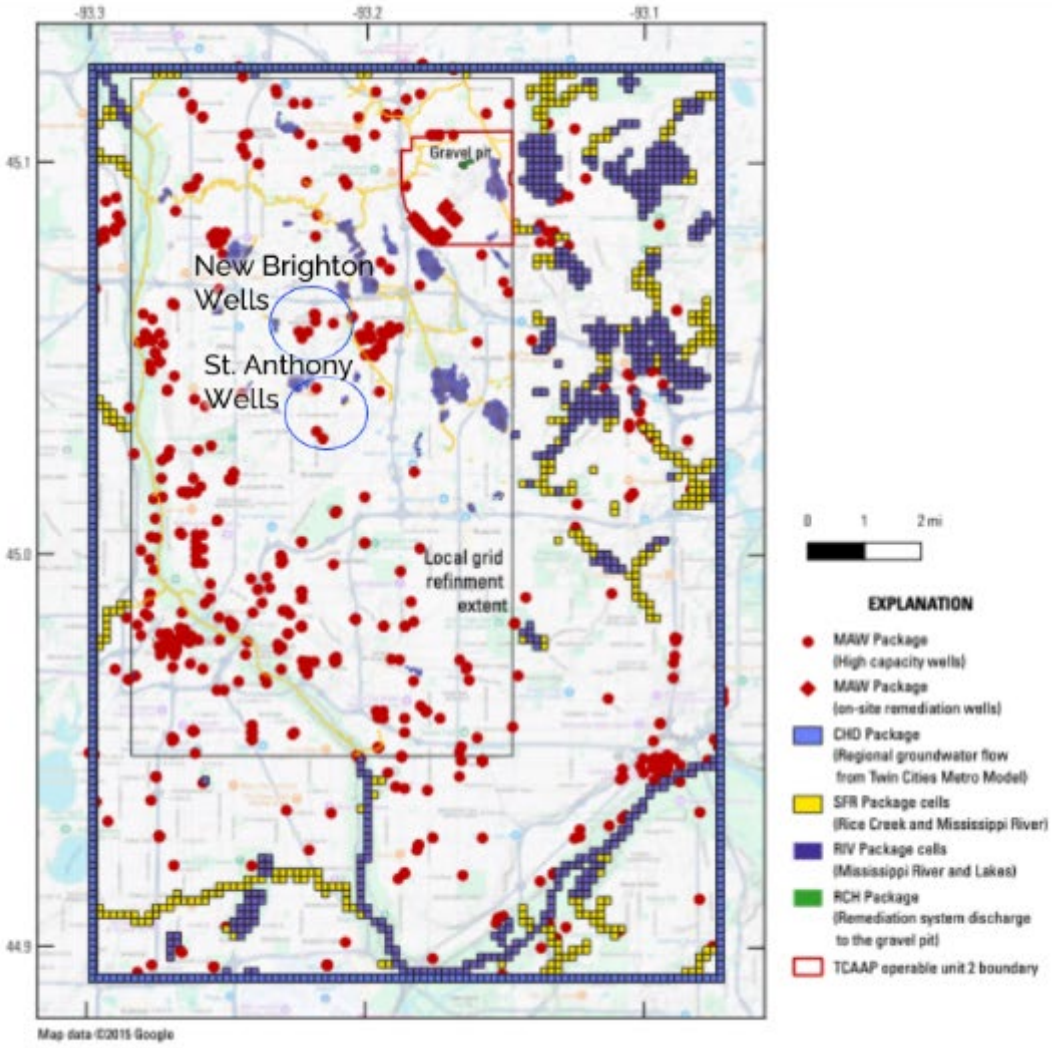
Meg Haserodt: mhaserodt@usgs.gov

Andy Leaf: aleaf@usgs.gov

Supplemental Model Information

Model boundary conditions

- Perimeter boundaries developed from Metro Model 3 flow solution
- Surface water developed from NHDPlus high resolution dataset (Buto and Anderson, 2020)
- Rice Creek and Mississippi River in local refinement area represented with Streamflow Routing package (SFR) (head-dependent flux boundary with stream water balance; simulated stages)
- Mississippi River in parent model and most lakes > ~7 acres simulated with River Package (RIV) (head-dependent flux boundary with specified stages)
- 1988-2020 average water use from the MNDNR Water permitting and reporting system (MNDNR, 2025)
- Groundwater recharge from Soil Water Balance Code



