

# OPEN HOUSE FORMER NEBRASKA ORDNANCE PLANT

16 JUNE 2020 AT 6:00 P.M.  
VIRTUAL MEETING VIA WEBEX

Molly Boughan

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U.S. Army Corps of Engineers Kansas City District

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# VIRTUAL MEETING ETIQUETTE

- Please mute the volume on your computers or phones.
- Please hold all questions and comments until the end of the presentation.
- Additional questions and comments can be emailed or submitted:

## By mail:

**USACE, Kansas City District**  
**ATTN: Ms. Molly Boughan**  
**601 E. 12th Street**  
**Kansas City, MO 64106**

## By email:

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# TONIGHT'S AGENDA

- Project Posters
- CE Presentation
- Omadi Bedrock Formation Phase III Assessment Update
- Focused Extraction Well FEW-19 Pre-Design Update
- 2021 Groundwater Profiling Investigation Update

***Remember, it's your meeting.***



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## Former Nebraska Ordnance Plant Open House Schedule



### Upcoming Events

June 16, 2021 - 2020 Containment Evaluation (Virtual Meeting)

Fall 2021 (tentative) – Site Tour



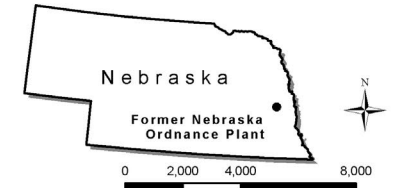
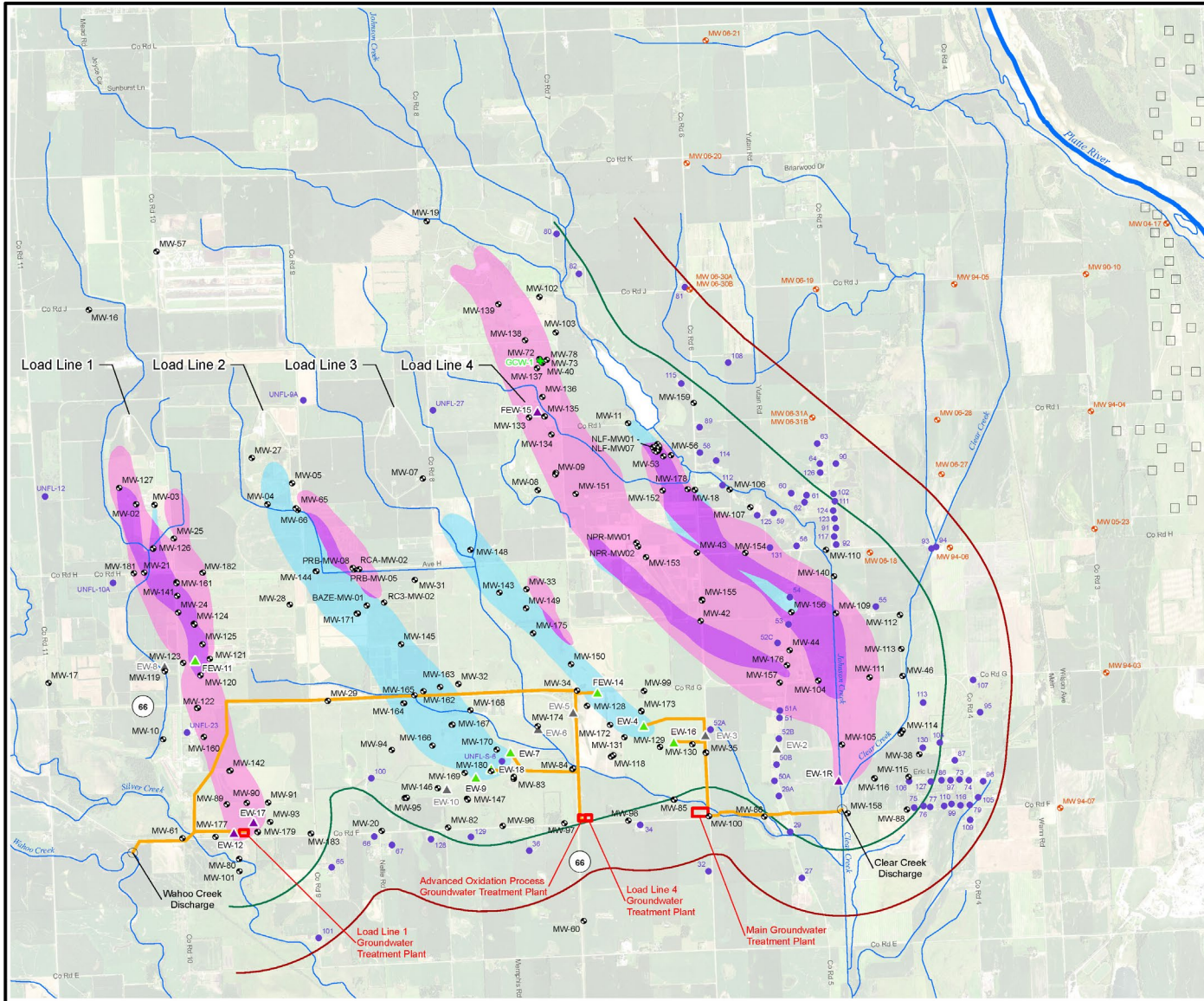
Open house sessions are held semiannually. These open house sessions provide local landowners and other interested parties up-to-date information regarding site activities. Project staff, representing several disciplines including geology, hydrogeology, chemistry, and engineering, are available during these meetings to answer questions and provide technical support. The fall 2021 open house is tentative, depending on the status of COVID-19. Updates will be posted to the project website:  
<https://www.nwk.usace.army.mil/Missions/Environmental/Environmental-Projects/NOP/>



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**Figure 1-2**  
**Site Layout**  
**Former Nebraska Ordnance Plant**  
 Mead, Nebraska  
 Site-Wide Work Plan



- Legend**
- Groundwater Monitoring Well/Well Cluster
  - Water Supply Well
  - ▲ Groundwater Extraction Well
  - ▲ Groundwater Extraction Well with AOP UV Treatment Unit
  - ▲ Groundwater Extraction Well (Inactive)
  - ◆ Groundwater Circulation Well
  - Metropolitan Utility District Extraction Well
  - Metropolitan Utility District Monitoring Well
  - Effluent Discharge
  - Effluent Pipeline
  - Half-Mile Buffer Zone
  - One-Mile Buffer Zone
  - Groundwater Treatment Plant

- Contaminant Plume**
- Approximate Area of TCE at a Concentration of 5 µg/L or Greater (2020)
  - Approximate Area of RDX at a Concentration of 2 µg/L or Greater (2020)
  - Approximate Area of Both TCE at a Concentration of 5 µg/L or Greater and RDX at a Concentration of 2 µg/L or Greater (2020)

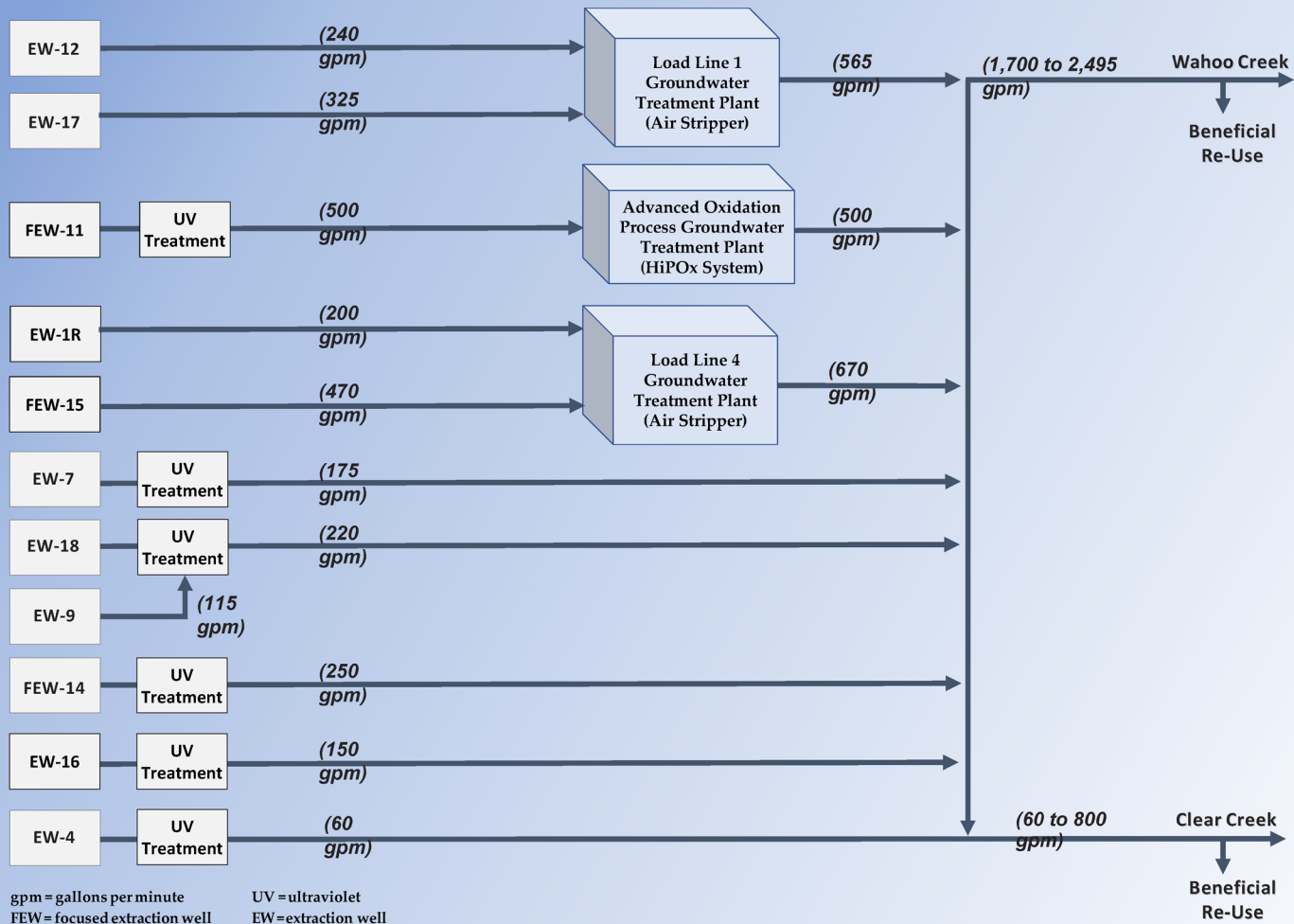
**NOTES:**  
 TCE and RDX plume delineations are based on Groundwater Monitoring Program data, direct-push data, and other data. The plume delineations represent a combination of the shallow zone data and the intermediate zone data.  
 AOP UV = Advanced Oxidation Process ultraviolet  
 TCE = trichloroethene  
 RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine  
 µg/L = micrograms per liter

Drawn by: MDH	Reviewed by:	 US Army Corps of Engineers Kansas City District
Date: 12/8/2019	Date:	
Version: 1	Revision Date / Initials:	



# Former Nebraska Ordnance Plant Current Groundwater Treatment Schematic

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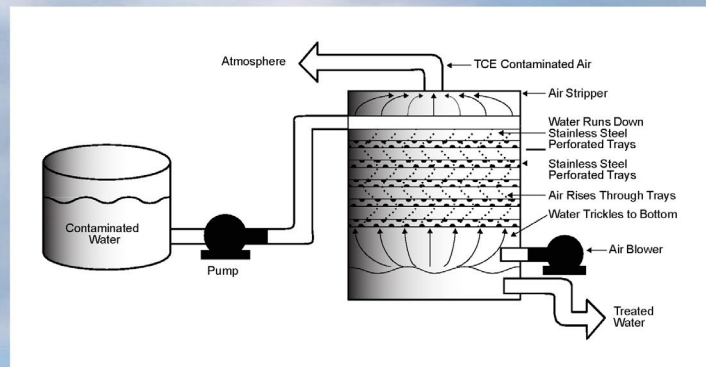
# Former Nebraska Ordnance Plant Air Stripper Treatment

**Step 1:** Groundwater that is contaminated with trichloroethene (TCE) is extracted and pumped to either Load Line 1 or Load Line 4 Groundwater Treatment Plants to be treated through air strippers.

