

MPE Operations and Shutdown Overview

GM Pontiac Centerpoint Campus West
AOI 53 - Building 33 - LNAPL Area 1
Pontiac, MI
September 8, 2008

Topics for Discussion

- Project Chronology
 - Investigation background
 - Remedial drivers
 - Remediation history
- MPE Shutdown Criterion
- Next Steps

Project Chronology – Investigation Background

- Identification
 - Fuel supply line supplying a fuel station south of Building 33 was found to be leaking in 1968/1969
 - Fuel line and fuel station abandoned in 1969 following discovery of leaking pipe, fuel lines capped
 - Subsurface petroleum impacts discovered in current work area in 1985 during geotechnical investigation for the expansion of Building 33

Project Chronology – Investigation Background

- Characterization
 - Product characterized as a mixture of gasoline and diesel-range hydrocarbons
 - Consistent with contents of historic underground fuel supply lines in area (gasoline, diesel, naphtha)
- Delineation
 - Initial delineation of LNAPL Area 1 completed in 2004
 - Follow-up work conducted in 2007 to refine delineation (concurrent with remediation)

Project Chronology – Remedial Drivers

- Observed in-well LNAPL thicknesses up to 10.2' (pre-MPE)
- Potential soil gas explosivity risk:
 - Well headspace LEL measurements
 - Calculations based on soil concentrations (volatilization of petroleum constituents from LNAPL into soil gas)
- Potentially significant exposures:
 - Volatilization from subsurface and potential vapor migration into indoor air

Project Chronology – Remediation History

- Total fluids recovery system operated between 1989-1991
 - 133 gallons recovered
- MPE pilot tested in 2004
 - 3,100 gallons recovered (50% liquid, 50% vapor)
- MPE full-scale implementation in 2006
 - 2,700 gallons recovered to date and following an asymptotic trend (5% liquid, 95% vapor)

