

Triad for Small Sites Demonstration Project

50,000 Data Points in 3 Days

South Dakota Petroleum Release Compensation Fund

MP Locations 01-23
Response Indicated in Green to Red
Legend: 01-05 in Tan
06-10 in Green
11-15 in Yellow
16-20 in Orange
21-23 in Red
Slice 1 - Center of Alley
Slice 2 - Center of 7th Street
View From Southwest

The Challenge

- Small sites
- Privately owned
- Aversion to spending money
- Aversion to extensive planning
- “Do only what we have to do”
- Fixed bureaucratic way of doing things

EMP Locations 01-23
Response Indicated in Green to Red
Soil Conductivity > 100mS/M in Tan

Slide 1 - Center of Alley
Slide 2 - Center of 7th Street
View From Southwest

The South Dakota Challenge

- Focus – Need to move ahead on 5 Legacy UST Sites = \$\$ sink hole
- Approach – Use Triad to Manage Uncertainty
 - Systematic Planning
 - Real-Time Measurement Systems
 - Dynamic Work Strategies

Sections 01-23
Response Indicated in Green to Red
Soil Conductivity > 100mS/M in Tan

Slide 1 - Center of Alley
Slide 2 - Center of 7th Street
View From Southwest

Systematic Planning

- **Team Approach – “The Players”**
 - State Regulatory Agency
 - Tank Fund
 - Owner/Consultant
 - Technical Experts (Field teams & lab)
- **“Just-n-Time” Training in Triad process before field work**
- **Site specific goals & objectives**

The Commitment

- “We will stay on-site until we get all the data you need to address the objectives in the work plan”

Dennis Round, SDPRCF

SDMP Locations 01-23
Response Indicated in Green to Red
Soil Conductivity > 100mS/M in Tan

Slide 1 - Center of Alley
Slide 2 - Center of 7th Street
View From Southwest

Team Decision Making



Systematic Planning – Key Elements

- Political Leadership – sold concept
- Facilitation – upfront agreement
- Dynamic Work Plan
- Onsite Leadership – drove the process and stuck to the plan
- Communication – addressed everyone's concerns

Benefits to the Players

- State Regulators – data and confidence in the results
- Tank Fund - action
- Owners - closure
- Consultants – piece of the action

UMP Locations 01-23
Response Indicated in Green to Red
Soil Conductivity > 100mS/M in Tan

Slide 1 - Center of Alley
Slide 2 - Center of 7th Street
View From Southwest

Real-Time Measurement Tools

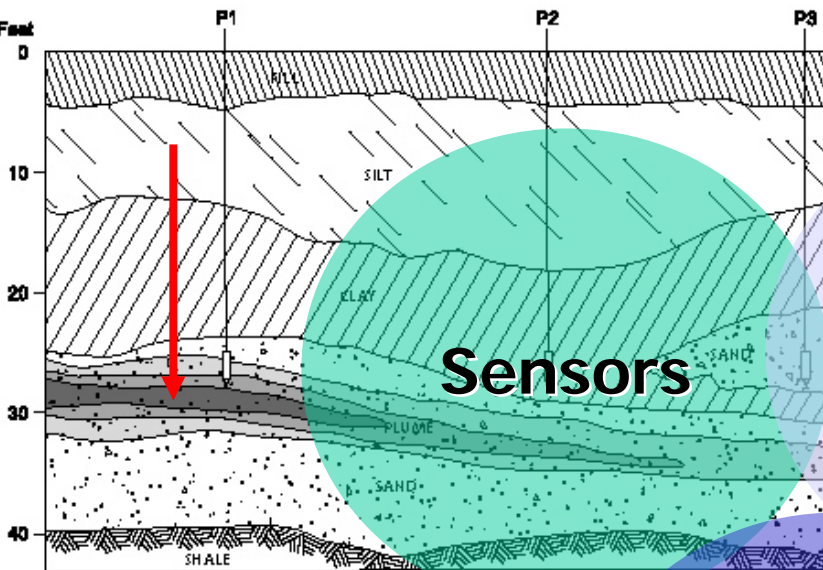
Decision-Making

- **Direct Sensing**
 - Membrane Interface Probe w/ Electrical Conductivity
- **SmartData Solutions®**
 - Internet link to the field
 - Frequent data uploads
 - 3D graphics
 - Measurement of uncertainty
- **SmartScan™ screen**
 - MtBE, TBA, and EDB
- **Confirmatory soil & groundwater samples**
- **“Real time” lab analyses**

Green to Red
Soil Conductivity > 100mS/M in Tan

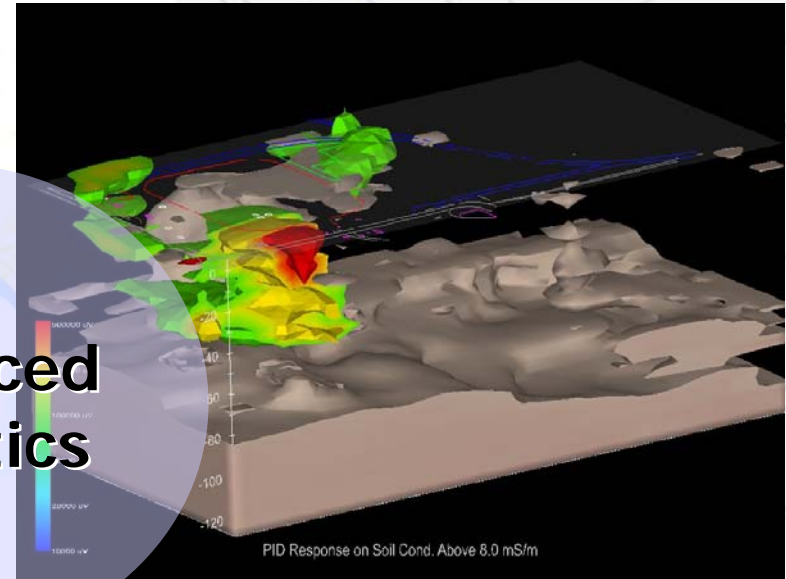
Slide 1 - Center of Alley
Slide 2 - Center of 7th Street
View From Southwest

SmartData Solutions® (Patent Pending)



