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Implementation and Optimization of Air Sparge/Soil Vapor Extraction System with Horizontal and Vertical Wells – a case study

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Presentation Outline

- Site History
- Site Conceptual Model
- Selecting a Remedial Technology
- Interim Measures and Pilot Tests
- Full Scale Implementation
- Implementation Challenges
- Results
- Conclusions

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Site History

- Active manufacturing facility – 1966 to present
- 180 acres
- 1.6 million square foot building and several outbuildings
- Multiple OUs and SWMUs
- Contaminants of concern
  - Chlorinated solvents
  - PNAs
  - Hydraulic oils/PCBs
  - VOCs
  - Heavy metals

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Site History –
Former UST Farm

- Former UST Farm
  - 16 USTs (730 to 15,000 gallons)
  - Fuels, waste paints and solvents
- History
  - Previous activities removed a number of tanks
  - Process utility lines not removed or abandoned
  - Interim remedial actions
    - Passive recovery
    - Vacuum enhanced recovery

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Conceptual Site Model

- Geology
- Hydrogeology
- Contaminant concentrations
- Extent of impacts

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Conceptual Site Model –
Geology

- Profile orientation
  - North to South

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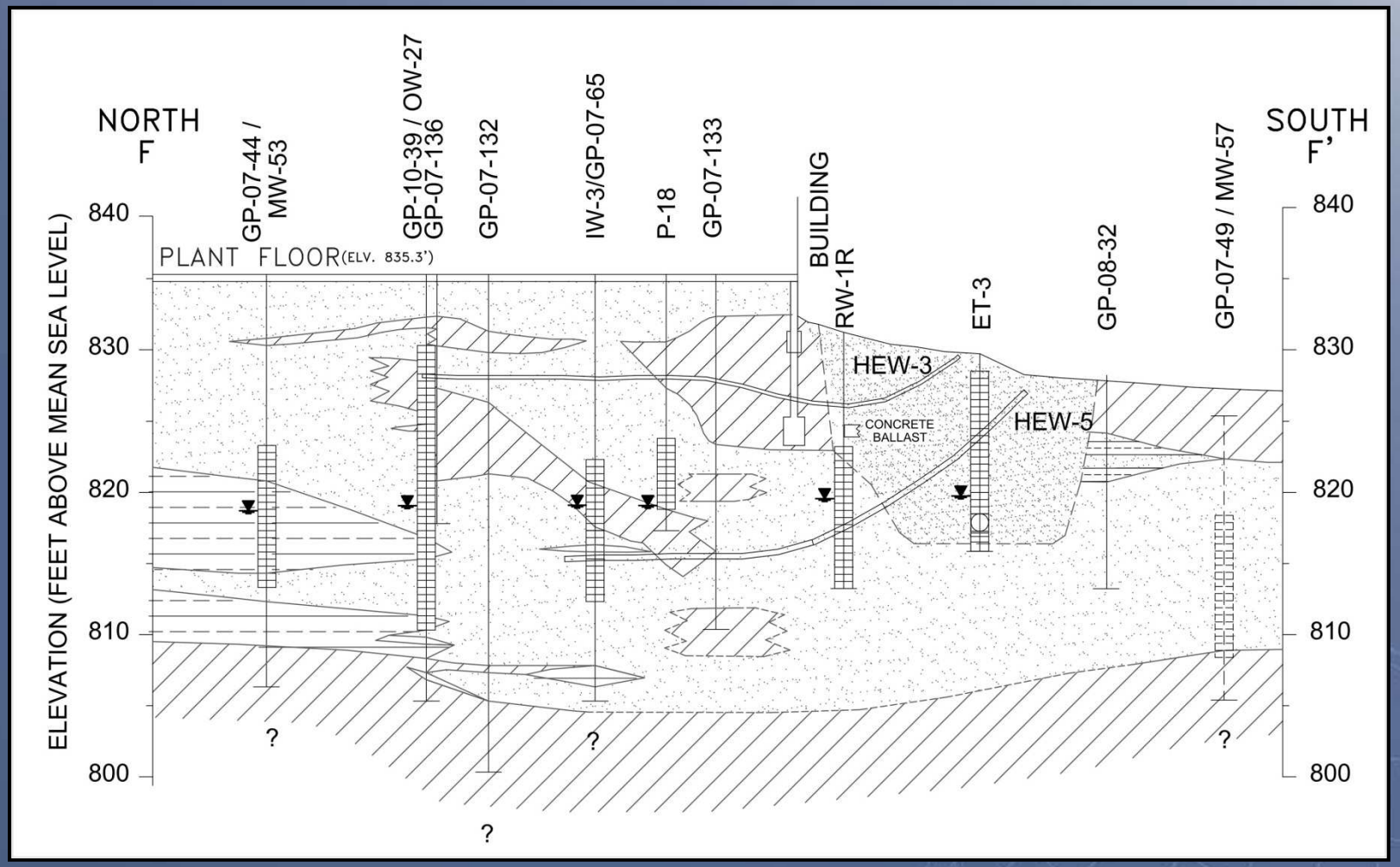
Conceptual Site Model –
Geology