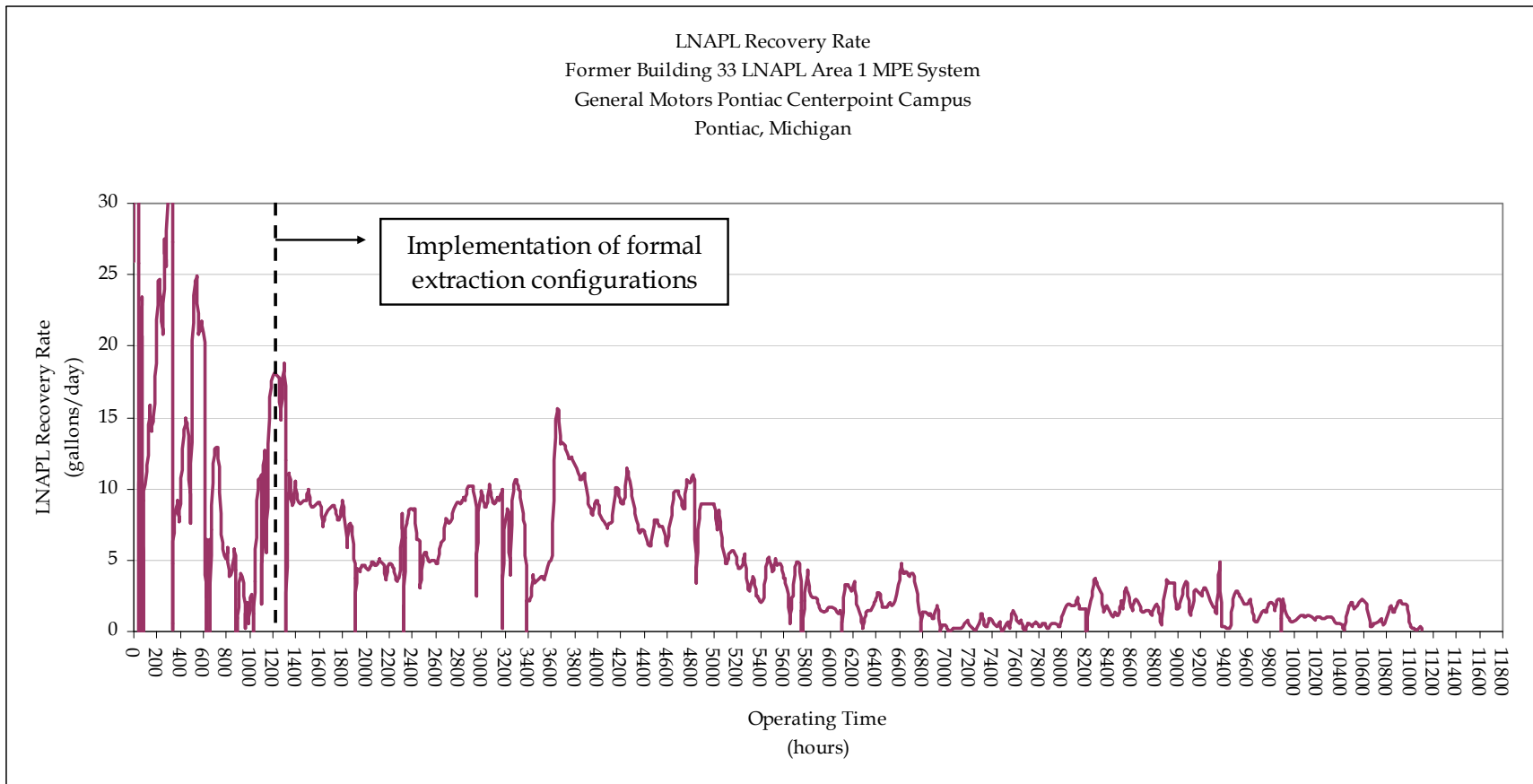
MPE Shutdown Criterion

- “Free-phase LNAPL will be removed to the extent practical where risk to human health is present”
 - Final Decision (U.S. EPA, 2006)
- “Operation of the system will be deemed complete when the recovery rate exhibits a sustained asymptotic trend. Following this point, further recovery with MPE technology will be impracticable. Remaining residual LNAPL will be assumed to be effectively unrecoverable.”
 - Corrective Measures Work Plan, Former Building 33, LNAPL Area 1 (CRA, 2006)

