Kirtland Air Force Base Fuel Leak Cleanup

November 17, 2015

Welcome

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U.S. Air Force

Progress Report by:

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A Partnership for Success

A collaborative technical team is solving the complex hydrogeologic and engineering challenges posed by fuel leak

New Mexico Environment Department

Air Force Civil Engineer Center

Albuquerque Bernalillo County Water Utility Authority

City of Albuquerque New Mexico 1706

United States Environmental Protection Agency

USGS science for a changing world

New Mexico Bureau of Geology and Mineral Resources

CB&I

US Army Corps of Engineers

NGS

INTERA GEOSCIENCE & ENGINEERING SOLUTIONS

Colorado State University

PORTAGE

NEPTUNE AND COMPANY

AECOM

noblis For the best of reasons

Thomson and Associates

Team Members

The following people are gratefully acknowledged for their contributions towards the progress that has been made during 2015

NMED
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Dave Cobrain
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Ryan Flynn
Steve Huddleson
John Kieling
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Dennis McQuillan
Steve Pullen
Stephen Reuter
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Kathleen Romalia
Stuart Shealy
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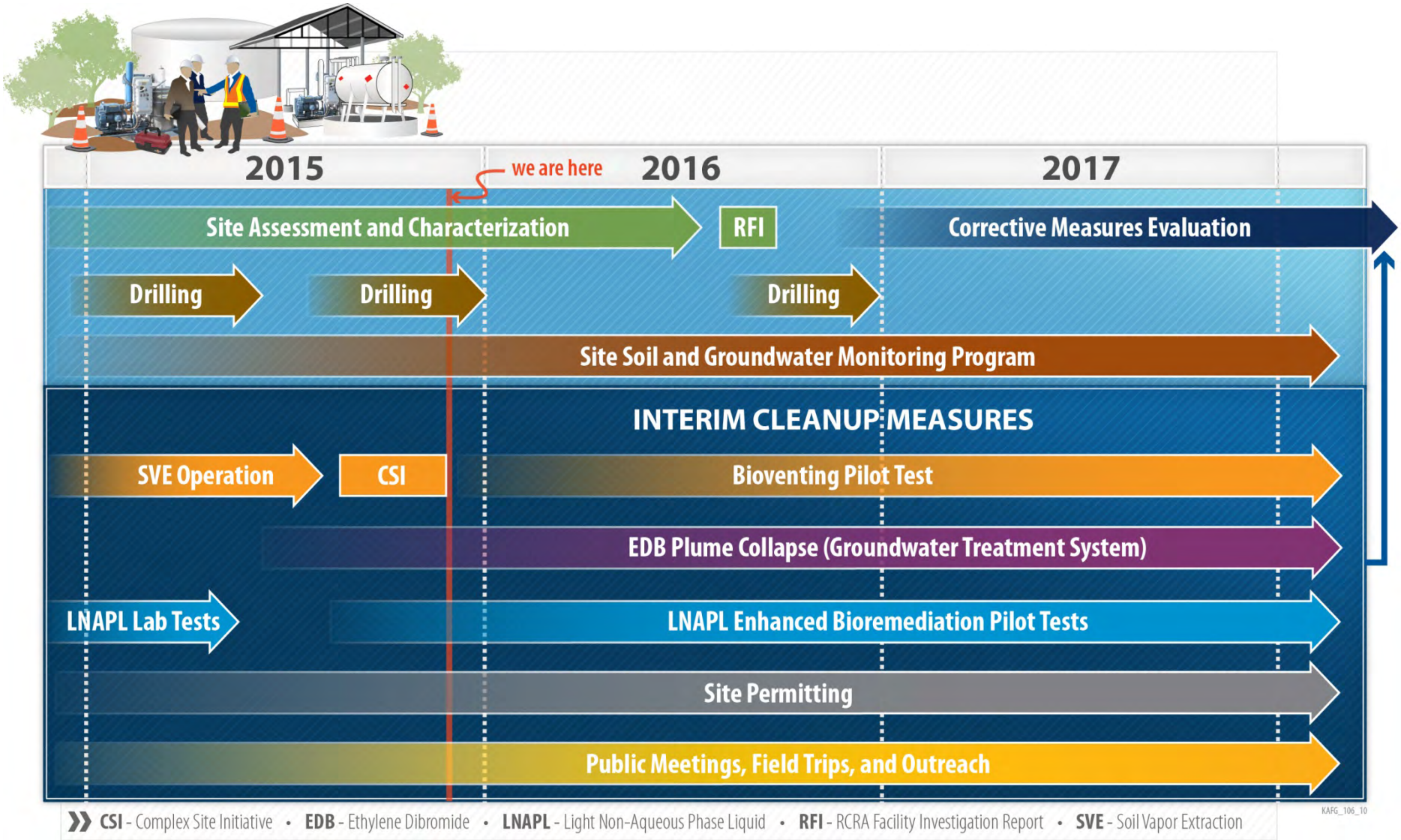
Jason Tarbert
Jim Teo
Jon Vail

Cherokee
Jennifer Schneider

Current Timeline



Major Progress Since July

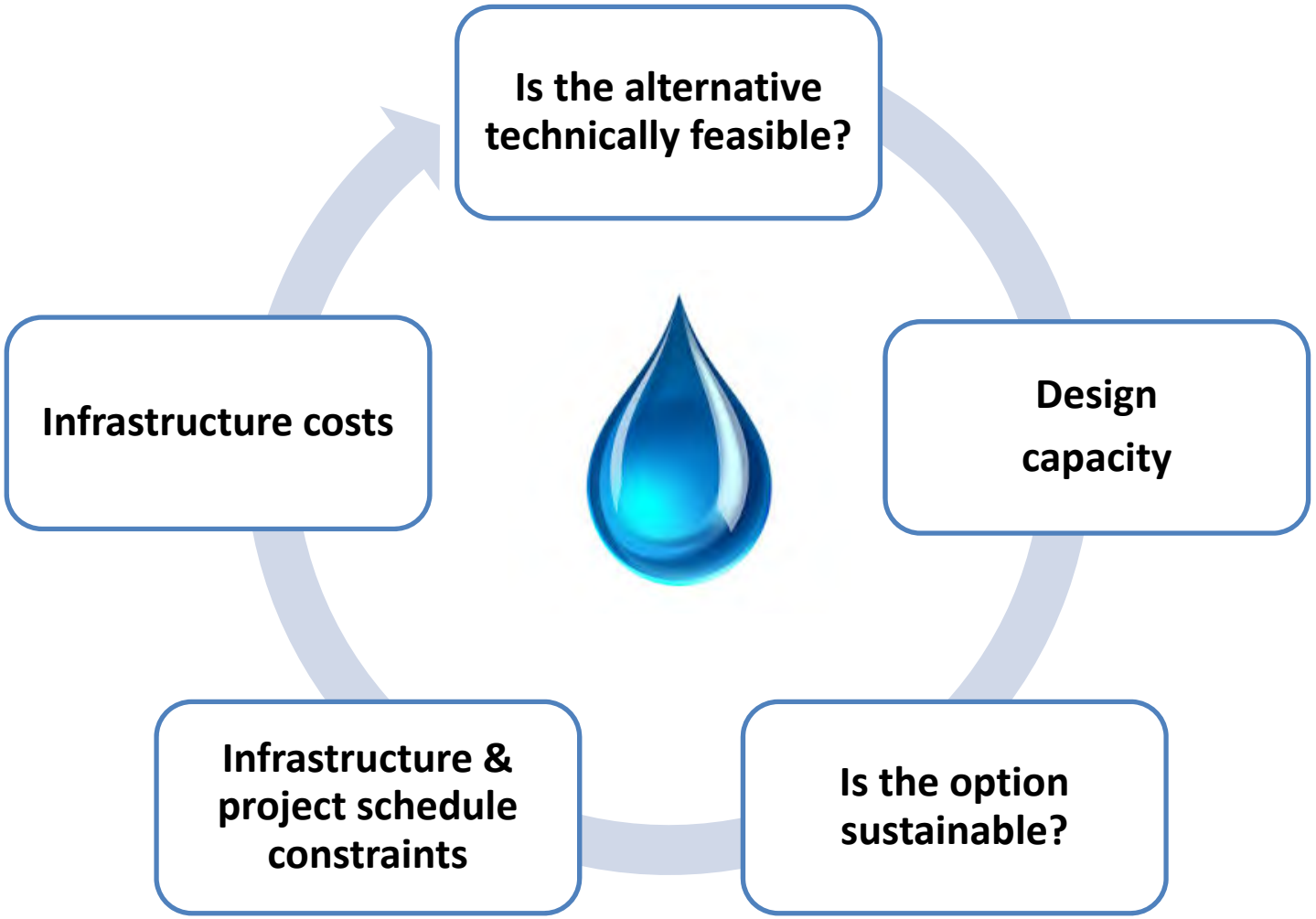
- **Five university guest lectures, six public events including public field trip and briefing the New Mexico Legislative Radioactive and Hazardous Materials Interim Committee**
- **Northern extent of dissolved ethylene dibromide (EDB) plume is defined**
    - **Four new groundwater monitoring wells drilled and sampled**
- **Aquifer performance test on first extraction well**
- **Water level measurements across base**
- **Revised modeling using new data**

Major Progress Since July

- Temporary treatment system continued remove EDB from groundwater
- Two additional extraction wells drilled and developed
- Full-scale groundwater treatment system (GWTS) to be operational by Dec 2015
- Conducting community relations plan update which includes gauging interest in Restoration Advisory Board
- Independent panel of experts created, reviewed Light Non-Aqueous Phase Liquid (LNAPL) technologies
- Identifying options for beneficial reuse of treated water

Beneficial Use of Treated Water

Important factors partners considered when evaluating beneficial use alternatives:



NMED 2015 Strategic Plan – How Did We Do?