**Step 2:** The TCE-contaminated groundwater is aerated as it flows down through the air stripper and over a series of perforated trays. Air is blown upward through the perforated trays and through the contaminated groundwater. TCE is then removed from the groundwater and is transferred from the liquid phase to the gas phase.

**Step 3:** The gas-phase TCE is transferred to the air. Quantity of TCE emitted to the air is below the NDEE limit of 5 tons per year.

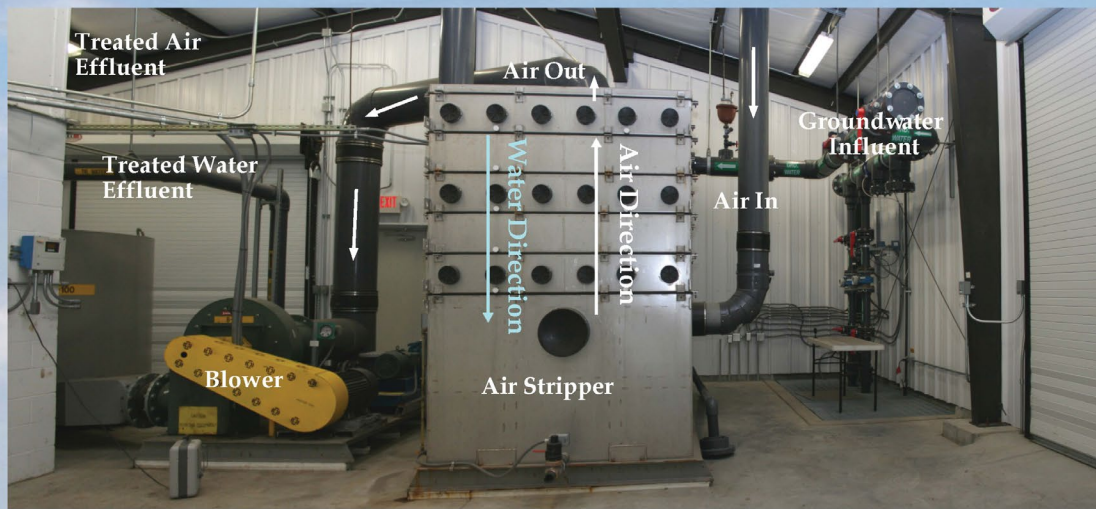
**Step 4:** The treated groundwater is discharged to Wahoo Creek.



## FACT

Since startup in 2006, the Load Line 1 Groundwater Treatment Plant has:

- Removed over 3,274 pounds of TCE.
- Treated over 3.25 billion gallons of water.



## FACT

Since startup in 2010, the Load Line 4 Groundwater Treatment Plant has:

- Removed over 6,286 pounds of TCE.
- Treated over 3.16 billion gallons of water.



Perforated tray found inside the air stripper that is used to disperse water and increase surface area.



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# WATER SUPPLY WELL PROGRAM

FORMER NEBRASKA ORDNANCE PLANT, MEAD, NEBRASKA

## SAMPLING OF WATER SUPPLY WELLS



What Water Supply Wells does the U.S. Army Corps of Engineers sample?

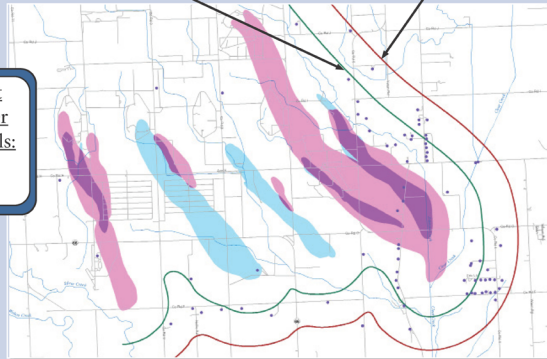
### HALF-MILE BUFFER ZONE

Water Supply Wells located less than 1/2 mile from the delineated TCE and RDX groundwater contamination plumes.

### ONE-MILE BUFFER ZONE

Water Supply Wells located less than one mile from the delineated TCE and RDX groundwater contamination plumes.

Final Target Groundwater Cleanup Goals:  
TCE = 5 µg/L  
RDX = 2 µg/L



What if there is a detection of TCE and/or RDX above the Final Target Groundwater Cleanup Goals in the Water Supply Well?



Granular Activated Carbon (GAC) Unit

How long will I need to use my GAC unit?  
Alternate water supply may be eliminated if TCE and/or RDX are below the Final Target Groundwater Cleanup Goals for three consecutive years.

**STEP 1:** The residence is provided bottled water within 3 days of the detection.



**STEP 2:** The Water Supply Well is resampled.

**STEP 3:** If the resample confirms that TCE and/or RDX levels are above the Final Target Groundwater Cleanup Goals, then a whole house GAC unit will be installed to treat the water. The U.S. Army Corps of Engineers will maintain the GAC unit.

**STEP 4:** The inlet and outlet of the GAC unit will be sampled twice per year. Results are sent to the landowner after each sampling event.



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# SOLAR ENERGY SAVINGS

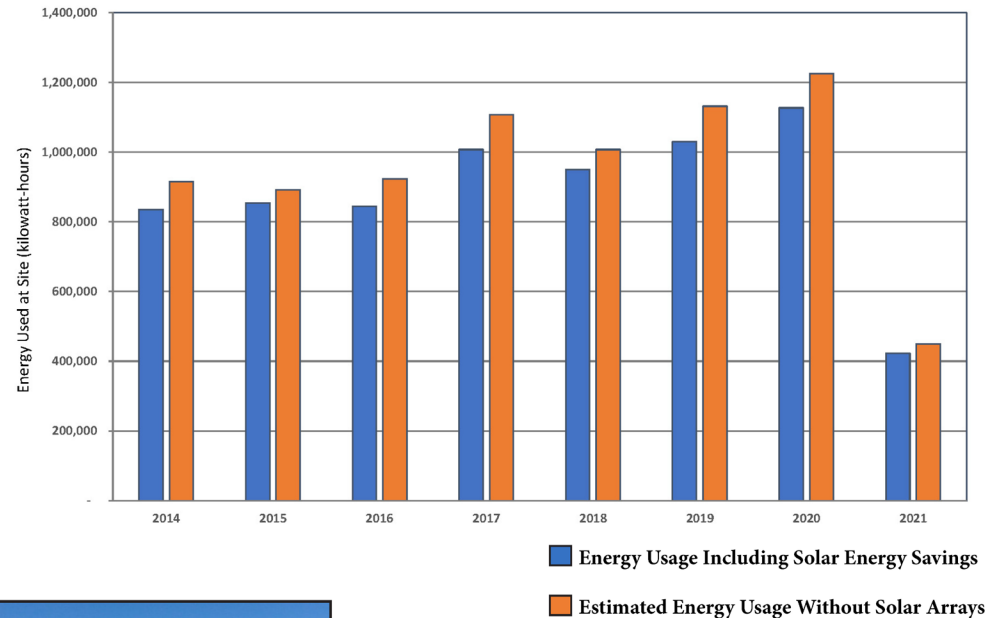
## FORMER NEBRASKA ORDNANCE PLANT, MEAD, NEBRASKA



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- ▶ Three solar arrays are installed at the Site and use the natural energy of the sun to produce electricity.
- ▶ Each solar array can generate up to 25 kilowatts of power which supplements power for the treatment systems at the Site.
- ▶ The solar arrays located at the Main treatment plant and the Advanced Oxidation Process/Load Line 4 treatment plants were started up in January 2014.
- ▶ A third solar array, located near the pump house for focused extraction well 14, was started in early March 2017.
- ▶ From January 1, 2014, through April 30, 2021, the solar arrays have generated over 658,772 kilowatt-hours of energy.

SOLAR ENERGY SAVINGS AT THE SITE



Solar array near focused extraction well FEW-14 pump house



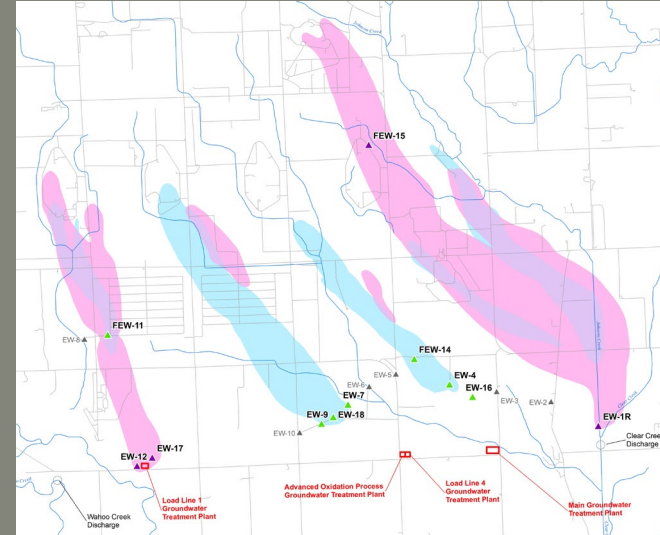
Solar array at Advanced Oxidation Process/Load Line 4 treatment plants



Solar array at Main treatment plant

# OPEN HOUSE FORMER NEBRASKA ORDNANCE PLANT

## 2020 CONTAINMENT EVALUATION



Brad Brink  
 U.S. Army Corps of Engineers  
 Kansas City District



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# THE CONTAINMENT EVALUATION