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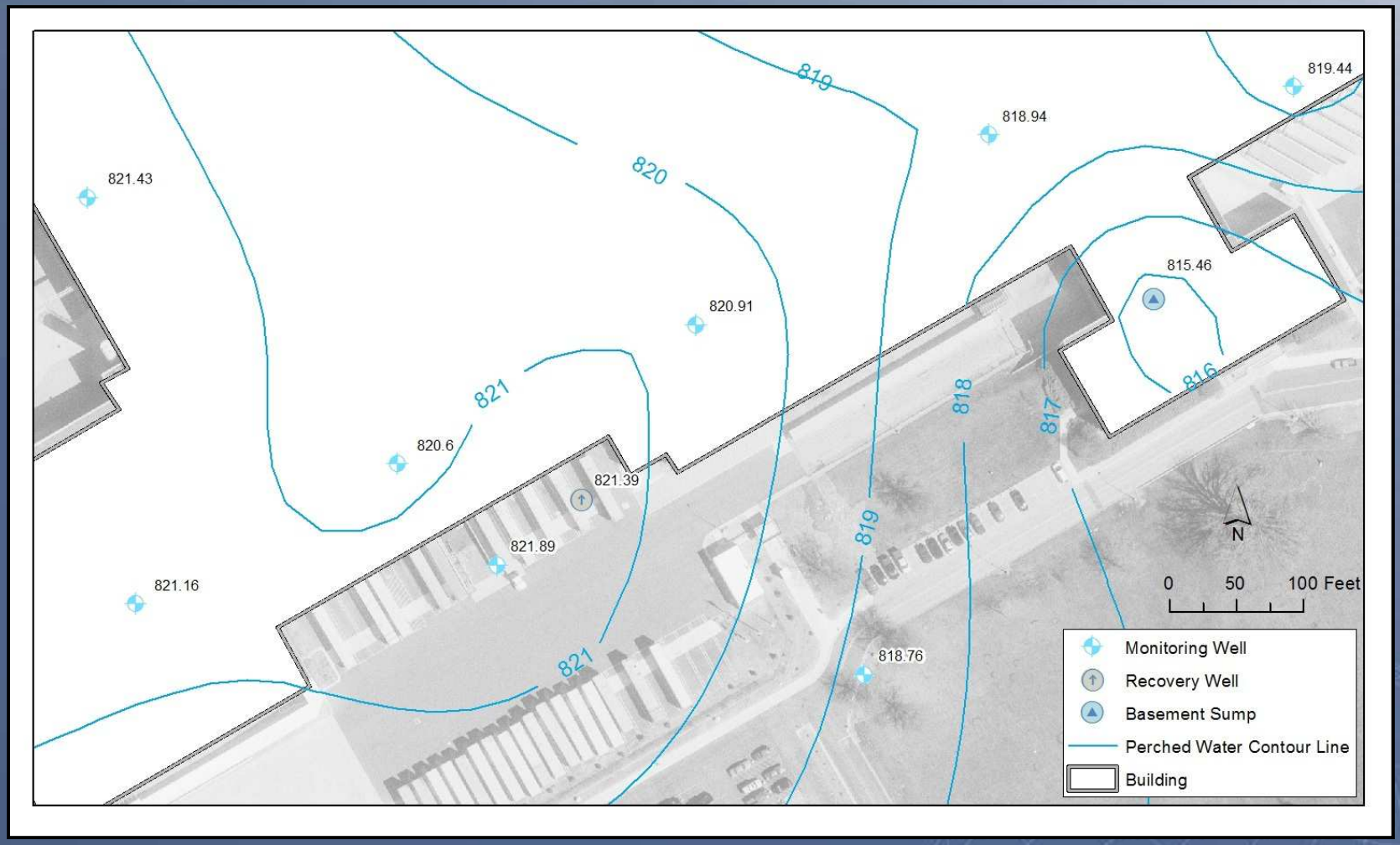
Conceptual Site Model –
Hydrogeology



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Conceptual Site Model –
Concentrations in Perched Water

Contaminant of Concern	Maximum Detected Concentration (µg/L)	Cleanup Standard (µg/L)
Acetone	**11,000,000**	2,100
Benzene	51	5
Cis-1,2-DCE	645	70
Ethylbenzene	7,900	74
MEK	**5,200,000**	38,000
MIBK	55,000	5,200
TCE	180	5
1,2,4-TMB	96	63
Toluene	410,000	790

Total Mass: ~17M ug/L

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Conceptual Site Model –
Concentrations in Soil

Contaminant of Concern	Maximum Detected Concentration (µg/Kg)	Cleanup Standard (µg/Kg)
Acetone	**1,000,000**	15,000
Benzene	130	100
Ethylbenzene	690,000	1,500
MEK	240,000	260,000
Methylene Chloride	150	100
PCE	190	100
1,2,4-TMB	2,000	2,100
Toluene	**3,000,000**	16,000