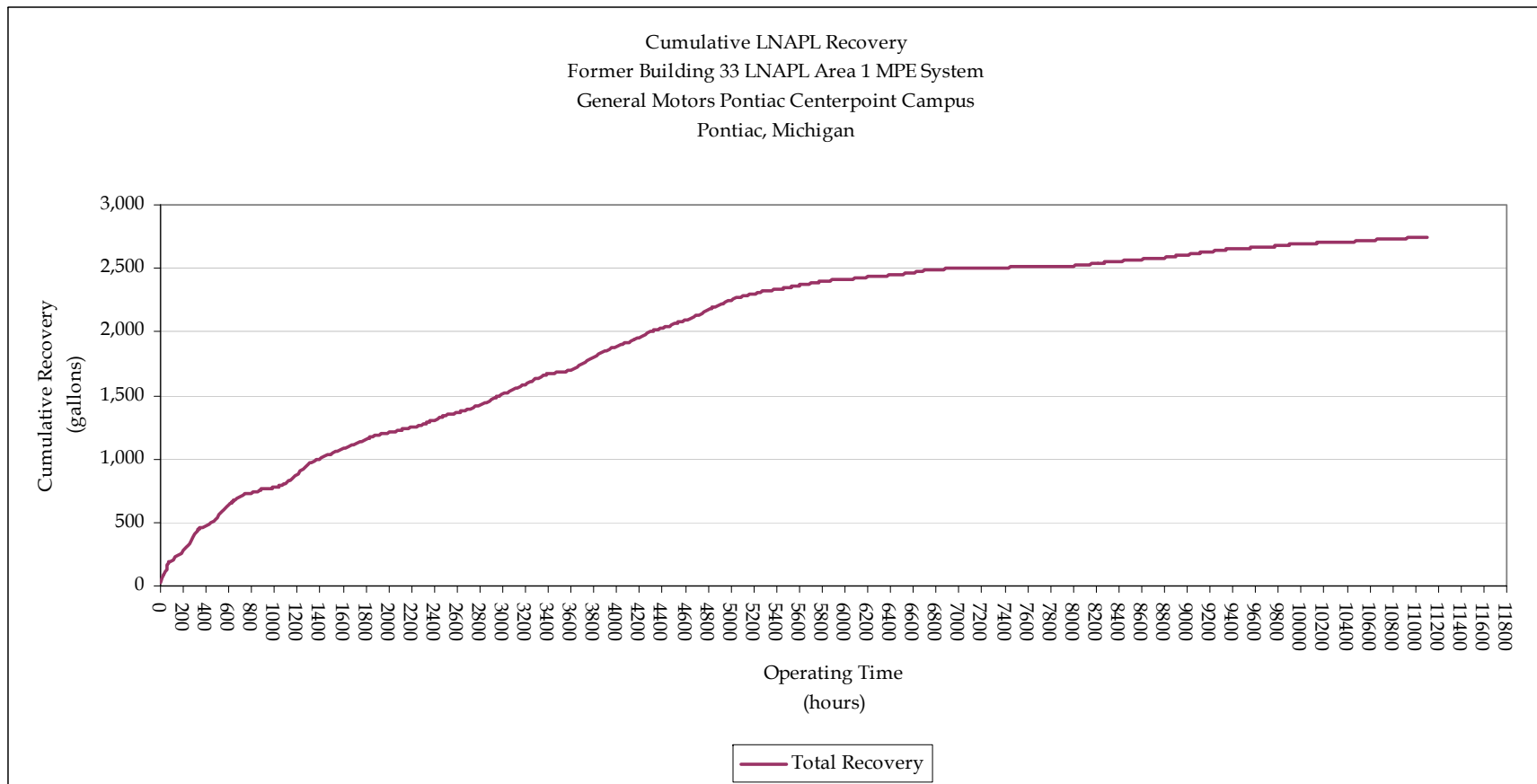
MPE Shutdown Criterion

- Asymptotic trend established by:
 1. Plot of cumulative recovery over time
 2. Plot of recovery rate over time

MPE Shutdown Criterion - Overall Recovery Rate



MPE Shutdown Criterion - Overall Cumulative Recovery



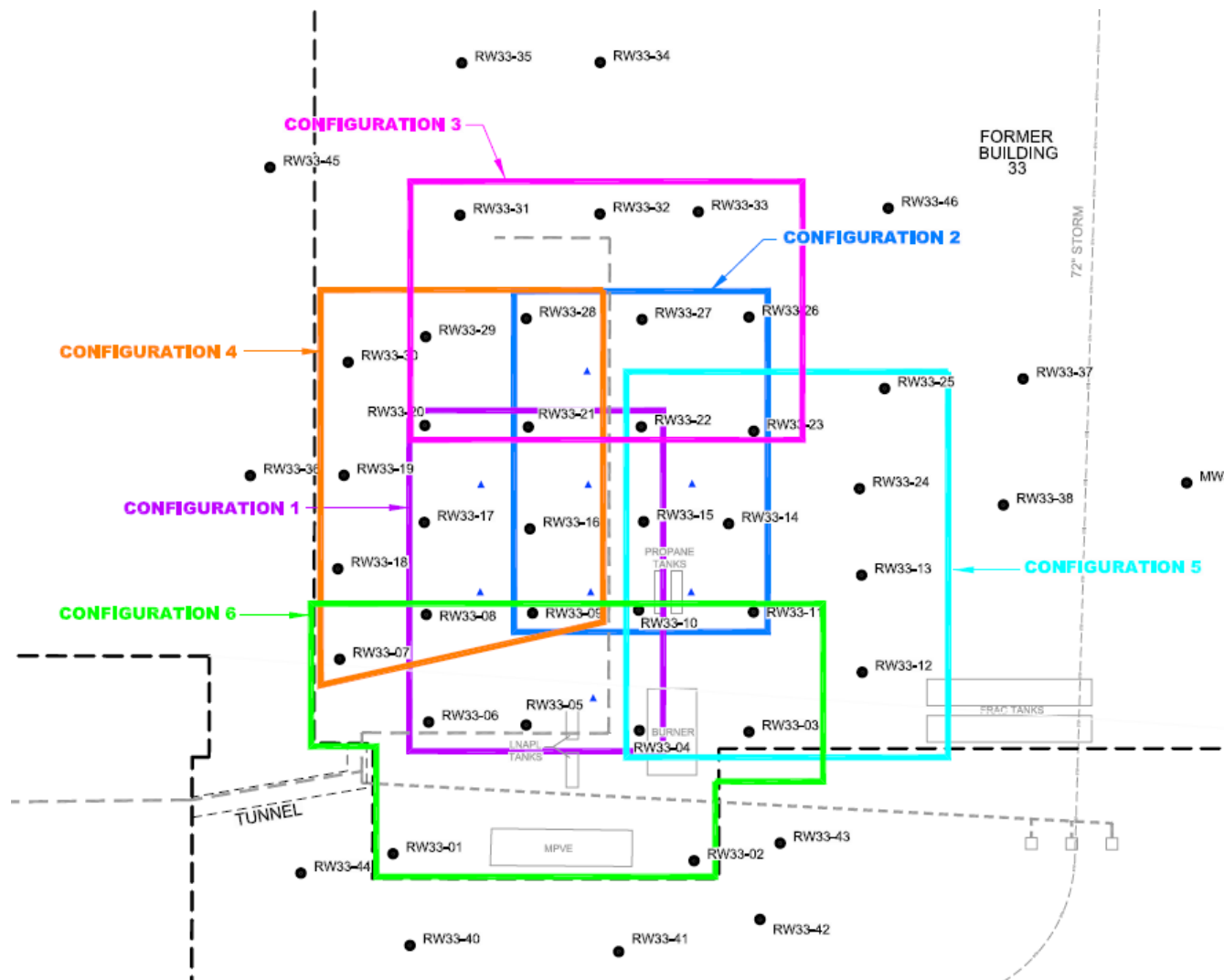
MPE Shutdown Criterion – Supporting Information

