VOLUNTARY REMEDIATION PLAN
SEMI-ANNUAL PROGRESS REPORT #5

SOUTHERN STATES, LLC
30 GEORGIA AVENUE
HAMPTON, GEORGIA

HSI No. 10141

NOVEMBER 15, 2017

Prepared for

SOUTHERN STATES, LLC
30 Georgia Avenue
Hampton, Georgia

VOLUNTARY REMEDIATION PLAN
SEMI-ANNUAL PROGRESS REPORT #5

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JOHN O. SCHWALLER
No.001617
GEORGIA REGISTERED PROFESSIONAL GEOLOGIST

John O Schwaller, PG
(GA. Registration No. 1617
Project Manager

EMA
Environmental Management Associates, LLC
5262 Belle Wood Court, Suite A
Buford, Georgia 30518

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CERTIFICATION OF GROUNDWATER REPORT

I certify that I am a qualified ground-water scientist who has received a baccalaureate or post-graduate degree in the natural sciences or engineering, and have sufficient training and experience in ground-water hydrology and related fields, as demonstrated by state registration and completion of accredited university courses, that enable me to make sound professional judgments regarding ground-water monitoring and contaminant fate and transport. I further certify that this report was prepared by me or by a subordinate working under my direction.

John O. Schwaller
Printed Name (GA Professional Geologist 1617)

Signature (Professional Geologist)

1.0 PROJECT SUMMARY

On behalf of Southern States, LLC (SSL), Environmental Management Associates, LLC (EMA) is submitting this Voluntary Remediation Plan – Semi-Annual Progress Report #5 (Progress Report) to the Georgia Environmental Protection Division for SSI's manufacturing facility located at 30 Georgia Avenue, Hampton, Georgia. This Progress Report has been prepared to meet the requirements contained in the Georgia Voluntary Remediation Program Act and covers the activities conducted since the submittal of Progress Report #4 dated April 15, 2017.

The SSL site (Site) is located at 30 Georgia Avenue, Hampton, Henry County, Georgia. The surrounding properties are predominantly residential. A topographic map (Property Location Map) of the surrounding area is included as Figure 1. A Site Plan is presented as Figure 2.

SSL began manufacturing operations at the Hampton, GA location in 1940. SSL manufactures high-voltage electrical switches and fuses at its 30-acre manufacturing facility located in Hampton, Georgia. In 1986, SSL conducted a focused groundwater investigation to determine the impact from an existing wastewater sludge impoundment. The results of this and subsequent investigations identified a release of select VOCs had occurred at the Property. In December 1989, SSL and the Georgia Environmental Protection Division (EPD) entered into a Consent Order (Order), No. EPD-HW-529. The Property was listed on the Hazardous Site Inventory on June 30, 1997 as Site No. 10141.

Since 1986, the Property has been the subject of a number of investigations which identified the presence of volatile organic compounds in the soil and groundwater.

EMA prepared the VRPAP and submitted to EPD on October 30, 2014. EPD approved the VRPAP with conditions and comments in two letters dated April 10, 2015.

EMA conducted two formal injections (June 2015 and January 2016 as proposed) of an in-situ chemical oxidation (ISCO) reagent (PeroxyChem's (formerly FMC Corporation) Klozur® sodium persulfate mixed with an alkaline activator (sodium hydroxide) to form sulfate and hydroxyl radicals) to reduce the existing groundwater contamination to levels at or below the Type 4 RRS proposed in the VRP. ISCO application was performed at three specific areas identified on Figure 3 with the following rationale:

Treatment Area	*Rationale*
Zone A – MW-39	suspected source zone (~ 200,000 µg/L TCE);
Zone B – TP-1 / TP-2	lateral impact area (~ 2,000 µg/L TCE); and

Zone C – MW-18	pilot study to determine saprolite/shallow bedrock treatment effectiveness on MW-32.

In June 2015, EMA's subcontractors, REM-CON, LLC and Geo Lab Probing Services, installed temporary injection points at each of the three treatment zones. The injection points include open screened areas targeting the contaminant zones from 12 feet (ft) below ground surface (bgs) to 35 ft bgs. The sodium persulfate reagent was injected throughout the overburden aquifer. ISCO injections occurred in June 2015 and January 2016.