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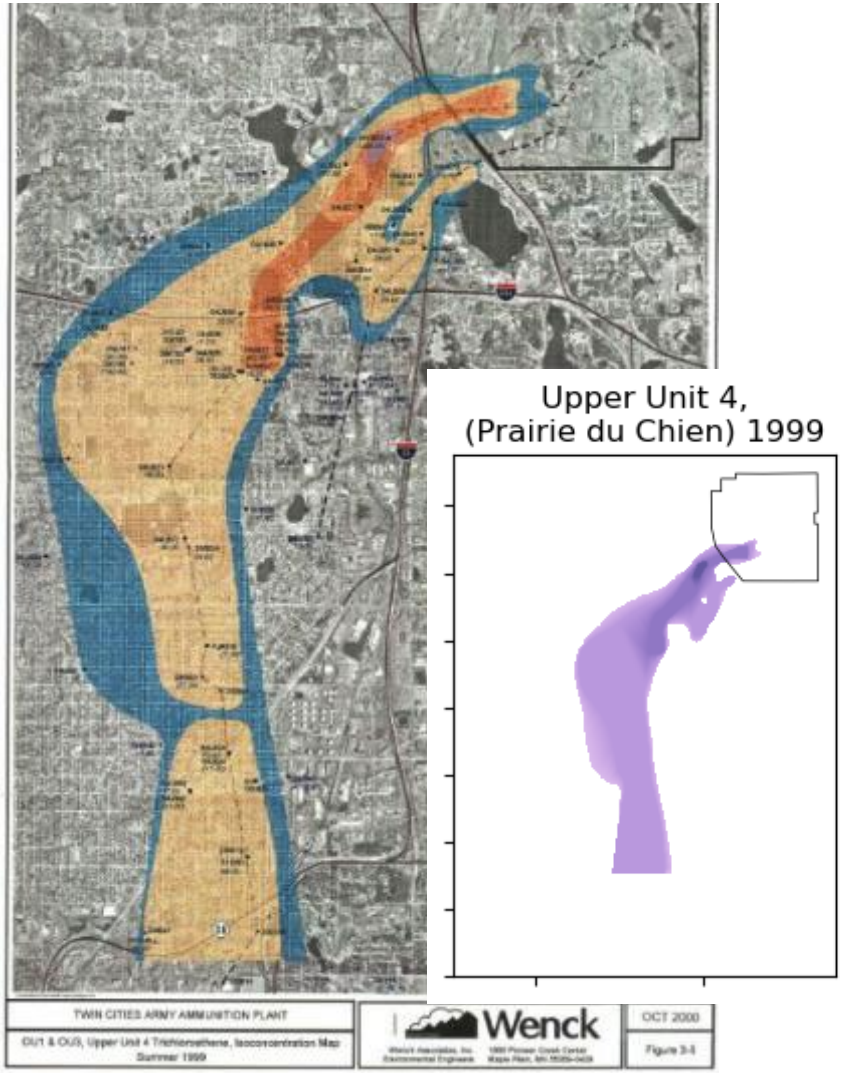
Transport model setup

- MODFLOW 6 Groundwater Transport
- Packages and assumptions
  - Advection
  - Dispersion
  - Mobile Storage and Transfer
    - Linear sorption for TCE
    - No sorption for 1, 4-Dioxane
    - No decay (degradation) for either species
  - Continuing source concentrations at sites I, G, and D (Mass Source Loading Package)
  - 1,4-dioxane loading (but no TCE) applied to gravel pit recharge (Source and Sink Mixing Package) in flow stress period 1
  - "Hot start" with initial conditions based on the TCE plume in 1999 and 1,4-dioxane plume in 2017
  - Initial concentrations based on maximum of rasterized, interpreted plumes and kriged observed concentrations in each model layer



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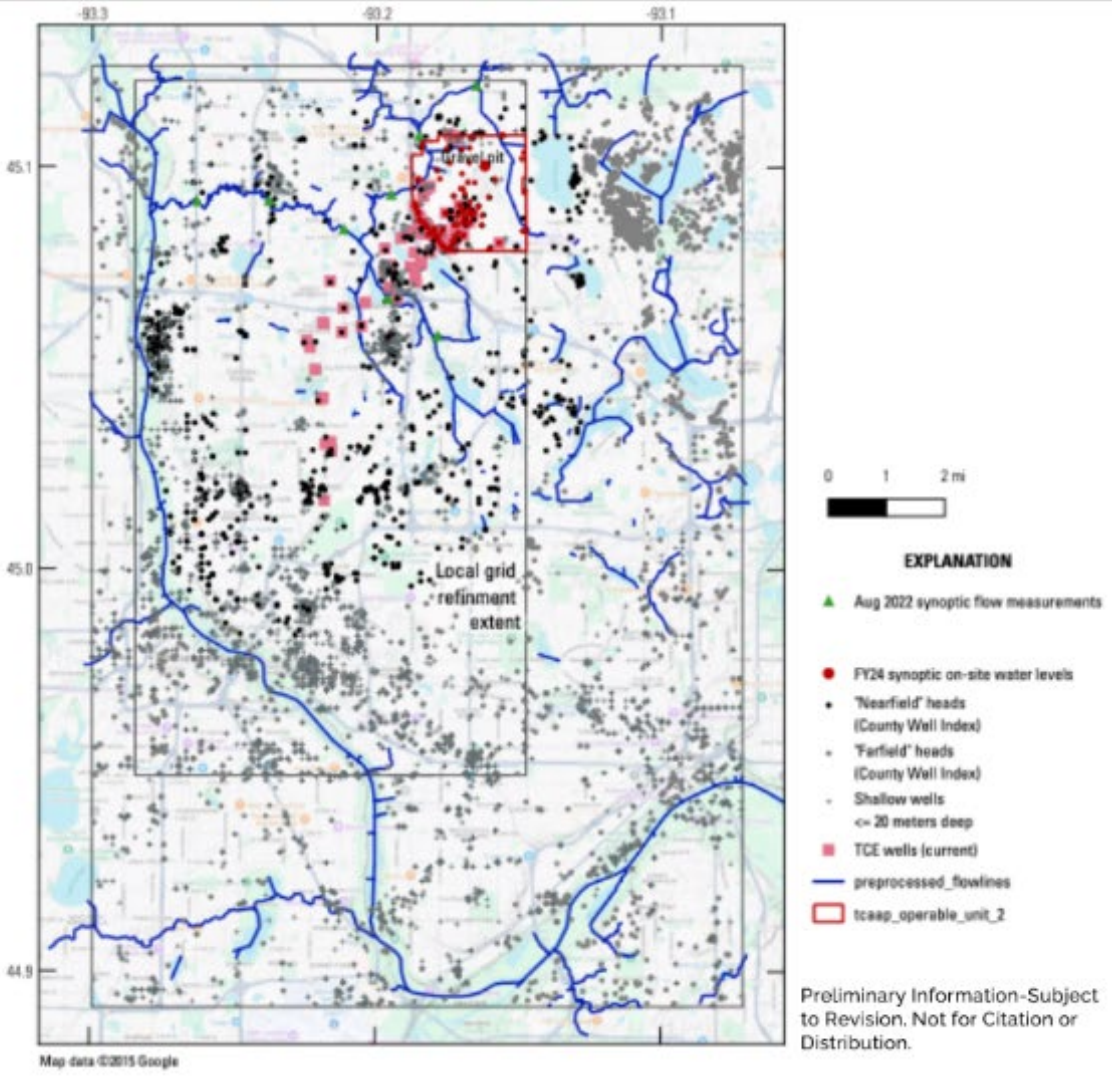
History matching observations

