Implementation of Monitored Natural Attenuation Combined with Source Zone Control and a Technical Impracticability Waiver at Air Force Plant 4

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Air Force Plant 4

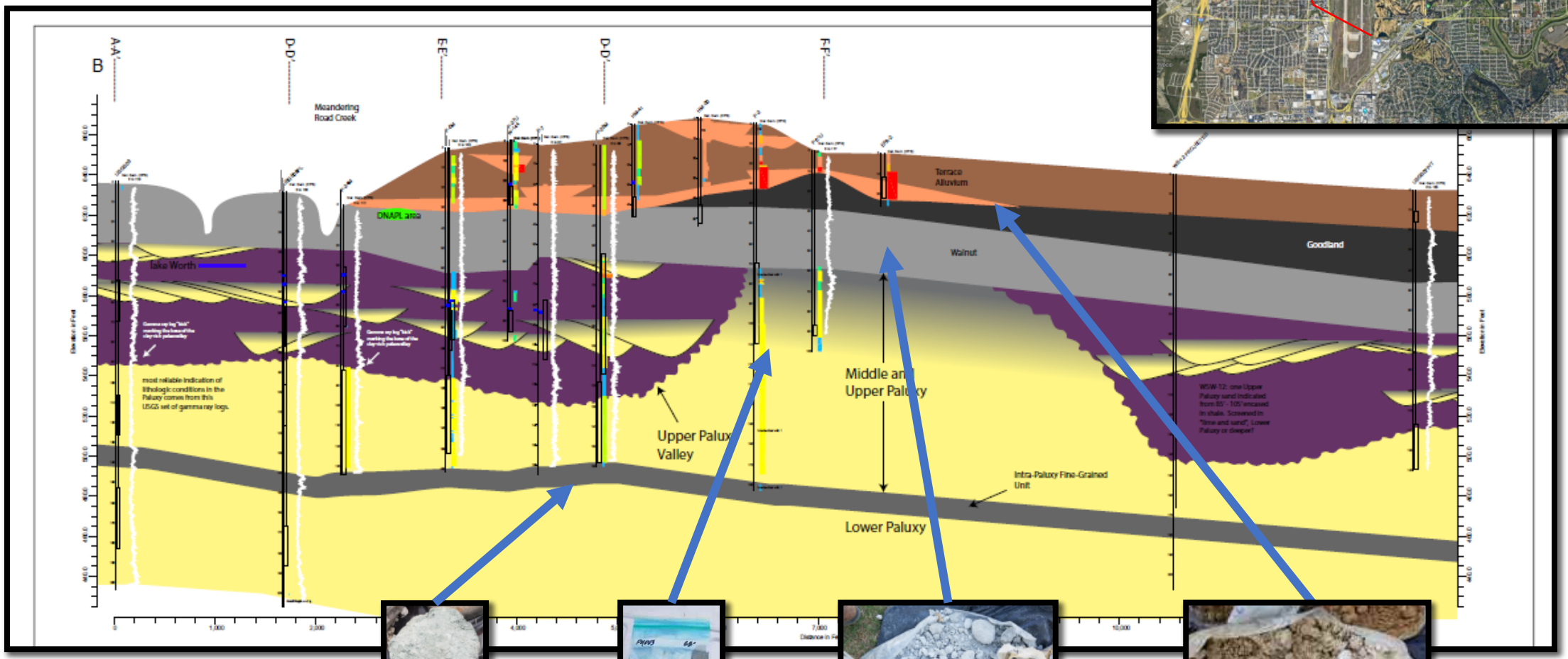
- 726-acre government-owned, contractor-operated facility in Fort Worth, Texas
- Current production site of the F-35
- Contaminated with TCE and daughter products
- Limited contamination of chromium
- On NPL with ROD in place since 1996
- In 2014, EPA indicated the ARARs were not protective in the long term
- Required a ROD Amendment to update the remedial goals for all groundwater to the MCLs

