



May 13, 2016

Ms. Addie Walker
Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201-1708

Subject Line: Laurens Data Gap Investigation Results Meeting Summary

Dear Ms. Walker:

Thank you for taking the time to meet with representatives from 3M Company (3M) and Arcadis U.S. Inc (Arcadis) on May 4, 2016. This letter has been prepared to summarize the discussions during the meeting and the path forward resulting from those discussions. A summary of the PowerPoint presentation from the meeting has been sent via email for your reference.

- Arcadis presented a summary of the conceptual site model (CSM), completed investigation activities and results for both Plants 1 and 2, and updates to the CSM as a result of the investigation
- Arcadis concluded that the data available for both Plants 1 and 2 are sufficient for developing a remedial approach to be submitted as part of an FFS
- DHEC discussed some additional areas where wells may be needed to complete delineation, which included:
 - Southwest of MW-68
 - West of stream on Plant 2 plume, in the area where the former hydropunch borings were completed
- All parties agreed that additional wells could be installed during the implementation of the selected remedial alternative
- Arcadis discussed the use of an adaptive design/phased approach for remedy implementation. This would include a smaller scale implementation initially, which will be used to confirm the design parameters and refine the approach followed by a second phase to complete implementation, as needed. DHEC was agreeable to this approach.
- Arcadis presented the approach for the FFS evaluation, specifically the impacted media to be addressed and remedy considerations for both Plants 1 and 2.
- DHEC requested that a list of the potential remedies to be reviewed to be submitted to their attention prior to submitting the FFS. DHEC also stated that No Action should be included as a baseline.

- At the conclusions of the meeting, the parties agreed to the following schedule:
 - A letter outlining the remedial alternatives to be evaluated and the evaluation criteria will be submitted to DHEC by June 15, 2016
 - The FFS will be submitted to DHEC by August 15, 2016.

In addition to the meeting, DHEC asked via phone call how the investigation results would be submitted. Per DHEC's recommendation, the results from the investigation will be included with the semi-annual report that details the results of the groundwater sampling event. This report will be submitted to DHEC by August 1, 2016.

We appreciate you taking the time to meet with us. If you have any additional comments or questions, please feel free to call me at 651-736-3135.

Sincerely,



Jeannie Martin, MBA
Advanced Environmental Scientist

Enclosure

cc: Tom Darby, ARCADIS

3M LAURENS

Investigation Summary and Path Forward

May 4, 2016

Agenda

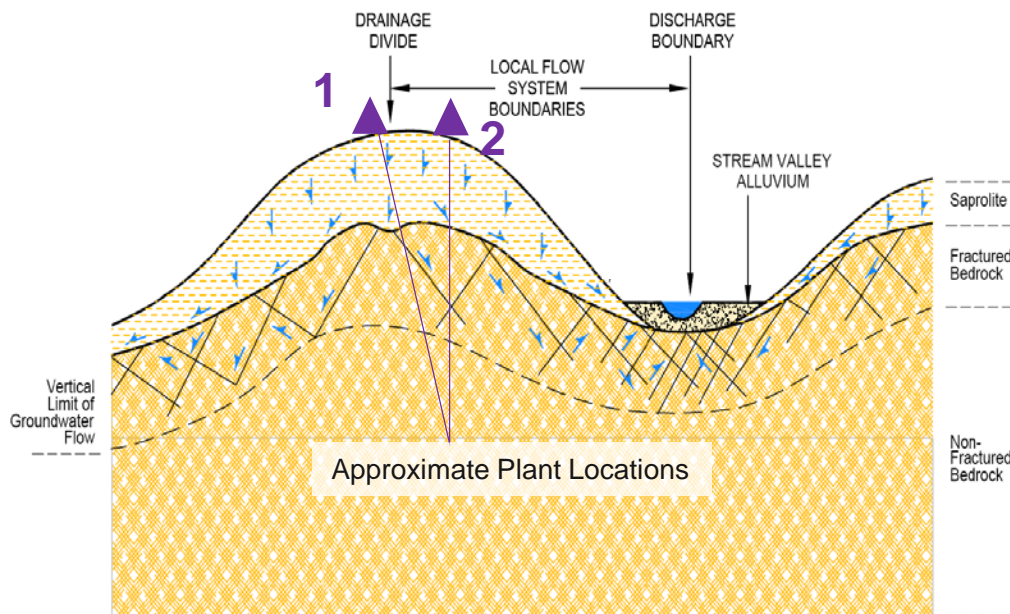
- Objectives
- CSM Overview
- Investigation Summary
- Results and CSM Updates
- Road Map for Completing FFS

Objectives





- Review findings from high resolution site characterization
- Present revised CSM with identified primary flux zones
- Present road map for Focused Feasibility Study (FFS) preparation
 - Impacted media identification
 - Screening criteria and Corrective Action Objectives (CAOs)
 - Remedial alternative development
 - FFS outline

CSM Overview and Investigation Approach

CSM Overview



Legend

-  Recent Alluvium
-  Saprolite
-  Fractured Gneiss
-  Groundwater Flow Direction