This Semi-Annual VRP Progress Report No. 5 was prepared in accordance with the VRP and covers the activities conducted since the Semi-Annual Progress Report No. 4 submittal and covers the period April 16, 2017 through October 15, 2017. These activities included a semi-annual groundwater monitoring event, groundwater fate and transport modeling, limited soil removal, and a screening level ecological risk assessment.

2.0 ACTIONS TAKEN SINCE LAST SUBMITTAL

2.1 GROUNDWATER PERFORMANCE MONITORING

Groundwater performance monitoring was performed in June 2017. The following select monitoring wells were utilized for the long term monitored natural attenuation (MNA) groundwater monitoring to determine the effectiveness of the groundwater remediation and confirm fate and transport model:

<u>Monitoring Wells</u>

<u>Overburden</u>
- MW-9;
- MW-13;
- MW-17;
- MW-18;
- MW-19;
- MW-21;
- MW-35;
- MW-39;
- MW-40;
- MW-41;
- TP-1; and
- TP-2.

<u>Bedrock Wells</u>
- MW-20;
- MW-28;
- MW-31;
- MW-32;
- MW-36;

Groundwater samples were collected on June 8, 2017 using the low-flow purging and sampling technique referenced in USEPA Region IV's SESD Operating Procedures - Groundwater Sampling SESDPROC-301-R4, April 2017. Peristaltic pumps using disposable Teflon tubing was used for the purging and sampling. Static groundwater level measurements were recorded at each monitoring well on June 8, 2017. The measurements were made with a pre-cleaned "Slope" electronic water level detector and were reported to the nearest 0.01-foot based on a fixed point on the top of the well casing. A potentiometric contour map for the shallow water table was prepared based on the groundwater elevations presented in Table 1 and is provided as Figure 3. For the bedrock monitoring wells, a potentiometric contour map is presented as Figure 4. The groundwater flow directions in both the shallow water table and the bedrock are consistent with historic monitoring events.

During the low-flow purging procedure, field measurements of reduction oxidation potential (redox), dissolved oxygen (D.O.), turbidity, pH, conductivity, and temperature were recorded. Once the field measurements stabilized for three consecutive readings, samples were collected directly into the pre-preserved laboratory supplied containers. Monitoring well purge records are presented in Appendix A.

The groundwater samples were delivered under standard chain-of-custody (COC) protocols to Analytical Environmental Services, Inc. (AES) located in Atlanta, Georgia. AES is an accredited laboratory under the National Environmental Laboratory Accreditation Program (NELAC) (Accreditation ID: E87582). The groundwater samples were submitted for select target compound list (TCL) volatile organic compounds (VOCs) including 1,4-dioxane by SW-846 Method 8260B and select MNA parameters.

The detected compounds observed during the monitoring events since the baseline event of June 2015 through the June 2017 monitoring event are summarized in Table 2. Figures 5 and 6 present the most recent overburden total VOC and TCE iso-concentration contours, respectively. Figures 7 and 8 present the most recent bedrock total VOC and TCE iso-concentration contours. The analytical reports are included in Appendix A.

2.2 DISCUSSION AND CONCLUSIONS

Review of the groundwater data presented in Table 2 indicates favorable results following the groundwater remediation activities with minimal to no rebound. Of significant note are the following reductions from the June 2015 total chlorinated VOC baseline concentrations:

<u>Overburden Wells:</u>
MW-13: 143 µg/L to 82 µg/L (approximately 43 % reduction);
MW-39: 214,900 µg/L to 6,414 µg/L (approximately 97% reduction);
MW-40: 5,438 µg/L to 1,302 µg/L (approximately 76% reduction);
MW-41: 4,170 µg/L to 664 µg/L (approximately 84% reduction); and
TP-2: 856 µg/L to 550 µg/L (approximately 36% reduction).

<u>Bedrock Wells:</u>
MW-28: 15 µg/L to 7 µg/L (approximately 55% reduction);
MW-31: 15 µg/L to ND (approximately 100% reduction); and
MW-32: 118 µg/L to 88 µg/L (approximately 25% reduction).