Sensors

**Advanced
Analytics**



**Internet
Delivery**

Cycle Time = Hours

Slide 1 - Center of Alley
Slide 2 - Center of 7th Street
View From Southwest

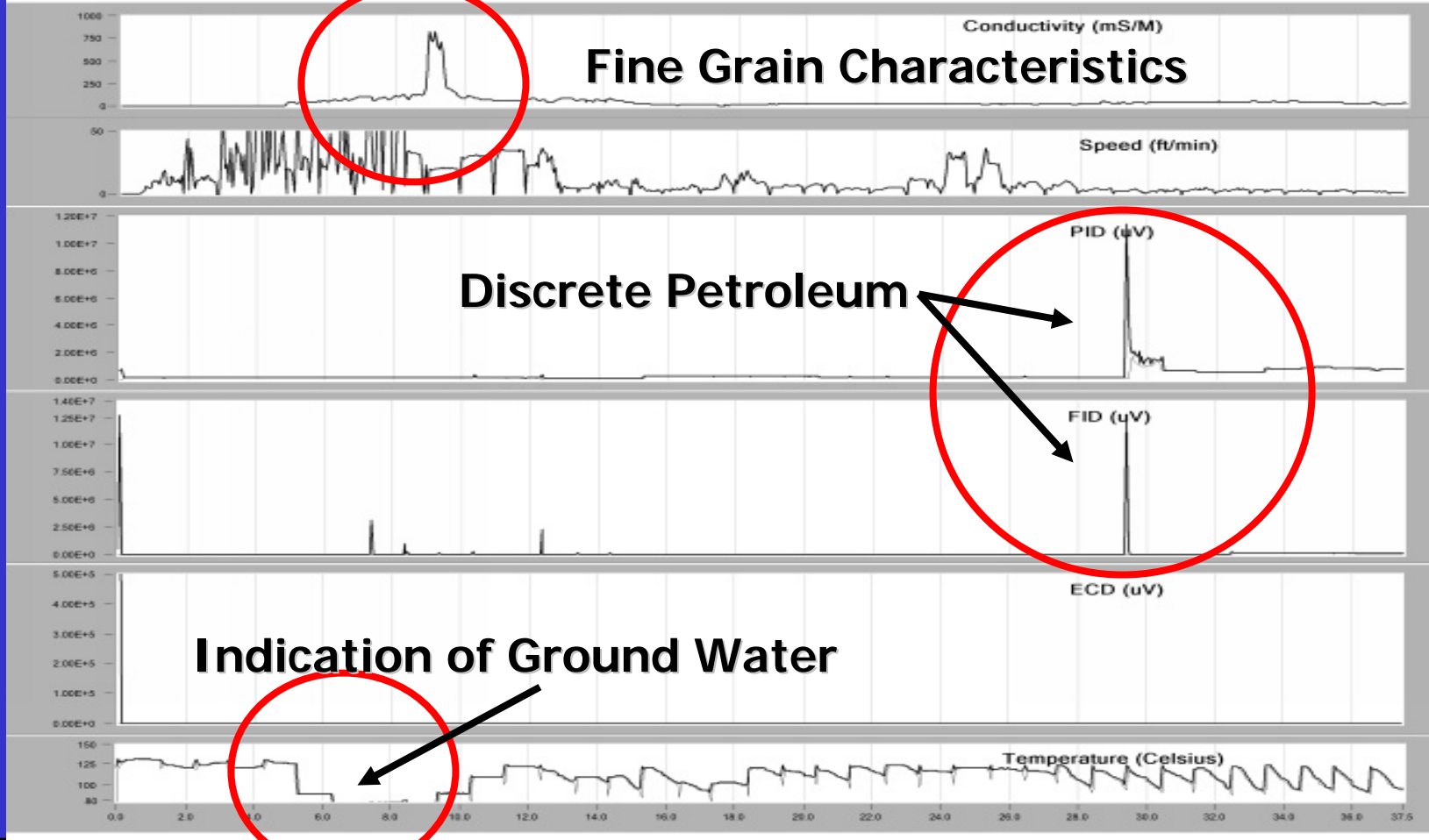
Membrane Interface Probe



- Continuous vertical profile of subsurface
- High data density – 20 data points/ft
- Real time information
- Responds to VOCs at sub-ppm levels
- Electrical conductivity provides a measurement of soil characteristics