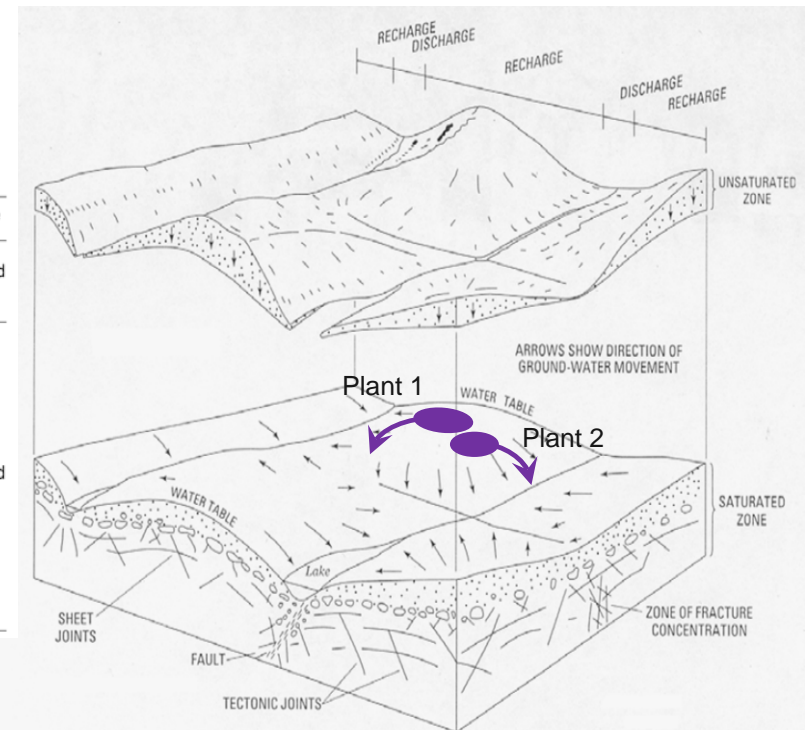
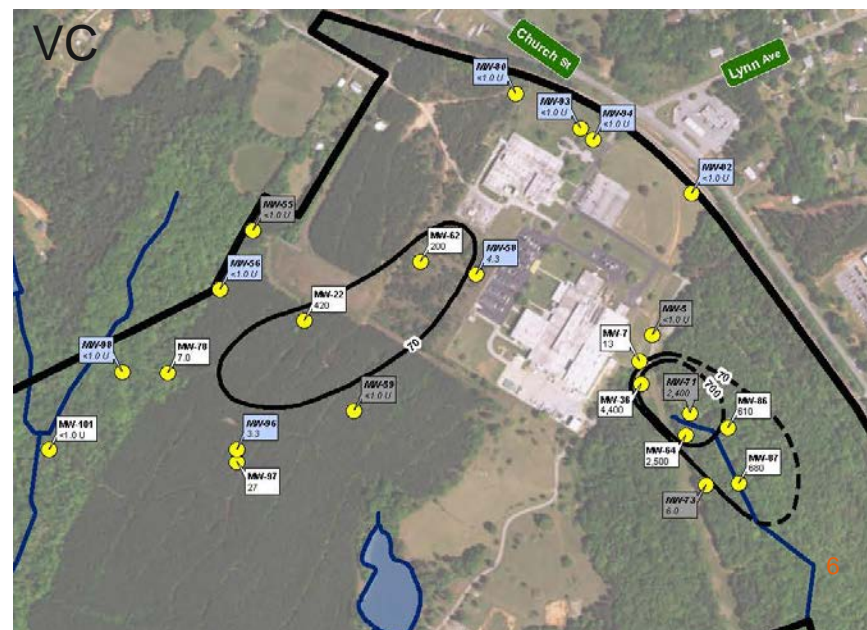
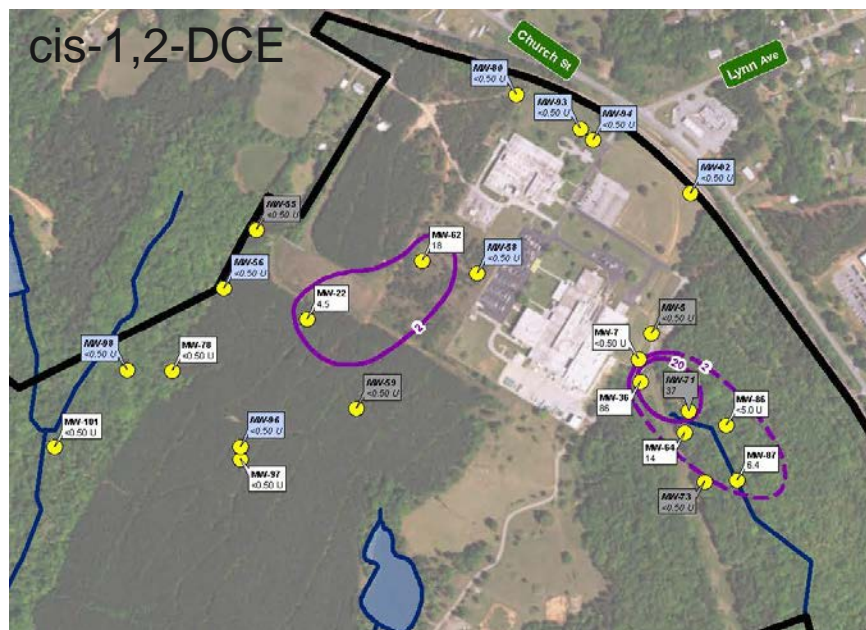
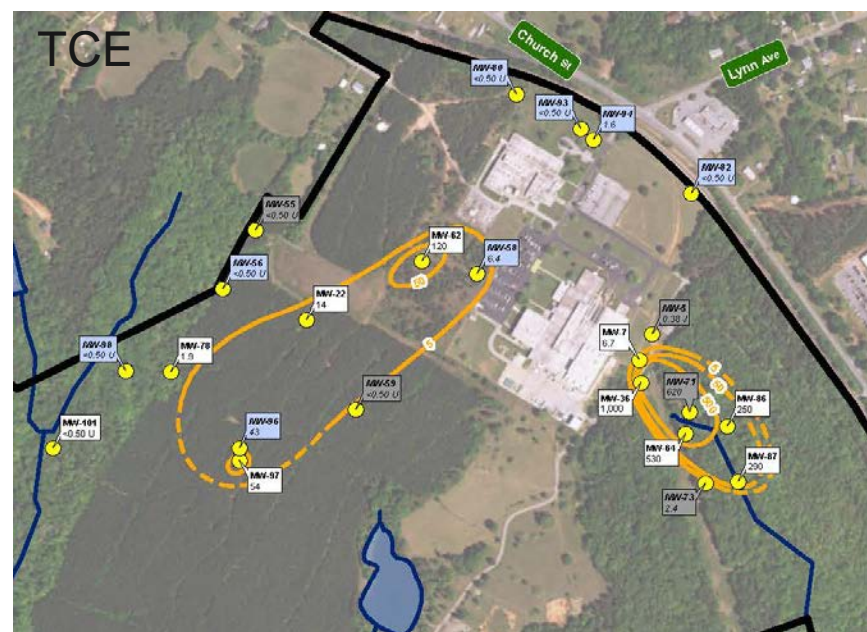
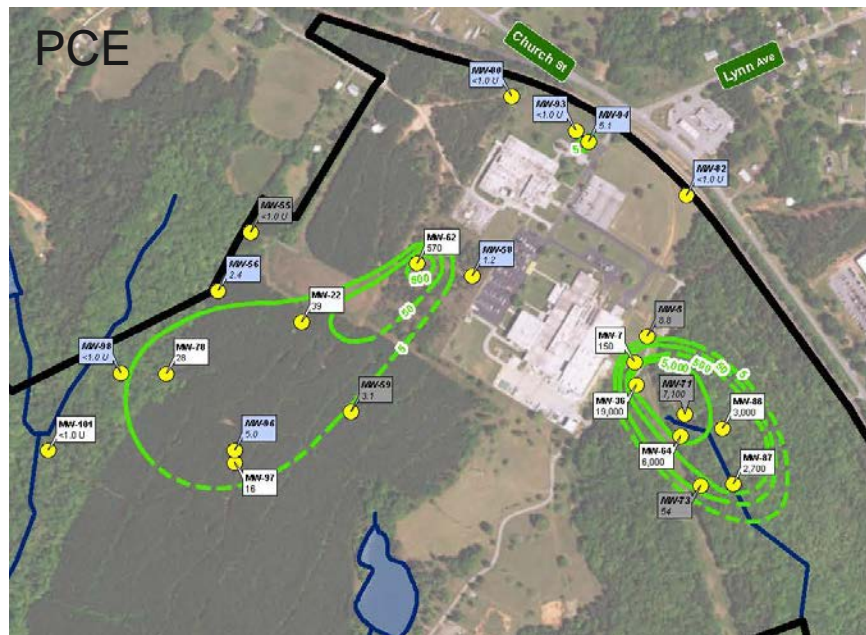
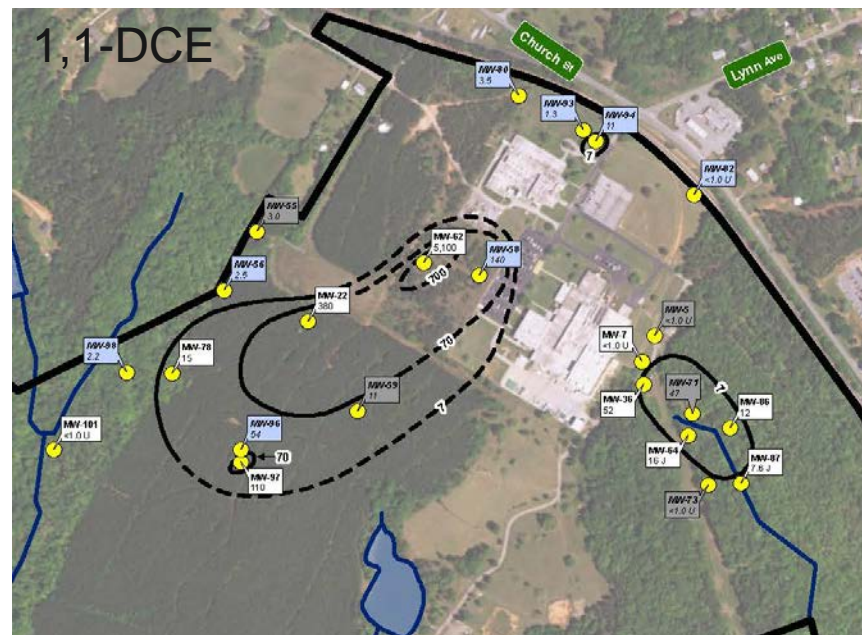
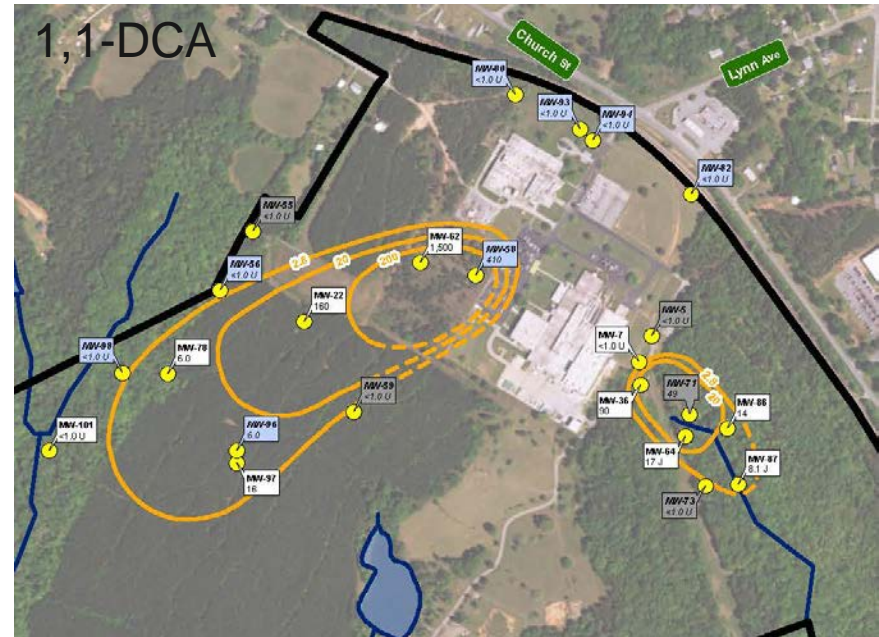
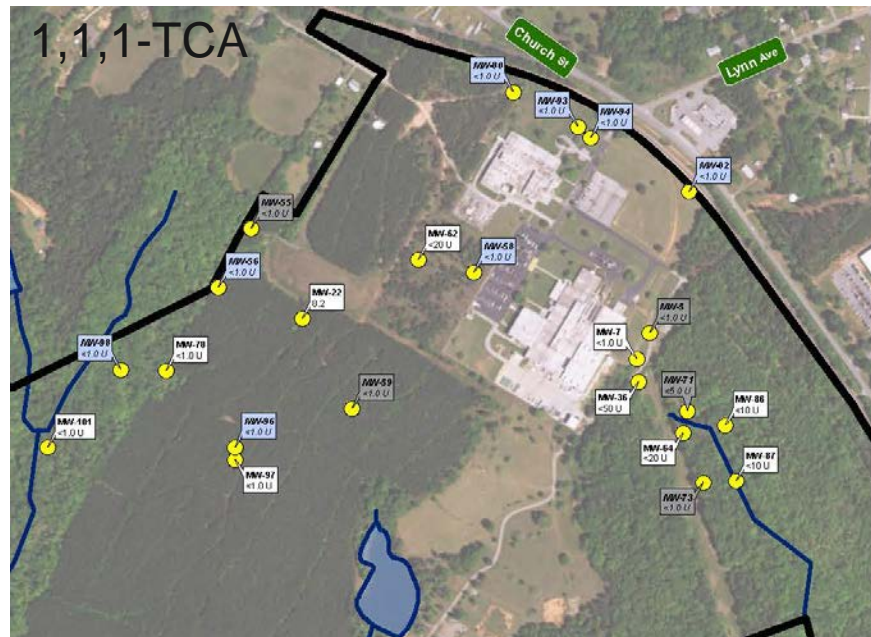


Figure 3. Diagram showing a conceptual view of the groundwater flow system in the Piedmont and Mountain Region of North Carolina. (from Daniel, 1990)