It is important to note that the data has been collected quarterly or semi-annually over a period of three years or more. In addition, where rebound has been observed immediately after remediation, the concentrations observed have not exceeded historic or baseline concentrations (i.e. monitoring well TP-1).

Table 2 presents the summary of analytical data collected since the baseline monitoring event of June 2015. Appendix B presents total VOC and select chlorinated contaminant trend graphs for select performance monitoring wells.

2.3 GROUNDWATER FATE AND TRANSPORT MODELING

Fate and transport modeling was conducted to support a HSRA Type 5 for select groundwater VOC COC's that exceed the Type 4 RRS. The HSRA Type I RRS's will be the off-site standards for groundwater VOC COC's at the point of exposure (POE). All downgradient properties within 1,000 feet of the delineated extent of contamination are owned and under the control of SSL. Further downgradient properties are on public water; therefore, the POE has been set to a point 1,000 feet downgradient from the edge of the contaminant plume identified by monitoring well MW-18. The point of demonstration (POD) well will be existing on-site monitoring well MW-17.

In an effort to determine whether this hypothetical receptor would be impacted, EMA utilized the BIOCHLOR Natural Attenuation Decision Support System, Version 2.2 (BIOCHLOR) to assist in determining the concentration and time frame when dissolved phase TCE in groundwater reaches the hypothetical POE. The model was also utilized to develop an ACL to determine the highest concentration allowed at the source area before the POE would be impacted at a concentration above the Type 1 RRS. For 1,1,2-TCA a one-dimensional mathematical model was used for the same purposes as BIOCHLOR does not specifically model this compound.

For the SS Site, the most conservative model using solute transport without decay (No Degradation) was utilized to determine contaminant transport.

Following the calibration run and using the most conservative "No Degradation" results from the models, the following was determined:

- The Type I groundwater RRS for TCE, cis-DEC, VC or 1,1,2-TCA is never observed at the hypothetical drinking water receptor using the current concentrations observed at the source;
- The following ACLs were developed assuming the highest source concentrations at MW-39 where the Type 1 RRS would not be exceeded at the theoretical POE at 100 years using the No Degradation output:
    - TCE – 50 mg/L;

- cis-DCE – 10 mg/L;
- VC – 8 mg/L; and
- 1,1,2-TCA – 30 mg/L.

The model report, input parameters, and the model outputs are presented in Appendix C.

Please note, although the models in BIOCHLOR utilized the No Degradation output as the most conservative model, there is evidence of anaerobic dechlorination and a 1st order decay model would apply. In addition, while the POE is located 1,000 feet downgradient of the edge of the contaminant plume, the property line is located an additional 475 feet downgradient, therefore, the total distance from the suspected source at MW-39 to the property line is approximately 1,843 feet.

2.4 LIMITED SOIL REMOVAL

As part of the proposed remedial activities, limited soil removal activities were performed at locations SED-3 and SED-4 illustrated on Figure 9. Subsurface soils were removed from these locations as they exhibited concentrations of total polychlorinated biphenyls (PCB) exceeding the Type I RRS of 1.55 mg/kg.

Approximately one cubic yard of soil was removed from location SED-3 from an approximately three feet by three feet by three feet depth. Approximately two cubic yards of soil were removed from location SED-4 from an approximately four feet by four feet by three feet depth.

Confirmatory soil sampling was performed at each location. One soil sample was collected from each sidewall from the 12-24-inch depth interval and the base of each location. All soil samples were collected in accordance with USEPA Region IV's SESD Operating Procedures – Soil Sampling SESDPROC-300-R3, August 2014.

The samples were delivered under standard chain-of-custody (COC) protocols to Analytical Environmental Services, Inc. (AES) located in Atlanta, Georgia. AES is an accredited laboratory under the National Environmental Laboratory Accreditation Program (NELAC) (Accreditation ID: E87582). The soil samples were submitted for PCB analysis by SW-846 Method 8082A.

PCB's were detected in some of the soil samples; however, no soil sample exceeded the Type 1 RRS of 1.55 mg/kg. Figure 9 presents the soil removal locations and summary of analytical data. The analytical reports are included in

Appendix A. All excavated soils were disposed off-site at Eagle Point Landfill a permitted solid waste facility. The manifest is presented in Appendix D.