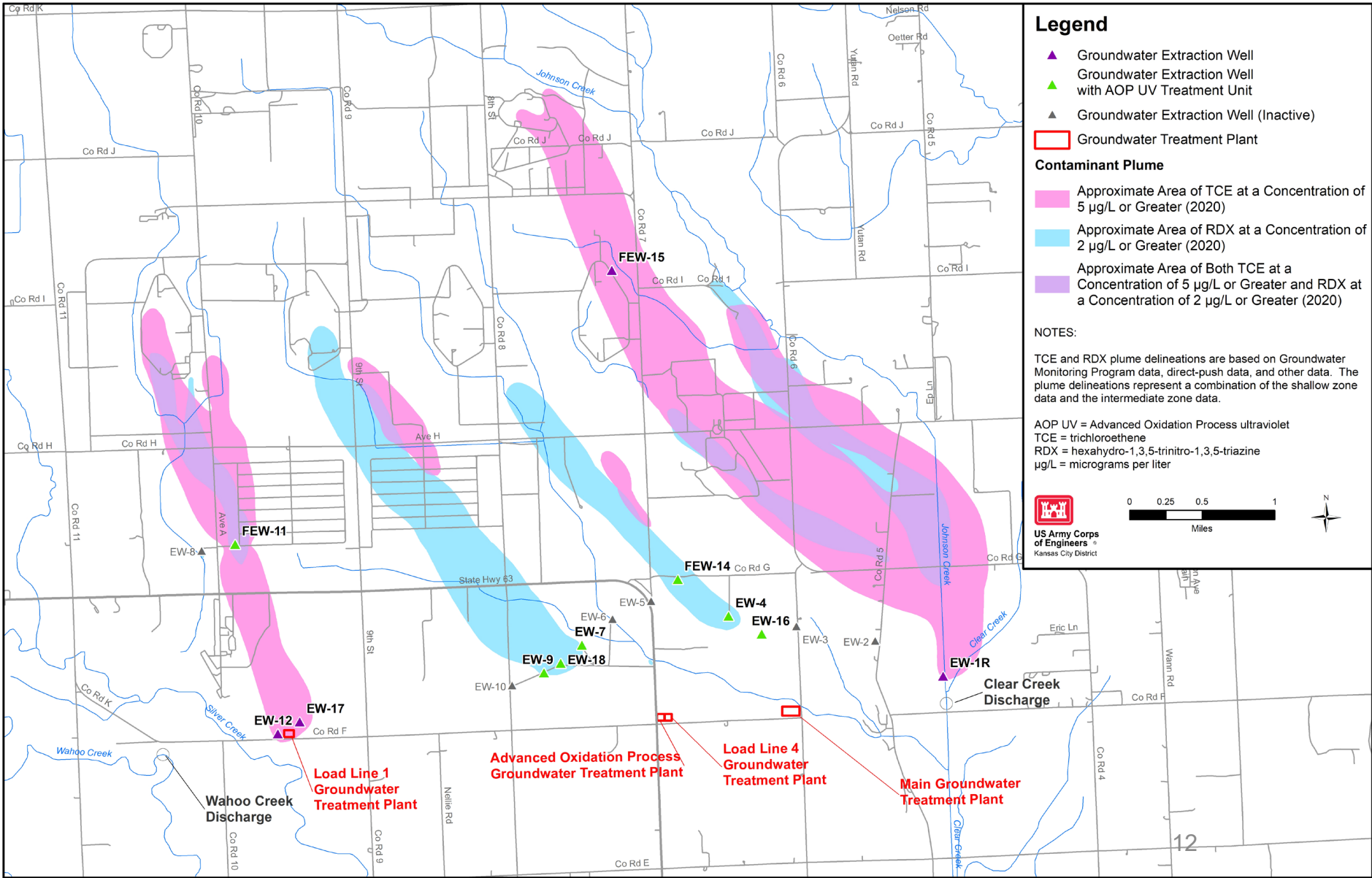
- U.S. Army Corps of Engineers evaluates containment annually at the former Nebraska Ordnance Plant site.
- Determines whether the hydraulic containment system is capturing the Operable Unit 2 Record of Decision contaminants of concern in groundwater that are above the Final Target Groundwater Cleanup Goals.



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# HYDRAULIC CONTAINMENT SYSTEM



## Legend

- ▲ Groundwater Extraction Well
- ▲ Groundwater Extraction Well with AOP UV Treatment Unit
- ▲ Groundwater Extraction Well (Inactive)
- Groundwater Treatment Plant

## Contaminant Plume

- Approximate Area of TCE at a Concentration of 5 µg/L or Greater (2020)
- Approximate Area of RDX at a Concentration of 2 µg/L or Greater (2020)
- Approximate Area of Both TCE and RDX at a Concentration of 2 µg/L or Greater (2020)

## NOTES:

TCE and RDX plume delineations are based on Groundwater Monitoring Program data, direct-push data, and other data. The plume delineations represent a combination of the shallow zone data and the intermediate zone data.

AOP UV = Advanced Oxidation Process ultraviolet  
 TCE = trichloroethene  
 RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine  
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# EVALUATING CONTAINMENT

## PRIMARY TOOL

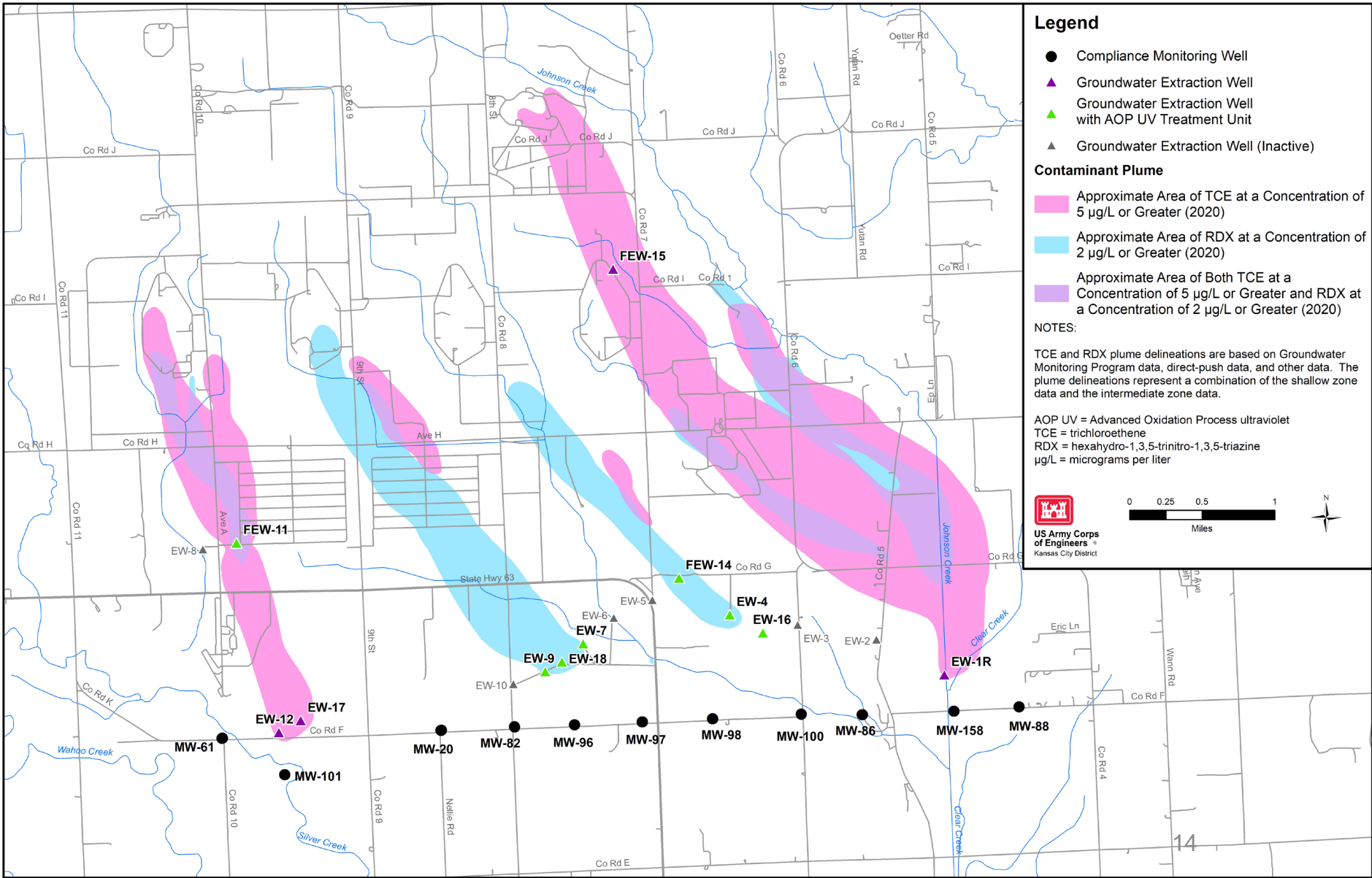
- Containment is determined from **chemical data** collected annually from compliance monitoring wells that are downgradient of the plumes.
- If contaminants of concern are **not detected above the Final Target Groundwater Cleanup Goals** in the compliance monitoring wells, then containment is met.



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# COMPLIANCE MONITORING WELLS



**Legend**

- Compliance Monitoring Well
- ▲ Groundwater Extraction Well
- ▲ Groundwater Extraction Well with AOP UV Treatment Unit
- ▲ Groundwater Extraction Well (Inactive)


**Contaminant Plume**

- Approximate Area of TCE at a Concentration of 5 µg/L or Greater (2020)
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0 0.25 0.5 1 Miles

14

# EVALUATING CONTAINMENT

## SECONDARY TOOL

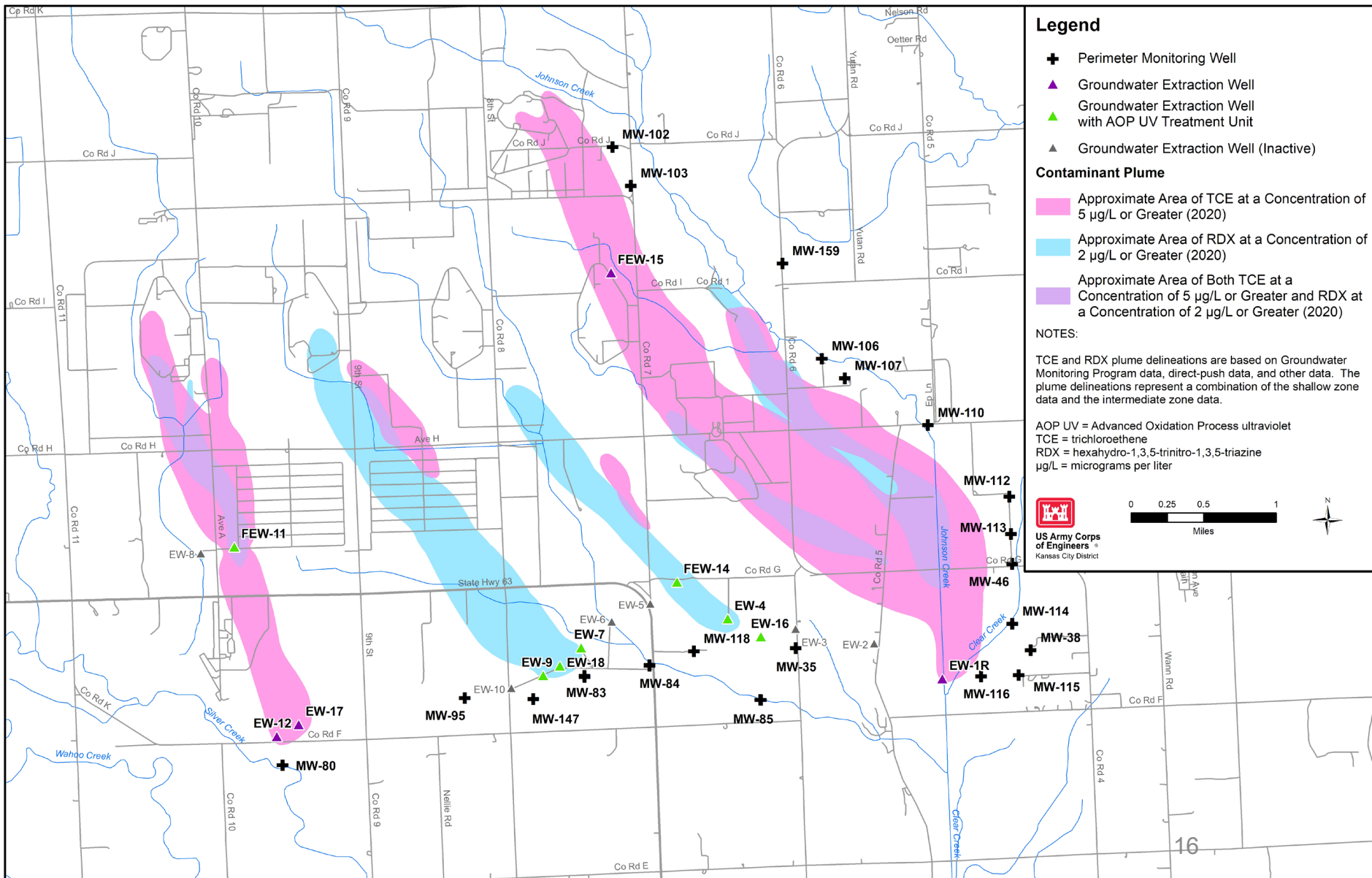
- **Perimeter wells** are located at the perimeter of the contaminant plumes and are monitored on a semi-annual basis.
- **Groundwater transport modeling** is performed to evaluate general performance or effectiveness of the hydraulic containment system.



