Kirtland Air Force Base Fuel Leak Cleanup

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Project Status Update

Radioactive and Hazardous Materials Committee

July 12, 2016

A Partnership for Success

A collaborative technical team is solving the complex hydrogeologic and engineering challenges posed by the fuel leak with support from Albuquerque's neighborhood groups

US Army Corps of Engineers

Elder Homestead Neighborhood Assoc.

Siesta Hills Neighborhood Assoc.

ABQ City Council District 6 Coalition of Neighborhood Assocs.

Christ United Methodist Church

HAWLEY GEOMATTERS

Thomson and Associates

Regulatory Basis

The New Mexico Environment Department (NMED) has been granted primacy by the U.S. Environmental Protection Agency to administer:

- The Safe Drinking Water Act (SDWA) program; and
- The Resource Conservation and Recovery Act (RCRA) program

Public water systems, such as the ABC Water Utility Authority, Kirtland AFB and the VA Hospital, must deliver water to consumers that meets SDWA standards.

Kirtland AFB must comply with their RCRA Hazardous Waste Permit, including the Corrective Action Process.

2016 Strategic Plan

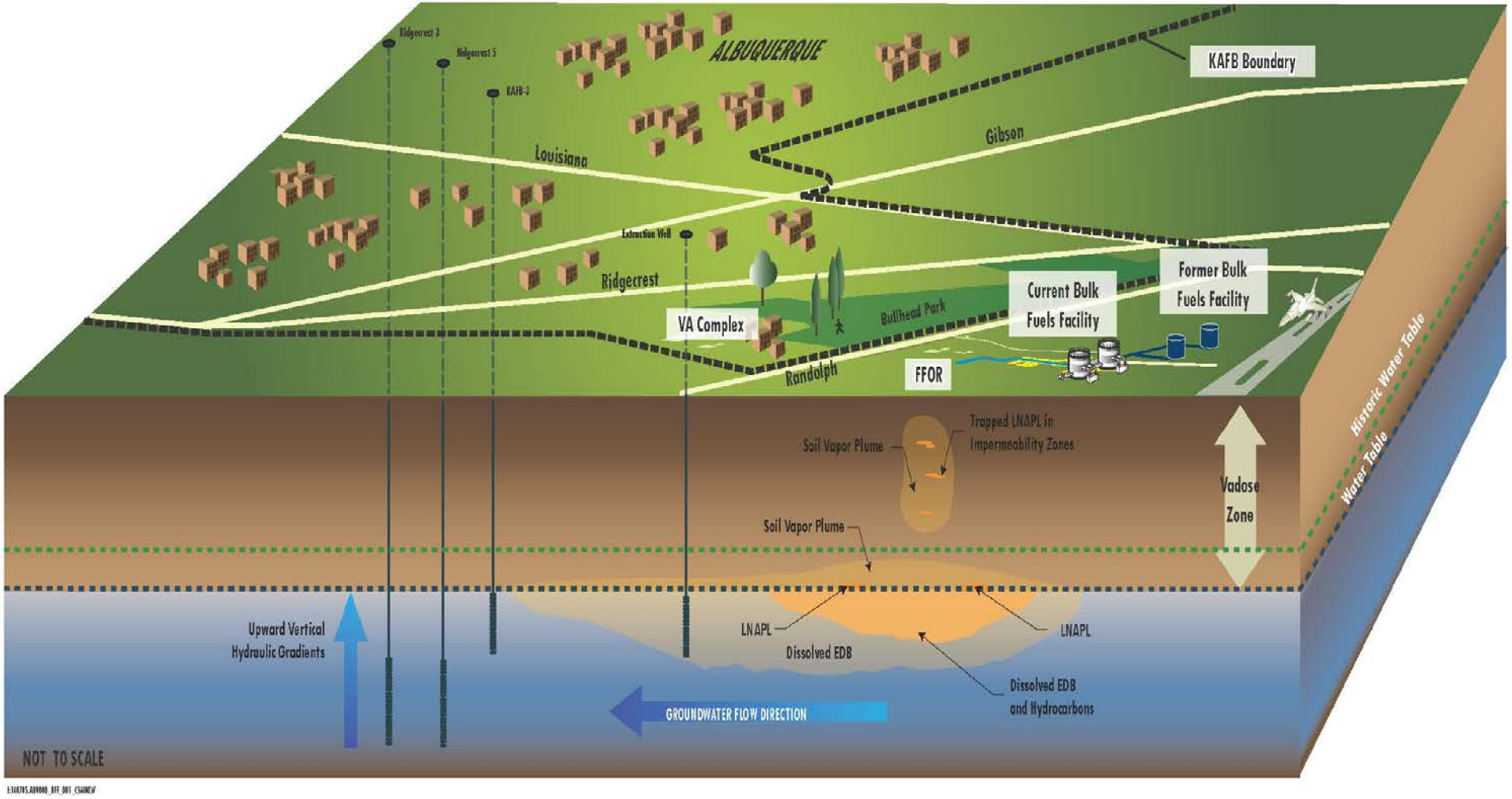
Goal: Protect Albuquerque's aquifer and drinking water supply wells in the area of the fuel leak

Strategies to Achieve the Goal:

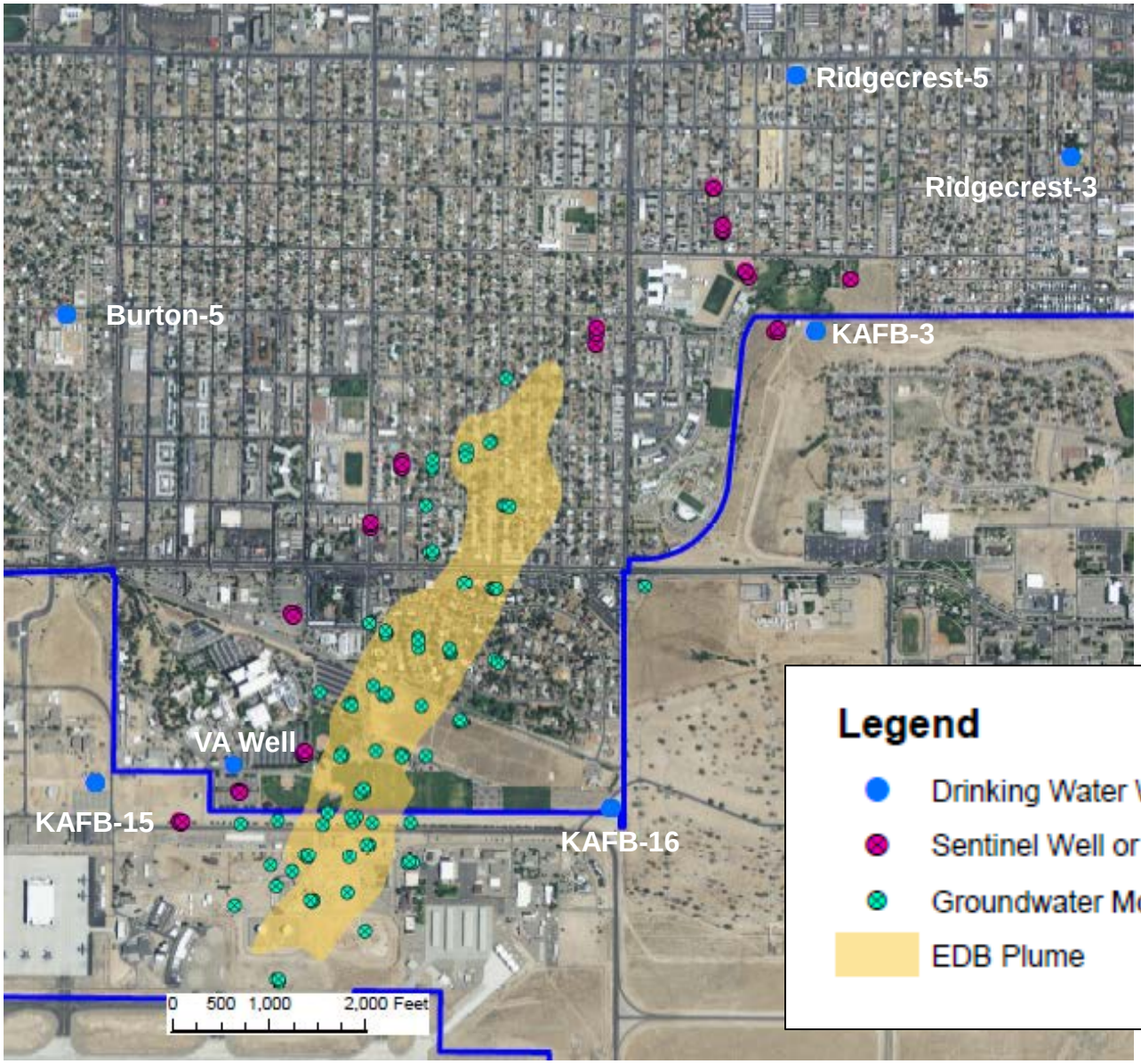
1. Implement a robust site monitoring & wellhead protection program
2. Characterize and remediate Light Non-Aqueous Phase Liquid (LNAPL), impacted soil, and associated dissolved phases in the source area
3. Collapse the dissolved ethylene dibromide (EDB) plume
4. Meet or exceed all requirements for providing public comment information and involvement

https://www.env.nm.gov/NMED/Issues/KirtlandFuelPlume/documents/KAFB2016StrategicPlan_Version2.0_Final.pdf

Conceptual Site Model Based on Current Data

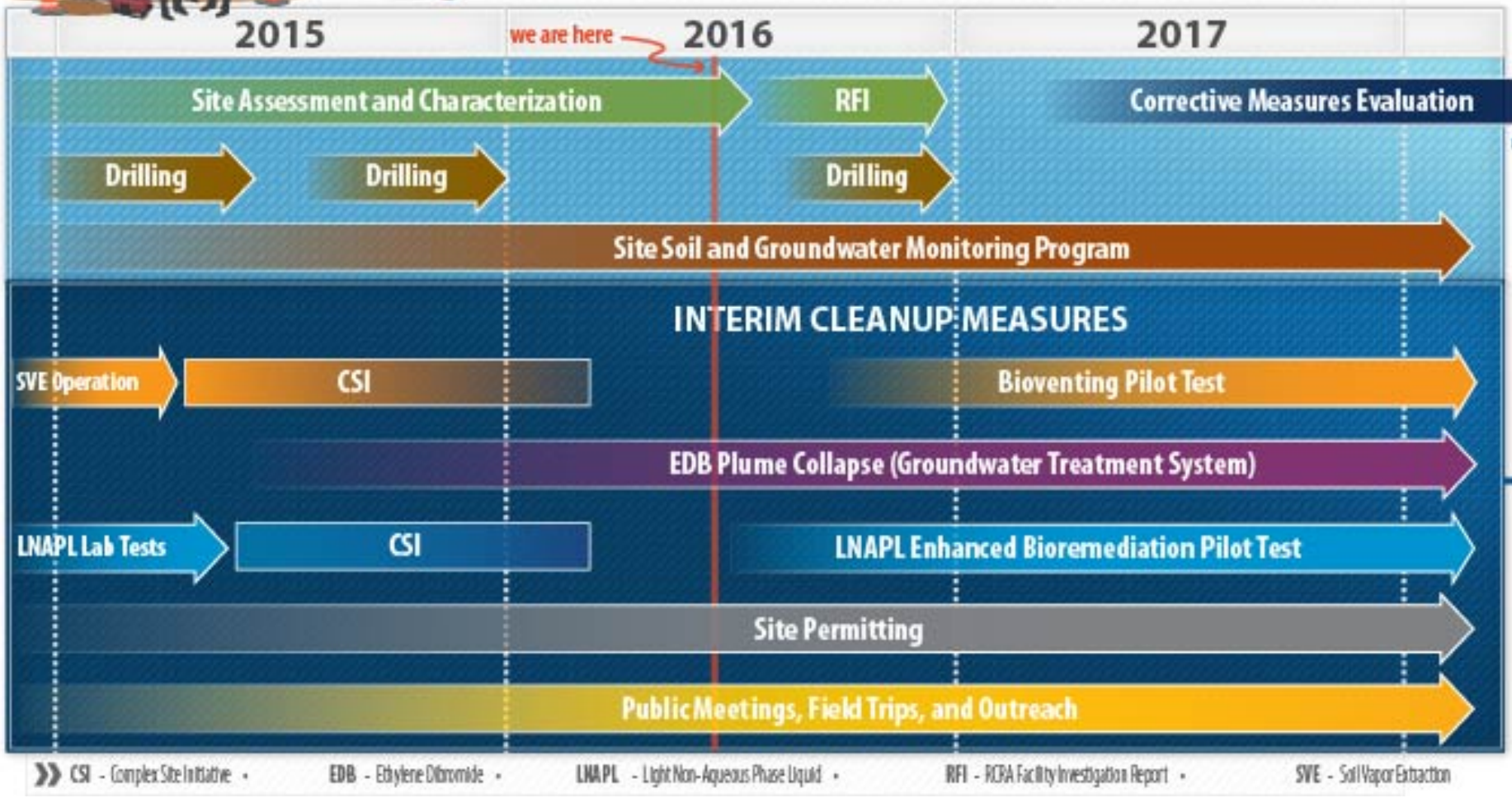


Drinking Water Protection



- Drinking water supply wells are tested monthly
- Sentinel wells are tested quarterly
- All wells have no detections of fuel contaminants

RCRA Timeline



Groundwater Cleanup

- Second and 3rd extraction wells installed and operating
- Full-scale groundwater treatment system began operation in Dec 2015
- Pilot test to reinject treated water back into the aquifer is underway
- Cone of depression in extraction zone is first milestone towards EDB plume collapse

