



Cardinal Yu Pin Manor

**SFPP Norwalk Tank Farm Update
Presented to the
Norwalk Restoration Advisory Board on
February 27th, 2020**



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Agenda

1. Site Overview
2. Remediation Systems Operations Update
 - SVE and Biosparge Systems
 - Groundwater and Total Fluids Extraction Systems
 - Mass Recovery Summary
3. Remediation System Expansion
 - Success with South-central Area Biosparge Well
 - Installation of Southeastern Biosparge Well
 - Expanded SVE System in Southeastern Area
 - South-central/Offsite “Stacked” Biosparging & SVE Well System
4. Path Forward
 - Road Map
 - Natural Source Zone Depletion (NSZD) Rate Evaluation

Site Overview

Site Location and SFPP Remediation Areas

Objectives

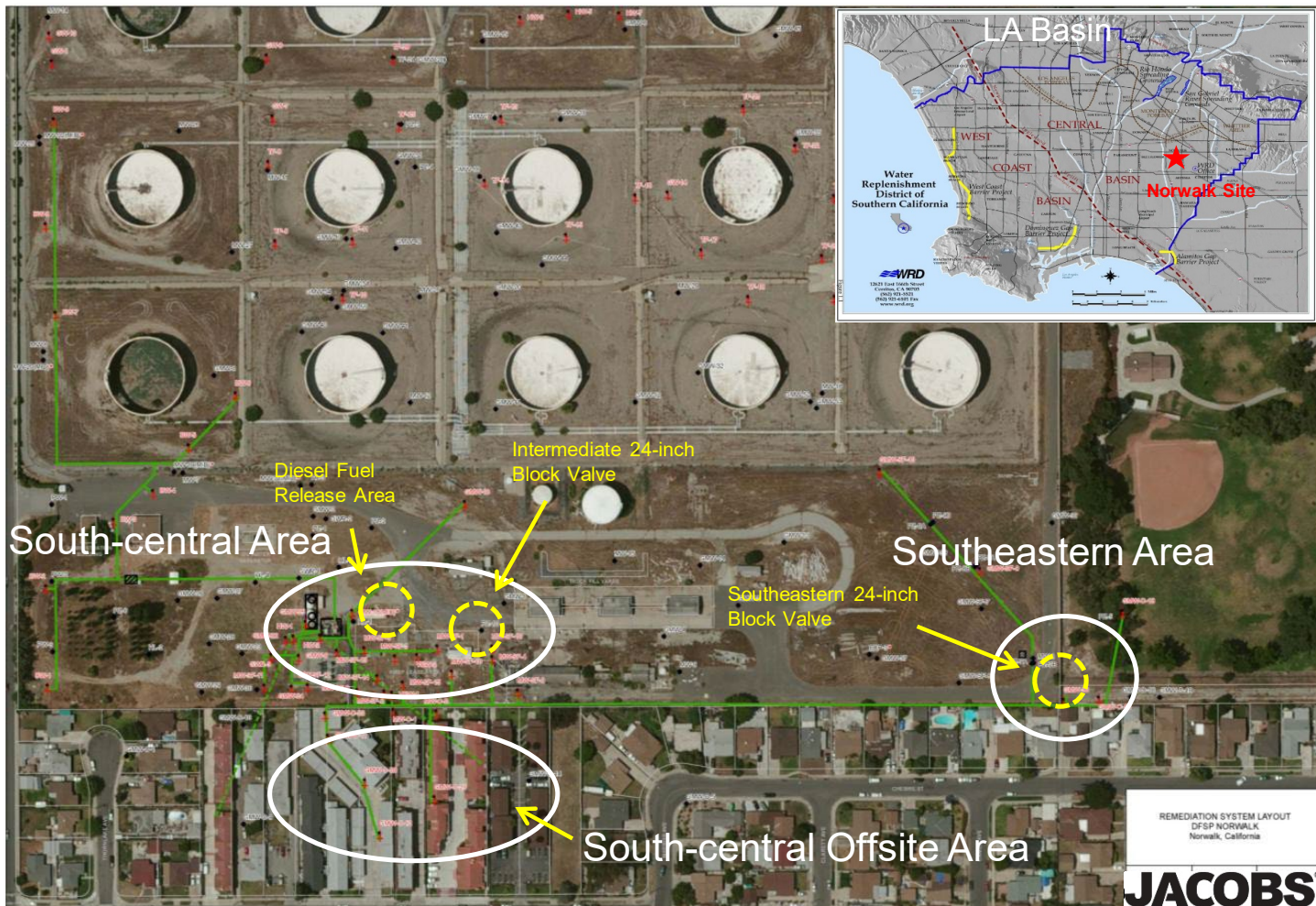
- Contaminant Mass Containment
- Contaminant Mass Removal

South-central and Southeastern Areas

- Horizontal Biosparge System
- Soil Vapor Extraction (SVE) System
- Groundwater Extraction (GWE) System
- Total Fluids Extraction (TFE) System