Total Mass: ~5M ug/Kg

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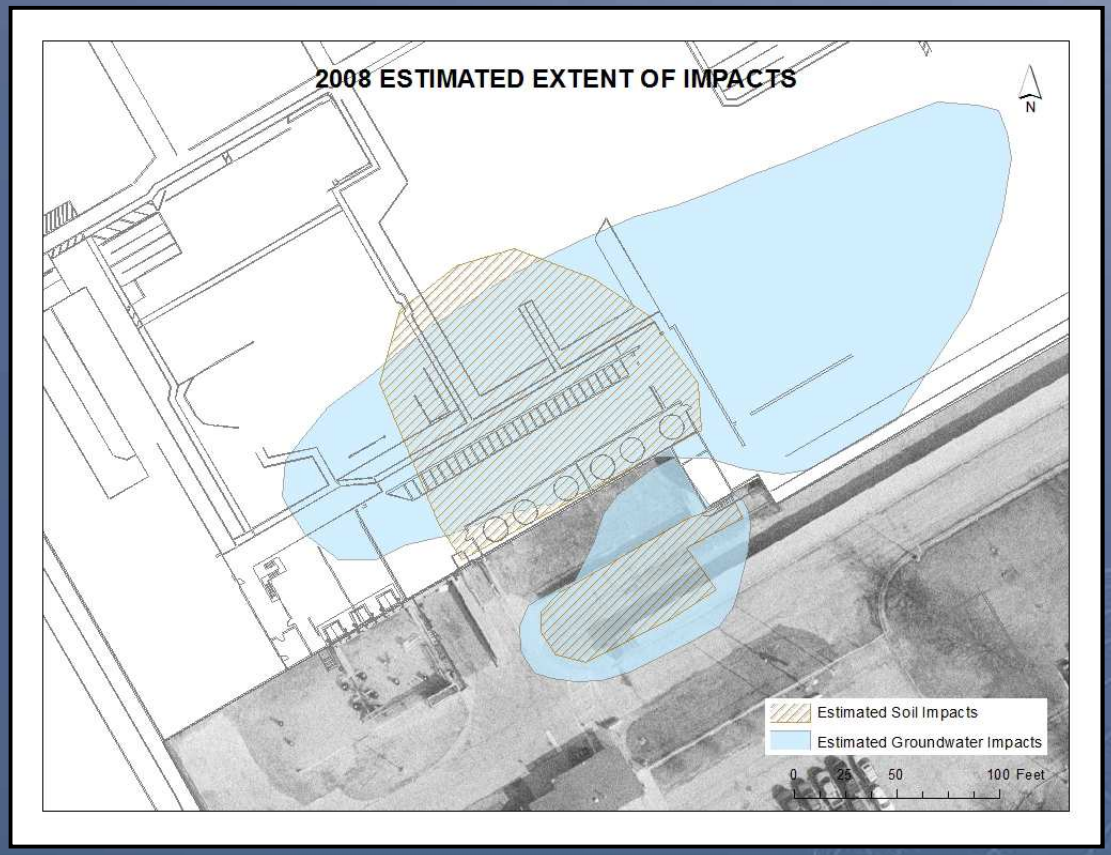
Conceptual Site Model –
Contaminant Extent in Perched Water and Soil

- Lateral Extent soil impacts: ~0.42 acres
- Lateral extent of perched water impacts: ~1.1 acres



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Selecting a Remedial Technology

- Completed a Corrective Action Matrix (CAM)
- Technologies evaluated against metrics
  - Threshold Criteria
  - Balancing Criteria
- Other metrics
  - Site end use
  - Stakeholder's additional remedial objectives
  - Identification and screening of remedial technologies
  - Media specific corrective measures standards

Selecting a Remedial Technology

- Remediation technologies evaluated
  - Institutional Controls
  - Containment
  - Removal and Offsite Disposal and/or Alternate Discharge
  - Ex-Situ Treatment
  - In-Situ Treatment

Selecting a Remedial Technology –
Corrective Action Matrix Results

- Soil
  - SVE
  - Excavation with offsite disposal*
- Perched Water
  - Extraction with onsite treatment and POTW discharge
  - Extraction with onsite treatment and NPDES discharge
  - Air Sparge
  - Bioremediation
  - Chemical oxidation
- Interim Measures* vs. Pilot Testing

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Interim Measures and Pilot Tests

- Interim Measures
  - Source excavation*
    - Excavation of tanks, soil and dewatering
    - Installed perched water recovery trench
    - Abandoned tank in place (under building)
  - Vacuum enhanced recovery
- Pilot Tests
  - ISCO desktop study for perched water
    - Data was not supportive of full scale
    - Access to plant floor was limited

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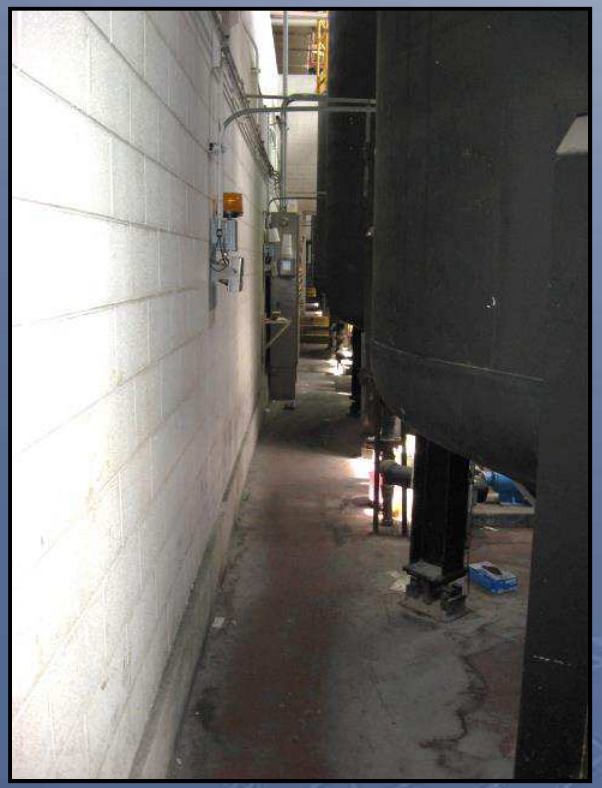
Interim Measures –
Source Removal



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Interim Measures –
Utility Relocation

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Implementation Challenges

- Active manufacturing plant
  - Interior – multiple obstacles
  - Exterior – truck parking, traffic
- Multiple stakeholders
- Security issues
- Plant projects
  - Scheduling
  - plant re-configuration and construction projects
  - Utility relocation and re-installation (water, gas, fire line, electric)
- Existing above and below grade infrastructure

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Results of Pilot Testing and Selection of Remedial Technology

- Combined Remedial Technology Selected
  - SVE/AS using Horizontal Wells
  - SVE/AS data indicated good zone of influence
- Remedial Technology Not Selected
  - Groundwater extraction with onsite treatment and POTW discharge
  - Groundwater extraction with onsite treatment and NPDES discharge
  - Bioremediation

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Full Scale Implementation

Horizontal Well Installation

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Full Scale Implementation
Horizontal Well Installation

- SVE Horizontal Well - April 2010
  - 150’ total length
    - 130’ of 3” 304SS screen
      - 64 slots/foot (0.012” x 1.5”)
    - 20’ of 3” SS casing
    - ~7’ below plant floor (final elevation)
- AS Horizontal Well – November 2010
  - 130’ total length
    - 60’ 4” SS screen
      - 80 slots/foot (0.012” x 1.5”)
    - 70’ 4” SS casing
    - ~18’ below plant floor (final elevation)