Aerial view of AFP4

Inside production building

F-35 over Fort Worth

The Geology



AFP4 Stratigraphy

Intra-Paluxy

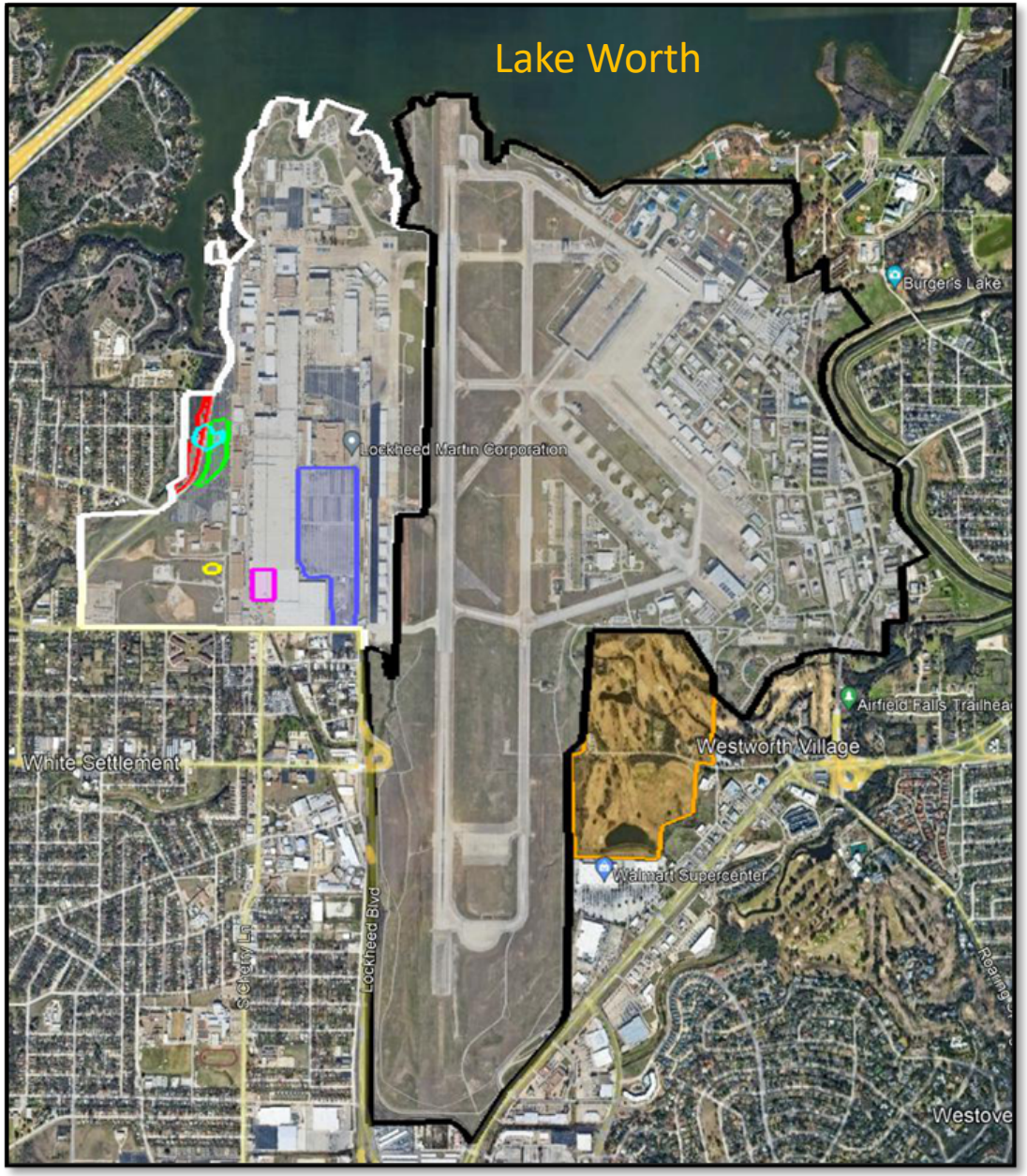
Upper Paluxy

Walnut

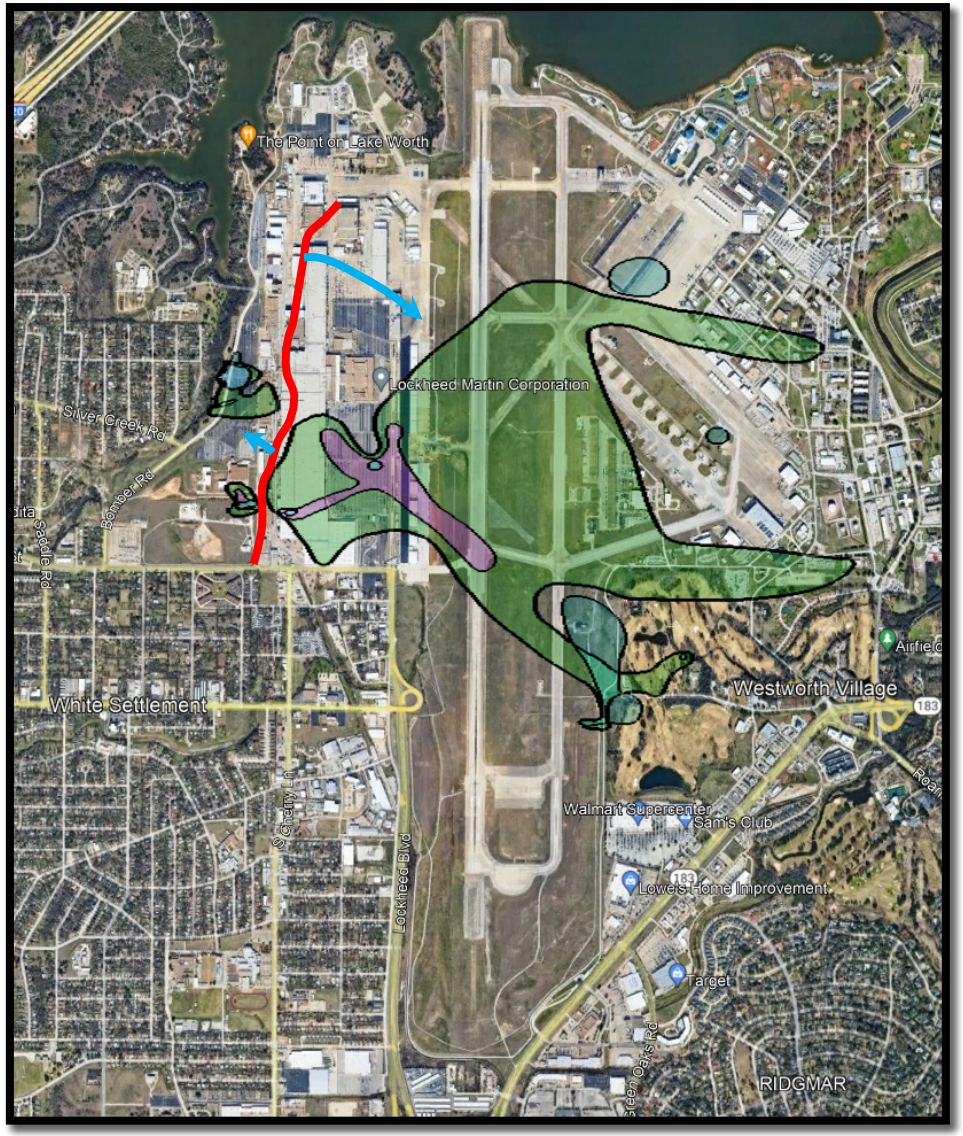
Terrace Alluvium

The Sites

- **AFP4** – Property owned by the Air Force (white)
- **NASFW** – Property owned by the Navy (**black**)
- **Building 181** – Site of large TCE spill (**pink**)
- **East Parking Lot** – Groundwater extraction system (**purple**)
- **Hawks Creek Golf Club** – Former Air Force property sold to Westworth Village (**orange**)
- **Landfills No. 1 and 3** – Former landfills on west side (**green** and **red**).
- **DNAPL Area** – Area within LF01/03 footprint that has pure phase product (Dense Non-Aqueous Phase Liquid) trapped in Walnut Formation fractures (**cyan**)
- **Chrome Pit No. 3** – Isolated plume on the southeast side that also has chromium (**yellow**)
- **Meandering Road** and **Farmers Branch Creeks**



The Plumes



Terrace Alluvium

- Groundwater divide runs along west side of the main assembly building
- Depth to groundwater ranges from approximately 3 (west) to 30 (east) feet below ground surface.
- Three separate plumes
  - East Side - 529 acres
  - Landfill Area -13 acres
  - Chrome Pit No. 3 - 4 acres

Trichloroethene >5 µg/L - green
cis-1,2-Dichloroethene >70 µg/L - pink
Vinyl Chloride >2 µg/L – cyan

The Plumes

Upper Paluxy Sand Channels

- Groundwater perched in isolated sand channels as indicated by widely varying groundwater elevations
- Depth to groundwater is approximately 40 to 65 feet below ground surface
- Observed in the central portion of the site

Trichloroethene >5 µg/L - green
cis-1,2-Dichloroethene >70 µg/L - pink
Vinyl Chloride >2 µg/L – cyan