PCE and Degradation Products

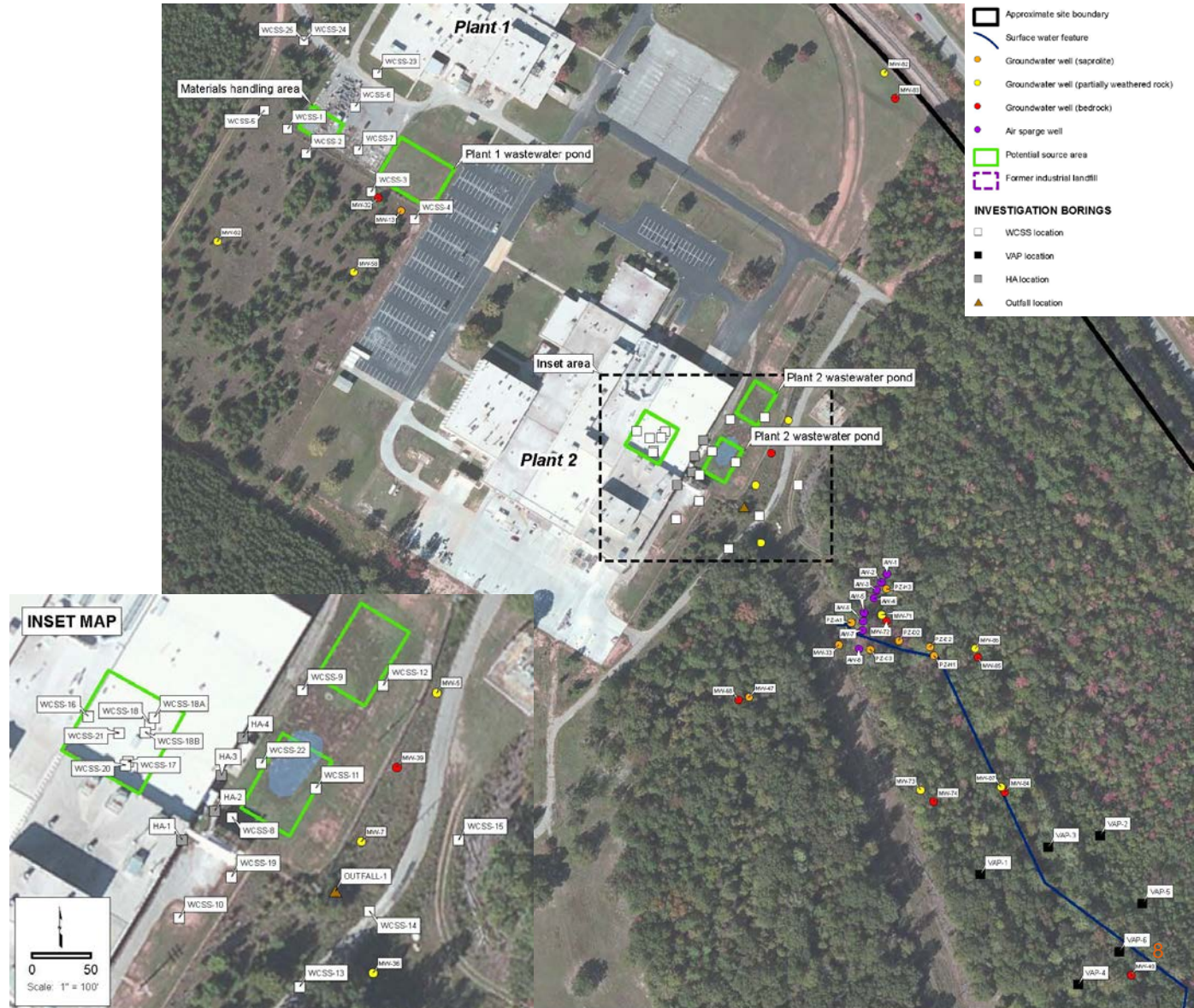


1,1,1-TCA and Degradation Products



Investigation Summary

- 24 WCSS boring
- 5 hand auger borings
- 6 VAP Locations
- 1,490 ft drilled
- 672 soil samples collected
- 11 water samples



