

# Kirtland Air Force Base Aviation Fuel Leak Cleanup

Panel Members: Kathryn Lynnes, Air Force  
Dennis McQuillan, NMED  
Rick Shean, Water Authority  
Mary Lou Leonard, AEHD



**New Mexico Water Law Conference**

**September 16, 2016**

# Panel Members

**Kathryn Lynnes** – Senior Advisor for Bulk Fuels Facility (BFF) Project, Air Force

**Dennis McQuillan** – Chief Scientist at the New Mexico Environment Department (NMED) with regulator oversight responsibilities on the BFF program

**Rick Shean** – Water Quality Hydrologist at the Albuquerque Bernalillo Water Utility Authority (Water Authority)

**Mary Lou Leonard** – Director of the City of Albuquerque Environmental Health Department (AEHD)

# BFF Site History

- **1951-53** – Kirtland Air Force Base (KAFB) BFF constructed
- **1953-75** – Handling of aviation gasoline which contained the additive ethylene dibromide (EDB)
- **1999** – KAFB discovered and notified NMED of leak, ceased using pipe, and initiated site investigations
- **2001** – KAFB notified NMED of detected fuel constituents in groundwater
- **2003-15** – Soil vapor extraction (SVE) remediation
- **2007** – Light non-aqueous phase liquid (LNAPL) discovered
- **2007-08** – LNAPL skimming pilot test
- **2009** – Rising water table begins to smear LNAPL within aquifer
- **2014-present** – Interagency partnership, additional interim corrective measures
- **2015** – Groundwater cleanup begins
- **2016** – Cone of depression observed around toe of ethylene dibromide (EDB) plume

# Air Force Perspective



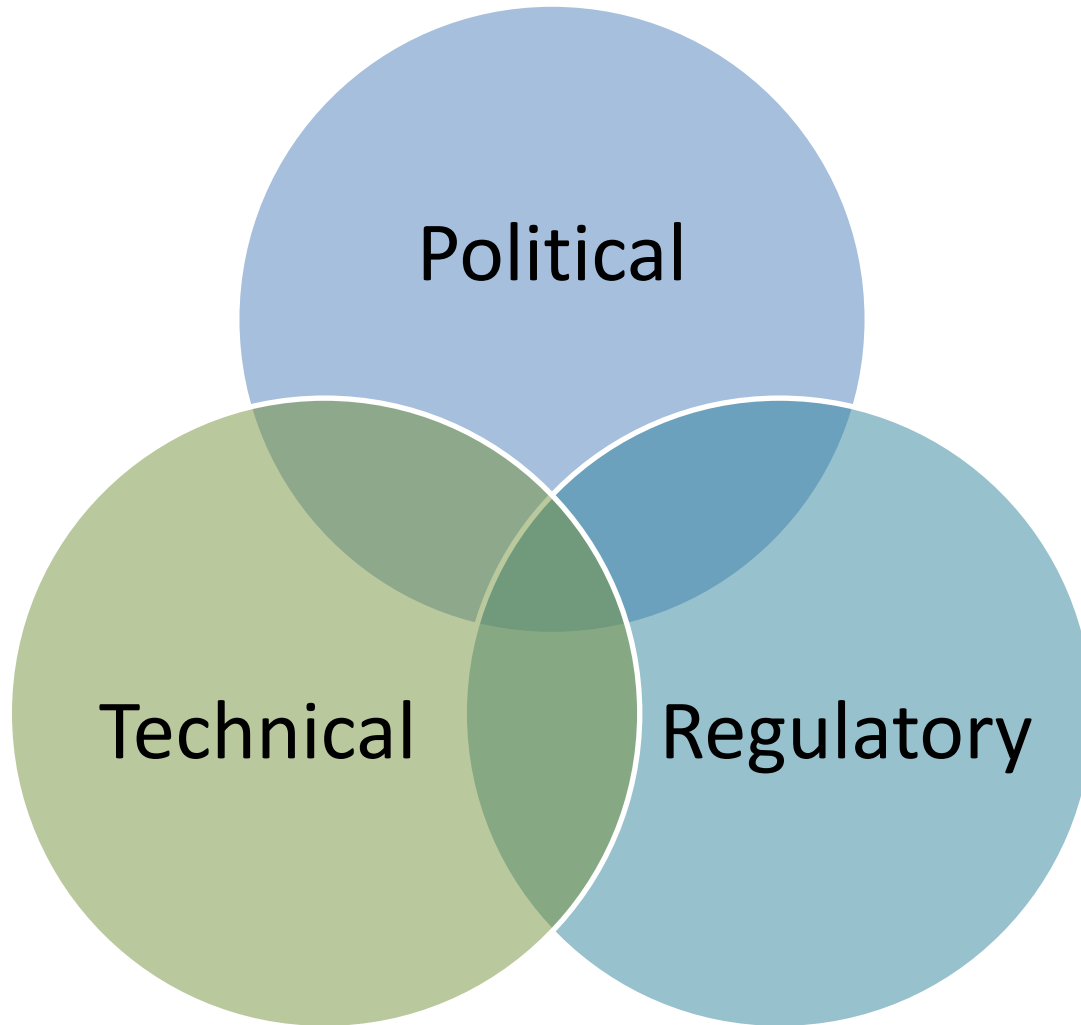
**Kate Lynnes**  
**Air Force Senior Advisor**

# Air Force Commitment

- Cleaning up the KAFB fuel leak is one of the top priorities of the Air Force
- Initiating groundwater cleanup in June 2015 was a huge milestone in this project
- Working collaboratively with NMED, the Water Authority, City of Albuquerque, and EPA has been critical to our success
- Air Force and NMED will not allow fuel contamination to migrate into any drinking water wells

# The Three Key Components to Success

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# Political Component

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- The Air Force created a new Air Force Project Team
- Expansion of the community engagement program
- Commitment to improving inter-governmental communication and coordination

# New Air Force Project Team

- The Air Force Civil Engineering Center (AFCEC) assigned Dr. Adria Bodour as the technical lead
- The U.S. Army Corps of Engineers assigned a dedicated Project Manager for contract oversight
- The Air Force brought in a Highly Qualified Expert based in Albuquerque



# Expanded Community Engagement

- Direct public access to technical experts during public meetings and field trips
- Door-to-door outreach in neighborhoods affected by drilling
- Increased transparency – all documents are on the web
- Community Relations Plan
- Presentations to a wide-range of group

# Government – to – Government Communication

- Regular updates to the Federal Congressional Delegation, City and County elected officials and staff, the Radioactive and Hazardous Materials Committee, and the Water Authority Board
- Regular stakeholder meetings
- Technical working groups that include the City of Albuquerque and the Water Authority

# Evidence of Change

Albuquerque Free Press (May 2016)

News ▾ Opinion ▾ Food & Drink ▾ Lifestyle ▾ Arts ▾ Events ▾ Multimedia ▾ Back Issues ▾ Dating ▾ About ▾

## Industrial Strength Clean-up

In State/Local May 4, 2016 Dennis Domrzalski 85 Views 0 comments



Recent Posts


- Good ART New Fulcrum Fund Arts August 2, 2016
- The Rational 2016 A&E Columns August 2, 2016
- Paper Asks: Is National August 2, 2016

Albuquerque Journal (March 2015)

## Officials outline Kirtland fuel spill cleanup efforts

By Ollie Reed Jr. / Journal Staff Writer  
Friday, March 13th, 2015 at 12:03am

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From left, hydrogeologist Tom Champlon talks to Albuquerque residents Tanner and David Gay and Bridget Llanes about a display illustrating the Kirtland fuel spill. (Marka Brose/Albuquerque Journal)

ALBUQUERQUE, N.M. — Officials spearheading the Kirtland Air Force Base fuel spill cleanup project told more than 100 people attending a public meeting that the planning and the talking is done and the doing has started.

Albuquerque Journal (July 2016)

Editorials

## Editorial: KAFB, NM have cleanup flowing in right direction

By Albuquerque Journal Editorial Board  
Tuesday, July 19th, 2016 at 12:02am

# Regulatory Component

The BFF cleanup is a regulatory tort with many layers:

- Corrective Action requirements in RCRA permit → Hazardous Waste Bureau
- Air quality, noise permits, and right-of-entry license agreements → City of Albuquerque
- Class V underground injection control (UIC) for the injection of treated groundwater → Ground Water Quality Bureau
- Point of Diversion permits and prohibition on groundwater use over plume → Office of the State Engineer

# RCRA Corrective Action Process

Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) to collect data to support corrective action decisions.

