

Norwalk Tank Farm Update

Presented to the Norwalk Tank Farm
Restoration Advisory Board

On behalf of KMEP

August 11, 2011

Presentation Overview

- KMEP Update
 - Remediation Operations Update
 - NPDES Permit Update
 - TBA Treatment System
 - Additional Assessment Update
 - Biodegradation Assessment
 - Five -Year Action Plan Progress Report
- First Semiannual 2011 Monitoring Update

Remediation Operations Update

- Objectives
 - Contaminant Mass Containment
 - Contaminant Mass Removal
- South-Central and Southeast Areas
 - Soil Vapor Extraction (SVE) System
 - Groundwater Extraction (GWE) System
 - Total Fluids Extraction (TFE) System
 - Free product
 - Groundwater
- West Site Barrier
 - Groundwater Extraction
 - Discontinued August 2008
 - Shut-down based on low concentrations of MTBE and 1,2-DCA
 - Currently monitoring TBA and other constituents

Remediation Systems

- South-Central Area
 - 18 TFE wells (product and groundwater)
 - 24 onsite and 6 off-site SVE wells (most collocated with TFE wells)
 - 2 GWE Wells
- Southeastern Area (24-inch Block Valve Area)
 - 3 TFE wells (GMW-O-15, GMW-O-18, GMW-36)
 - 2 offsite SVE wells (both collocated with TFE wells)
 - 2 GWE Wells
- Treatment and Discharge
 - SVE Vapors
 - Treatment – Thermal catalytic oxidizer (catox)
 - Discharge – Atmosphere under SCAQMD Permit
 - TVE Liquids – Oil/Water Separator
 - Oil/Water Separator – Free product recycled offsite
 - Groundwater Treatment – Liquid-phase GAC
 - Groundwater Discharge – Coyote Creek under NPDES permit

Remediation Systems

- Operations & Maintenance Activities
 - Weekly Inspection and Maintenance
 - Weekly Data Collection
 - Vapor flow rate, vacuum, groundwater extraction rates, hours of operations, and other system parameters
 - Monthly Pump Inspections
 - Measurement of Individual Well Vapor Concentrations
 - Collection and Analysis of System Influent and Effluent Vapor and Groundwater Samples
 - Gauging of Select Remediation Wells

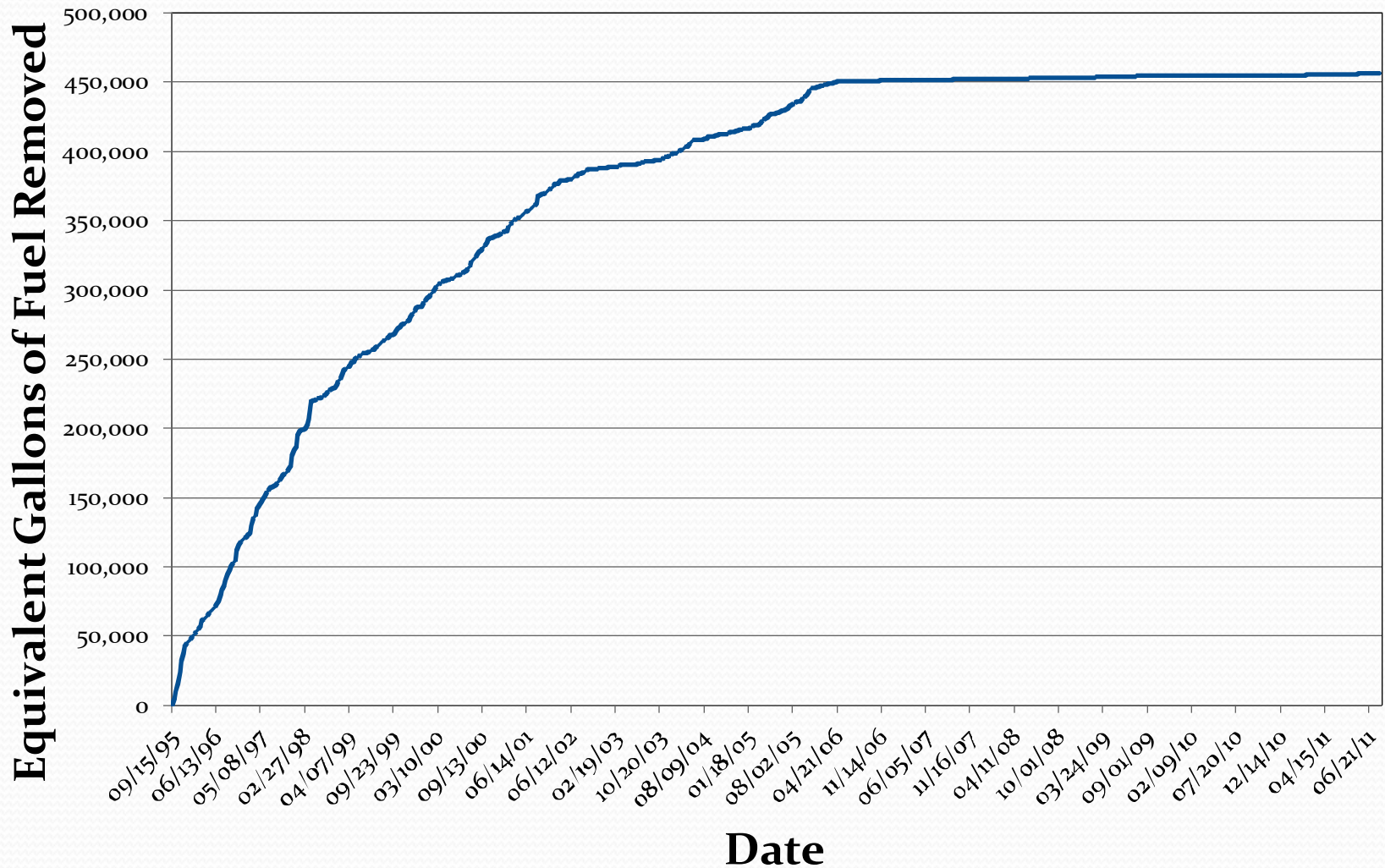
SVE System Operations Summary

- Equivalent Fuel Treated

- Based on weekly monitoring of influent vapor concentration, vapor extraction flow rate, and hours of operation.
- Pounds / 6.6 lbs/gal = gallons
- 1st Quarter 2011 – 994 gallons (6,561 pounds)
- 2nd Quarter 2011 – 175 gallons (1,153 pounds)
- Since Second Addendum – 4,276 gallons (28,222 pounds)
- Since 1995 – Approx. 456,000 gallons (3 million pounds)

SVE System Operations Summary

Cumulative Fuel Removed by Vapor Extraction To Date



TFE/GWE System Operations Summary

- Groundwater Extracted

- 1st Quarter 2011

- South-Central Area – 2,820,685 gallons
- Southeast Area – 314,343 gallons
- West Site Barrier – none (shutdown in third quarter 2008)

- 2nd Quarter 2011

- South-Central Area – 2,084,092 gallons
- Southeast Area – 822,385 gallons
- West Site Barrier – none (shutdown in third quarter 2008)

- Since 1995

- South-Central Area – 48.1 million gallons
- Southeast Area – 12.8 million gallons
- West Site Barrier – 26.9 million gallons

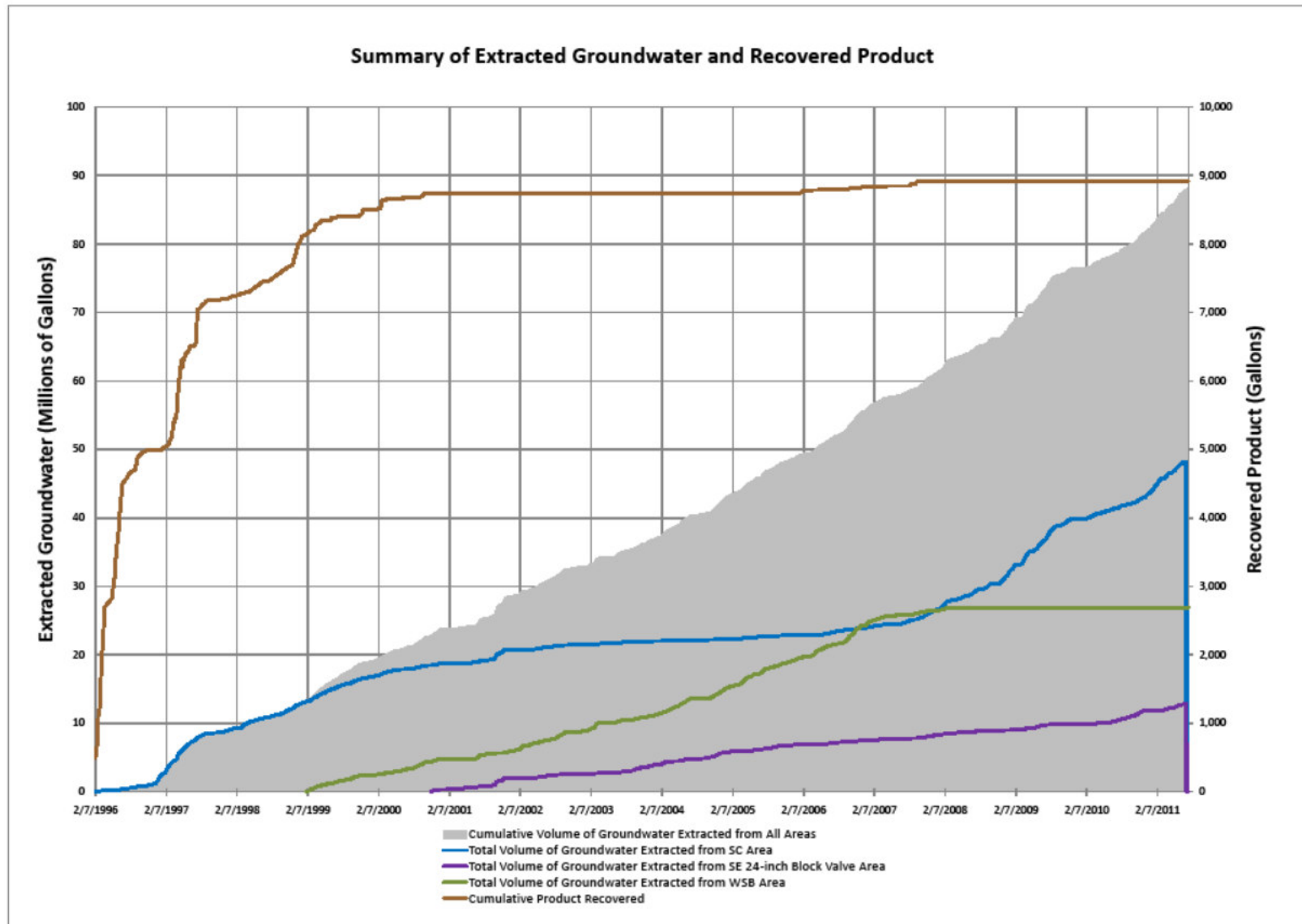
TFE/GWE System Operations Summary

- Mass of TPH removed in Groundwater Extracted
 - 1st Quarter 2011– 22 gallons (142 pounds)
 - 2nd Quarter 2011– 10 gallons (63 pounds)
 - Since implementing Second Addendum
 - 213 gallons (1,407 pounds)

TFE System Operations Summary

- Free Product Extracted
 - 1st and 2nd Quarter 2011
 - Free product has generally decreased since implementing the Second Addendum
 - Volume of free product recovered is small and emulsified
 - Free product not observed to accumulate in the product holding tank.
 - Free product not estimated for 1st and 2nd Quarter 2011
 - Since 1995 – 8,917 gallons