<u>Goal</u>: Protect Albuquerque's aquifer and the drinking water supply wells in the area of the fuel leak

<u>Strategies to Achieve the Goal</u>:

1) **Continue robust groundwater and wellhead monitoring**

2) **Collapse the dissolved EDB Plume away from the Albuquerque Bernalillo County Water Utility Aquifer Wells**

3) **Clean up soil in the leak area**

4) **Remediate LNAPL and associated dissolved phases in the LNAPL area**

5) **Meet or exceed all requirements for providing public information and involvement**

NMED 2016 Strategic Plan – Official Draft

***Goal*: Protect Albuquerque's aquifer and the drinking water supply wells in the area of the fuel leak**

Strategies to Achieve the Goal:

1) **Implement a robust site monitoring and wellhead protection program**

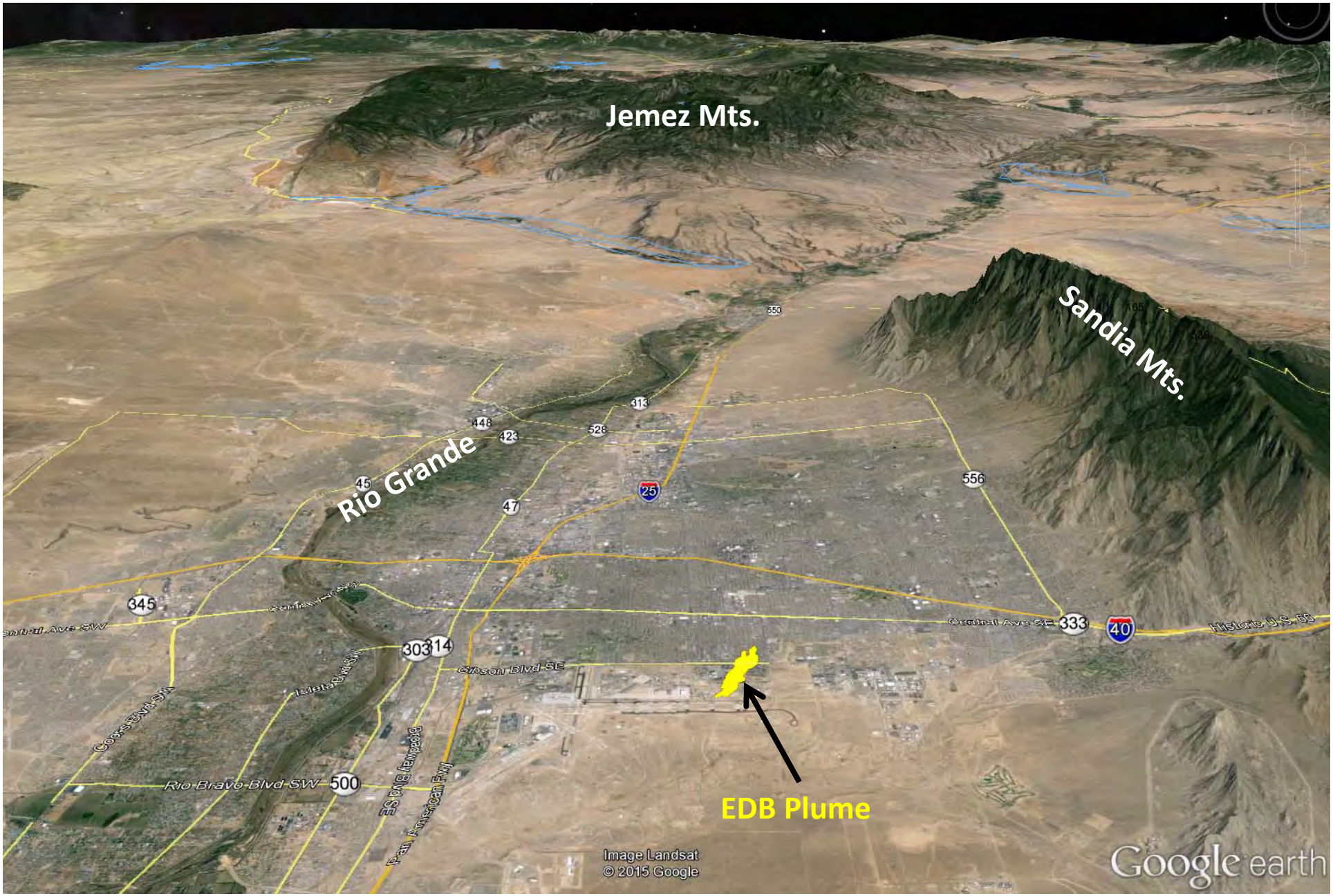
2) **Characterize and remediate LNAPL, impacted soil, and associated dissolved phases in the source area**

3) **Collapsed the dissolved EDB plume**

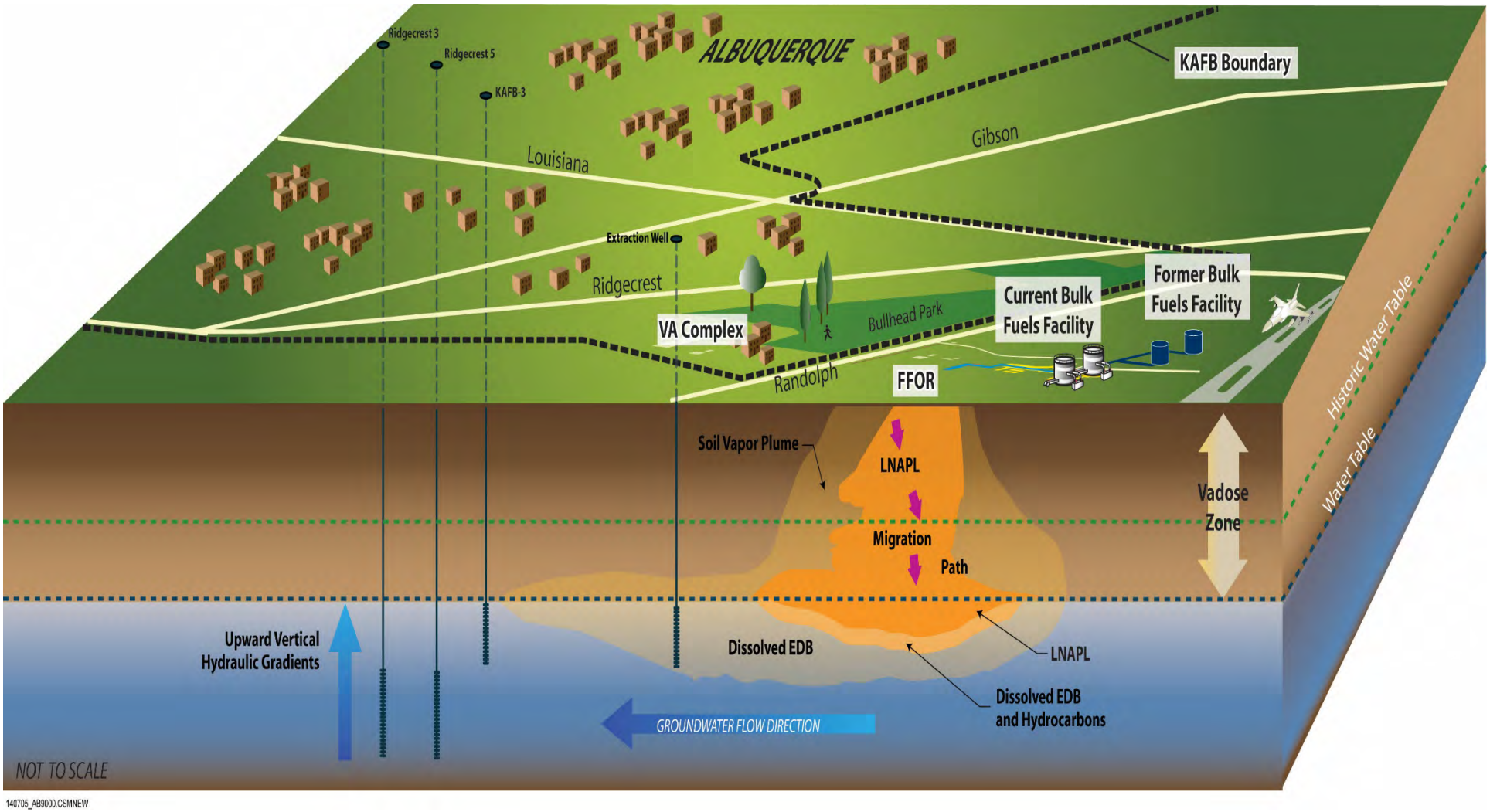
4) **Meet or exceed all requirements for providing public information and involvement**

NMED Website & Listserv: http://www.nmenv.state.nm.us/

Middle Rio Grande Basin



Conceptual Site Diagram



Plume Anatomy

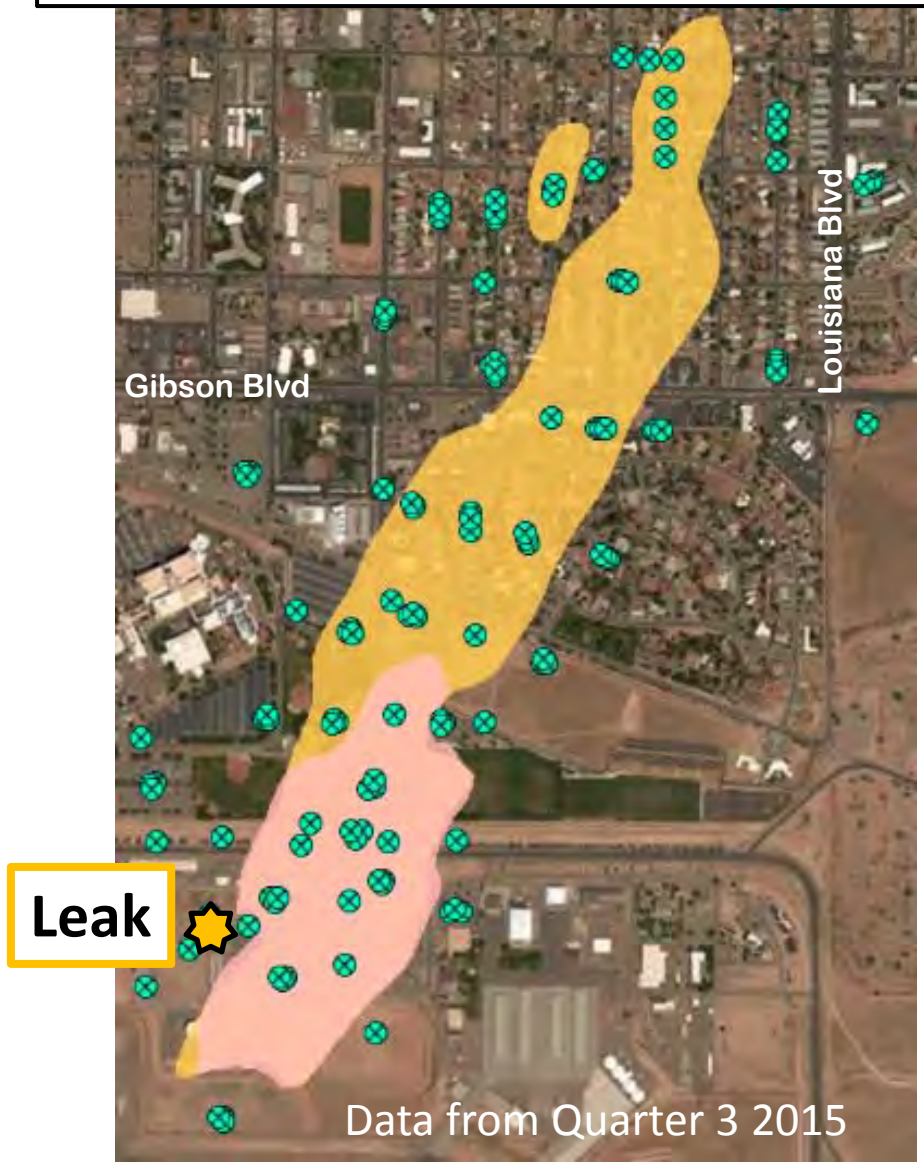
Distal Plume:

- **Only dissolved EDB @ low ppb**
- **No biodegradation**

Source Area:

- **Highest fuel concentrations**
- **Residual LNAPL**
- **Dissolved Hydrocarbons**
- **Dissolved EDB**

Elevated alkalinity and bromide from biodegradation



Interim Measure Cleanup Strategies

Collapse EDB Plume:

- Away from drinking water supply wells
- To contain EDB mass

Pilot Tests:

- Enhanced biodegradation
- Bioremediation sparging
- Bioventing

Completed:

- Soil excavation
- Soil Vapor Extraction (SVE)

Drinking Water Protection

Monthly testing of drinking water supply wells in the vicinity of the plume shows no detections of fuel contaminants

Drilling & Hydrologic Investigations

Thank You Neighborhoods!