2.5 SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT

Background

A Screening Level Ecological Risk Assessment (SLERA) was performed by Dr. Chris Saranko and staff of Geosyntec Consultants and a report was prepared and included in Appendix E. This assessment was conducted in accordance with several guidance documents from the United States Environmental Protection Agency (EPA) including, *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessment* (EcoRAGS) (EPA, 1997); *Region 4 Ecological Risk Assessment Supplemental Guidance* (EPA, 2015a). Compliance with these guidance documents meets the Georgia Environmental Protection Division (EPD) requirements for ecological risk assessment.

The EPA ecological risk assessment paradigm includes eight general steps (EPA, 1997):

Step 1 - Screening-Level Problem Formulation and Effects Evaluation;
Step 2 - Screening-Level Exposure Estimate and Risk Calculation;
Step 3 - Baseline Problem Formulation;
Step 4 - Study Design and DQO Process;
Step 5 - Verification of Field Sampling Design;
Step 6 - Site Investigation and Data Analysis;
Step 7 - Risk Characterization; and
Step 8 - Risk Management.

Steps 1 and 2 comprise the SLERA, which evaluates the potential risks to wildlife exposed to chemical constituents by providing a conservative estimate of the risks that may exist for wildlife, and incorporating uncertainty in a precautionary (i.e., highly conservative) manner. The purpose of the SLERA is to indicate either: 1) that there is a high probability that there are no ecologically significant risks for wildlife; or 2) to indicate the need for remediation and/or additional ERA-related activities (EPA, 2001, 2015a). Step 3 is the initial step of the baseline ecological risk assessment (BERA) and it is often split into Step 3A – screening refinements, and Step 3B – baseline problem formulation. A BERA is more complex than a SLERA and typically incorporates more realistic wildlife exposure information. Only those wildlife receptors and constituents that the SLERA identifies as posing potential risks are carried forward to a BERA.

The ERA process produces a series of clearly defined scientific management decision points (SMDPs)(EPA, 1997). The SMDPs represent critical steps in the process where ecological risk management decision-making occurs. The EPA risk assessment model provides for the first SMDP either after Step 2 or as part of Step 3A, with a second SMDP after the completion of Step 3B. Generally, the following types of decisions are typically considered at the SMDPs:

- whether the available information is adequate to conclude that ecological risks are negligible and, therefore, there is no need for any further action on the basis of ecological risk;
- whether the available information is not adequate to make a decision at this point, and the ecological risk assessment process will continue; or
- whether the available information indicates a potential for adverse ecological effects, and a more thorough assessment (or remediation) is warranted.

The full report presented as Appendix E presents Steps 1 through 3A of the EPA's ERAGS process.

<u>Summary and Conclusions</u>

SMDPs represent critical steps in the ecological risk assessment process where risk management decision-making occurs. The first SMDP in the ERA process typically occurs at the end of Step 2 or Step 3A (EPA 2001). The purpose of the flexibility of the first SMDP is so that additional evaluation of risks can occur, and reporting can be streamlined into a single report. Generally, one of the following conclusions is reached at this SMDP (EPA, 1997):

- there is adequate information to conclude that ecological risks are negligible and therefore no need for remediation on the basis of ecological risk;
- the information is not adequate to make a decision at this point, and the ecological risk assessment process will continue to Step 3 (or 3B); or
- the information indicates a potential for adverse ecological effects, and a more thorough assessment is warranted.

Based on the elevated screening-level HQs calculated by comparing maximum detected PCB concentrations to default ESVs in Step 2, it was decided to further evaluate the PCB impacts using a limited number of food chain models in Step 3A. This portion of the Problem Formulation step is designed to more realistically identify the nature and extent of ecological risks in order to support informed environmental management decision-making (EPA, 1997, 2001).

The results of the food chain modeling indicate that the overall risks to populations of both birds and mammals are low, particularly considering the limited spatial extent of COPEC concentrations that exceed the food chain-based ecological RGs. In addition, the relatively disturbed characteristics of the habitat in the areas most affected by the contamination, and the conservative nature of the food chain calculation support the use of lowest-observed adverse effects level (LOAEL)-based RGs for remedial decision making.