TFE System Operations Summary



Remediation System Operations Summary

- SVE System
 - 1st Quarter 2011
 - Operated 61% of time
 - 2nd Quarter 2011
 - Operated 75% of time
 - Operated 88% of time (excluding planned shutdowns for groundwater monitoring)
- TFE/GWE System
 - 1st Quarter 2011
 - Operated 74% of time
 - 2nd Quarter 2011
 - Operated 80% of time
 - Operated 90% of time (excluding planned shutdowns for groundwater monitoring)

Remediation System Downtime

- SVE System
 - Groundwater monitoring activities
 - Routine maintenance activities
 - Drain water condensate from manifold
 - Facilitate carbon changeouts for GWTS
 - Replaced low pressure natural gas switch
 - Inspection of thermocouple wiring
 - Repaired actuator motor and dilution air valve
 - Installation of digital chart recorder
- TFE/GWE System
 - Groundwater monitoring activities
 - Carbon changeouts
 - High level alarms for transfer tank
 - Changed bag filters, cleaned bag filter housing, oil/water separator, replaced transfer pump
 - Repairs to manifold and GAC vessel
 - Cleaning out southeastern area conveyance lines
 - Re-development of southeastern area wells

Remediation System Downtime

- Well Redevelopment

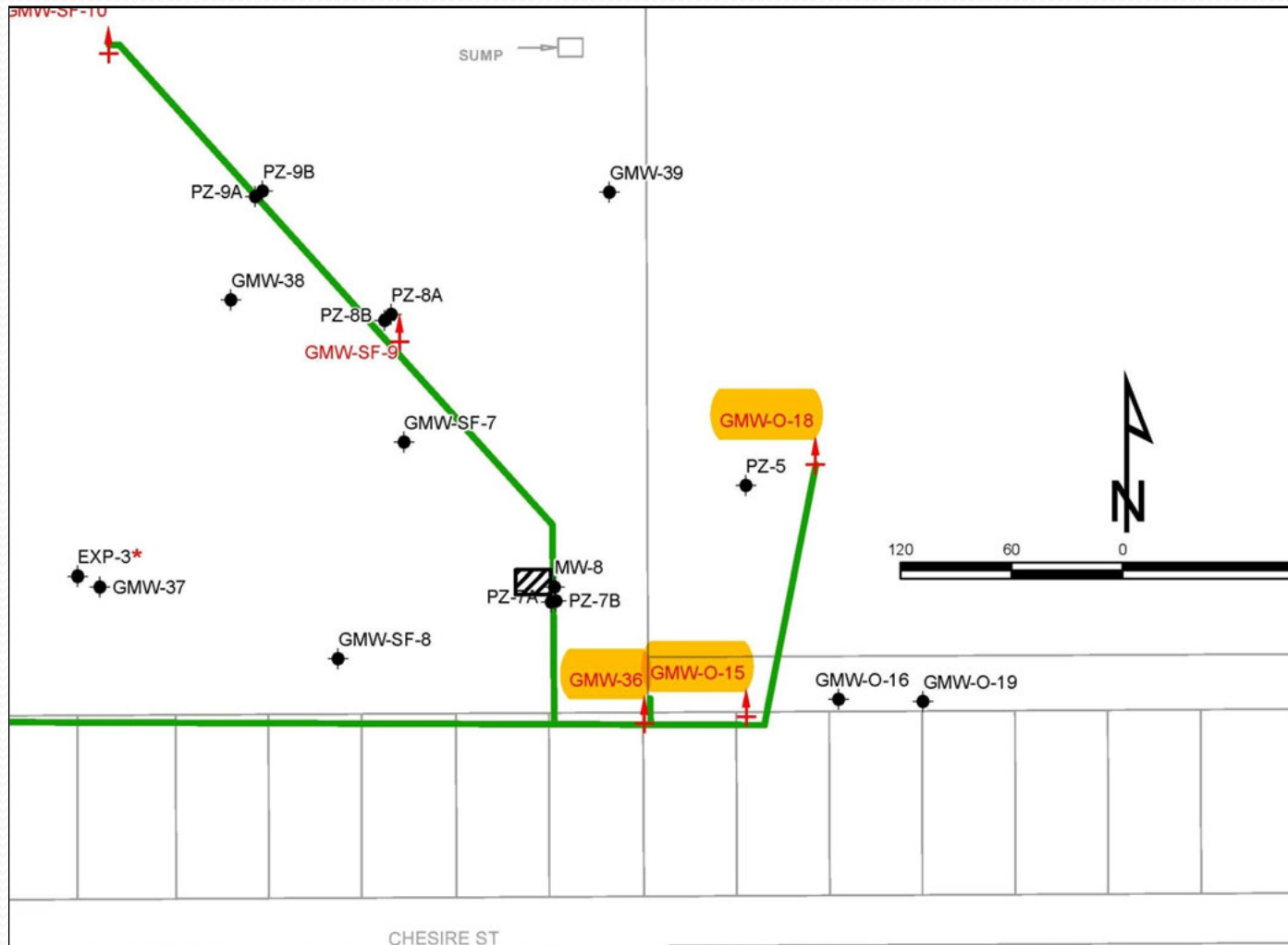
- Issue

- Influent to GWTS is high in suspended solids and product sheen. Solids and product material causes excessive clogging and frequent change outs of the influent bag filters to the GWTS.
- Redevelopment will remove these materials from the filter pack and surrounding formation which may reduce clogging and change outs of the influent bag filters.

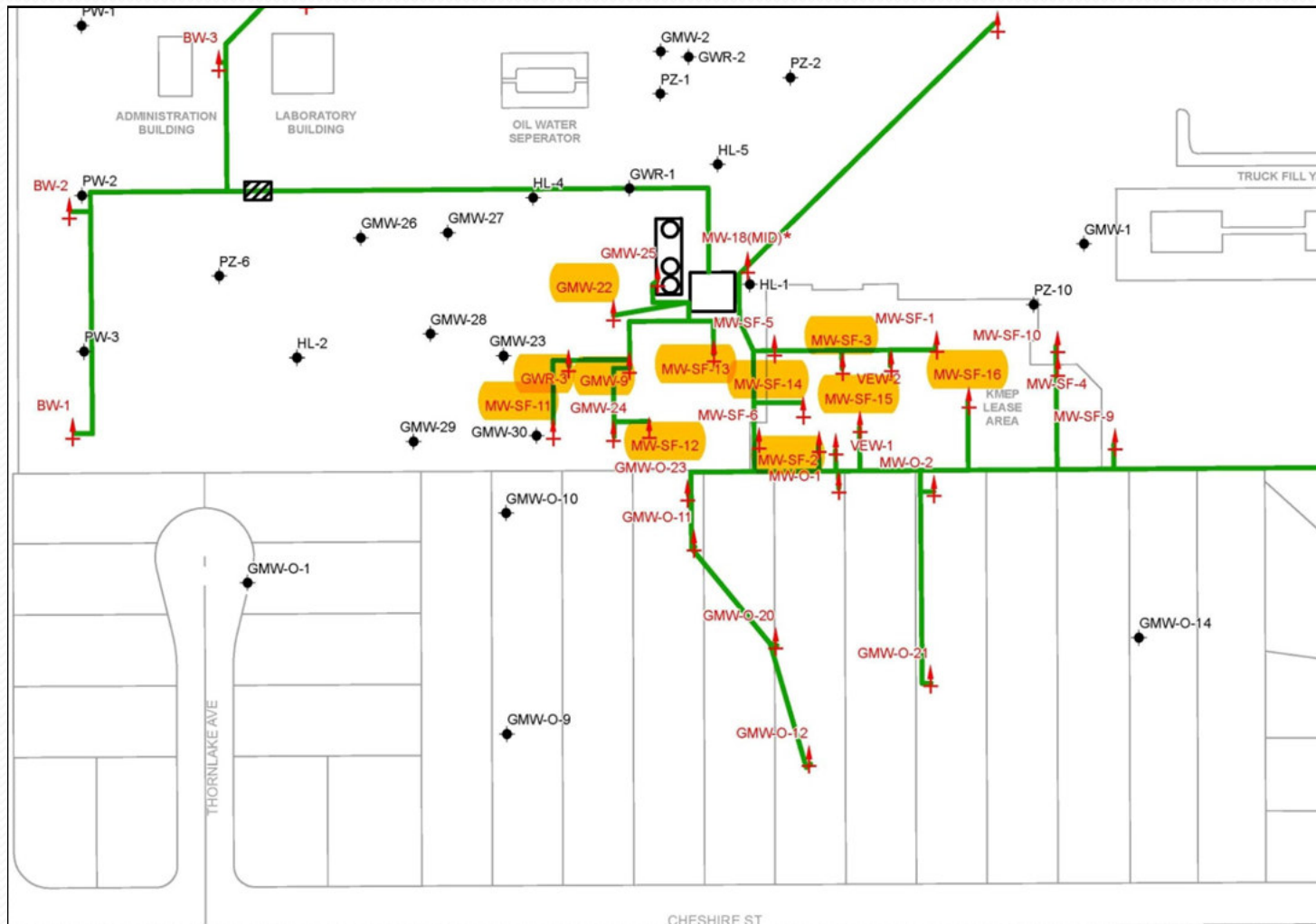
- Field Activities

- Mobilize a well development rig and bail, swab, and purge groundwater until turbidity levels are reduced
- Three southeastern wells redeveloped in June 2011
- Eleven wells in south-central area redeveloped in July 2011

Southeastern Area Wells



South-central Area Wells



Remediation System Maintenance

- Implementing several maintenance and upgrade activities to improve operation of the TFE/GWE system
 - Install new flow meters, totalizers, solenoid valves for air compressors
 - Inspect wellheads, replace fittings and well boxes
 - Pulled, cleaned, refurbished or replaced, and reinstalled extraction pumps
- These maintenance activities increased treatment system downtime, but will decrease future downtime and increase performance

Preventative Maintenance

- Check pump operation – monthly
- Pump inspection/cleaning/maintenance - ongoing
- Bag filter replacements – weekly minimum
 - Transfer pump replaced on March 18, 2011
- Backwashing of lead carbon vessel
- Pre-catalyst back pressure monitoring – Weekly
 - Monitor for particulate buildup on catalyst cells
- Sampling between GAC vessels – bi-weekly
 - Monitor for breakthrough prior to last vessel
 - Carbon change outs on January 26, February 28, April 22, May 20, and June 7, 2011

Preventative Maintenance

- System-specific preventative maintenance schedule for each of the other components of the remediation system
 - South-central System
 - Southeastern System
- Example system-specific preventative maintenance activities
 - Check/inspect valves, blowers, chemical pumps, level switches, hoses, and catox flame arrestor
 - Clean filters (various types), flow sensors, valves, transfer pumps, and catox catalyist
 - Change oil and air filters in various equipment
 - Check/replace belts and hoses on various equipment
 - Maintain pneumatic pumps
 - Clean oil/water separator and sumps
 - Drain and/or pressure wash holding tanks

Planned Remediation Activities

- Continue focusing remedial efforts on South-central and Southeastern areas
 - Continue operating TFE, GWE, and SVE systems
 - Continue system maintenance, inspections, and data collection on weekly basis
 - TBA treatment
- Monitor concentrations of 1,2-DCA, MTBE, and TBA in western area and restart WSB if necessary
 - TBA evaluation summary emails submitted to RWQCB on March 1, 2011 and June 1, 2011.
 - TBA concentrations remain low or non-detect in northwestern part of site; an overall decrease in extent and concentration observed from October 2010 to April 2011
 - Lack of clear trend of increasing TBA in WSB area
 - Recommendation that WSB extraction system remain off but continue to monitor for TBA and other constituents during routine groundwater sampling