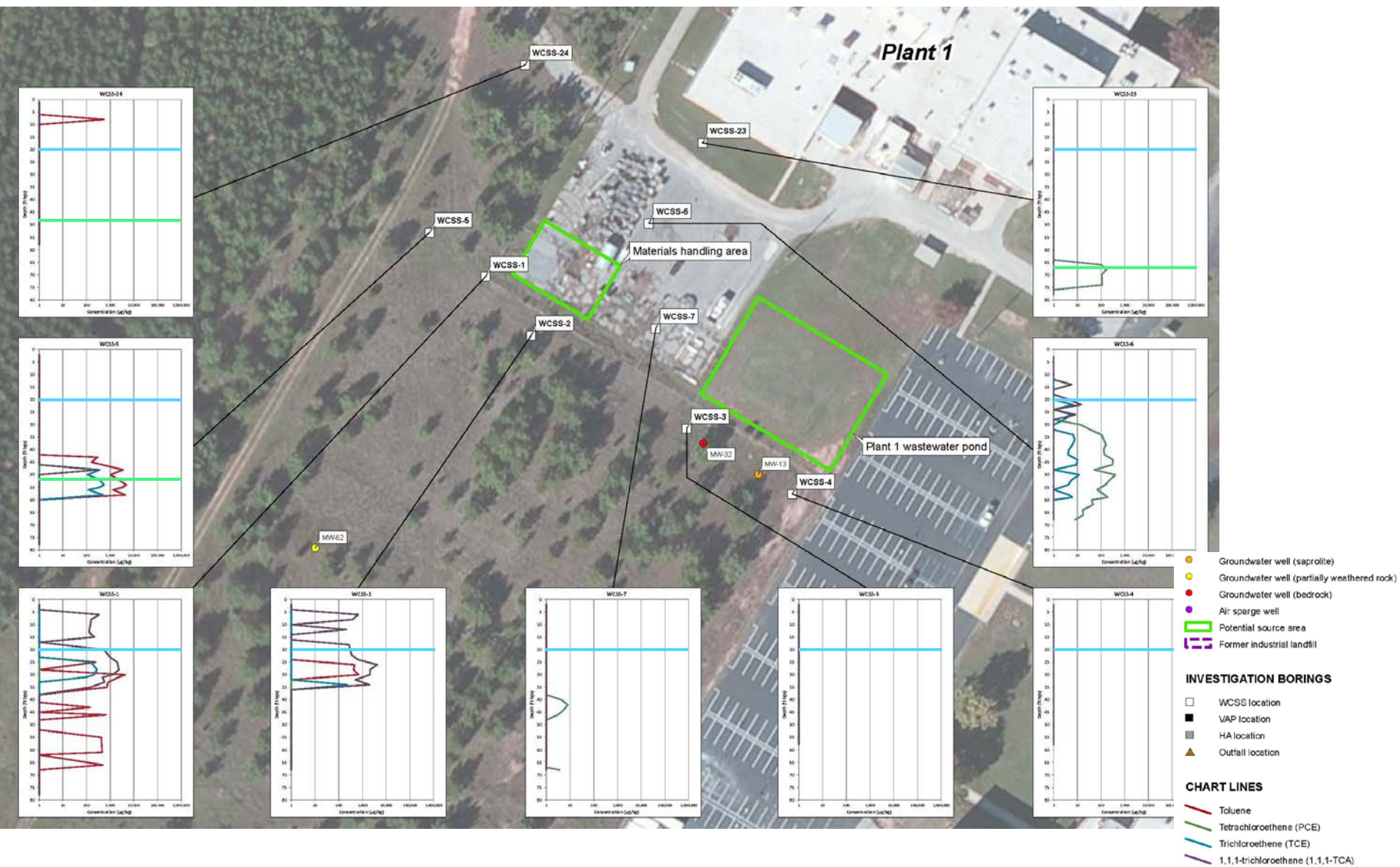
Investigation Summary



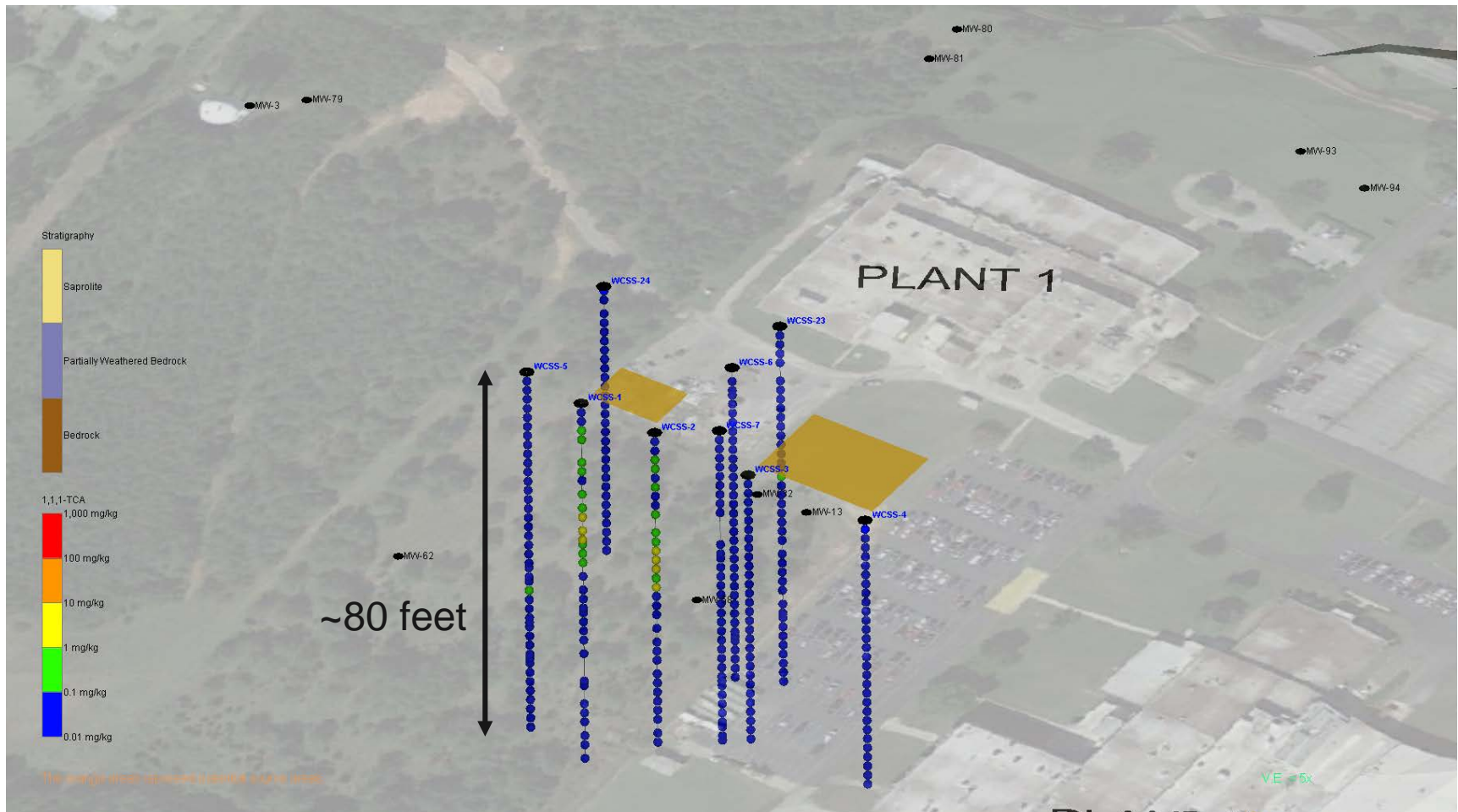
Plant 1 Results and CSM Update

Plant 1 Results

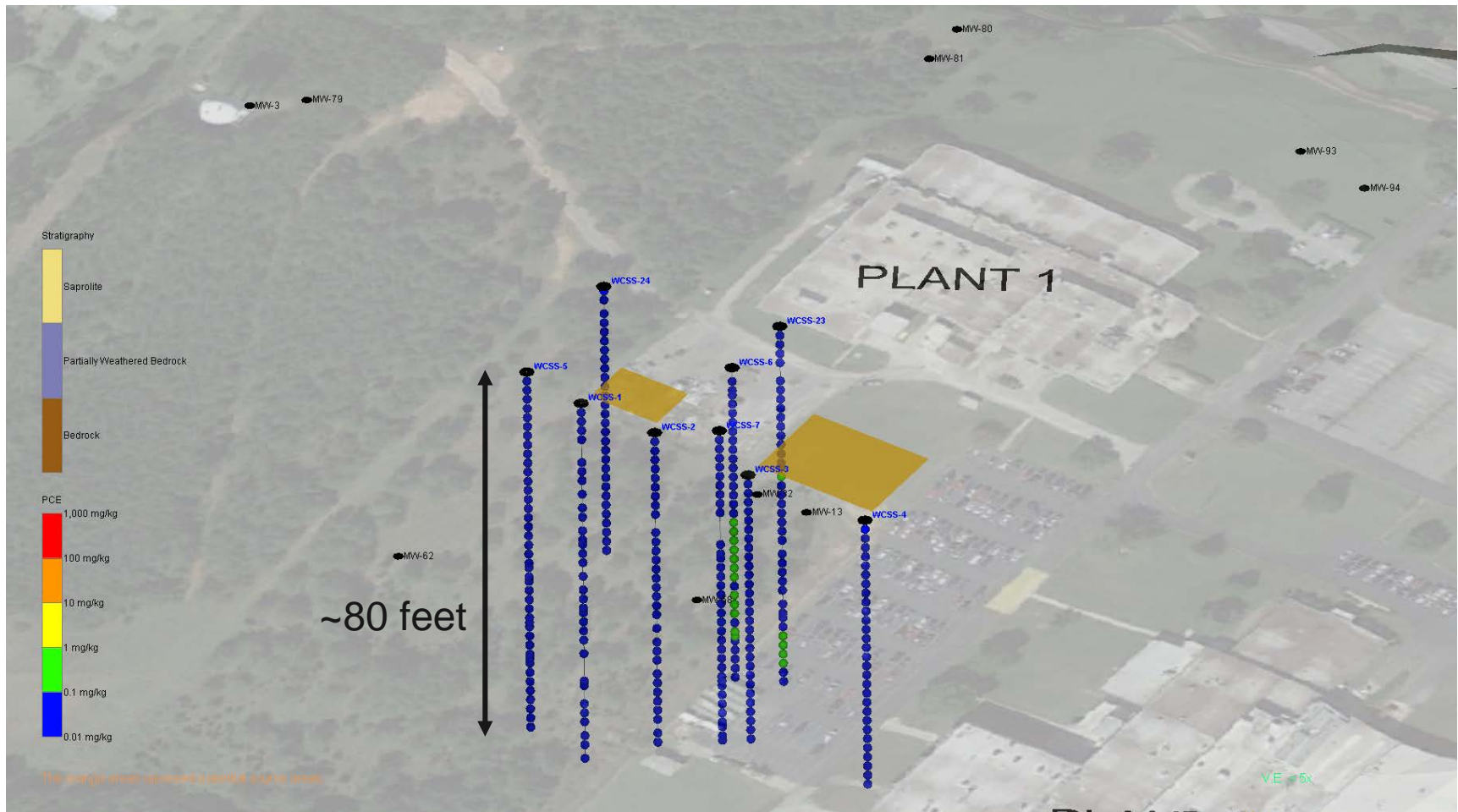
- Identified COCs
 - PCE, TCE and associated daughter products
 - 1,1,1-TCA and associated daughter products
 - Toluene
- Materials Handling Area appears to be the primary source
- Former Plant 1 Pond does not appear to be an ongoing source
- COCs identified in saprolite with discharge to underlying PWR
- COC concentrations reduced along transport pathway, daughter products evident
- Identified source areas are consistent with observed dissolved-phase plume in historical monitoring well and surface water sampling network



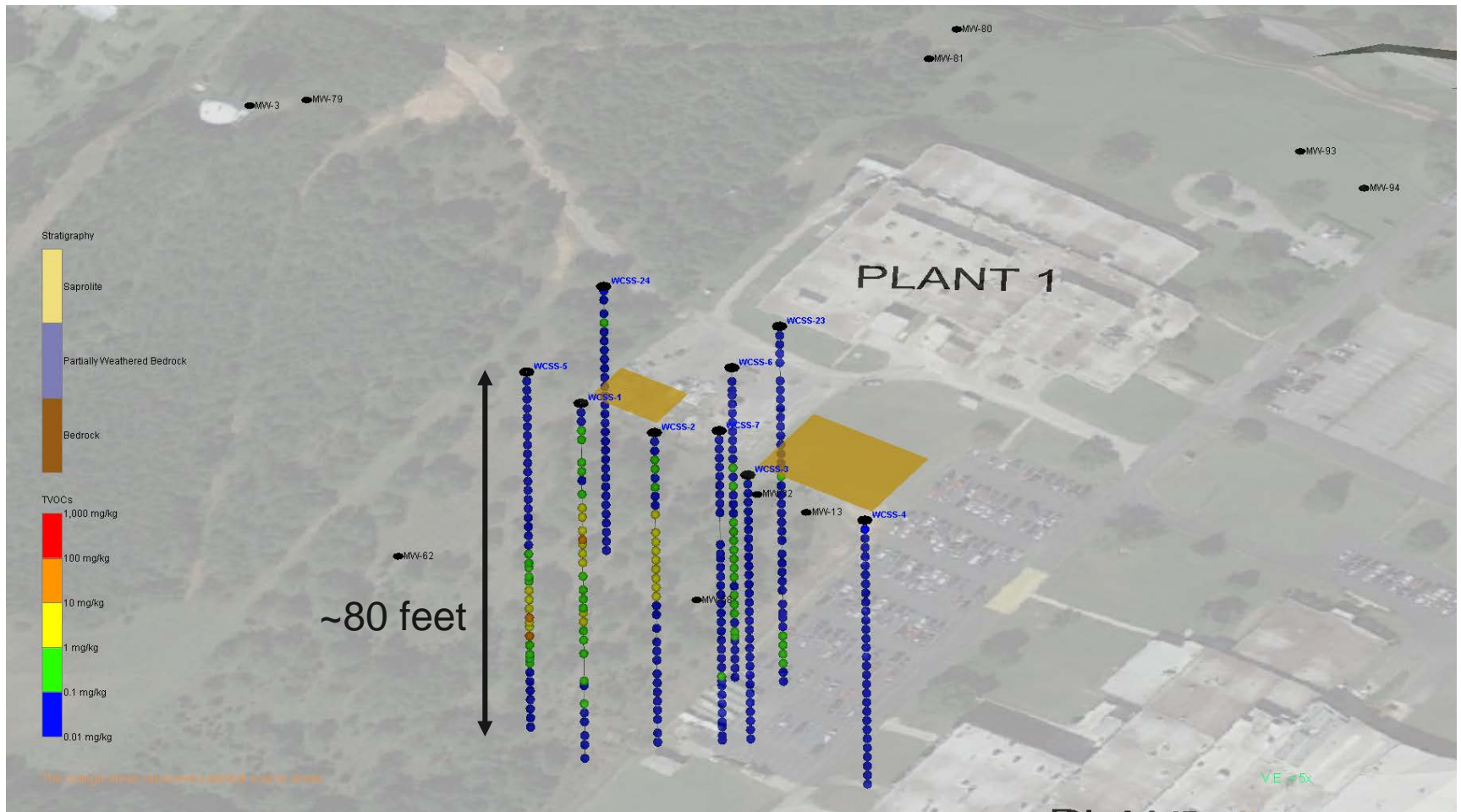
Plant 1 Results (1,1,1-TCA)