South-central Offsite Area

- Horizontal Biosparge and SVE System
- GWE System
- TFE System



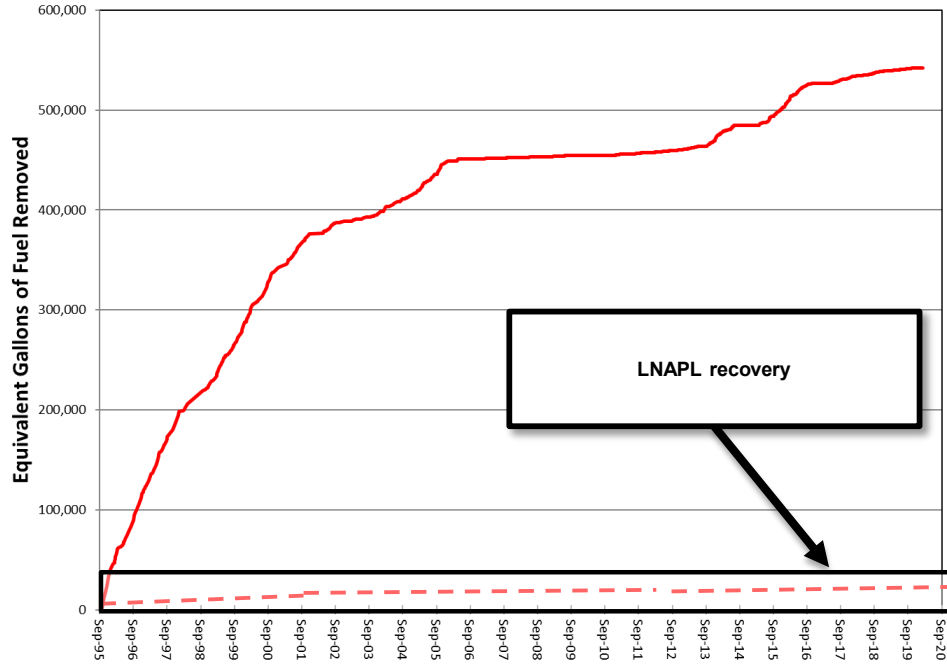
Remediation Systems Operations Update

Remediation Systems Operations Summary

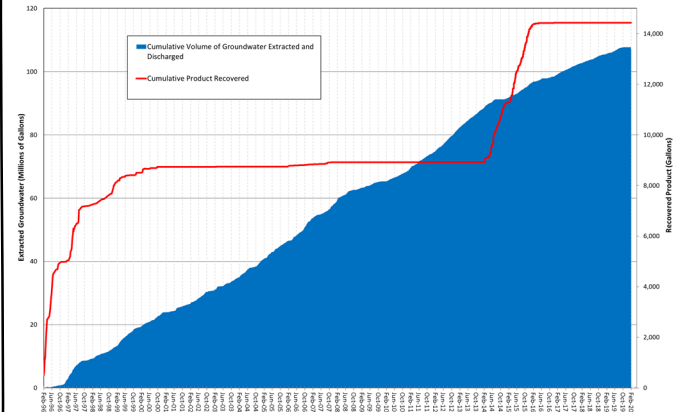
Time	SVE Runtime	Biosparge Runtime	SVE Mass Removal	GWTS Runtime	GWTS Removal Volume	Notes
Q1 2019	75%	44%	3,492 lbs (529 gal)	74%	574,268 gal	<p>-The GWTS, SVE, and biosparge systems were shutdown from the end of Dec 2018 to Jan 11 to repair air compressors that supply air to pneumatic valves on the RTO and the pneumatic pumps in the wells.</p> <p>-Biosparging at the site was suspended during 4Q2018 to Feb 9 to accommodate the installation, inspection, and start-up of the new 883-scfm biosparge system.</p>
Q2 2019	84%	79%	6,286 lbs (952 gal)	80%	848,498 gal	-The SVE, biosparge, and GWTS were shut down on Apr 9 to Apr 23, to facilitate gauging and sampling activities during the first semiannual groundwater sampling event that was conducted April 16 to 23, 2019.
Q3 2019	99%	91%	6,984 lbs (1,058 gal)	91%	818,916 gal	-A crack in the bioreactor acid tank was observed on July 23, 2019. The automatic acid supply pump was turned off until the tank is replaced. In the interim, muriatic acid is manually loaded into the bioreactors to balance pH levels.
Q4 2019	65%	63%	2,822 lbs (427 gal)	29.4%	84,944 gal	<p>-The SVE, biosparge, and GWTS were shut down from October 22, 2019 through November 5, 2019 for the second semiannual groundwater sampling and annual soil vapor sampling events.</p> <p>-The GWTS was shut down on November 11, 2019 due to a leak in the secondary effluent polishing vessel. The GWTS will remain offline until a new carbon vessel is installed, scheduled for February 2020.</p>
Total (Q1 – Q4)	~80%	~70%	19,583 lbs (2,966 gal)	~68%	2.3 million gal	-The SVE system was shut down from November 26, 2019 through December 9, 2019 due to a malfunctioning chart recorder. The SVE was restarted when a temporary replacement chart recorder was calibrated and installed. The site specific chart recorder was shipped to the manufacturer for repairs

Site Mass Recovery Summary

Cumulative Fuel Removed by Vapor Extraction To Date

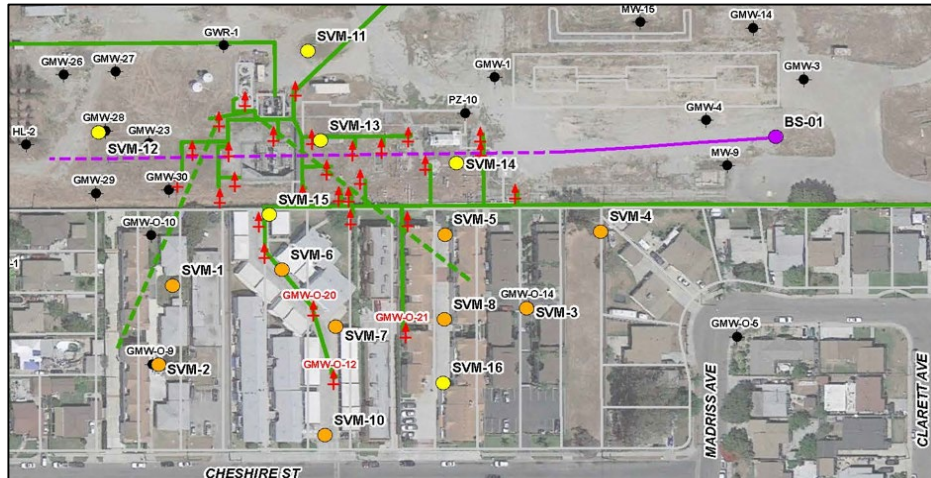
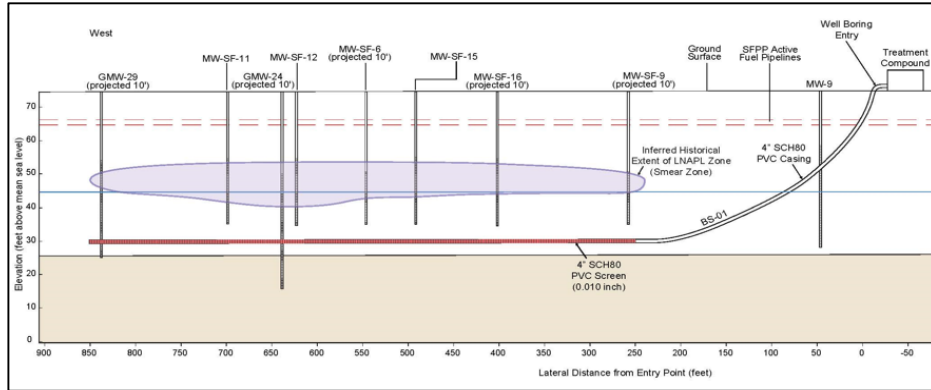


