

Norwalk Tank Farm Update

Presented to the Norwalk Tank Farm
Restoration Advisory Board
August 24, 2017



ch2m

KINDER MORGAN

Agenda

- Kinder Morgan Update
 - Remediation Systems Operations Summary
 - Completed Remediation Activities
 - Planned Remediation Activities
 - Summary of First-half 2017 Semiannual GW monitoring



Site Location and SFPP Remediation Areas



Site Location and SFPP Remediation Areas



Remediation Systems Operations Summary

Remediation Systems Operations Summary

■ SVE and Biosparge Systems

– 1st Quarter 2017

- Did not operate during the first quarter due to SVE installation activities

– 2nd Quarter 2017

- Operated 22% of time (97% excluding planned shutdowns)
- SVE system was restarted on June 6, 2017.
- Biosparge system was restarted on June 27, 2017.

■ TFE/GWE System

– 1st Quarter 2017

- Operated 96% of time (100% excluding planned shutdowns)

– 2nd Quarter 2017

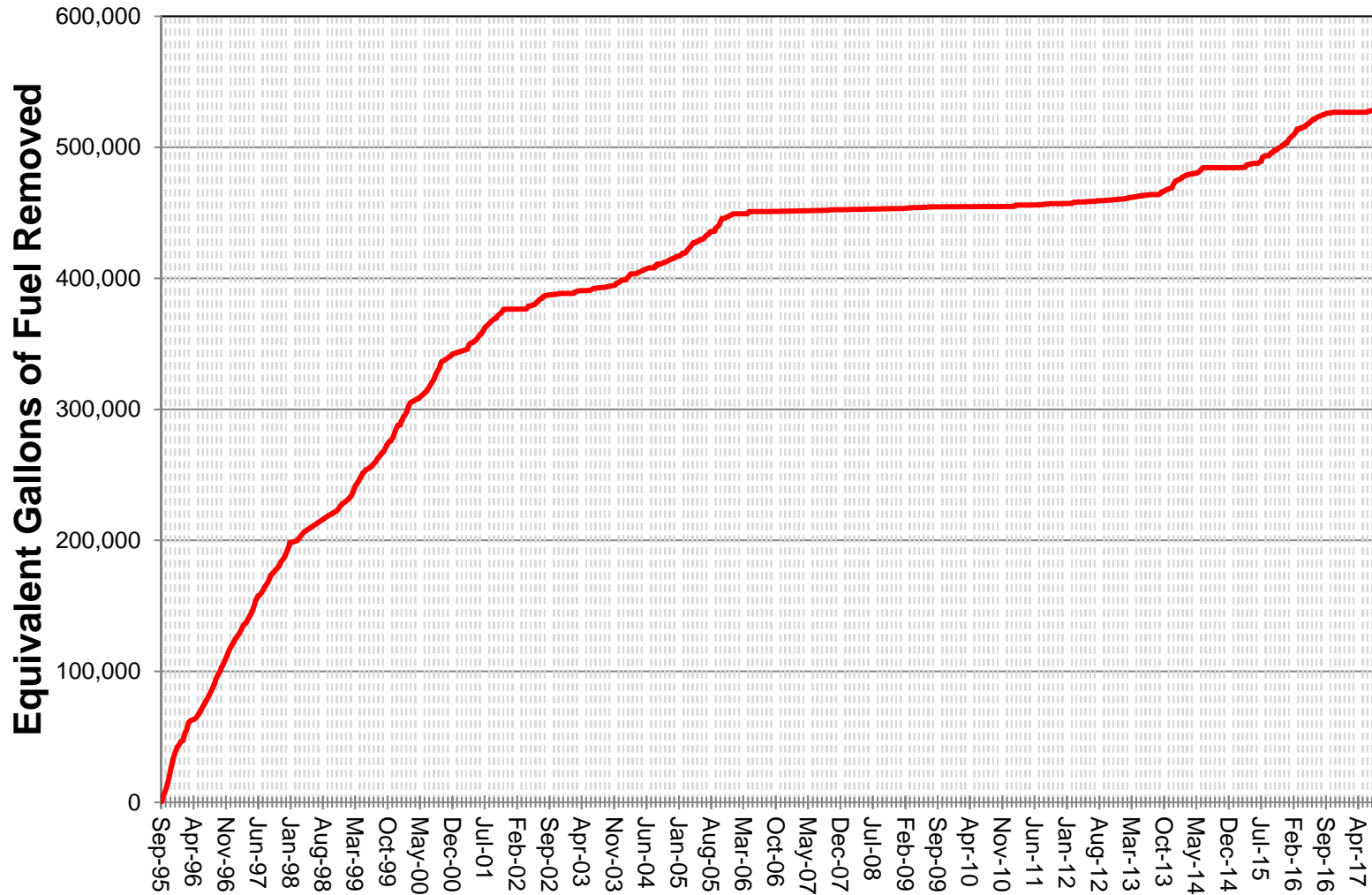
- Operated 89% of time (100% excluding planned shutdowns)
- Shutdown was to facilitate gauging and sampling activities for the first semiannual groundwater sampling event.

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
 - 1st Quarter 2017 – 0 gallons (0 pounds)
 - No mass removal due to downtime from RTO installation
 - 2nd Quarter 2017 – 912 gallons (6,022 pounds)
 - Low mass removal due to downtime from RTO installation
 - Since 1995 – Approx. 526,800 gallons (3.47 million pounds)

SVE System Operations Summary

Cumulative Fuel Removed by Vapor Extraction To Date



TFE/GWE System Operations Summary

- Groundwater Extracted
 - 1st Quarter 2017
 - South-Central and Southeast Areas – 1,224,622 gallons
 - 2nd Quarter 2017
 - South-Central and Southeast Areas – 800,613 gallons
 - Since 1995
 - South-Central and Southeast Areas– 100.7 million gallons
 - West Side Barrier – 26.9 million gallons

TFE/GWE System Operations Summary

■ Equivalent Fuel Treated – TFE/GWE

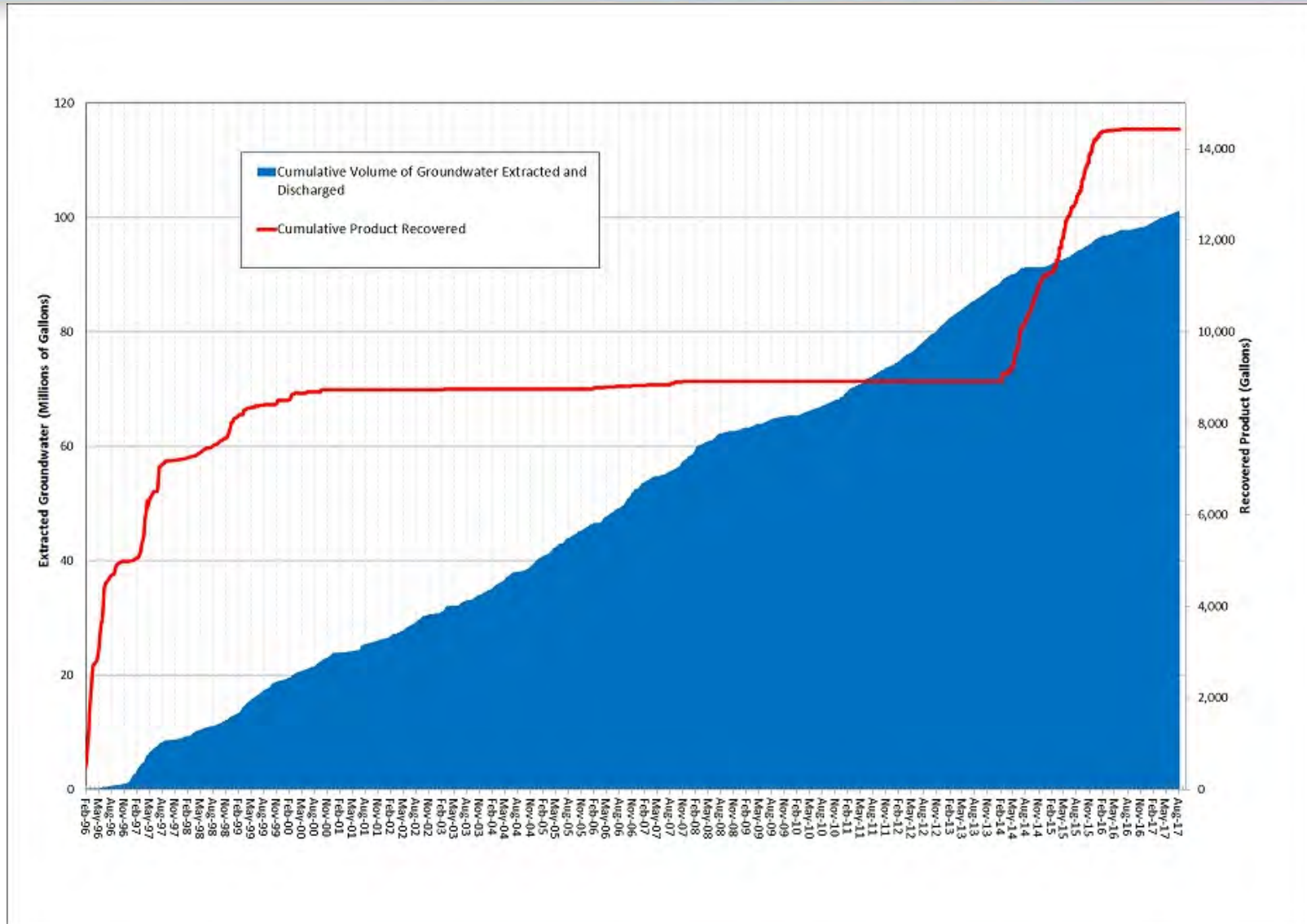
- Based on monthly monitoring of influent TPH concentration and volume of extracted groundwater.
- Conversion Factor = 6.6 lbs/gal
- 1st Quarter 2017 – 1.5 gallons (9.6 lbs)
- 2nd Quarter 2017 – 11 gallons (73 lbs)
- Lower mass removal due to downtime from OWS system install and SVE demolition, and decreased TPH concentration in groundwater influent (due to biosparge activities)