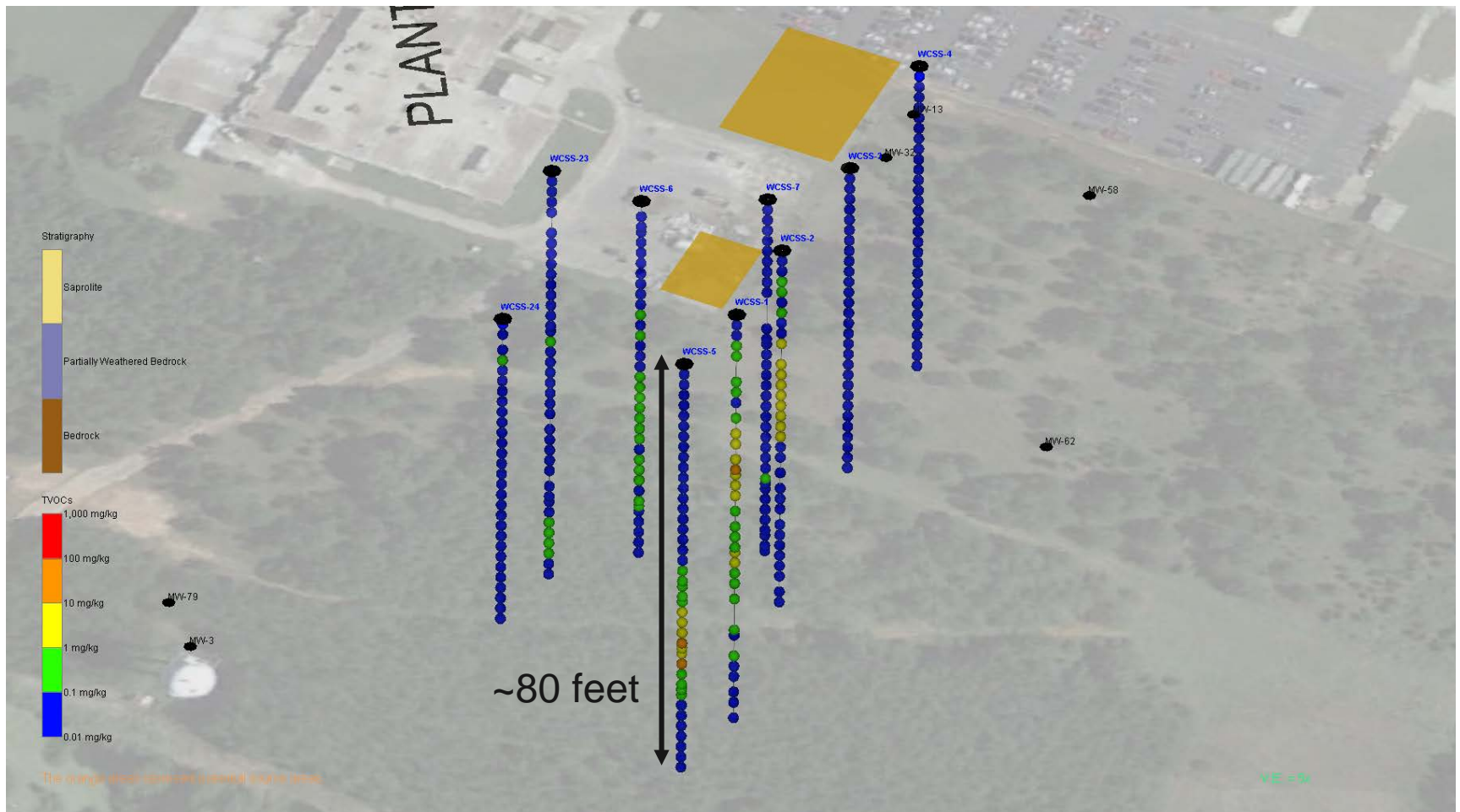
Plant 1 Results (PCE)



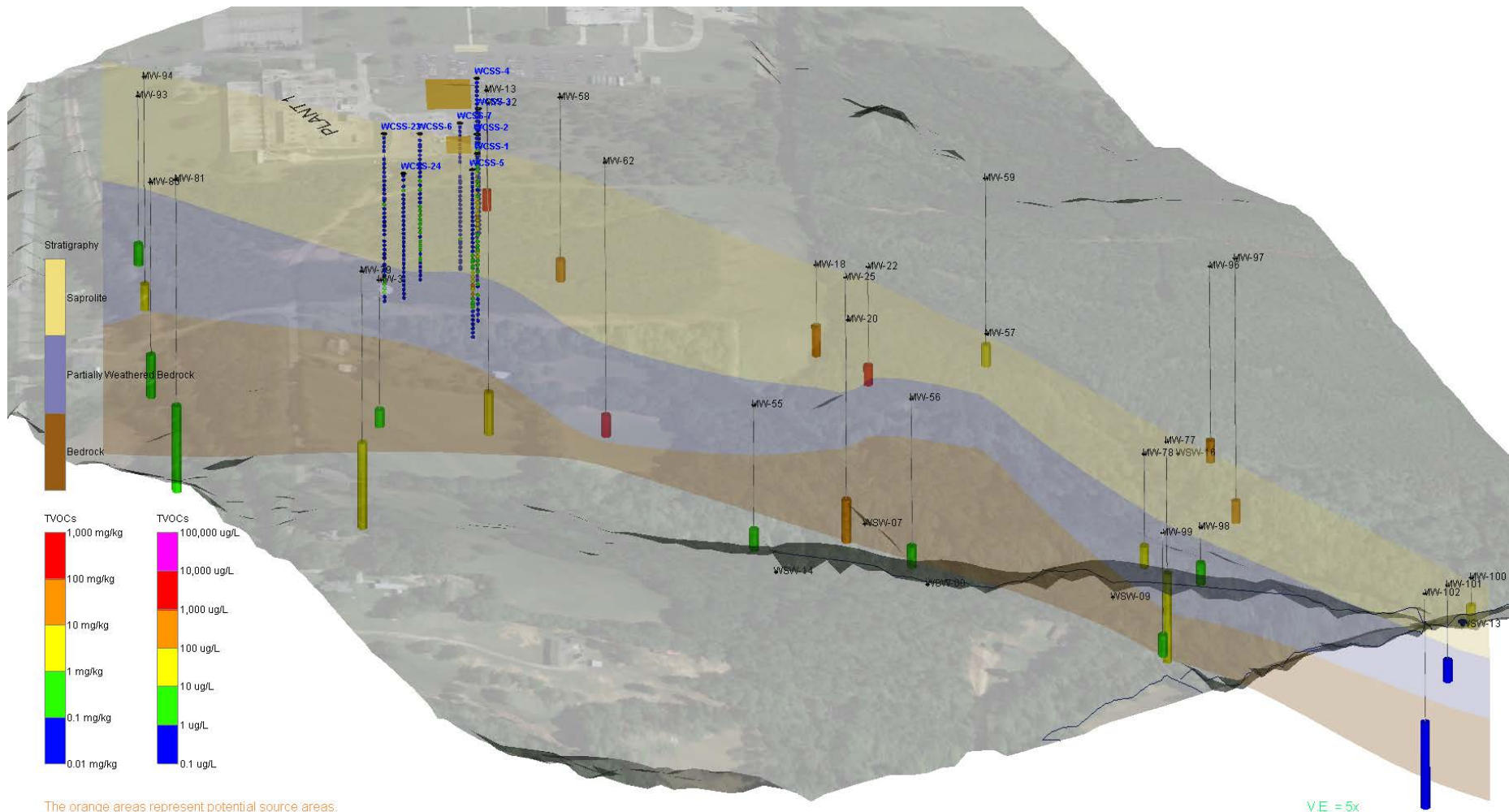
Plant 1 Results (TVOC)



Plant 1 Results (TVOC)

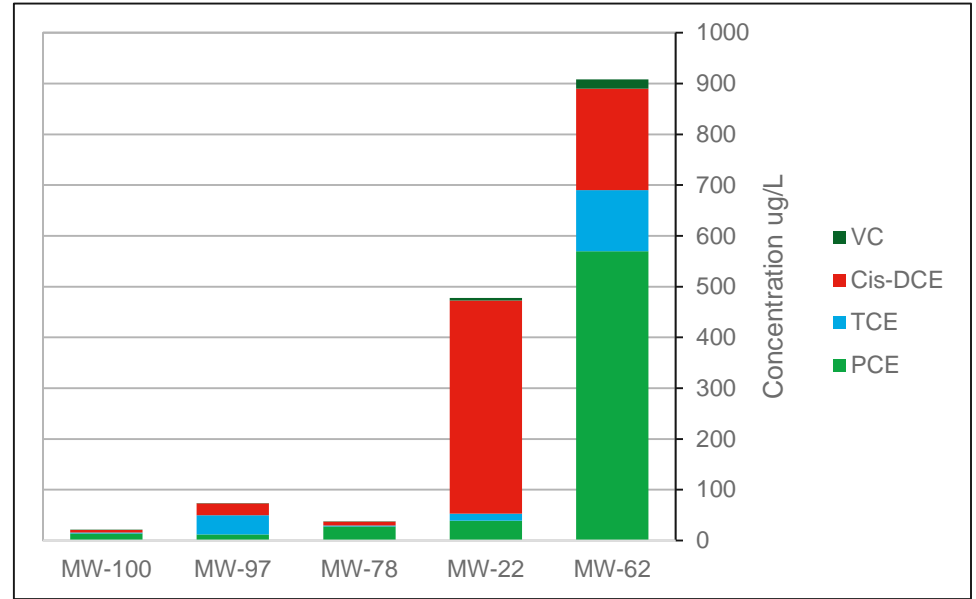
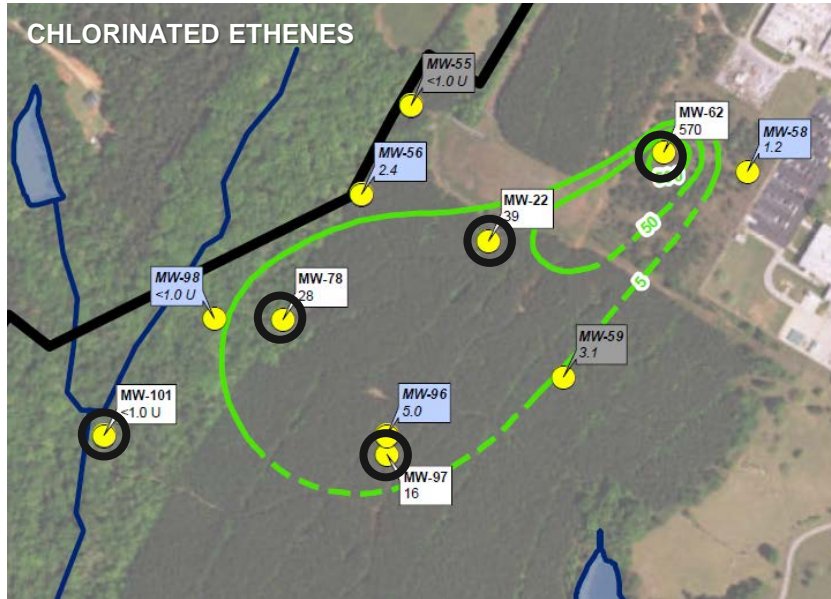