As detailed in the October 2017 VRP Progress Report for the SS site (EMA, 2017b), the two locations with the highest detected concentrations of PCBs (SED-3 and SED-4) were excavated in May 2017. The PCB concentrations in samples from these two locations were excluded from the SLERA and Step 3A screening refinements. The 95% UCL for PCBs in the combined soil/sediment dataset is below the most conservative LOAEL RG based for invertivorous mammals (1.1 mg/kg)[1]. Based on these considerations, the potential for ecological risks at the SS site have been adequately mitigated and it is not necessary to advance the ecological risk assessment beyond Step 3A.

2.6 CLEANUP STANDARDS

Soil

The soil cleanup standards for the PCB COC will be the HSRA Type 1 RRS for everywhere except for the former landfill which will be capped and therefore fall under a HSRA Type 5 RRS classification.

Groundwater

The groundwater cleanup standards for the VOC COC will be a combination of HSRA Type 1, 4, 5 RRS. All COCs identified will meet the Type 1 or 4 RRS with the exception of the following compounds in which a Type 5 RRS will be applied via a groundwater well restriction covenant and in which an ACL has been determined:

- TCE – 50 mg/L;
- cis-DCE – 10 mg/L;
- Vinyl chloride – 8 mg/L; and
- 1,1,2 – Trichloroethane – 15 mg/L

Sediment

No additional evaluation is required. The LOAEL RG for PCB in sediment is 1.1 mg/kg. No sediments on the property exceed this value.

[1] The PCB 95% UCLs in the individual soil and sediment datasets are also below the LOAEL RG for terrestrial mammals.

3.0 PROPOSED REMEDIATION PLAN

It is SSL's objective to implement this VRP to satisfy the requirements of the Georgia Voluntary Remediation Program Act for the preparation of a VRP Compliance Status Report.

3.1 REMEDIAL OPTIONS

EMA proposed a combination of the following remedial actions to meet the objective for the Property:

<u>Soil</u>

- Removal of soil exceeding the Type 1 RRS for PCBs at locations SED-3 and SED-4 and confirmatory sampling; and
- Completion of the capping of portions of the former landfill.

<u>Groundwater</u>

- Limited in-situ chemical oxidation (ISCO);
- Monitored natural attenuation/Groundwater Monitoring; and
- Future land use and groundwater restriction covenants.

<u>Sediment</u>

- Ecological risk assessment to determine remedial options for the exposed portion of Little Bear Creek.

3.1.1 <u>Removal of Soil</u>

The soil exceeding the Type 1 RRS for PCB COC at location SED-3 and SED-4 identified on Figure 9 has been removed and all surface soils meet the Type 1 RRS.

3.1.2 <u>Installation of a Cap over portions of the Existing Former Landfill</u>

To prevent future surface soil migration of PCB COC contamination, industrial worker or trespasser contact with these soils, and minimize VOC COC migration within the groundwater, a permanent cap is proposed for portions of the former landfill area adjacent to Little Bear Creek. The objective of the cap would be to minimize rainfall infiltration and run-off. The permanent cap design will be a combination of reinforced concrete slab, asphalt, or geotextile membrane and vegetated soil.

The concrete or asphalt area of the cap will be physically constructed to serve the dual purpose of site cap and lay down yard for SSL. The cap will be designed to provide adequate surface water run-off drainage and minimize erosion. Vegetative soil would be placed on the sloped areas not conducive to physical use. A HSRA Type 5 RRS for PCB COC in subsurface soil would be met for this area.

3.1.3 Limited ISCO Groundwater Treatment

The use of in-situ chemical oxidation (ISCO) reagents was implemented at select suspected overburden groundwater source area locations to reduce the VOC COC concentrations. Treatment in select areas where groundwater currently exceeds the Type 4 RRS was performed throughout the area surrounding monitoring well locations MW-39, TP-1/TP-2, and MW-18. Performance monitoring was evaluated through quarterly and semi-annual groundwater sampling events and determined to be highly effective with an approximate 95% reduction in the MW-39 area. The treatment of the overburden significantly reduces the source that is impacting the bedrock groundwater zone.