TFE System Operations Summary

■ Free Product Extracted

- 1st Quarter 2017
 - 2-gallons of free product accumulated in the product holding tank
- 2nd Quarter 2017
 - No free product accumulated in the product holding tank
- Less product recovered due to decline in measurable product in extraction wells as a result of biosparge activities
- Since 1995 – 14,426 gallons product extracted

TFE/GWE System Operations Summary



Completed Remediation Activities

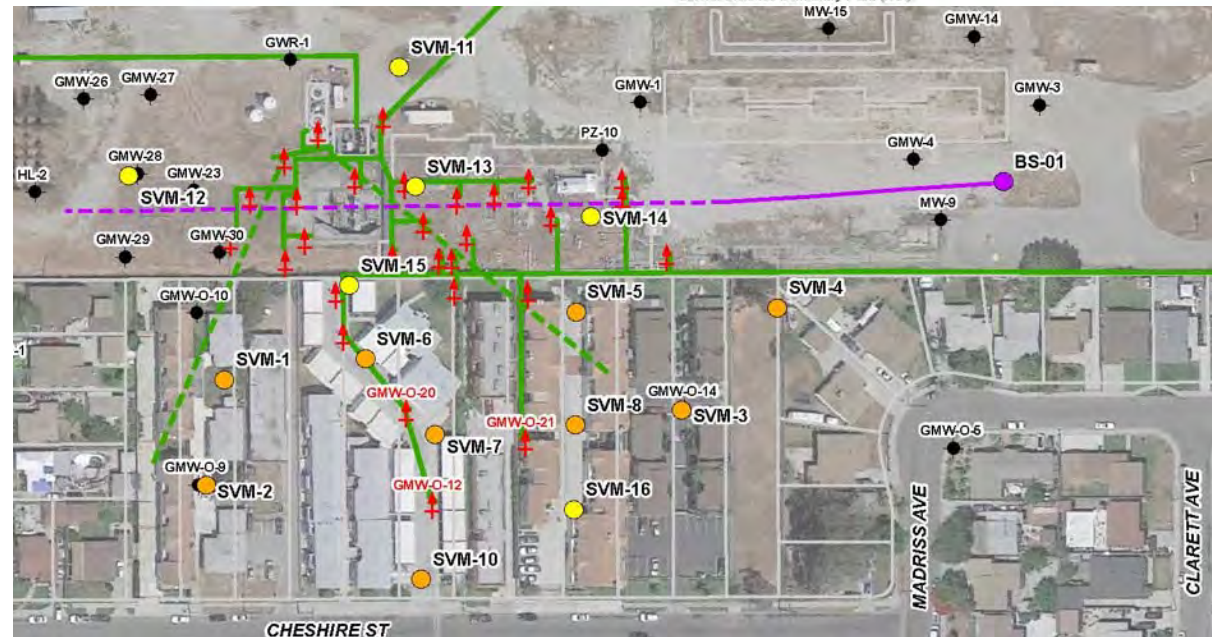
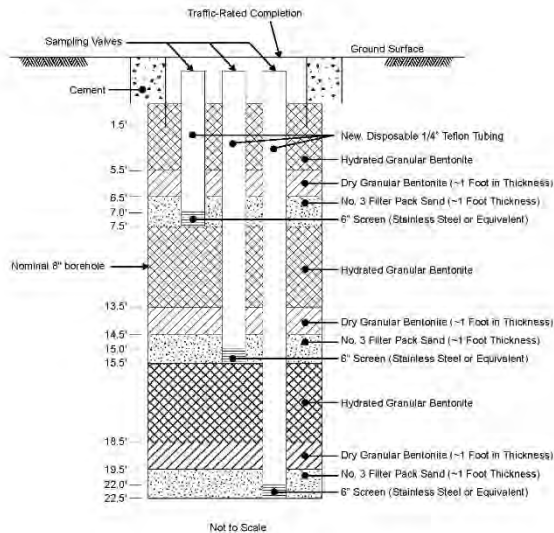
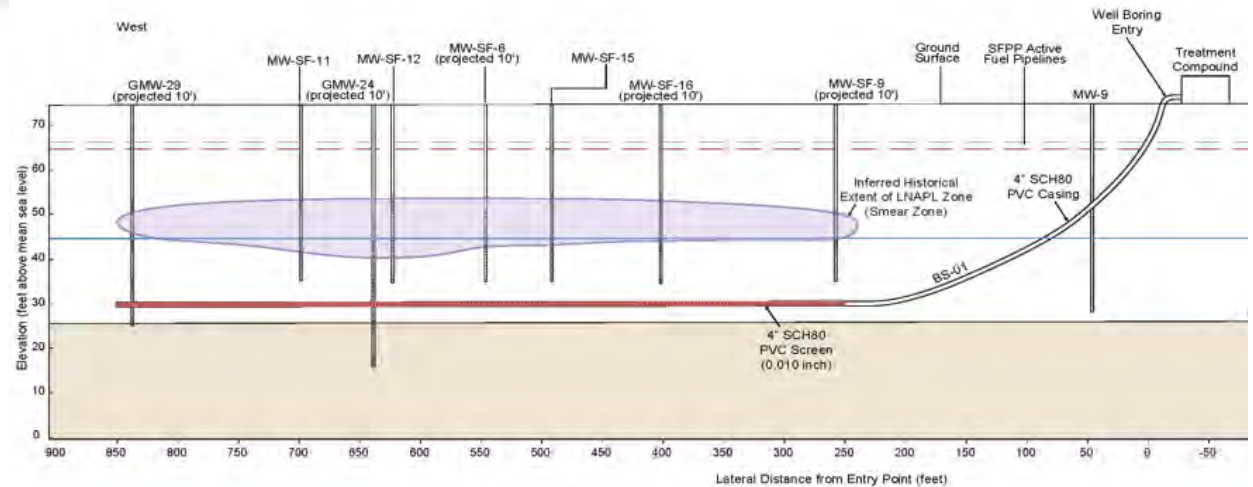
Horizontal Biosparge Well and SVP Array

Well Casing and Screen

- SCH 80 PVC 4-inch diameter well
- Open slot design (no sand pack required); slot width 0.010 inches
- Screen depth of 45 feet bgs
- 250 feet of riser casing; 600 feet of screen

Soil Vapor Monitoring Probe Network

- SVM-1 through SVM-16
- Double or Triple Nested (7, 15, 22 feet bgs)



Biosparge Pilot Study Conclusions

- Tracer Testing
 - Data supports zone of influence of ~50 feet on both sides of well
 - Tracer gas reported in well PZ-2, located 200 feet away!
- Soil Vapor Monitoring
 - Highest VOCs during first few months of operation
 - Vapor Intrusion (VI) risk in shallow media highest in onsite area closest to the biosparge well screen
 - Offsite VI risk is minimal assuming continued operation of the SVE system
- Groundwater Monitoring
 - Average reduction in product thickness of 1 to 2 feet
 - 100 percent reduction in 16 of 21 wells monitored
 - Significant reduction in dissolved-phase hydrocarbons for wells primarily located within ~50 to 100 feet

Biosparge Pilot Study Conclusions

■ Recommendations

- Continued operation of the south-central system.
- Expansion of the biosparge system to the SE area of the site, which will include a second horizontal well scheduled to be installed in the third or fourth quarter of 2017.