The Plumes

Upper and Middle Paluxy

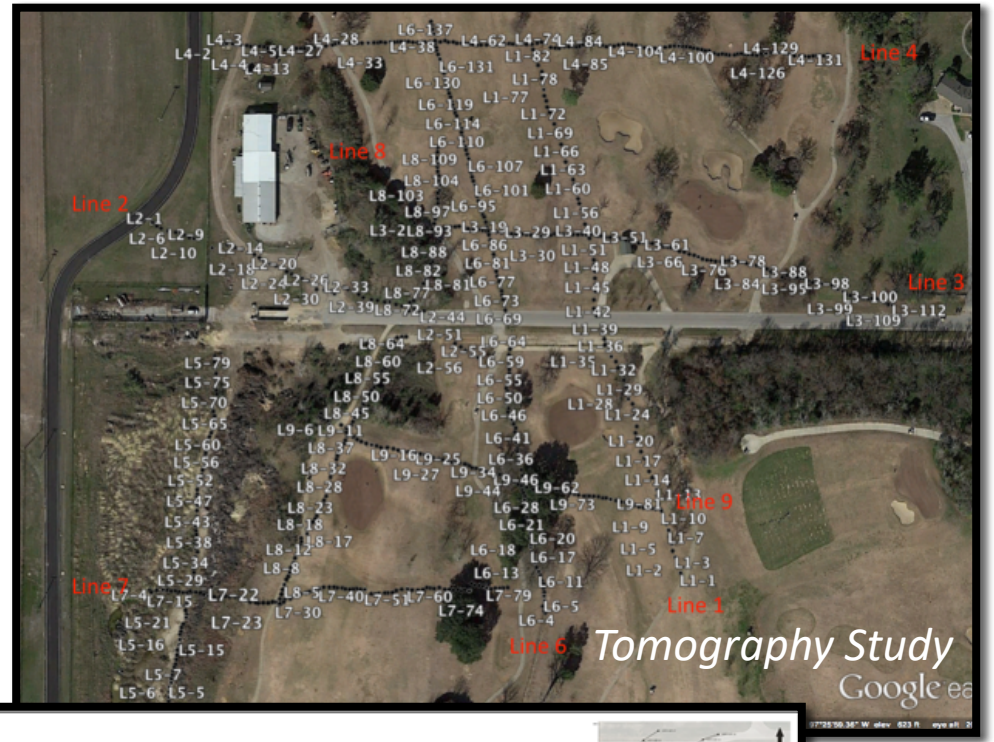
- Groundwater flow is from the northwest (Lake Worth) to the southeast (golf course).
- Depth to groundwater is approximately 55 to 9 feet below ground surface
- Small plumes observed under Landfills No. 1/3 (DNAPL area) and Chrome Pit No. 3 areas
- Contamination likely a result of poorly constructed monitoring wells that acted as a conduit from the Terrace Alluvium

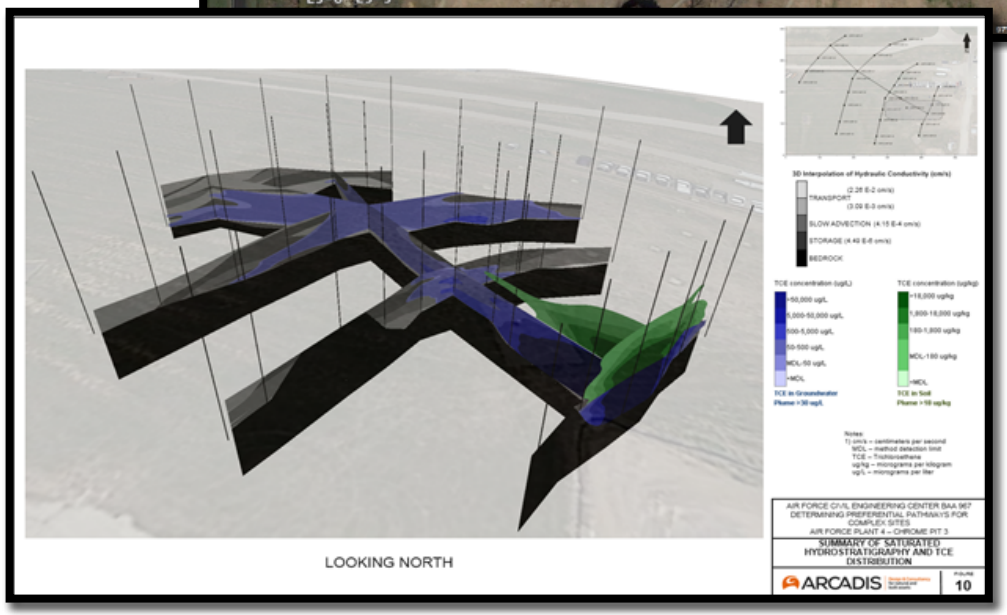
Trichloroethene >5 µg/L - green
cis-1,2-Dichloroethene >70 µg/L - pink
Vinyl Chloride >2 µg/L – cyan

Complex Site Initiative

2014-2017

- Evaluated existing ROD remedies
- Identified data gaps
- Updated the conceptual site model
- Performed a geophysical tomography and hydrological tomography study at Hawks Creek Golf Club
- Performed a thermal enhanced natural source zone depletion evaluation within the DNAPL area of Landfill No. 1
- Performed a stratigraphic flux analyses at Chrome Pit No. 3
- Performed an MNA evaluation across all groundwater plumes