- Site investigations are done to define the nature and extent of contamination
- Site investigations are typically performed in data-driven phases
- The phased approach may be perceived by the public as “too much studying and not enough action”
- The BFF RFI report will include a risk assessment
- Both the RFI report and the risk assessment must be approved by the NMED

# Risk Assessment

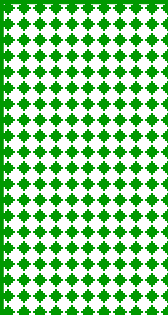
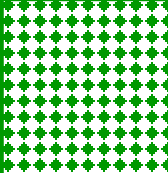
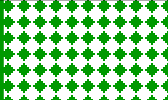
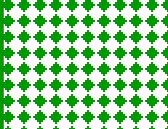
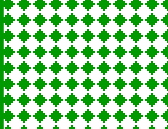
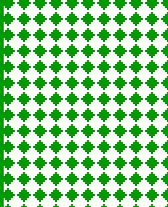
- The data collected during the RFI must be evaluated to determine if the contaminants released poses a threat to human health or the environment
- This evaluation process uses both screening levels and cleanup criteria established by the NMED in their *Risk Assessment Guidance for Site Investigations and Remediation* (July 2015)

# Exposure Pathways

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		<p><b>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.</b></p> <p>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.</p>
Surface Soil		<p><b>Surface soil contamination never migrated off of Kirtland.</b></p> <p>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. <u>Contaminated soil has been excavated and removed for off-site disposal.</u></p>
Surface Water		<p><b>There is no pathway for contaminants to enter surface water.</b></p>
Vapor Intrusion		<p><b>Homes and businesses are not at risk for vapor contamination.</b></p> <p><u>There is no off-Base surface or near-surface soil contamination,</u> and groundwater contaminants are too deep, to allow vapors to enter homes and buildings.</p>
Garden Vegetables		<p><b>There is no risk of contamination to garden vegetables.</b></p> <p>ABCWUA water is safe for irrigation. <u>There is no off-Base surface soil contamination, and vapors from groundwater are too deep, for fuel to contaminate garden vegetables.</u></p>
Recreational Activities		<p><b>There is no risk of contamination to people enjoying recreational activities in Bullhead Park or in the Dog Park.</b></p> <p>Reclaimed ABCWUA water is used to irrigate the parks. There is <u>no off-Base surface soil contamination, and vapors from groundwater are too deep,</u> to pose a risk to people in the park areas.</p>

(June 2016)

 <b>Safe</b>	 <b>Use Caution</b>	 <b>Unsafe</b>
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# Interim Measures

KAFB's RCRA Permit provides for the implementation of Interim Measures (IMs) if NMED determines that

*“such measures are necessary to reduce or prevent migration of hazardous wastes or hazardous constituents that have, or may result in, an unacceptable human or environmental receptor exposure to hazardous waste or hazardous constituents while long-term corrective action remedies are being evaluated and implemented”*

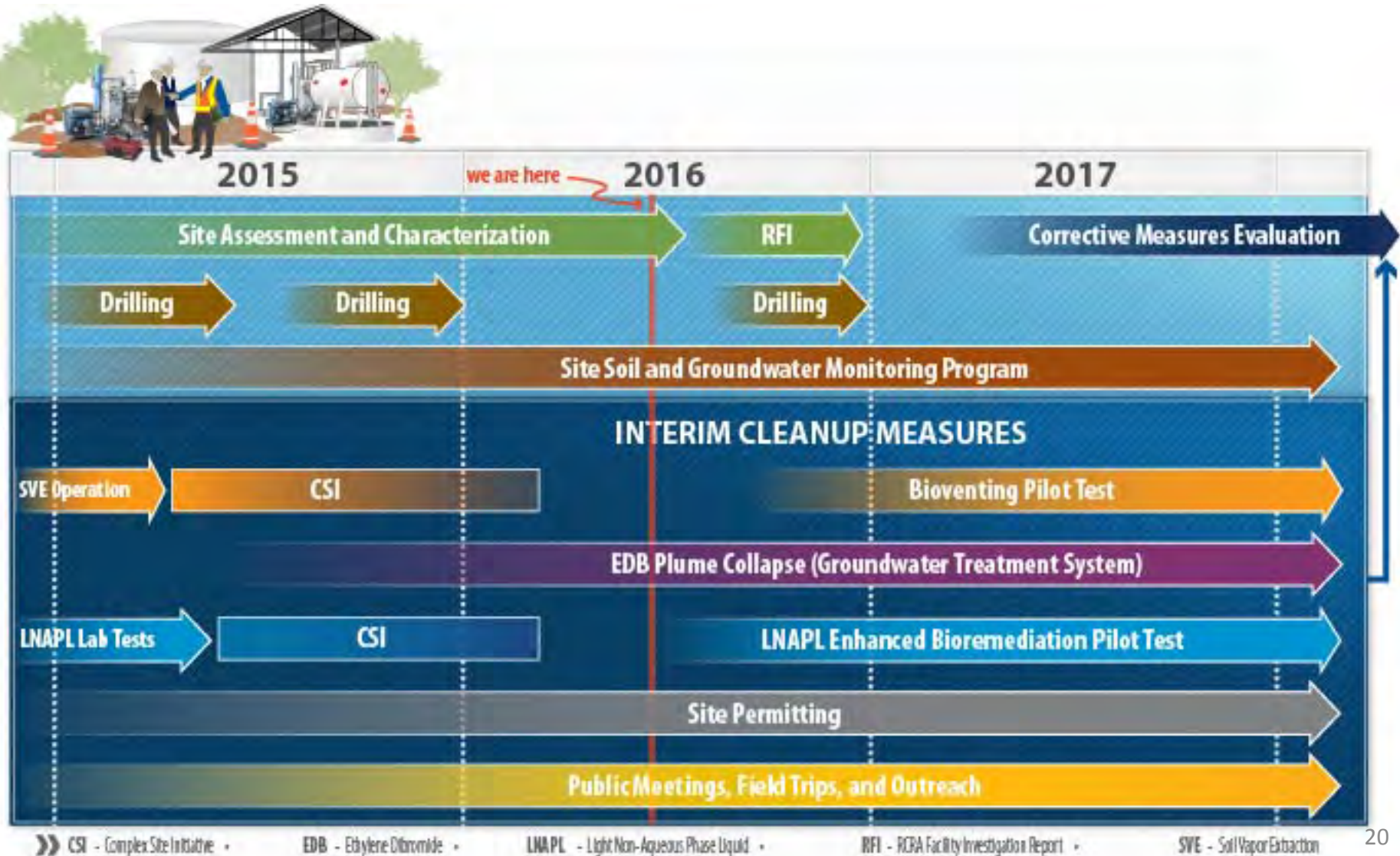
# The Use of IMs in the BFF cleanup

- Implementation of robust IMs is evidence of the Air Force's commitment to this cleanup
- EDB Plume Collapse
  - Deputy Secretary Mark Correll committed to the Air Force to up to eight extraction wells
  - The GWTS was built in four months
- Source Area
  - Soil removal
  - 12 years of soil vapor extraction
  - Two pilot projects coming later this year

# RCRA Corrective Measures Evaluation

- The NMED will direct the Air Force to perform a Corrective Measures Evaluation (CME) once the RFI and risk assessment have been approved
- The CME will evaluate potential remedial alternatives against threshold and evaluation criteria defined in the KAFB RCRA permit
- As part of the CME Report, the Air Force will recommend a remedy or remedies to NMED.
- NMED's selection of a final remedy(ies) will include a robust public participation process required by RCRA
- After the public hearing, NMED will select a final remedy or remedies and will issue a written response to public comments