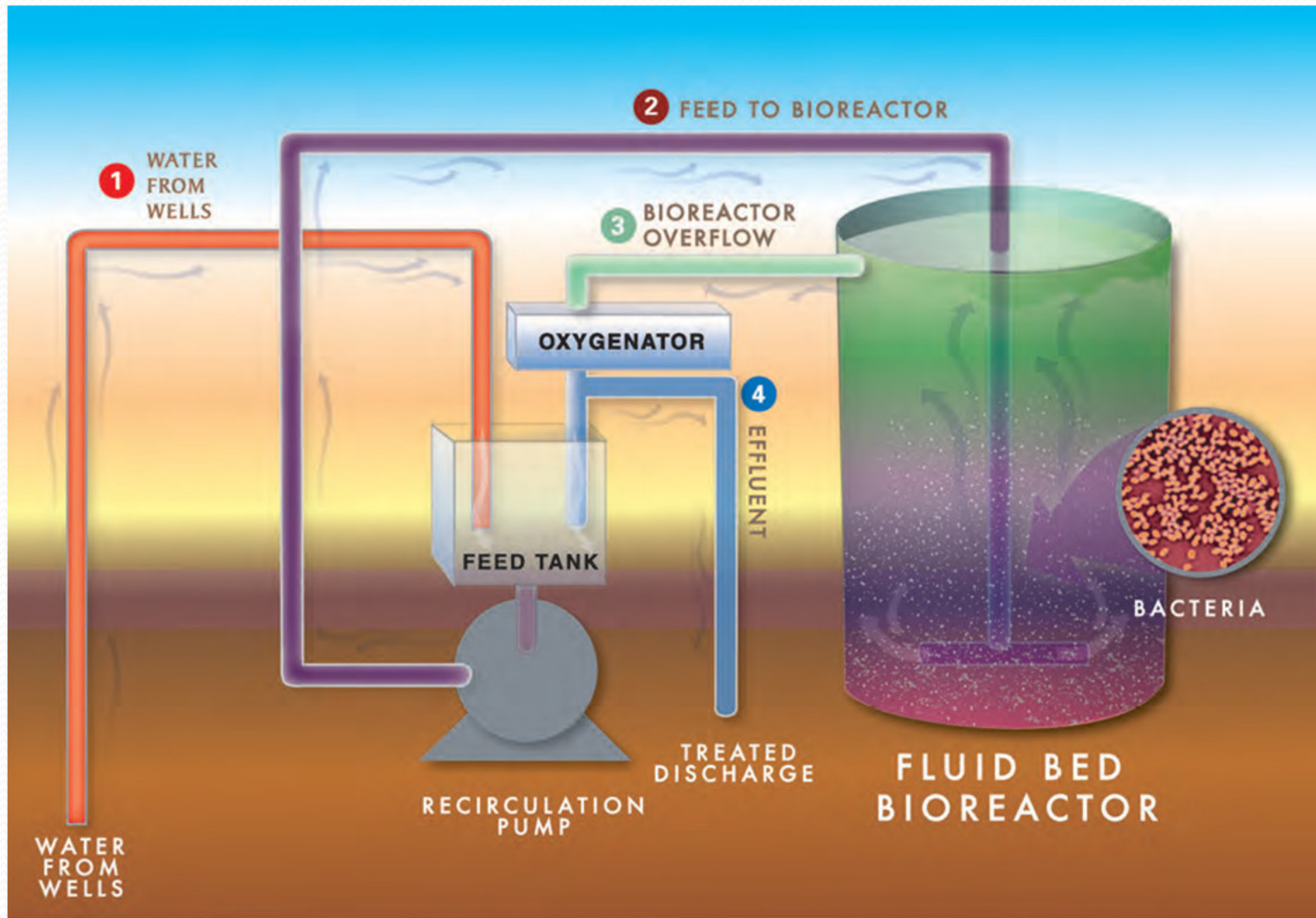
NPDES Permit Update

- Treated groundwater discharged to Coyote Creek under NPDES permit
 - Previous permit expired in October 2010
 - Tentative permit issued in December 2010
 - Final permit issued in June 2011
 - Tertiary butyl alcohol (TBA) added as new discharge parameter
 - RWQCB and SFPP negotiated a Time Schedule Order (TSO) which allows SFPP to operate system at interim discharge limit for TBA to allow time to upgrade the GWTS
 - SFPP added temporary TBA treatment units to existing GWTS. Both units are currently operational.

TBA Treatment System

- Fluidized bed bioreactors (FBBRs)
 - FBBRs consist of aboveground tanks containing microorganisms, primarily bacteria, which attach to the surfaces of sand grains or granular activated carbon (GAC) granules. These particles are distributed or fluidized in the tank by the upward flow of the water in the tank.
 - The microorganisms consume TBA and other dissolved gasoline components (such as MTBE and TPH-g) as food, using oxygen supplied from ambient air and/or oxygen boosters.

FBBR Schematic Flow



Cardno ERI, 2008

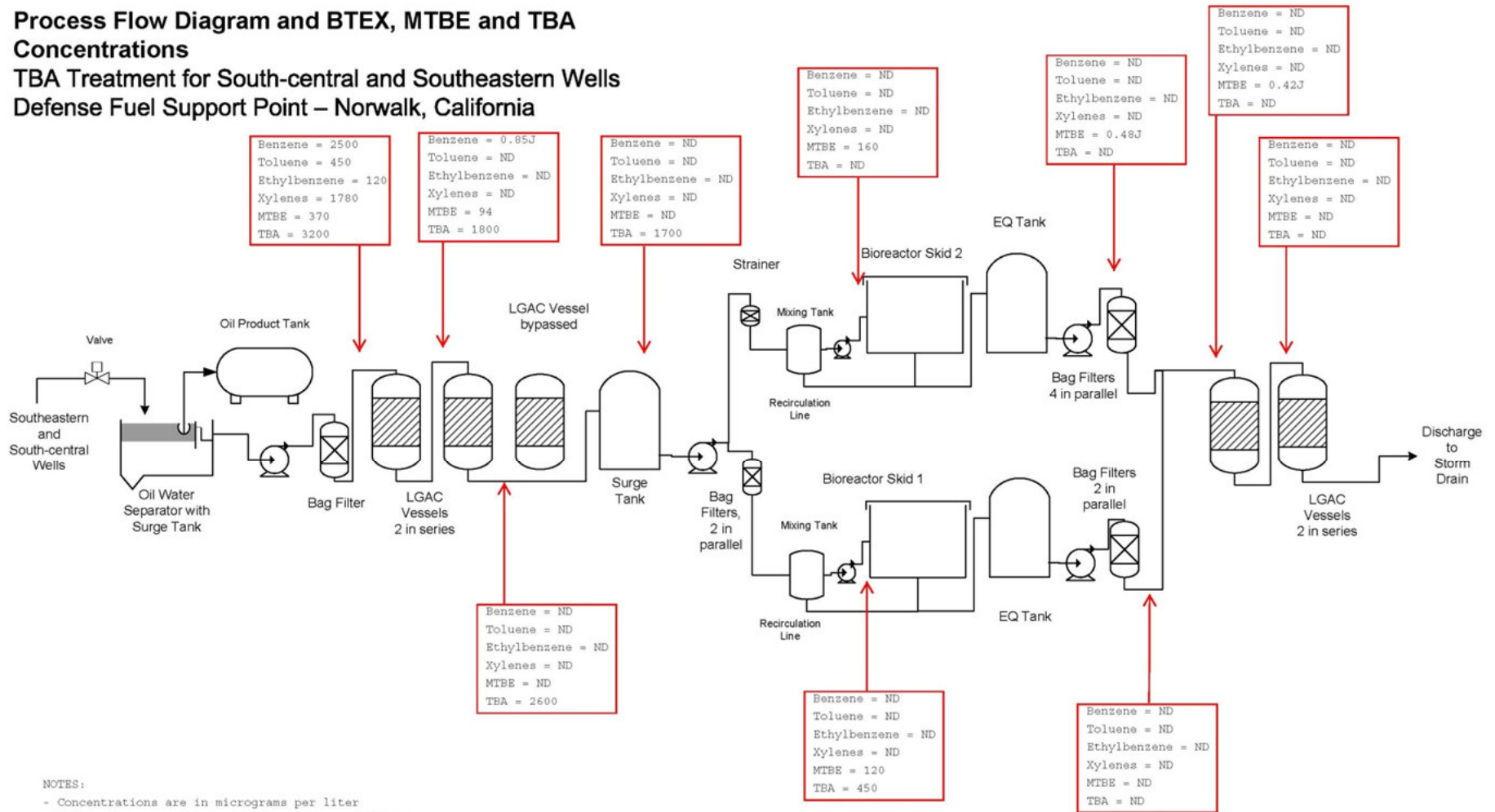
TBA Treatment System



Process Flow Diagram

Process Flow Diagram and BTEX, MTBE and TBA Concentrations

TBA Treatment for South-central and Southeastern Wells Defense Fuel Support Point – Norwalk, California



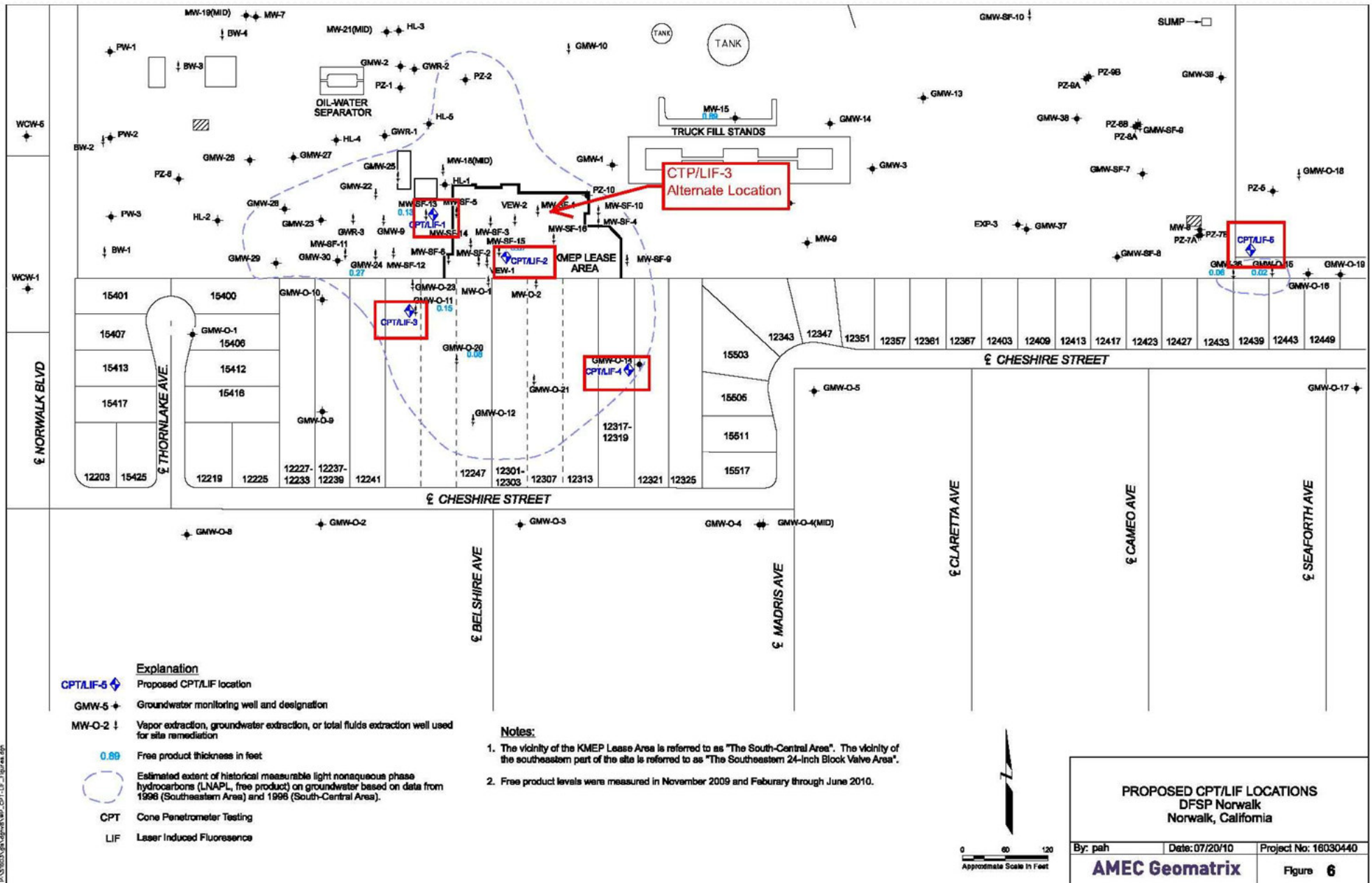
NOTES:

- Concentrations are in micrograms per liter
- BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
- MTBE = Methyl Tert-Butyl Ether
- TBA = Tert-Butyl Alcohol
- ND = Not Detected Above the Reporting Limit
- J = Estimated Concentration
- Results for July 27, 2011 sampling

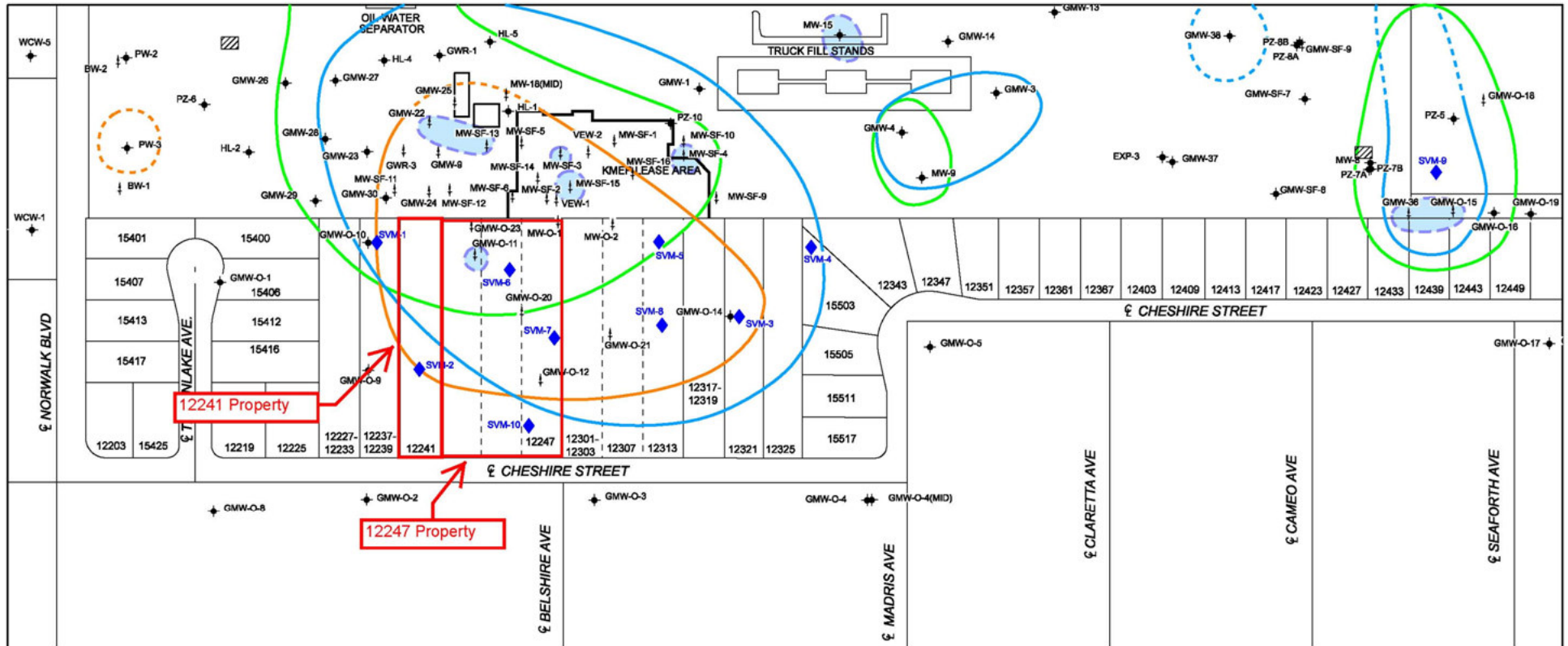
Additional Assessment

- Vertical Assessment of LNAPL in Soil
- South-Central Residential Area Vapor Study
- Southeastern 24-Inch Block Valve Area
- Schedule
 - Work Plans submitted to RWQCB and approved
 - Southeastern 24-inch Block Valve field investigation complete
 - Access agreements being finalized for other two investigations
- Expected to be completed this year
- Scope of work described in July 2010 RAB meeting

Vertical Assessment of LNAPL in Soil



South-Central Residential Area Vapor Study

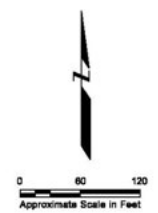


Explanation

- ◆ SVM-10 Proposed soil vapor monitoring point and designation
- + GMW-5 Groundwater monitoring well and designation
- † MW-O-2 Vapor extraction, groundwater extraction, or total fluids extraction well used for site remediation
- Estimated extent of detected dissolved benzene in groundwater based on data from April 2009; dashed where inferred
- Estimated extent of detected dissolved 1,2-dichloroethane in groundwater based on data from April 2009; dashed where inferred
- Estimated extent of detected dissolved methyl tert-butyl ether in groundwater based on data from April 2009; dashed where inferred
- Estimated extent of measurable light nonaqueous phase hydrocarbons (LNAPL, free product) on groundwater based on data from April 2009; dashed where inferred.

Notes:

1. The vicinity of the KMEF Lease Area is referred to as "The South-Central Area". The vicinity of the southeastern part of the site is referred to as "The Southeastern 24-Inch Block Valve Area".
2. Estimated extents of petroleum hydrocarbon constituents are from Figures 5, 6, and 7 of the First Semi-Annual 2009 Groundwater Monitoring Report, AMEC, July 27, 2009.



PROPOSED SOIL VAPOR MONITORING POINT LOCATIONS DFSP Norwalk Norwalk, California		
By: pah	Date: 05/27/10	Project No: 16030440
AMEC Geomatrix		Figure 2

P:\16030440\GIS\Map_SouthCentralResidentialArea_VaporStudy_Figures.mxd

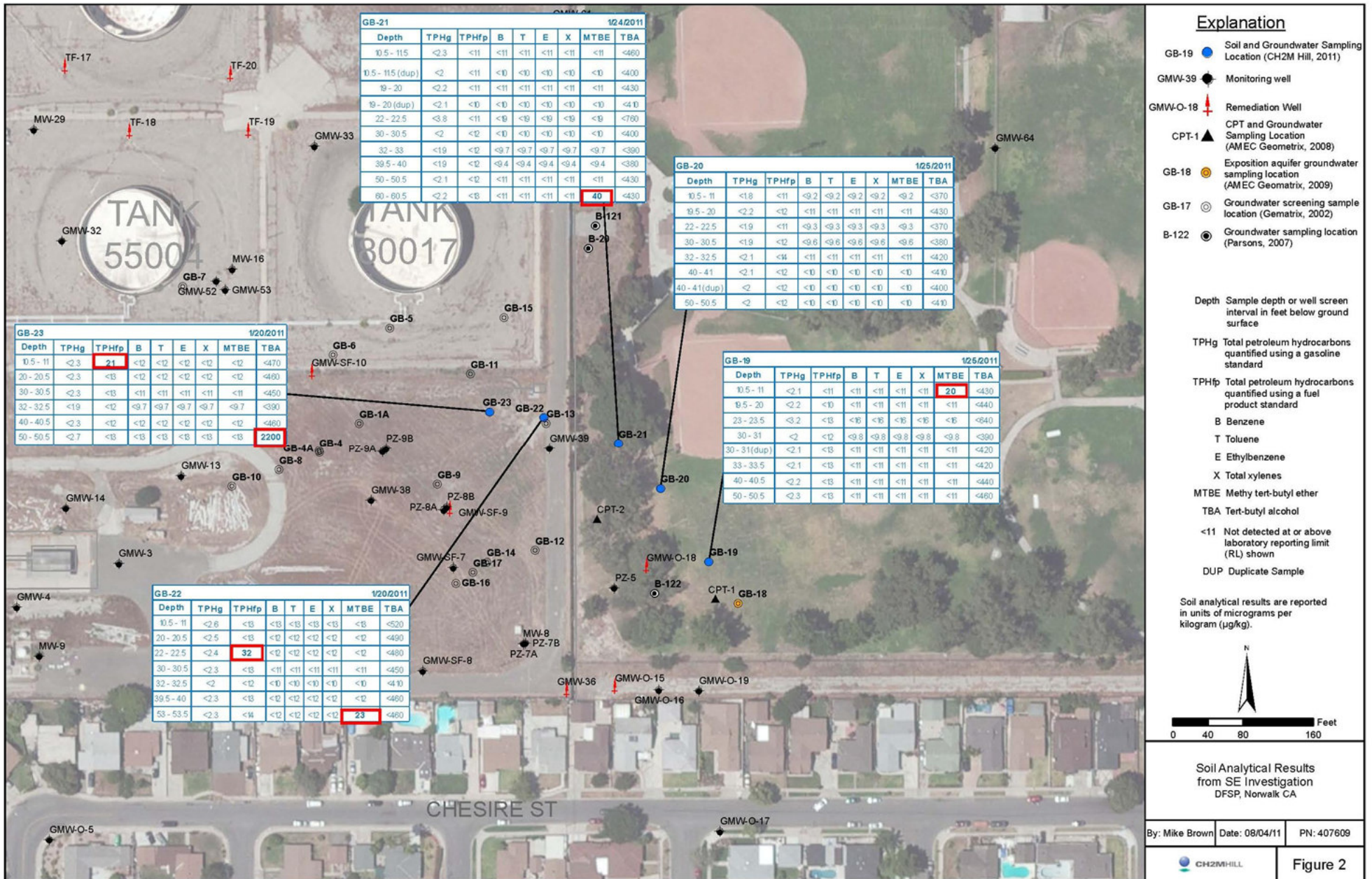
Southeastern 24-Inch Block Valve Area

- Additional Off-site Assessment– Complete
 - Field work conducted in July 2008
 - Soil gas sampling, lithologic profiling through aquitard (CPT), and discrete-depth GW sampling (CPT) in uppermost aquifer
 - Results documented in Report (AMEC, August 28, 2008)
- Supplemental Vertical Delineation – Complete
 - Field work conducted in November 2009
 - Continuous drilling, soil sampling and grab GW sampling in Exp Aquifer
 - Results presented at January 28, 2010 RAB Meeting
 - Results documented in Report (AMEC, April 23, 2010)
- Step-Out Investigation in Vicinity of Well GMW-O-18
 - Field work completed in January 2011