1. Operational strategy
2. System vacuum and hydraulic influence
3. System performance

MPE Operational Strategy

- Extraction network arranged into 6 different extraction configurations of 12 wells each
- Each configuration operated until recovery rate stabilized at a low level
- Each configuration operated twice in this manner
- All wells in extraction area operated multiple times (configurations overlap)

MPE Operational Strategy



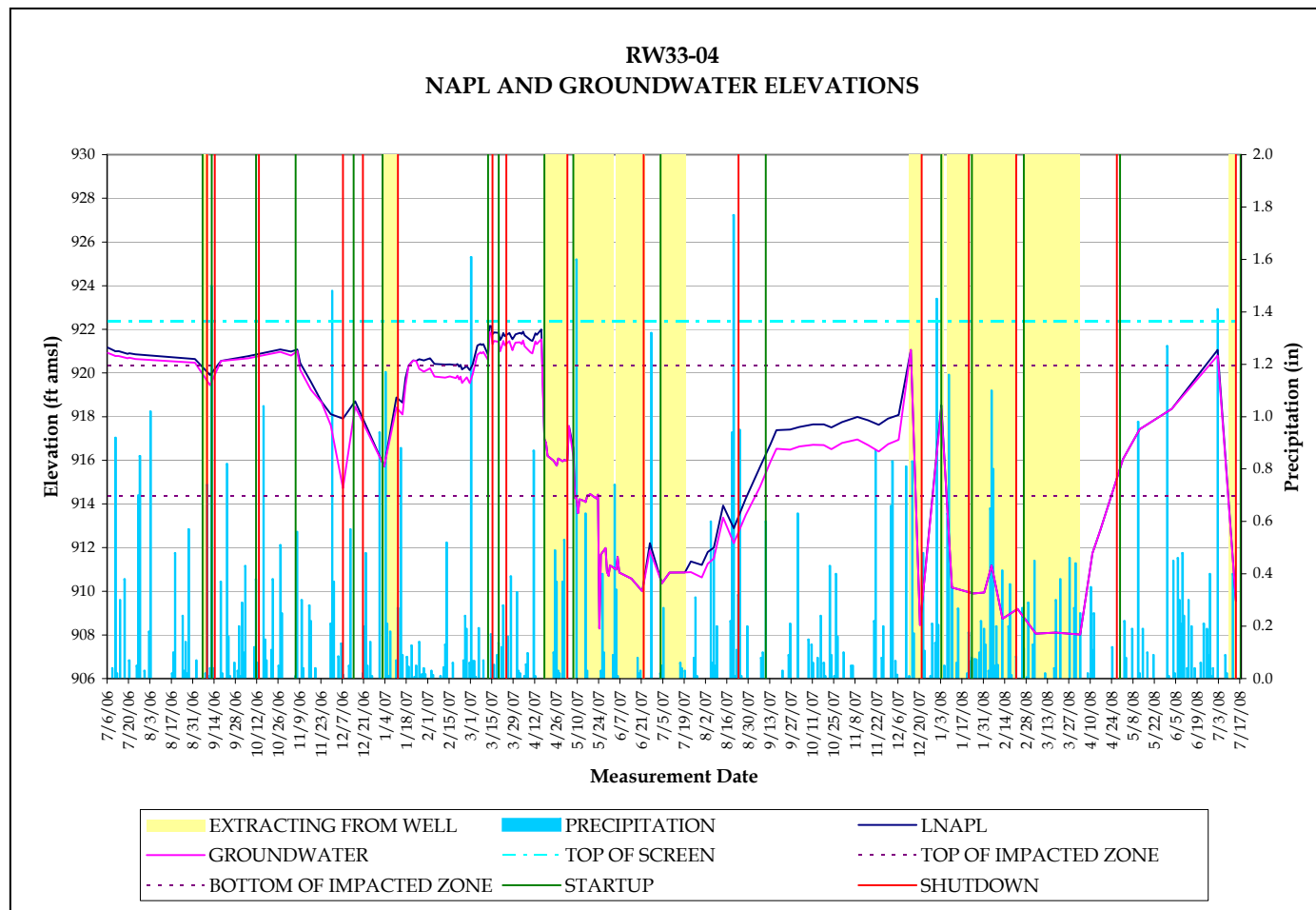
MPE System Influence

- High vacuum applied to all extraction wells over at least 2 extraction periods
- Average extraction wellhead conditions:
 - Vacuum = 14-18”Hg
 - Air flow = 70-110 acfm per well
- All extraction wells dewatered to below the lowest elevation of LNAPL impacts over at least 2 extraction periods
- Vacuum and hydraulic influence extended beyond the extraction area