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# PERIMETER MONITORING WELLS





# EVALUATING 2020 CONTAINMENT

Information collected and evaluated:

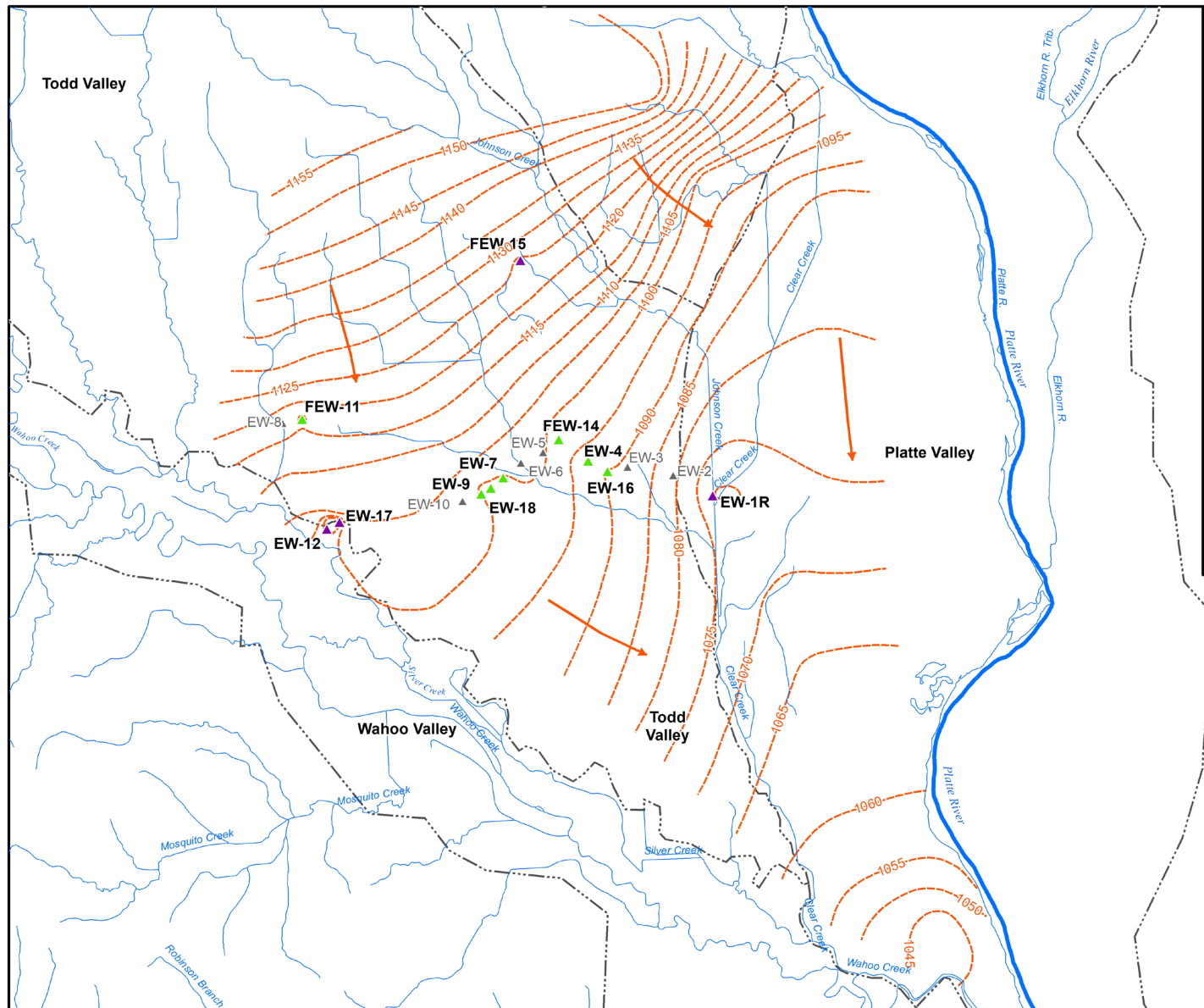
- **Water Levels** - 474 monitoring wells once or twice a year
- **Groundwater Samples** - 33 compliance wells and 58 perimeter wells
- **Drinking Water Samples** - 50 water supply wells
- **Pumping Rates** - Extraction Wells, Metropolitan Utilities District, Lincoln Water System, the Village of Mead, the City of Ashland, and the University of Nebraska-Lincoln Agricultural and Research Development Center.



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# 2020 GROUNDWATER FLOW



## Legend

- ▲ Groundwater Extraction Well
- ▲ Groundwater Extraction Well with AOP UV Treatment Unit
- ▲ Groundwater Extraction Well (Inactive)
- - - August 2020 Potentiometric Contour
- Flow Direction
- - - Basin Boundary

### NOTES:

Water level elevations in feet above mean sea level.

Observation wells are not plotted on this map; however, observation well water levels were used in the production of the potentiometric surfaces.

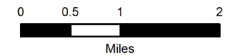
The 5-foot contour interval does not illustrate drawdown at all extraction wells.

August 2020 data collected on August 24, 2020.

AOP UV = Advanced Oxidation Process ultraviolet



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# GROUNDWATER MONITORING

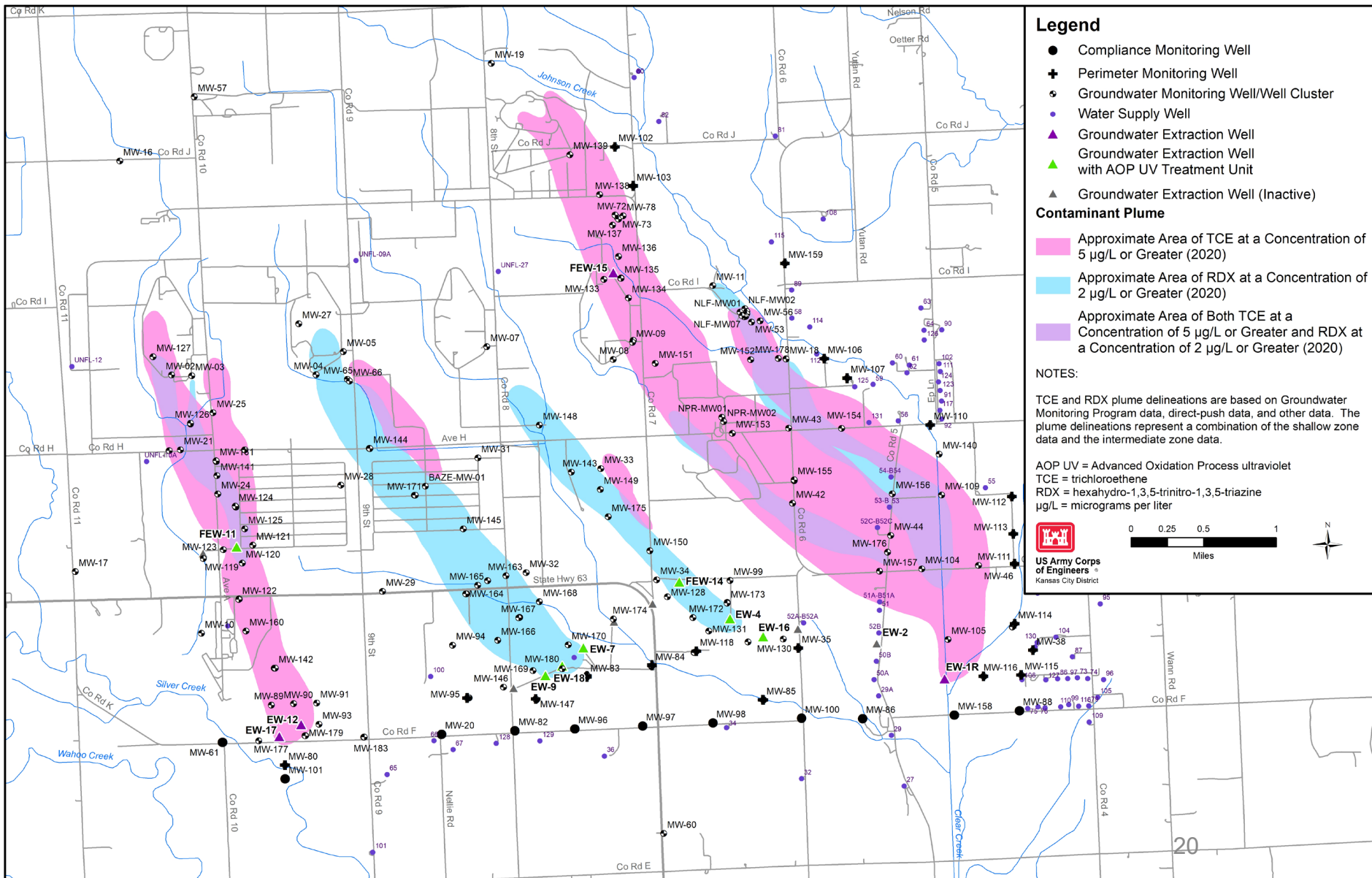
- Groundwater data will continue to be collected during the annual Groundwater Monitoring Program from:
  - Water Supply Wells
  - Select Monitoring Wells
  - Compliance Monitoring Wells
  - Perimeter Monitoring Wells



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# WELL NETWORK



**Legend**

- Compliance Monitoring Well
- ⊕ Perimeter Monitoring Well
- ⊗ Groundwater Monitoring Well/Well Cluster
- Water Supply Well
- ▲ Groundwater Extraction Well
- ▲ Groundwater Extraction Well with AOP UV Treatment Unit
- ▲ Groundwater Extraction Well (Inactive)

**Contaminant Plume**

- Approximate Area of TCE at a Concentration of 5 µg/L or Greater (2020)
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0 0.25 0.5 1  
 Miles

20

# 2020 CONTAINMENT EVALUATION CONCLUSIONS

- Containment has been achieved for 2020.
- **No contaminants of concern were detected** in any of the compliance wells above the Final Target Groundwater Cleanup Goals in 2020.
- RDX was detected in one perimeter well (MW-84B) slightly above the Final Target Groundwater Cleanup Goal in the Spring (3.1  $\mu\text{g/L}$ ), but follow-up sampling results were non-detect.
- An increasing RDX concentration has been observed at MW-180 located at the leading edge of the Load Line 2 plume. As a precaution, the flow rate in extraction well EW-18 was increased to 220 gpm in April 2021.



