

Norwalk Tank Farm Update

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Presented to the Norwalk Tank Farm
Restoration Advisory Board
February 22, 2018



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KINDER MORGAN

Agenda

- Kinder Morgan Update
 - Remediation Systems Operations Summary
 - Completed Remediation Activities
 - Planned Remediation Activities



Remediation Systems Operations Summary

Site Location and SFPP Remediation Areas



Site Location and SFPP Remediation Areas



SVE and Biosparge Operations Summary

■ SVE and Biosparge Systems

– 3rd Quarter 2017

- SVE = 92% run-time
- SVE was shut down from September 1 to 7, 2017, for the soil vapor probe sampling.
- Biosparge = 90% run-time

– 4th Quarter 2017

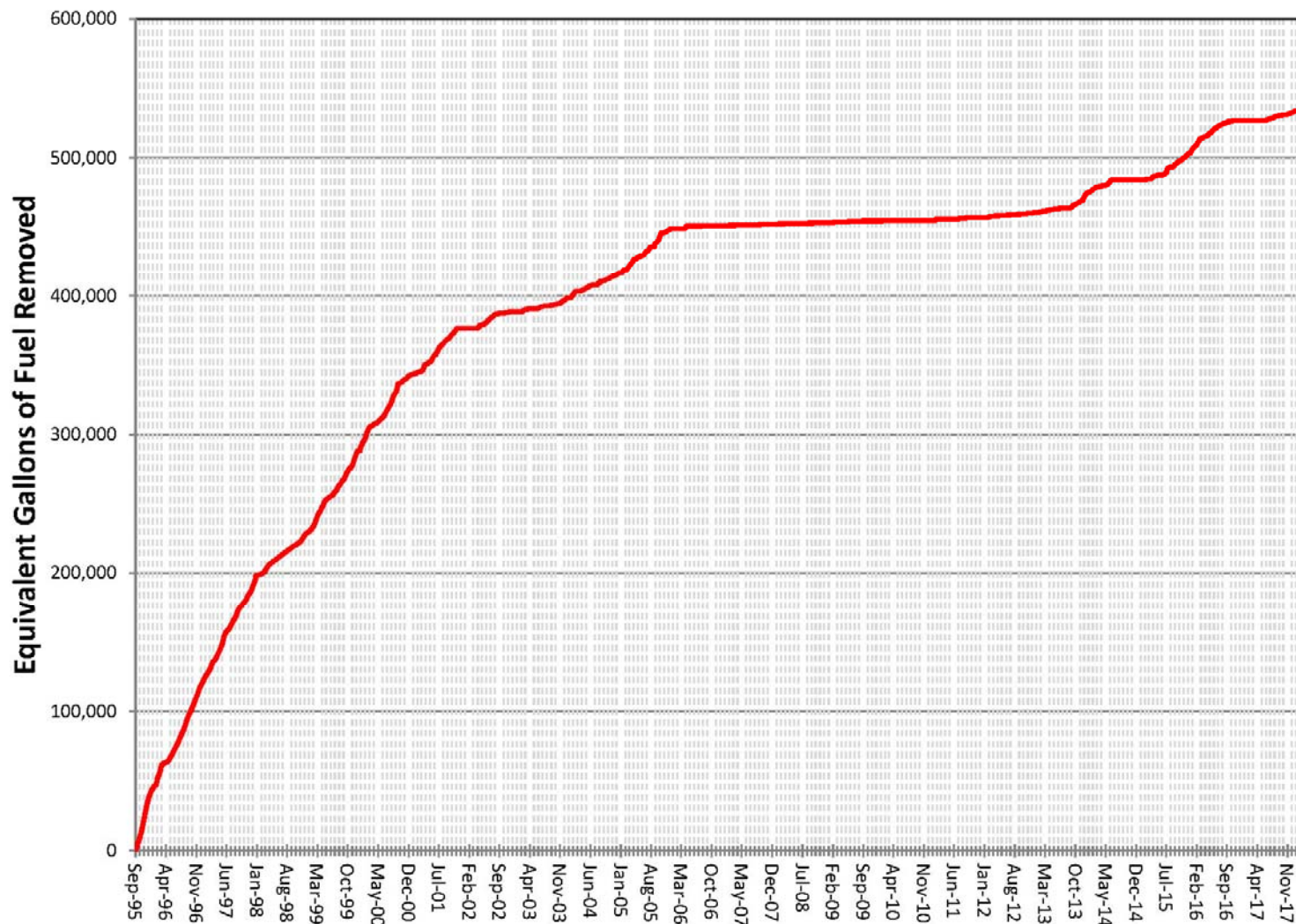
- SVE = 68% run-time
 - SVE was shut down from September 26 through October 6, 2017, to facilitate gauging and sampling activities for the second semiannual groundwater sampling event. Other shutdowns for routine maintenance.
- Biosparge = 52% run-time (68% of the time excluding planned shutdowns).
 - Biosparge system was shutdown from November 13 through November 21, 2017, for the installation of the new southeast biosparge well.