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Full Scale Implementation – *SVE/AS*

- System Details
  - Roots Rotary Blowers
    - SVE max extraction rate 450 cfm with typical operation rate at 350 cfm
    - AS max flow rate 150 cfm with typical operation rate at 30 cfm
  - 80 gallon internal KO tank
  - 300 gallon external KO tank
  - 3 carbon vessels used in series

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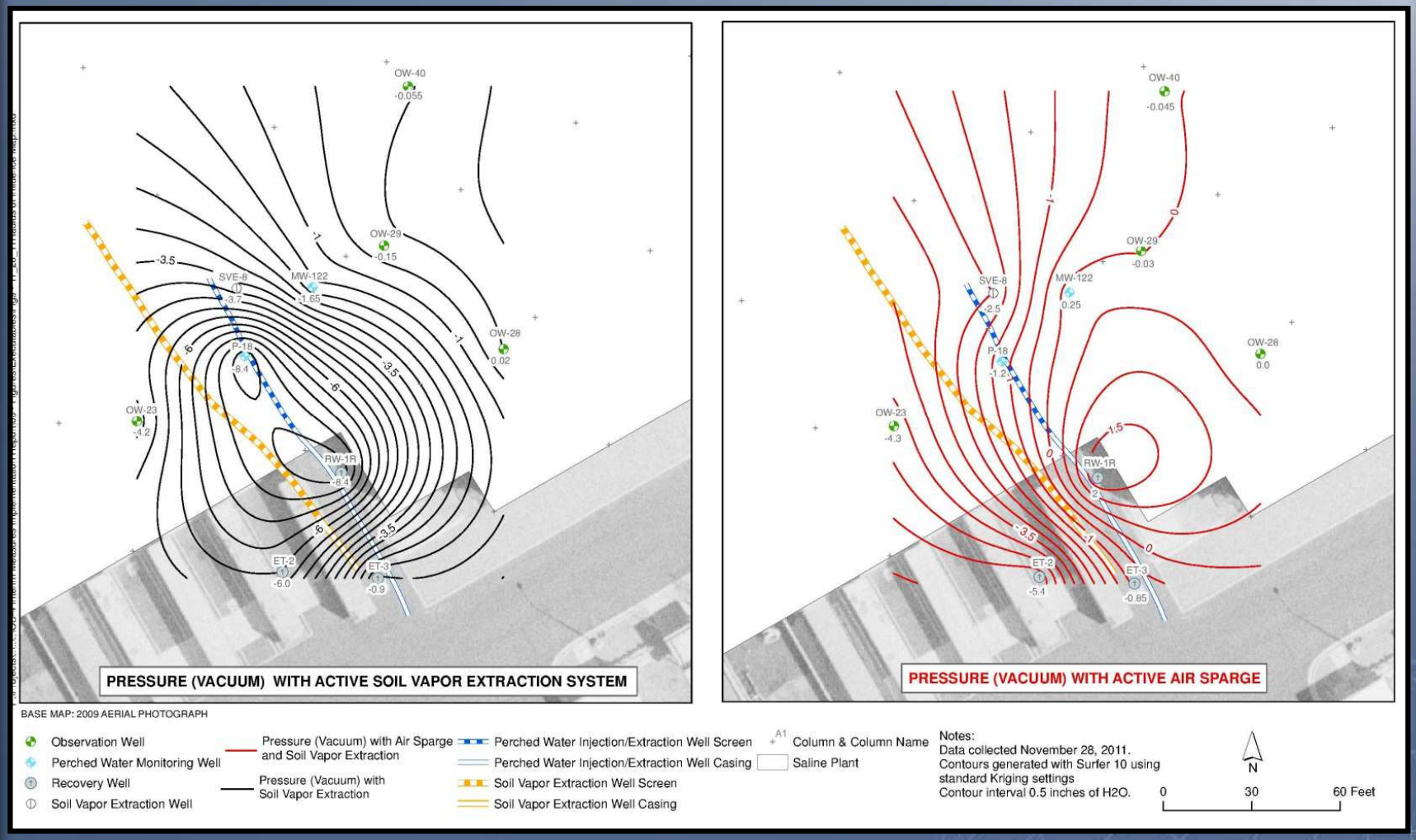
Radius of Influence
SVE/AS with Horizontal Wells



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Full Scale Implementation – *SVE/AS*

- Installation of vertical SVE wells in January 2012
  - 3 interior vertical SVE wells
  - 2 exterior vertical SVE wells
- Interior plant reconfiguration
  - Required 4 changes to interior SVE vertical wells
  - System down time