3.1.4 Monitored Natural Attenuation / Groundwater Monitoring

Subsequent to the ISCO injections, select groundwater monitoring wells were sampled. Continued long term monitoring will be implemented as a continued remedial option which will include monitored natural attenuation parameters as well as the groundwater COC to validate the fate and transport model predictions. A summary of the monitoring program details is as follows:

Overburden Wells	Bedrock Wells
MW-9, MW-13, MW-17, MW-18, MW-21, MW-35, MW-39, MW-40, MW-41, TP-1, and TP-2	MW-19, MW-20, MW-28, MW-31, MW-32, and MW-36

The MNA parameters will include ferrous iron, sulfide, sulfate, nitrate, alkalinity, chloride, carbon, dioxide, and dissolved methane and ethane/ethane, VOC analysis, and field parameters which will include pH, conductivity, ORP, D.O., and temperature.

The semi-annual monitoring period is expected to be a period of 5 years but may be adjusted as conditions warrant.

3.1.5 Future Land Use and Groundwater Restriction Covenants

Based on the limited exposure pathways present on the Property, institutional controls will be utilized at the Property to eliminate future exposure pathways for on-site exposure. The City of Hampton currently has a zoning prohibition (Ord. No. 77, § 2.01, 10-12-93) requiring approval prior to digging, drilling, or boring a well for water which was enacted in 1993. The City of Hampton has not approved a well since the inception of the ordinance.

SS will implement a site specific UEC that conforms with the Uniform Environmental Covenants Act (O.C.G.A. § 44-16-1) to include a site specific groundwater use restriction as part of the site limitations.

3.1.6 Ecological Risk Assessment

A screening-level ecological risk assessment (SLERA) was performed as discussed in Section 2.5. The results of the SLERA indicate that no further action is required.

4.0 SCHEDULE AND FUTURE SUBMITTALS

A semi-annual groundwater sampling event including additional monitoring wells and monitored natural attenuation parameters is scheduled for December 2017.

A partial cap and re-vegetation to cover exposed areas of the former landfill will be initiated in quarter one 2018 to prevent further surface water infiltration and potential movement of any subsurface contaminants.

A Projected Milestone Schedule, showing timelines for the above items, is included in Appendix F.

Semiannual progress reports will continue to be submitted updating the progress and implementation of the VRPAP throughout the program. Additionally the Projected Milestone Schedule will be updated to show progress on the VRP objectives. The VRP Progress Report #6 will be submitted by April 15, 2018.

5.0 PROFESSIONAL GEOLOGIST CERTIFICATION STATEMENT

"I certify under penalty of law that this report and all attachments were prepared by me or under my direct supervision in accordance with the Voluntary Remediation Program Act (O.C.G.A. Section 12-8-101, et seq.). I am a professional engineer/professional geologist who is registered with the Georgia State Board of Registration for Professional Engineers and Land Surveyors/Georgia State Board for Professional Geologists and I have the necessary experience and am in charge of the investigation and remediation of this release of regulated substances.