SVE Systems Operations Summary

- Equivalent Fuel Treated - SVE
 - Based on weekly monitoring of influent vapor concentration, vapor extraction flow rate, and hours of operation.
 - Conversion Factor = 6.6 lbs/gal
 - 3rd Quarter 2017 – 3,043 gallons (20,086 pounds)
 - 4th Quarter 2017 – 2,437 gallons (16,087 pounds)
 - Since 1995 – Approx. 533,442 gallons (3.52 million pounds)

SVE System Operations Summary

Cumulative Fuel Removed by Vapor Extraction To Date



TFE/GWE System Operations Summary

- TFE/GWE System
 - 3rd Quarter 2017
 - Operated 95% of time
 - 4th Quarter 2017
 - Operated 96% of time
 - Shutdown was to facilitate gauging and sampling activities for the second semiannual groundwater sampling event.

TFE/GWE System Operations Summary

■ Groundwater Extracted

- 3rd Quarter 2017
 - South-Central and Southeast Areas – 1,021,222 gallons
- 4th Quarter 2017
 - South-Central and Southeast Areas – 812,187 gallons
- Since 1995
 - South-Central and Southeast Areas– 76 million gallons
 - West Side Barrier – 26.9 million gallons
 - Total groundwater extracted since 1995 – 102.6 million gallons

TFE/GWE System Operations Summary

■ Equivalent Fuel Treated – TFE/GWE

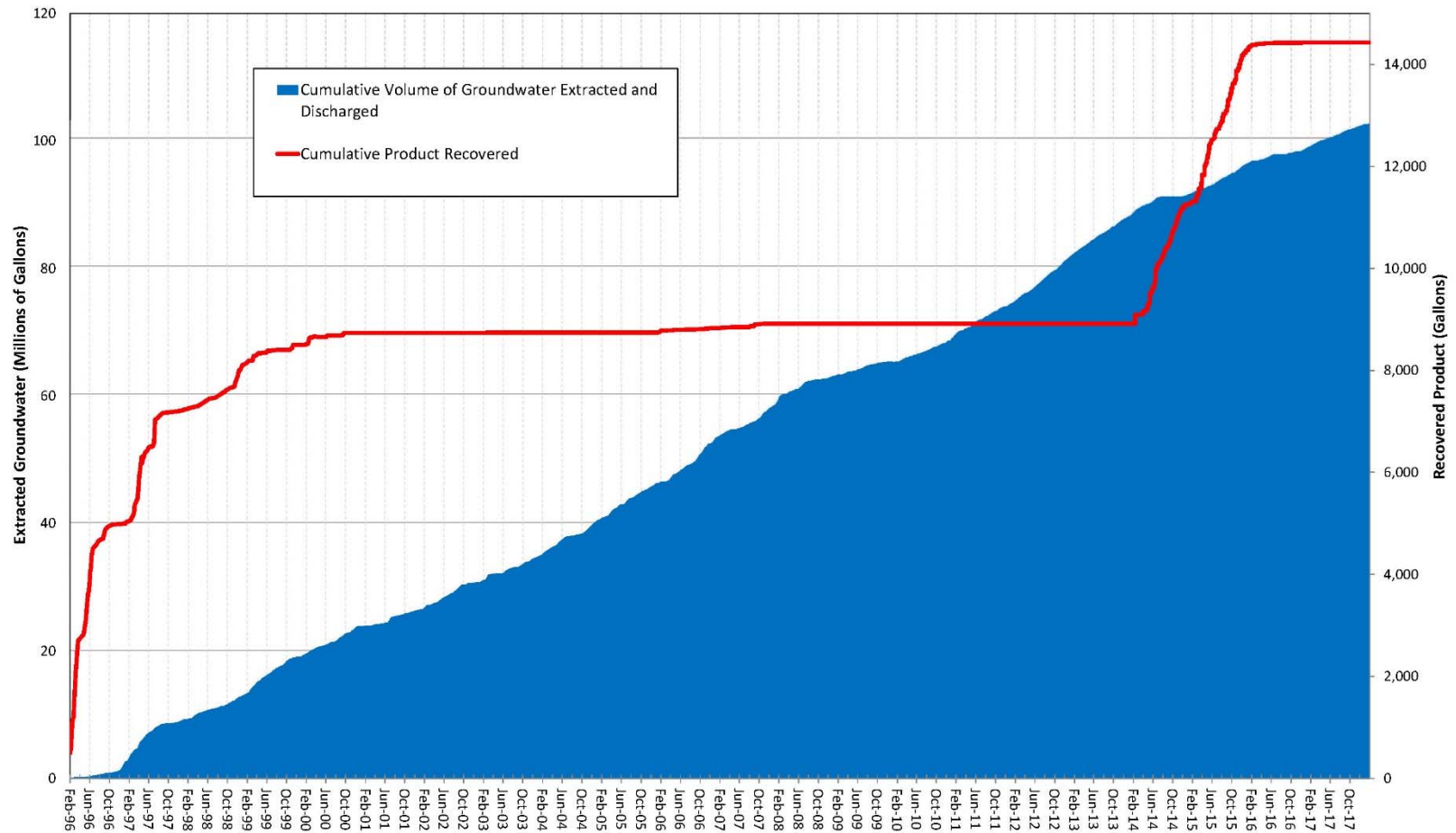
- Based on monthly monitoring of influent TPH concentration and volume of extracted groundwater.
- Conversion Factor = 6.6 lbs/gal
- 3rd Quarter 2017 – 20 gallons (131 lbs)
- 4th Quarter 2017 – 17 gallons (111 lbs)
- Decreased TPH concentration in groundwater influent (likely due to ongoing remedial activities)