# Questions

**WE THE PEOPLE**  
insure domestic Tranquillity, provide for the common  
and our Posterity, do ordain  
this Constitution



# OPEN HOUSE FORMER NEBRASKA ORDNANCE PLANT

## OMADI BEDROCK FORMATION PHASE III ASSESSMENT UPDATE

Gordon Jamieson  
Project Manager, Former Nebraska Ordnance Plant  
U.S. Army Corps of Engineers Kansas City District

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# INTRODUCTION

- At the FNOP Site, there are approximately 100 feet of sands and gravels just below the ground surface.
- The Omadi Formation is a layer of bedrock underneath the sands and gravels.
- It consists of sandstone layers with occasional thin layers of shale and ranges from 30 to 120 feet thick.
- Beneath the Omadi is a thick layer of shale, a fine-grained bedrock, that limits the amount of groundwater that can flow downward.



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# PURPOSE OF PHASE III ASSESSMENT

- The purpose of the Phase III Assessment was to:
  - Assess the depth and overall area of contamination in bedrock upgradient of the compliance and perimeter wells.
  - Assess hydraulic conductivity within the Omadi bedrock, or lateral groundwater flow through bedrock.
  - Assess the vertical gradients within the Omadi, or upward/downward pressure-driven gradients.

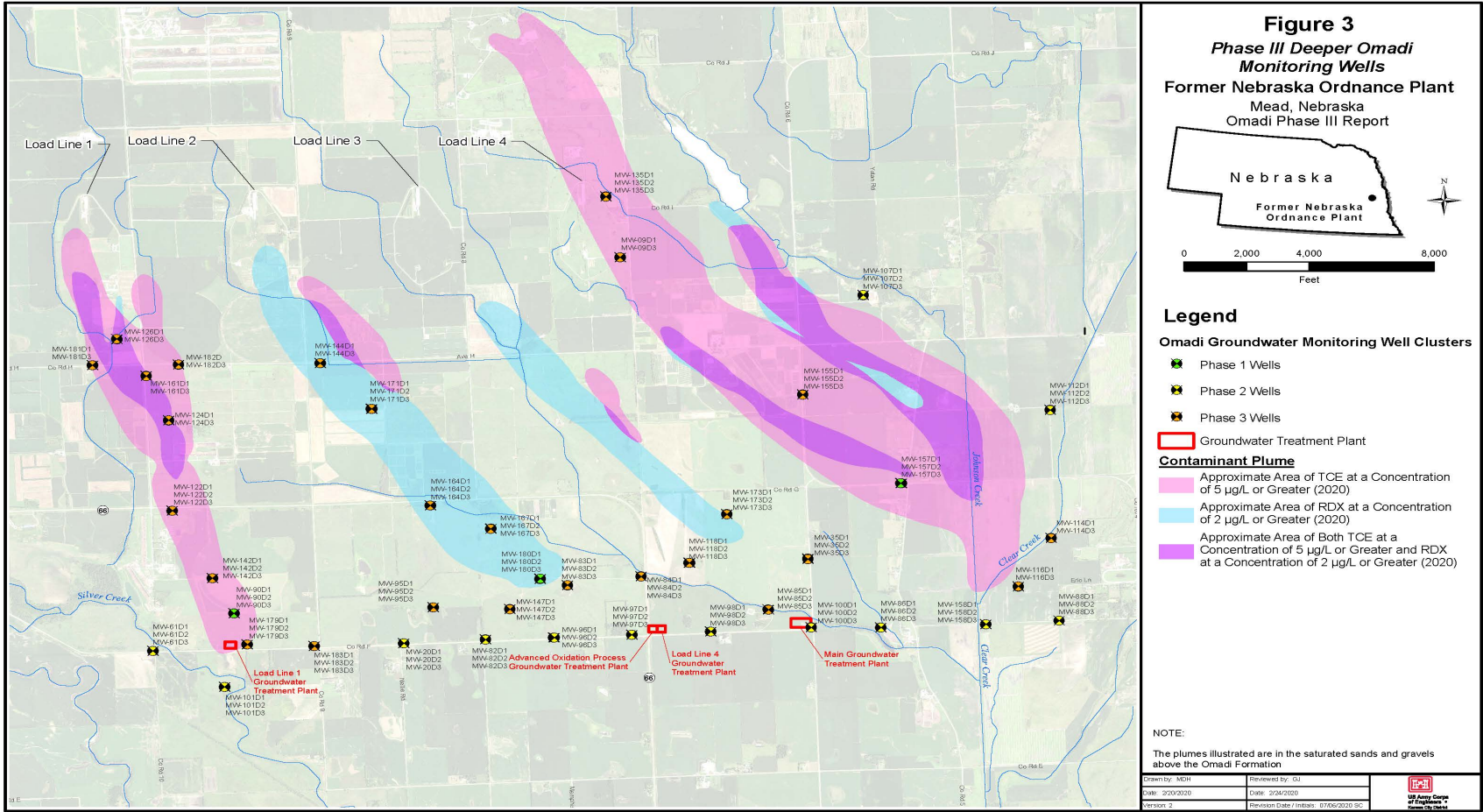


## PHASE III ASSESSMENT – PREVIOUS WORK

- Spring and Summer 2019: Installed 69 monitoring wells at 26 locations across the Site.
  - TCE was detected in LL1 and LL4 at concentrations above 5 µg/L in 12 of the 69 new Omadi wells.
  - RDX was detected in LL2 at a concentration above 2 µg/L in one new Omadi monitoring well.
- One data gap was identified north/upgradient of MW-126.
  - MW-126 is the most northerly Omadi well cluster installed in the LL1 plume.
  - A TCE concentration in the MW-126D1 monitoring well was measured at 1,060 µg/L.



# OMADI MONITORING WELL LOCATIONS



## 2021 FIELD ACTIVITIES

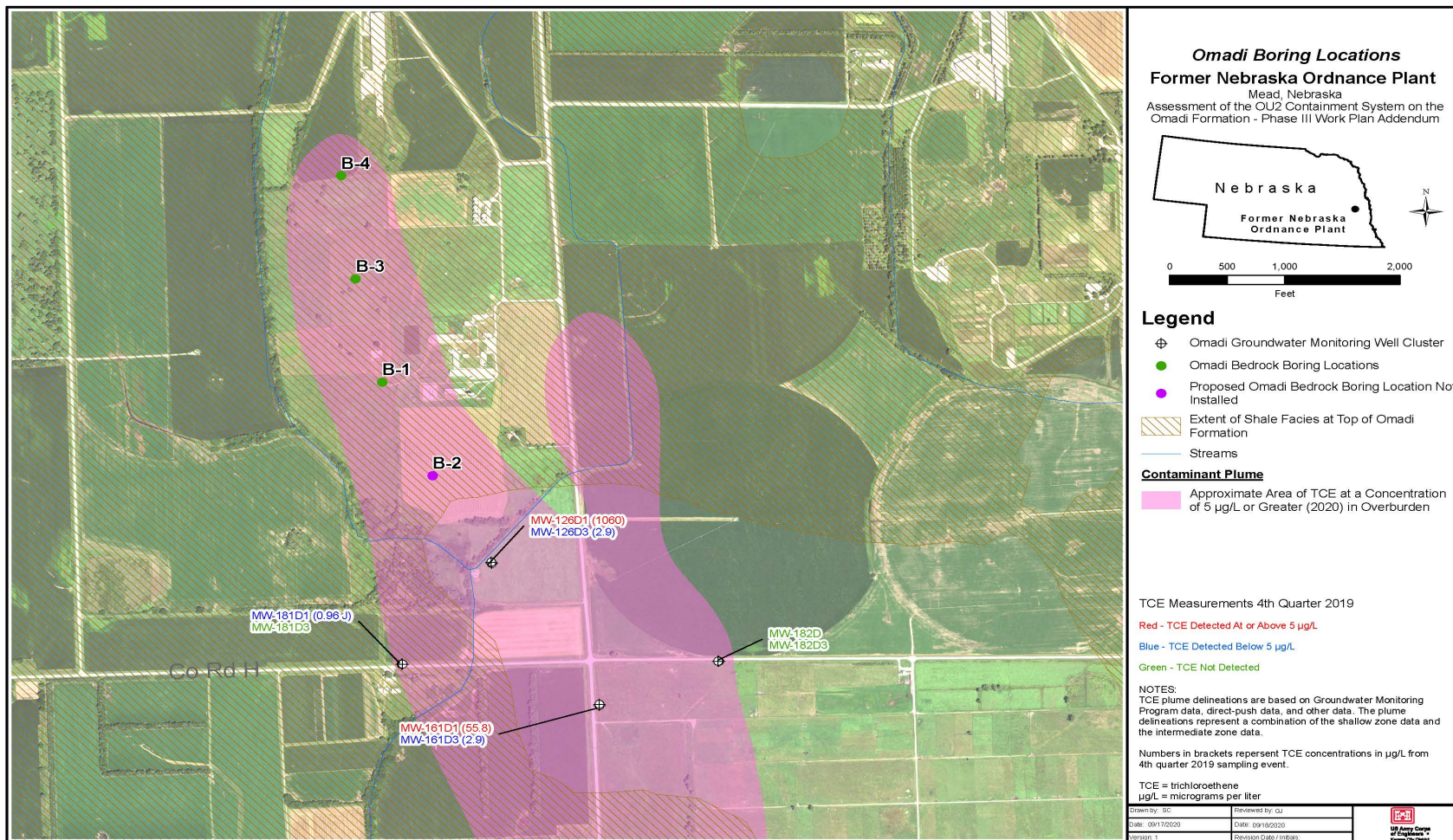
- Performed field activities in April and May of 2021.
- Installed 3 bedrock borings north of MW-126.
- Based on groundwater data, installed 4 monitoring wells at 2 boring locations (B1 and B4).
  - Wells installed as nests of two wells per location, to obtain data from varying depths in the Omadi.
  - Wells will be sampled initially in third quarter of 2021.