The Air Force, NMED, and all the collaborating organizations sincerely thank the neighborhoods for putting up with the temporary road blocks and noise from the well drilling rigs

Data-Driven Investigation & Cleanup

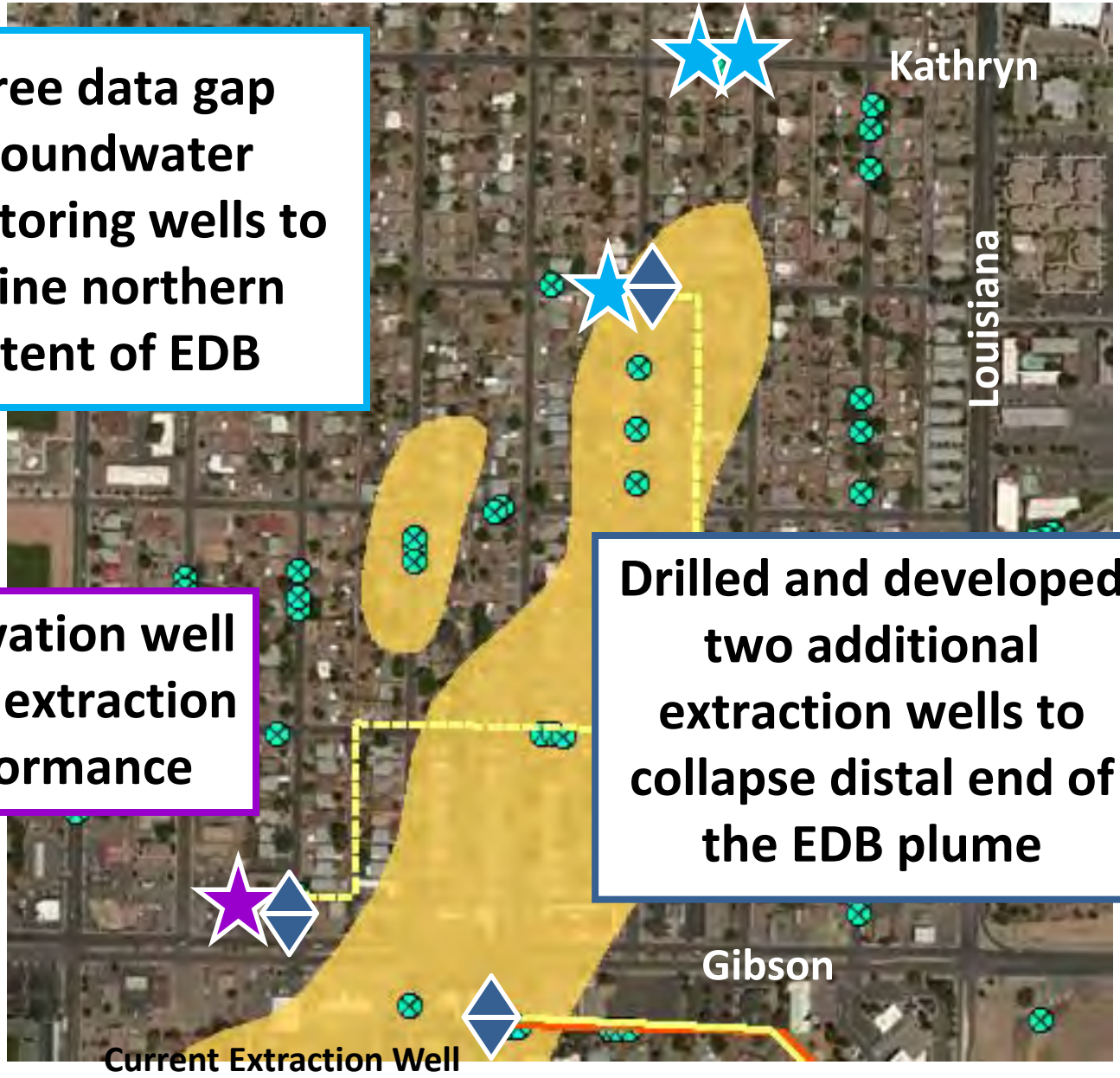
- **The Air Force and NMED have a vision for how the investigation and cleanup will proceed**
- **Work plans are developed for specific actions**
- **We drill, construct, measure, sample and test**
- **Then, we evaluate all available data to make decisions on what the next steps should be, and prepare the next work plans**
- **This flexibility provides efficiency and cost effectiveness**

Additional Well Drilling Completed

Three data gap groundwater monitoring wells to define northern extent of EDB

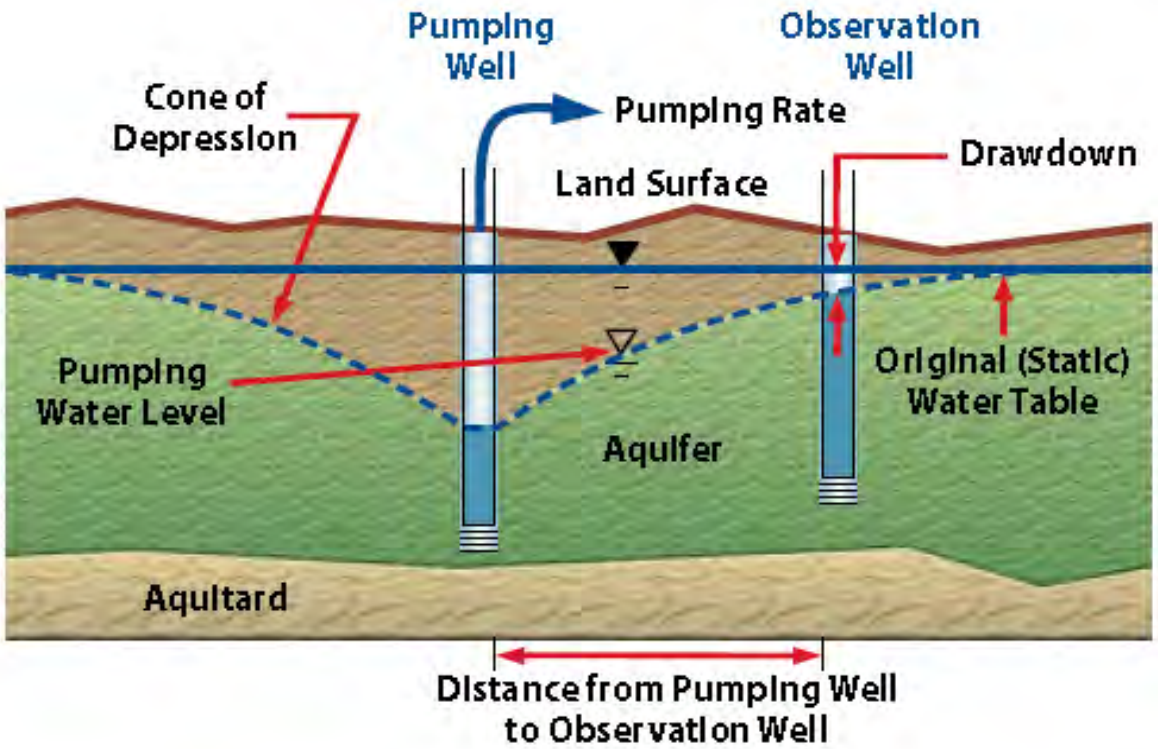
One observation well to monitor extraction well performance

Drilled and developed two additional extraction wells to collapse distal end of the EDB plume