Cumulative Groundwater Extracted



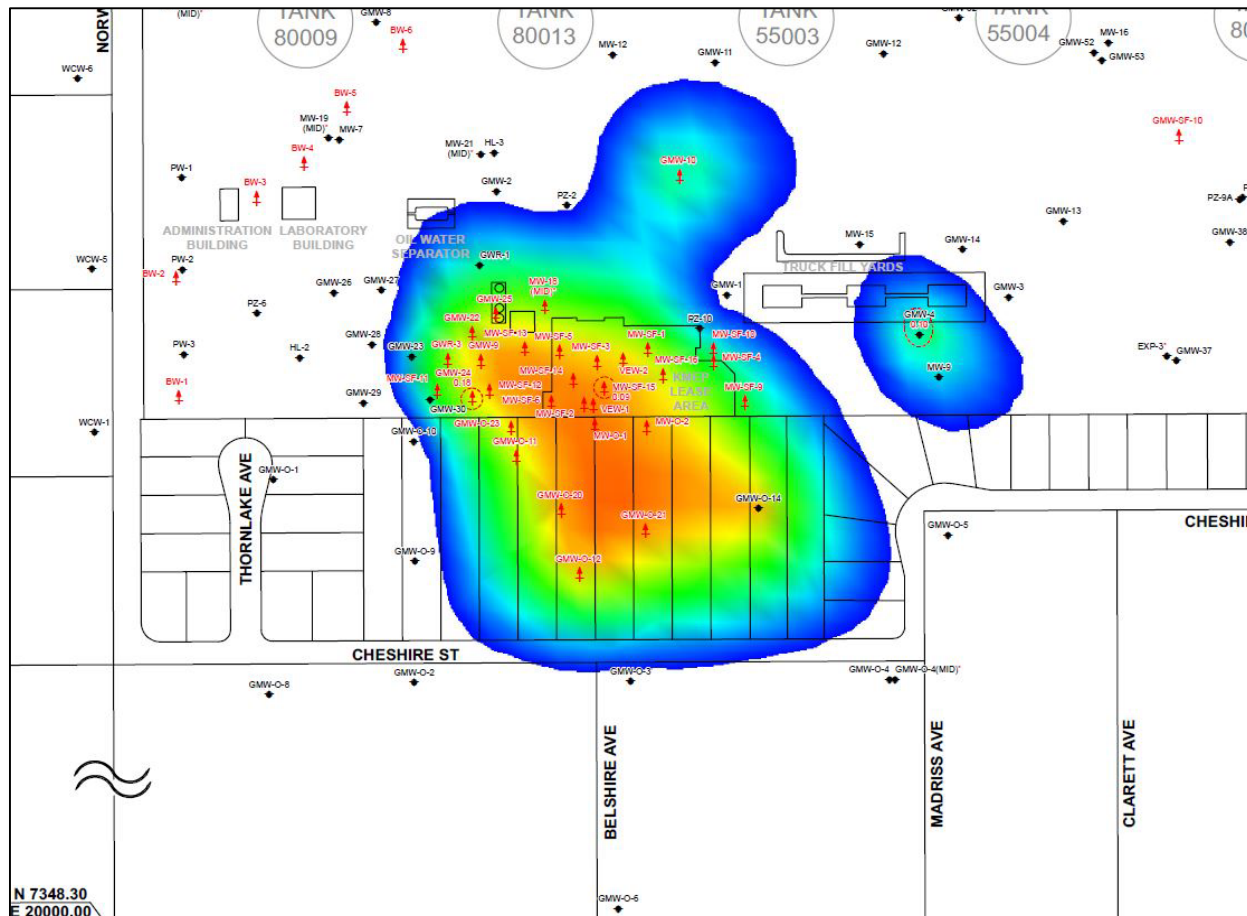
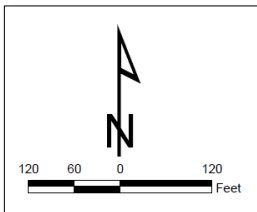
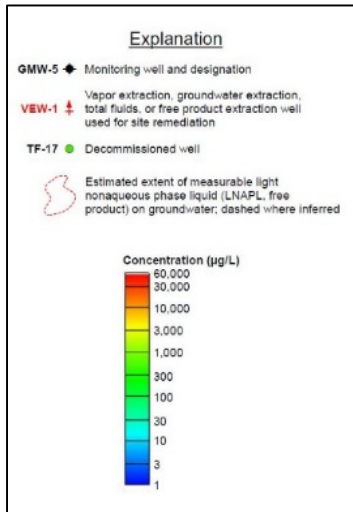
Remediation System Expansion