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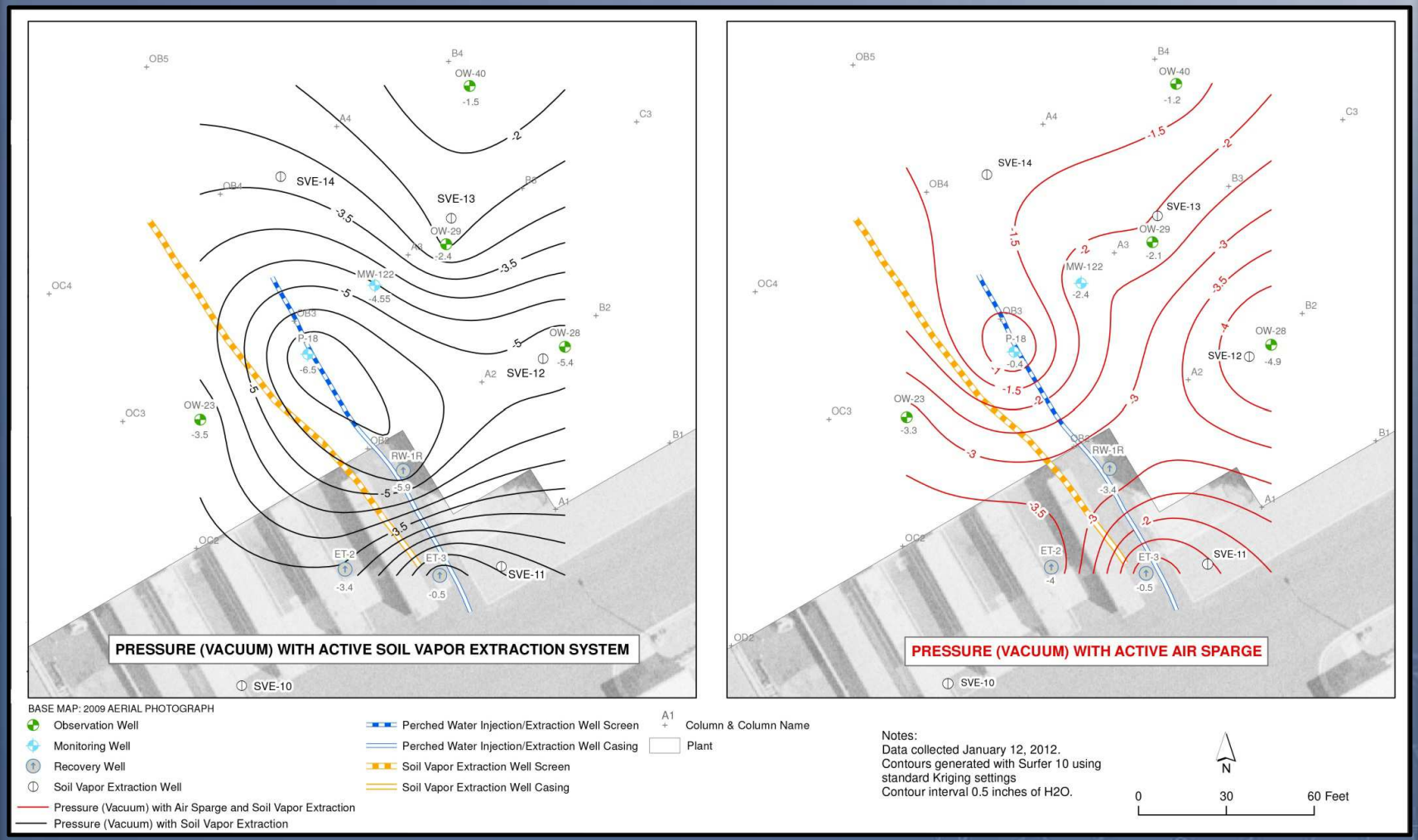
Radius of Influence

SVE/AS with Horizontal and Vertical Wells



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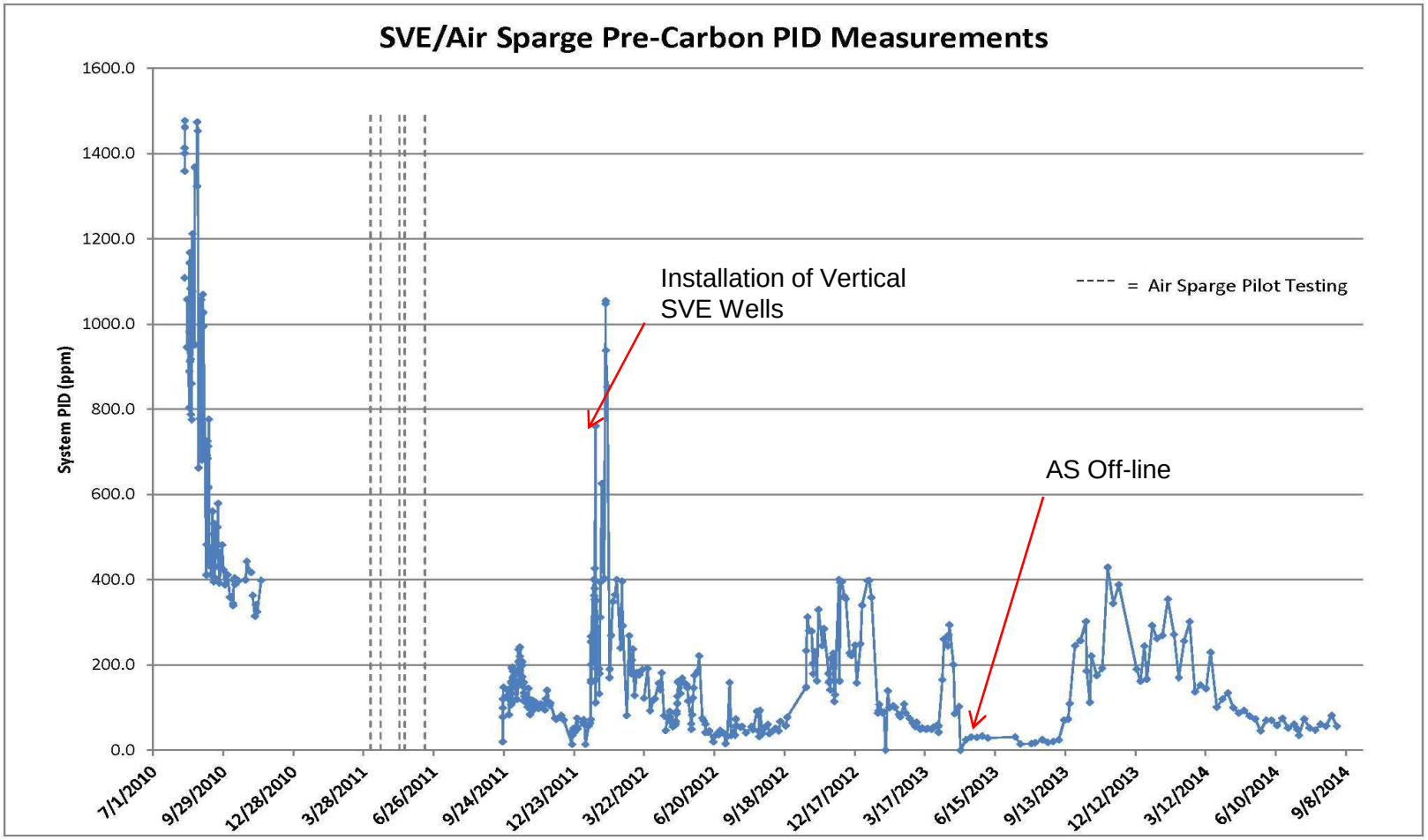
Results –
SVE/AS with Horizontal Wells