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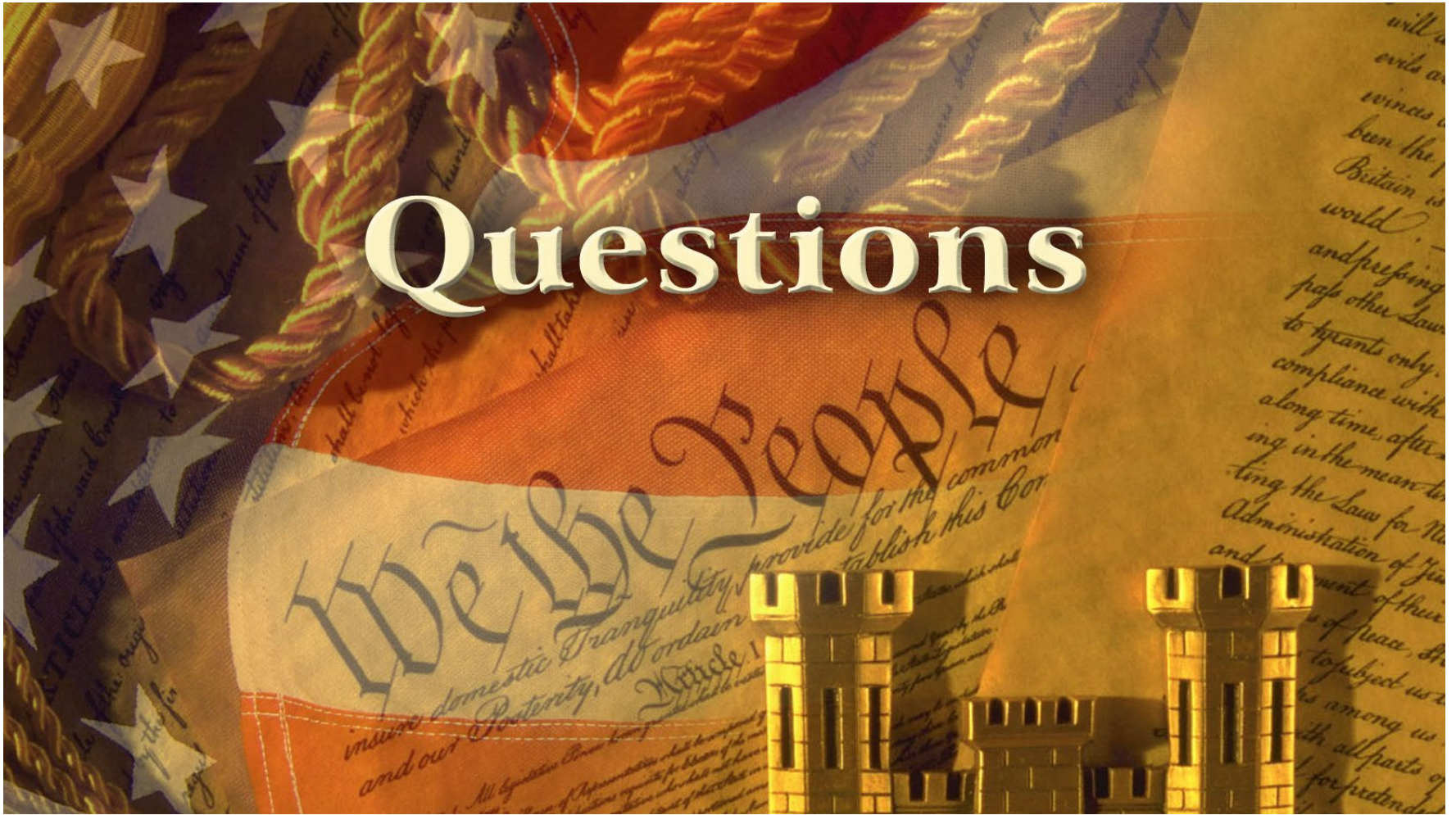
# 2021 OMADI BORING LOCATIONS



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# Questions



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# OPEN HOUSE FORMER NEBRASKA ORDNANCE PLANT

## FOCUSED EXTRACTION WELL FEW-19 PRE-DESIGN ACTIVITIES

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Project Manager, Former Nebraska Ordnance Plant

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# INTRODUCTION

- A focused extraction well (FEW-19) will be added within the LL4 plume area to decrease the timeframe required to remediate the LL4 plume.
- Pre-design activities are underway to determine the optimal location of FEW-19 and to collect design information.



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# PRE-DESIGN ACTIVITIES

The following activities were completed in 2020:

- Groundwater Modeling
  - Determine best location for overall LL4 remedy optimization
- Direct Push Groundwater Sampling
  - Target highest groundwater concentrations
- Geophysical Survey
  - Aid in extraction well placement
- Test Well Installation and Pump Test (FEW-19)
  - Evaluate maximum pumping rate and drawdown

In 2021:

- Offset Test Well Installation and Pump Test (FEW-19R2)
  - Determine better location with fewer fine sands



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## TEST WELL AND PUMP TEST

- In December 2020, a test well, observation well, and piezometer were installed at the location for FEW-19, near Direct Push 2 (DP-2).
- A pump test was performed to determine the maximum sustainable pumping rate for FEW-19.
- Due to the presence of fine sand in the immediate vicinity of the test well, the FEW-19 location was not ideal.
- An offset test well was installed and another pump test was conducted to determine a more suitable location.



# OFFSET TEST WELL AND PUMP TEST

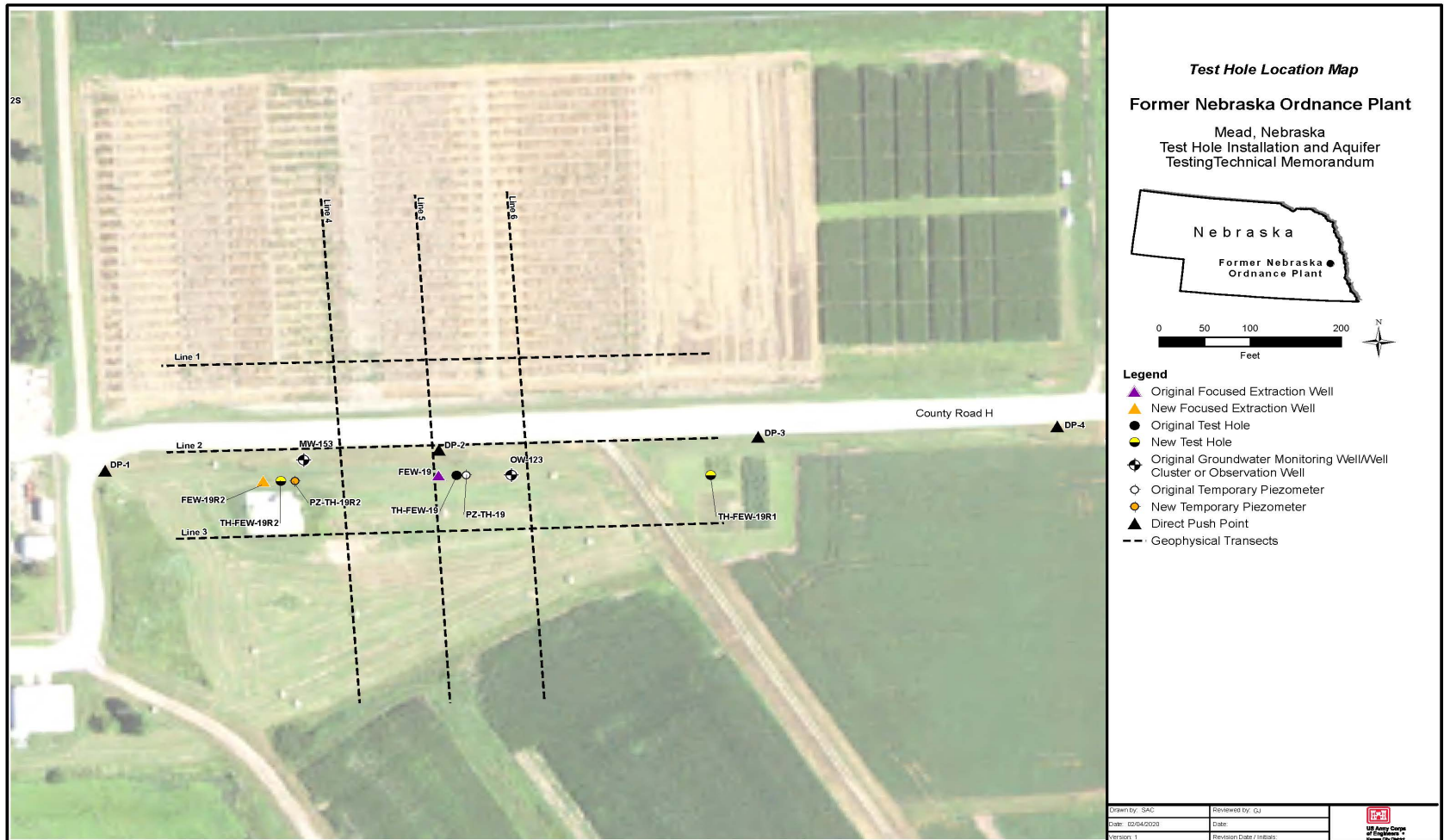
- Two borings were drilled and logged east and west of the first test hole.
- Based on lithology, the western location was selected for the test well (TH-FEW-19R2) due to the increased presence of coarse sand and lack of fine sands.
- In May 2021, a temporary piezometer was installed next to the test well and another pump test was performed.
- The results are currently being reviewed. The new location appears to be promising to support a higher pumping rate at FEW-19.



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# TEST HOLE LOCATION MAP



T:\civicus\_ARMY\_CORPS\_OF\_ENGINEERS\_KANSAS\_CITY\Nebraska Ordnance Plant\MapDocs\170781\Open\_House\202108\Open\_House\170781\_FIG\_FEW-19\_Proposed and Test Well Locations.mxd

# FUTURE ACTIVITY

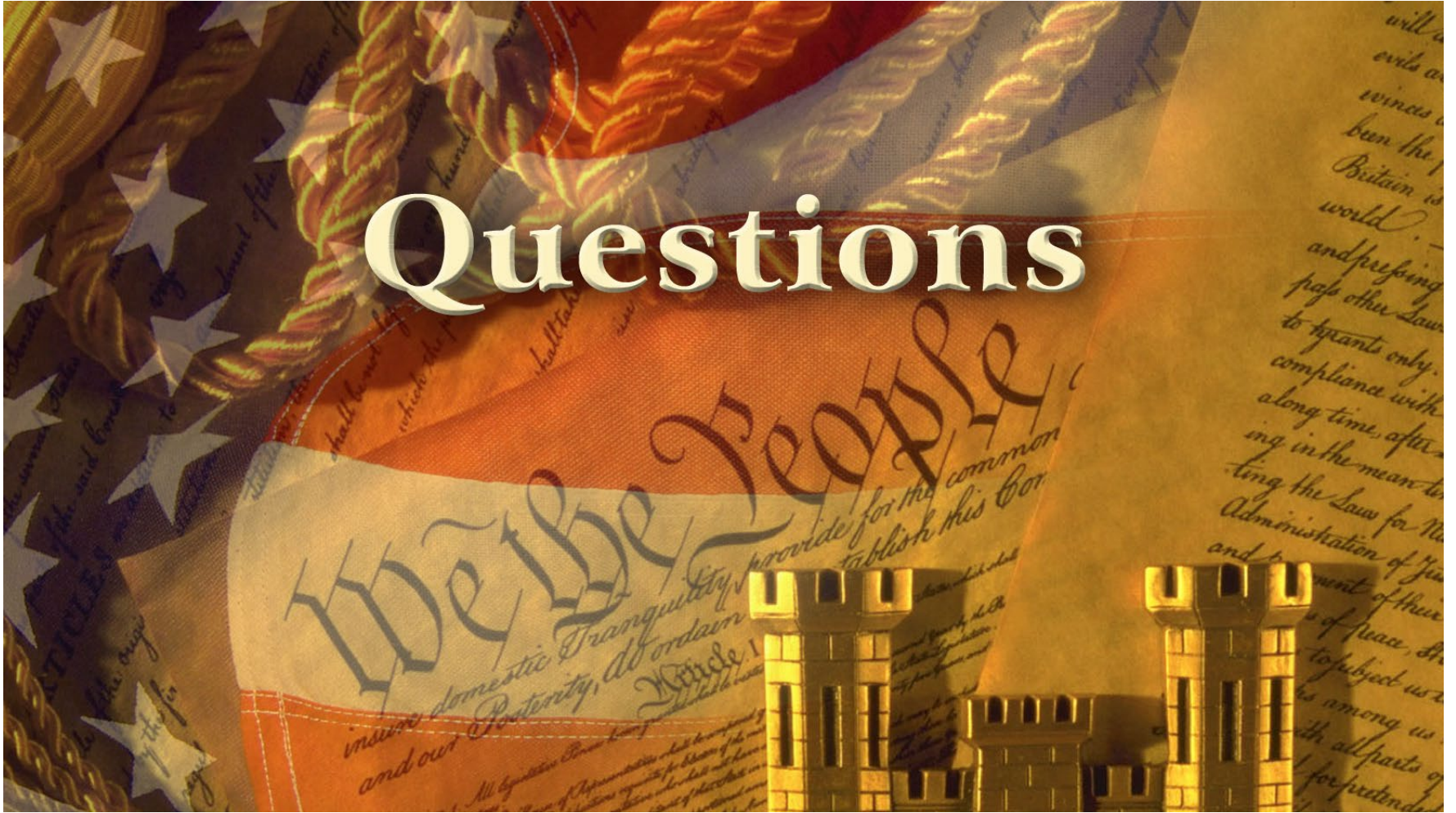
- Pre-design information will be used to design FEW-19, including conveyance piping; architectural, structural, mechanical, and electrical specifications; the treatment process; and instrumentation/control elements.
- The design phase will begin later this year.
- A schedule for the construction of FEW-19 has not yet been established.