■ Biosparge Restart

- Biosparge was restarted on June 27, 2017
- Air Flow increased in a step wise manner going from 200 SCFM and increasing weekly until air flow is up to 500 SCFM.
- Maximum VOC concentration during start up is >2000 ppmV (as hexane) in SVM-11 (15 feet and 21 feet bgs).
- Maximum VOC concentration a month after start up is 957ppmV (as hexane) in SVM-12 (22 feet bgs).
- VOC concentration (as hexane) into SVE system increased slightly from 220 ppmV to 580 ppmV at start up.

New Regenerative Thermal Oxidizer Unit

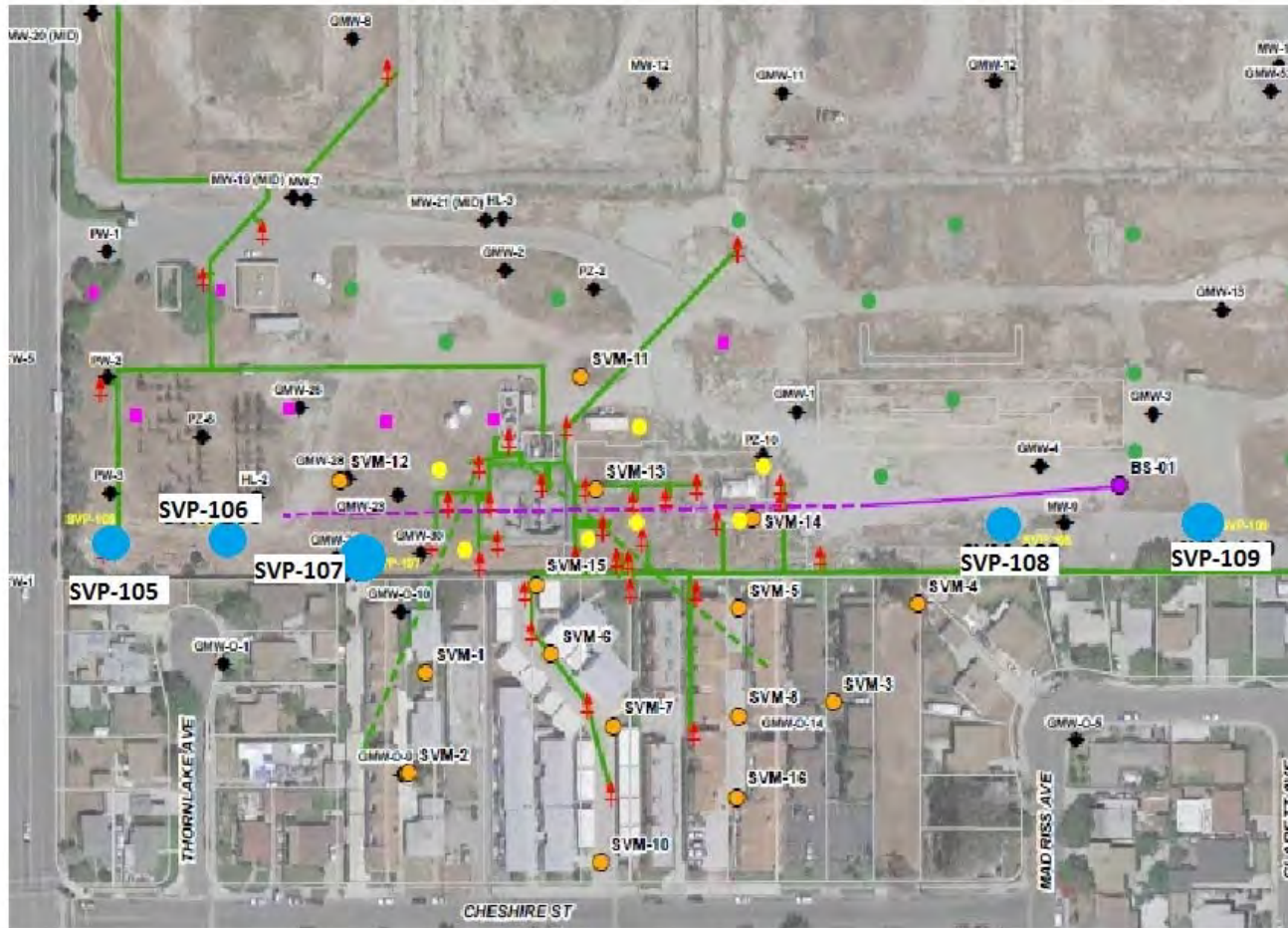


RTO Efficiency

■ RTO

- RTO was restarted on June 6, 2017
- New RTO showed a 99% destruction efficiency.
 - Total VOC Concentration (as hexane) decreased from 220 ppmV to 1.8 ppmV in June.
 - Total VOC Concentration (as hexane) decreased from 580 ppmV to 2.6 ppmV in July.
- RTO Operation Parameters
 - Average Airflow in June and July 2017 – 1,262 SCFM
 - Average Temperature in June and July 2017 – 1,618°F
 - Maximum Airflow – 2,204 SCFM, below permitted flow 3,000 SCFM
 - Minimum Temperature – 1,538°F, above permitted temperature of 1,500°F

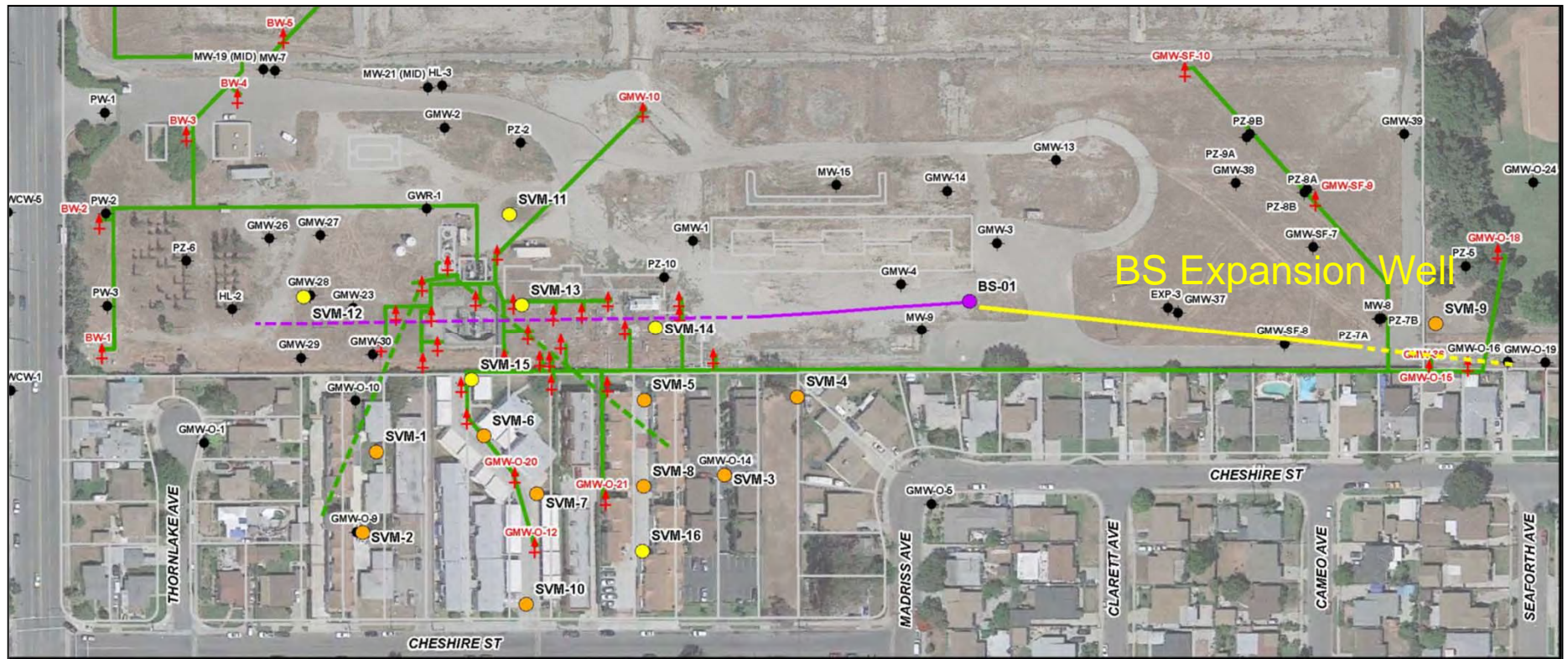
36-Acre Investigation SVP Installation



- Five double nested soil vapor probes (5 and 10 feet bgs) were installed on August 3, 2017. (SVP-105 to SVP-109).
- Soil samples were collected on August 3, 2017.
- Soil vapor samples collected on August 17 and 18, 2017 while SVE and biosparge on.
- Soil vapor samples with the SVE and biosparge off is scheduled for October 2017.