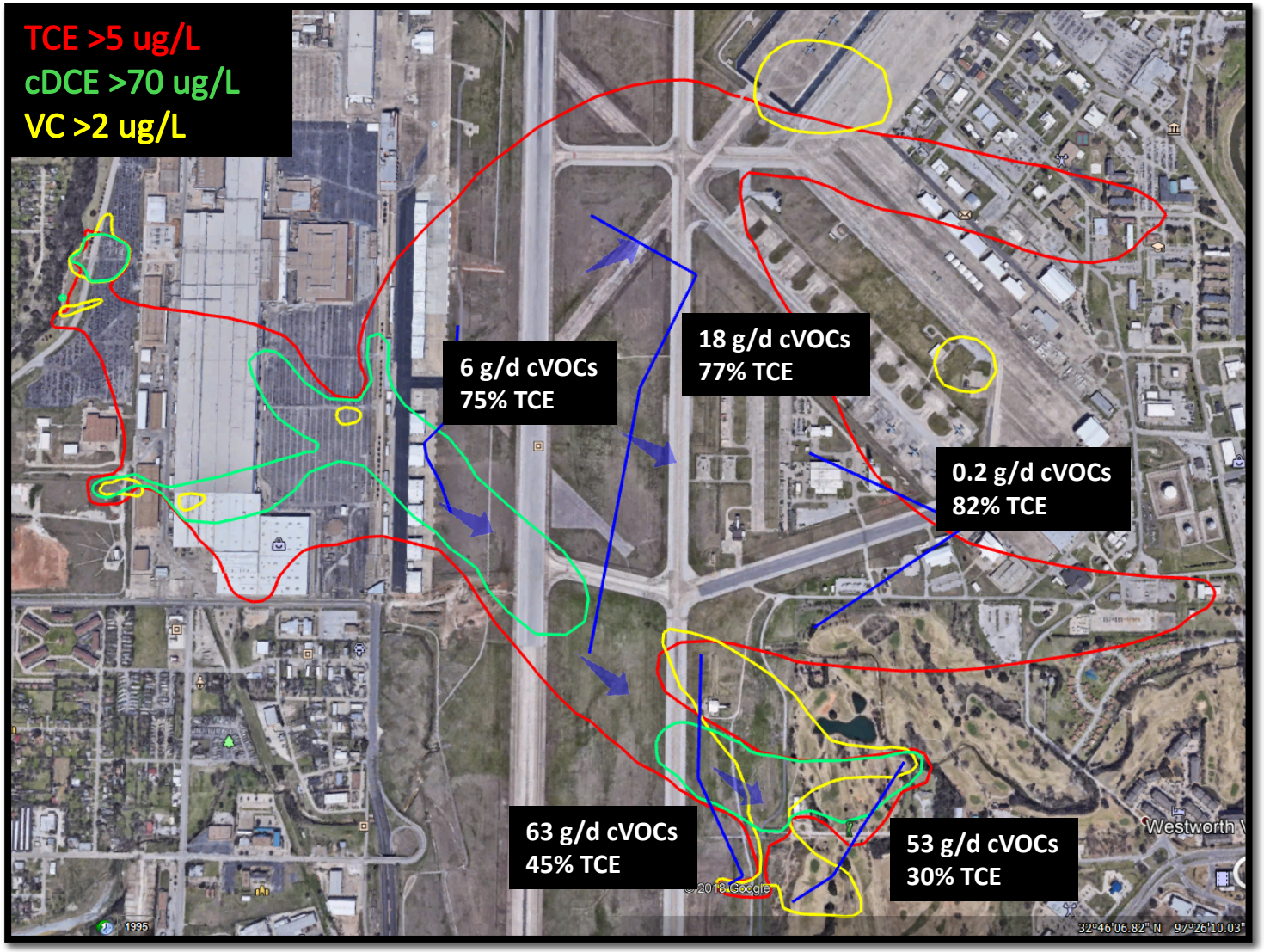


Stratigraphic Flux Analyses at CP3

Complex Site Initiative

Conclusions

- MNA was occurring
- Contaminant mass was not migrating at appreciable rates downgradient of the source areas
- There was no hydraulic connection between the Terrace Alluvium and Paluxy Aquifer