MPE System Influence

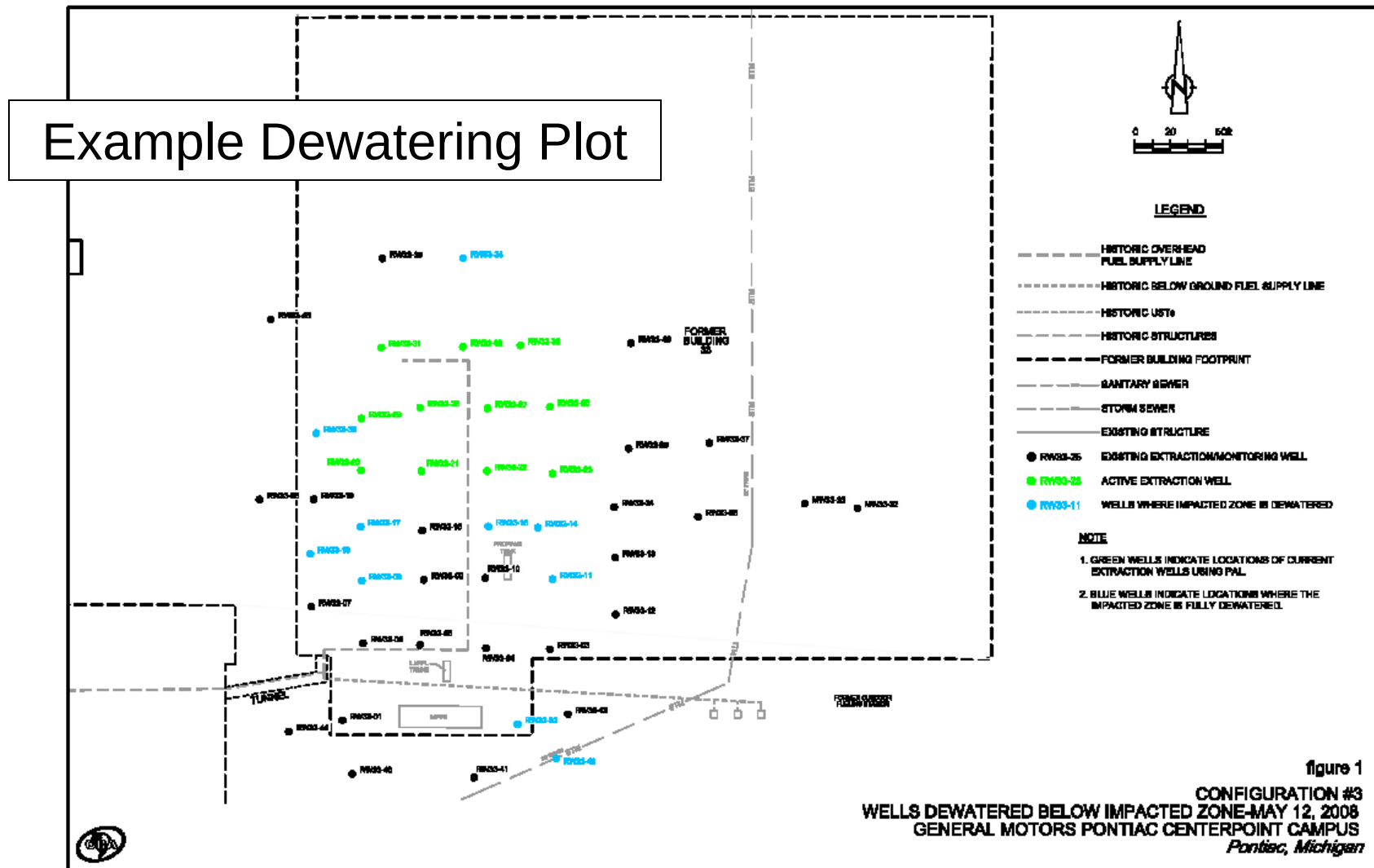
- Documentation:
 - Plots of in-well groundwater and LNAPL elevation monitoring data (with impacted zones shown for each well)
 - Groundwater elevation contour plots show hydraulic influence
 - Well headspace pressure contours show vacuum influence