Planned Remediation Activities

Biosparge Expansion Well



Biosparge Expansion Well in Southeastern Area (Q3 or Q4 2017)

- SCH 80 PVC 4-inch diameter well
- Screen depth of 45 feet bgs; open slot design (no sand pack required)
- 500 feet of riser casing; 250 feet of screen
- New, larger air compressor (Kaeser 175HP) will be installed in 2018 to run the SE biosparge well and possible additional offsite biosparge well.

LNAPL Mobility Evaluation – Conceptual Site Model

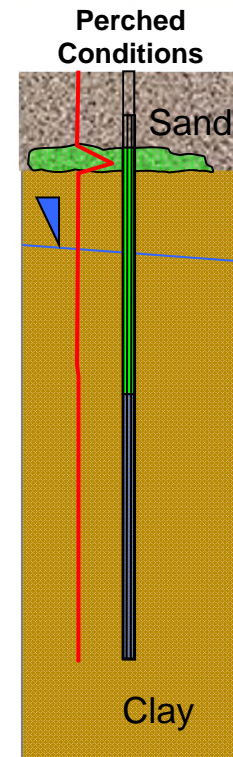
- Previous CSM prepared for the site in 2013.
- CSM incorporated CPT-LIF borings, gauging data, pore fluid saturation tests, stepped free product mobility (laboratory) tests, in-situ free product mobility (field) tests, and dissolved phase extent.
- Three dimensional extent of LNAPL using gauging and LIF data identified
- Laboratory tests indicate LNAPL had very low mobility
- Baildown tests show mostly low mobility with higher mobility at one location

LNAPL Mobility Evaluation – Conceptual Site Model

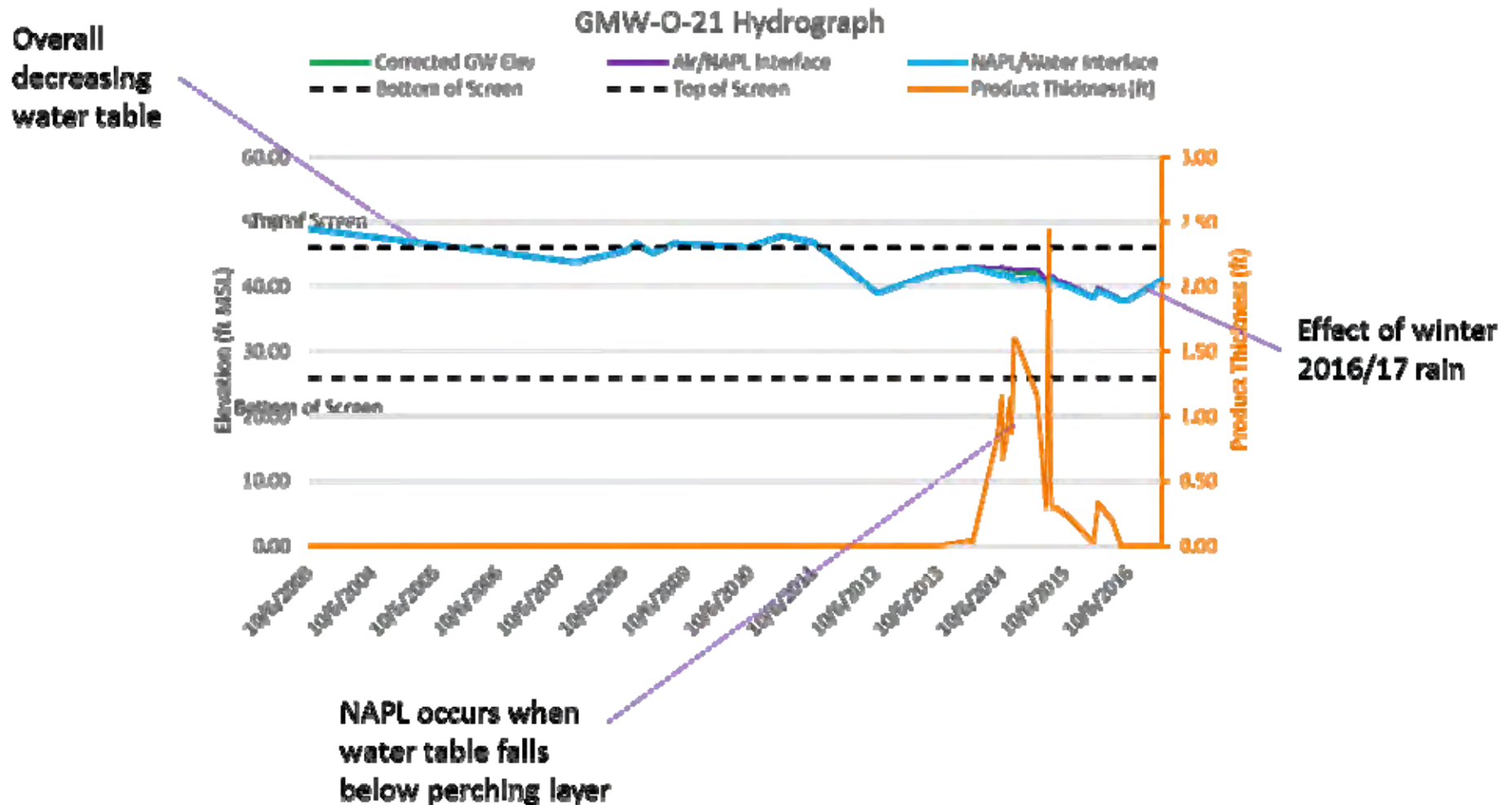
- What, if any, effect did historic rainfall in southern California during winter 2016/2017 have on LNAPL extent, mobility, and overall risk?
- CH2M is currently evaluating the CSM to answer this question, focusing primarily on:
 - Hydrographs/Stratigraphy
 - Precipitation Data
 - Dissolved Phase Trends
 - Statistical Tools (e.g., diagnostic gauge plots, which are tool that can be used to determine whether LNAPL is unconfined, confined, or perched)

LNAPL Mobility Evaluation – Preliminary Findings

- Water levels in wells as a response to heavy winter rain only went up a marginal amount, and not enough to reverse the overall decreasing trend of the past 8-12 years (in fact barely enough to stop the overall decline).
- Initial analysis suggests potentially up to half of wells analyzed exhibit some degree of perching conditions, which results in exaggerated in-well NAPL thickness measurements.



LNAPL Mobility Evaluation – Preliminary Findings (Typical Hydrograph)



LNAPL Mobility Evaluation – Preliminary Findings

- Large fluctuations in LNAPL thickness may be observed as water table fluctuates near perching interface in some wells
- Therefore, the distribution of LNAPL **in the well** may change as a result of rising/lowering water table, but the mobility **in the formation** is unlikely to be affected, absent any new releases.
- Tech memo summarizing the CSM update to be published in September.