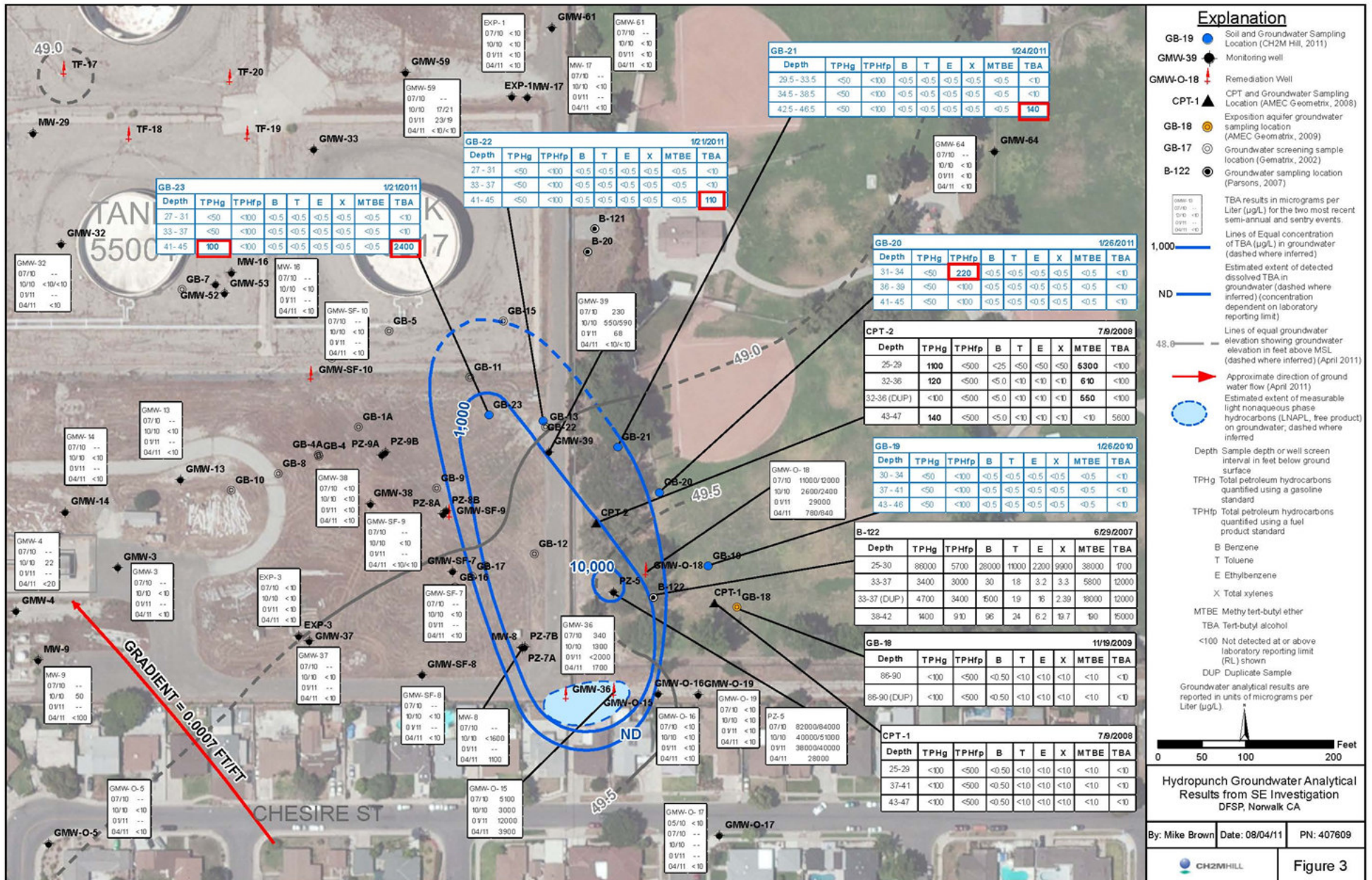
Southeastern 24-Inch Block Valve Area

- Step-Out Investigation in Vicinity of Well GMW-O-18
 - Objective
 - Delineate impacts in groundwater in southeastern area
 - Approach – investigate 5 x locations (GB-19 – GB-23):
 - Direct push field methods to top of aquitard (50 ft bgs)
 - Drilling, continuous coring, and lithologic logging
 - Discrete-depth soil and groundwater sampling
 - Soil and grab groundwater samples analyzed TPHg, TPHfp, BTEX, and Oxygenates

Soil Analytical Results



Groundwater Analytical Results



Southeastern 24-Inch Block Valve Area

- Soil Results

- MTBE was detected in one discrete-depth sample at each of three soil borings: GB-19 (20 micrograms per kilogram [$\mu\text{g}/\text{kg}$] at 10.5 to 11 feet bgs), GB-21 (40 $\mu\text{g}/\text{kg}$ at 60 to 60.5 feet bgs), and GB-22 (23 $\mu\text{g}/\text{kg}$ at 53 to 53.5 feet bgs).
- TPH-fp was detected in two soil borings (GB-22 and GB-23) at depths less than approximately 22 feet bgs. The maximum TPH-fp concentration was reported in boring GB-22 (32 $\mu\text{g}/\text{kg}$).
- TBA was detected at GB-23 (2,200 $\mu\text{g}/\text{kg}$) at a sample depth of 50 to 50.5 feet bgs.
- All other target analytes for the remaining soil samples were not detected.

Southeastern 24-Inch Block Valve Area

- Groundwater Results

- TPH-g was detected in boring GB-23 (100 micrograms per liter [$\mu\text{g}/\text{L}$]) at a sample depth of 41 to 45 feet bgs.
- TPH-fp was detected in boring GB-20 (220 $\mu\text{g}/\text{L}$) at a sample depth of 31 to 34 feet bgs.
- TBA was detected in one discrete-depth sample at each of three soil borings: GB-21 (140 $\mu\text{g}/\text{L}$ at 42.5 to 46.5 feet bgs), GB-22 (110 $\mu\text{g}/\text{L}$ at 41 to 45 feet bgs), and GB-23 (2,400 $\mu\text{g}/\text{L}$ at 41 to 45 feet bgs).
- All other target analytes for the remaining groundwater samples were not detected.

Southeastern 24-Inch Block Valve Area

- Summary and Conclusions

- Depth of Bellflower aquitard encountered at 47 feet bgs compares well with previous investigations in 2008 and 2009; Bellflower aquitard composed of predominantly fine grained material with interbedded coarser grained material
- TPH, MTBE, and fuel oxygenates were not detected in soil or groundwater samples from the uppermost groundwater zone in two easternmost borings (GB-19 and GB-20), except MTBE in one shallow soil sample above the water table and one discrete-depth groundwater sample. Only other detected constituent at the other offsite location (GB-21) was MTBE in soil (below the water table) and TBA in one discrete-depth groundwater sample.
- Horizontal groundwater flow direction is to the northwest in an onsite direction, which would carry any offsite contamination onsite that is not within the TFE capture zone
- TBA concentration contour lines are consistent with previous groundwater reports except that contours are now interpreted to extend onsite further toward the northwest.
- Low level of detected constituents and onsite groundwater flow direction indicate that the lateral extent of dissolved phase constituents to the east is defined
- Previous results from deep boring (GB-18) showed no impacts to the upper portion of the Exposition aquifer

Biodegradation Assessment

- Remediation Objectives
 - Contaminant Mass Containment
 - Contaminant Mass Removal
- Current approach in South-Central and Southeast Areas
 - Soil Vapor Extraction (SVE) System
 - Groundwater Extraction (GWE) System
 - Total Fluids Extraction (TFE) System
 - Free product
 - Groundwater
- Naturally occurring biodegradation also plays an important role in achieving the remediation objectives, but is not quantified
- Question: How do we quantify biodegradation and enhance its use in achieving remediation objectives?

Biodegradation Assessment

Mass Removal of Remediation System

	GWE/TFE (lbs)	SVE (lbs)	Total (lbs)
2007 Totals	395	3,742	4,137
2008 Totals	311	5,878	6,189
2009 Totals	161	9,387	9,548
2010 Totals	334	1,501	1,835
2011 Totals (projected)	410	10,020	10,430
Average	322	6,106	6,428

Note:

~ 546 lbs of free product removed during 2007

0.0 lbs of product removed from 2008 to 2011

Biodegradation Assessment

- Biodegradation
 - Change in form of compounds carried out by living creatures such as microorganisms
 - Under the right conditions, microorganisms can cause or assist in chemical reactions that change the form of contaminants to reduce human and ecological health risks.
 - Biodegradation is important because many components of petroleum hydrocarbon contamination can be destroyed by microorganisms
 - Biodegrading microorganisms can be found almost anywhere and can be very safe and effective

Biodegradation Assessment

- Biodegradation can occur in vadose zone (above the water table) and below the water table
 - SFPP is currently assessing the biodegradation rate in the vadose zone
 - Preliminary biodegradation rates in the upper water table aquifer has been estimated using EPA guidance
 - Annual biodegradation rate in groundwater ranges between 300 and 1,100 lbs (TPH quantified as gas)
 - Average annual mass removal (from 2007 to 2010) using the GWE/TFE system is 300 lbs

Biodegradation Assessment

Mass Removal of Remediation System and Biodegradation

	GWE/TFE (lbs)	SVE (lbs)	Total (lbs)	Biodegradation in Groundwater (lbs)	Biodegradation in Vadose Zone (lbs)
2007 Totals	395	3,742	4,137	---	---
2008 Totals	311	5,878	6,189	---	---
2009 Totals	161	9,387	9,548	---	---
2010 Totals	334	1,501	1,835	---	---
2011 Totals (projected)	410	10,020	10,430		
Average	322	6,106	6,428	300 to 1,100 *	TBD

* - Based off groundwater data collected in October 2010 and April 2011

Five-Year Action Plan Progress Report

- Second Addendum to Remedial Action Plan
 - Submitted – November 2006
 - Approved – April 2007
 - Remediation system enhancements
 - Expanded the SVE and TFE system into onsite areas where residual LNAPL appeared to remain
 - 5-Year Schedule to Submitting Closure Request
 - August 2012
- Update provided in February 19, 2010 Letter to RAB
 - Revised Schedule to Submitting Closure Request
 - September 2013
- Remediation System Effectiveness Evaluation provided in Report by AMEC (May 14, 2010)

Five-Year Action Plan Progress Report

Status	Task	Date Completed or Projected	Second RAP Addendum
Completed	Receive Approval from RWQCB	April 2007	December 2006
	Begin Remediation System Expansion	May 2007	--
	Begin Upgrades to Groundwater Treatment System	August 2007	--
	Complete Remediation System Improvements	December 2007	February 2007
	Full-Scale Remediation Startup	January 2008	--
	Begin SVE Rebound Testing	December 2008	August 2008
	Submit First Annual Remediation Progress Report	January 2009	February 2008
	Submit Second Annual Remediation Progress Report	January 2010	--
	Complete SVE Rebound Testing	As conditions allow	February 2009
Submit Third Annual Remediation Progress Report	January 2011	--	
Future	Begin Bioventing Operation	After free product removal	March 2009
	Submit Fourth Annual Remediation Progress Report	January 2012	--
	Begin Bioventing Rebound Testing	TBD	December 2009
	Begin Verification Groundwater Monitoring	TBD	June 2010
	Complete Bioventing Testing	TBD	June 2010
	Submit Fifth Annual Remediation Progress Report	January 2013	--
	Complete Verification Groundwater Monitoring	When cleanup objectives are met	June 2010
	Submit Closure Request to RWQCB	When cleanup objectives are met	August 2012



Questions?