MPE System Hydraulic Influence



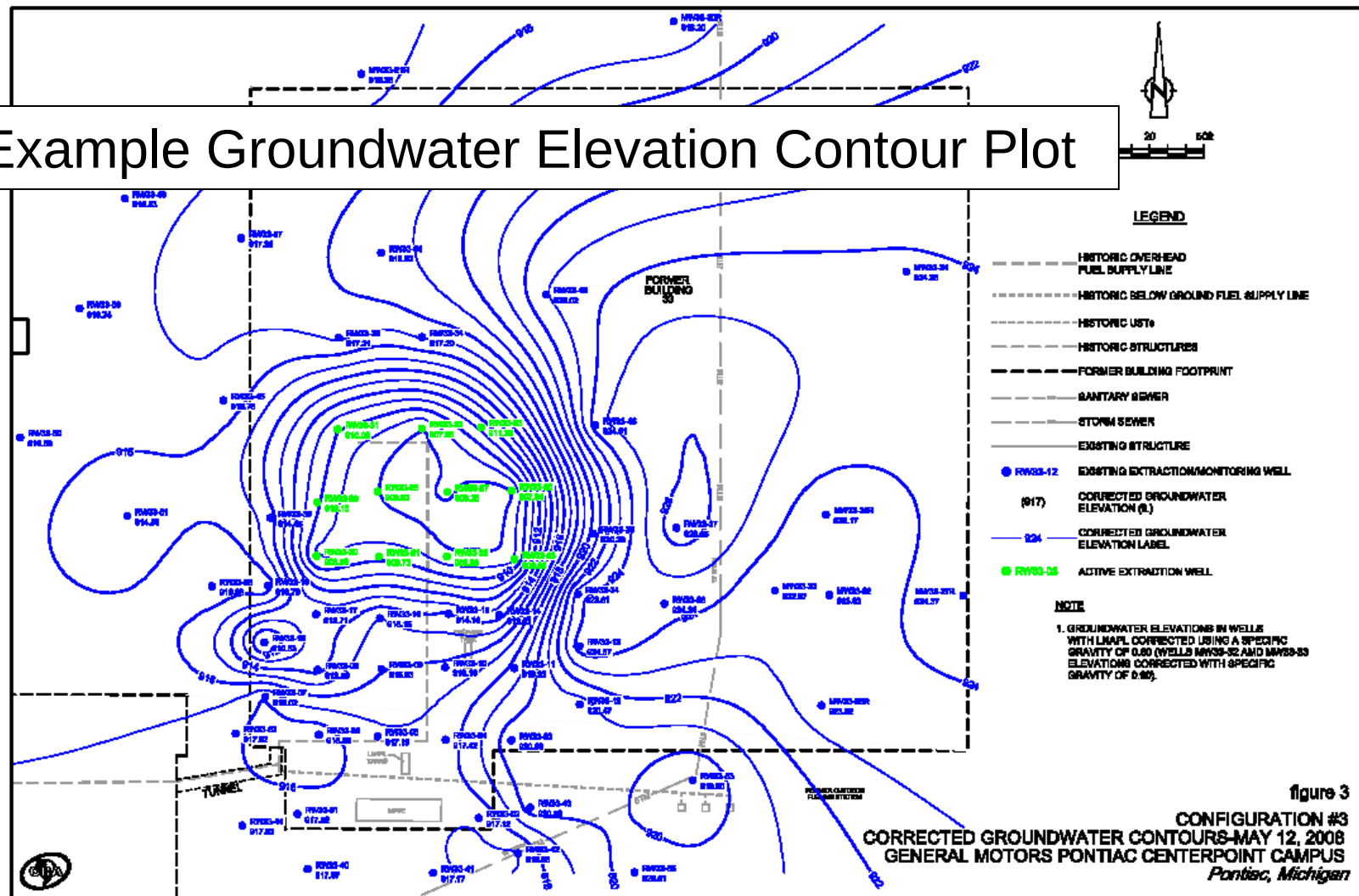
Example In-Well Groundwater and LNAPL Elevation Monitoring Graph