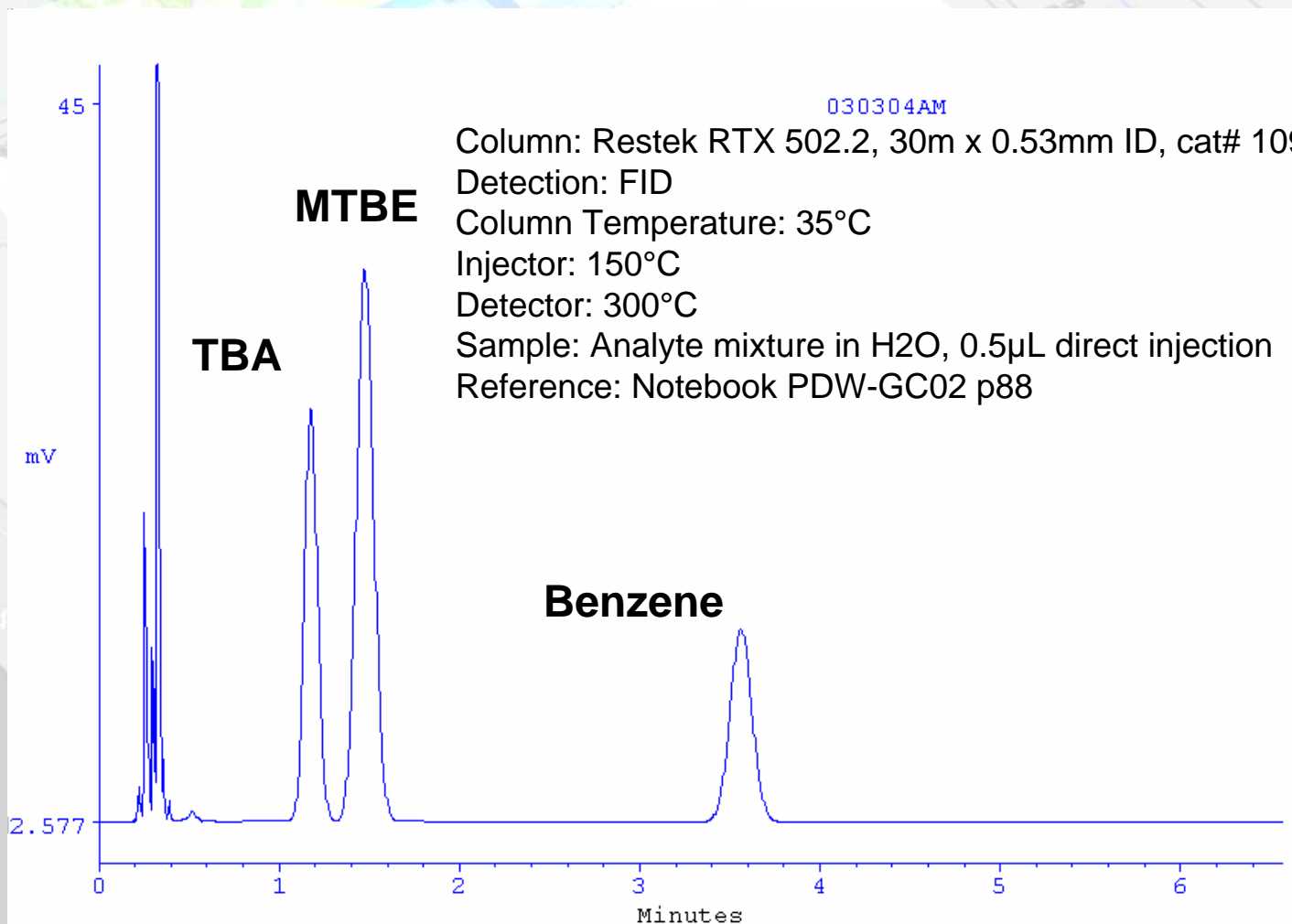
You Can't Afford To Miss

Log: C:\dirim95\LOGFILES\MIP_88.dat



Sample Data from *SmartScan*TM

(Patent Pending)



Generic Protocol

1. In-situ performance check of sensors in known source area
2. Verification of background
3. Rapid vertical and horizontal delineation of contaminant plume – approx 300-ft of data each day
4. Determine any impact to receptors
5. Confirmatory soil and groundwater sampling
6. Screen for MtBE, TBA, and EDB
7. Daily update of 2D/3D maps via Internet link to support decision making in the field
8. Off-site laboratory analyses

All Triad project team members present in the field

T&T Standard



Assessment Planning

- Team meeting (conference call) to set site specific objectives and concerns
- Establish site specific website
 - Password protected
 - Load site maps
 - Load location of existing wells
 - Load known historical data
 - Load know underground utilities
- Build initial 3D Site Conceptual Model

UST Tier I Requirements

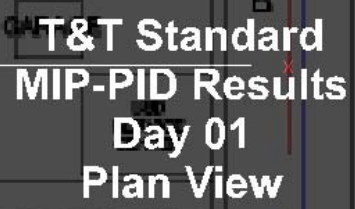
- ✓ Standardized scope of work
- ✓ Locate all private and public water wells
- ✓ Note current use of the site
- ✓ Provide copy of applicable portion of tax map
- ✓ Locate all underground utilities

Day 01 – Initial Screening

- Site H&S Briefing
- Verification
 - Underground utilities
 - Receptors
 - Site use
- Direct Sensing Operations
 - UST Area: 2 borings
 - Piping & Dispenser Area: 5 borings
 - Background: 2-4 borings
 - Total: 7-10 borings ~ 300 ft of data
 - Borehole closure
- SmartData Operations
 - GPS all boreholes
 - MIP logs uploaded 2X daily
 - Update 3D model
 - Update website and field

UST Tier I Requirements

- ✓ Screen identified receptors for hydrocarbons
- ✓ UST Area: 2 borings to 25-ft or to groundwater table
- ✓ Piping & Dispenser Area: 5 borings to 10-feet or to groundwater table
- ✓ Background: 1 boring to 10-ft or to groundwater table
- ✓ Describe lithology for each soil sample
- ✓ Screen for organic vapors
- ✓ Prepare soil boring logs