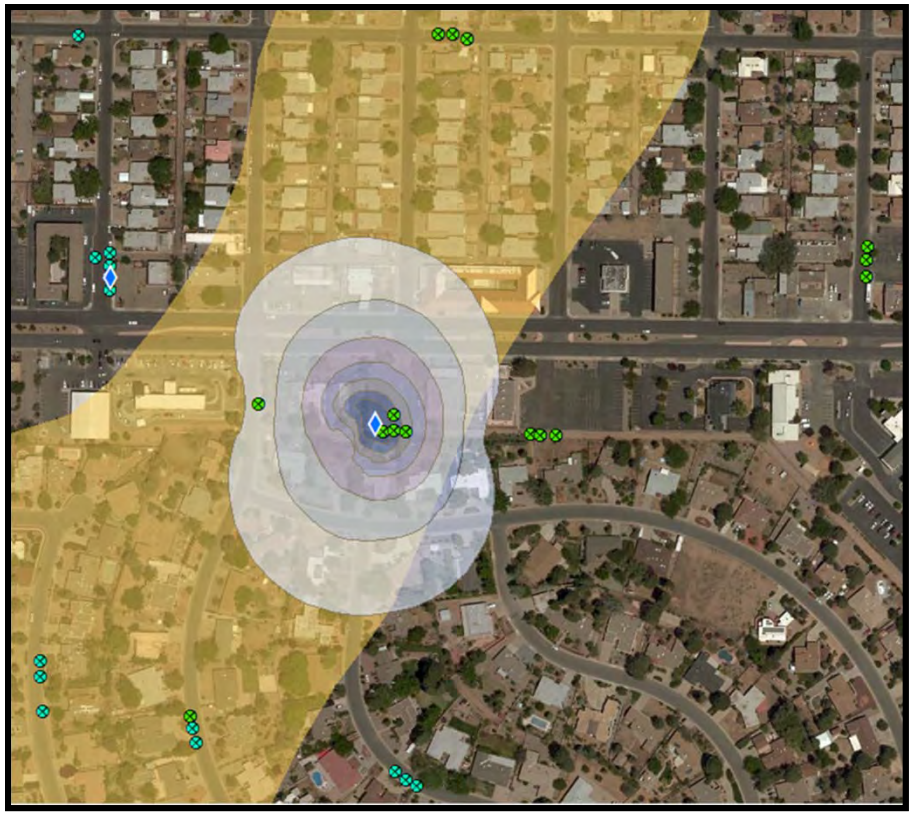


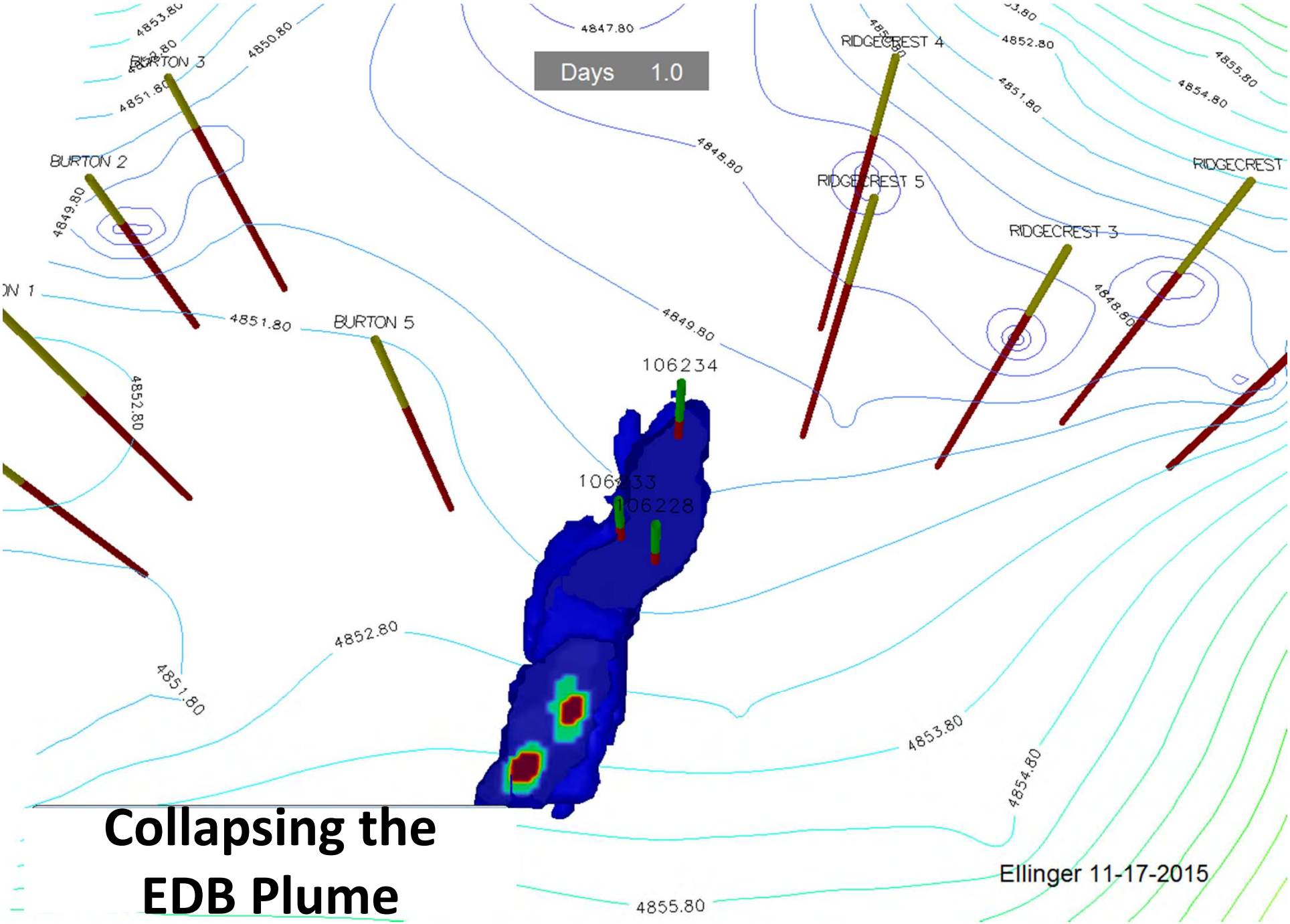
Aquifer Performance Testing

- Completed in August 2015
- Sustained pumping of the extraction well
- Measure water-level drawdown in pumping well and in observation wells
- Measure water-level recovery after pumping ends
- Use pump test data to calculate hydraulic properties of aquifer



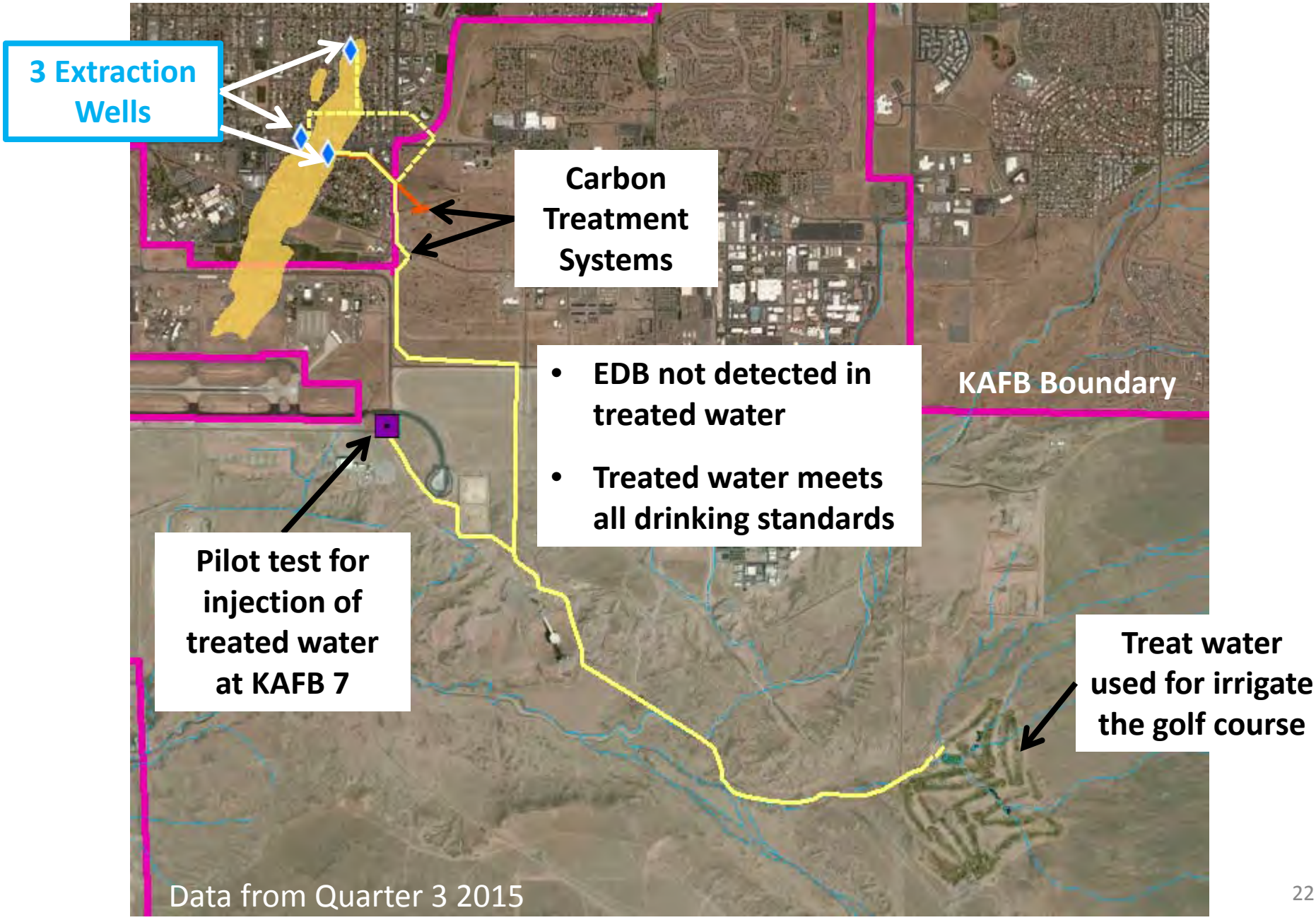
Extraction Well Cone of Depression





Collapsing the EDB Plume

Groundwater Treatment System



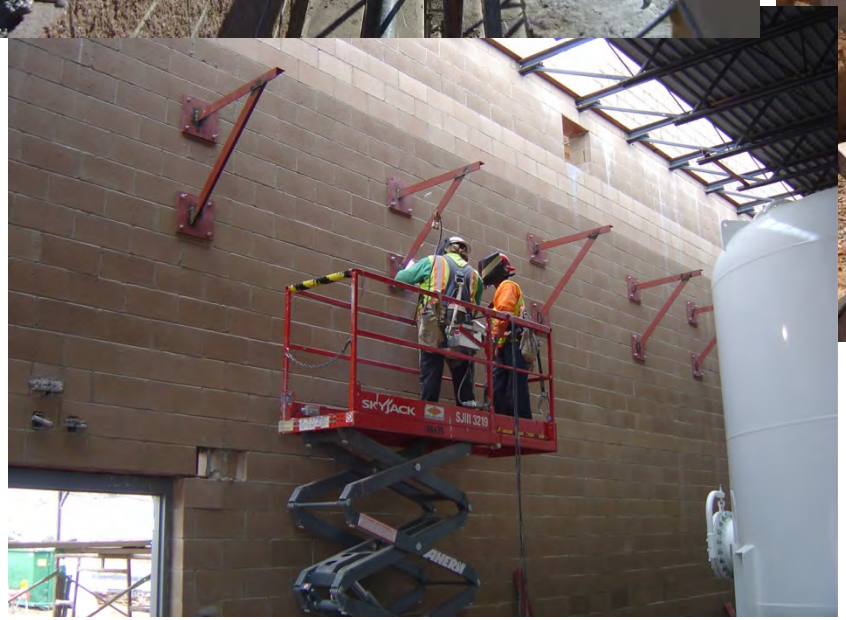
- EDB not detected in treated water
- Treated water meets all drinking standards