South-central Horizontal Biosparge Well

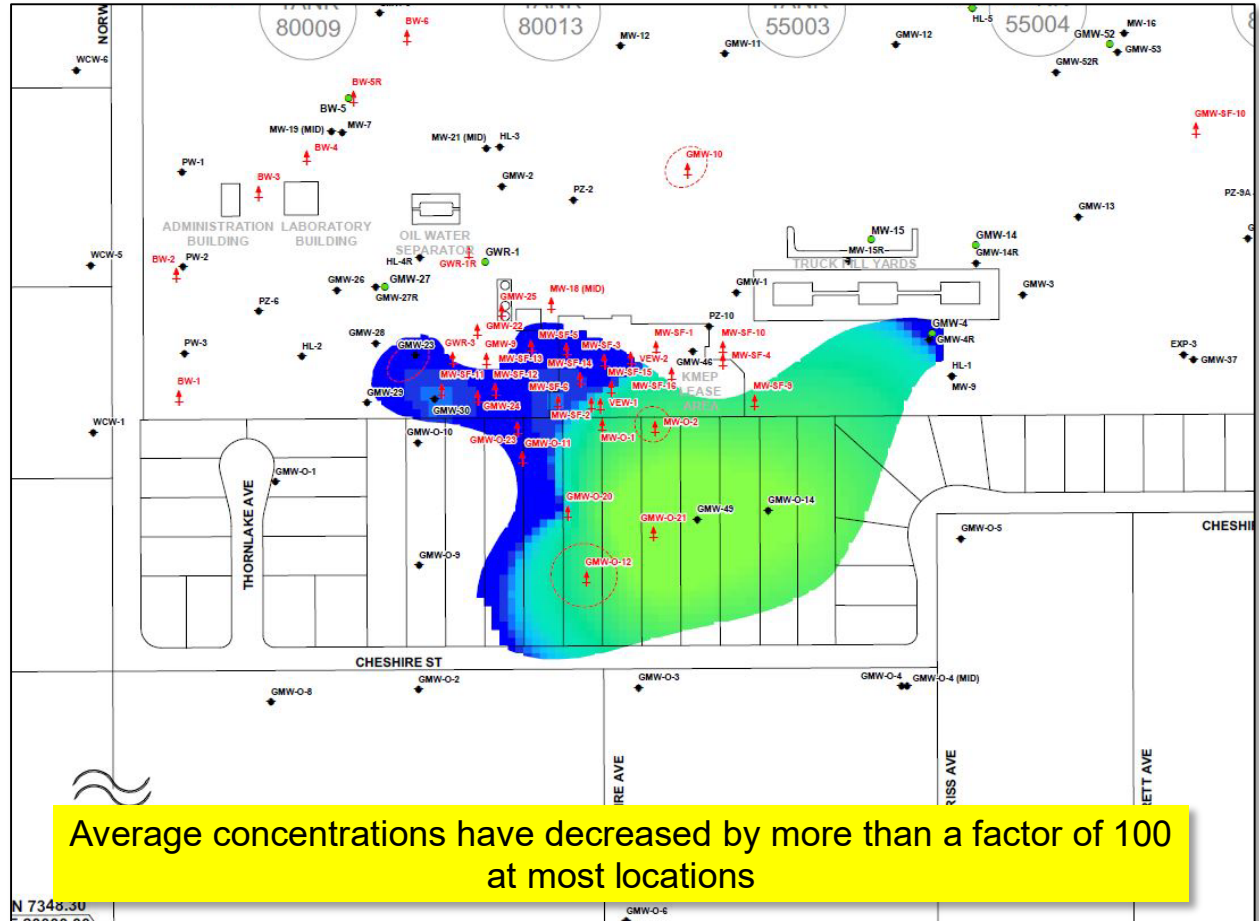
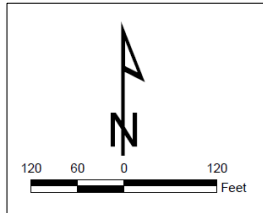
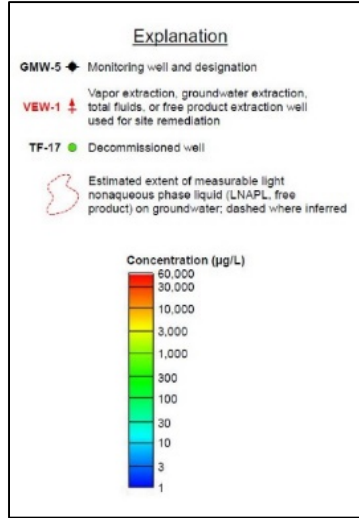


- Installed horizontal well in Q4 2015
- 850 feet long with 600 feet of screen
- Screen is located within the approximate extent of the dissolved phase in the south-central area and below the LNAPL smear zone (approximately 45-foot bgs)
- Operated from Q1 2016 to Q4 2019
- Highly successful; reached technical endpoint in 2+ years (significantly reduced LNAPL extent and mobility)
- Water Board endorsed plan for temporary shut-down in September 2019