First Semiannual 2011

Groundwater Monitoring Report

- Sentry Event
 - January 2011 – DLA Energy
 - January 2011 – SFPP
- Semiannual Event in April
 - April 2011 – DLA Energy
 - April 2011 – SFPP
- Monthly Events
 - February, March, May, and June 2011 – SFPP
 - 6 Southeastern Area Wells
 - GMW-36, GMW-O-15, GMW-O-16, GMW-O-18, GMW-O-19, and PZ-5

First Semiannual 2011

Groundwater Monitoring Report

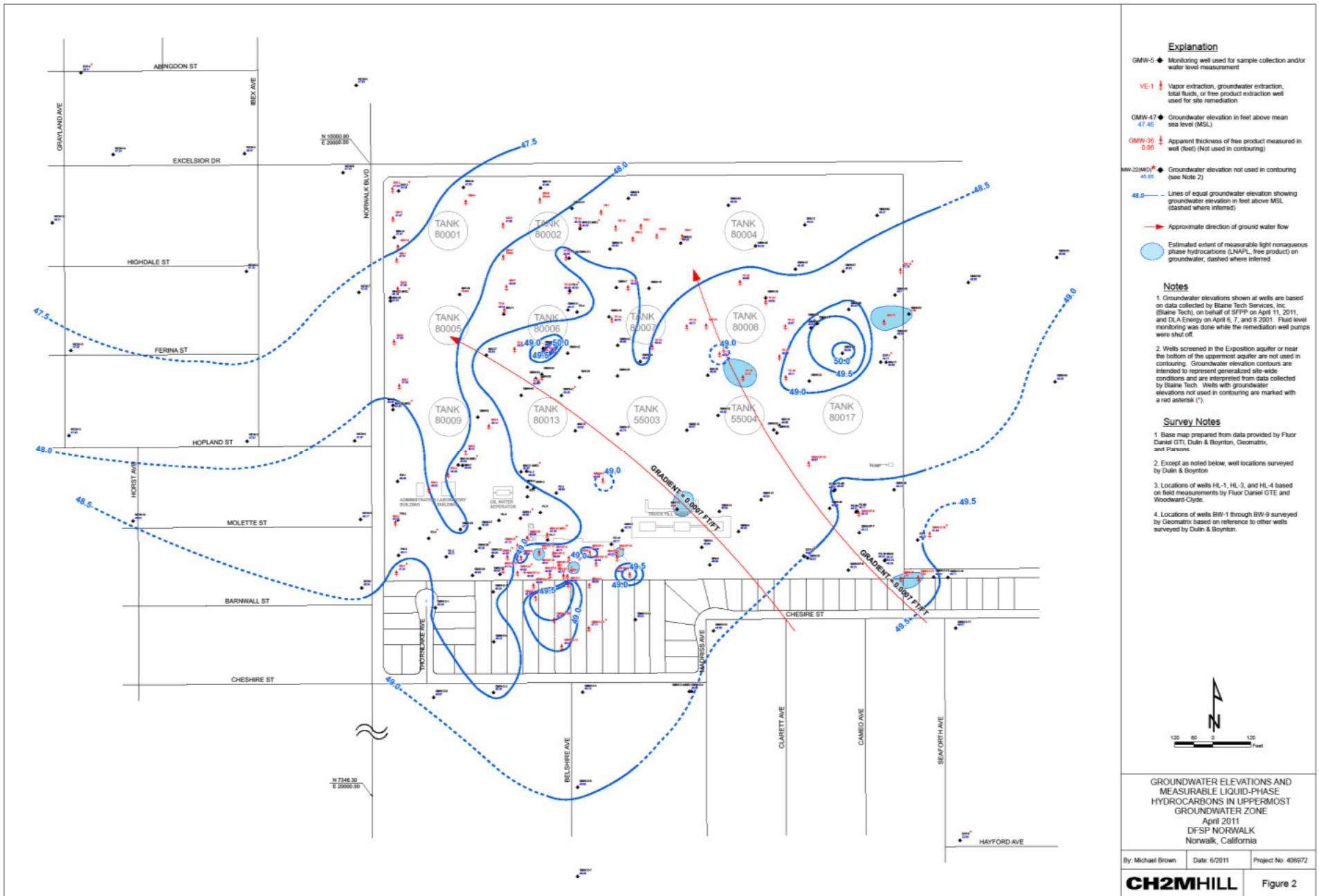
- Well Gauging and Sampling by Blaine Tech
 - Low-flow sampling methods
 - 138 wells gauged
 - 124 wells sampled
 - SVE/TFE/GWE turned off prior to gauging and sampling

First Semiannual 2011

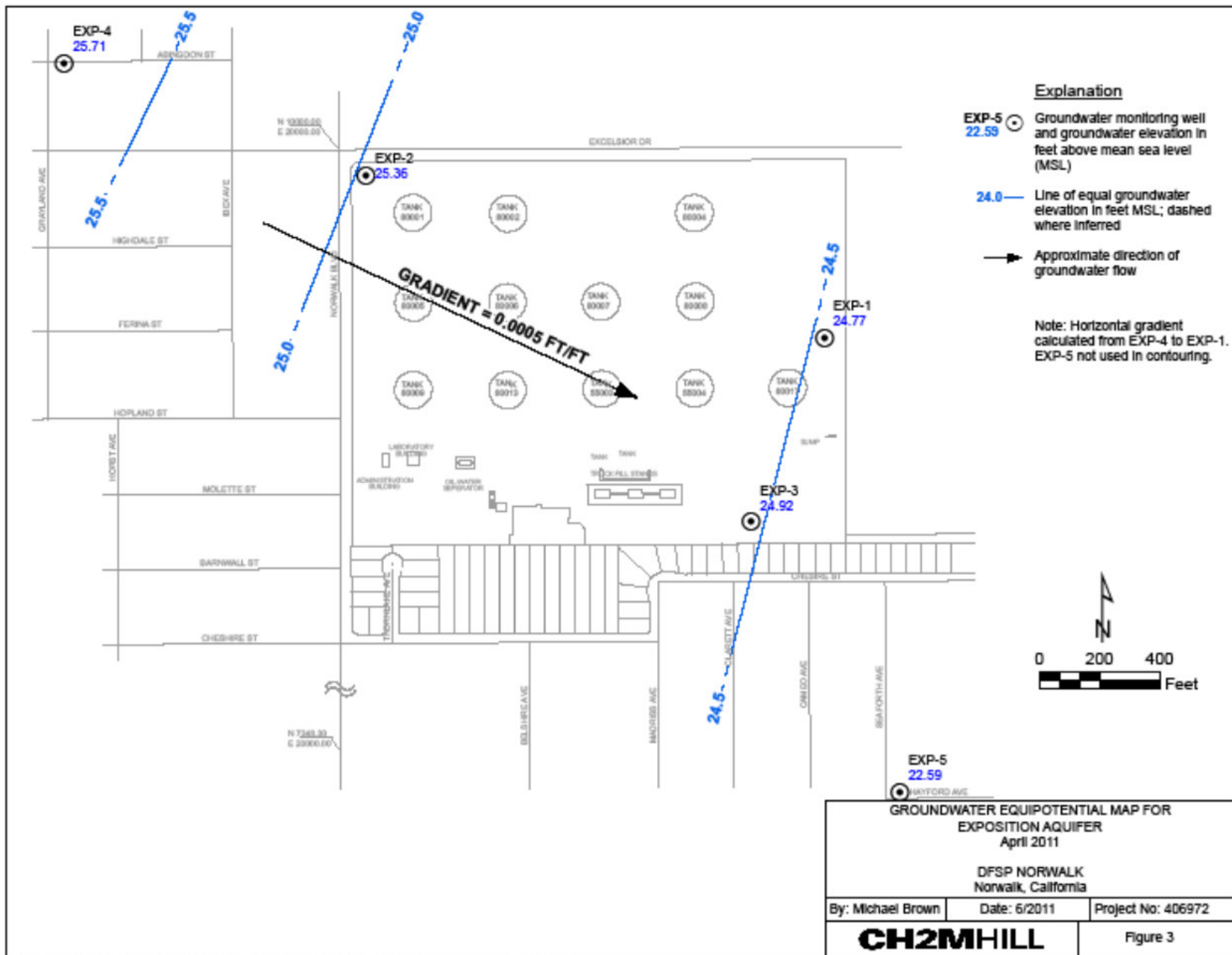
Groundwater Monitoring Report

- Groundwater levels during April 2011 generally similar to those encountered during previous monitoring events.
- Uppermost Aquifer Groundwater Elevations and Flow
 - Groundwater elevations approximately 1.2 feet higher than those reported for October 2010
 - Horizontal hydraulic gradient ranged from 0.0007 ft/ft toward the north-northwest
- Exposition Aquifer Groundwater Elevations and Flow
 - Groundwater elevations up to approximately 2-foot higher than those reported for October 2010
 - Horizontal groundwater gradient was approximately 0.0005 ft/ft toward the southeast, substantially different than the uppermost groundwater zone

Groundwater Elevations - Water Table



Groundwater Elevations - Exposition



First Semiannual 2011

Groundwater Monitoring Report

- Free product measured in 9 of 183 wells gauged
 - (GMW-36, GMW-62, GMW-O-15, GW-15, MW-15, MW-SF-10, MW-SF-13, MW-SF-15, and TF-18). Thicknesses ranged from 0.01 feet to 1.93 feet in GMW-36
 - Product sheen also observed in wells GW-6, GW-8, and MW-26 in the northwestern area
 - Free product present in the following areas, as interpreted from the current monitoring data, remediation system operations, and historical detections
 - Northern tank farm area (TF-18)
 - Eastern area (GW-15)
 - Truck rack area (MW-15)
 - South-central area (MW-SF-10, MW-SF-13, MW-SF-15)
 - Southeastern 24-inch block valve area (GMW-36, GMW-o-15)