# Current Project Timeline

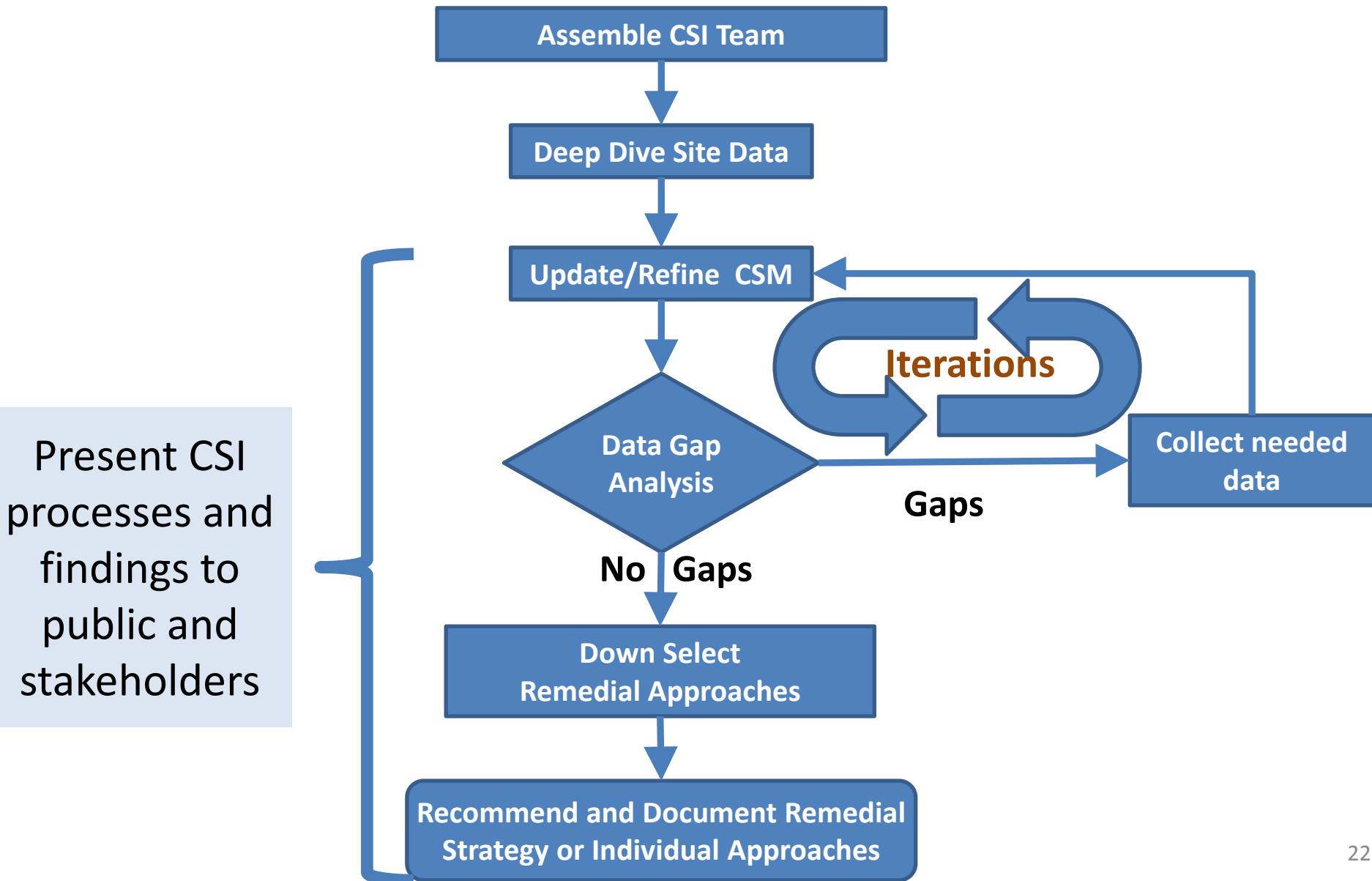


# Technical Component

BFF uses a data-driven, collaborative technical approach that includes:

- Complex Site Initiative (CSI)
- Technical working groups
- Innovative pilots
- Cost consciousness

# AFCEC Complex Site Initiative



# CSI Tools

## Geographical Information System

- Platform for maintaining, communicating, and analyzing site data

## Geostatistical Temporal/Spatial optimization software

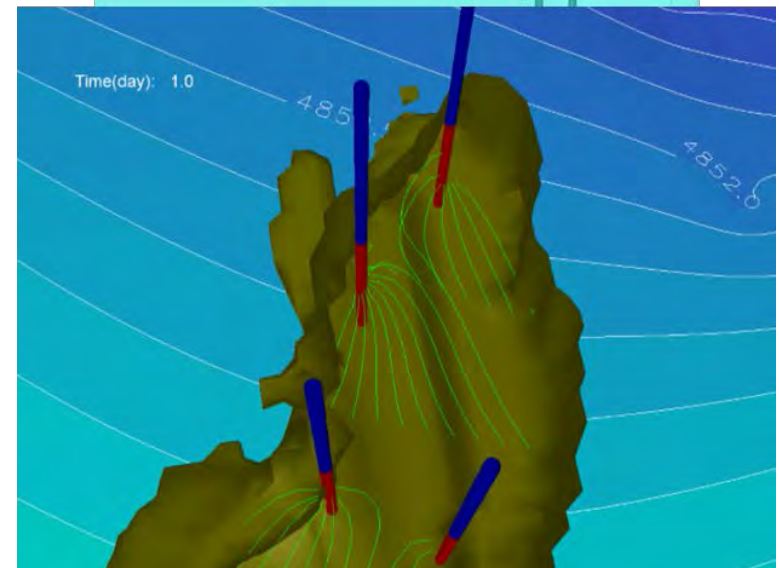
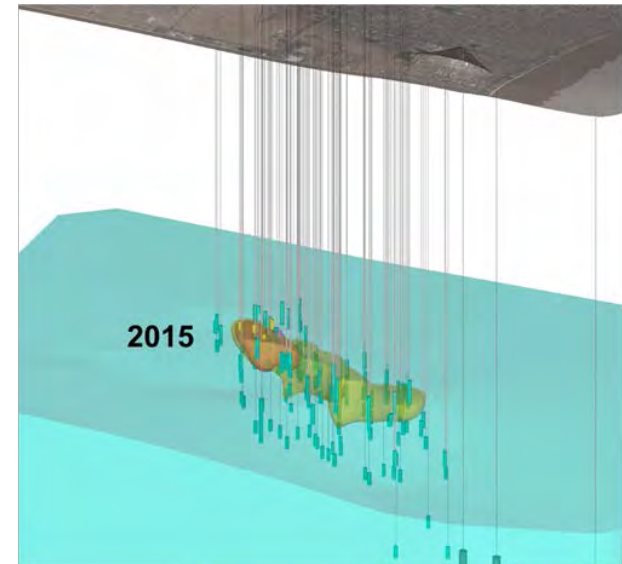
- Evaluates sampling frequency and monitoring network along with visualization of non-linear trends

## Sequence Stratigraphy

- A best fit interpretation of imperfect data sets including geophysical and lithologic logs integrated in the context of depositional analogues

## Groundwater Modeling

- Analytic element and finite difference



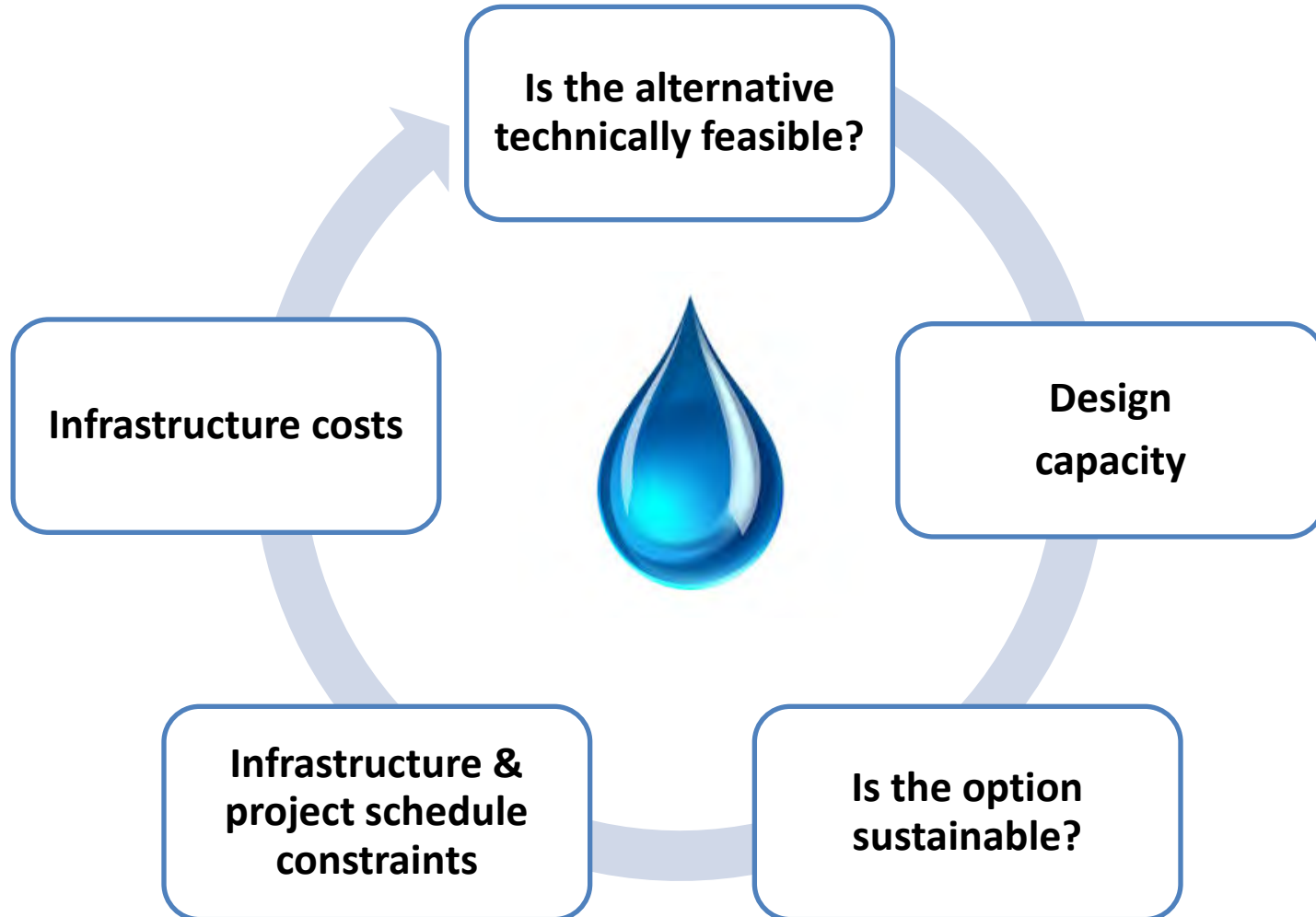
# Reducing Project Cost to Taxpayers Without Compromising Public Health & Safety

- **Multiple monitoring wells in a single borehole**
  - Multiple well completion produces better data, is significantly less expensive, less disruptive to the neighborhood, and safer for workers
- **Optimization of groundwater monitoring**
  - With 4 years of robust monitoring data, it is no longer necessary to test every well for every chemical analyte on a quarterly basis
- **Passive diffusion bag (PDB) sampler validation study**
  - If validated, PDB sampling will be significantly less expensive, safer for workers, and produce less waste
- **Elimination of duplicative permitting**
  - Requiring both a RCRA Hazardous Waste Permit and a WQCC Groundwater Discharge Permit for the same cleanup approach was inefficient and wasteful



# Beneficial Use of Treated Water

Important factors partners considered when evaluating beneficial use alternatives:



# NMED Perspective



**Dennis McQuillan**  
**NMED Chief Scientist**

# 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, the Albuquerque Bernalillo County Water Utility Authority (ABCWUA), Kirtland AFB and the VA Hospital, must deliver water to consumers that meets SDWA standards.