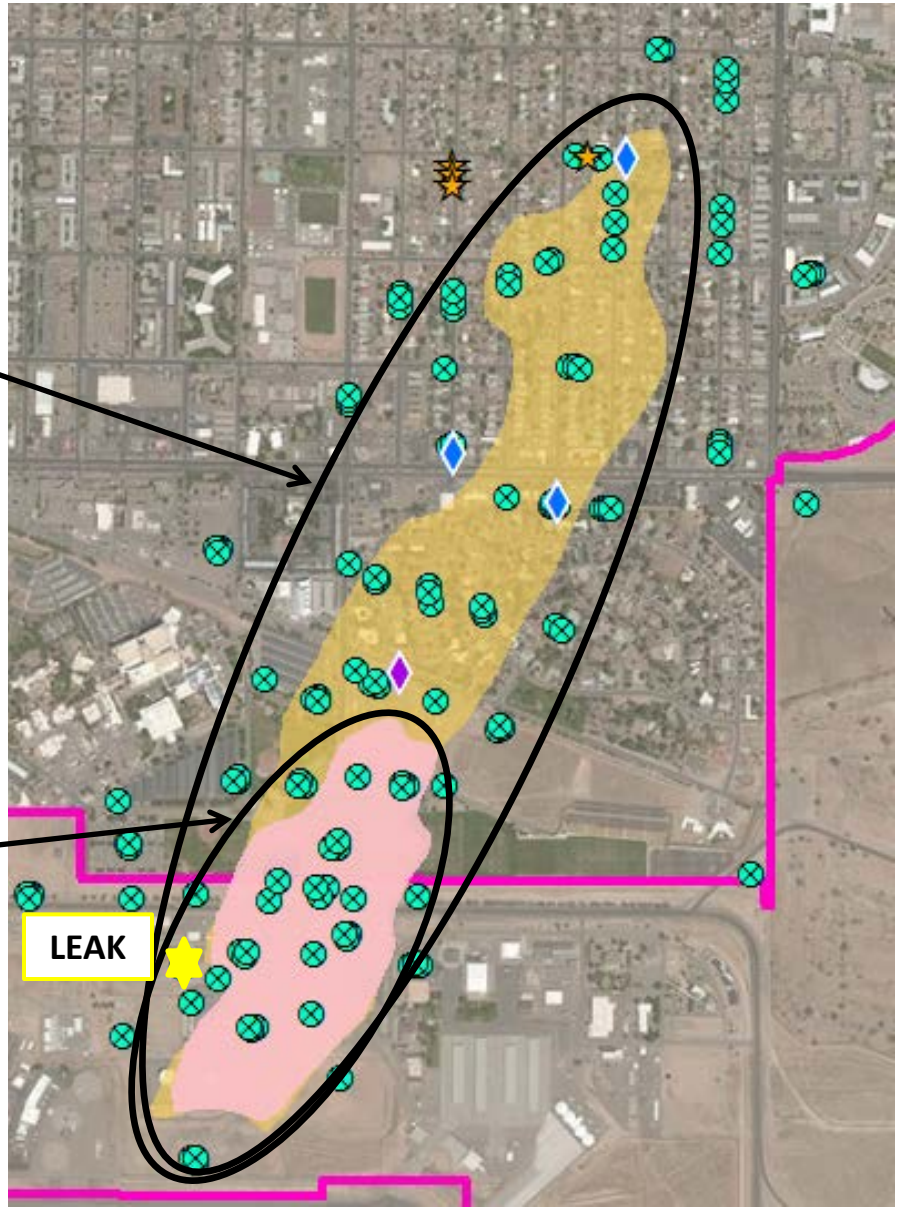
Anatomy of the Fuel Plume

EDB Plume

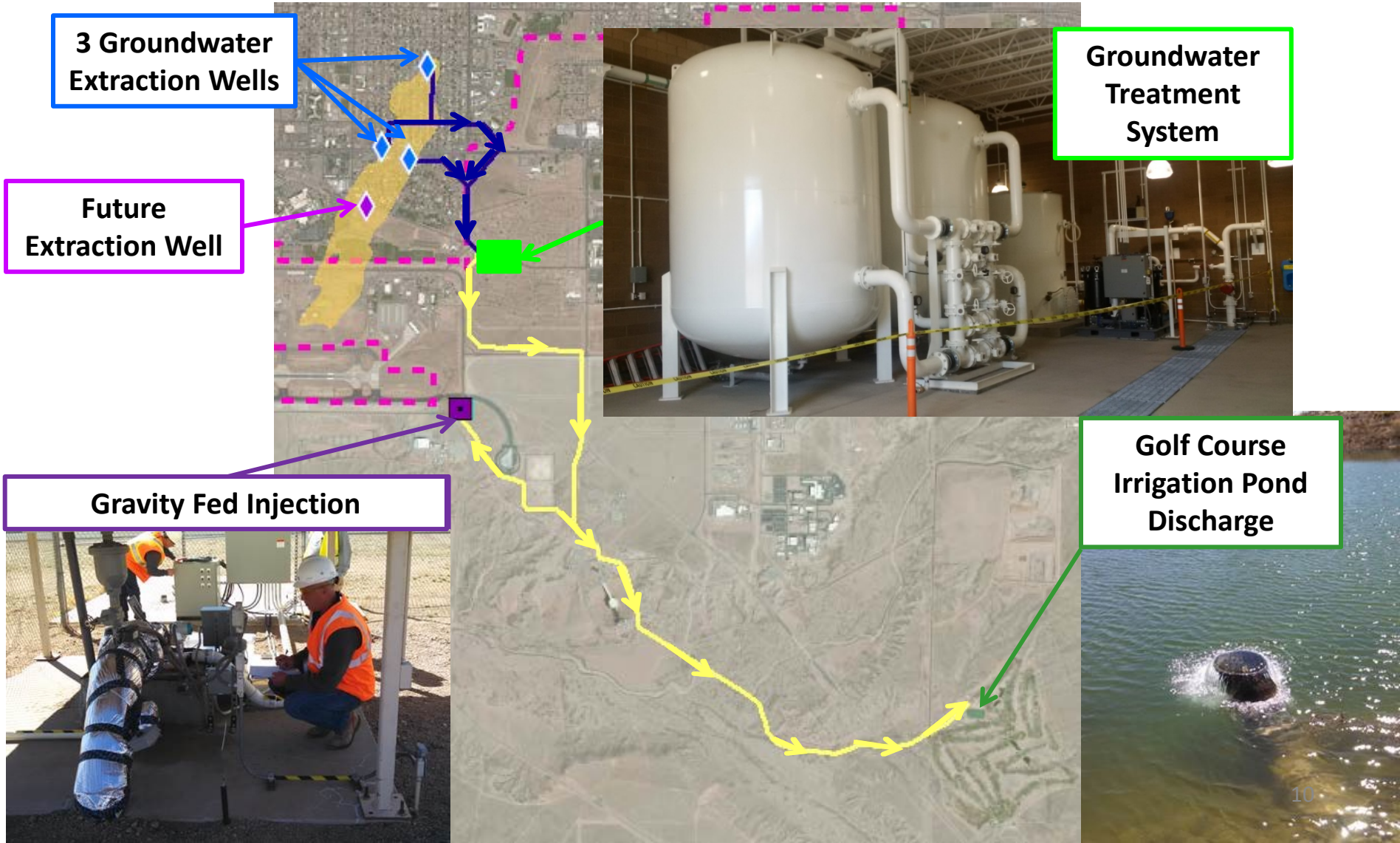
- Downgradient portion shows evidence of hydrolysis (i.e., breaking chemicals down by reacting with water) through new stable isotope data
- Average downgradient concentrations are low, less than 0.1 part per billion (ppb) or micrograms per liter (µg/L)
- EDB is anaerobically degrading in source area