First Semiannual 2011

Groundwater Monitoring Report

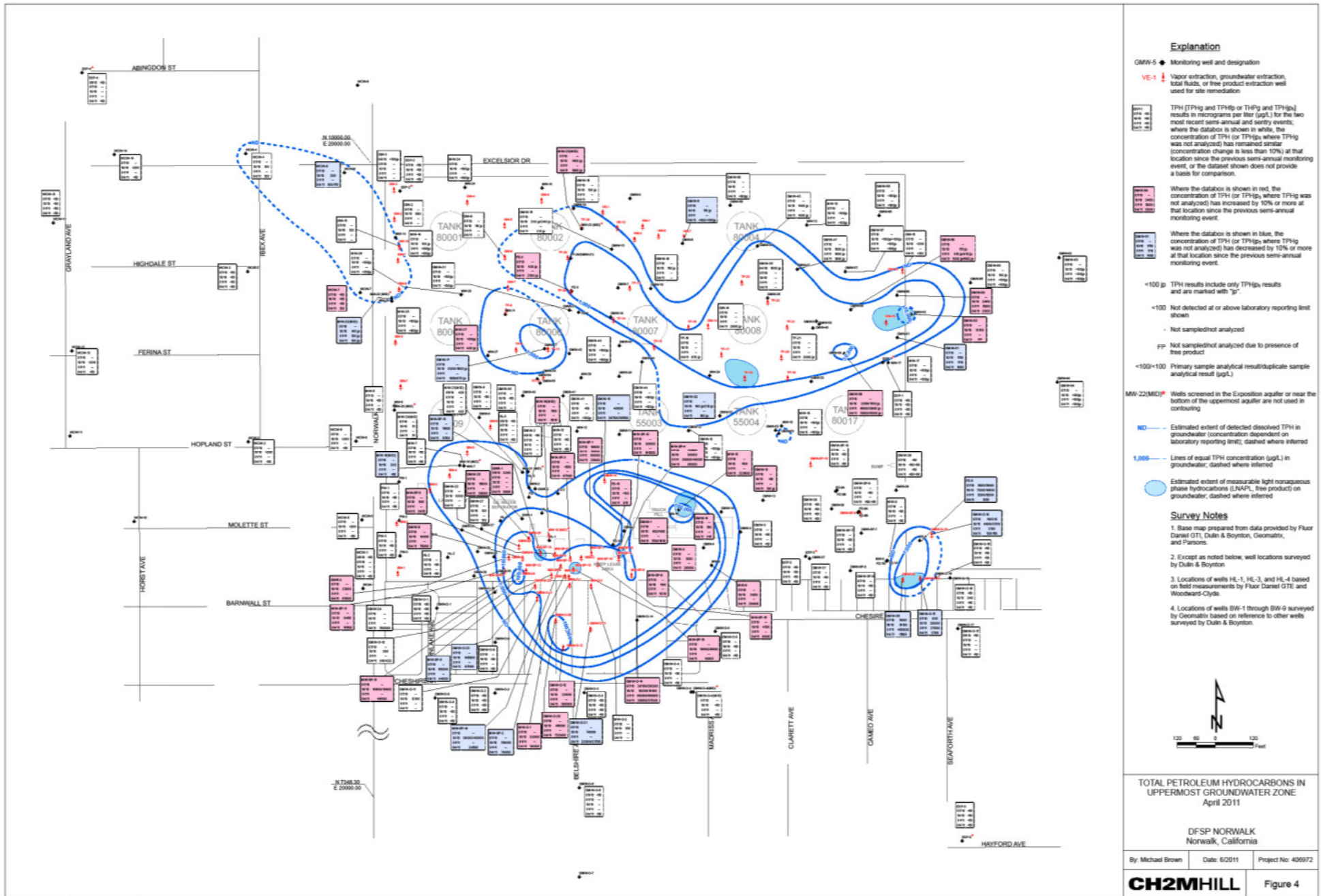
- Exposition Aquifer wells sampled:
 - EXP-1, -2, and -3 sampled twice by DLA Energy and SFPP
 - EXP-4 sampled once by SFPP
 - EXP-5 sampled twice by SFPP
- All analytical results were Non Detect (ND), except for the following:
 - MTBE and 1,-2 DCA were detected at EXP-3 in both SFPP and DLA energy split samples in January 2011, at concentrations below 1.0 ug/L near the laboratory reporting limit
 - MTBE and 1,-2 DCA were detected at EXP-3 in both SFPP and DLA energy split samples in April 2011, at concentrations below 1.3 ug/L near the laboratory reporting limit
- These types of low-level detections occasionally (infrequently) occur in the EXP wells but are generally not repeatable. SFPP and DLA Energy will continue to monitor the EXP wells and closely watch for any future potential detections.

First Semiannual 2011

Groundwater Monitoring Report

- Uppermost Aquifer Wells
 - In most areas, the lateral extents of TPH, benzene, MTBE, and 1-2-DCA in groundwater remain similar to those interpreted during recent previous monitoring events
 - TBA lateral extent decreased across site compared to October 2010 interpretation
 - Concentrations are influenced by water level fluctuations

Total Petroleum Hydrocarbons



Explanation

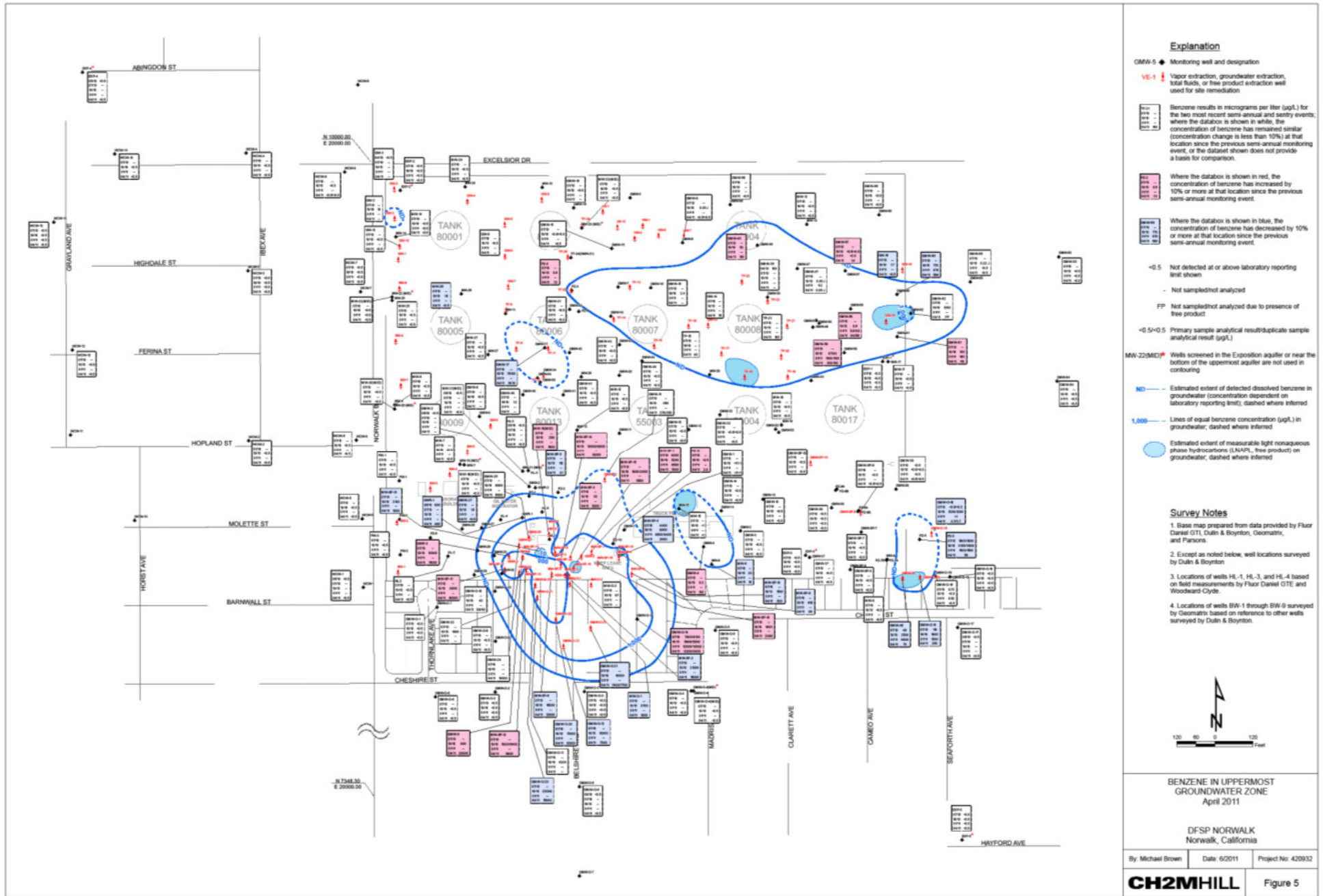
- GMW-5 Monitoring well and designation
 - VE-1 Vapor extraction, groundwater extraction, total fluids, or free product extraction well used for site remediation
 - TPH (TPHg and TPHlp or THp and TPHlg) results in micrograms per liter (µg/L) for the two most recent semi-annual and yearly events; where the databox is shown in white, the concentration of TPH (or TPHgs where TPHg was not analyzed) has remained similar (concentration change is less than 10%) at that location since the previous semi-annual monitoring event, or the databox shown does not provide a basis for comparison.
 - Where the databox is shown in red, the concentration of TPH (or TPHgs where TPHg was not analyzed) has increased by 10% or more at that location since the previous semi-annual monitoring event.
 - Where the databox is shown in blue, the concentration of TPH (or TPHgs where TPHg was not analyzed) has decreased by 10% or more at that location since the previous semi-annual monitoring event.
 - <100 µg TPH results include only TPHgs results and are marked with "g".
 - <100 Not detected at or above laboratory reporting limit shown
 - Not sampled/not analyzed
 - FF Not sampled/not analyzed due to presence of this product
 - <100-100 Primary sample analytical result/duplicate sample analytical result (µg/L)
 - MW-22(MD) Wells screened in the Exposition aquifer or near the bottom of the uppermost aquifer are not used in contouring
 - ND Estimated extent of detected dissolved TPH in groundwater (concentration dependent on laboratory reporting limit), dashed where inferred
 - 1,000 Lines of equal TPH concentration (µg/L) in groundwater, dashed where inferred
 - Estimated extent of measurable light nonaqueous phase hydrocarbons (LNAPL, free product) on groundwater, dashed where inferred
- ### Survey Notes
1. Base map prepared from data provided by Fluor Daniel GTI, Dulin & Boynton, Geomatrix, and Parsons.
 2. Except as noted below, well locations surveyed by Dulin & Boynton
 3. Locations of wells HL-1, HL-3, and HL-4 based on field measurements by Fluor Daniel GTE and Woodward-Clyde
 4. Locations of wells BW-1 through BW-9 surveyed by Geomatrix based on reference to other wells surveyed by Dulin & Boynton.