Summary of First-half 2017 Semiannual Groundwater Monitoring

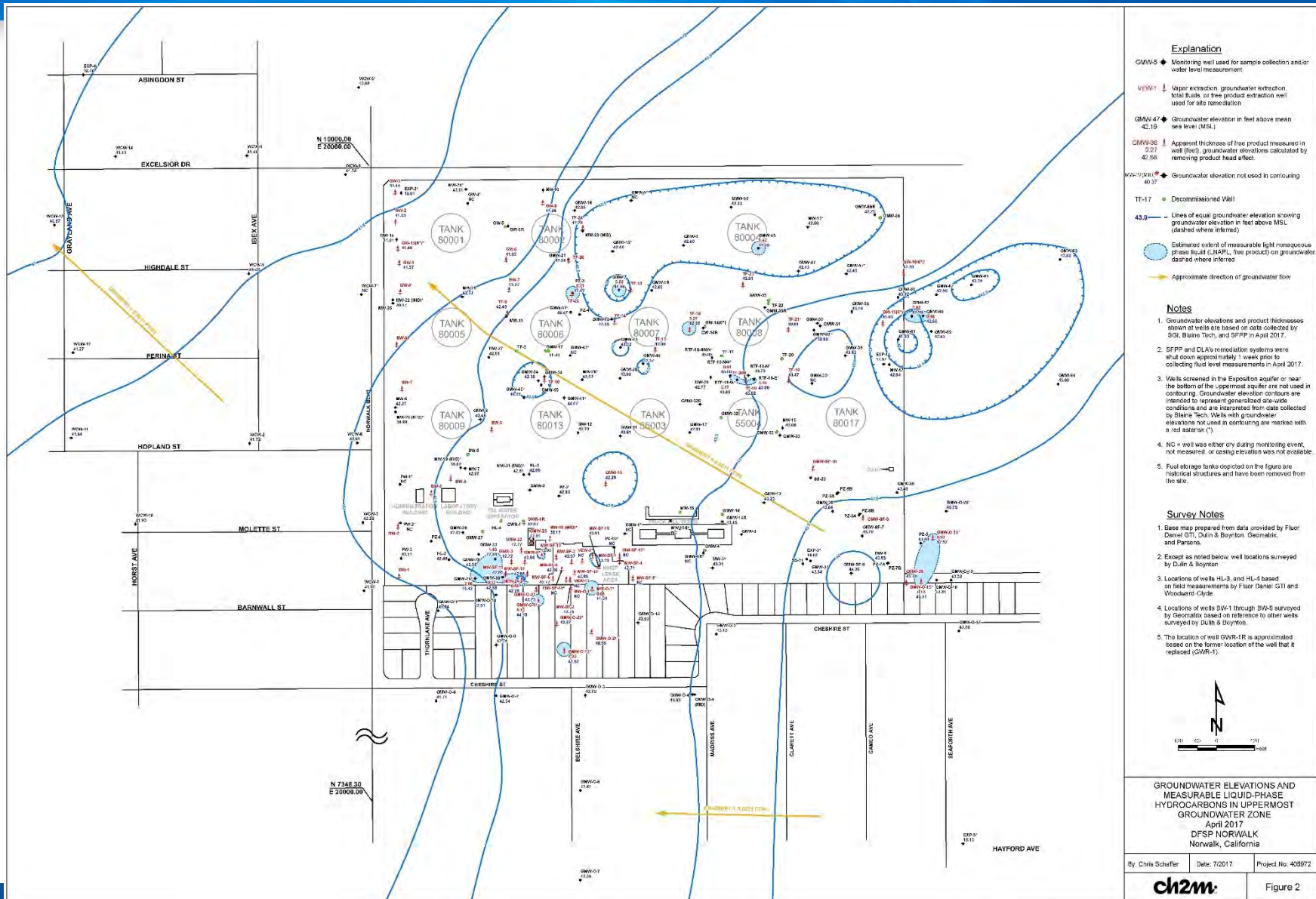
First Semiannual 2017 Groundwater Monitoring Report

- Site-wide monitoring in April 2017 – both KMEP and DLA
- Well Gauging (Blaine Tech and SGI)
 - 167 wells gauged
- Well Sampling (Blaine Tech and SGI)
 - Low-flow sampling methods (submersible pumps)
 - 116 wells sampled (split samples collected in EXP-1, EXP-2, and EXP-3)
 - SFPP and DLA remediation systems remained offline during gauging activities

First Semiannual 2017 Groundwater Monitoring Report

- **Uppermost Aquifer Groundwater Elevations and Flow**
 - Groundwater elevations increased over most of the site, but decreased in the western portion of the site and offsite to the west compared to April 2016
 - Unlike past events, there was a lack of converging flow toward the site
 - Horizontal hydraulic gradient of 0.0011 to 0.0021 ft/ft with overall flow direction to the northwest
- **Exposition Aquifer Groundwater Elevations and Flow**
 - Groundwater elevations were generally lower than those reported for April 2016
 - Horizontal hydraulic gradient was approximately 0.0003 ft/ft to the east-northeast, similar to the historical flow direction

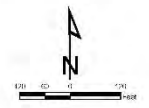
Groundwater Elevations - Water Table



- Explanation**
- GW-5 ◆ Monitoring well used for sample collection and/or water level measurement
 - VIEW1 ↓ Vapor extraction, groundwater extraction from fluids on free product extraction well used for site remediation
 - GW-47 ◆ Groundwater elevation in feet above mean sea level (MSL)
 - GW-36 ◆ Apparent thickness of free product measured in well (ft); groundwater elevations calculated by removing product head effect
 - GW-17/20/31 ◆ Groundwater elevation not used in contouring
 - TT-17 ◆ Decommissioned Well
 - 43.5 — Lines of equal groundwater elevation showing groundwater elevation in feet above MSL (dashed where inferred)
 - Estimate of extent of measurable light nonaqueous phase liquid (LNAPL, free product) on groundwater, dashed where inferred
 - Approximate direction of groundwater flow

- Notes**
1. Groundwater elevations and product thicknesses shown at wells are based on data collected by SGI, Blaine Tech, and GFFP in April 2017.
 2. SFFP and DLAs remediation systems were shut down approximately 1 week prior to collecting fluid level measurements in April 2017.
 3. Wells screened in the Exposure aquifer or near the bottom of the uppermost aquifer are not used in contouring. Groundwater elevation contours are intended to represent generalized site-wide conditions and are interpreted from data collected by Blaine Tech. Wells with groundwater elevations not used in contouring are marked with a red asterisk (*).
 4. NC = well was either dry during monitoring event, not measured, or casing elevation was not available.
 5. Fuel storage tanks depicted on the figure are historical structures and have been removed from the site.

- Survey Notes**
1. Base map prepared from data provided by Fluor Daniel G11, Dulin & Boynton, Geomatics, and Parsons.
 2. Except as noted below, well locations surveyed by Dulin & Boynton.
 3. Locations of wells HL-3 and HL-4 based on field measurements by Fluor Daniel G11 and Woodward-Clyde.
 4. Locations of wells BW-1 through BW-5 surveyed by Geomatics based on references to other wells surveyed by Dulin & Boynton.
 5. The location of well GWR-1R is approximated based on the former location of the well that it replaced (GWR-5).



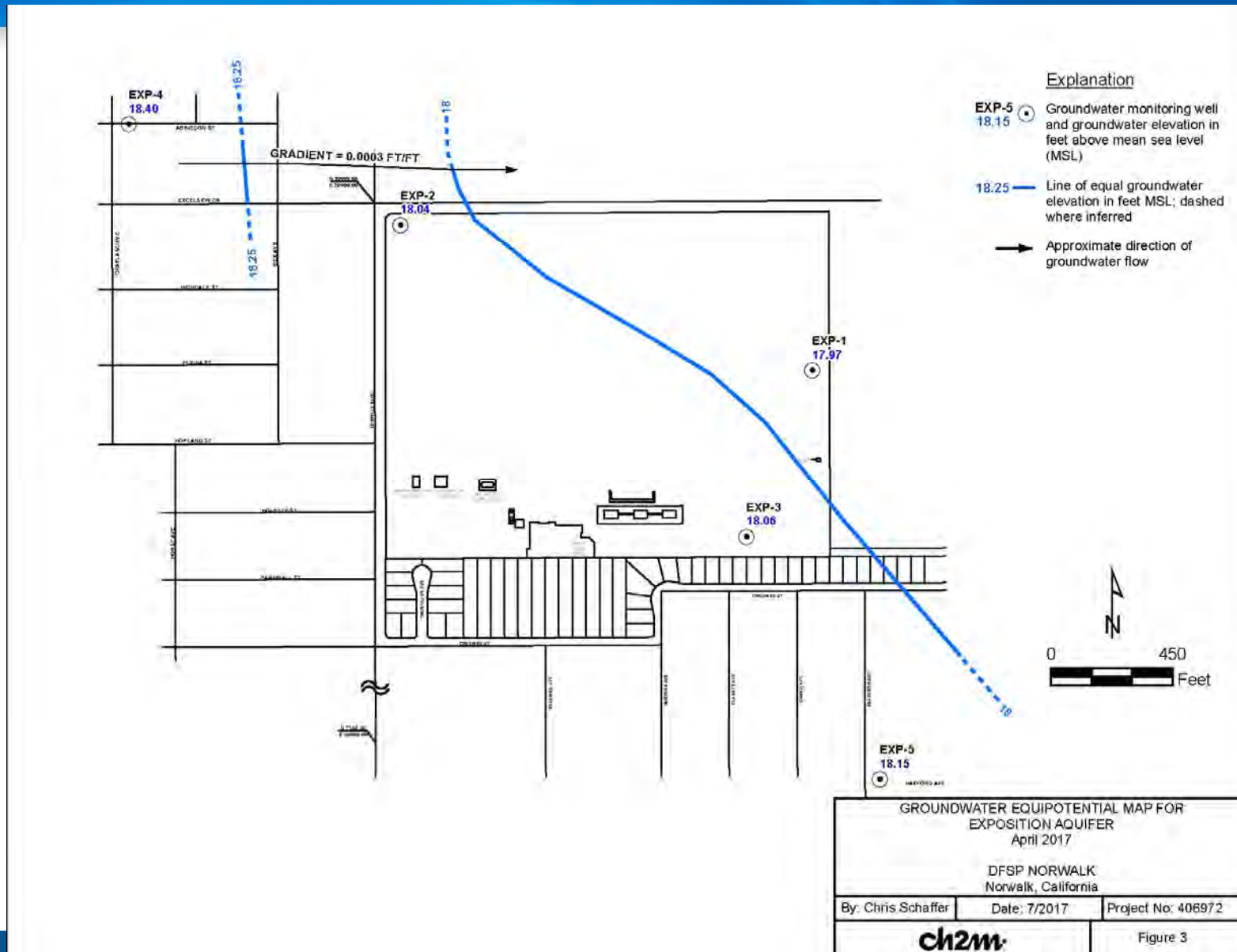
GROUNDWATER ELEVATIONS AND MEASURABLE LIQUID-PHASE HYDROCARBONS IN UPPERMOST GROUNDWATER ZONE