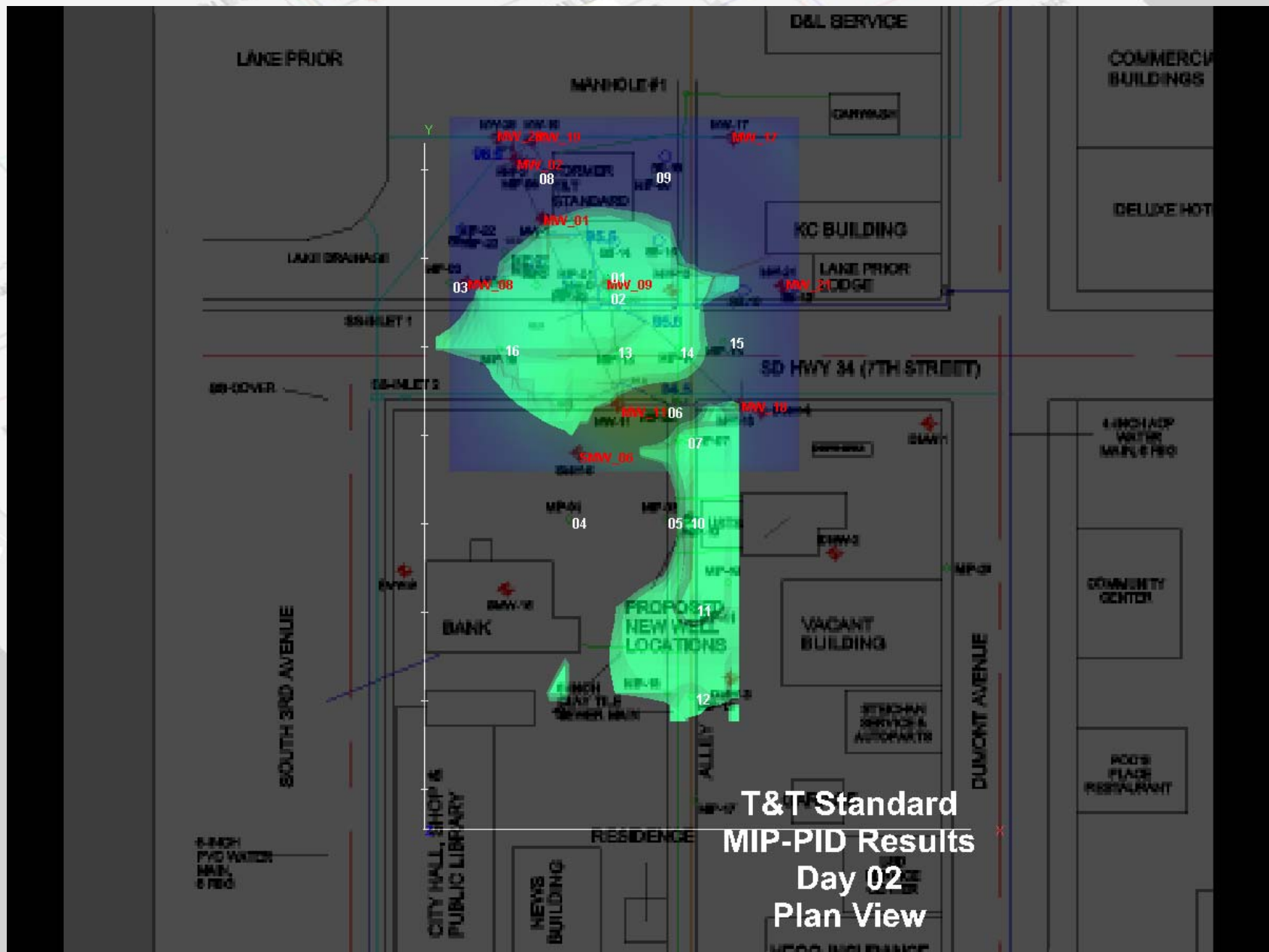


Day 02 - Receptors

- Site H&S Briefing
- Direct Sensing Operations
 - Evaluate impact to receptors
 - Determine if receptors are conduits for HCs
 - 7-10 borings ~ 250 ft
- SmartData Operations
 - GPS all boreholes
 - MIP logs uploaded 2X daily
 - Update 3D model
 - Update website and field
- Triad team review receptor impact and select sample locations