- County Well Index groundwater levels
  - Affected by varying climate and local pumping conditions over several decades
  - Many shallow monitoring wells that represent either perched water or vertical gradients that can't be resolved by the model
- Rice Creek flow measurements approximate-taken under median flow conditions
- Synoptic measurements of streamflow, TCAAP site monitoring data, & USGS gravel pit stage measurements provide coherent picture of horizontal and vertical gradients
- Observations of TCE concentrations grouped into monitoring wells vs extraction wells
- Log-weighting of TCE concentrations with truncation of near-zero simulated values



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Parametrization / History matching approach

- MODFLOW 6 Groundwater Flow, MODPATH 7 and MODFLOW 6 Groundwater Transport models combined in single forward run
- Parameter estimation algorithm: PEST++IES
- Hydraulic conductivity
  - Initial values from previous studies and MN Geological Survey
  - Multiplier parameters by zone, by zone and layer, and pilot points (regular 500m spacing; only in local grid refinement area)
  - Vertical anisotropy estimated; converted to Kv in forward run
- Global recharge multiplier of 0.5 to 2
- SFR package:
  - Global Kv multiplier
  - Rice Creek inflows allowed to vary from -50 to +100%
- RIV package conductance multipliers allowed to vary by lake from 0.0001 to 100
- MAW package pumping rates allowed to vary by well by +/- 20%
- Effective porosity and initial contaminant concentration multipliers estimated on finer (300m) pilot point grid only within the plume area
- Dispersivity (longitudinal, transverse, and vertical) multiplied globally and by layer and zone
- Continuing source concentrations multiplied by site, by site and layer, and by cell
- Distribution coefficient (for TCE linear sorption; Kd = Koc x foc) estimated globally
- Localization: no connections allowed between flow-related observations and transport model properties

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What's Next

- OU1
  - New Brighton new well drilling and installation.
  - Begin industrial well abandonment (3 wells).
  - Begin installation of 4 monitoring wells.
- OU2
  - Begin abandonment of 42 monitoring wells.
  - Begin installation of 1 monitoring well including optimization of the monitoring well network.
  - Begin Risk Assessment for unrestricted land use.
  - 135 Primer Tracer Area – sold.
- OU3
  - Continue groundwater monitoring.
- Round Lake
  - Continue remedial design.
- Administrative Record/Information Repository
  - Army working with Arden Hills Army Training Site (AHATS) to enlarge space.

TCAAP Points of Contact

- Thomas Toudouze, U.S. AEC Environmental Support Manager
  - thomas.p.toudouze2.civ@army.mil
  - 520-674-1984
- Viral Patel, U.S. EPA Remedial Project Manager
  - patel.viral@epa.gov
  - 312-886-6943
- Brigitte Hay, MPCA Environmental Specialist/Project Manager
  - brigitte.hay@state.mn.us
  - 651-757-2497

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Next Meeting Agenda

- Recommend next RAB meeting 17 February 2026.
- Review/Approve minutes of last meeting
- Old Business
- Cleanup Status Update
- New Business
- Next Meeting Agenda
- Public Comments

Public Comments and Questions

- Does anyone have any comments, concerns or suggestions?
- Topics for future RAB meetings?
- Additional administrative requirements for RAB?
- Suggestions for improvement of RAB?
- You can ask questions now or at anytime using the email listed on the website.