TFE/GW System Operations Summary

■ Free Product Extracted

- 3rd Quarter 2017
 - No free product accumulated in the product holding tank
- 4th Quarter 2017
 - No free product accumulated in the product holding tank
- Decline in measurable product in extraction wells; therefore no product recovered.
- Since 1995 – 14,426 gallons product extracted

TFE/GWE System Operations Summary



Completed Remediation Activities

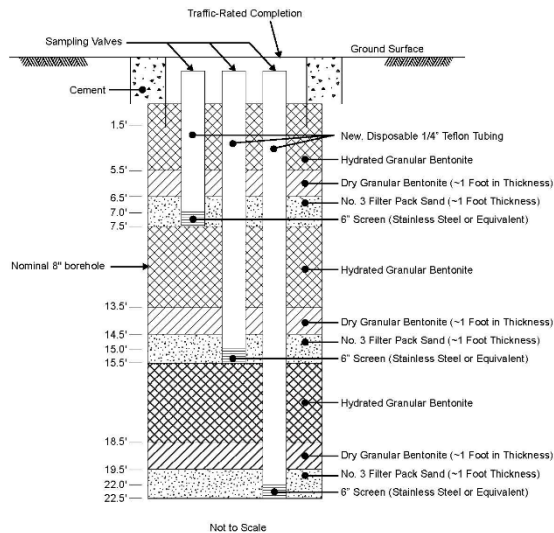
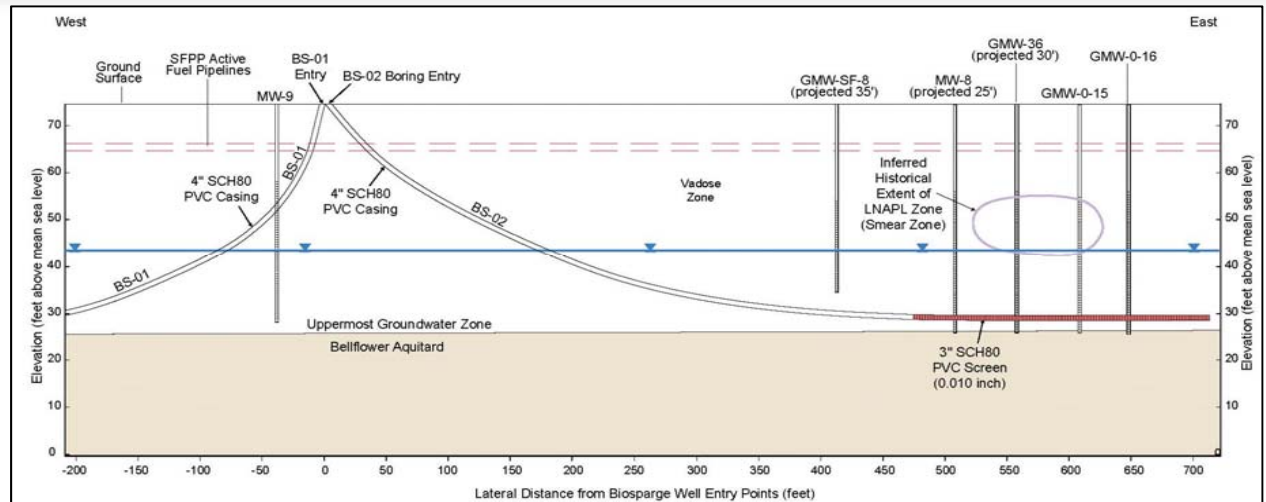
Southeastern Horizontal Biosparge Well