MPE System Hydraulic Influence



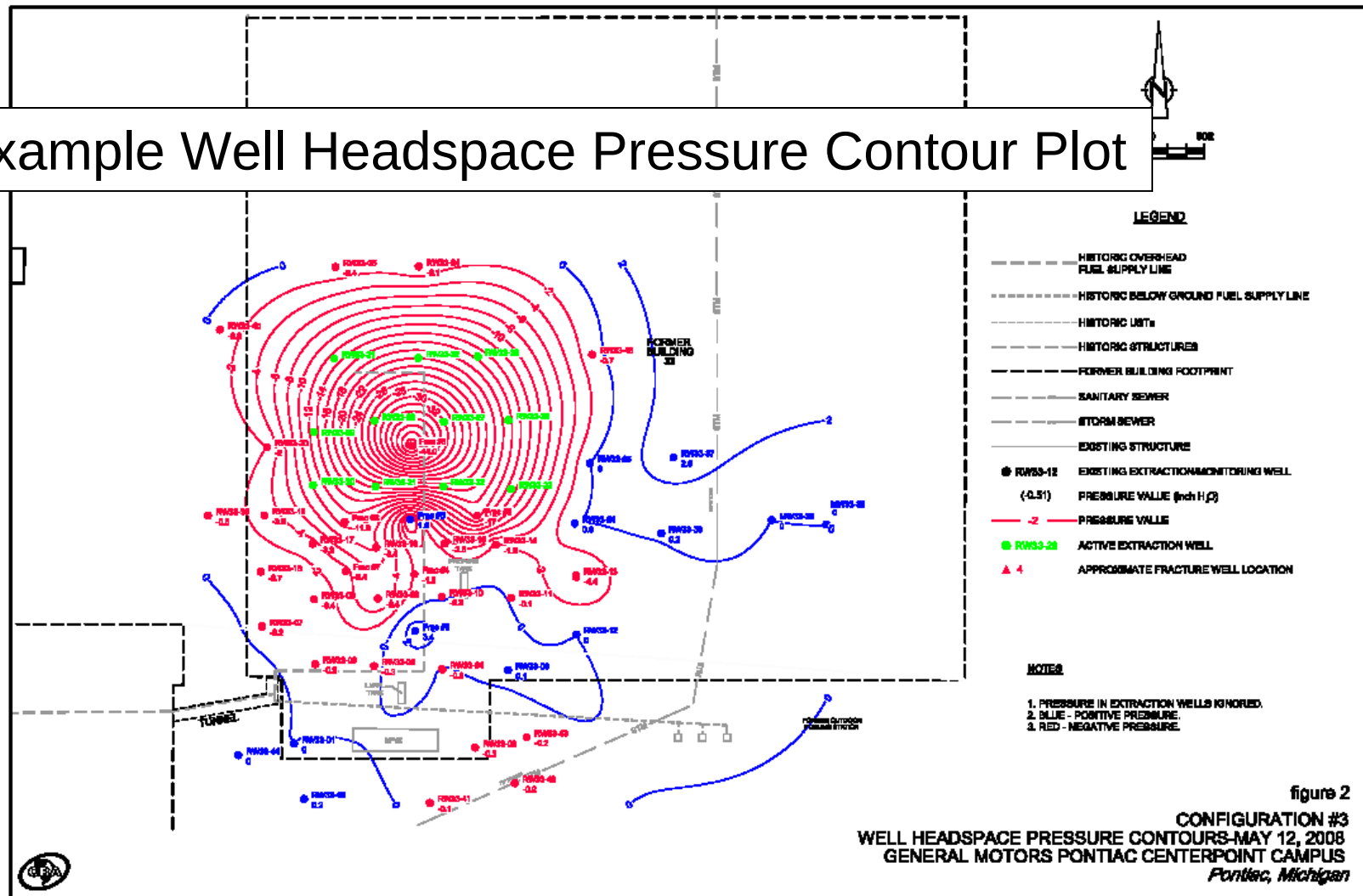
MPE System Hydraulic Influence

Example Groundwater Elevation Contour Plot



MPE System Vacuum Influence

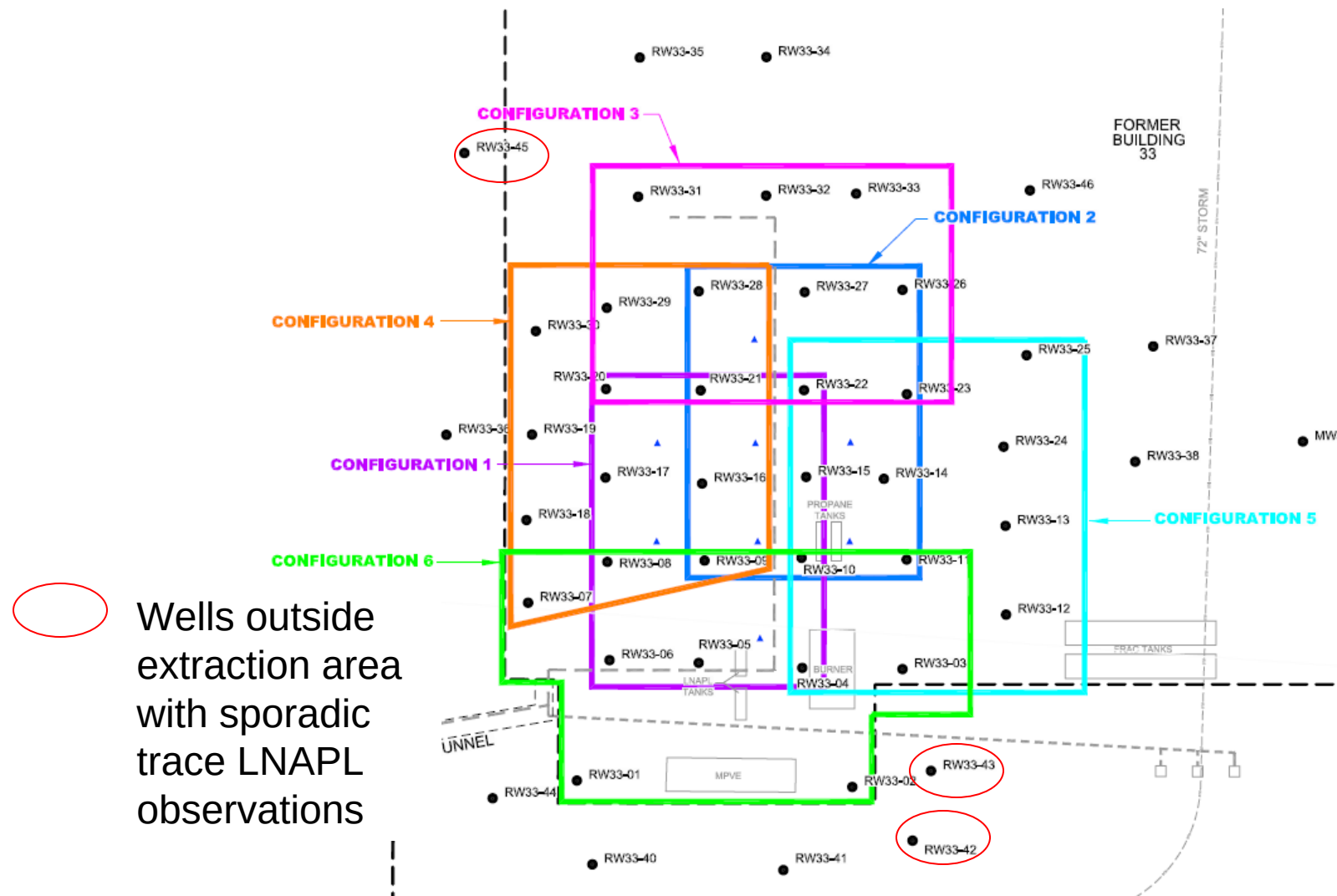
Example Well Headspace Pressure Contour Plot



MPE System Influence

- All wells with observed LNAPL have been extracted from with the exception of 3 wells with sporadic trace LNAPL observations: RW33-42, RW33-43 and RW33-45

MPE System Influence



MPE System Influence

- RW33-42:
 - LNAPL detected in 4 of 80 monitoring events
 - Maximum LNAPL = 0.10'
 - Current LNAPL = 0.01'
- RW33-43
 - LNAPL detected in 9 of 105 monitoring events
 - Maximum LNAPL = 0.01'
 - Current LNAPL = none
- RW33-45
 - LNAPL detected in 2 of 140 monitoring events
 - Maximum LNAPL = 0.01'
 - Current LNAPL = none
- System vacuum influence has been demonstrated at these 3 wells

MPE System Performance

- System performance:
 - Applied vacuum = 15-21”Hg
 - Air flowrate = 800-1,300 acfm
 - % up-time since Sept-06 = 64.7%
 - % up-time in last 6 months = 92.4%
- Documentation:
 - System data logging
 - System activity logs

Final MPE Operations

- After 2 complete extraction cycles, 2 week shutdown period
- Any wells exhibiting significant LNAPL layers following shutdown period may be targeted for one final extraction effort
- Extraction will be discontinued once the recovery rate stabilizes at a low level

MPE Shutdown Conclusions

- MPE shutdown is contingent on demonstrating an asymptotic recovery trend
 - The MPE system has met the end-point criterion (i.e., the MPE system has aggressively recovered what it can)
- Potential exposures post-MPE will be evaluated

Next Steps

- Post-MPE evaluation:
 - LNAPL, groundwater perimeter monitoring
 - Soil, groundwater, soil vapor sampling
 - Risk assessment
- Long-term monitoring:
 - Semi-annual groundwater monitoring
 - LNAPL perimeter monitoring
- Institutional controls to mitigate potential exposures from residual LNAPL (if necessary)