The cleanup of the BFF leak must comply with the corrective action provisions in KAFB's RCRA permit.

# NMED Commitment

- Cleaning up the KAFB fuel leak is one of the top priorities of the New Mexico Environment Department (NMED).
- Initiating groundwater cleanup in 2015 was a huge milestone in this project.
- Working collaboratively with KAFB, Albuquerque Bernalillo County Water Utility Authority (ABCWUA), City of Albuquerque, and U.S. EPA has been critical to our success.
- NMED and the Air Force will not allow fuel contamination to migrate into any drinking water wells.

# 2016 Strategic Plan

New Mexico Environment Department (NMED) Final 2016 Strategic Plan is available online:

<http://www.nmenv.state.nm.us>

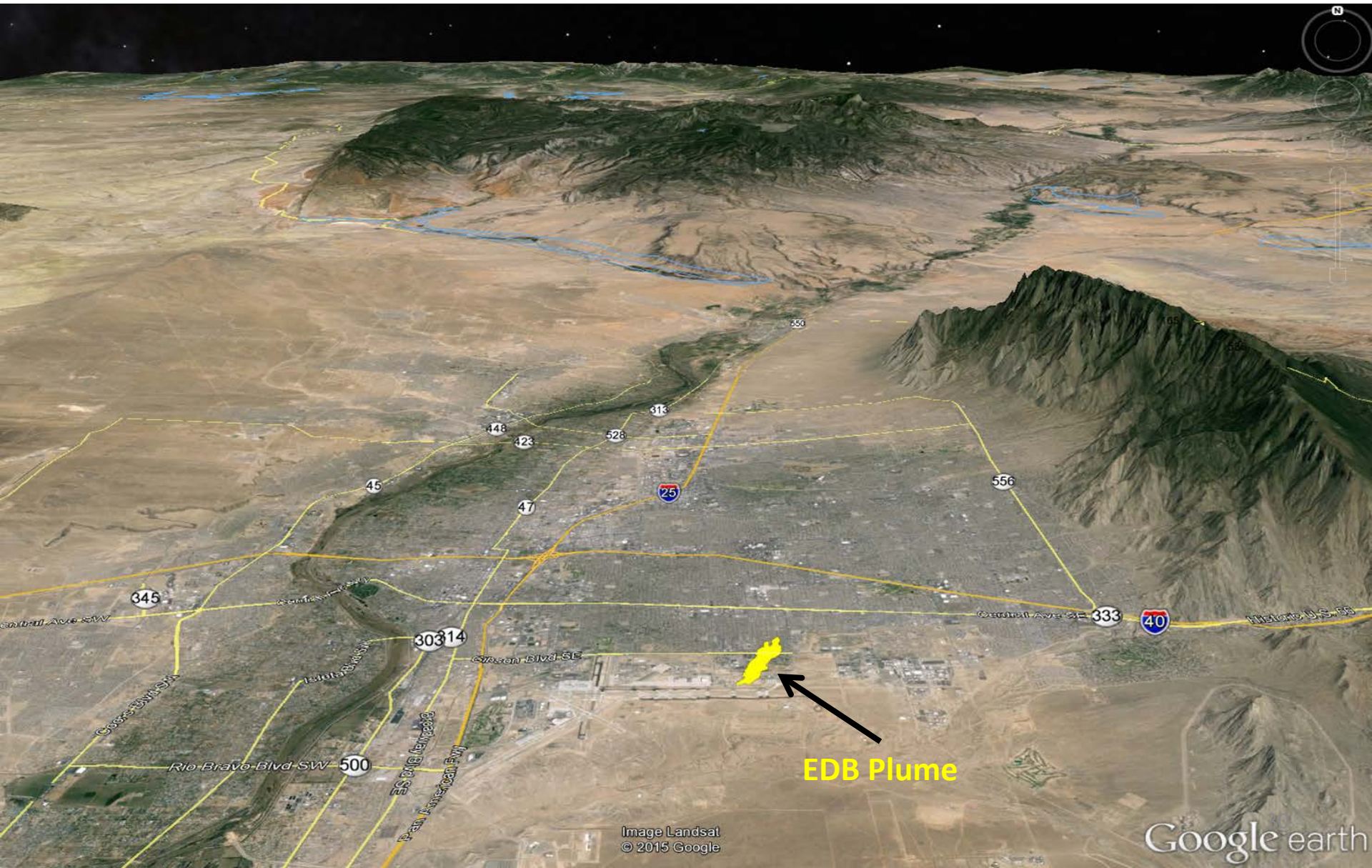
***Goal: Protect Albuquerque's aquifer and drinking water supply wells in the area of the fuel leak***

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

# Conceptual Site Model Animation

<https://www.env.nm.gov/NMED/Issues/KirtlandFuelPlume/KAFBProjectImages.html>



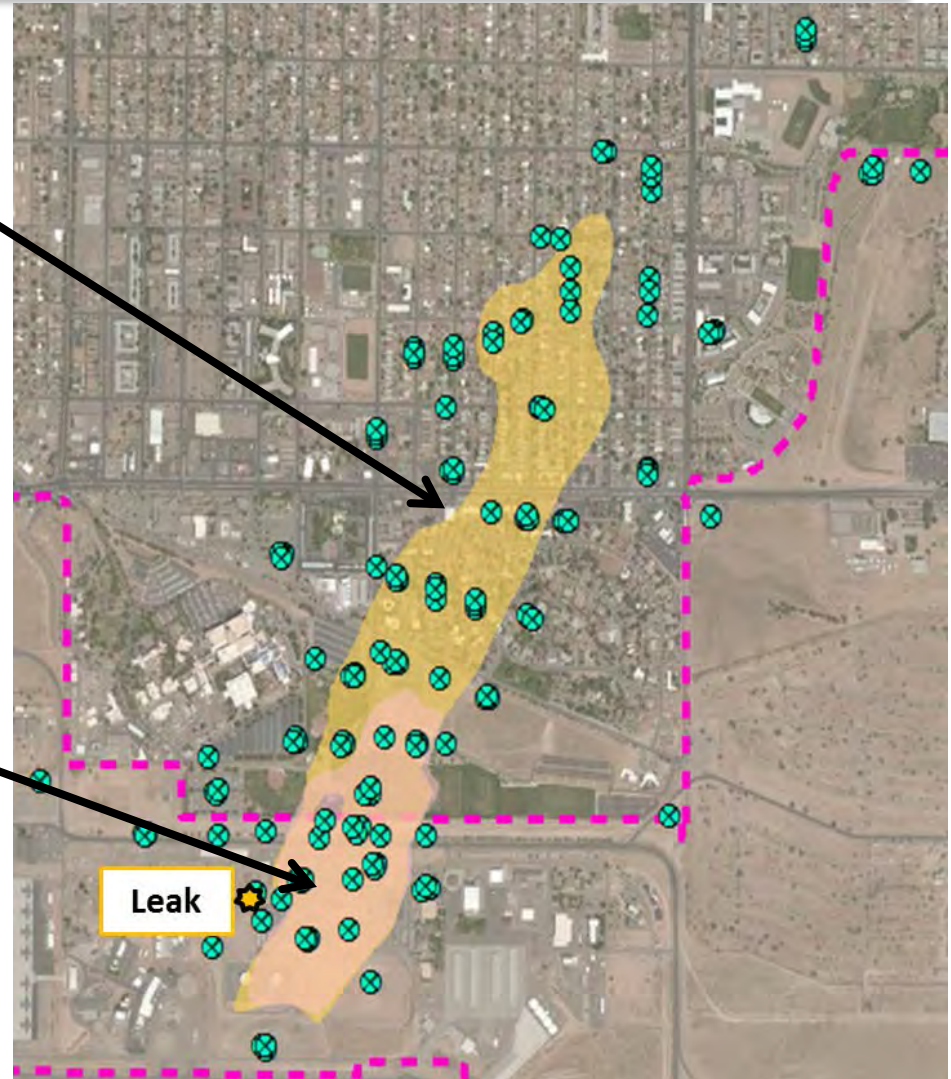
# Plume Anatomy

## ***Mid and Distal Plume (groundwater only)***

- Only dissolved EDB at low ppb
- EDB degradation by hydrolysis

## ***Source Area (soil and groundwater)***

- Residual LNAPL
- Soil vapor hot spots in leak area
- Dissolved hydrocarbons and EDB
- Groundwater concentrations up to high ppb low ppm
- Biodegradation of both hydrocarbons and EDB in soil and groundwater