2013 Groundwater Benzene Concentrations (Pre-Biosparging)

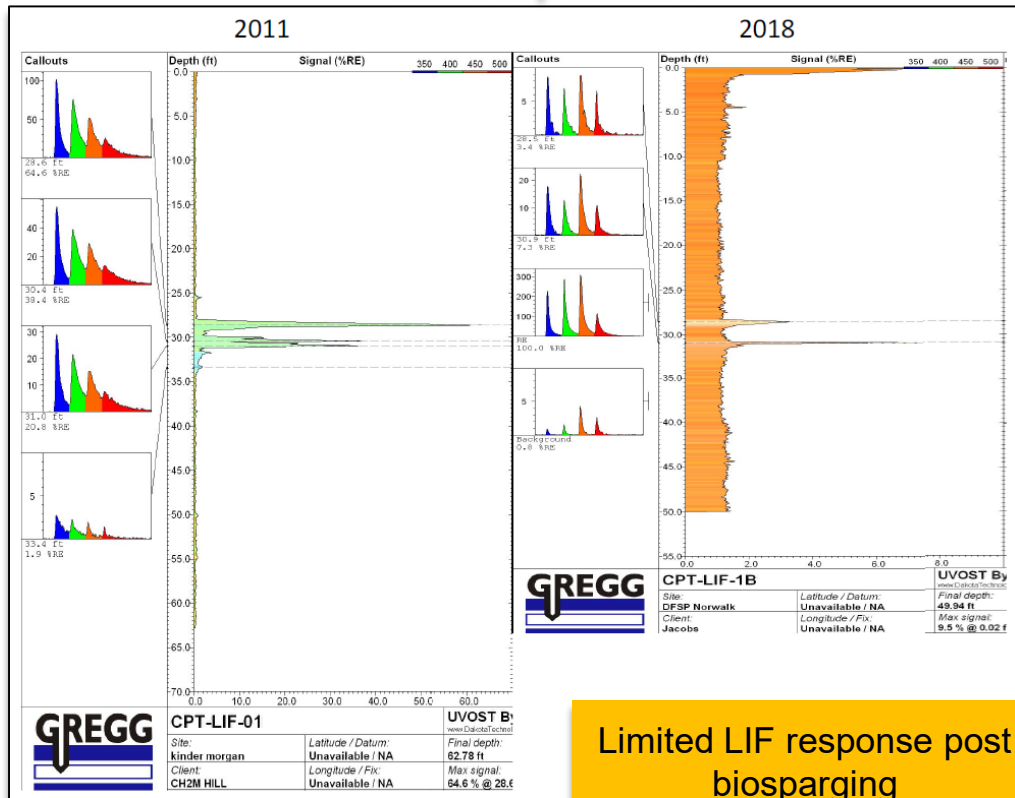


2019 Groundwater Benzene Concentrations (Post Biosparging)



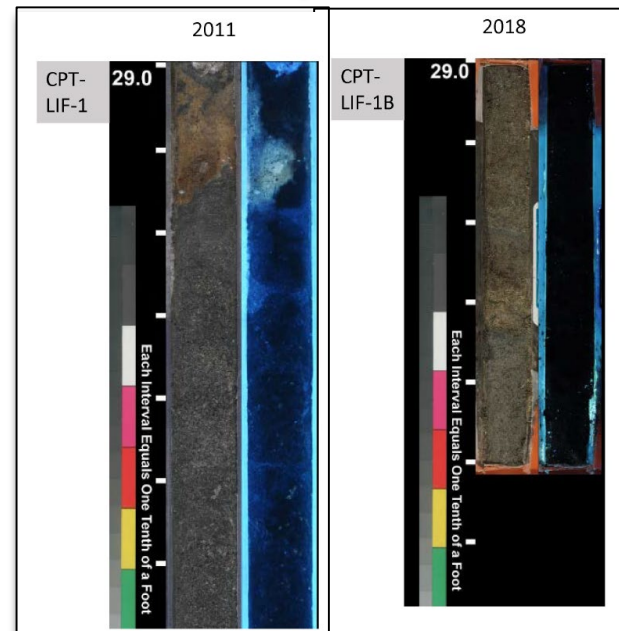
Before and After Biosparge LIF and Soil Cores

LIF Replicates



Limited LIF response post biosparging

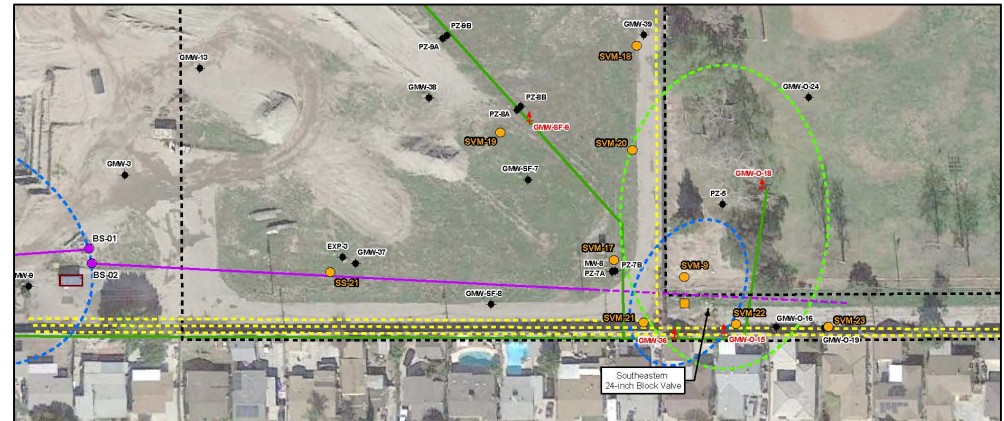
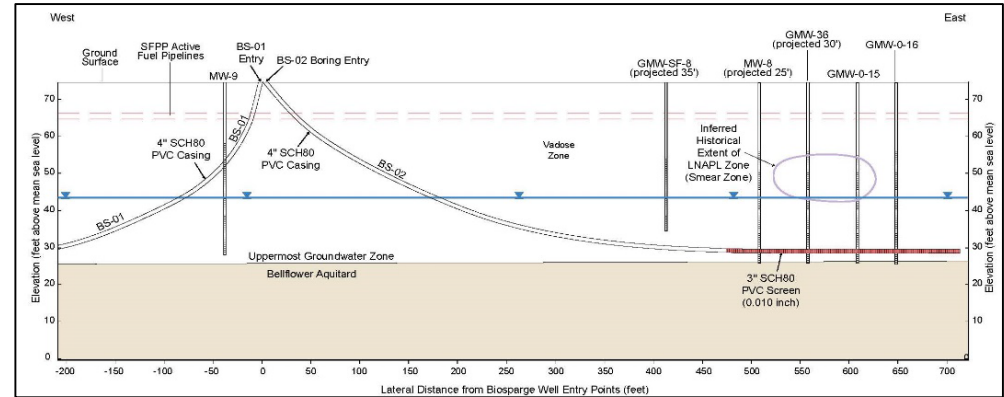
Soil Core Photograph Replicates