- UST Tier I Requirements

- ✓ Screen identified receptors for hydrocarbons

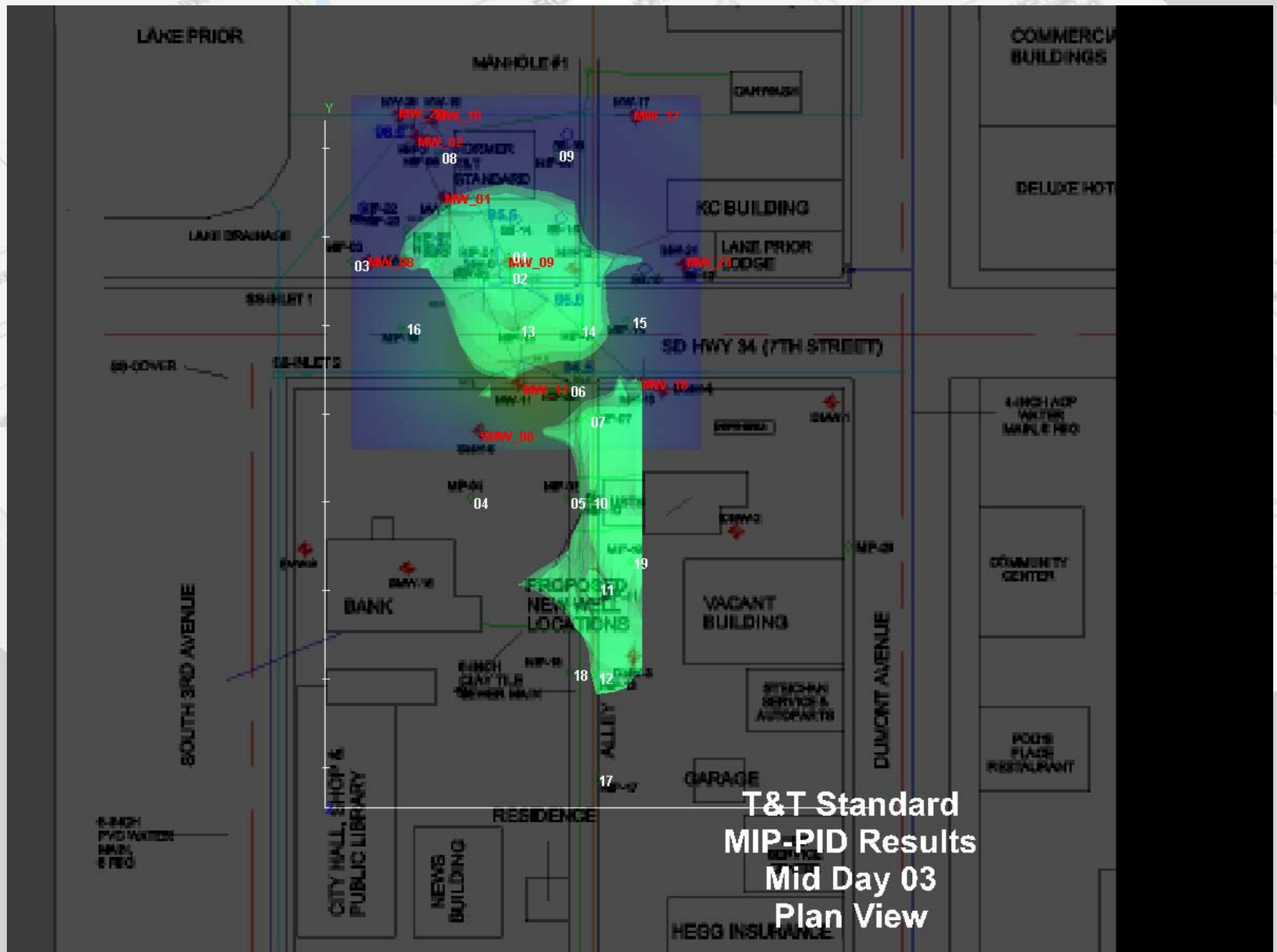


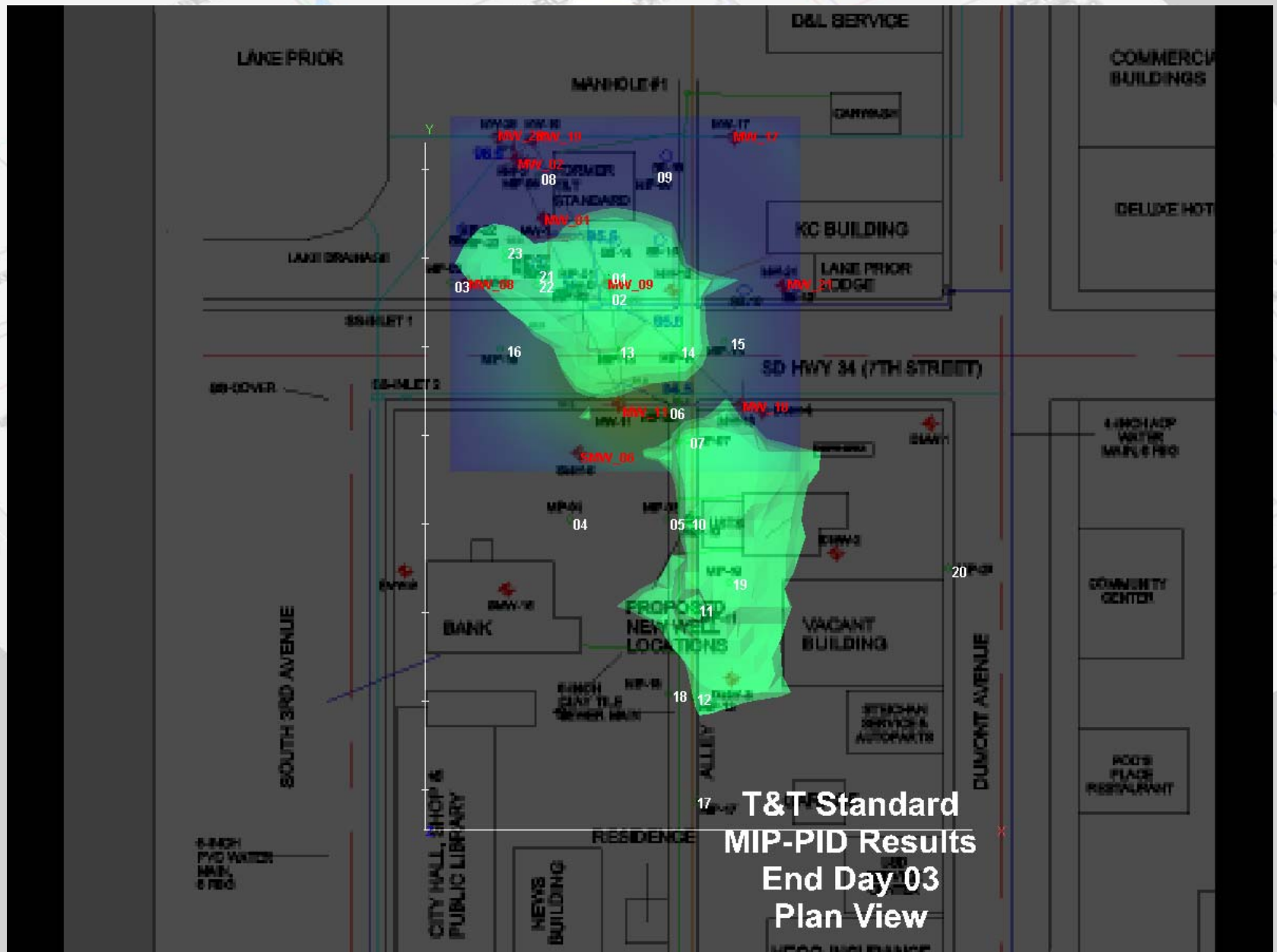
Day 03 –Verification

- Site H&S Briefing
- Direct Sensing Operations
 - SmartScan™ analysis
- SmartData Operations
 - Update images & model
- Soil Sampling
 - UST Area: 2 borings
 - Piping/Dispenser: 5 borings
 - Background: 1 boring
- Groundwater Sampling
 - All impacted water supply wells within 500-ft
 - Install 3 micro-wells and sample (optional)
- Vapor Sampling
 - Receptor areas with potential for explosive conc
 - Install vapor monitoring implants (optional)

UST Tier I Requirements

- ✓ UST Area: 2 soil borings to 25-ft or to groundwater table
- ✓ Piping & Dispenser Area: 5 borings to 10-feet or to groundwater table
- ✓ Background: 1 soil boring to 10-ft or to groundwater table
- ✓ Describe lithology for each soil sample
- ✓ Screen for organic vapors
- ✓ Prepare soil boring logs





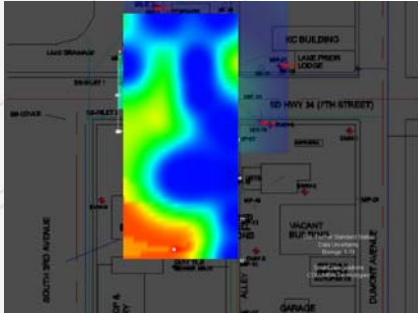
Day 04 –Ground-Water Wells (Optional)

- Site H&S Briefing
- Installation of Monitoring Wells

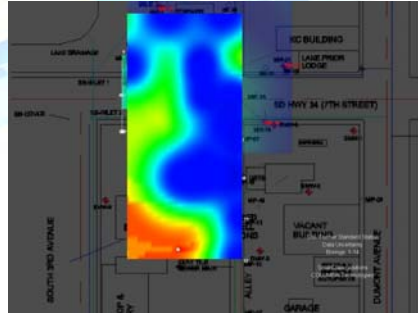
UST Tier I Requirements

- ✓ Total of three 2-inch PVC casing wells with 10-ft screens
- ✓ Boring with highest organic vapor response
- ✓ Background soil boring
- ✓ 1 Additional well in a position on the site to determine the direction of ground-water flow AND concentrations of CoC in the source area