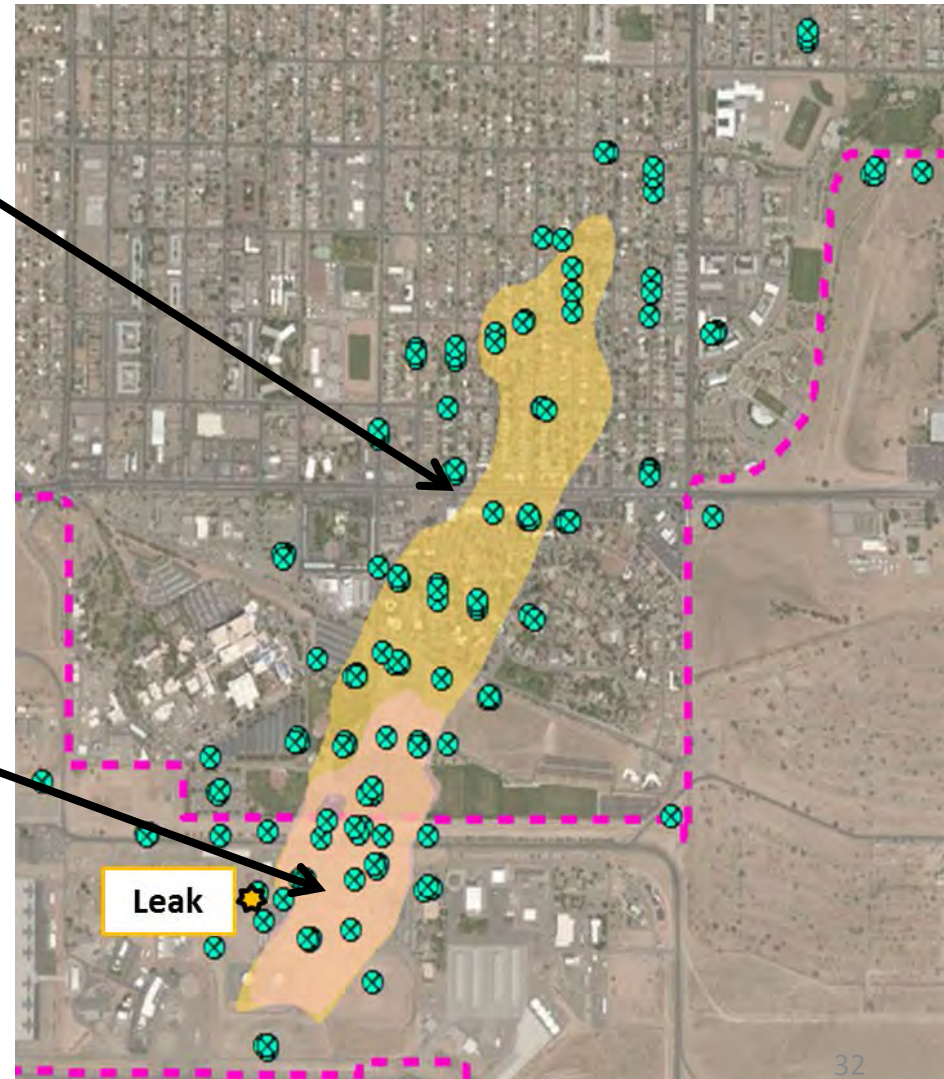
# Interim Corrective Measures Strategy

## ***Mid and Distal Plume (groundwater only)***

- Collapse dissolved EDB plume using groundwater pump and treat

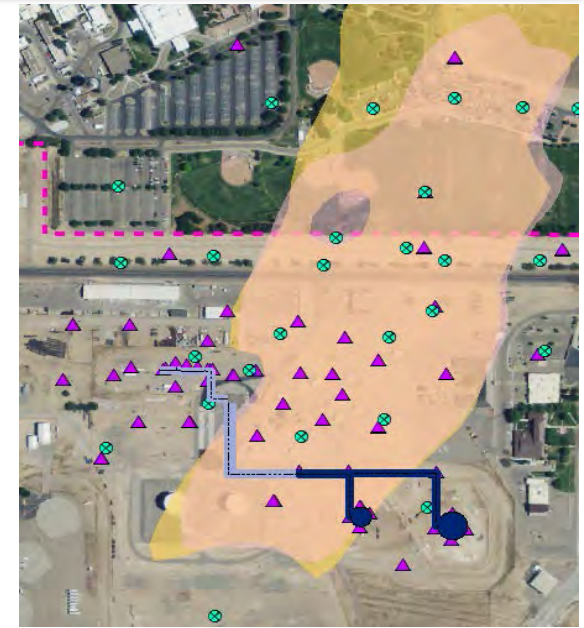
## ***Source Area (soil and groundwater)***

- Excavate contaminated soil
- Soil vapor extraction
- Bioventing pilot test
- In situ biodegradation pilot test





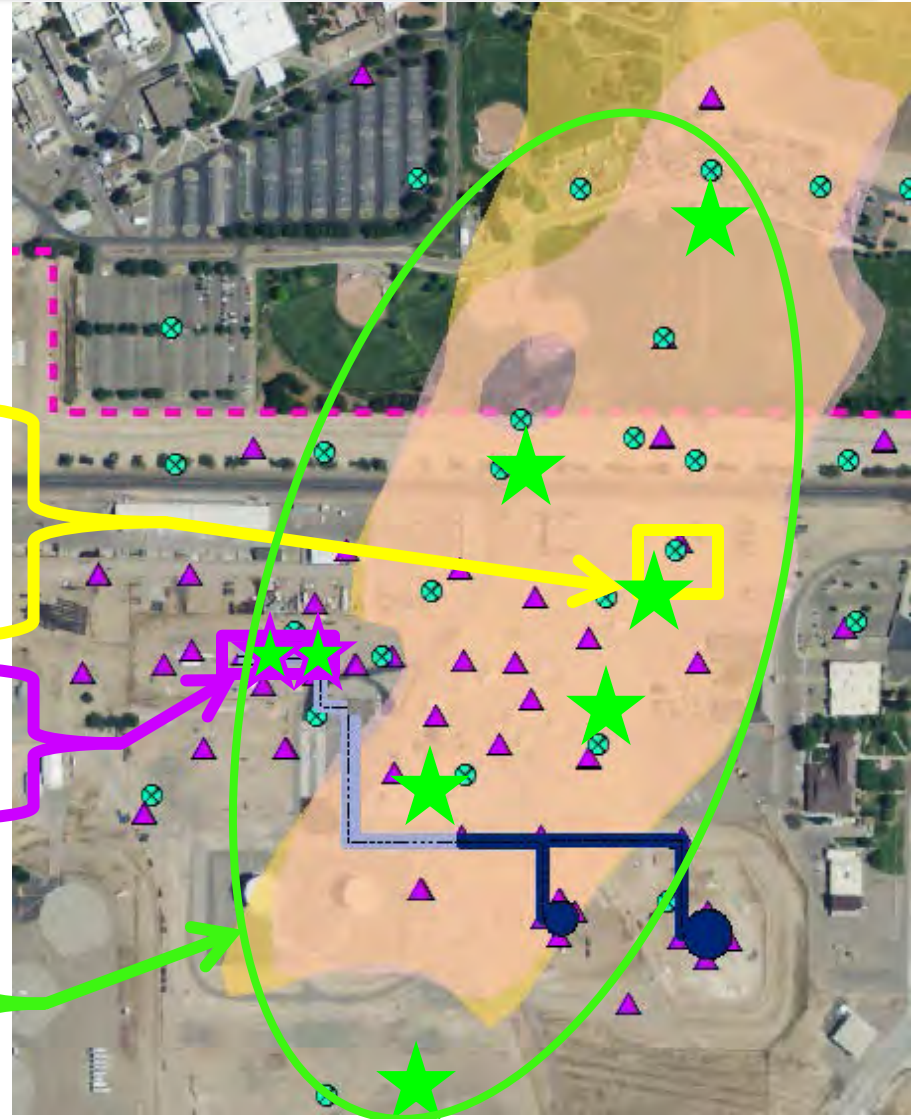
# Source Area Characterization & Remediation