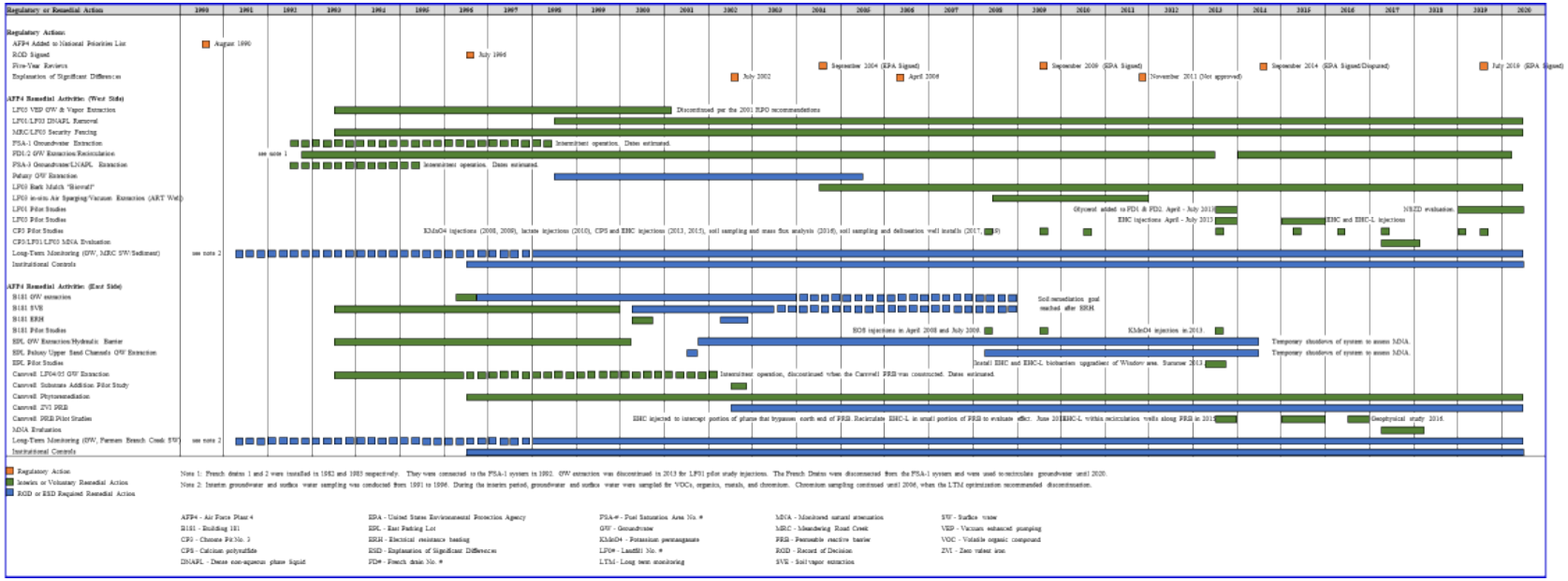


Mass Flux Analyses across East TA Plume

Focused Feasibility Study

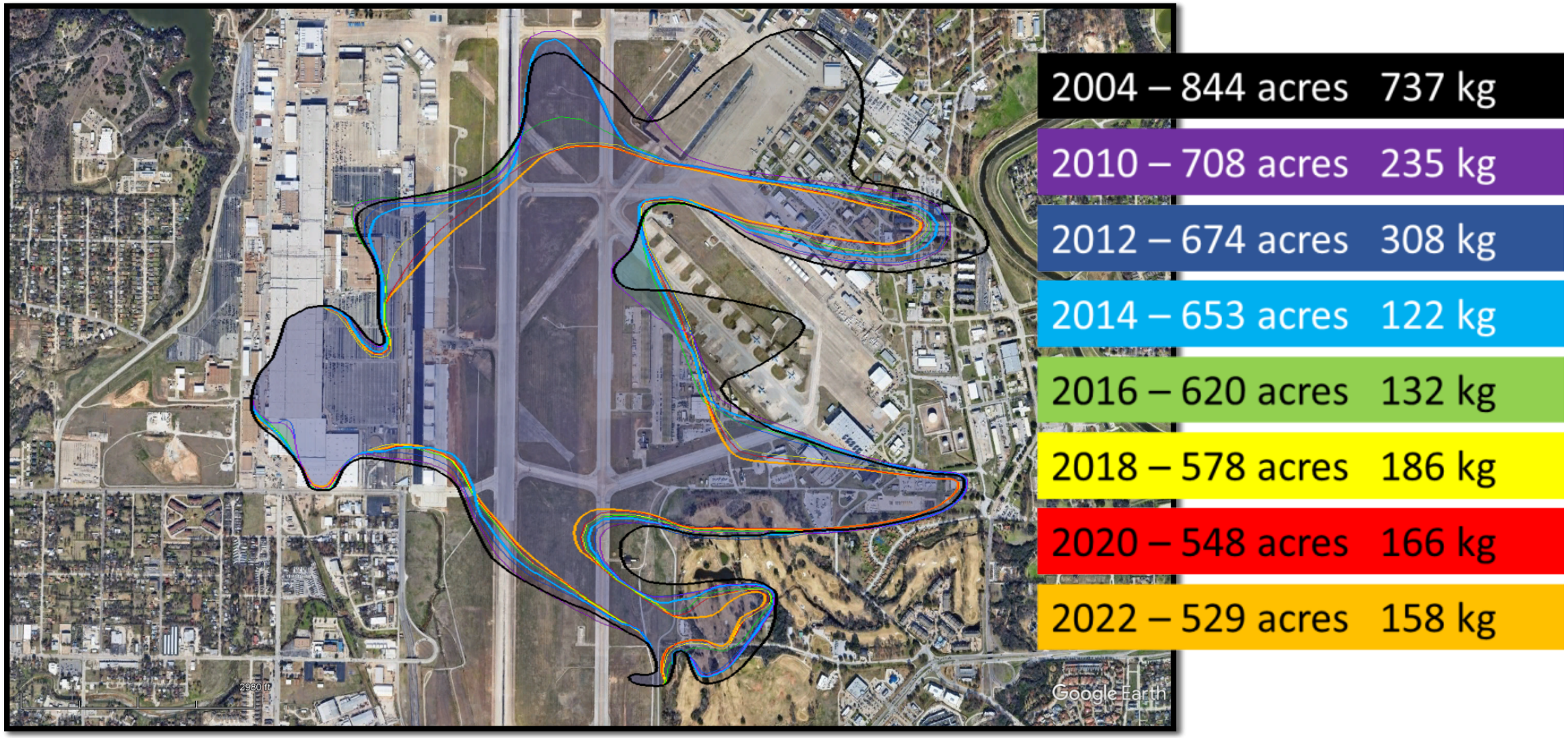
2017-2021

- Evaluated formerly implemented and existing technologies
  - Pump and Treat
  - ERH
  - SVE
  - VEP
  - ISCO
  - Bioremediation
  - Phytoremediation
  - ZVI PRB
  - Biowall
  - Geochemical fixation
- Evaluated MNA
- Evaluated in-situ Bioremediation (*permanent injection wells*)