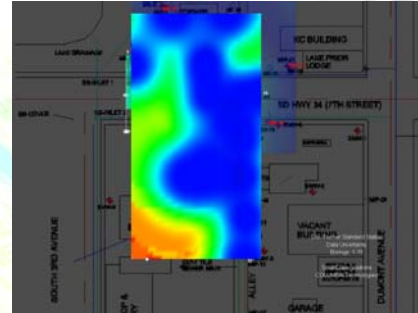
Managing Uncertainty



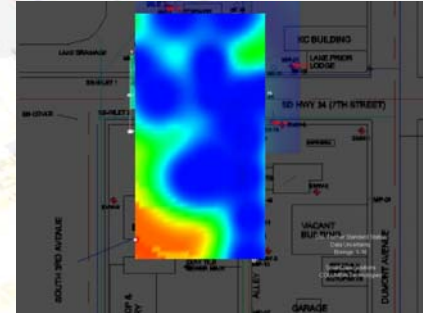
MIP-13



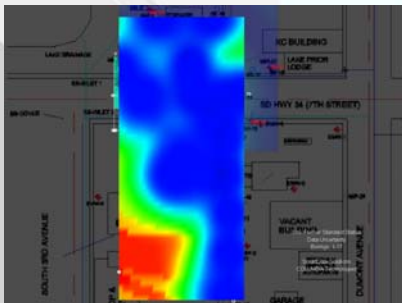
MIP-14



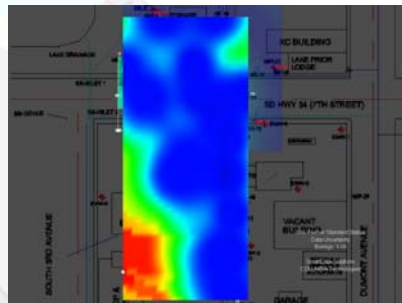
MIP-15



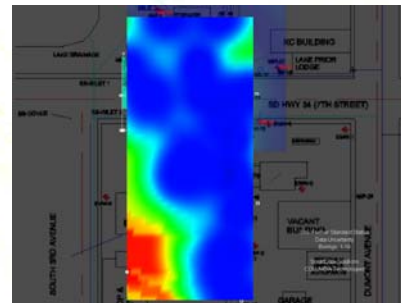
MIP-16



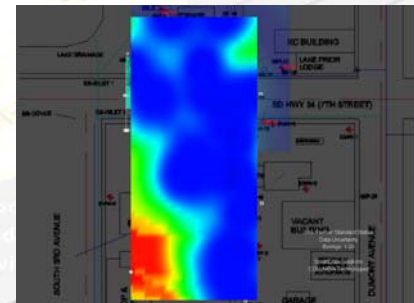
MIP-17



MIP-18



MIP-19



Slide 1 - Center of Alley
Slide 2 - Center of 7th Street
View From South

MIP-20

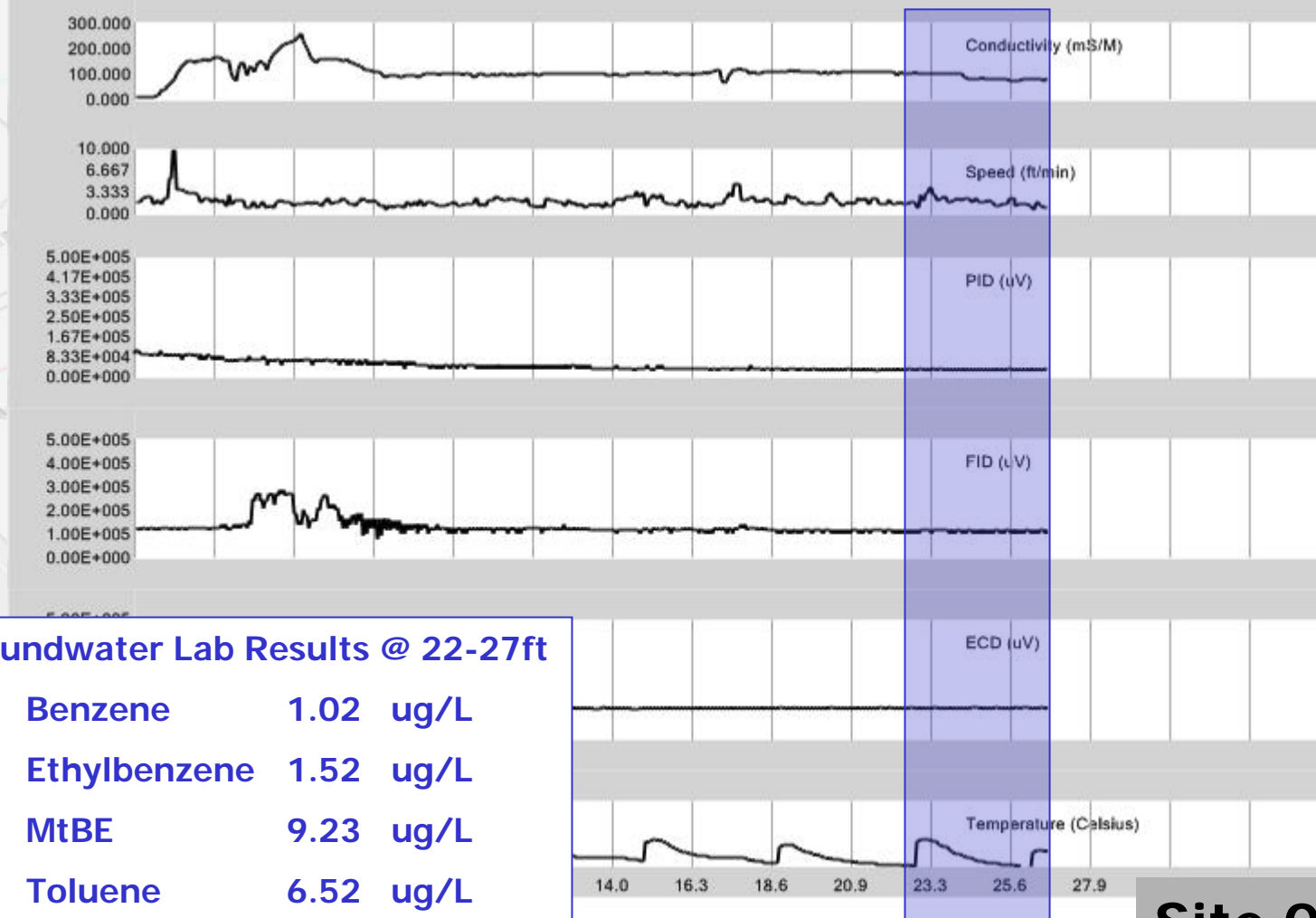
How do we know MIP worked?

Collaborative Data Sets

MIP Locations 01-23
Response Indicated in Green to Red
Soil Conductivity > 100mS/M in Tan

Slide 1 - Center of Alley
Slide 2 - Center of 7th Street
View From Southwest

T and T Standard: MIP Log - MIP-04



Groundwater Lab Results @ 22-27ft

| | | |
|--------------|------|------|
| Benzene | 1.02 | ug/L |
| Ethylbenzene | 1.52 | ug/L |
| MtBE | 9.23 | ug/L |
| Toluene | 6.52 | ug/L |
| Xylenes | 6.78 | ug/L |
| TPH – Gas | <100 | ug/L |