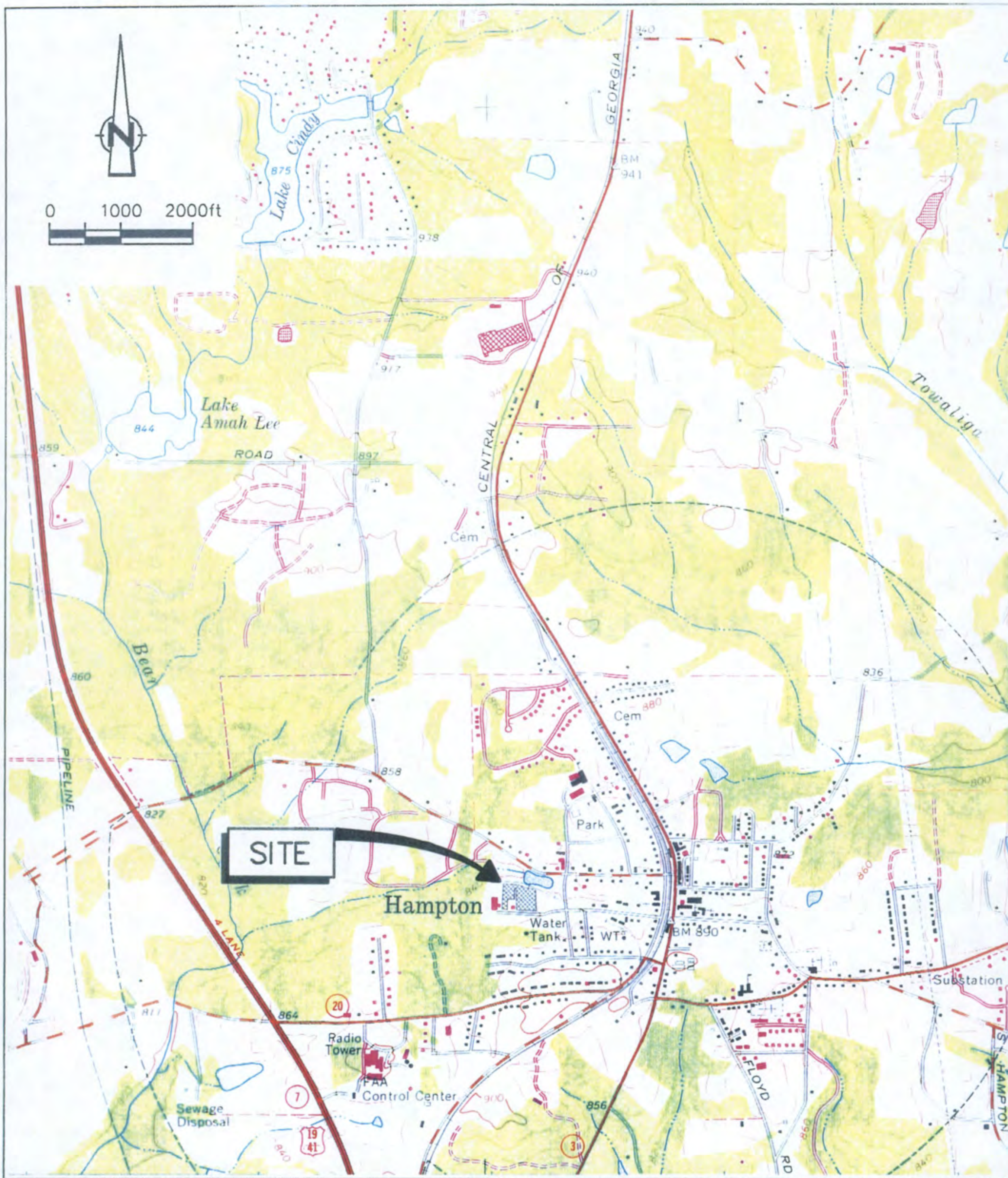
Furthermore, to document my direct oversight of the Voluntary Remediation Plan development, implementation of corrective action, and log term monitoring, I have attached a monthly summary of hours invoiced and description of services provided by me to the Voluntary Remediation Program participant since the previous submittal to the Georgia Environmental Protection Division.

The information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. "