Source Area

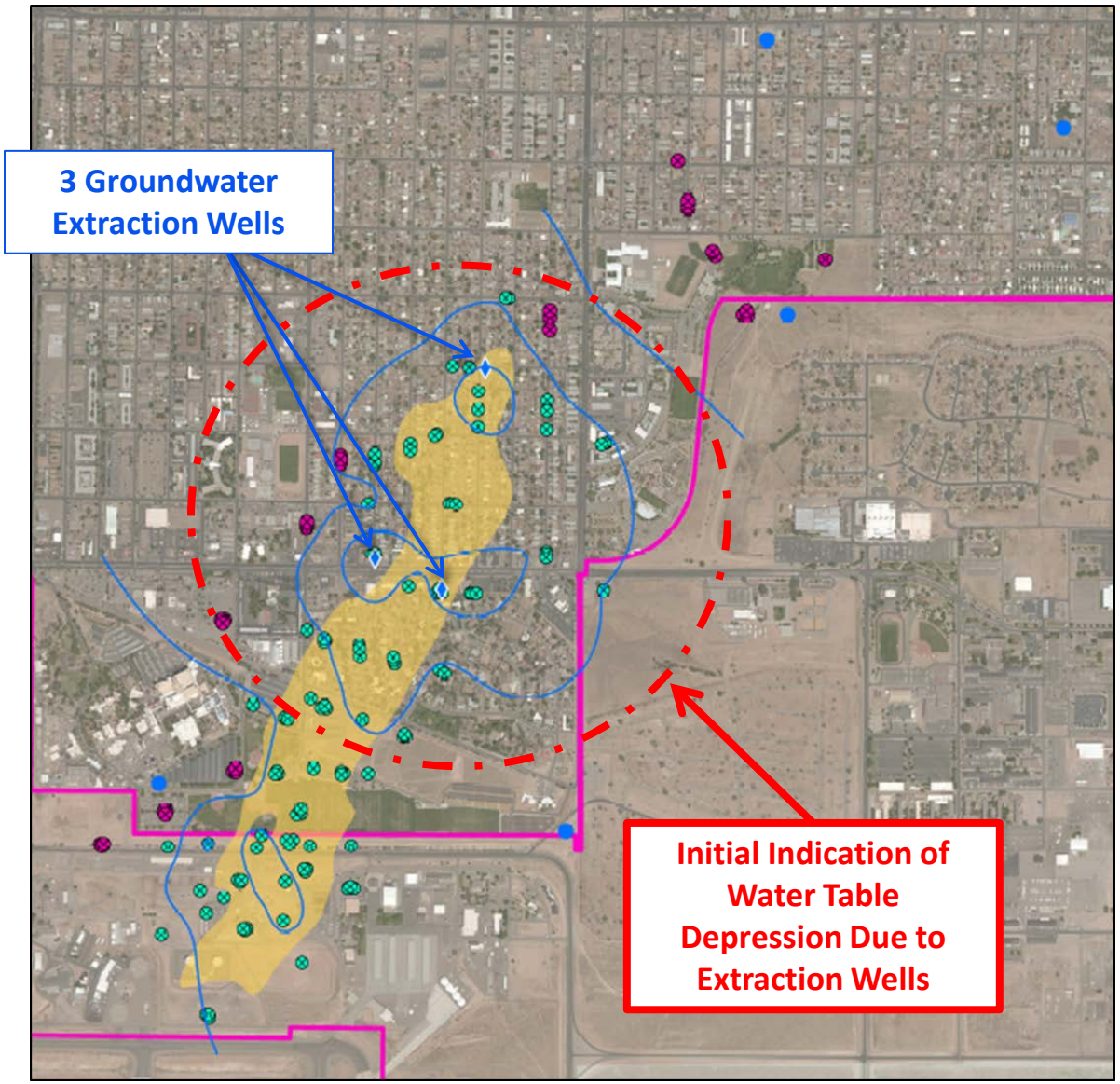
- Residual LNAPL
- Dissolved EDB and hydrocarbons
- Hydrocarbons are being biodegraded by natural bacteria in the groundwater and soil



Groundwater Treatment System



2nd Quarter 2016 Groundwater Levels Evidence of Success

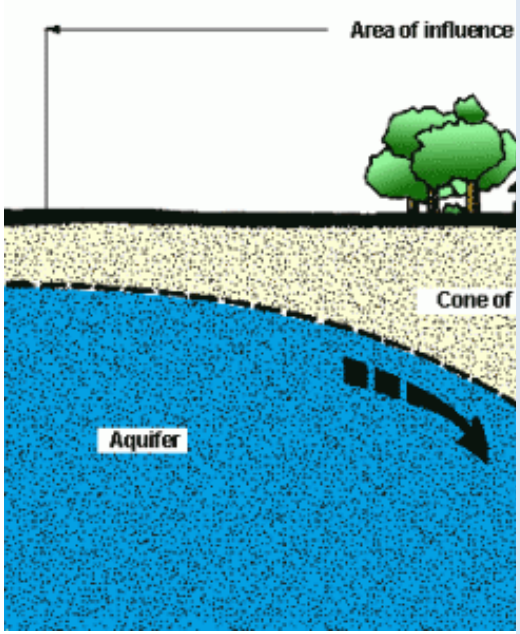


- The "cone of depression" from the first three extraction wells indicates successful removal of EDB-contaminated groundwater
- Plume collapse will be confirmed with EDB concentration trends

Legend

- Extraction Well
- Groundwater Monitoring Well
- Sentinel Well or Well Nest
- Drinking Water Well
- Q2 2016 Shallow GW Contours (04-20-16)
- Q4 2015 EDB Plume
- KAFB Base Boundary

What is a “Cone of Depression”?



- Forms in the water table when g
  directions by a pumping well
- Measured water levels in grounc
  extraction well define the area o
- One method used to determine if an extraction well is capturing the EDB plume

Risk Highlights

Potential risk occurs when a human or ecological receptor is exposed to contamination

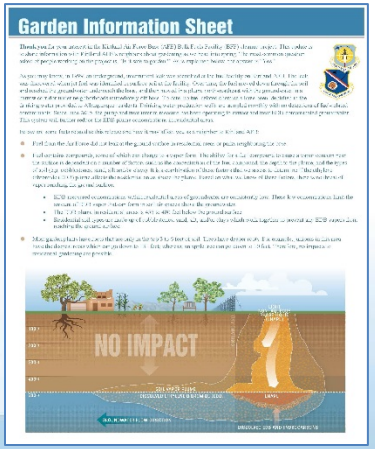
No exposure pathways or risks from BFF fuel contamination are present