Site 02
MIP 04

Soil Lab Results @ 5-7.5 ft

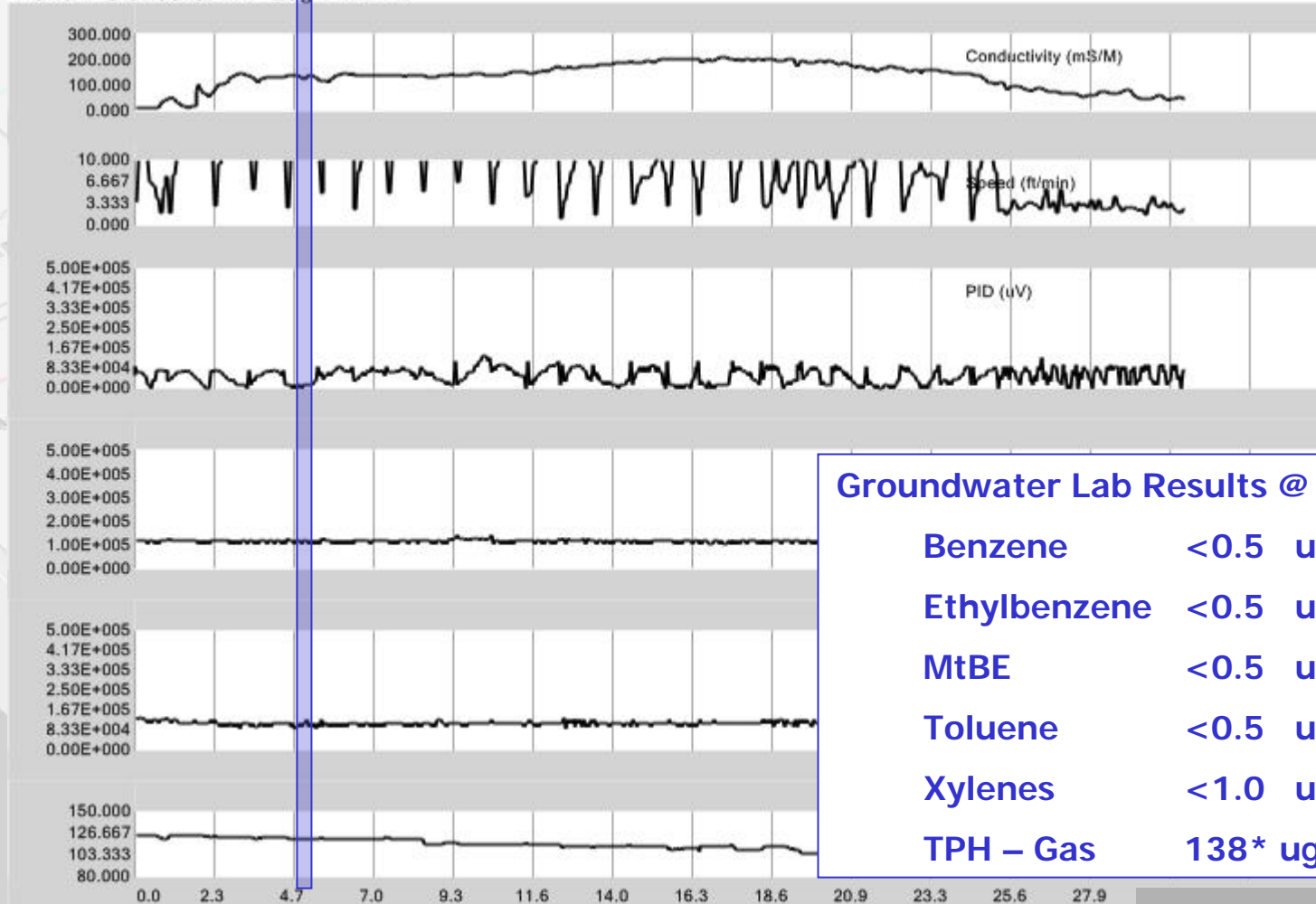
| | |
|--------------|------------|
| Benzene | 1.02 mg/Kg |
| Ethylbenzene | 1.52 mg/Kg |
| MtBE | 9.23 mg/Kg |
| Toluene | 6.52 mg/Kg |
| Xylenes | 6.78 mg/Kg |

Groundwater Lab Results @ 5-7.5 ft

| | |
|--------------|------------|
| Benzene | 5740 ug/L |
| Ethylbenzene | 4370 ug/L |
| MtBE | <250 ug/L |
| Toluene | 9910 ug/L |
| Xylenes | 21100 ug/L |

Site 02
MIP 11

T and T Standard: MIP Log - MIP-17

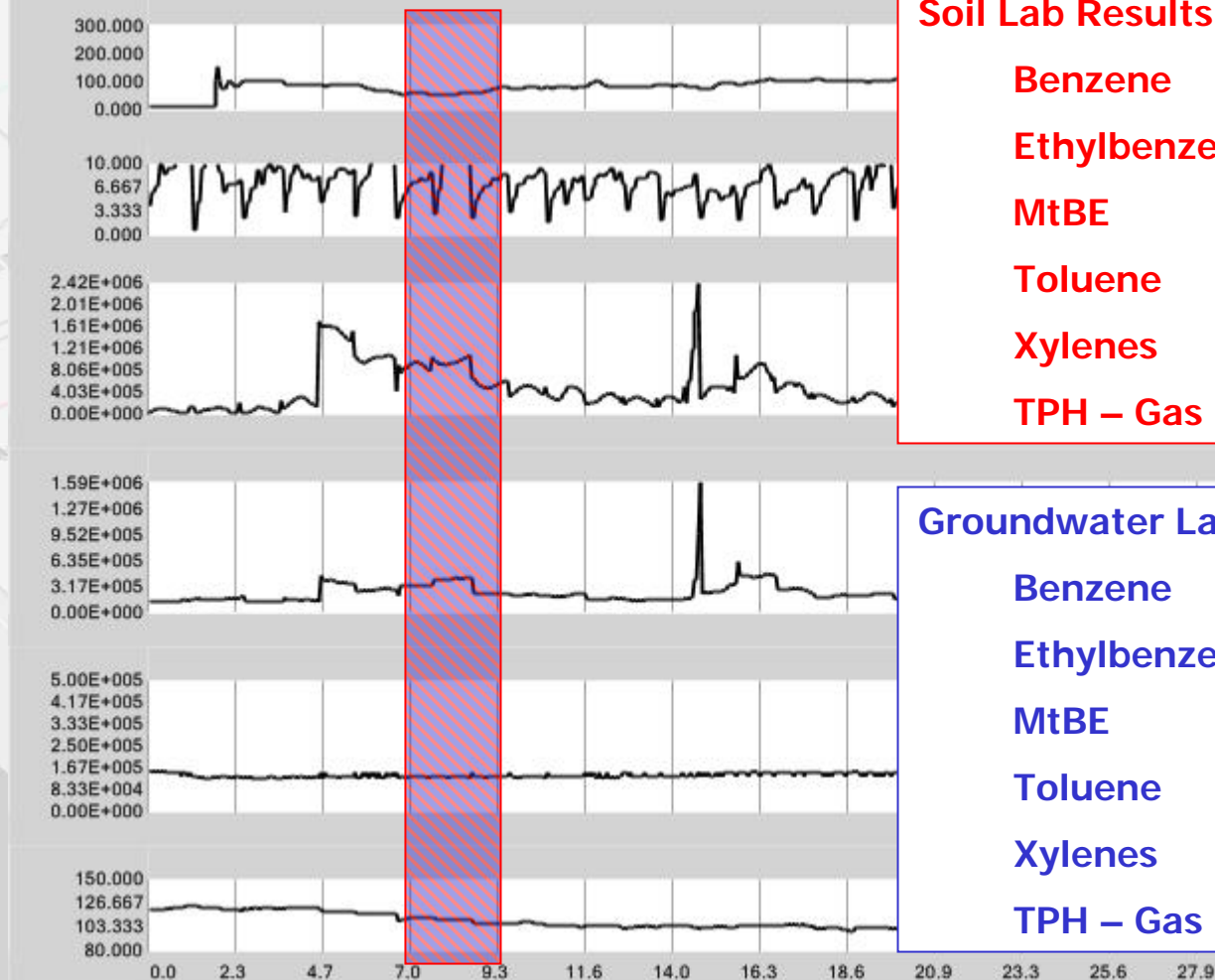


Groundwater Lab Results @ 5 ft

| | |
|--------------|-----------|
| Benzene | <0.5 ug/L |
| Ethylbenzene | <0.5 ug/L |
| MtBE | <0.5 ug/L |
| Toluene | <0.5 ug/L |
| Xylenes | <1.0 ug/L |
| TPH – Gas | 138* ug/L |