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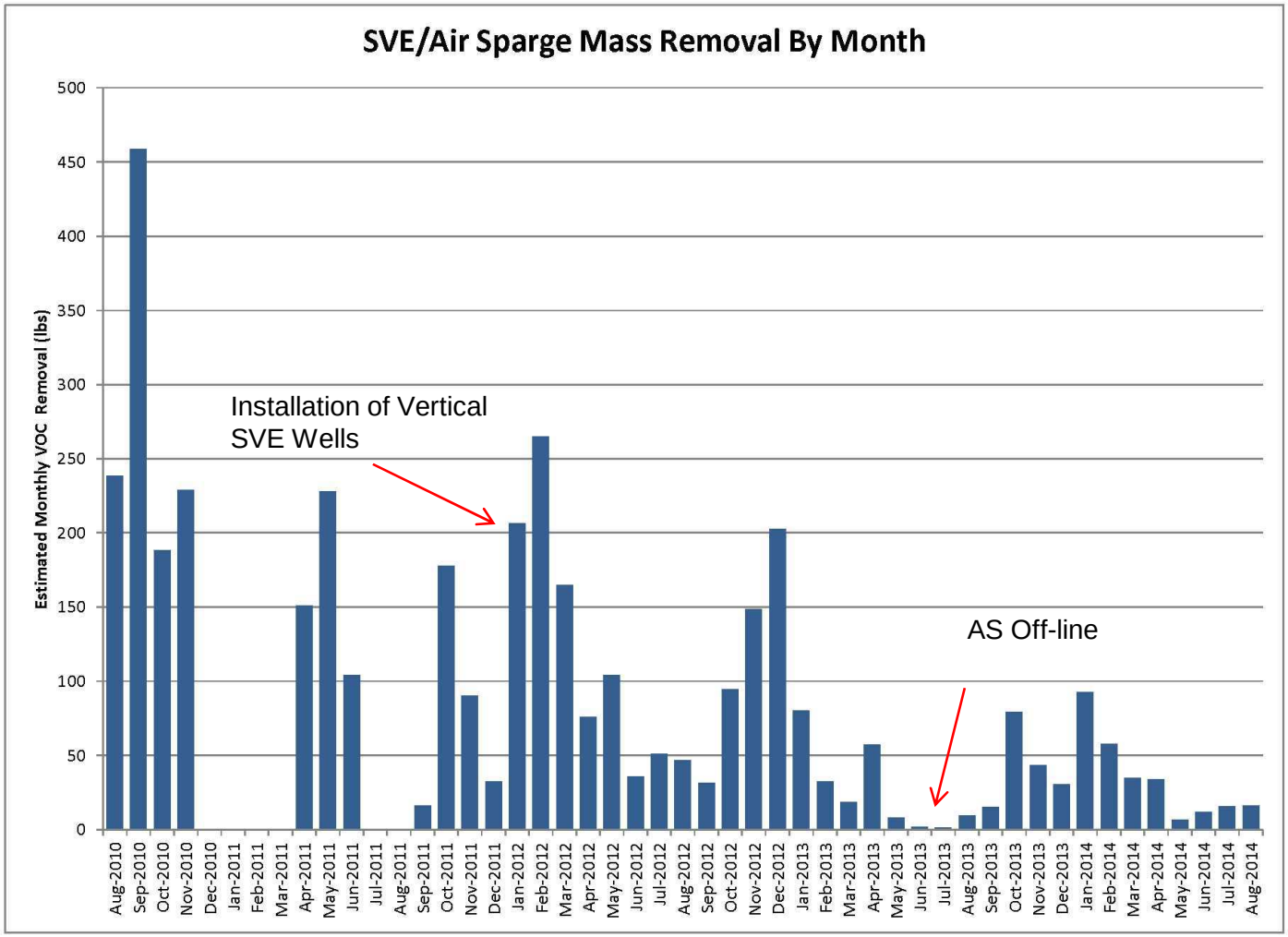
Results –
SVE/AS with Horizontal Wells