Well Casing and Screen

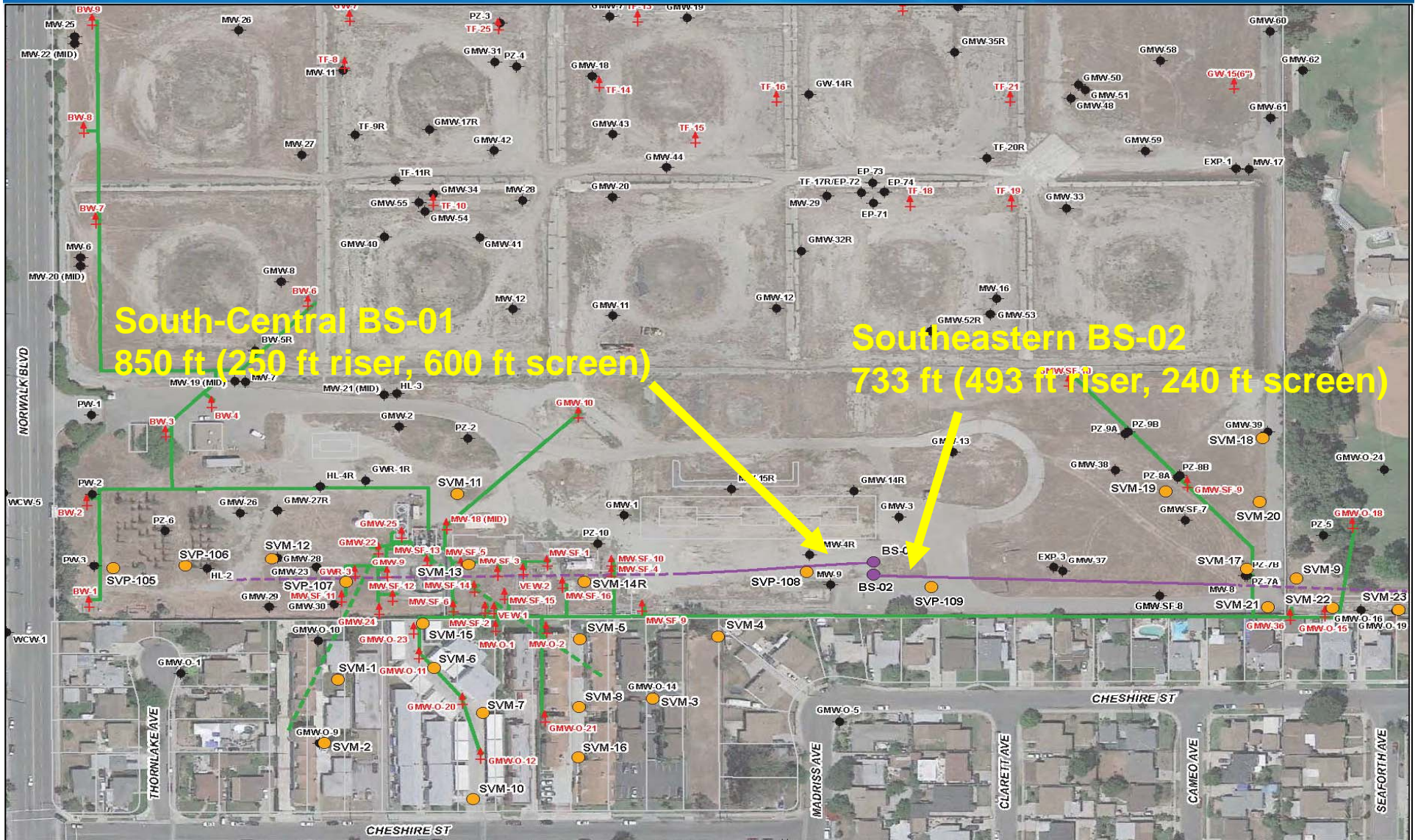
- SCH 80 PVC 4-inch diameter well
- Open slot design (no sand pack required); slot width 0.012 inches
- Screen depth of 45 feet bgs
- Total length = 733 feet
- 493 feet of riser casing; 240 feet of screen

Soil Vapor Monitoring Probe Network

- SVM-9, -17, -21, -22, -23, etc.
- Double or Triple Nested (7, 15, 22 feet bgs)