Groundwater Treatment System Construction

Mason Wall Grout Placement for GWTS Building

Extraction Wellhead Construction

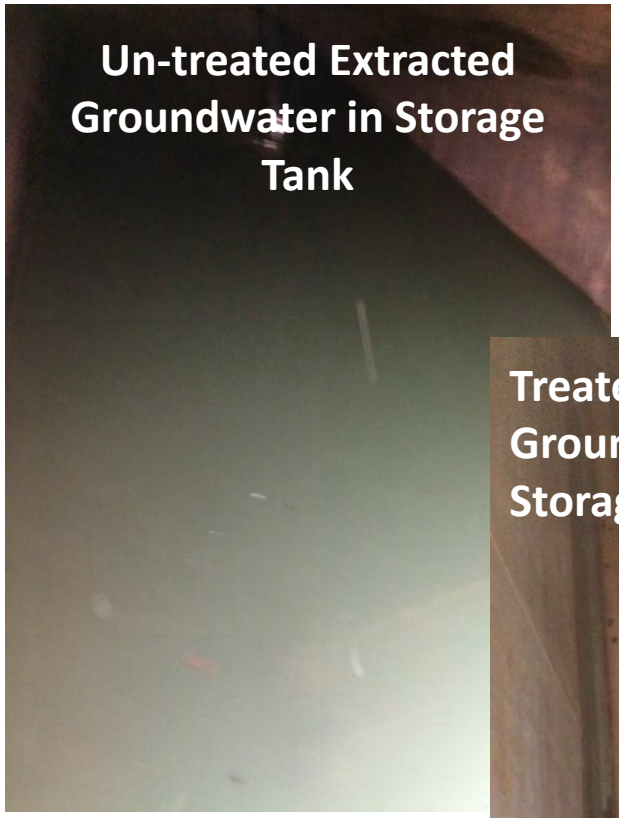
Installation of Discharge Pipe

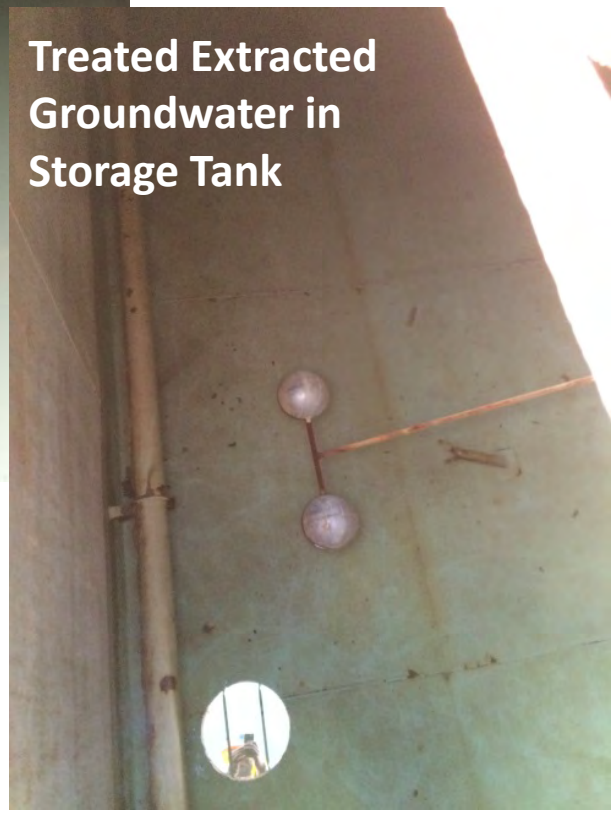


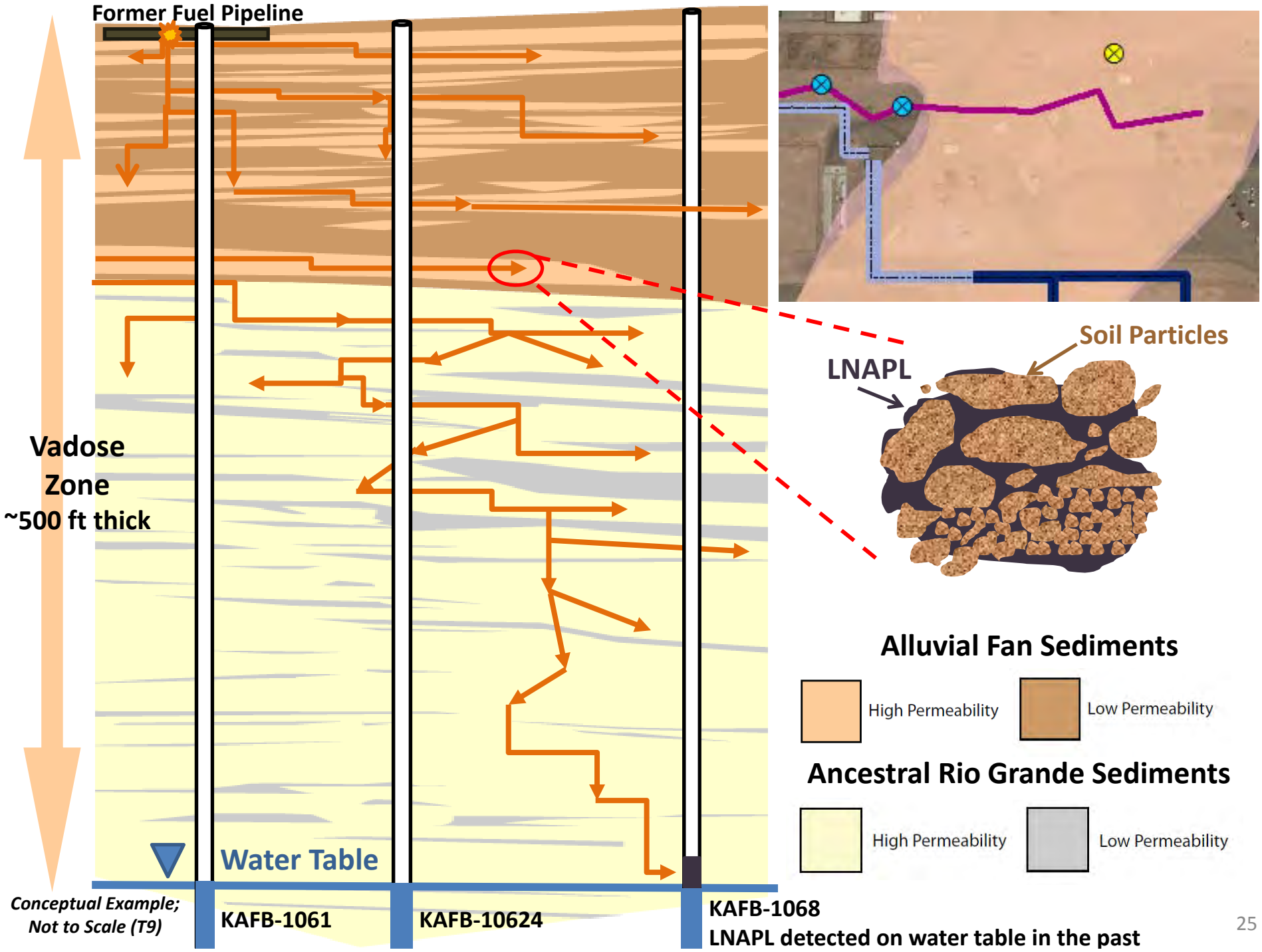
Welding Pipe Supports inside GWTS Building

Groundwater Takeaway

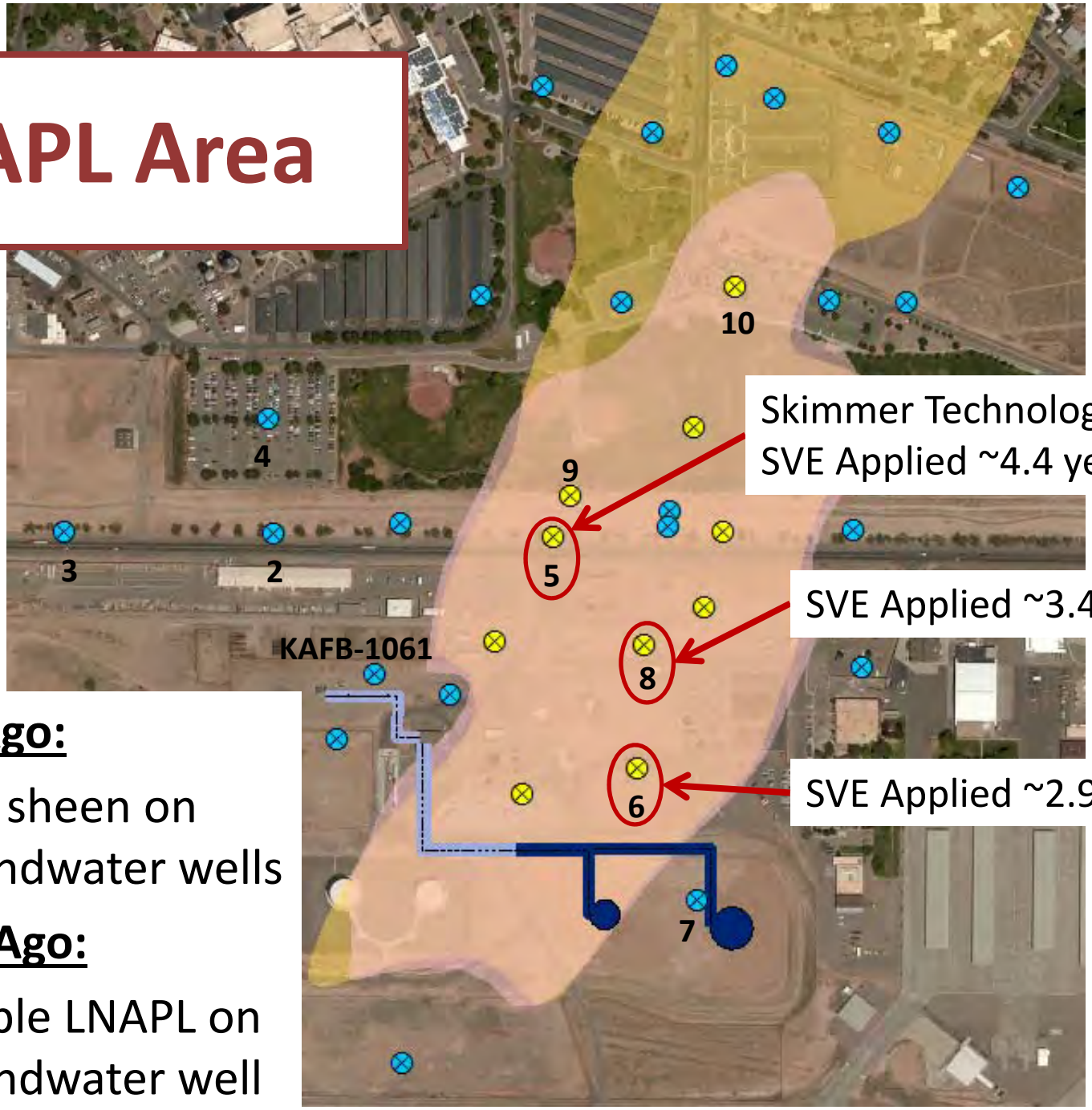
- First extraction well has treated 16 million gallons and removed 6,413 mg of EDB
- EDB not detected in treated water
- Treated water meets all drinking water standards
- Treated water is being used to irrigate Kirtland golf course
- Evaluating beneficial reuse options






Former Fuel Pipeline
Vadose Zone
~500 ft thick
Water Table
Conceptual Example; Not to Scale (T9)
KAFB-1061
KAFB-10624
KAFB-1068
LNAPL detected on water table in the past
Soil Particles
LNAPL
Alluvial Fan Sediments
High Permeability
Low Permeability
Ancestral Rio Grande Sediments
High Permeability
Low Permeability