April 2017
 DFSF NORWALK
 Norwalk, California

By: Chris Schaffer Date: 7/2017 Project No. 408872

ch2m Figure 2

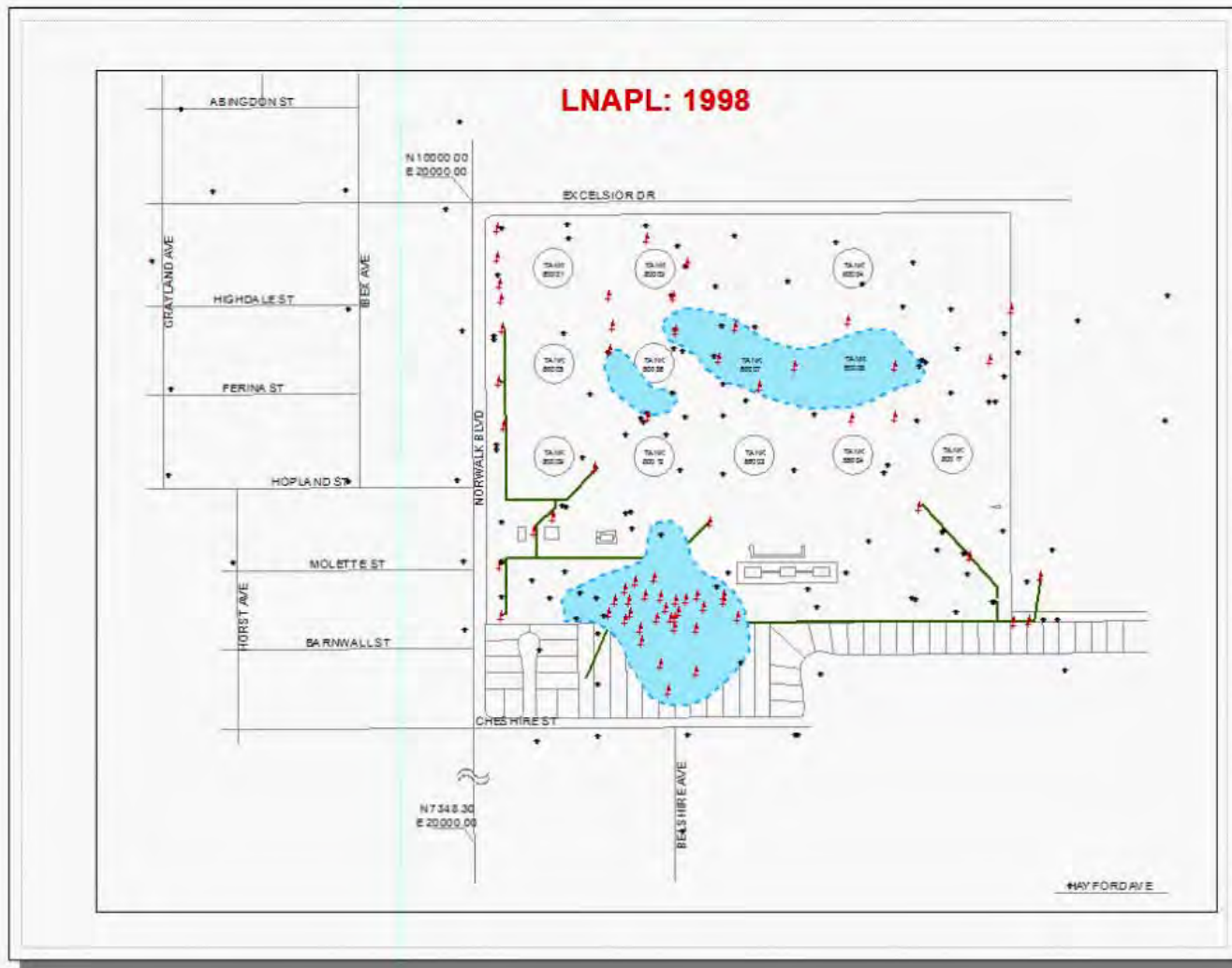
Groundwater Elevations - Exposition



First Semiannual 2017 Groundwater Monitoring Report

- Free product measured in 18 of the 167 wells that were gauged.
 - North-central area: GMW-7, GMW-45, PZ-3, TF-16, RTF-18-E, RTF-18-W, and RTF-18-NW
 - Eastern area: GMW-62 and GMW-68
 - South-central area: GMW-23, GMW-24, GMW-29, GMW-30, GMW-O-11, GMW-O-12, and MW-O-2
 - Southeastern area: GMW-O-15 and GMW-O-18
 - Thicknesses ranged from 0.01 foot in PZ-3 to 4.2 feet in GMW-O-12
- Decrease in product thickness and areal extent is likely a result of increased precipitation during the winter and biosparging in the south-central area.

LNAPL Extent – 1998 to 2017



First Semiannual 2017 Groundwater Monitoring Report

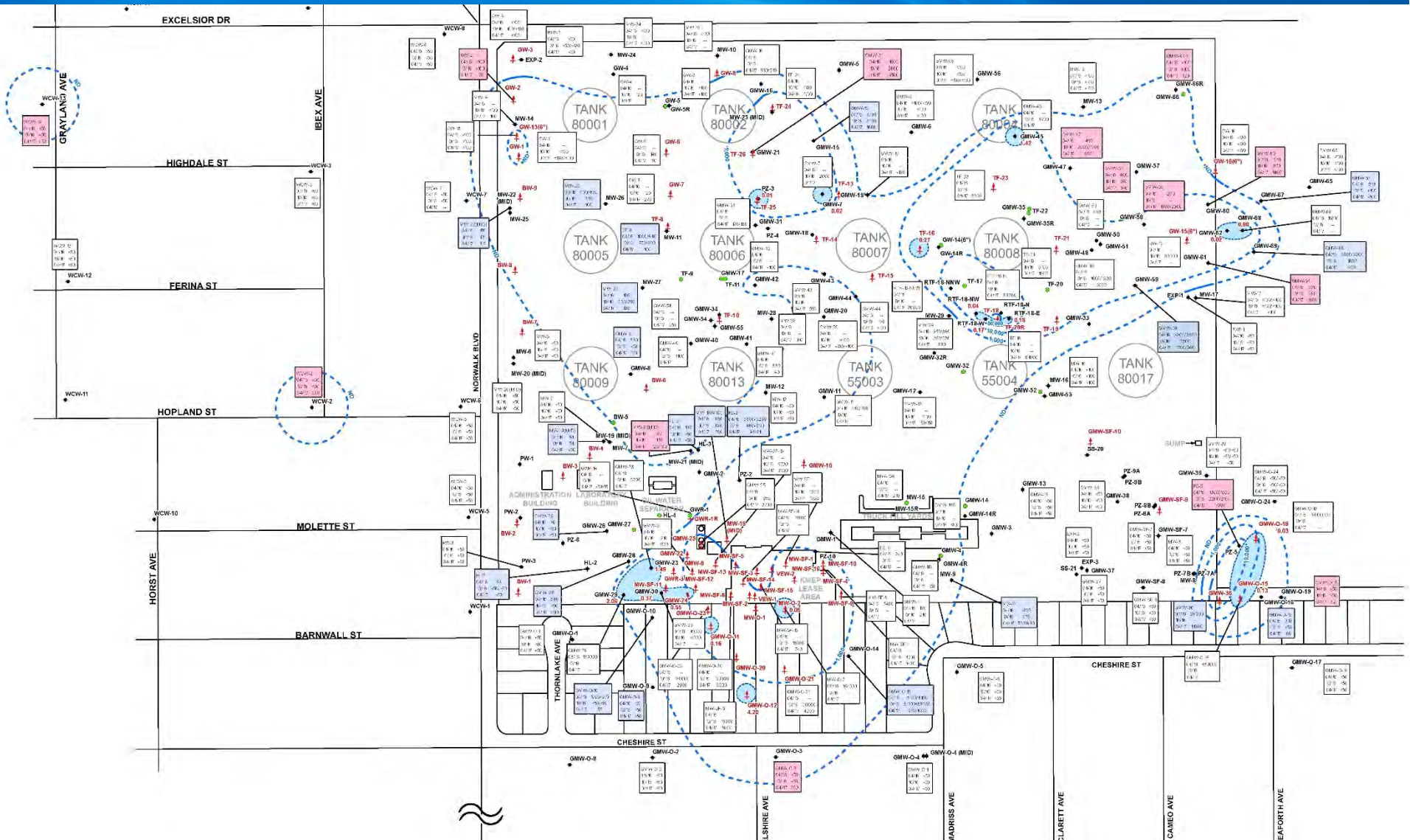
■ Uppermost Aquifer Wells

- In most areas, the lateral extents of TPH, benzene, 1-2-DCA, MTBE, and TBA have been reduced from the historical maximum and appear to be consistent with previous monitoring events
- Reduction and consistency of plumes is a result of hydraulic containment by the treatment systems and attenuation mechanisms
- Free product accumulation in several remediation and monitoring wells declined in magnitude and extent due to increased precipitation and biosparge operations in the south-central area
- Low level detections of MTBE and 1,2-DCA and plume extents in the western area do not warrant restarting the WSB treatment system.