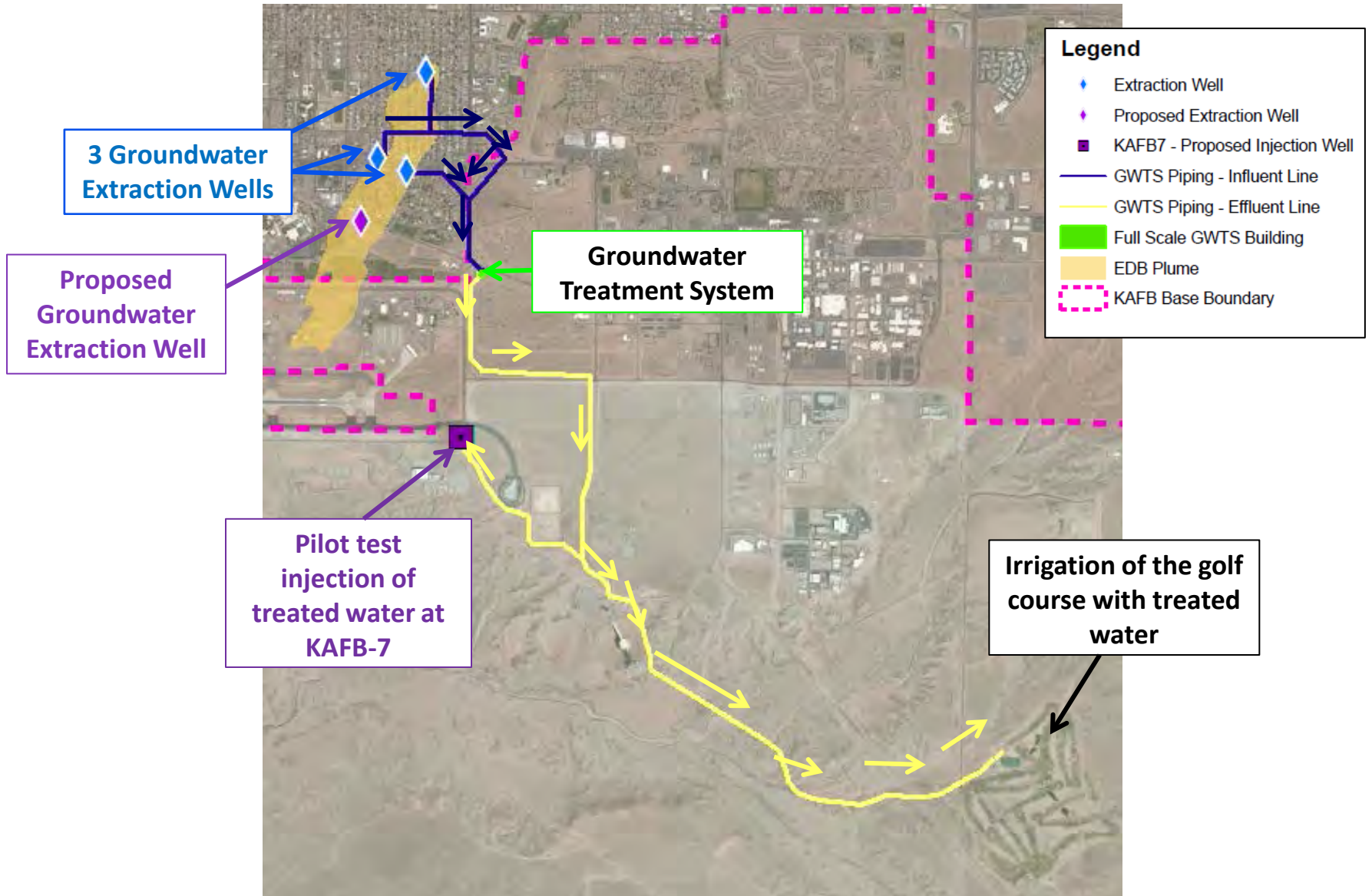
- Nearly 5,000 tons of soil have been removed from the site since 1999
- Soil vapor extraction (SVE) removed roughly 780,000 gallons of fuel
- Residual fuel smeared and is a source of EDB in the groundwater

# Source Area Characterization & Remediation

- On-going in situ respiration and rebound data collection and analysis ▲
- Implement in situ biodegradation of EDB pilot test
- Bioventing pilot test scoping and work plan
- Soil coring in source area scoping and work plan

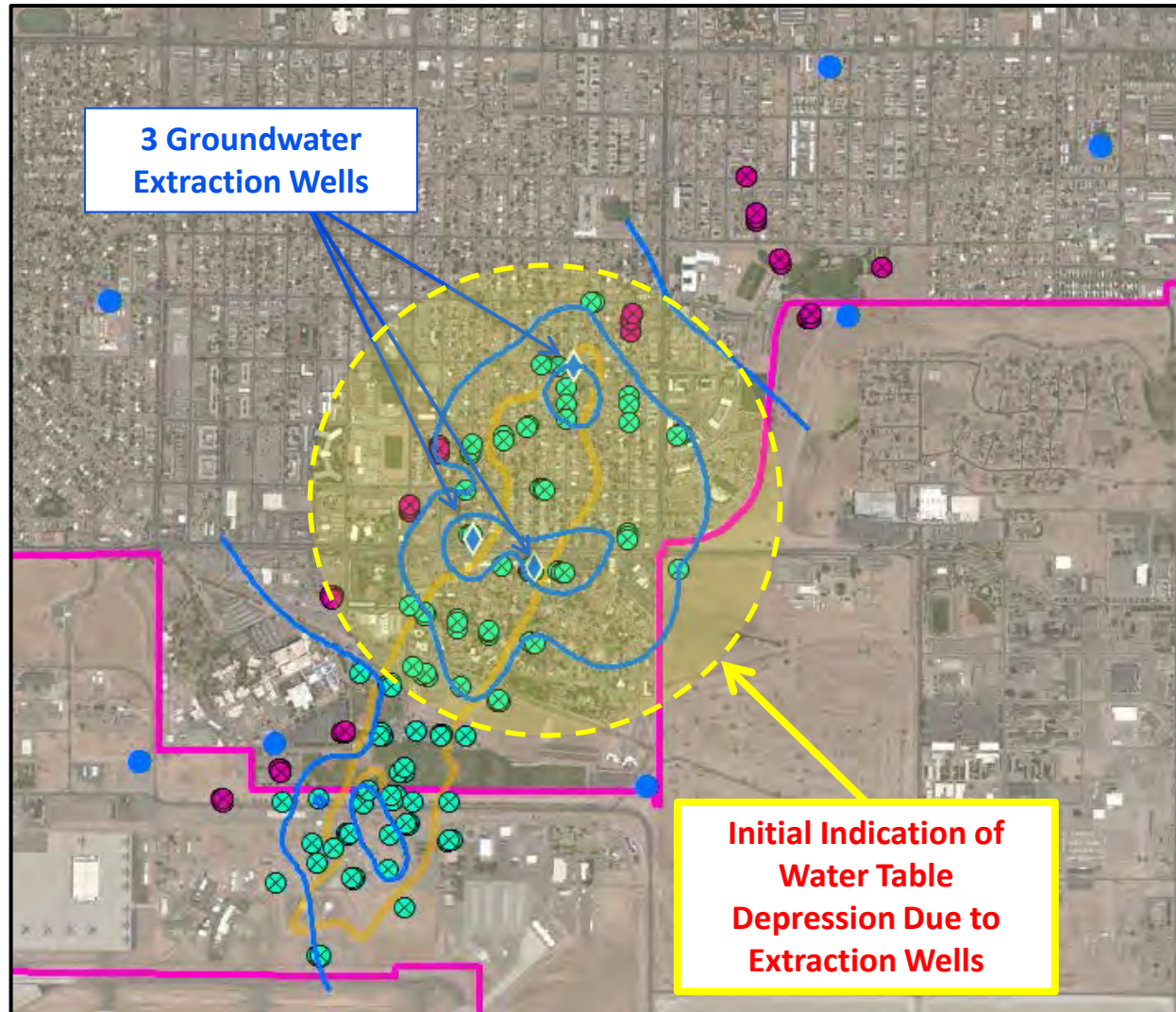


# EDB Plume Collapse



# Cone of Depression

## Evidence of Success

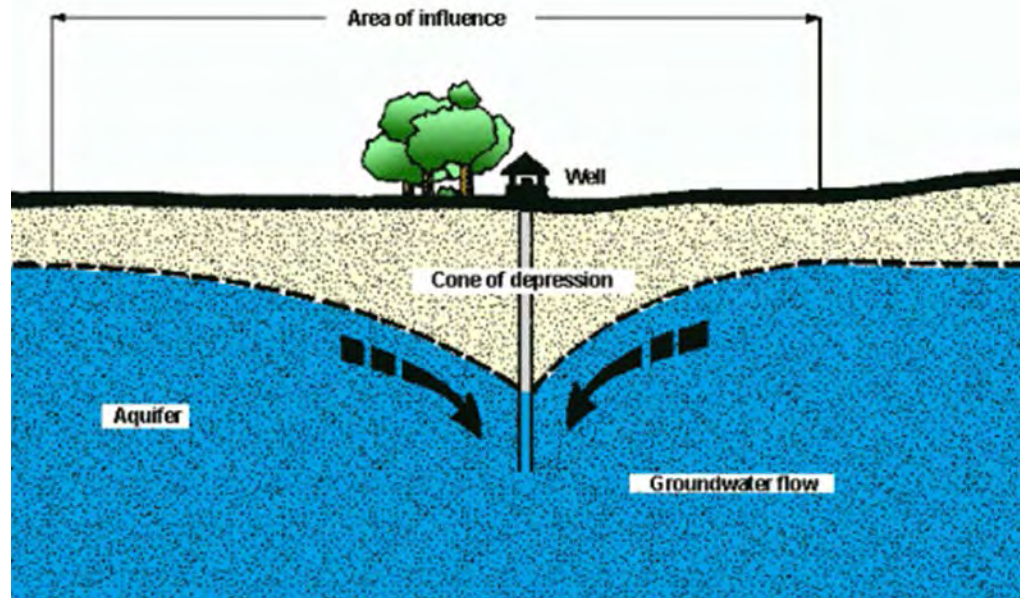


- The “cone of depression” from the first three extraction wells indicates successful removal of EDB-contaminated groundwater
- Plume collapse will be confirmed with EDB concentration trends