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# Questions



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# OPEN HOUSE FORMER NEBRASKA ORDNANCE PLANT

## 2021 GROUNDWATER PROFILING INVESTIGATION

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U.S. Army Corps of Engineers Kansas City District

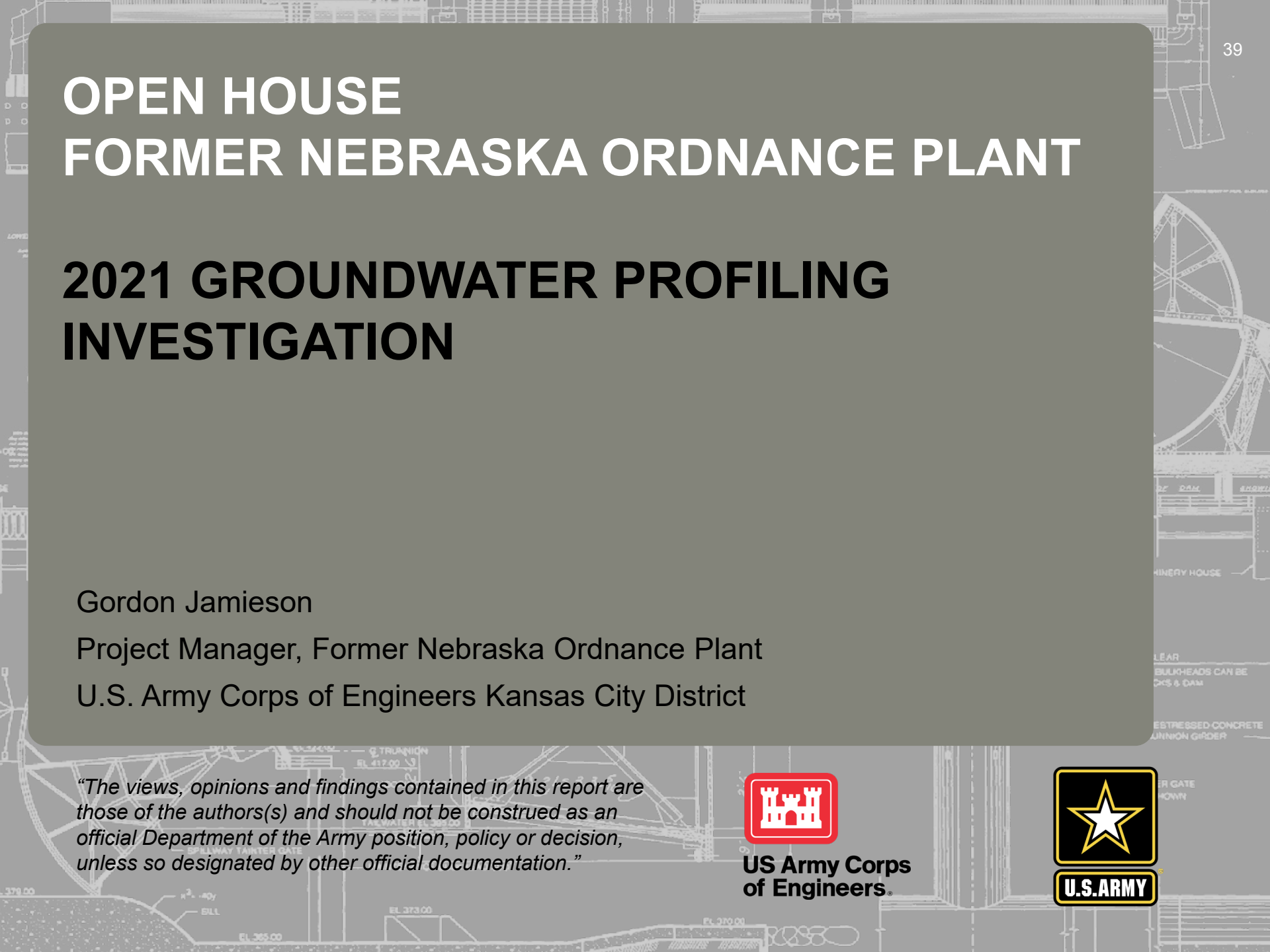
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# INTRODUCTION

- During fourth quarter 2019, an anomalous TCE exceedance [6.9 micrograms per liter (ug/L)] was observed within the LL3 groundwater plume.
- During the second quarter of 2019, an elevated RDX detection (55 ug/L) was observed in MW-11 within the LL4 groundwater plume.
- To better understand these observations, a groundwater profiling investigation was conducted from April to mid-June of 2021.
- The last time a similar investigation was conducted was in 2010, which formed the basis for the TCE plume depiction in LL2 and LL3.
- A total of 89 direct push borings were advanced.



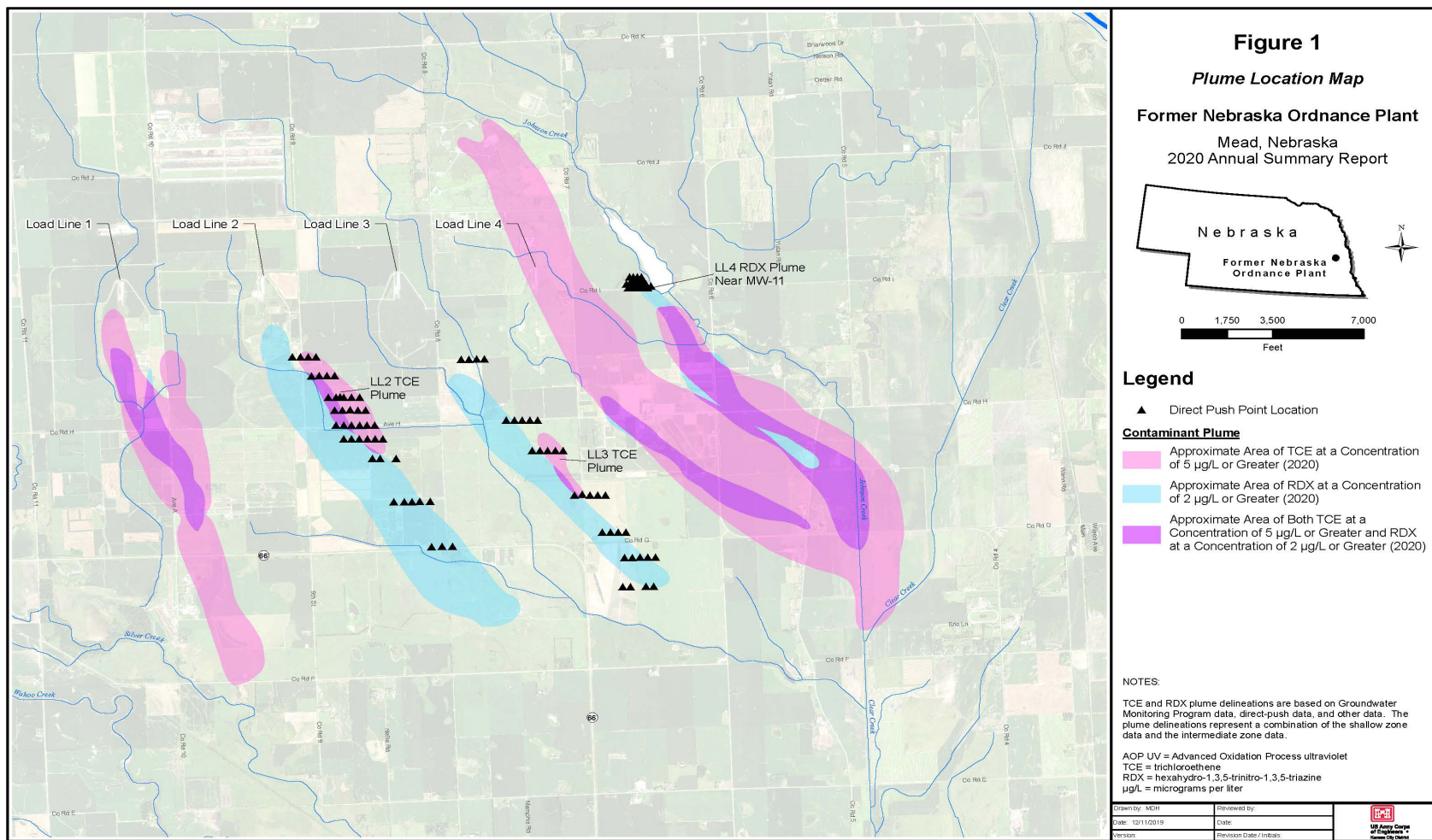


# PURPOSE OF THE GROUNDWATER PROFILING INVESTIGATION

- Refine the horizontal and vertical extent of TCE contamination within the LL2 and LL3 groundwater plumes, which were previously understood to contain primarily RDX.
- Refine the horizontal and vertical extent of RDX contamination near monitoring well MW-11.
- Install permanent monitoring wells to monitor long-term changes.
  - Monitoring well locations will be selected and installation will begin later this year.