Plant 1 CSM Update

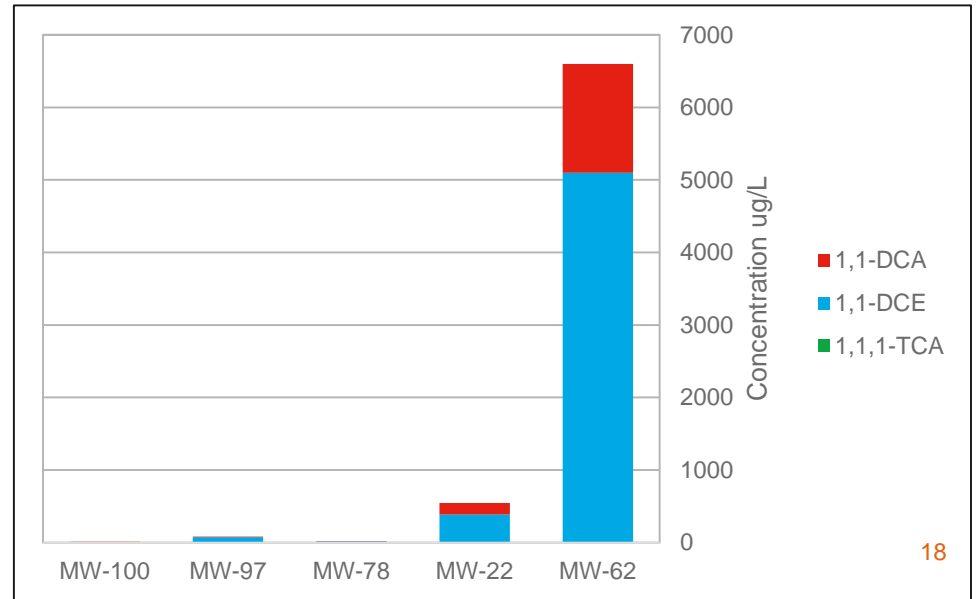
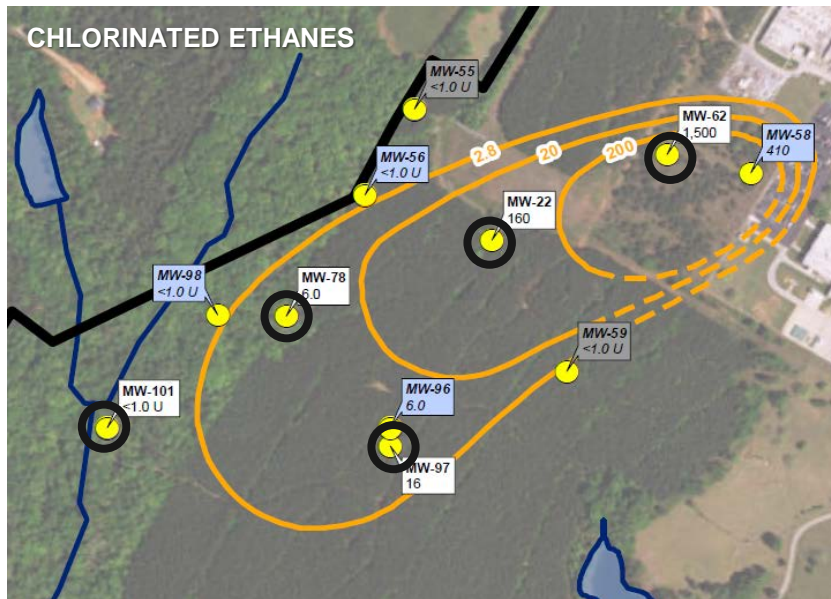


Plant 1 COC Transport

CHLORINATED ETHENES



CHLORINATED ETHANES



Geochemistry, COC Fate and Transport

Parameter	Range in Plume
Dissolved oxygen	0.42 – 6.75 mg/L
TOC	400 – 2,300 µg/L
Dissolved iron	170 – 22,000 µg/L
Sulfate	ND
Methane	1.3 – 1,400 µg/L
Ethene	0.13 – 5.7 µg/L
Ethane	0.23 – 3.5 µg/L

- Toluene serves as electron donor and contributes to reduced redox conditions
- Highly reduced groundwater conditions
- Significant biological attenuation ongoing
- Both biological and physical attenuation mechanisms contribute to plume stability and control
- COCs depleted at point of groundwater discharge

Primary Observations and Recommendations – Plant 1

Delineation assessment

- Remaining Plant 1 saprolite source material identified
- Updated CSM is consistent with plumes defined by existing monitoring well network (saprolite, PWR, bedrock)
- Data sufficient for remedial alternative development

Path Forward

- Identify and screen applicable remedial strategies (passive or active)
- Consider need for future monitoring wells, supplemental characterization, or pilot testing as part of FFS process and remedial alternative selection

Plant 2 Results and CSM Update

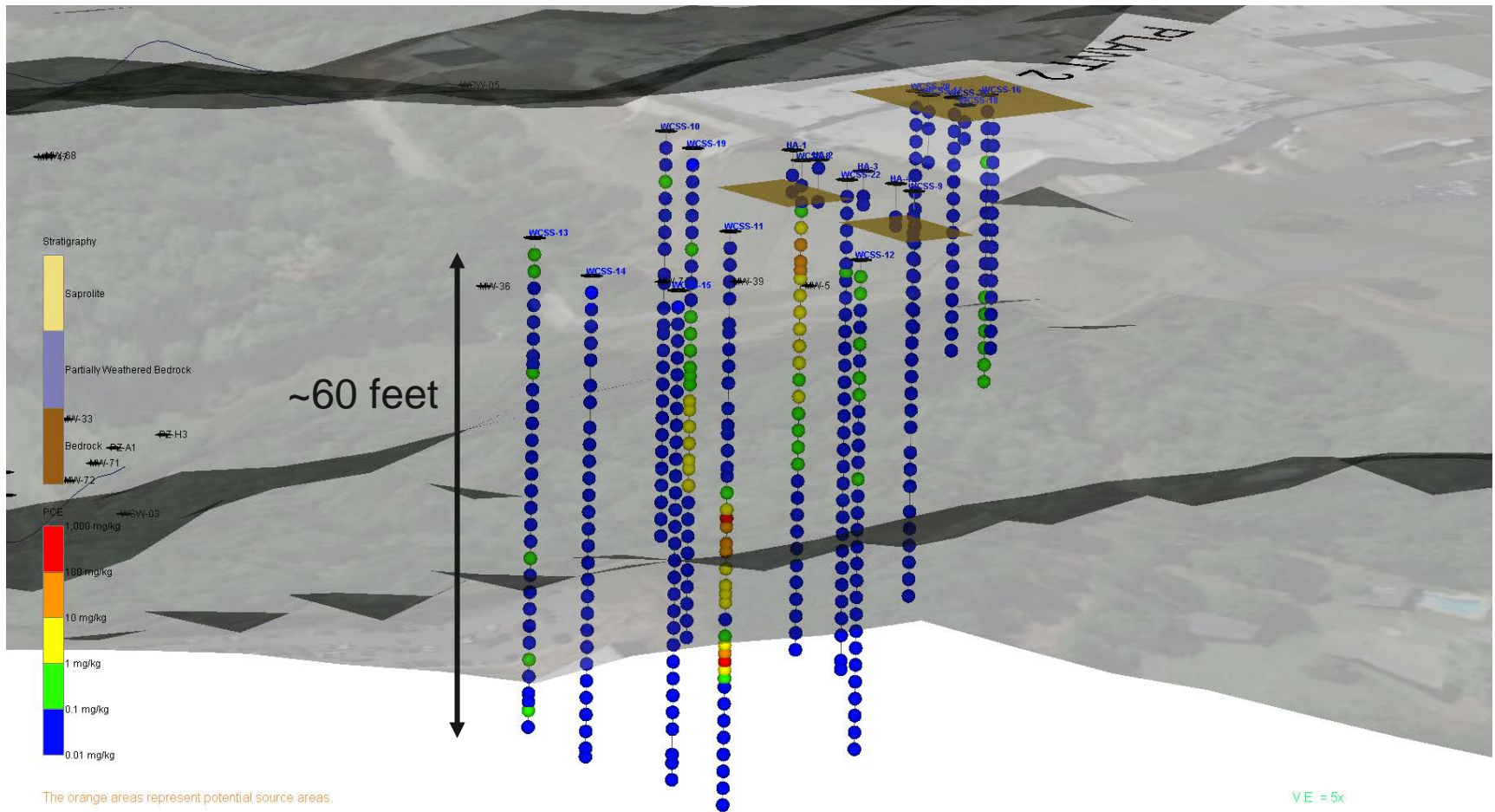
Plant 2 Results

- Identified COCs
 - PCE, TCE and associated daughter products
- Source identified upgradient of the ponds, near the eastern exterior wall of Plant 2, near WCSS-8
- No source area identified beneath Plant 2
- Former Plant 2 Ponds not identified as a source
- COCs identified in saprolite with discharge to underlying PWR
- COC concentrations reduced along transport pathway, daughter products evident
- Identified source areas are consistent with observed dissolved-phase plume in historical monitoring well and surface water sampling network