Potential Exposure Pathway	Risk Level	Explanation
Drinking Water		**Drinking water provided by the Albuquerque Bernalillo County Water Utility Authority (ABCWUA) continues to be free of any detectable fuel contamination and is safe for all uses.** Public drinking water wells near the groundwater contamination plume are tested monthly, and show no detections of any fuel compounds. Sentinel wells, which are monitoring wells located between the drinking water wells and the contamination plume, are tested quarterly and show no detections.
Surface Soil		**Surface soil contamination never migrated off of Kirtland.** Surface soil contamination has only occurred at the Kirtland Air Force Base Bulk Fuels Facility (BFF) industrial area which is not accessible to the general public. Contaminated soil has been excavated and removed for off-site disposal.
Surface Water		**There is no pathway for contaminants to enter surface water.**
Vapor Intrusion		**Homes and businesses are not at risk for vapor contamination.** There is no off-Base surface or near-surface soil contamination, and groundwater contaminants are too deep, to allow vapors to enter homes and buildings.
Garden Vegetables		**There is no risk of contamination to garden vegetables.** ABCWUA water is safe for irrigation. There is no off-Base surface soil contamination, and vapors from groundwater are too deep, for fuel to contaminate garden vegetables.
Recreational Activities		**There is no risk of contamination to people enjoying recreational activities in Bullhead Park or in the Dog Park.** Reclaimed ABCWUA water is used to irrigate the parks. There is no off-Base surface soil contamination, and vapors from groundwater are too deep, to pose a risk to people in the park areas.

(June 2016)

Safe	Use Caution	Unsafe

Garden Information Sheet



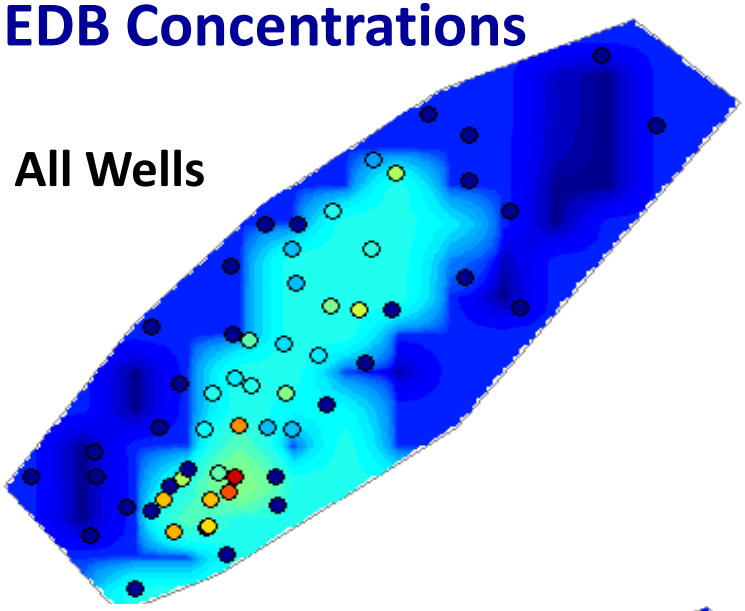
Groundwater Monitoring Optimization

Phased Approach

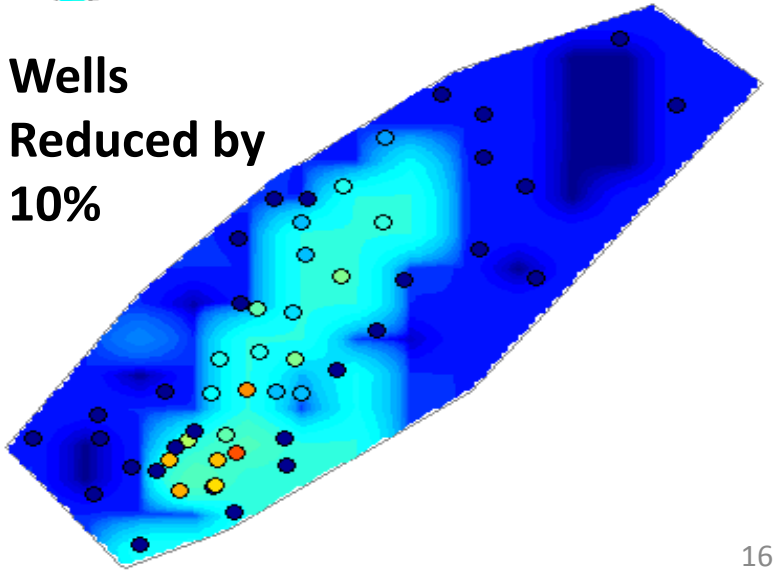
1. Removed 97 compounds from analyte list and the associated reporting requirements
2. Reduced analytical methods and sampling frequency at wells with established trends
3. Revised sampling methodology to diffusion bag samplers
4. Identified 25% of well network is redundant
5. Soil-vapor network undergoing optimization