Site 02
MIP 17

T and T Standard: MIP Log - MIP-19



Soil Lab Results @ 7-9 ft

| | |
|--------------|------------|
| Benzene | <.1 mg/Kg |
| Ethylbenzene | 23.5 mg/Kg |
| MtBE | <.1 mg/Kg |
| Toluene | .968 mg/Kg |
| Xylenes | 105 mg/Kg |
| TPH – Gas | 1810 mg/Kg |

Groundwater Lab Results @ 7-9 ft

| | |
|--------------|------------|
| Benzene | 496 ug/L |
| Ethylbenzene | 1760 ug/L |
| MtBE | <5 ug/L |
| Toluene | 170 ug/L |
| Xylenes | 7600 ug/L |
| TPH – Gas | 41400 ug/L |

10-20X Variation between soil & gw

**Site 02
MIP 19**

Project Summary

- **People:** Team approach
- **Speed:** 3-4 Days
- **Got the data requested by all parties:**
 - 20-30 Borings
 - 50,000 Data Points
- **Internet link:** Real time decision-making tools
- **All RBCA Tier I & II requirements met**
- **Uncertainty Managed = Closure - Action**

We can close sites AND save money!

Changing Skeptics into Believers



Slide 1 - Center of Alley
Slide 2 - Center of 7th Street
View From Southwest

Challenges

- Depth
- Access
- Tangents
- Weekend Decisions
- Ownership
- Committment

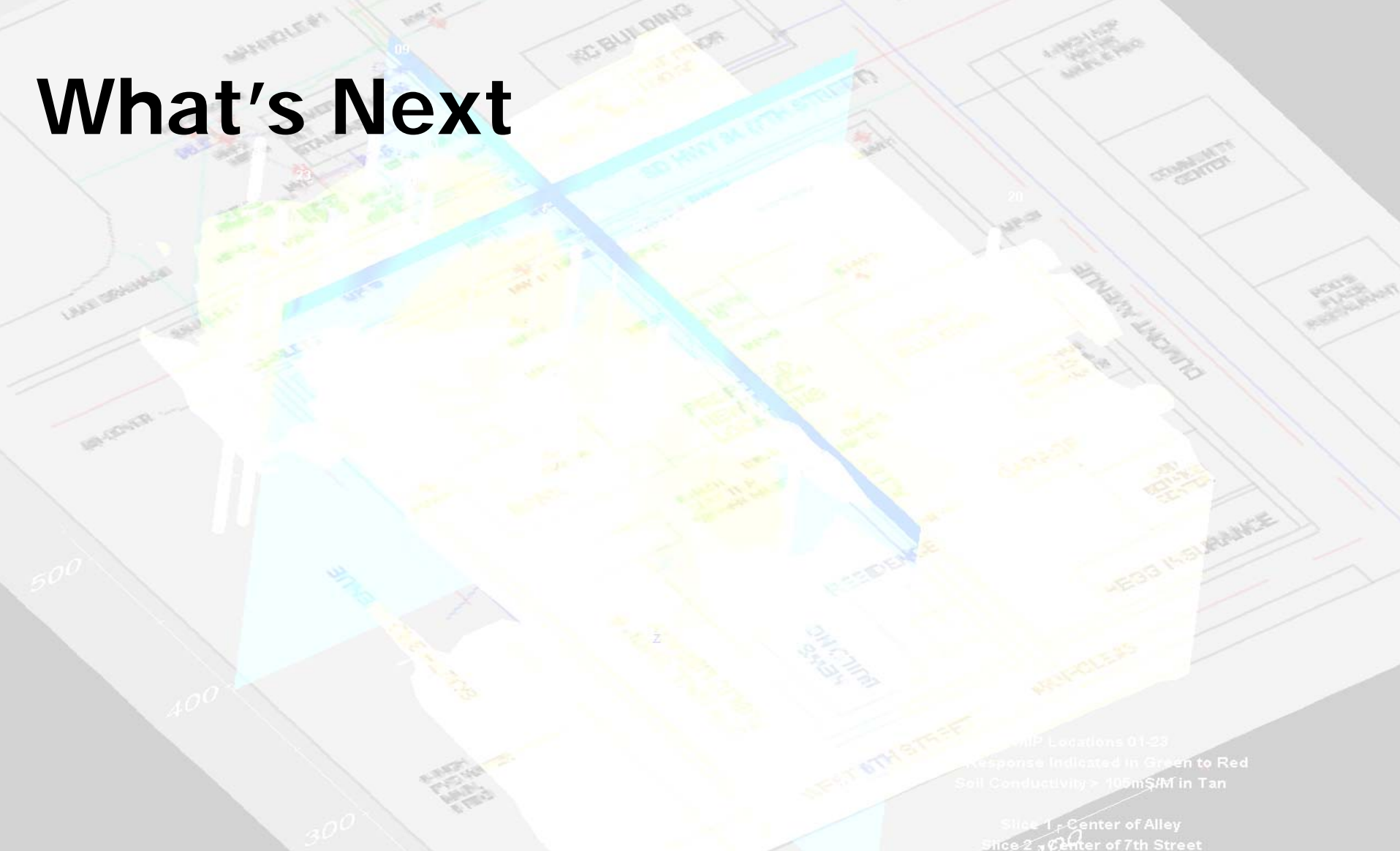
SWMP Locations 01-23
Response Indicated in Green to Red
Soil Conductivity > 100mS/M in Tan

Slide 1 - Center of Alley
Slide 2 - Center of 7th Street
View From Southwest

Issues

- People - Just in time training and facilitation critical
- Direct push based technology – not applicable to all sites
- Vapor intrusion needs to be addressed
- Managing the applecart

What's Next



Start Saving Money and Time!