### 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

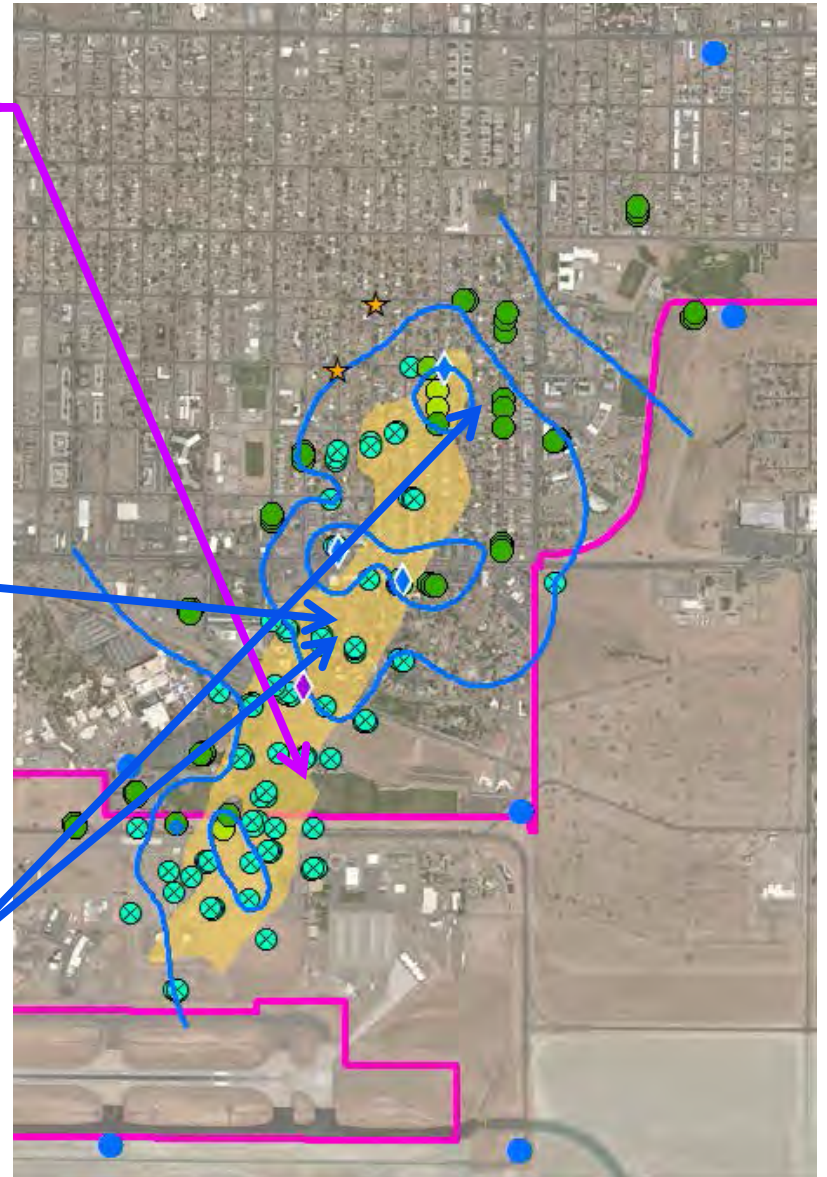
# What is a “Cone of Depression”?



- Forms in the water table when groundwater is extracted in all directions by a pumping well
- Measured water levels in groundwater monitoring wells near the extraction well define the area of influence and capture zone
- One method used to determine if an extraction well is capturing the EDB plume

# EDB Plume Collapse

- Drill and install 4<sup>th</sup> extraction well south of Ridgecrest
- Design expansion of GWTS for increased treatment capacity
- Redevelop KAFB-106233
- Install sand filters to address GWTS fouling
- Conduct aquifer testing of extraction wells



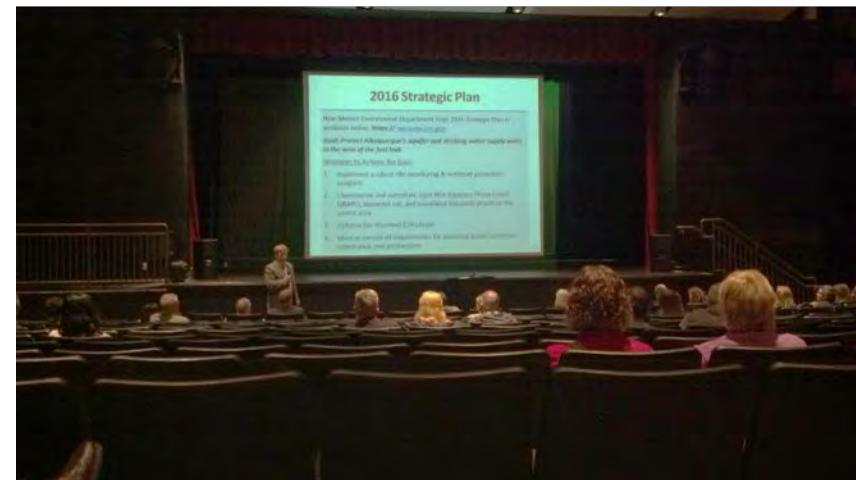
# Reformulating Public Outreach

- Giving the public direct access to technical experts in poster sessions and geologic field trips
- Air Force and NMED technical working groups - collaboration
- Implement a data-driven decision process for characterizing, evaluating and selecting interim measures under RCRA
- Increase public awareness and involvement through implementing proactive and transparent communication – Strategic Plan



# Improved Public Relations

- Dramatic improvement as reflected by
  - Lower attendance at public meetings and field trips
  - Questions have dramatically changed to clarifications versus confrontational
  - Applause versus cursing
- Revising the community stakeholder involvement plan
- This should be iterative and dynamic progress





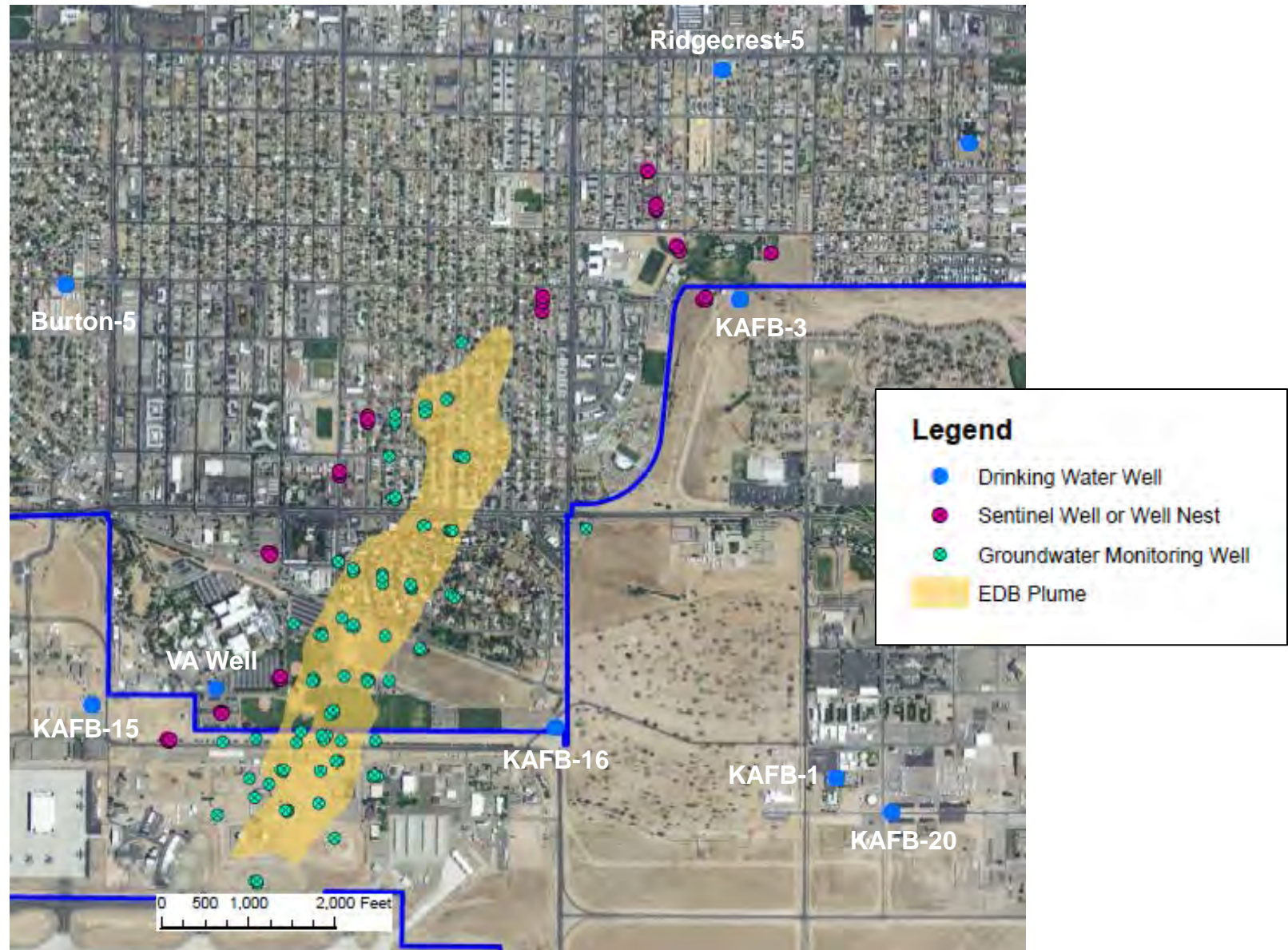
# Albuquerque Bernalillo County Water Utility Authority Perspective