TOTAL PETROLEUM HYDROCARBONS IN
UPPERMOST GROUNDWATER ZONE
April 2011

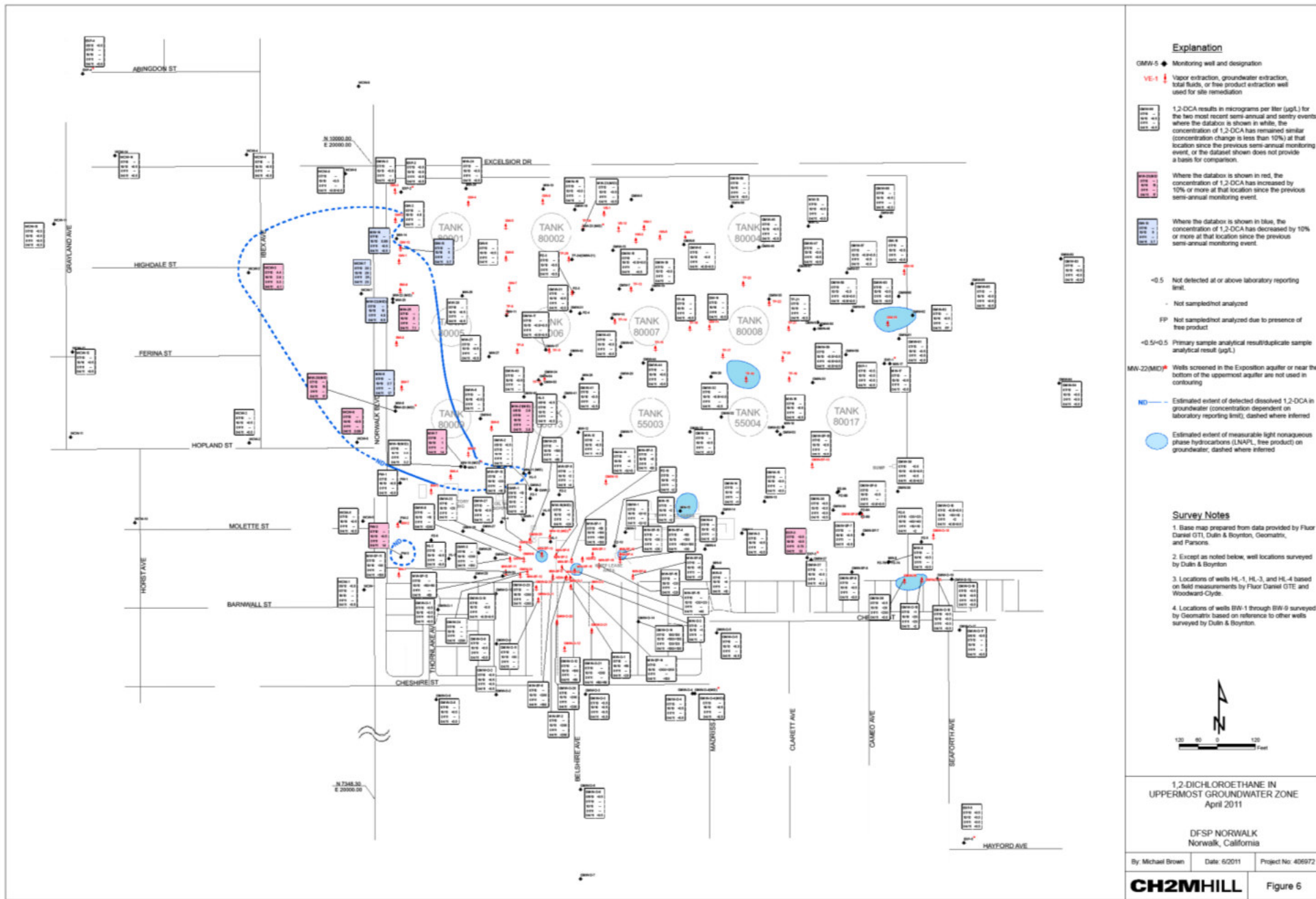
DFSP NORWALK
Norwalk, California

By: Michael Brown	Date: 6/2011	Project No: 406972
CH2MHILL		Figure 4

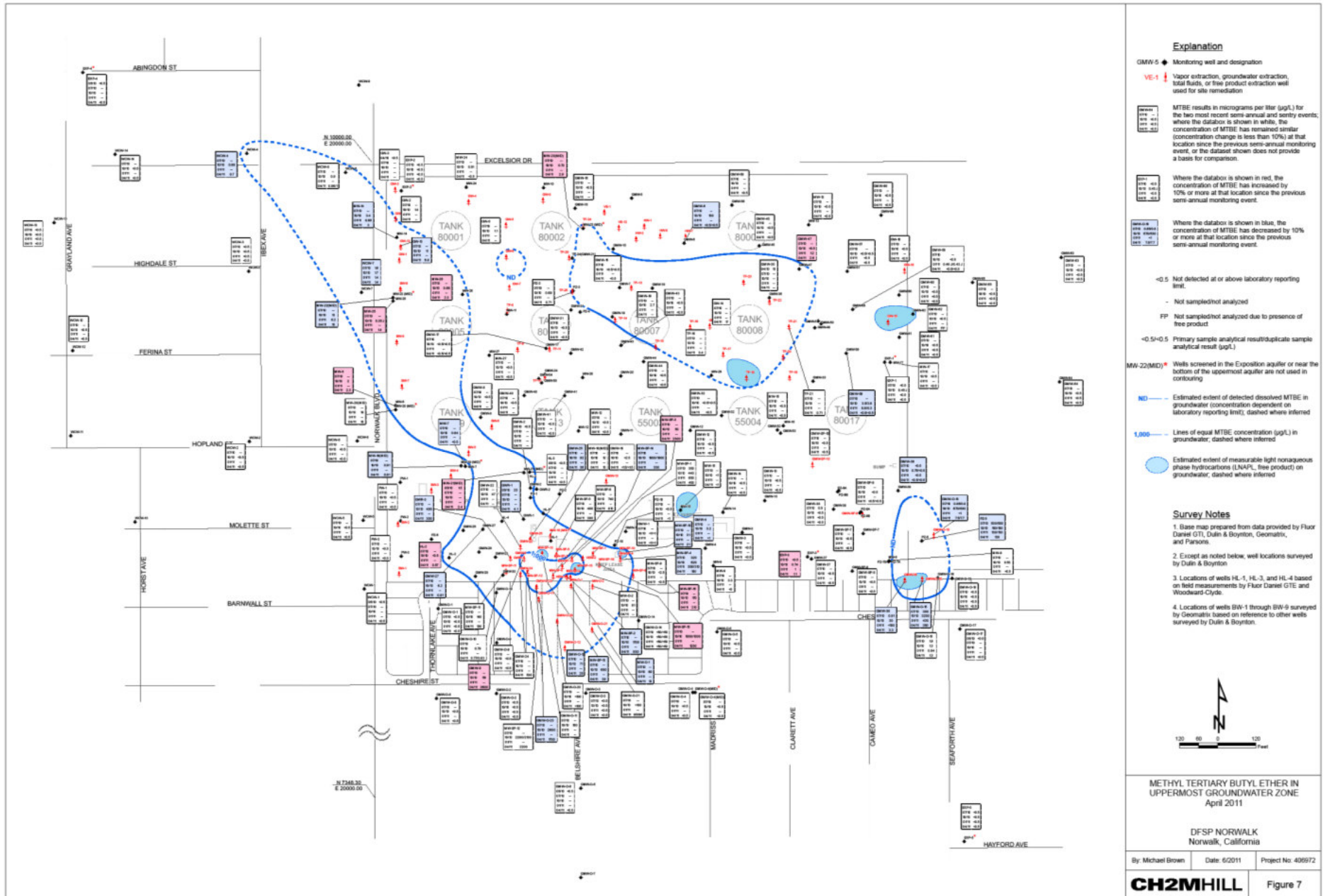
Benzene



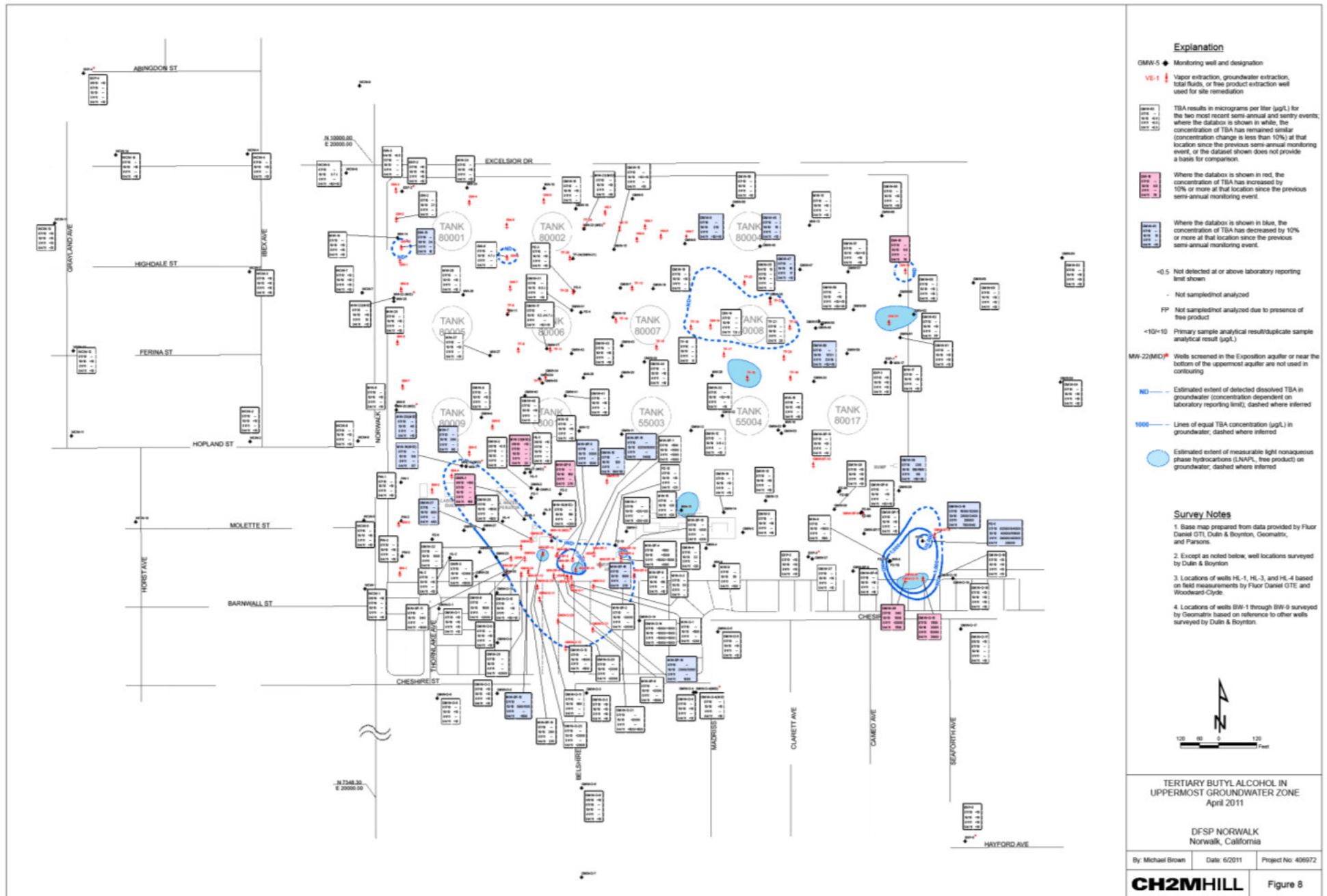
1,2-DCA



MTBE



TBA



Explanation

- GMW-5 ◆ Monitoring well and designation
- VE-1 ↓ Vapor extraction, groundwater extraction, total fluids, or free product extraction well used for site remediation
- | |
|--------------|
| 10000-100000 |
| 10000-100000 |
| 10000-100000 |
| 10000-100000 |

 TBA results in micrograms per liter (µg/L) for the two most recent semi-annual and sentry events, where the databox is shown in white, the concentration of TBA has remained similar (concentration change is less than 10%) at that location since the previous semi-annual monitoring event, or the dataset shown does not provide a basis for comparison.
- | |
|--------------|
| 10000-100000 |
| 10000-100000 |
| 10000-100000 |
| 10000-100000 |

 Where the databox is shown in red, the concentration of TBA has increased by 10% or more at that location since the previous semi-annual monitoring event.
- | |
|--------------|
| 10000-100000 |
| 10000-100000 |
| 10000-100000 |
| 10000-100000 |

 Where the databox is shown in blue, the concentration of TBA has decreased by 10% or more at that location since the previous semi-annual monitoring event.
- +0.5 Not detected at or above laboratory reporting limit shown
- Not sampled/not analyzed
- FP Not sampled/not analyzed due to presence of free product
- <10-10 Primary sample analytical result/duplicate sample analytical result (µg/L)
- MW-22(MD) Wells screened in the Exposition aquifer or near the bottom of the uppermost aquifer are not used in contouring
- ND Estimated extent of detected dissolved TBA in groundwater (concentration dependent on laboratory reporting limit), dashed where inferred
- 10000 Lines of equal TBA concentration (µg/L) in groundwater, dashed where inferred
- Estimated extent of measurable light nonaqueous phase hydrocarbons (LNAPL, free product) on groundwater, dashed where inferred

Survey Notes

1. Base map prepared from data provided by Fluor Daniel GTI, Dulin & Boynton, Geomatrix, and Parsons.
2. Except as noted below, well locations surveyed by Dulin & Boynton.
3. Locations of wells HL-1, HL-3, and HL-4 based on field measurements by Fluor Daniel GTE and Woodward-Clyde.
4. Locations of wells BW-1 through BW-9 surveyed by Geomatrix based on reference to other wells surveyed by Dulin & Boynton.

TERTIARY BUTYL ALCOHOL IN
UPPERMOST GROUNDWATER ZONE
April 2011

DFSP NORWALK
Norwalk, California

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CH2MHILL		Figure 8



Questions?