# PLUME LOCATION MAP



\\c:\eribus\_armsy\_corps\_of\_engineers\_kansas\_c11\nebraska Ordnance Plant\MapDoc\117011\qpl\_rpt\2020\qpl\_rpt\117011\_Plc\_01\_Plume\_Location\_Map.mxd



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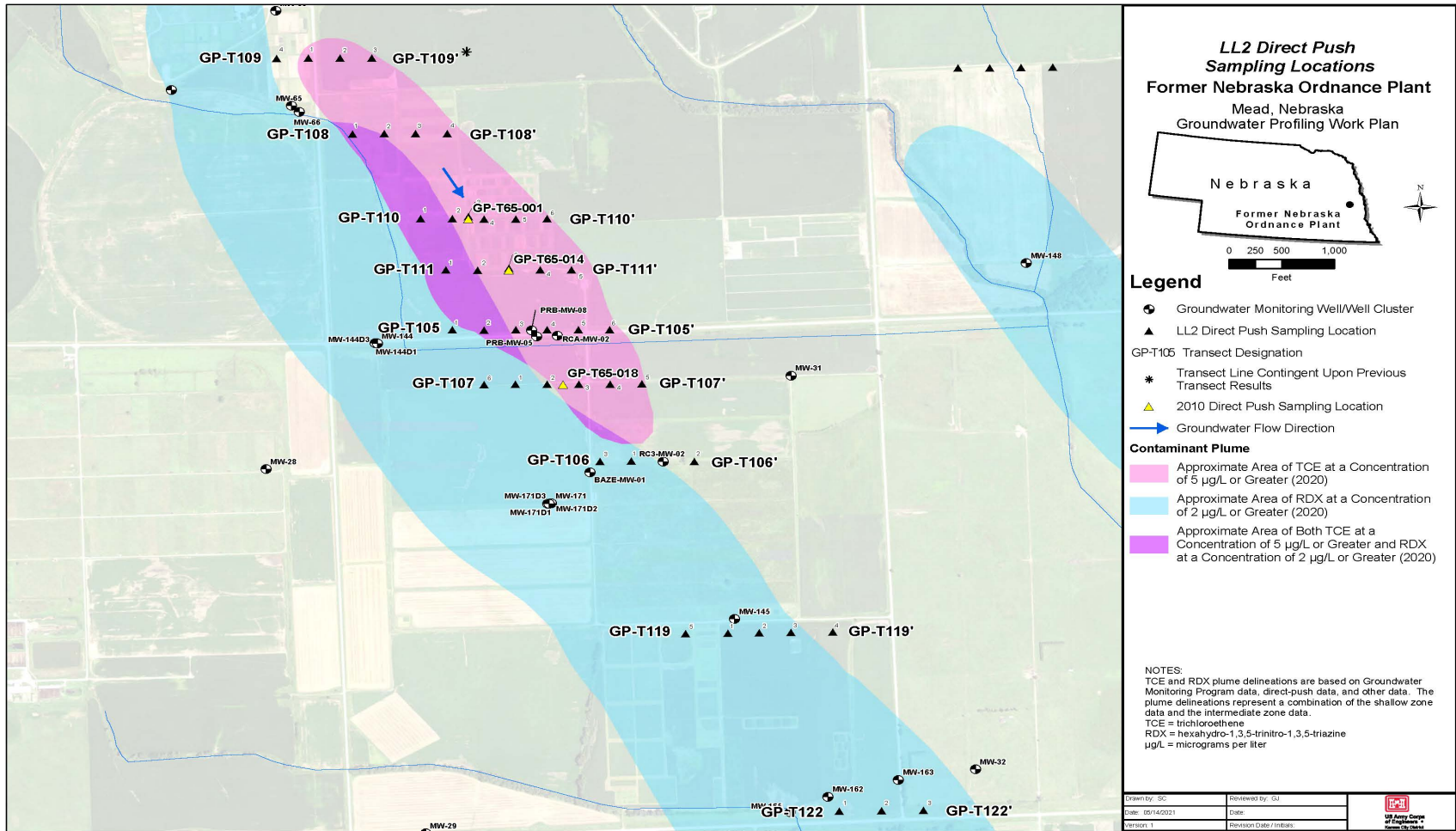


# FIELD ACTIVITIES

- Groundwater sampling was completed using direct push drilling along east-west oriented lines (across the plumes).
- Direct push rods were advanced to top of bedrock to collect the first sample, then raised to collect additional samples vertically every ten feet.
- These data provide a current picture of the extent of the plumes.
- Long-term data will be obtained from the permanent monitoring wells.



# LL2 DIRECT PUSH SAMPLING LOCATIONS



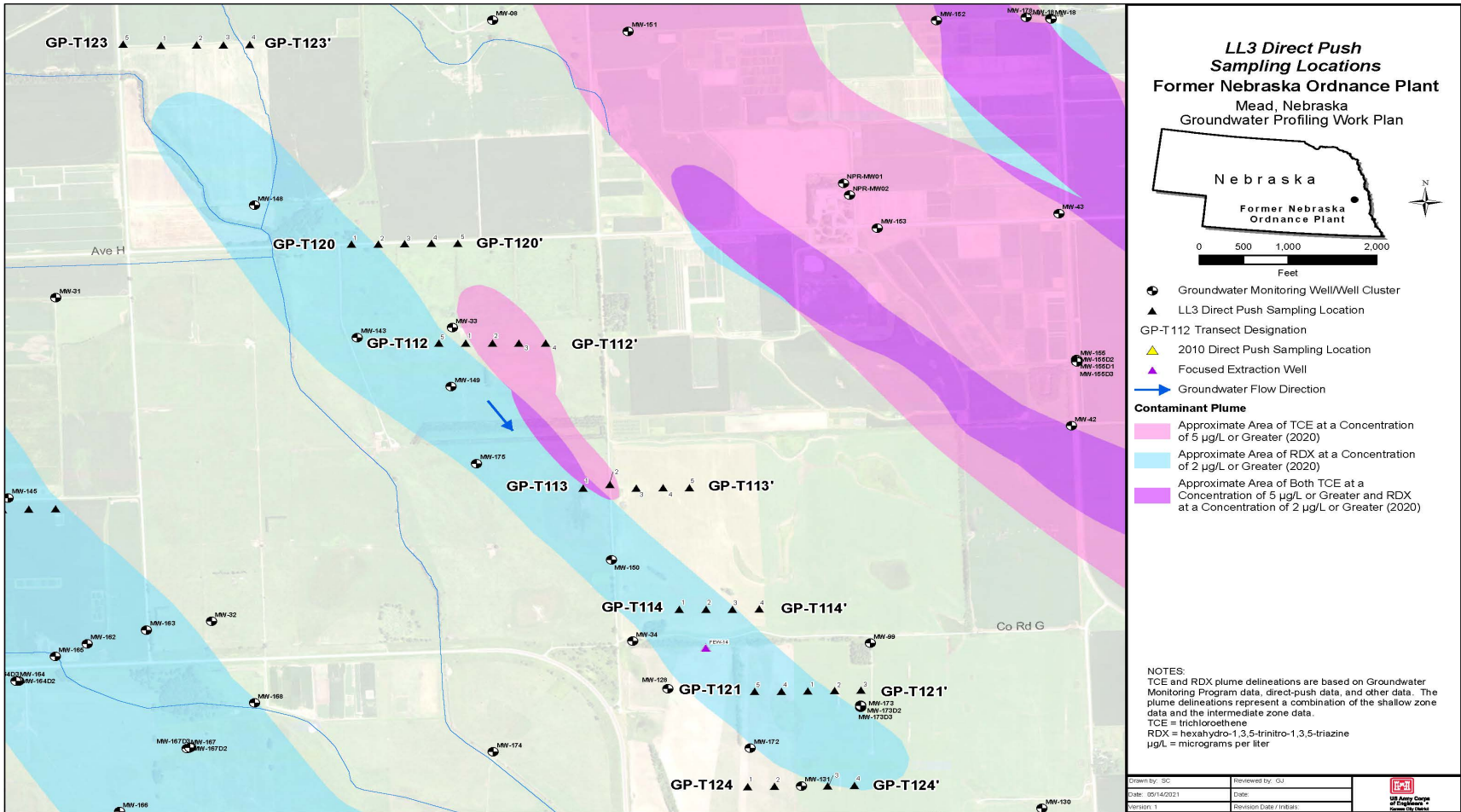
\\kcmz01us\_army\_corps\_of\_engineers\_kansas\city\Nebraska Ordnance Plant\MapDocs\117018\open\_folders\2106\open\_folders\117018\Fig\_LL2\_Direct\_Push\_Sampling.mxd



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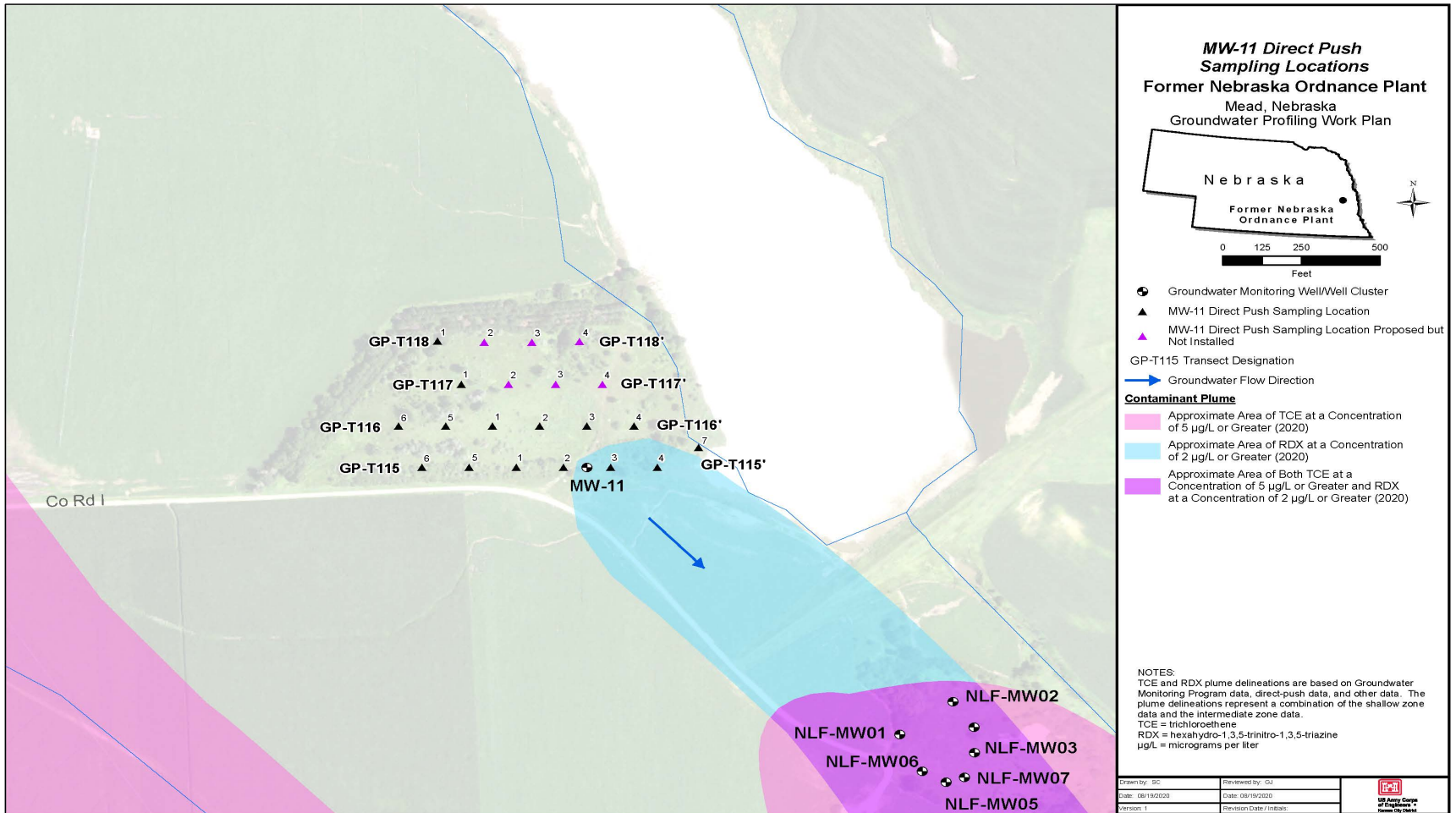
# LL3 DIRECT PUSH SAMPLING LOCATIONS



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# MW-11 DIRECT PUSH SAMPLING LOCATIONS



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# Questions