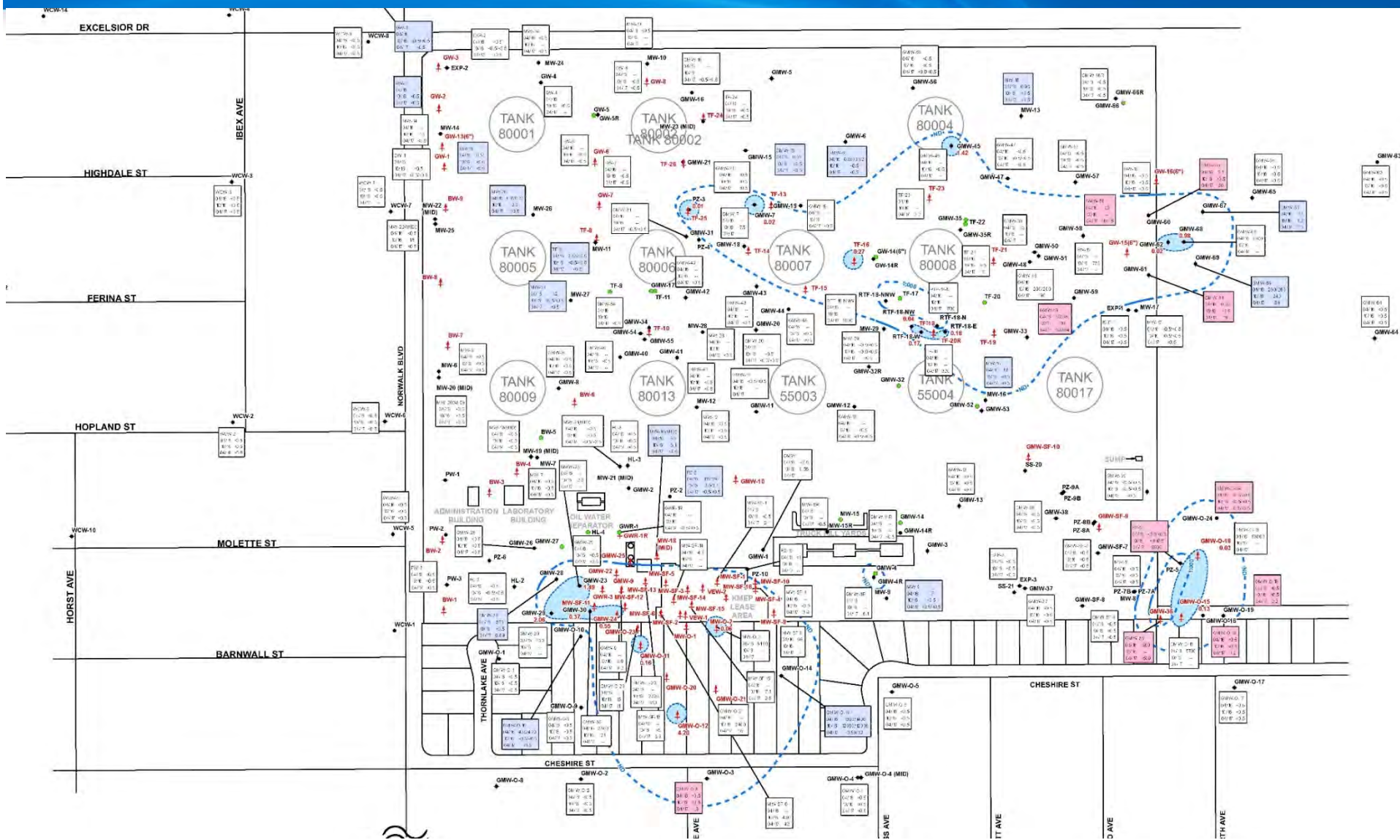
First Semiannual 2017 Groundwater Monitoring Report

- Exposition Aquifer wells sampled:
 - EXP-1, -2, and -3 sampled twice by DLA and SFPP
 - EXP-4 sampled once by SFPP
 - EXP-5 sampled once by SFPP
- All analytical results were Non Detect (ND), except for the following:
 - MTBE was detected at EXP-1 in the SFPP split sample at a concentration of 0.81 µg/L, near the laboratory reporting limit
- This type of low-level detection occasionally occurs in the EXP wells. SFPP and DLA Energy will continue to monitor the EXP wells and closely watch for any future potential detections.