Southeastern Horizontal Biosparge Well



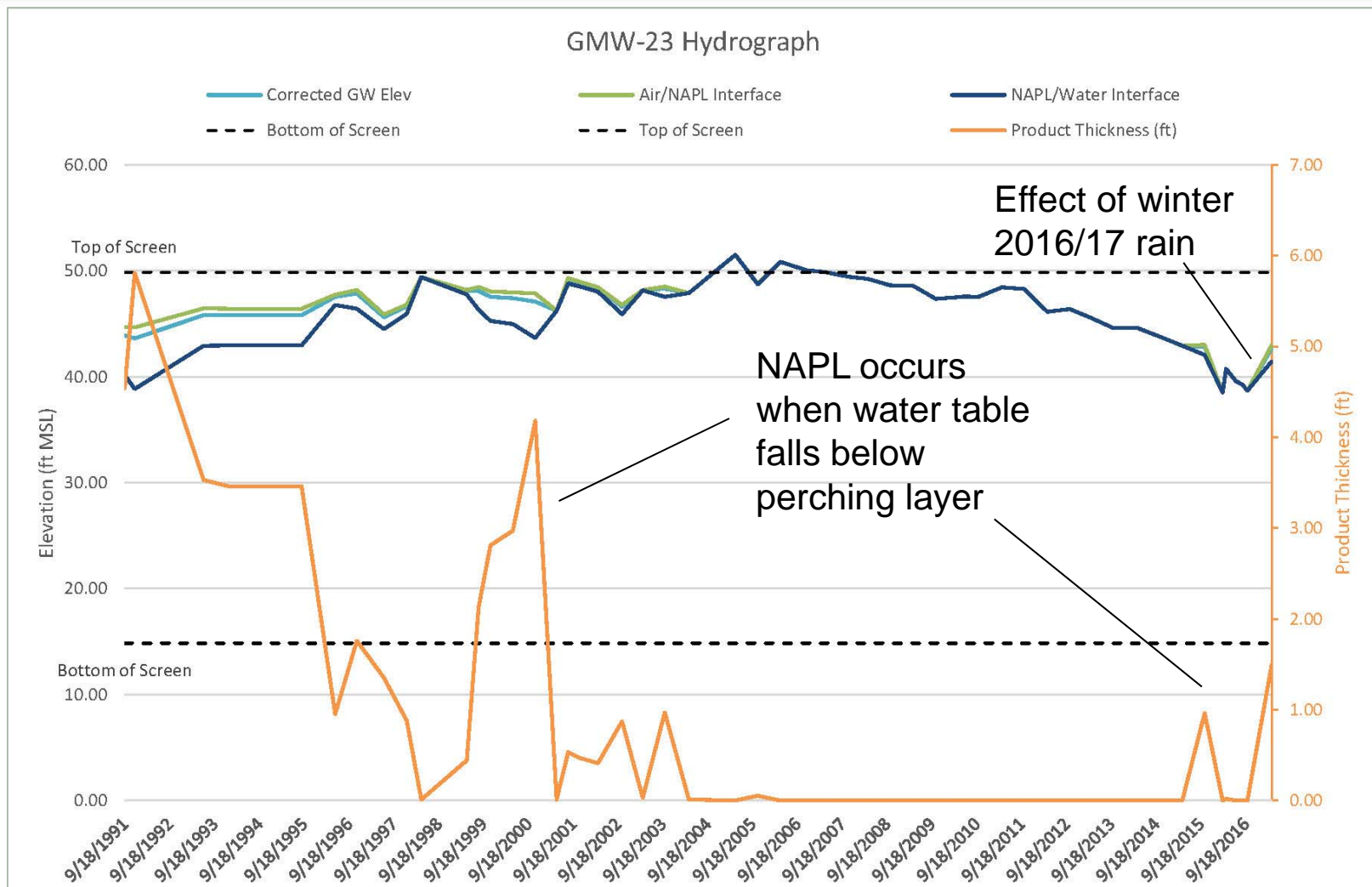
LNAPL Mobility Evaluation – Conceptual Site Model

- Previous CSM prepared for the site in 2013.
- CSM incorporated CPT-LIF borings (field), gauging data (field), pore fluid saturation tests (lab), stepped free product mobility tests (lab), in-situ free product mobility tests (field), and dissolved phase extent (field).
- Developed 3D extent of LNAPL using gauging and LIF data
- Laboratory tests indicate LNAPL had very low mobility
- Baildown tests indicated mostly low mobility at tested wells