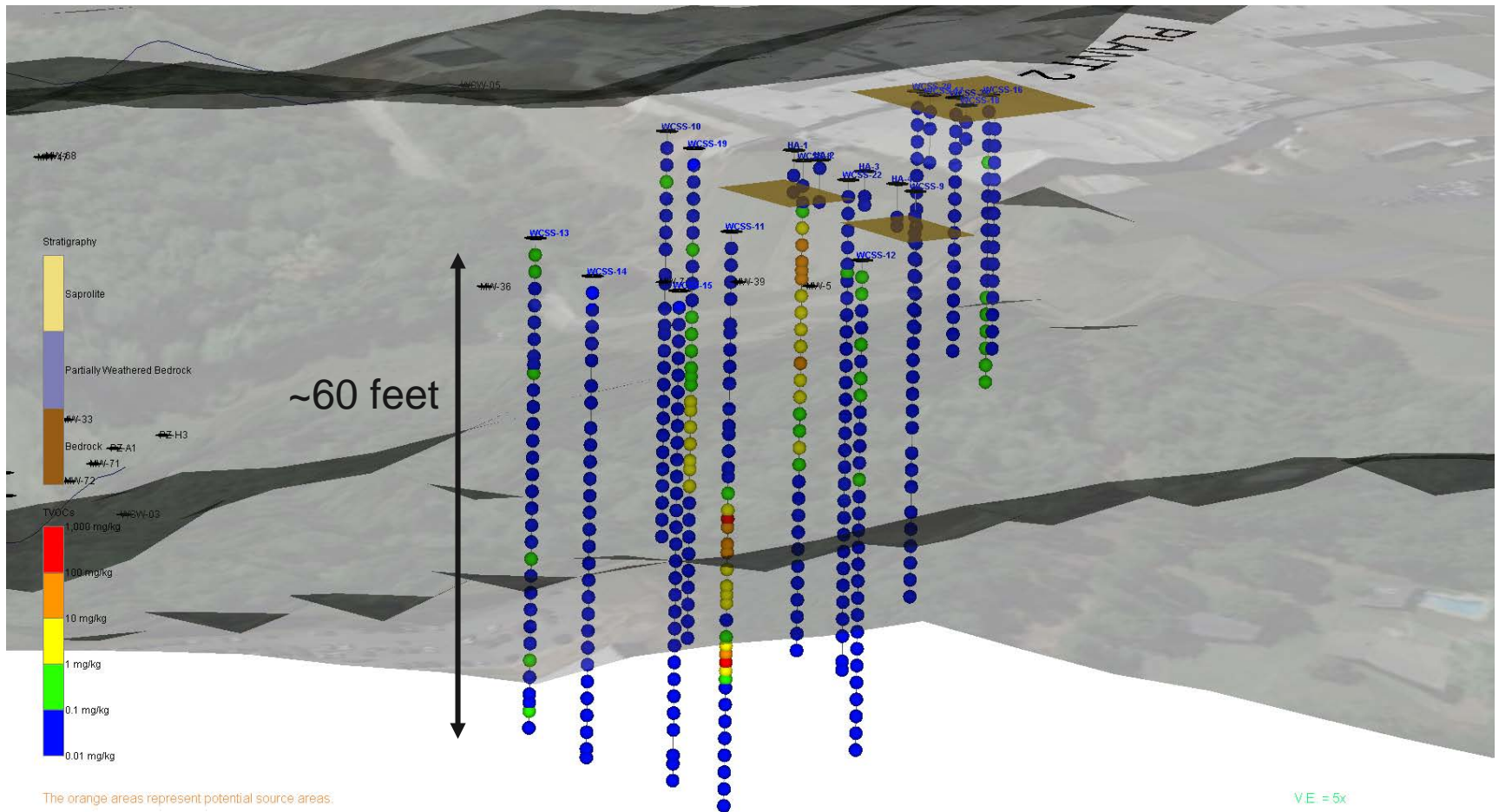
Plant 2 Results (TVOCs)



Plant 2 Results (PCE)

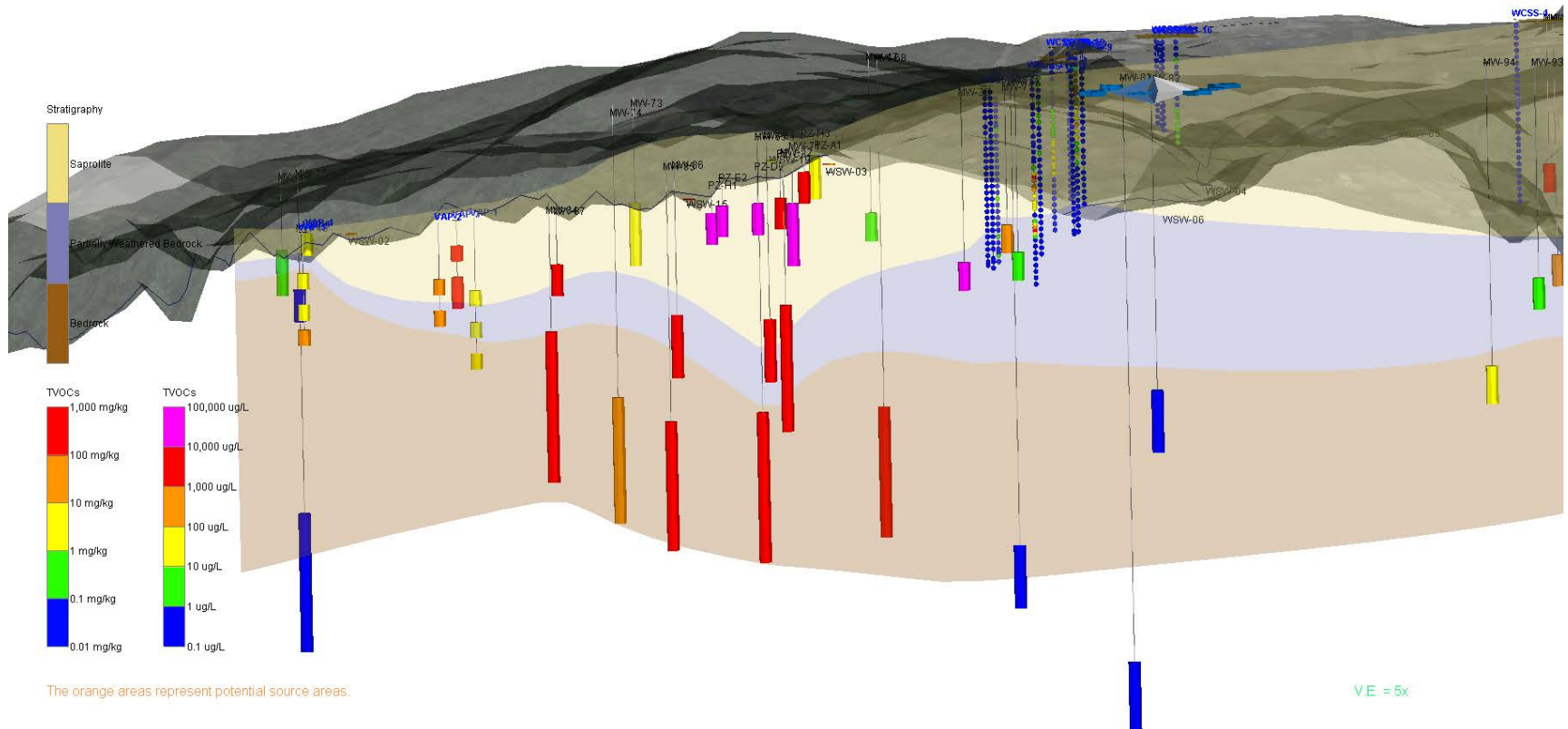


Plant 2 Results (TVOCs)