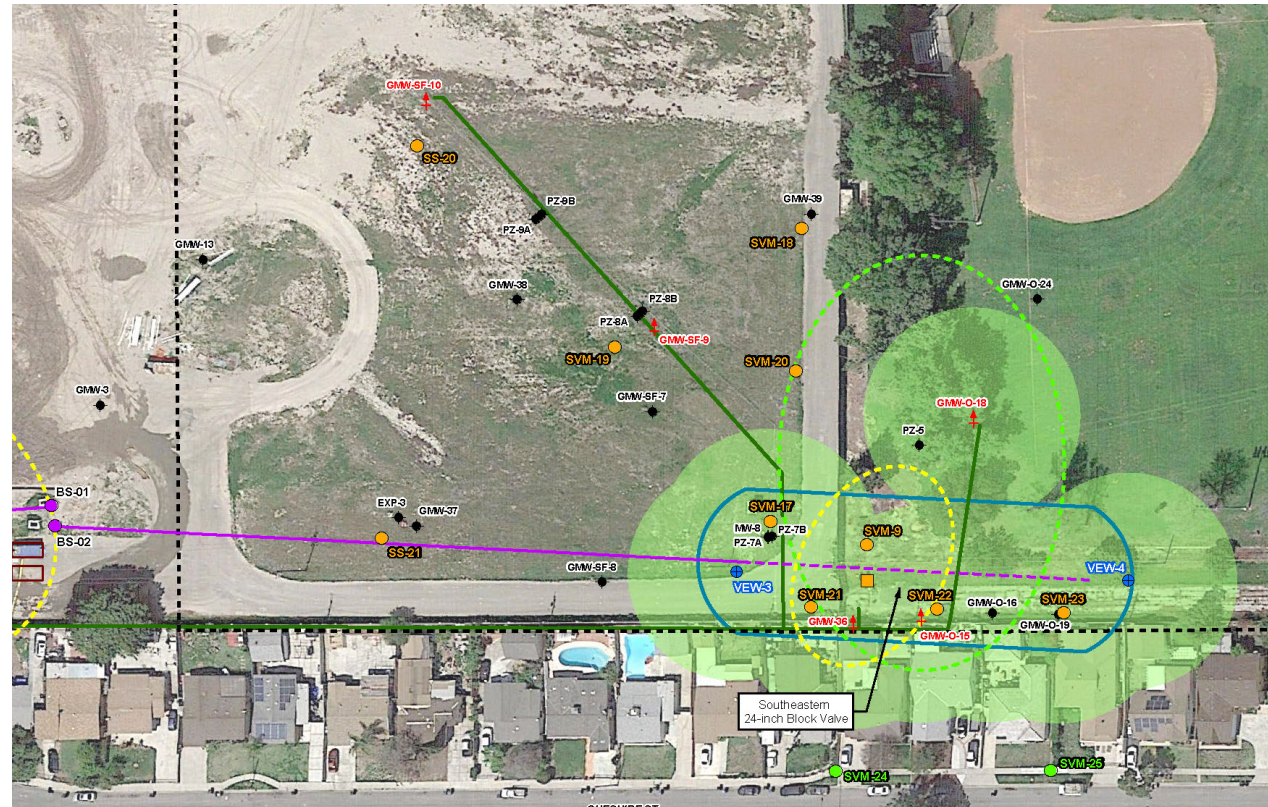
No visual fluorescence post biosparging

Southeastern Horizontal Biosparge Well

- Installed horizontal well in Q4 2017
- 733 feet long with 240 feet of screen
- Screen is located within the approximate extent of the dissolved phase in the southeastern area and below the LNAPL smear zone (approximately 45-feet bgs)
- Currently inactive pending start-up of expanded SVE system
- Startup likely in Q2 2020



Expanded Southeastern SVE System



- Performed Capture Zone Test in Q2 2018
- Realized the need to enhance the SVE system before operating new biosparge well (proximity to residential area)
- Installed 3 new SVE wells in Q1 2019
- Converted 3 existing MWs to SVE, replaced 1,200 ft header and connected new, existing, and converted SVE wells in Q3/Q4 2019.
- Installed additional soil vapor probes
- Will perform another Capture Zone Test in Q1 2020.
- Startup likely in Q2 2020



1

Photo 1 – Trenching
SVE lines (looking east
along ROW)



2

Photo 2 – Installing
SVE pipe (looking
east along ROW)



3

Photo 3 – Installing SVE
pipe (looking north
towards Holifield Park)