LNAPL Area



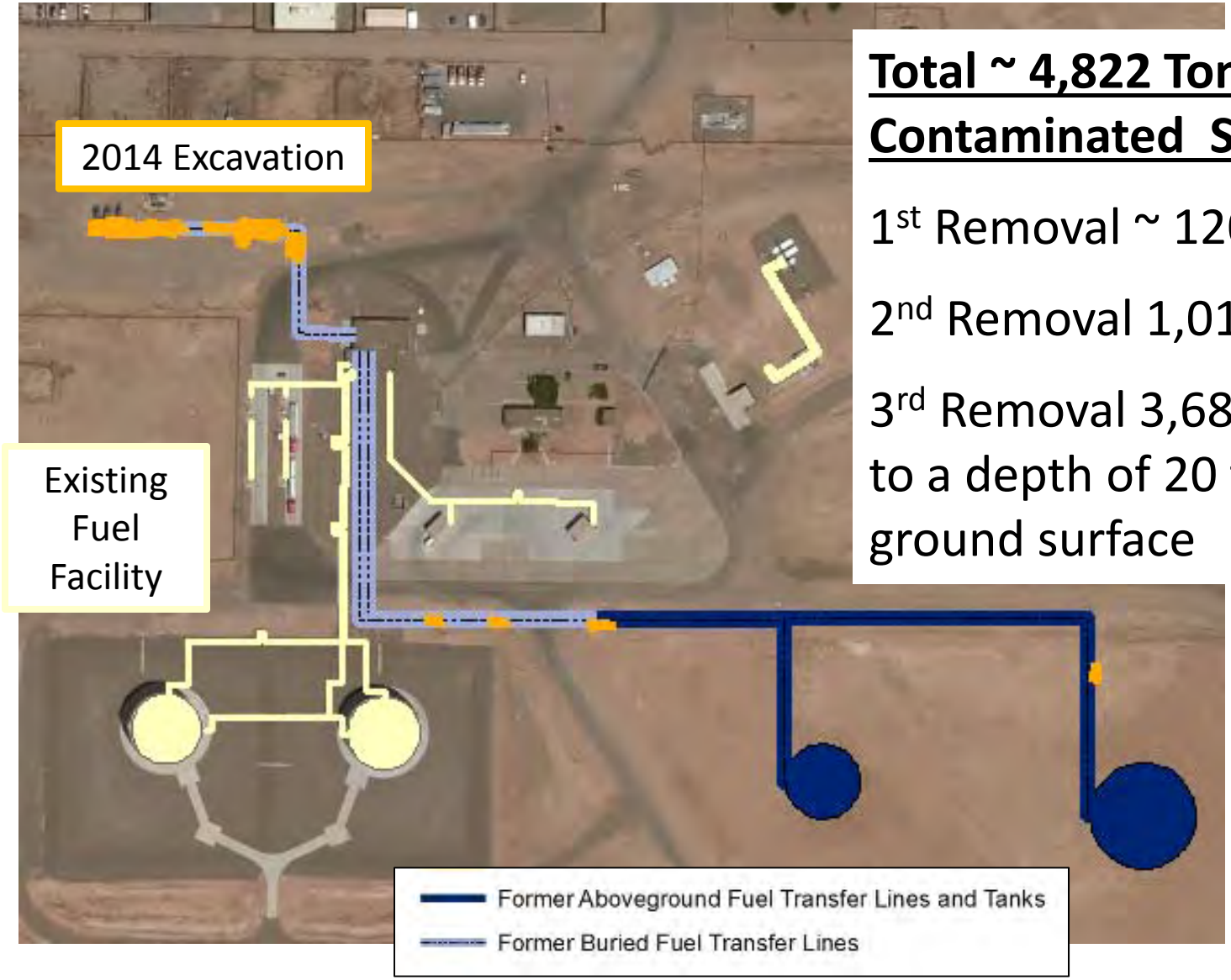
One Year Ago:

- Detected sheen on two groundwater wells

Two Years Ago:

- Measurable LNAPL on one groundwater well

Soil Excavation Success



<u>Total ~ 4,822 Tons Contaminated Soil Removed:</u>

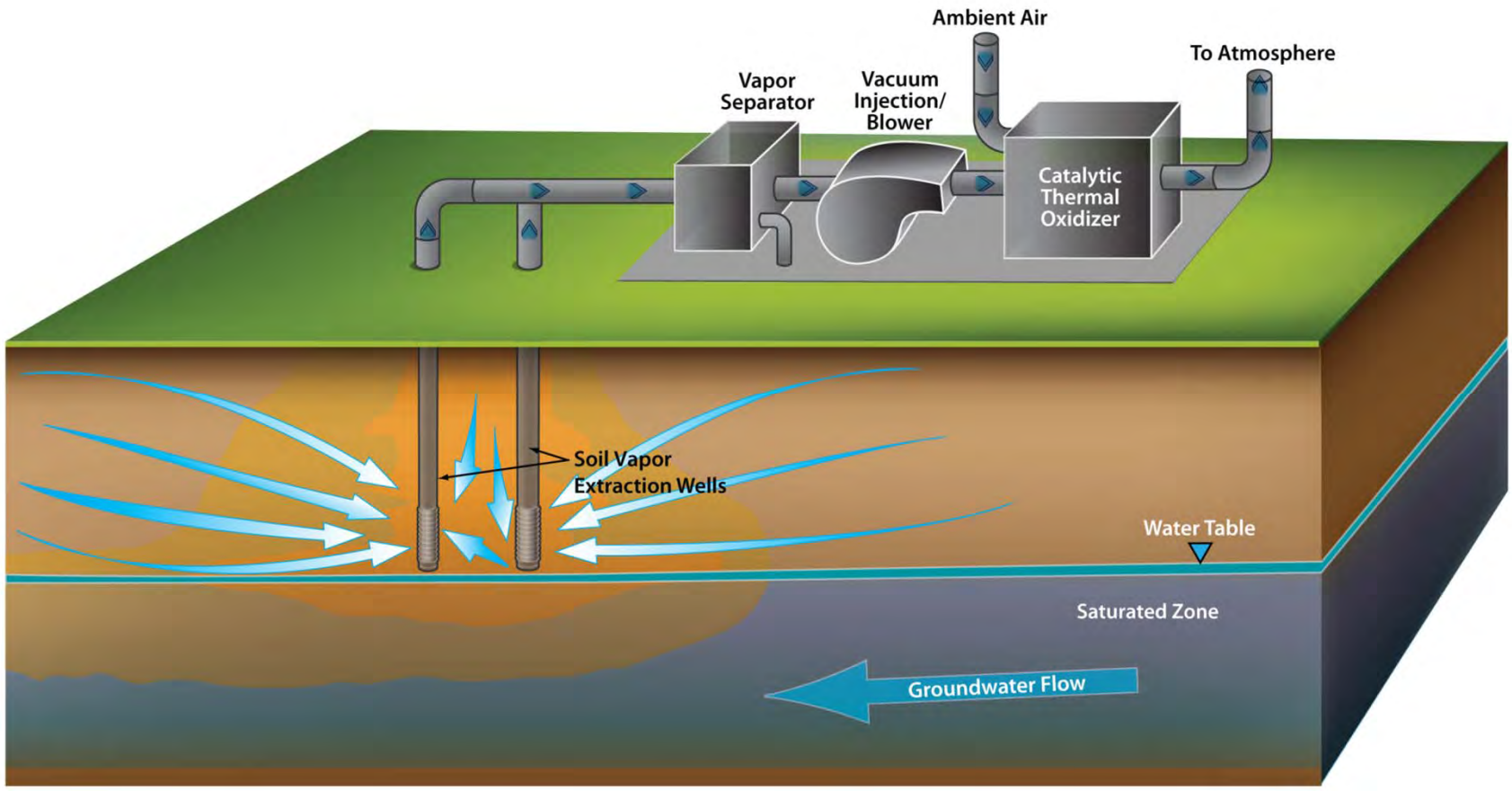
1st Removal ~ 120 tons in 2000

2nd Removal 1,018 tons in 2010

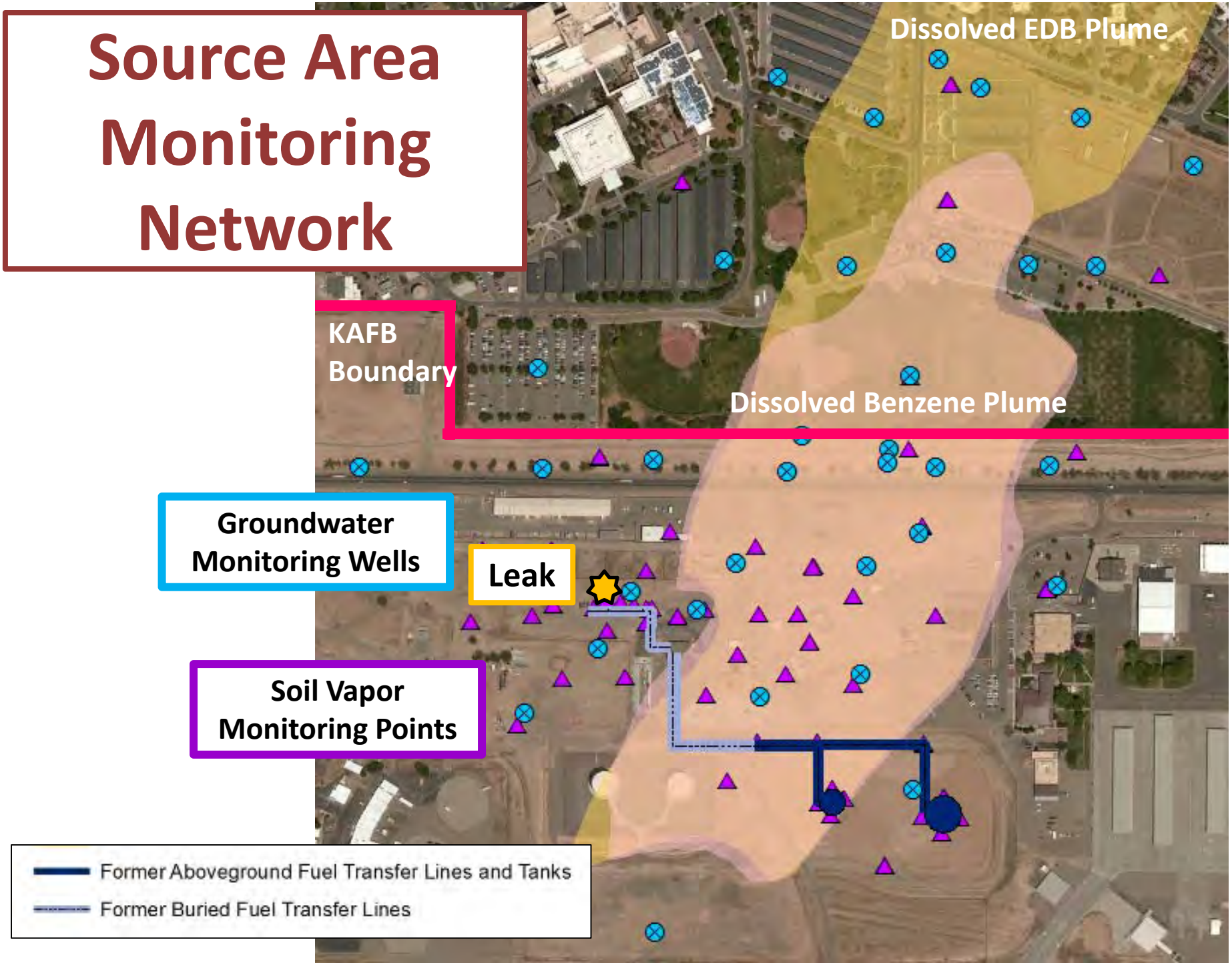
3rd Removal 3,684 tons in 2014 to a depth of 20 feet below ground surface