EDB Concentrations

All Wells



Wells Reduced by 10%



Optimization Reduced Annual Groundwater Monitoring Costs by $1.5M

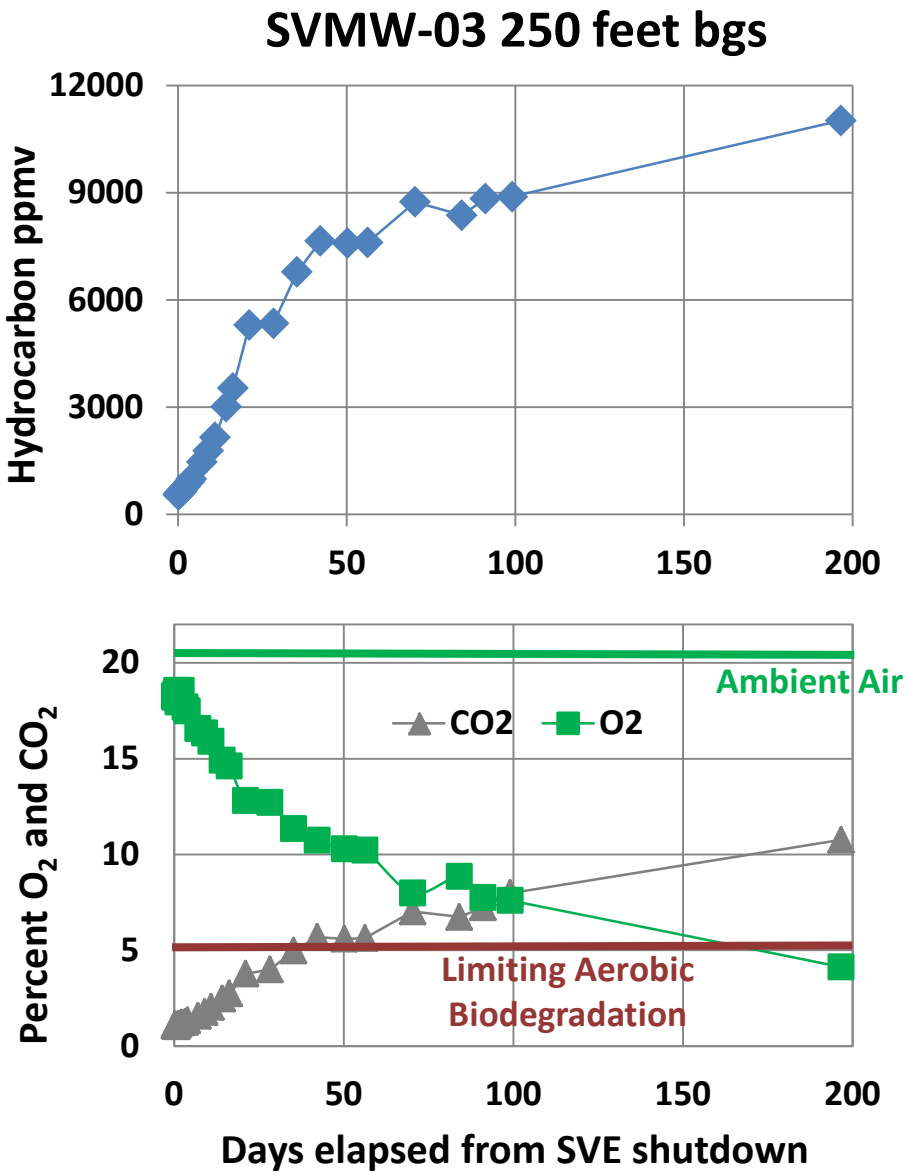
History of Soil Vapor Extraction

- **2003 – 2015:** After 12 years of soil vapor extraction (SVE) operation, more than 750,000 gallons of fuel contaminants have been removed through destruction and biodegradation
- **2015:** Determined it was time to turn off SVE system to monitor in-situ respiration of native bacteria and hydrocarbon (HC) rebound in vadose zone
- **2016:** Continued in-situ respiration and rebound testing to evaluate vapor trends to identify a more effective and efficient bioventing pilot test/interim measure

SVE Shutdown Test

Turn off SVE system to monitor HC rebound and in-situ respiration

- HC rebound between 50 – 250 feet below ground surface (bgs) beneath the leak area and some at 450 feet bgs over above dissolved-phase plumes
- Changes in oxygen (O_2)and carbon dioxide (CO_2) indicate aerobic HC degradation
- Some locations indicate microbial activity limited due to low water and oxygen levels

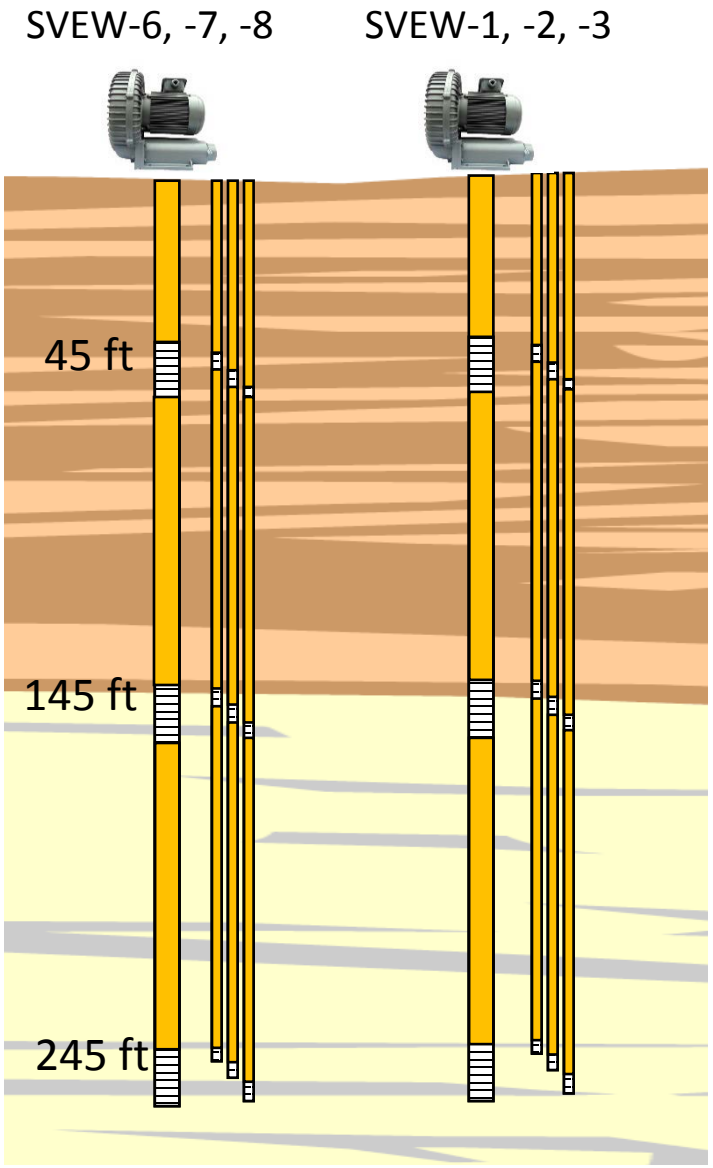


Bioventing Pilot Test

Bioventing is an in-situ technology that enhances aerobic biodegradation in the vadose zone

Conceptual design

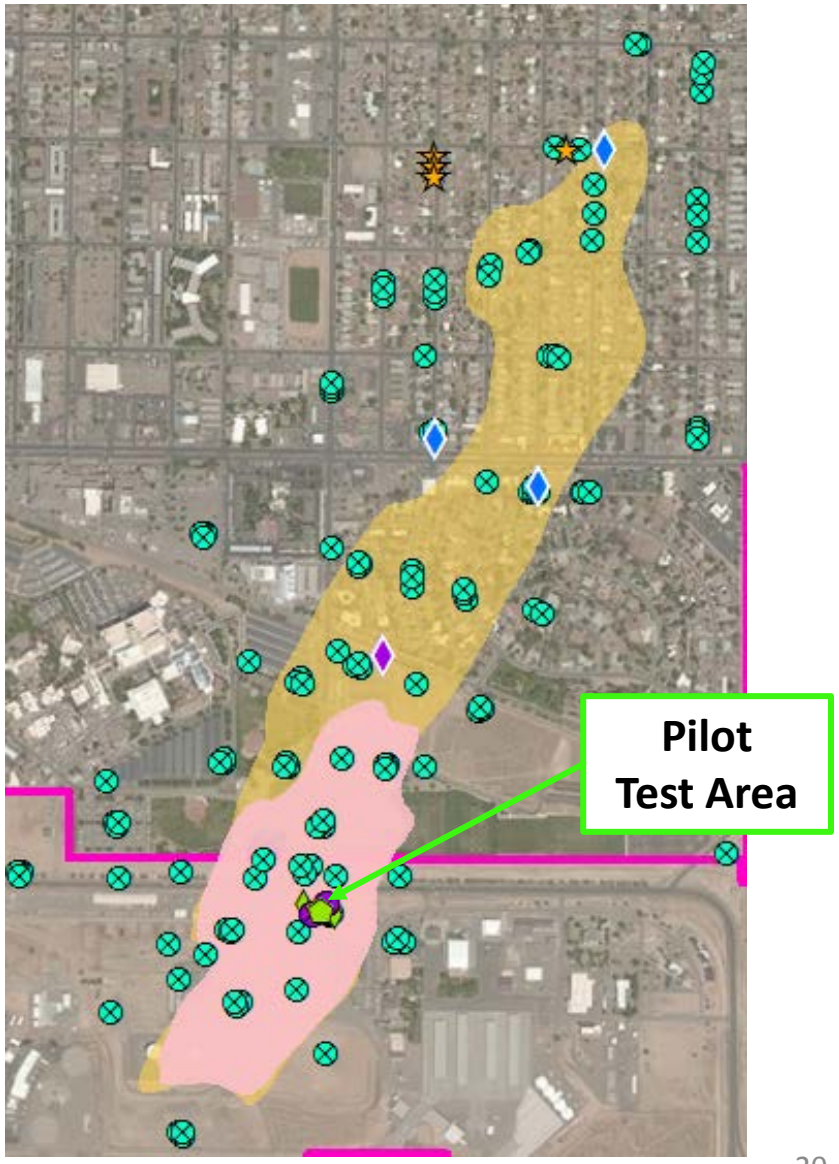
- Air injection only
  - Aerobic HC degradation
  - Aerobic EDB co-metabolism
- Low quantities of air will be injected to the soil to stimulate the bacteria by providing O_2
- Adding water will increase the bacteria activity in the soil