TPH



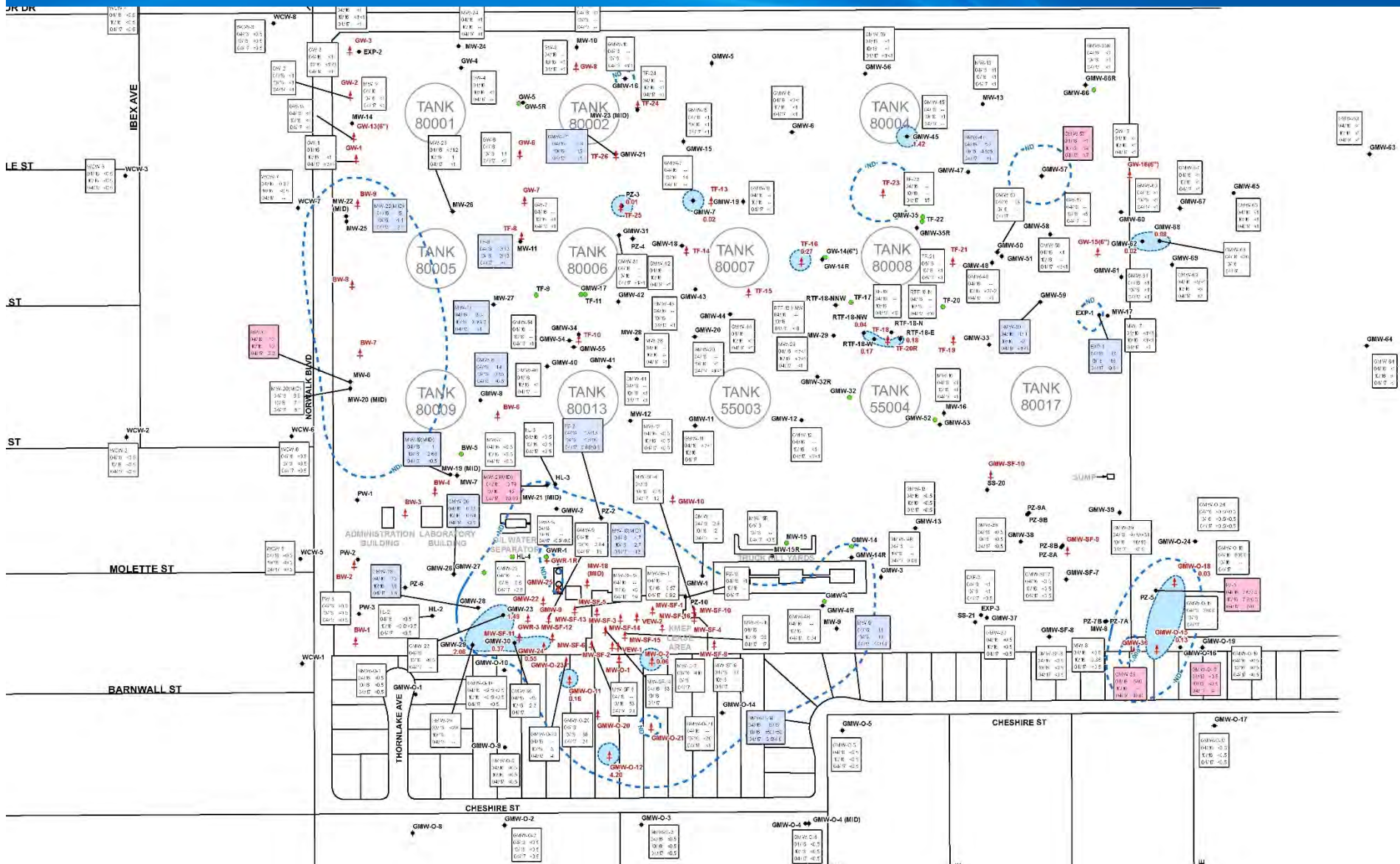
Benzene



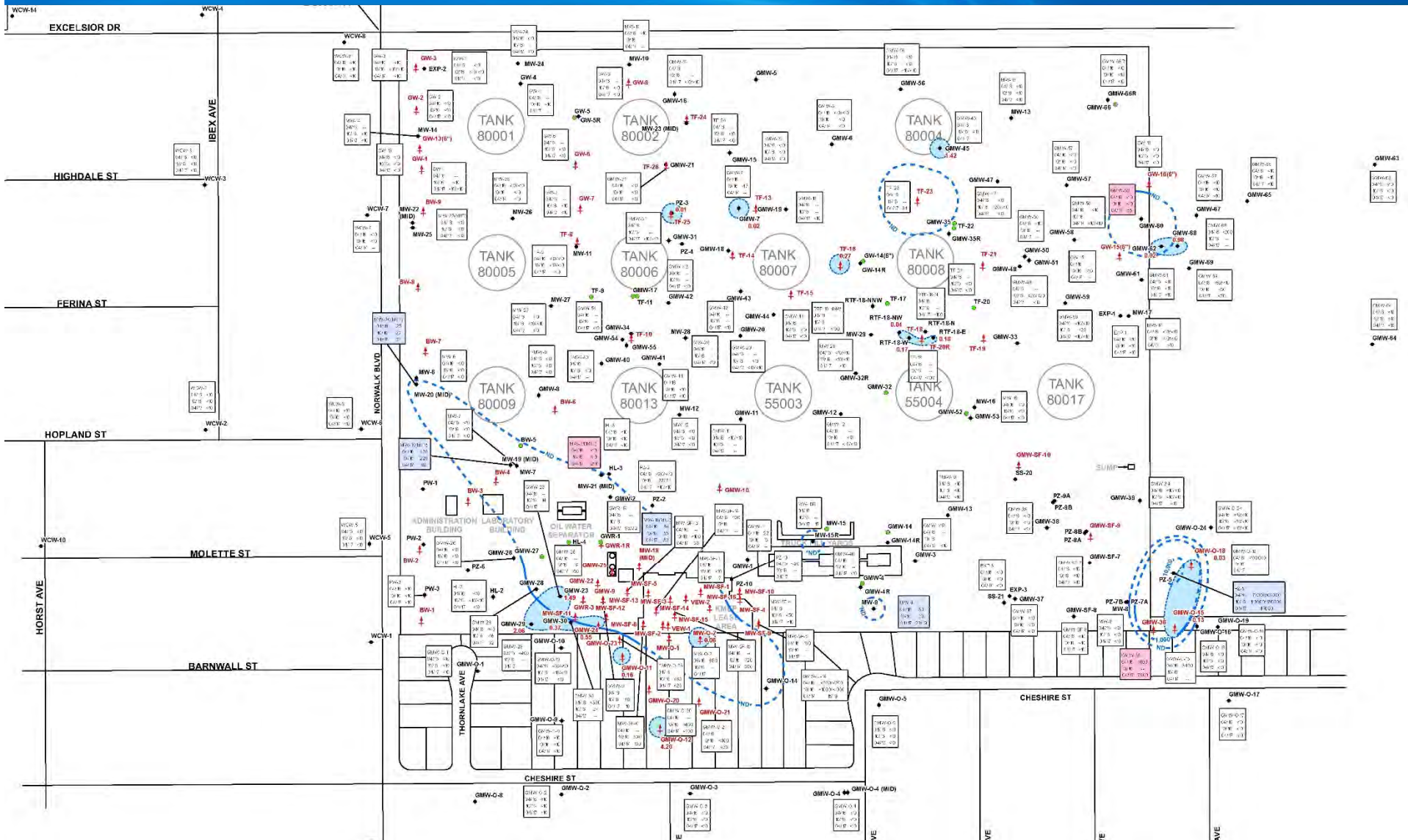
1,2-DCA



MTBE

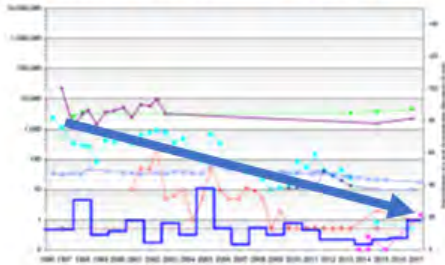


TBA

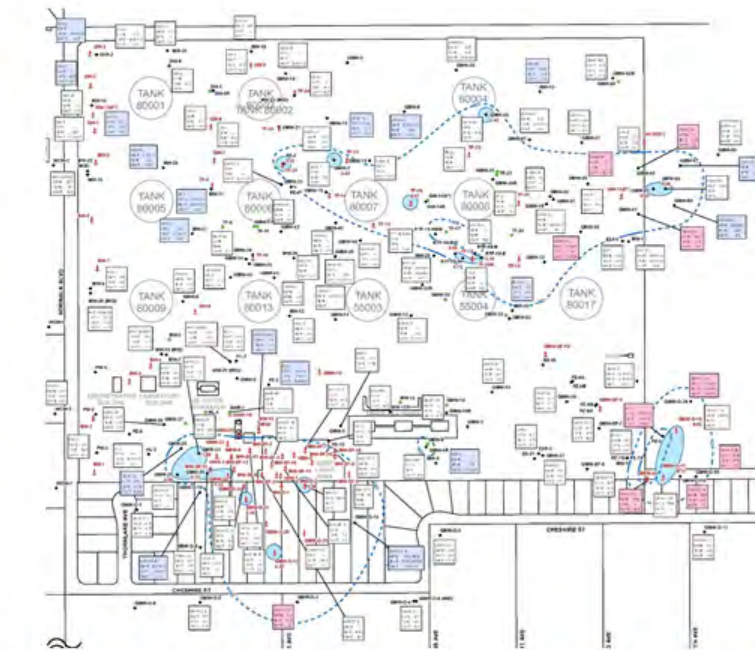
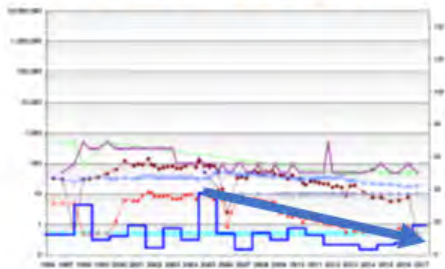


Time Series

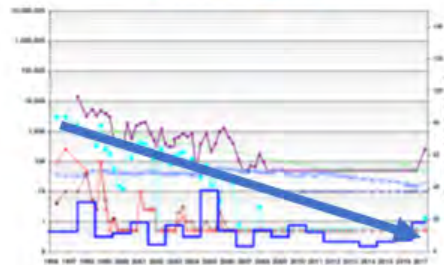
Tank Farm – GMW-45



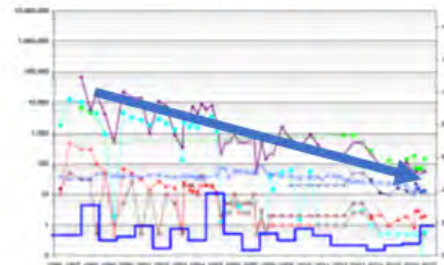
West – WCW-7



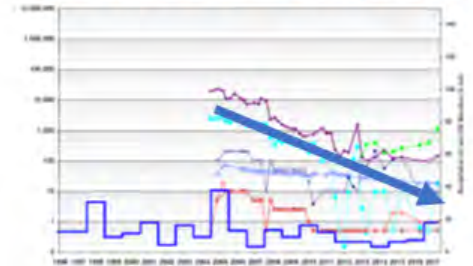
South Central –
GMW-O-3



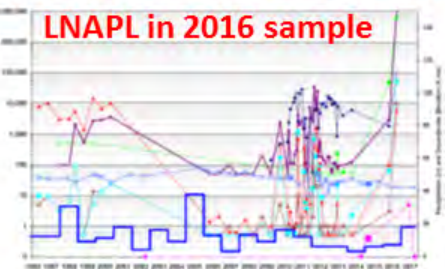
Truck Rack –
GMW-1



Northeast – GMW-61



Southeast – GMW-O-18



Questions