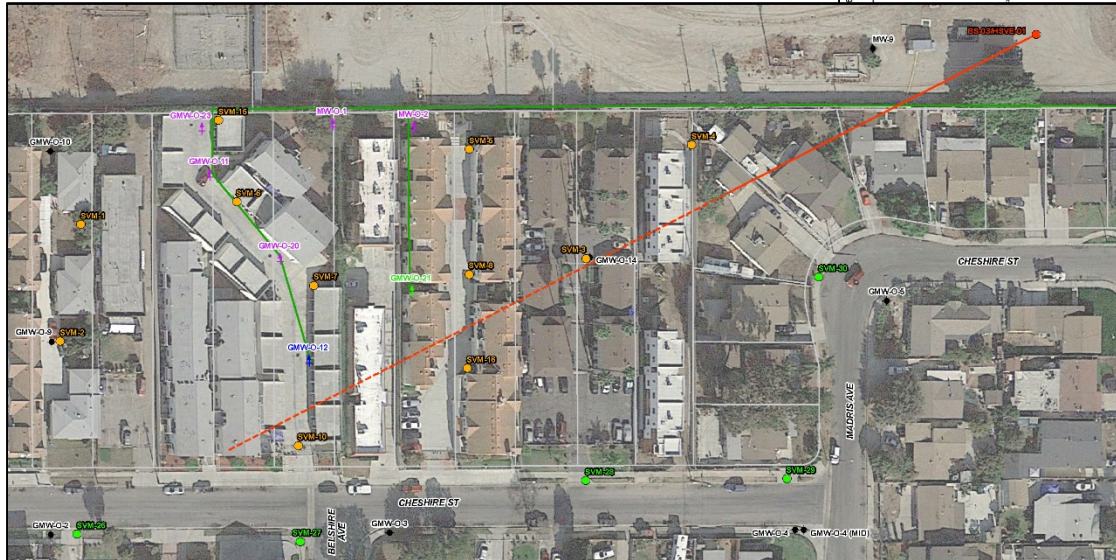
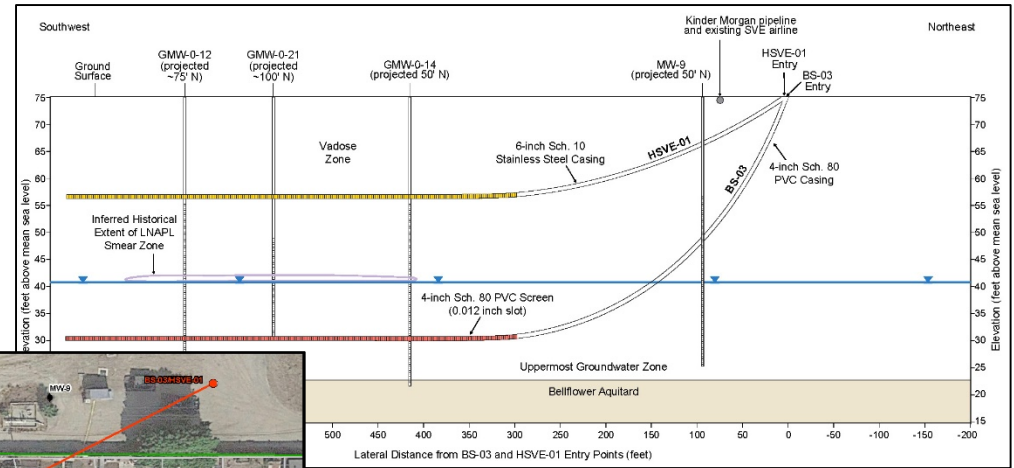


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Photo 4 – After
installing SVE pipe
(looking north towards
Holifield Park)

South-central/Offsite Horizontal Treatment Wells

- Installed vertically “stacked” biosparge and SVE wells in Q4 2019
- Biosparge well is 770 feet long, 500 ft screen, set at 45 feet bgs
- SVE well 742 feet long, 500 ft screen set at 21 feet bgs



- Screens are located within the approximate extent of the dissolved phase plume in the SC/offsite area
- SVE well primarily to manage vapors from biosparging
- Wells will be connected to treatment system in Q2 2020.
- Startup likely in second half of 2020