Albuquerque Bernalillo County  
Water Utility Authority

**Rick Shean**  
**Water Quality Hydrologist**  
**Water Authority**

# Drinking Water Wells



# Drinking Water Protection

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



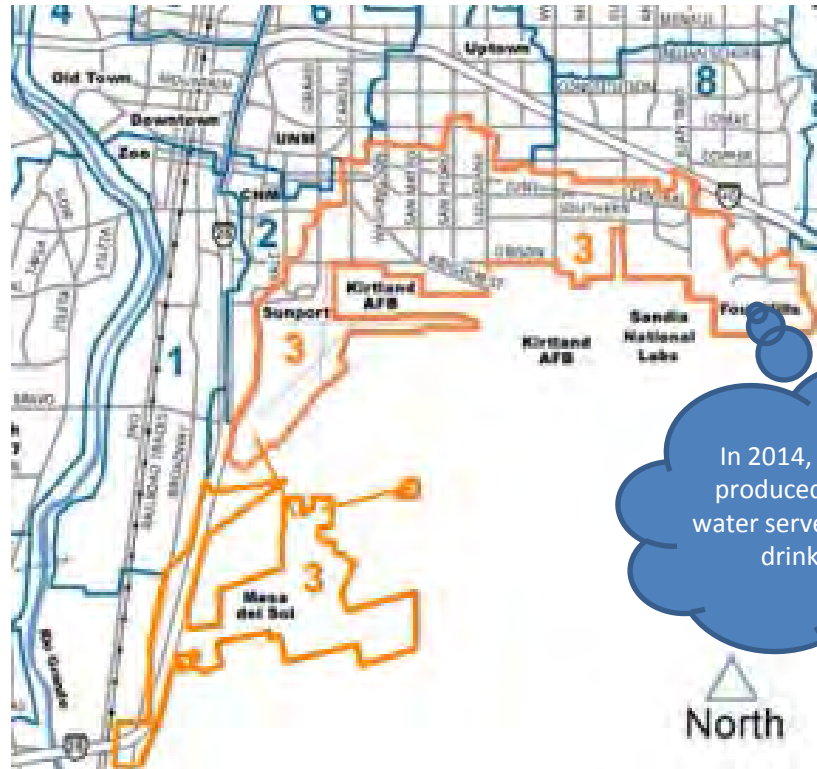
# Water Authority's Initial Concerns

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- Nature and extent of downgradient threat was largely unknown
- Slow pace of corrective action response
- Initially no plan to contain the downgradient dissolved EDB plume
- Unclear goals for the interim measure activities
- Water Authority not part of technical / stakeholder discussions

# Distribution Area 3

- Distribution Area 3, which encompasses the fuel spill, serves ~75,000 people in southeast Albuquerque.
- 10 active production wells in Area 3:
  - Burton Well Field (5)
  - Ridgecrest Well Field (5)
  - \* San Juan Chama Water also distributed in Area 3



# Water Authority Spill Related Activities

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- Since late 2008, voluntary monthly sampling/testing of nearby production wells – Burton and Ridgecrest Well Field.
- Monthly sampling for ethylene dibromide (EDB) and aviation gas / jet fuel constituents. (Safe Drinking Water Act only requires one sample every three years).
- No detections of contaminants related to fuel spill to date.

## Water Authority Spill Related Activities, cont.

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Water Authority hired independent contractor to perform:

- Review KAFB work plans, quarterly reports, and RCRA documents.
- Prepare technical memos to Water Authority staff, NMED and KAFB.
- Attend public and technical meetings and consult staff, senior management and decision makers.

# WUA Policies for KAFB BFF Spill

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- M-10-1 (2010): Authorizes Water Authority to hire independent environmental consultant to evaluate the remediation planning and groundwater resources in the vicinity of the plume.
- R-12-13 (2012): Authorizes an agreement with KAFB for Contingency Plan coordination, working with USGS on early warning wells, and requests that KAFB speed implementation of final remedy.
- R-12-14 (2013): Authorizes negotiations with KAFB for emergency measures to save Albuquerque's drinking water, placement of monitoring wells near the Ridgecrest wells, containment of the light nonaqueous phase liquid plume, and implementation of remediation technology to address the long-term contamination of the soils and aquifer.
- R-14-11 (2014): Declares that Water Authority will not allow EDB contaminated water at any level to enter the potable drinking water system.



# Protecting Our Supplies

- Conservation efforts have lowered per capita demand ~50% since mid 1990's.
- Diverse water supply portfolio:
  - Ground Water
  - Surface Water / San Juan - Chama
  - Recovered Water (ASR)
  - Reuse / Surface
  - Reuse / Wastewater
  - Reuse / Industrial
- There is sufficient redundancy to supply water at greater than average demand.
- Sentinel wells have been drilled to track plume's approach to Ridgecrest well-field
- System interconnectivity – Can move water from east side to west side.
- Increased nonpotable system use can maximize use of potable supplies.
- Aquifer storage and recovery projects will increase drought reserve.

# Water Authority Synopsis

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- In mid-2013, Air Force began more aggressive corrective action activities for the fuel spill.
- AFCEC involvement has been the game changer.
- Water Authority is an active participant in the technical meetings and input is being included in the interim measure process.
- Based on current conditions, the Water Authority's drinking water supply should be protected from the fuel spill contamination, if the current aggressive interim measures continue and final remediation activities are successful.

# City of Albuquerque Perspective



**Mary Lou Leonard**

**Director**

**Albuquerque Environmental Health Department**

# Game Changers

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- **Political and technical involvement at all levels of government**
- **Project transparency**



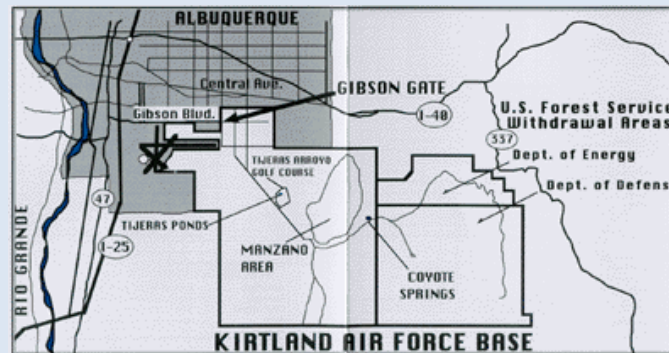
# Political Involvement

- Federal
- State
- County
- City
- Water Utility Authority



# City Specifics

- **Mayor seeks USAF commitment**
  - 3 trips to USAF Headquarters (2012-2014)
  - Sought assurance that KAFB site was a priority, and
  - Funding and staff resources would be in place



- **Mayor hosts all agency meeting September 2014**
  - To gain general concurrence on strategy going forward

# Technical Involvement

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- **2014-2016 NMED and USAF assign high level technical experts to project**
  - Able to agree on facts
  - Sound interim treatment system design and streamlined permitting/regulatory approvals
  - Ability to speak candidly and gain trust
  - Dedicated staff in place
- **Allowed project to go forward**

# Project Transparency

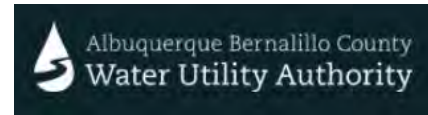
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- **Regular stakeholder meetings**
- **Regular technical meetings**
  - Develop best path forward – geochemistry, modeling, etc.
- **Regular community updates**
  - Jointly hosted and improved public meetings
  - City council and water authority
  - Neighborhood associations
  - Field trips



# 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



Sundance Consulting Inc.

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