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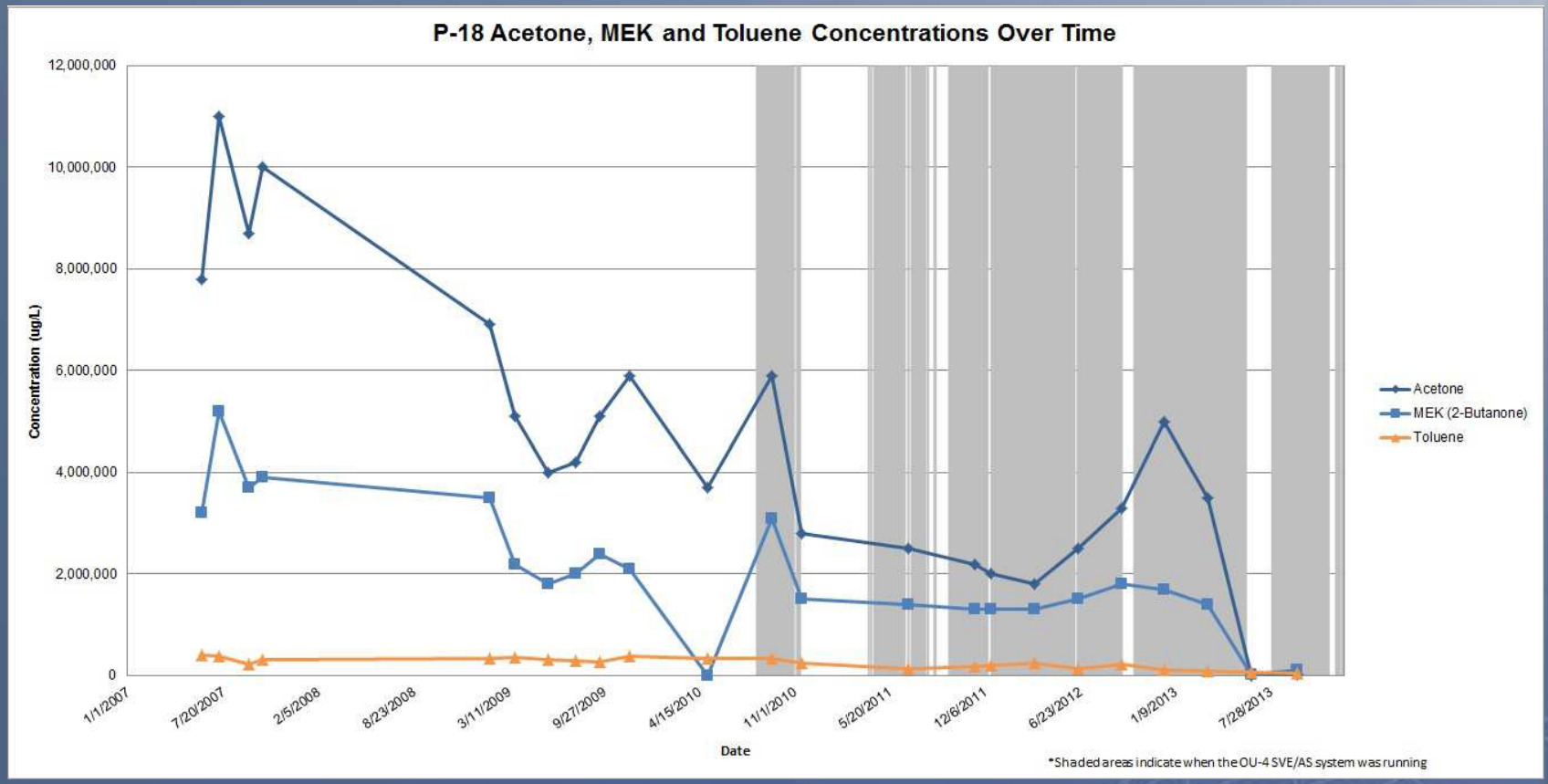
Groundwater Results - *SVE/AS with Horizontal Wells*



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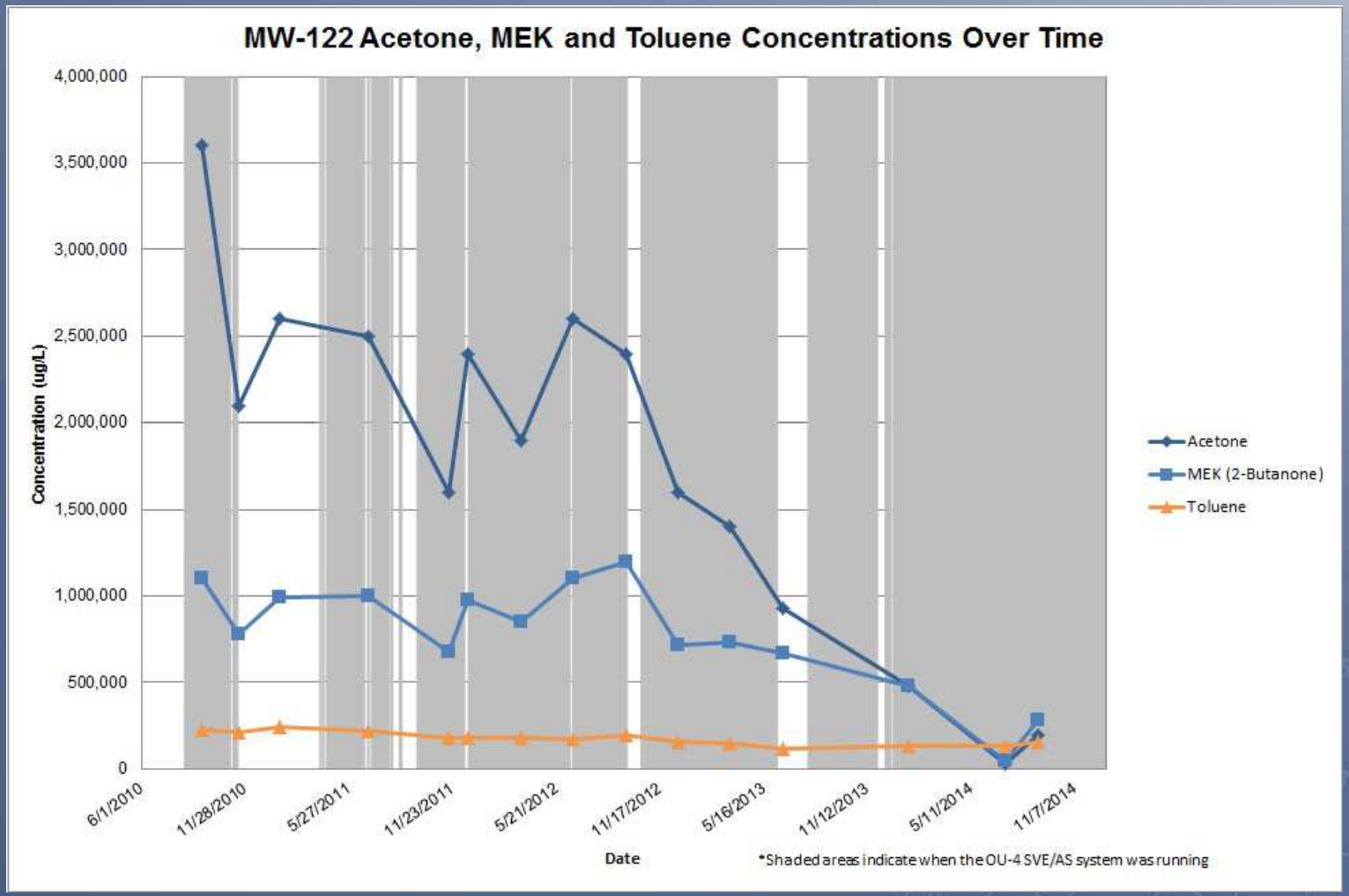
Groundwater Results - *SVE/AS with Horizontal Wells*