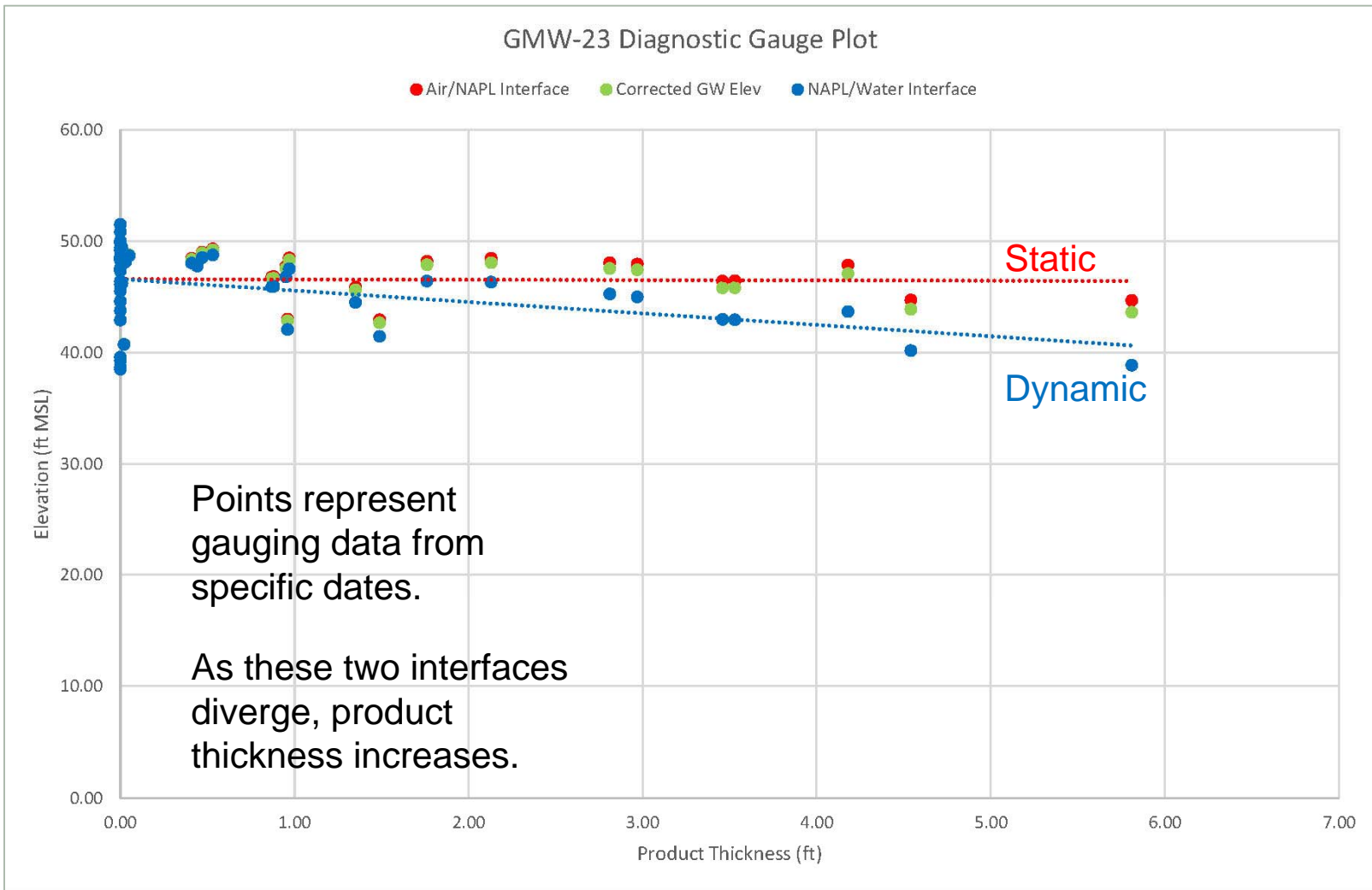
LNAPL Mobility Evaluation – Problem and Methodology

- Did historic rainfall during winter 2016/2017 affect LNAPL extent, mobility, and overall risk of plume migration?
- To answer that questions, we evaluated lots of data:
 - Hydrographs/Stratigraphy
 - Precipitation
 - Dissolved Phase Trends
 - Reviewed 18 wells that contained LNAPL in 2016/2017
- And used diagnostic gauge plots to help understand the data (a tool that can be used to determine whether LNAPL is unconfined, confined, or perched).
- Ultimately the data helps us classify LNAPL as residual, mobile, or migrating, which is key to managing the problem.