Soil Vapor Extraction Success

- More than 550,000 gallons of fuel recovered by SVE
- More than 200,000 gallons of fuel biodegraded
- After 12 years of SVE, soil vapor concentrations are decreasing
- In situ respiration and rebound testing ongoing



Source Area Monitoring Network



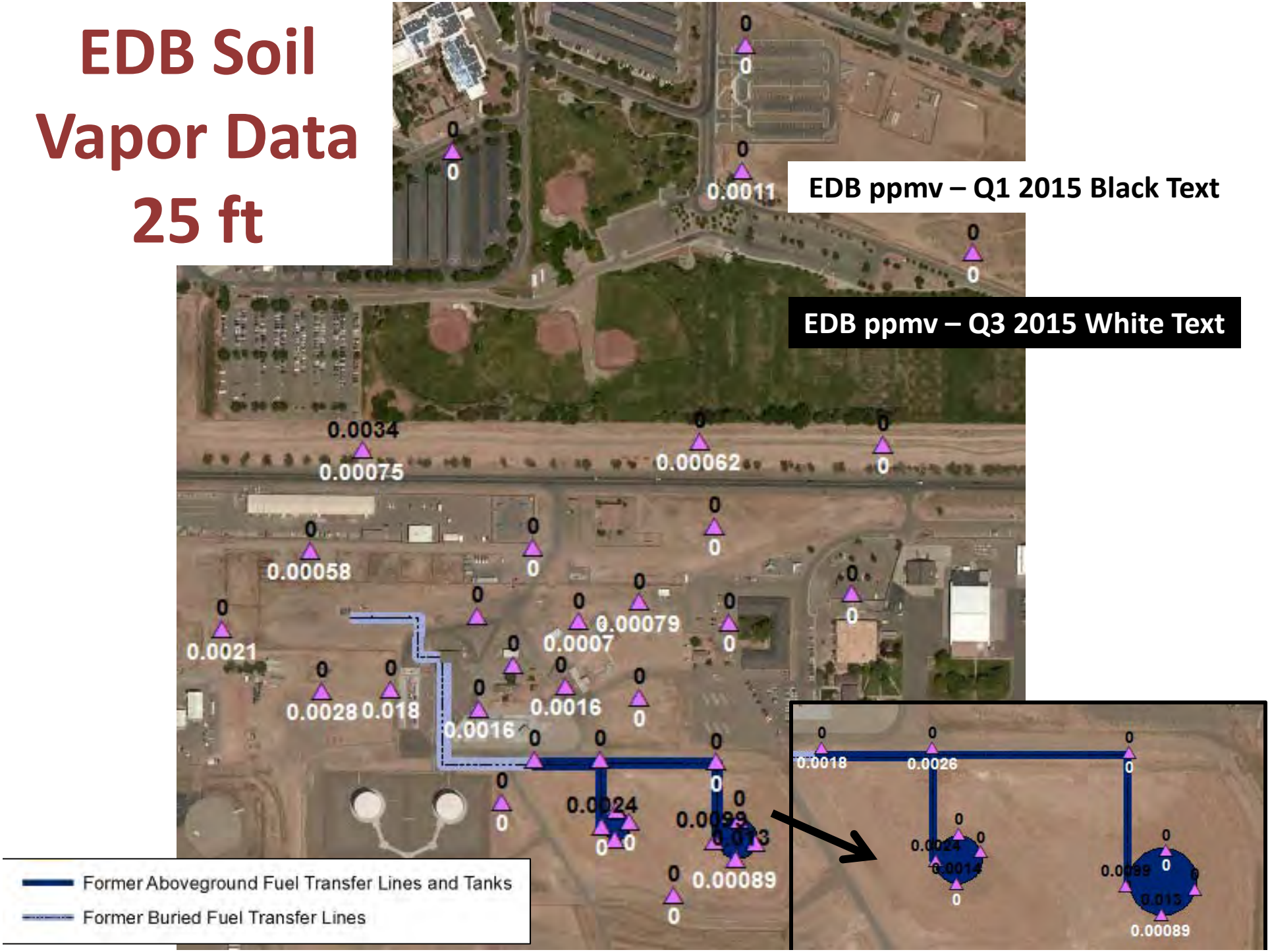
Soil Vapor Extraction Shutdown Test

Objective: Monitor in-situ respiration and hydrocarbon rebound in the vadose zone over 3 months; collected 6 month event (Q4 2015)

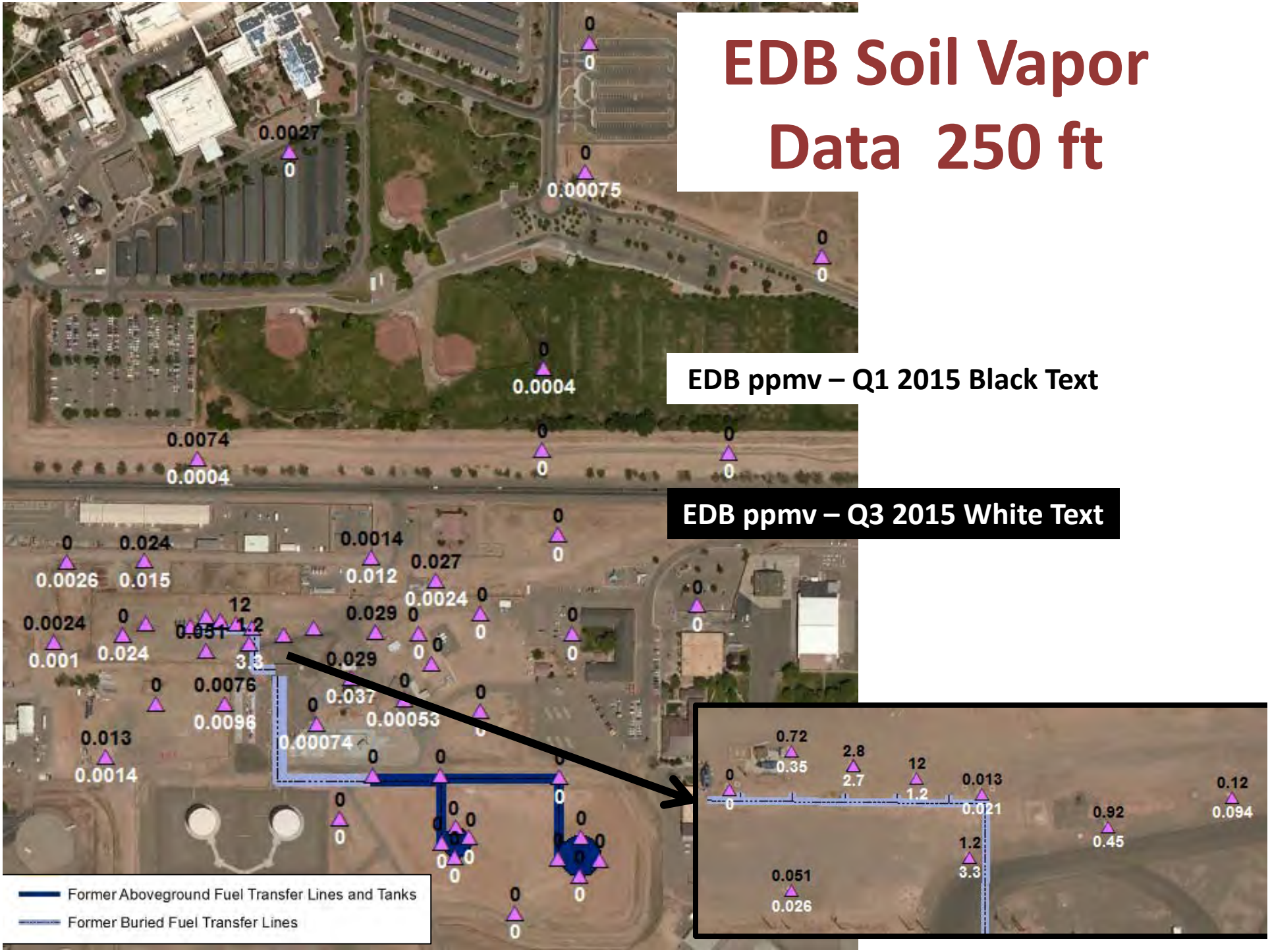
<u>Soil-vapor monitoring (SVM) included</u>:

- **Baseline, time-series, and final soil-vapor sampling**
- **Field and laboratory analyses**
  - **Horiba analyzes fuel hydrocarbons, oxygen (O_2), and carbon dioxide (CO_2)**
  - **Standard analytic methods**