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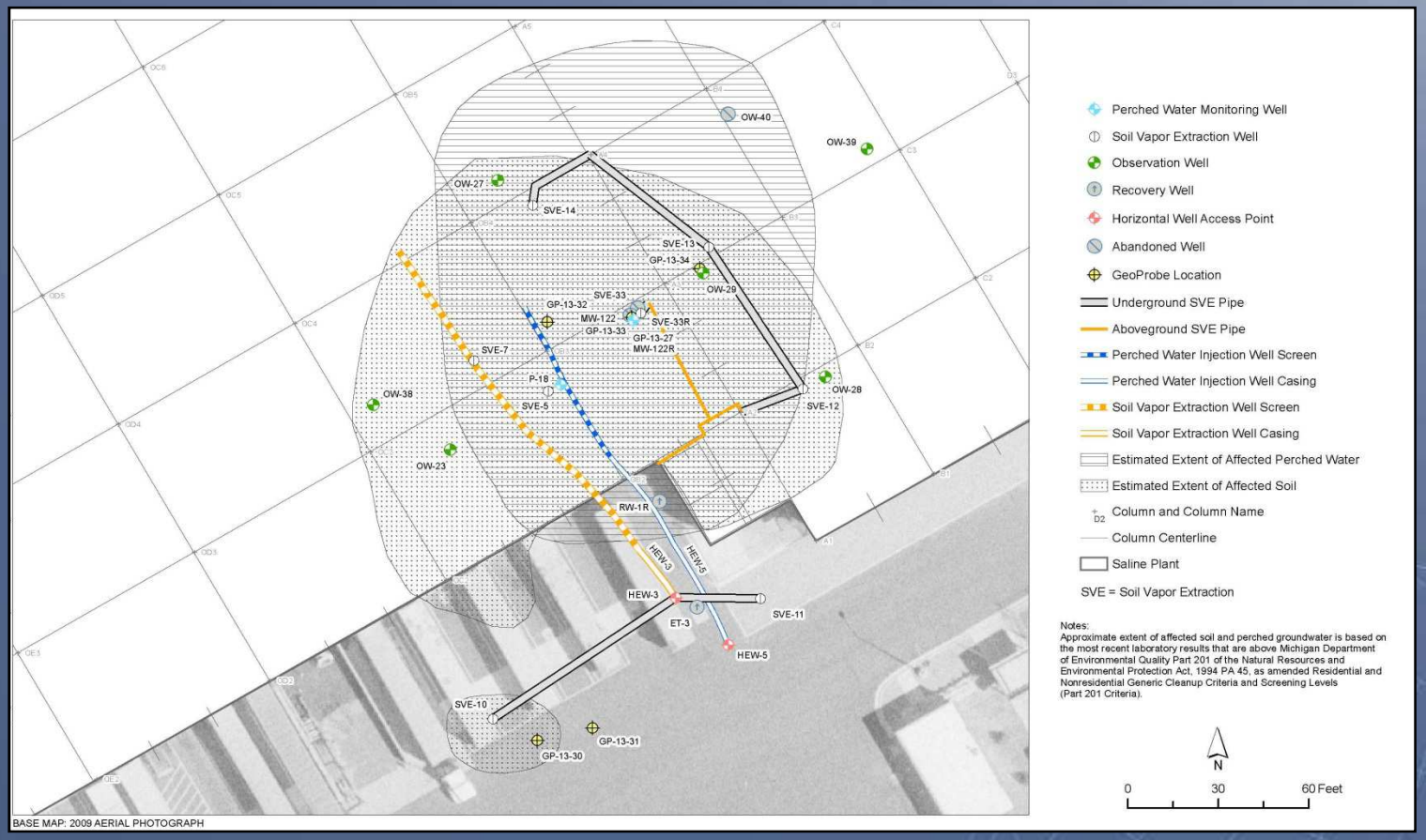
Results –
Contaminant Extent in Perched Water and Soil

- Lateral Extent soil impacts: ~0.44 acres
- Lateral extent of perched water impacts: ~0.41 acres (63% decrease)



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Conclusions

- Remedial activities were completed in conjunction with multiple Plant projects
- Above ground infrastructure installed during periods of Plant shutdown
- Installation of horizontal wells
  - Competent drilling firm
  - Accurate location of well during drilling
  - Threading the needle during installation
  - Proper well development
- Operation and Maintenance of system in winter
  - Generating a larger volume of condensate
  - Carbon vessel hoses froze
  - Heated cargo container to house the carbon vessels

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Before and After

Thank You

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