1

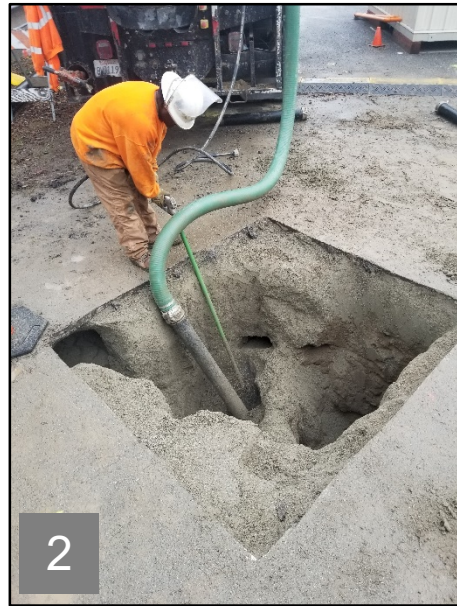


Photo 1 – Drilling the Horizontal SVE Well

Photo 2 – Using Hydrovac to Expose Fuel Pipelines

Photo 3 – Installing the Horizontal Biosparge Well Vault

2

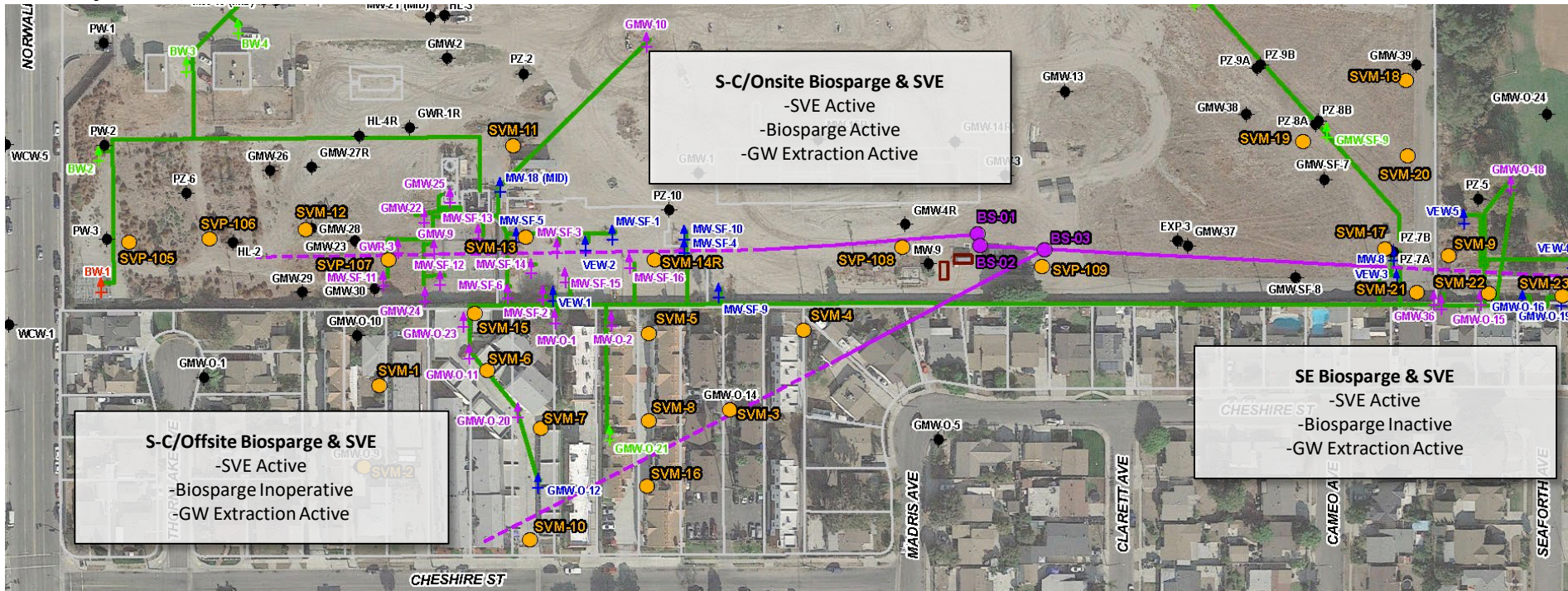


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Overview of All Remedial Activities

- SE and S-C/Offsite have similar LNAPL types and distribution as S-C/Onsite
- Biosparge treatment of both areas is anticipated to progress similarly to the onsite South-central Biosparge system



Path Forward

Road Map

Initiate NSZD Rate Evaluation

- NSZD (Natural Source Zone Depletion) = naturally occurring biodegradation processes that degrade residual LNAPL
- Water Board approved NSZD Plan in September 2019
- Temporarily suspend active remedies in South-central area and initiate NSZD evaluation using soil gas and groundwater indicators

Operate Southeastern Biosparge & SVE system

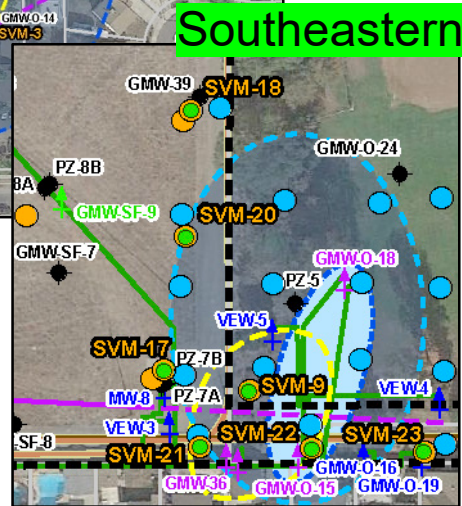
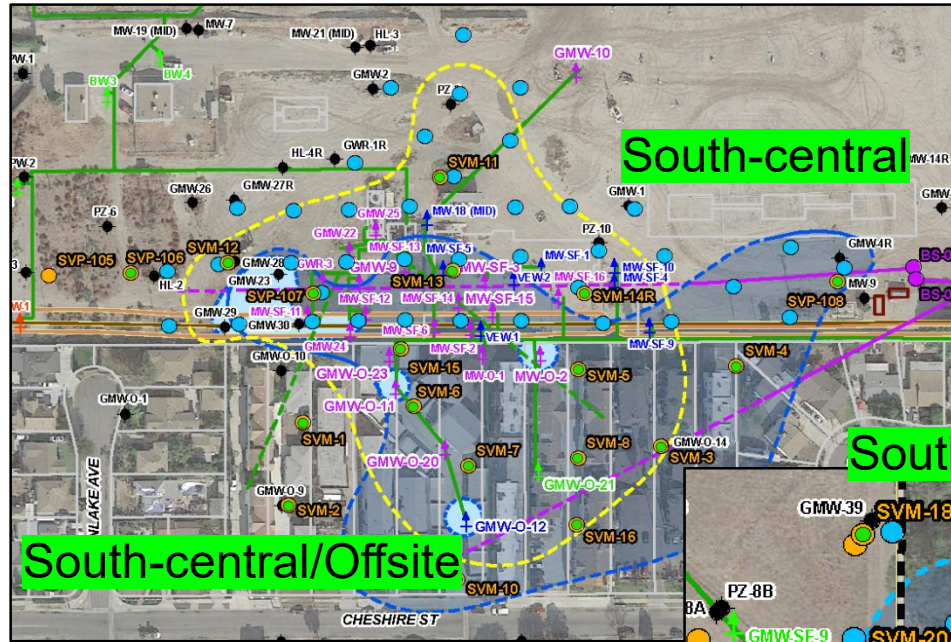
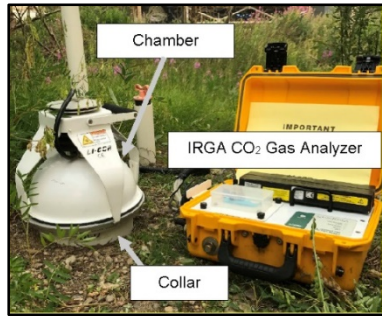
- Test recently expanded SVE capture zone
- Collect “baseline” NSZD measurements
- Turn on SVE system → Turn on biosparge system
- Expect to operate for ~2 years to reach technical endpoint (similar to South-central area)

Operate South-central/Offsite Biosparge & SVE System

- Connect new horizontal biosparge and SVE wells to existing treatment system
- Evaluate need for additional monitoring points (groundwater wells and/or soil gas probes)
- Collect “baseline” NSZD measurements
- Test horizontal SVE well capture zone
- Turn on system and run concurrently with southeastern system.

Natural Source Zone Depletion Evaluation

- Temporary suspension of active treatment in south-central area
- 12 to 18 month evaluation period
- Several complementary field sampling methods
- Contingency Measures if results unfavorable ☹️
- Remedy Transition if results are favorable 😊



LEGEND

- LI-COR Collar Location
- Vapor Monitoring Point for NSZD Evaluation
- Soil Vapor Probe/Soil Vapor Monitoring Probe

Questions?

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