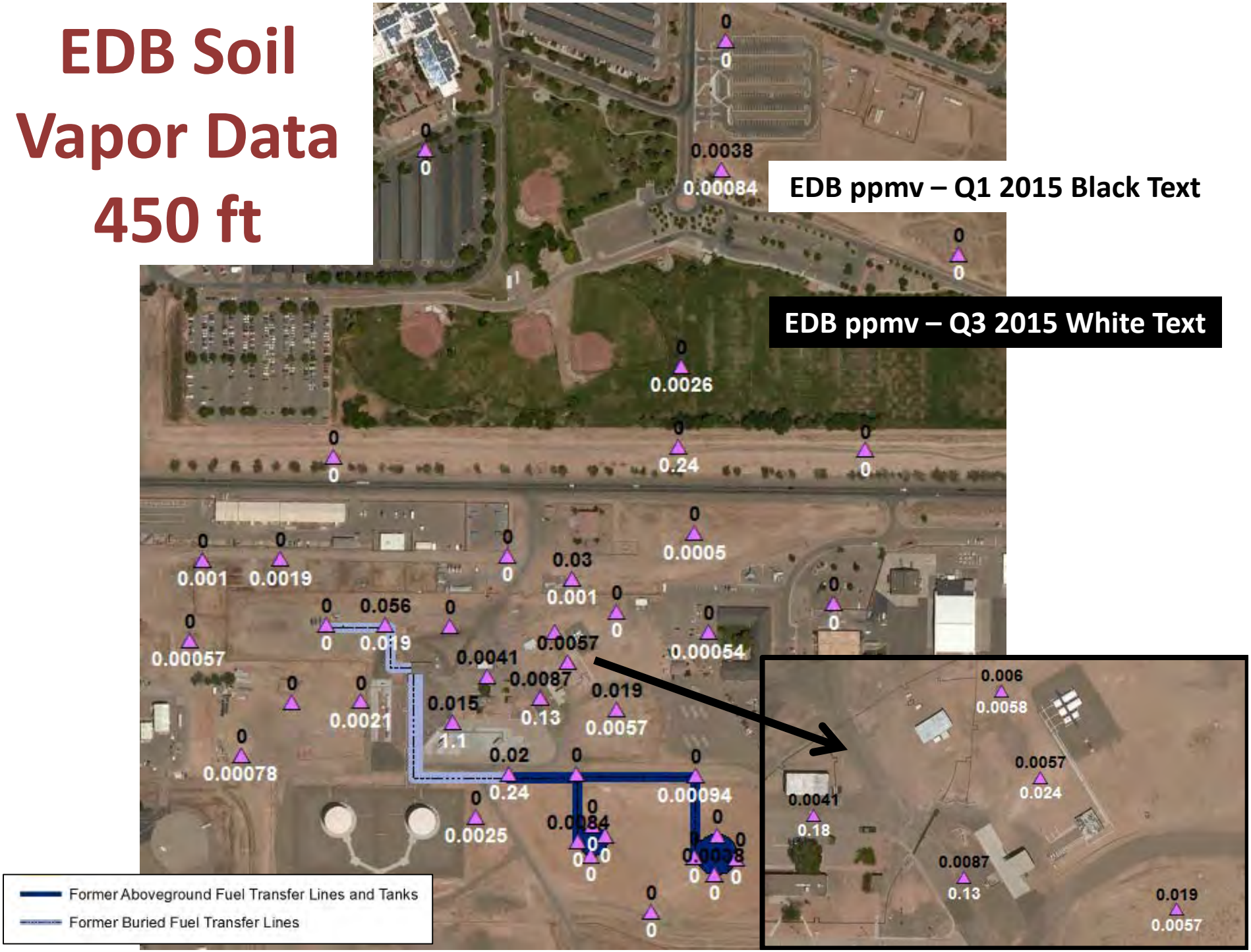
EDB Soil Vapor Data 25 ft



EDB Soil Vapor Data 250 ft

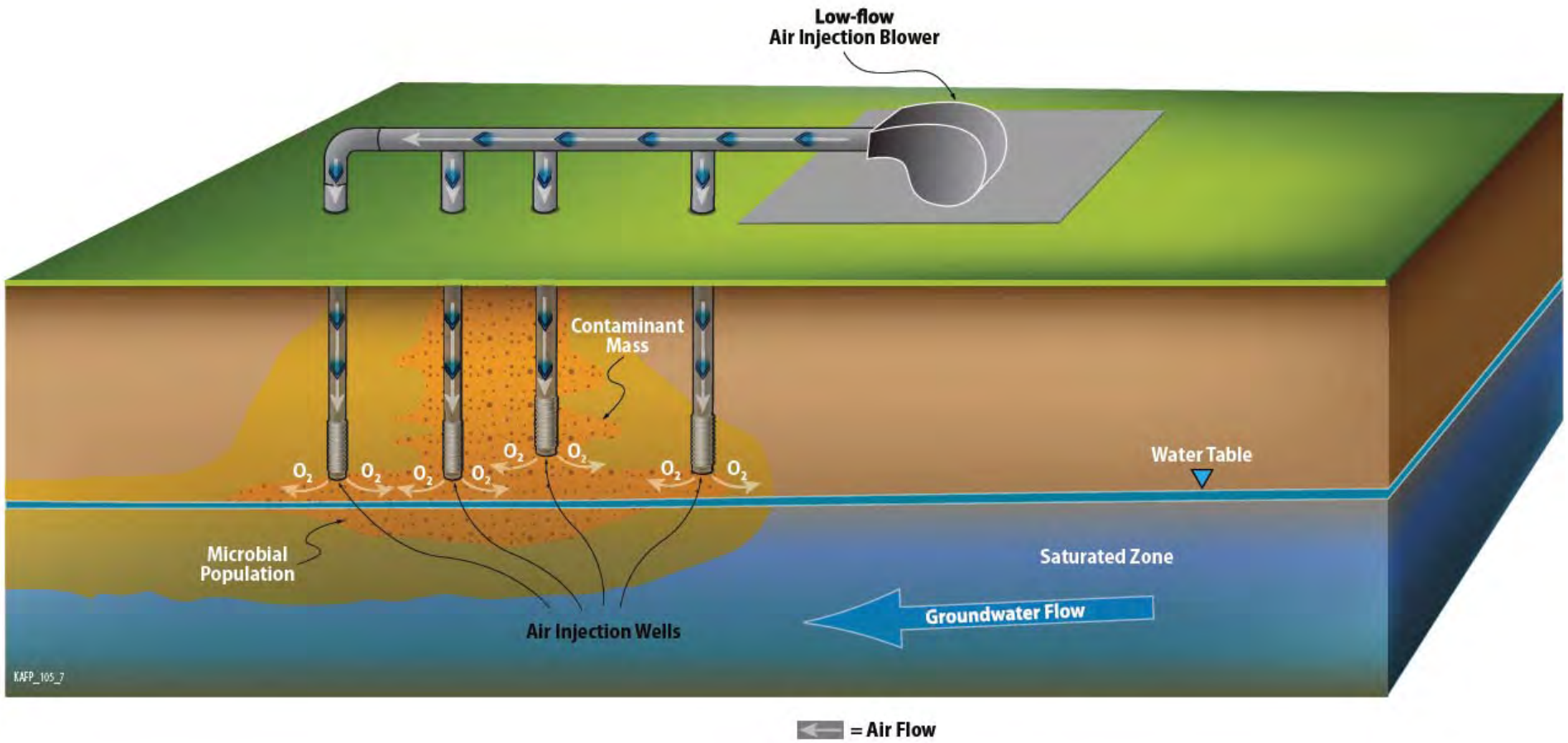


EDB Soil Vapor Data 450 ft



Bioventing Pilot Test

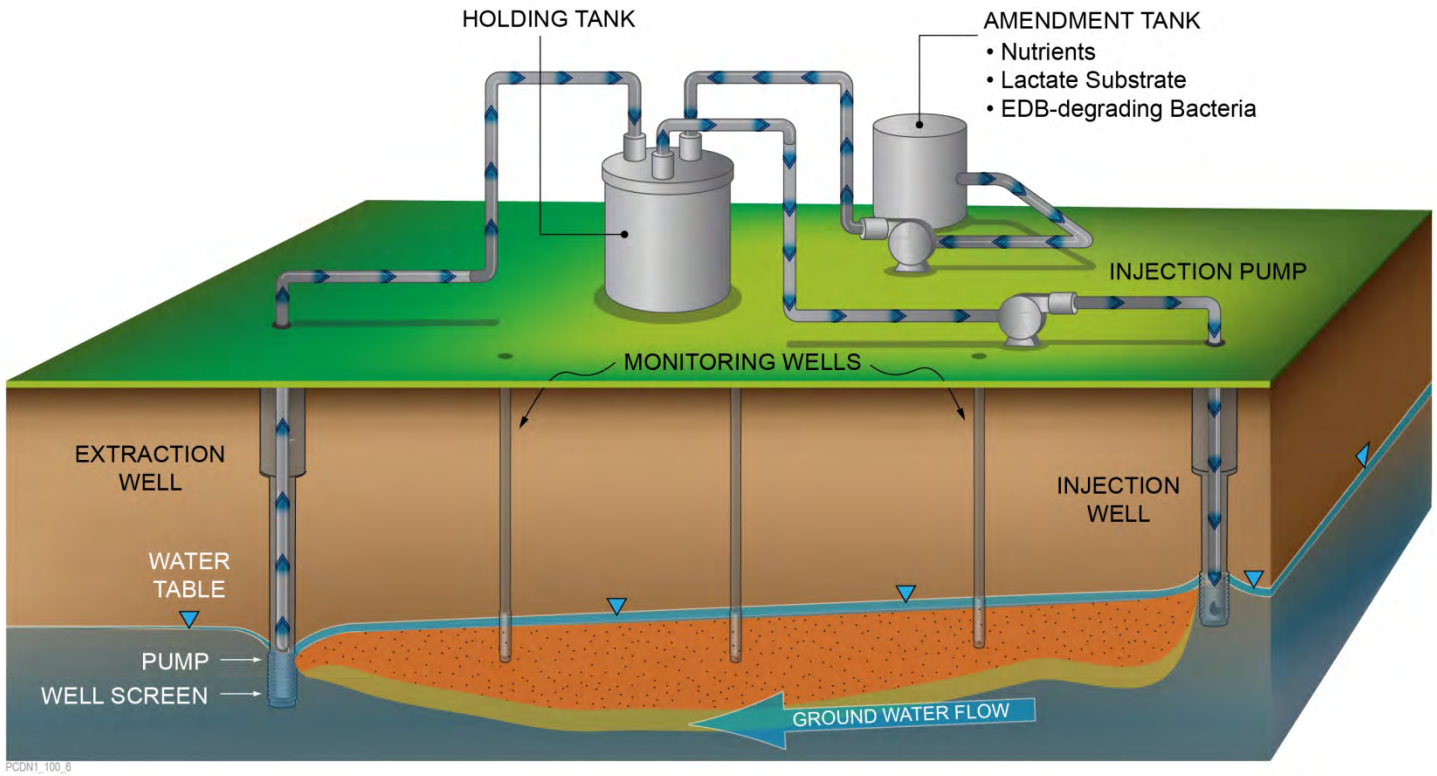
- **Air is injected into the vadose zone to deliver oxygen to soil bacteria to help them biodegrade contaminants**



Anaerobic Biodegradation Pilot Test

Groundwater Recirculation

- **Pump groundwater - Add amendments in phased approach**
- **Inject amended water up-gradient to create recirculation cell to support anaerobic biodegradation EDB**



Recap

- Drinking water supply wells show no contamination
- Advanced the conceptual site model
- Characterized the distal north end of the dissolved EDB plume
- Ongoing extract and treatment of dissolved EDB
- Finalizing Q4 2015 data collection to complete shutdown testing; bioventing pilot test in 2016
- Submitting work plan for an in-situ anaerobic pilot test

Questions & Answers

- **One question/comment per turn at the microphone**
- **Each question/comment will be allotted 3 minutes – please respect this time limit so others will have an opportunity to be heard**
- **In addition, comment cards have been made available**
  - **Return completed comment cards to Air Force staff**
  - **Questions will be incorporated into the FAQ portion of the Kirtland AFB BFF project website:**

www.kirtlandjetfuelremediation.com

How do I get more information?

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Air Force Bulk Fuels Facility website: www.kirtlandjetfuelremediation.com

Kirtland AFB website: http://www.kirtland.af.mil in the Environmental Issues section for Public Records