Technologies that had been implemented across AFP4 sites since 1990

Focused Feasibility Study

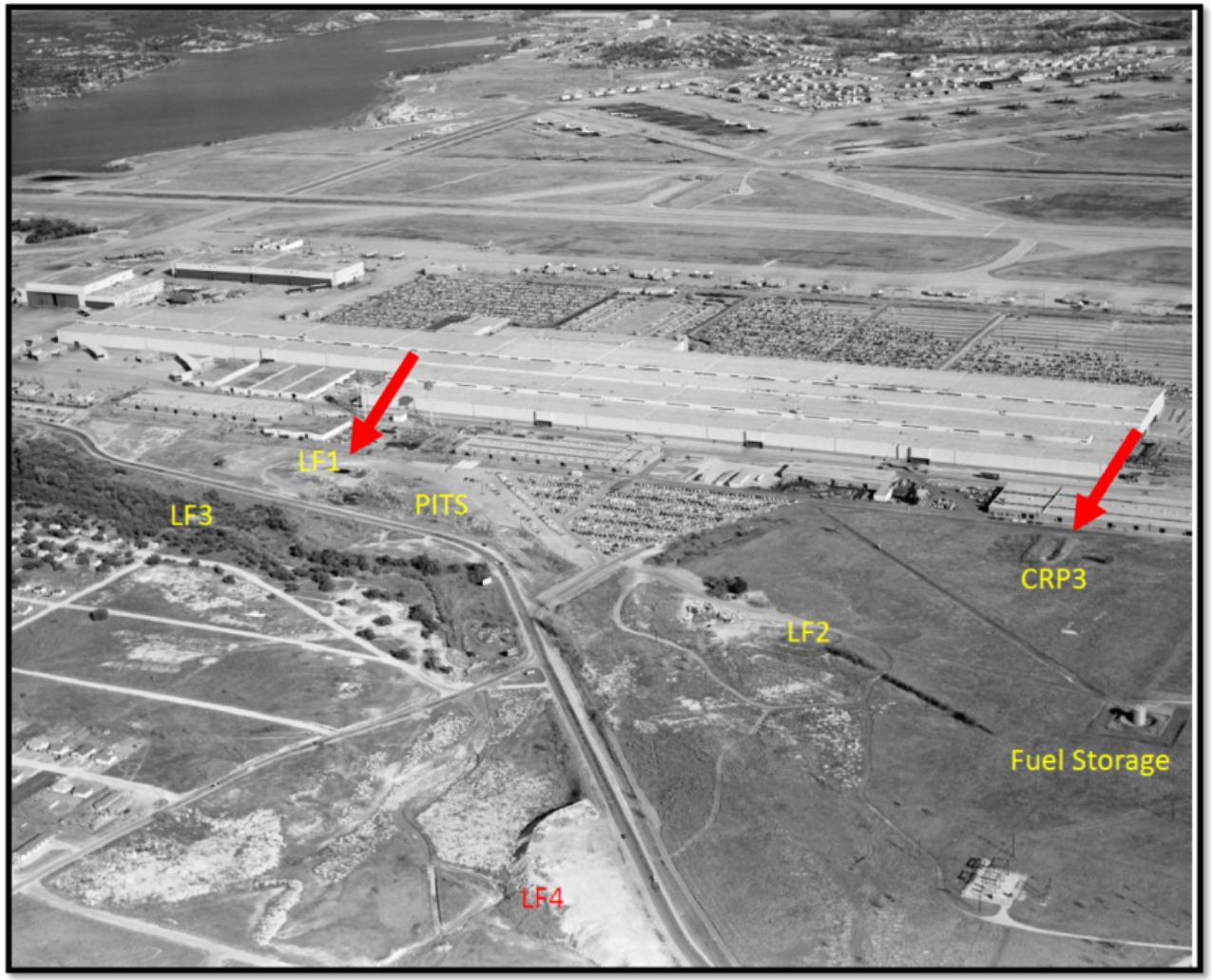


Terrace Alluvium TCE East Plume Size and Mass Over Time

Technical Impracticability Waiver

2020-2022

- Applied for 3 TI Waivers to waive ARAR of achieving MCLs in source areas
  - Landfills No.1 and 3 (granted)
  - Chrome Pit No. 3 (denied)
  - Building 181 (denied)
- May retry for denied areas after additional data is gathered