In Situ Anaerobic Degradation Pilot Test

Objective: To demonstrate in situ EDB biodegradation under anaerobic conditions using a phased amendment approach

- Reflects laboratory microcosm analysis outcomes
- Located near on-base groundwater well with increasing EDB concentrations
- Work plan will be submitted in July 2016 for NMED review and approval
- Planning to begin work in August 2016



Pilot Test Infrastructure

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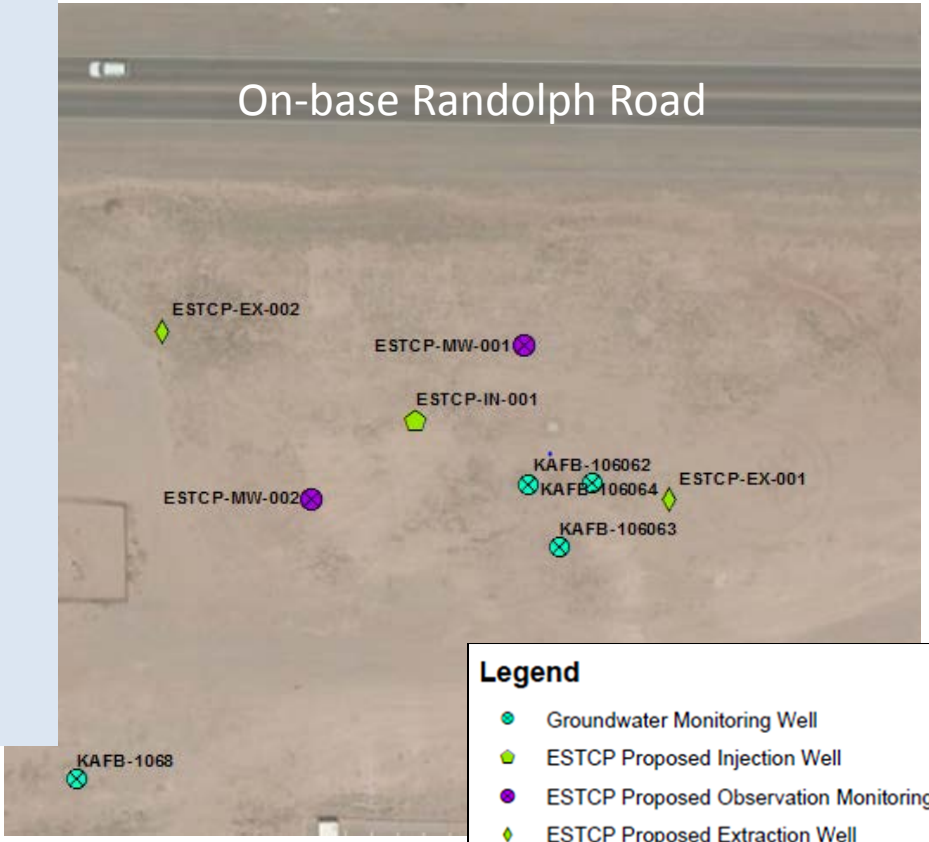
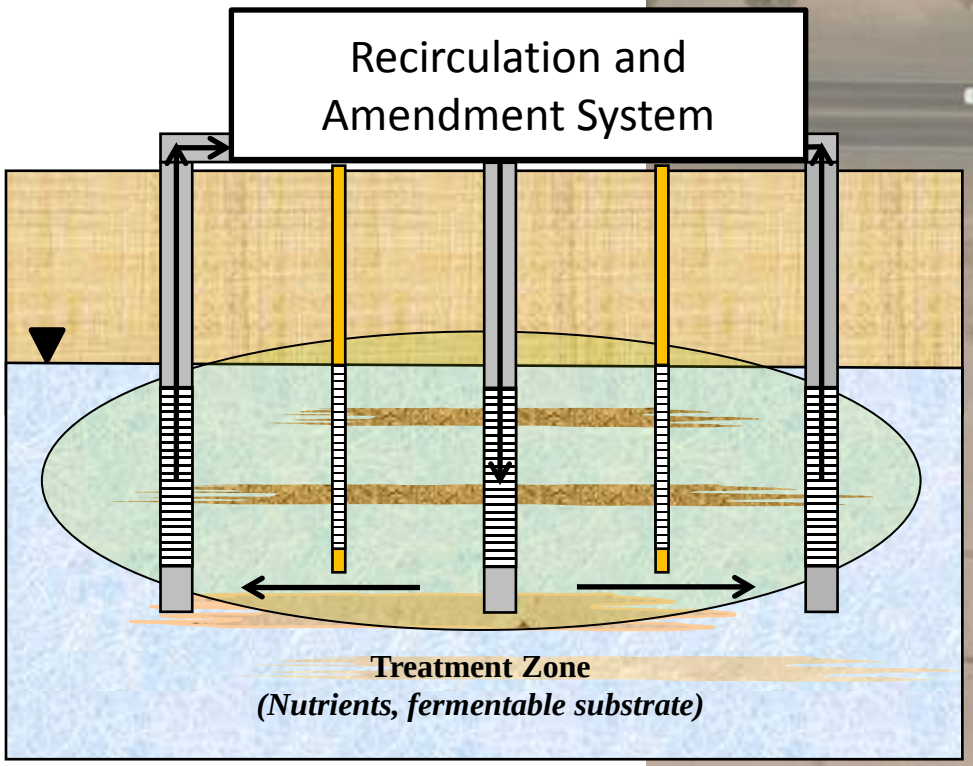
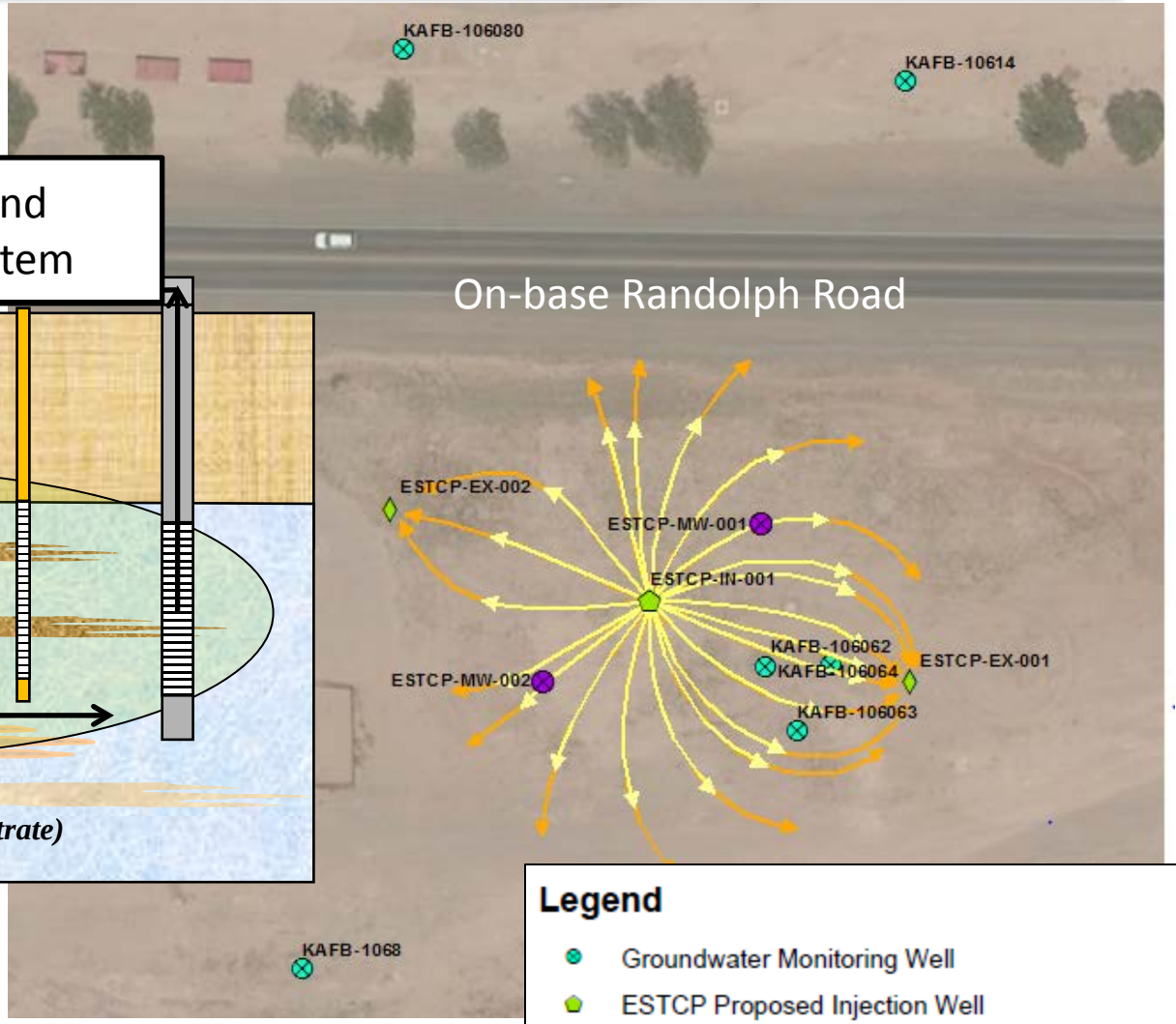
termediate)