LNAPL Mobility Evaluation – Typical Hydrograph

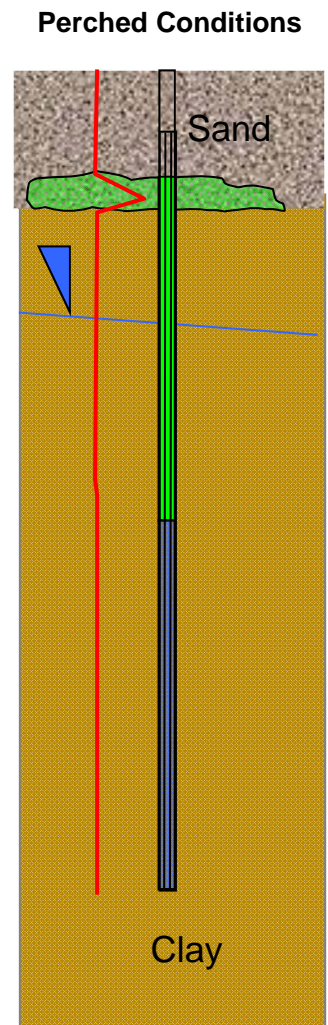


LNAPL Mobility Evaluation – Typical DGP

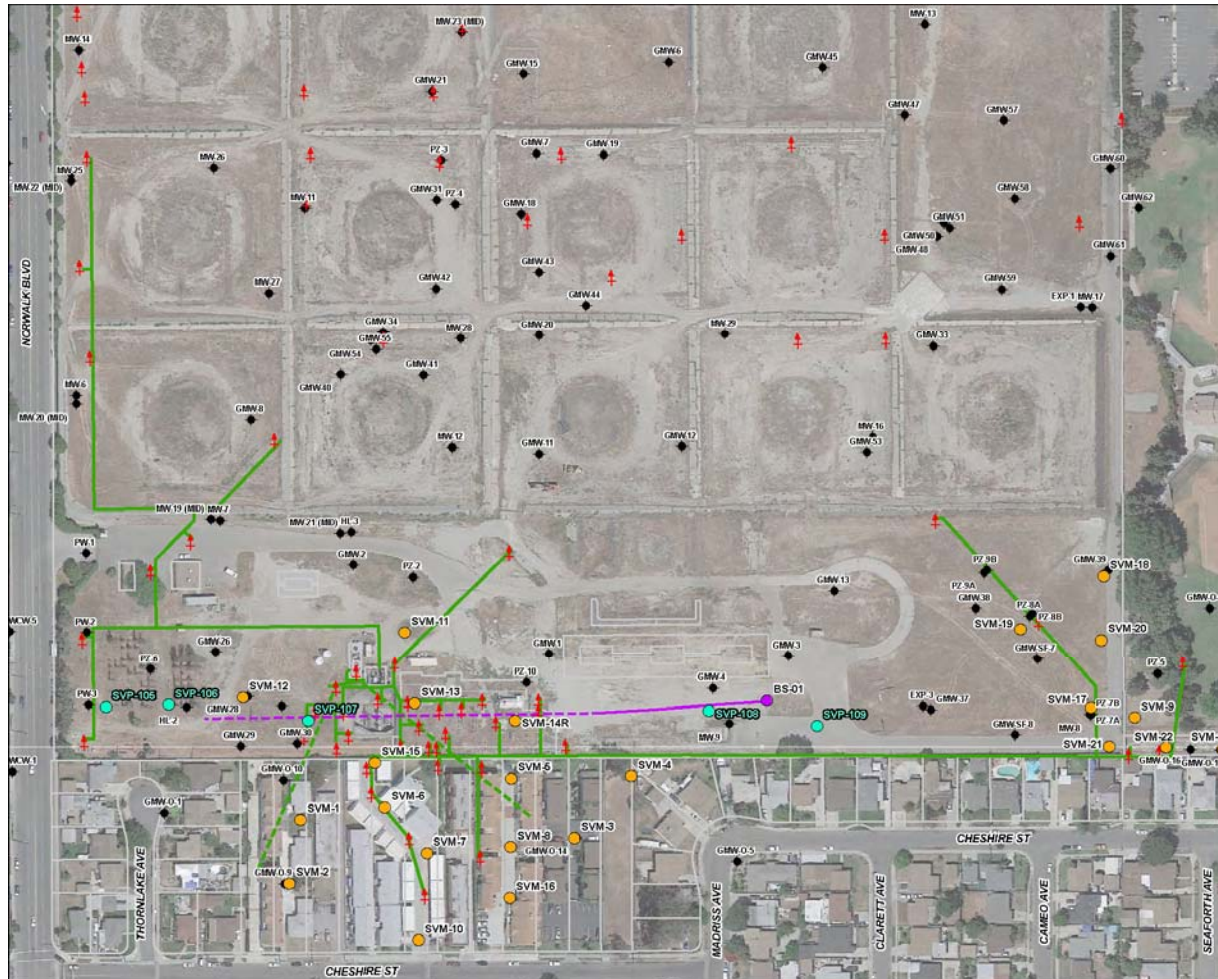


LNAPL Mobility Evaluation – Conclusions

- LNAPL thickness in wells is primarily dependent on water table elevation.
- Overall decrease in water level since it peaked in 2004/2005 (small blip in Q4 2016).
- Hydrographs and DGPs confirm that LNAPL is primarily under perched conditions.
- Perched conditions supports inverse relationship between water table and LNAPL thickness.
- Lines of evidence suggest that LNAPL is primarily stable and exists as residual saturation
- Changes in rainfall may change in-well LNAPL thickness, but mobility will not change significantly.