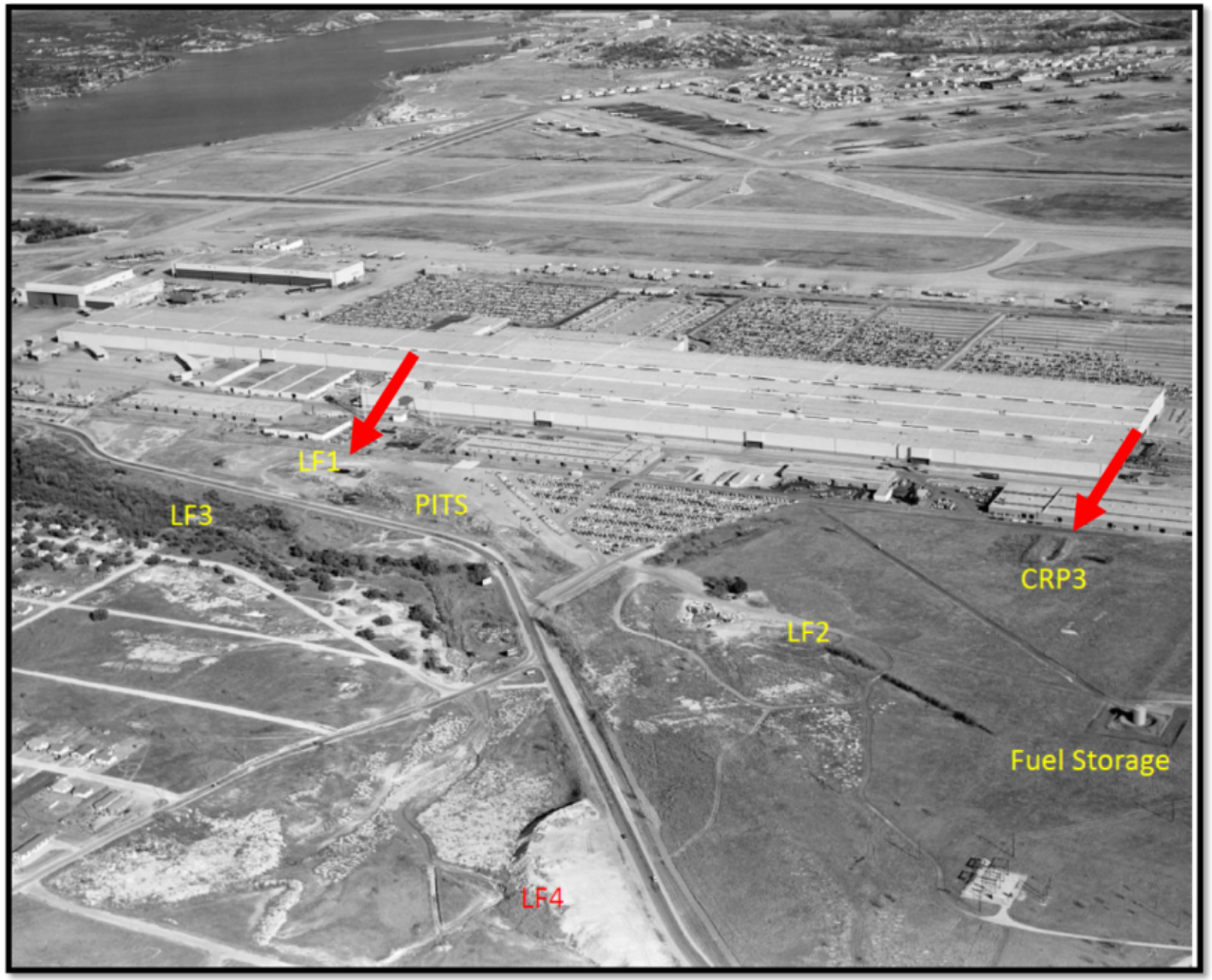


Historical aerial photo of AFP4. Waste pits are visible in former Landfill No. 1 and Chrome Pit No. 3 areas.

Proposed Plan and ROD Amendment

2020-2023

- Selected MNA for all groundwater bearing units
  - Based on Cost and Implementability
  - Set time frames for each unit
  - To be evaluated every 5 years
- DNAPL recovery with a TI Waiver of MCLs in DNAPL area of Landfills No. 1 & 3
- Contingencies included for in-situ bioremediation or natural source zone depletion if MNA does not meet performance objectives



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A Big Thanks to the Whole Team!

AFCEC
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