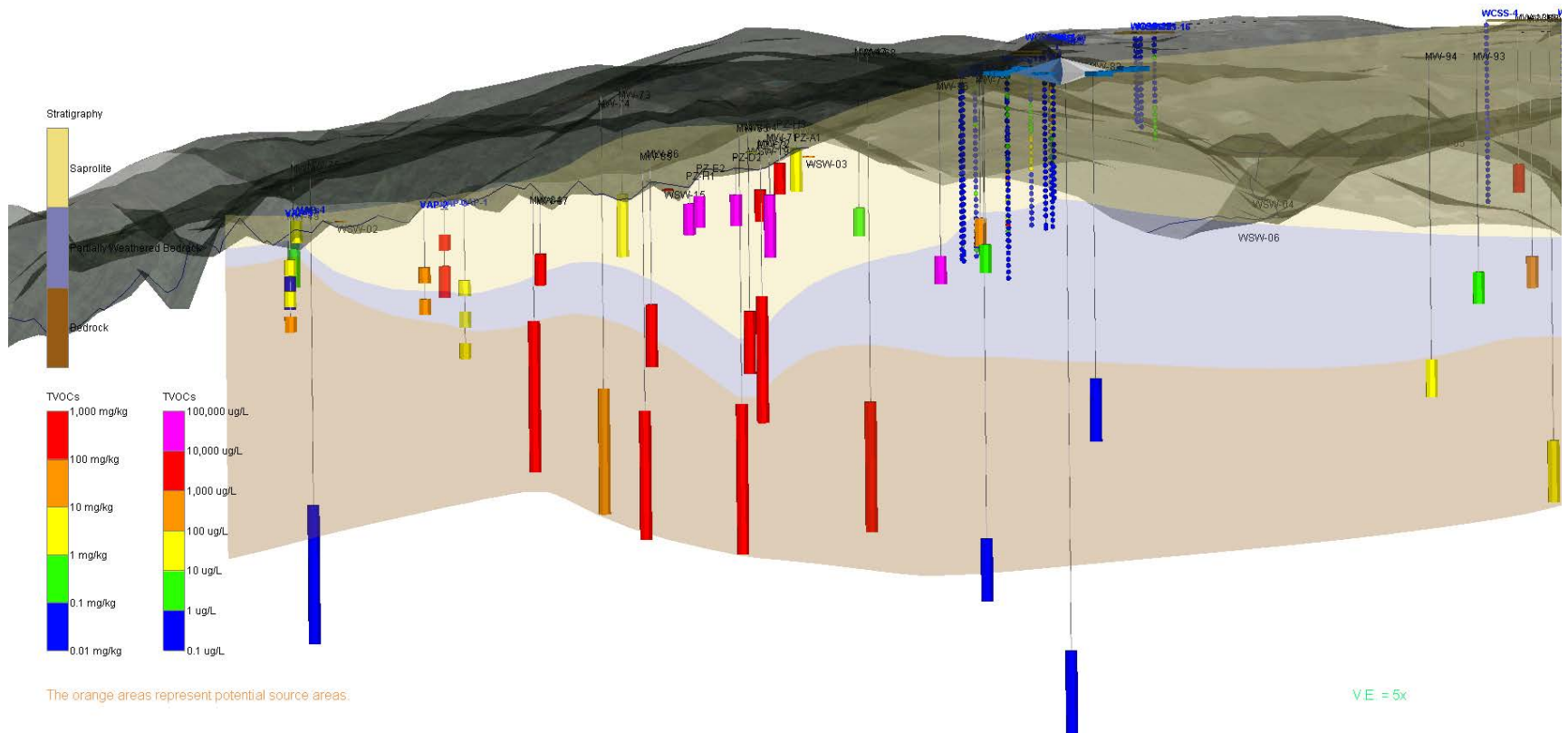




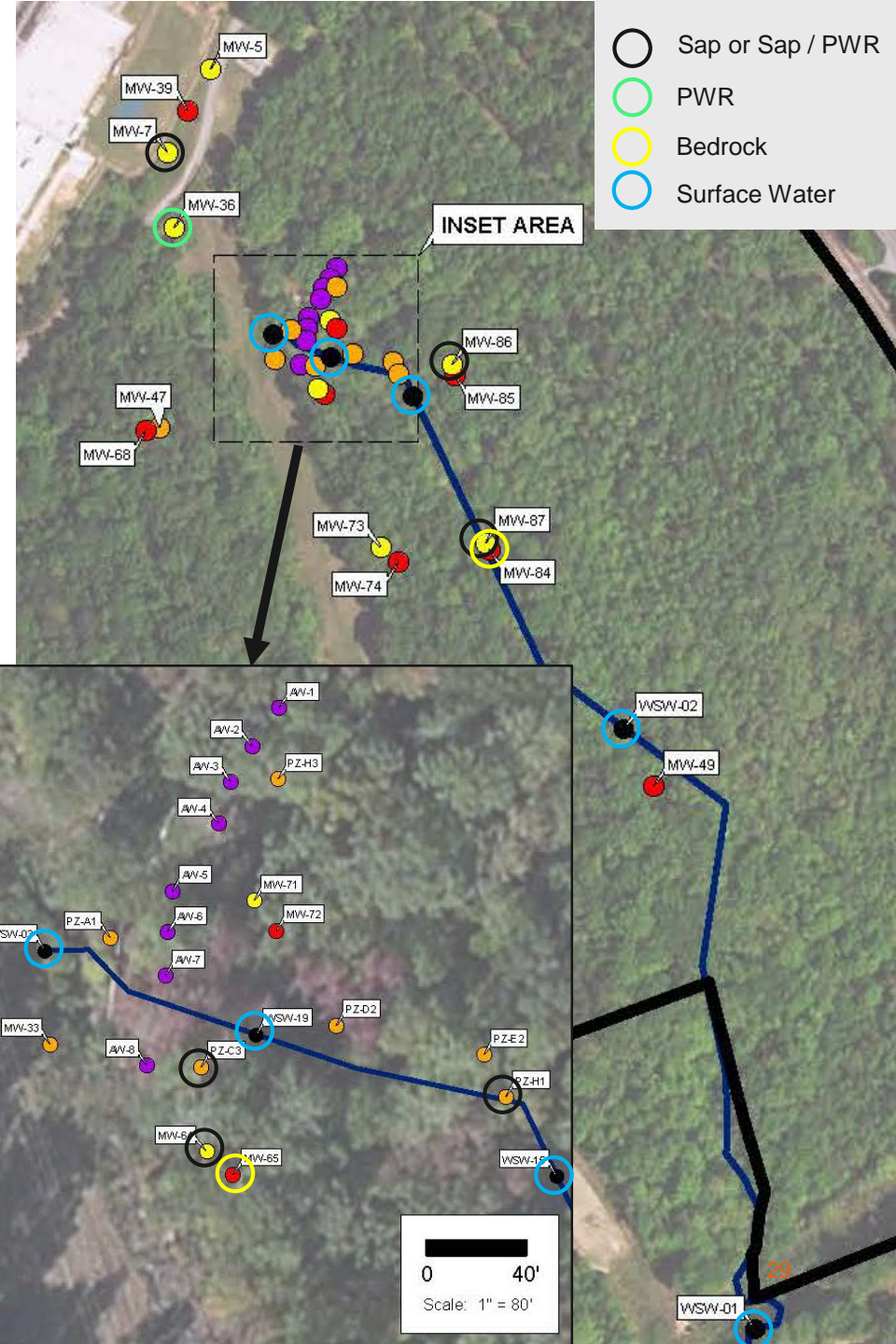
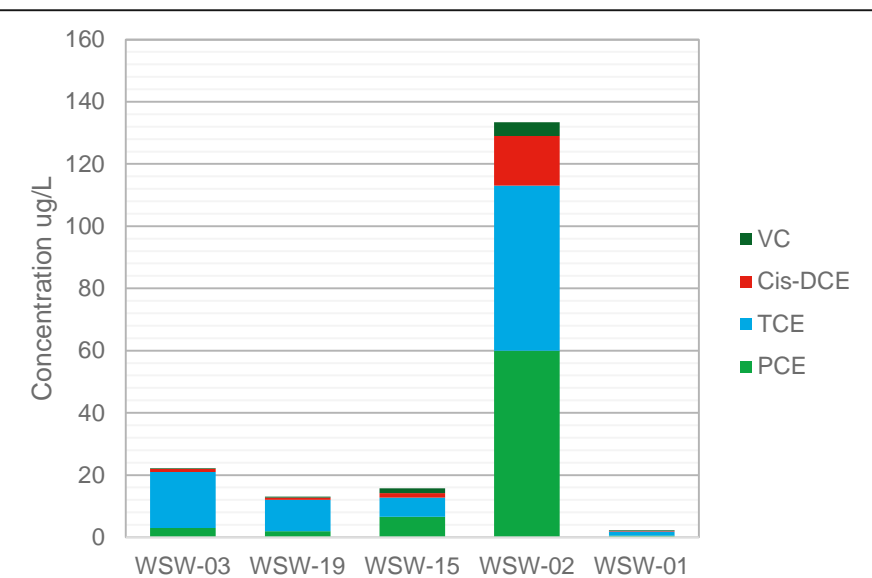
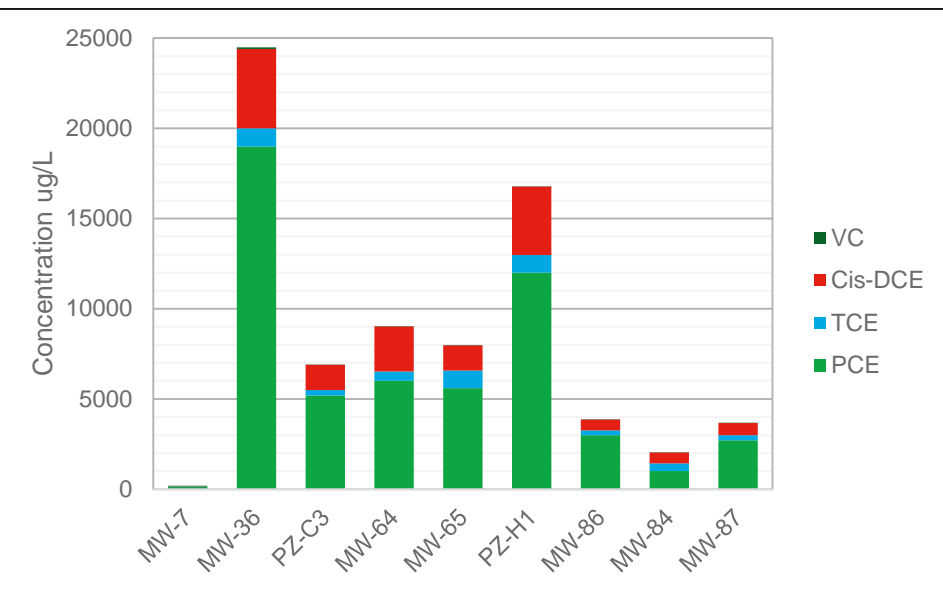
Plant 2 CSM Update (PCE)



Plant 2 CSM Update (TVOCs)



Plant 2 COC Transport



Geochemistry, COC Fate and Transport

Parameter	Range in Plume
Dissolved oxygen	0.32 – 4.89 mg/L
TOC	260 – 1,600 µg/L
Dissolved iron	570 – 1,700 µg/L
Sulfate	ND
Methane	0.6 – 530 µg/L
Ethene	0.11 – 26 µg/L
Ethane	0.11 – 20 µg/L

- Evidence of reductive dechlorination
- Mildly reducing groundwater conditions
- COCs decrease along groundwater / surface water flow path

Primary Observations and Recommendations – Plant 2

Delineation assessment

- Vicinity of the Plant 2 source identified
- VAP data provide significant resolution to map downgradient COC transport
- Updated CSM is consistent with plumes in saprolite, PWR, and bedrock
- Data sufficient for remedial alternative development

Path Forward

- Identify and screen applicable remedial strategies (passive or active)
- Consider need for future monitoring wells, supplemental characterization, or pilot testing as part of FFS process and remedial alternative selection

Road Map for Completing FFS

Impacted Media – Plants 1 & 2

Media	Plant 1	Plant 2
Surface soil	No	No
Subsurface soil	Yes, but primary source near water table	Yes, outside and east of Plant 2 building
Groundwater	Saprolite, PWR, bedrock	Saprolite, PWR, bedrock
Surface water	No	Yes

FFS Remedy Considerations

- Develop focused list of effective remedies for Plants 1 & 2
- Plant 2 considerations:
 - Residual vadose zone source mass and contributions to underlying groundwater
 - Dissolved-phase transport in both saprolite and PWR
 - Discharge to stream
- Plant 1 considerations:
 - Identify potential cost-effective strategies to augment ongoing natural treatment concurrent with Plant 2 remediation
- Evaluate balance between level of aggressiveness and remedial timeframe to effectively balance potential exposure risks, implementability, and cost (CERCLA 9)
- Submit to DHEC by August 15, 2016

Remedial Development Process

1. Identify and screen applicable remedies as either stand-alone options or as part of combined remedial strategy
2. Finalize and submit FFS with recommendations for preferred remedial approach(-es)
3. Phased remedial implementation:

PHASE I

- Initiate remedy(-ies)
- Identify necessary design parameters
- Address remedy-specific delineation needs

PHASE II

- Expand remedy(-ies) based on Phase I results
- Remedial operation

PHASE III

- MNA
- ICs / ECs
- Closure