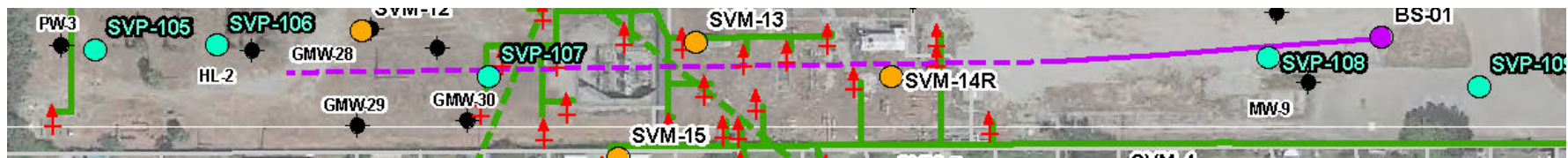
36-Acre Shallow Soil/Soil Gas Human Health Risk Assessment



- Five double nested soil vapor probes (5 and 10 feet bgs) were installed on August 3, 2017. (SVP-105 to SVP-109).
- Collected soil and soil gas samples.
- Compared results to soil cleanup goals for groundwater protection and direct contact with soil.

36-Acre Soil and Soil Gas Human Health Risk Assessment - Conclusions

- All results below soil cleanup goals for groundwater protection, except for TPH-d and naphthalene in SVP-108 at a depth of 10 ft.
- However, these concentrations in soil fall below risk-based screening levels for protection of workers from direct contact with soil and only slightly exceed groundwater protection criteria.
- The lack of significant hydrocarbon concentrations in soil vapor is consistent with the presence of an aerobic vadose zone that promotes biodegradation → this limits VI potential
- No human health risk in the upper 10 feet of soil in the southern portion of the 36-acre parcel.



Planned Remediation Activities

SVE Capture Zone Evaluation – Southeastern Area

- South-central Pilot Test
 - Data indicated avg ZOI of ~50 feet on both sides of well
 - ZOI up to 200 feet away in some areas
- Estimate Capture Zone
 - Measure vadose zone vacuum-pressure in area wells/probes
- Evaluate Risk of Offsite Migration
 - Install additional SVPs in residential area
- Potentially expand SVE system, as necessary

Install New Biosparge Compressor System



Air Compressor



Manifold



Digital Display



Compressed Air Tank

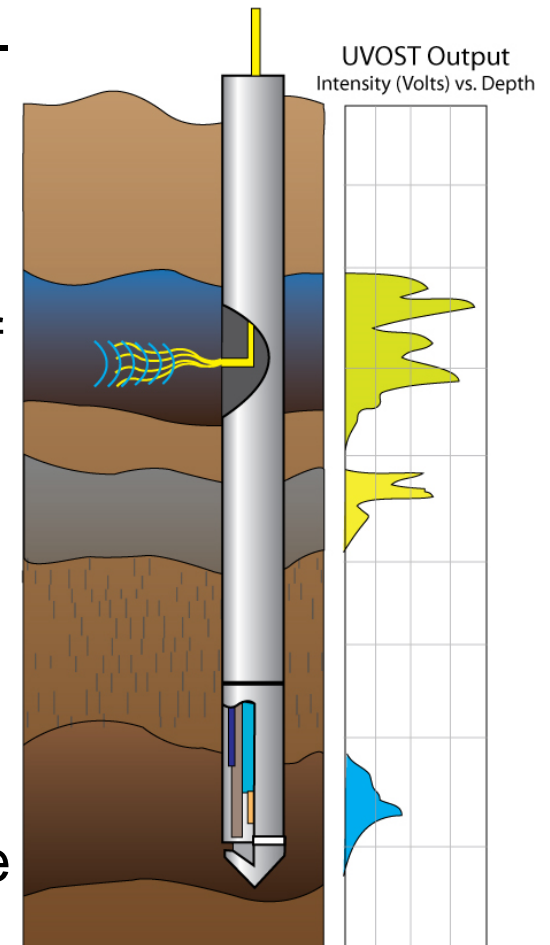
Kaiser 175 HP Rotary
Screw Air Compressor
(110 psi at 851 cfm)



Enclosure (8 x 20')

Post-Biosparging LNAPL Characterization in South-central Area

- Conduct a follow-up LNAPL study in the South-central area to evaluate changes in the subsurface since initiating biosparging activities.
- Comparative study of the vertical distribution of LNAPL prior to and following treatment.
- Study includes direct measurement of LNAPL pore fluid saturation and grain size distribution to correlate residual LNAPL saturation levels before and after treatment.
- In addition to remediation system operation/performance metrics, this will provide direct evidence of biosparging effectiveness.



Questions