monitoring wells



How is the Pilot Test Designed?





How will Pilot Test be Implemented?

- **Phase 1: Baseline Testing**
  - Approximately 1 month of recirculation
  - 2 months of monitoring
- **Phase 2: Biostimulation**
  - Addition of sodium lactate, diammonium phosphate [DAP] and yeast extract (i.e., inorganic nutrients)
  - Approximately 1 month of recirculation
  - 4 months of monitoring
- **Phase 3: Bioaugmentation**
  - Addition of sodium lactate, DAP, yeast extract, and microorganism culture
  - Approximately 1 month of recirculation
  - 2 months of monitoring

What's in Store for 2016?

- In Situ Anaerobic Degradation Pilot Test Work Plan (July 2016)
- Drill, install, and test 4th extraction well, south of Gibson (Late Summer 2016)
- Conduct aquifer testing of 2nd and 3rd extraction wells (Fall 2016)
- Drill and install data gap groundwater monitoring wells (Fall 2016)
- Expand groundwater treatment system to increase treatment capacity (Winter 2016)

What's in Store for 2016?

- Conduct field work for the In Situ Anaerobic Degradation Pilot Test in on-Base source area (Fall 2016)
- Prepare Bioventing Pilot Test Work Plan (Winter 2016)
- Prepare Continuous Soil Coring Work Plan (Winter 2016)
- Conduct technical working group meetings to optimize soil vapor sampling program, locate groundwater injection wells, and advance cleanup using current data (Summer/Fall/Winter 2016)

2016 Public Outreach To-Date

Date	Description
January 12, 2016	**Kirtland Partnership Committee:** Provided project update
February 10, 2016	**District 6 Neighborhood Coalition Meeting:** Provided project update
February 24, 2016	**Highland High School Advanced Placement Chemistry and Environmental Science:** Worked with chemistry students to design lab experiments and presented results to April public meeting participates
April 8, 2016	**New Mexico Geological Society Spring Meeting:** Presented on site stratigraphy and migration of the EDB plume at the BFF site
April 13, 2016	**New Mexico Tech Engineering Club:** Presented undergraduate and graduate engineering students on the BFF site
April 19, 2016	**Regular Public Meeting with Poster Session**
April 23, 2016	**Public Field Trip:** Toured groundwater treatment facility and discharge points
May 26, 2016	**International District Healthy Communities Coalition Meeting:** Provided project information
June 22, 2016	**Water Utility Authority Governing Board:** Provided project update
July 12, 2016	**New Mexico Legislature, Radioactive and Hazardous Materials Committee:** Provided project update

Currently Scheduled Public Outreach

Date	Description	Location
July 14, 2016	**Regular Public Meeting with Technical Deep Dive and Poster Session** 5:00 – 6:00 p.m. Technical Deep Dive 5:30 – 6:00 p.m. Poster Session 6:00 – 8:30 p.m. Presentation with Q&A	African American Performing Arts Center, 310 San Pedro Dr. NE
August 15, 2016	**Rotary Club of Albuquerque** 12:00 – 1:00 p.m.	Hotel Albuquerque, 800 Rio Grande Blvd. NW
August 2016	**Listening Session with Elected Officials** TBD	Location TBD
September 15-16, 2016	**New Mexico Water Law Conference** TBD	Santa Fe, NM
September 24, 2016	**Albuquerque International District Fair** 10:00 – 5:00 p.m.	Veterans Memorial Park, 1100 Louisiana Blvd SE
November 10, 2016	**Regular Public Meeting with Poster Session** 5:00 – 8:30 p.m.	African American Performing Arts Center, 310 San Pedro Dr. NE
November 2016	**Public Technical Workshop** TBD	Location TBD

Recap

- Drinking water supply wells continue to show no contamination
- 2nd Quarter 2016 groundwater data indicate first major milestone in plume collapse → lowering of water table at extraction wells locations
- Ongoing extraction and treatment of EDB-contaminated groundwater with a 4th extraction coming soon
- Work plans submittals; begin implementation of two interim measures/pilot tests in source area
- RFI Report submittal Winter 2016

How do I get more information?

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

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

QUESTIONS?