Mr. John O. Schwaller, P.G.
Georgia Registration No. 1617

____
Signature/Stamp

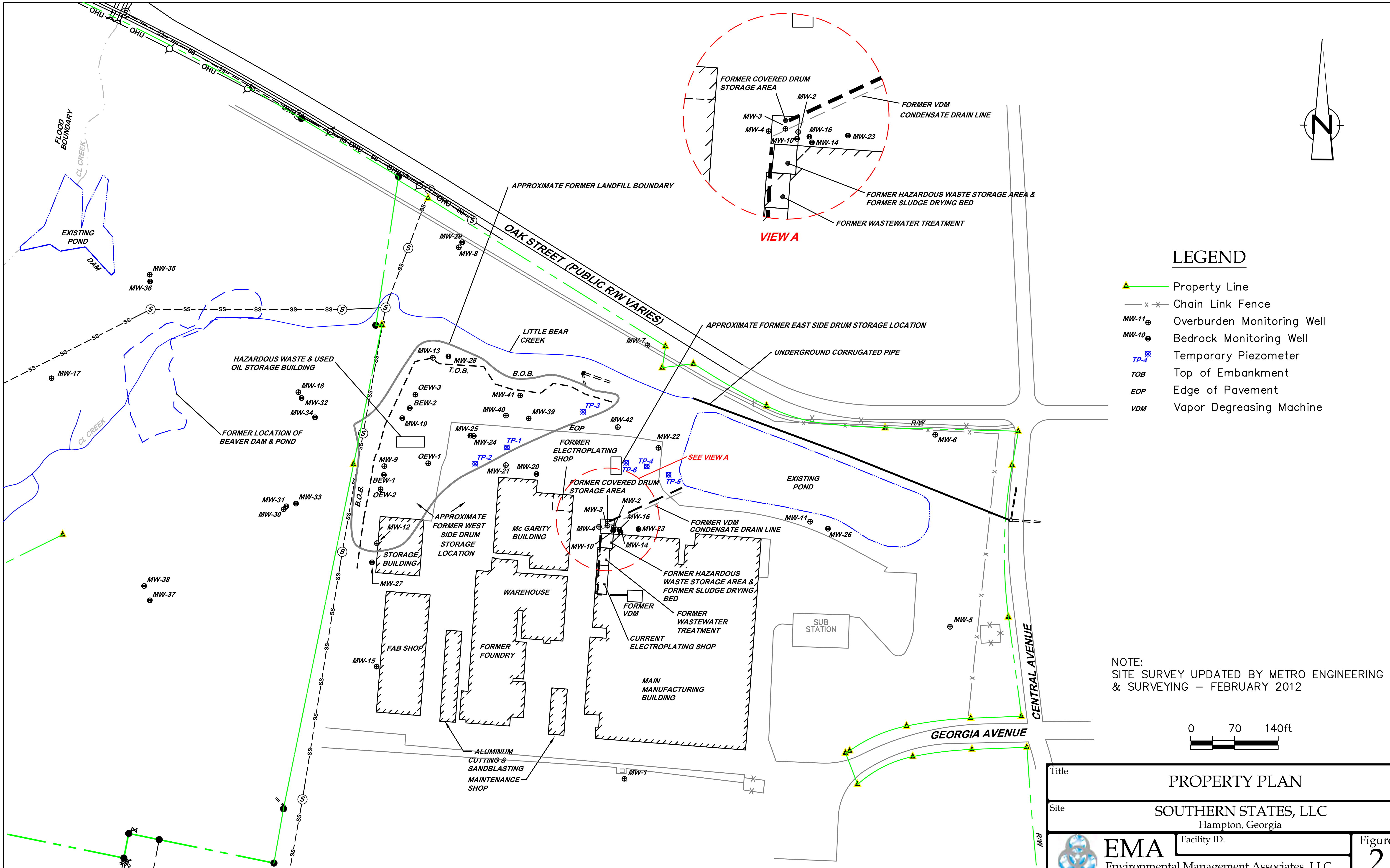
FIGURES



SOURCE: USGS QUADRANGLE;
HAMPTON, GEORGIA

figure 1

LOCATION MAP
SOUTHERN STATES SITE
Hampton, Georgia



VIEW A
FORMER COVERED DRUM STORAGE AREA
MW-2
MW-3
MW-4
MW-16
MW-23
MW-10
MW-14
FORMER VDM CONDENSATE DRAIN LINE
FORMER HAZARDOUS WASTE STORAGE AREA & FORMER SLUDGE DRYING BED
FORMER WASTEWATER TREATMENT
APPROXIMATE FORMER LANDFILL BOUNDARY
OAK STREET (PUBLIC R/W VARIES)
APPROXIMATE FORMER EAST SIDE DRUM STORAGE LOCATION
UNDERGROUND CORRUGATED PIPE
FLOOD BOUNDARY
CL CREEK
EXISTING POND
DAM
MW-35
MW-36
MW-29
MW-8
LITTLE BEAR CREEK
MW-7
MW-17
HAZARDOUS WASTE & USED OIL STORAGE BUILDING
MW-18
MW-32
MW-34
FORMER LOCATION OF BEAVER DAM & POND
MW-13
MW-28
T.O.B.
B.O.B.
OEW-3
BEW-2
MW-19
MW-41
MW-40
MW-39
TP-3
EOP
MW-42
MW-25
MW-24
TP-1
TP-2
FORMER ELECTROPLATING SHOP
MW-22
SEE VIEW A
TP-4
TP-6
TP-5
MW-9
OEW-1
BEW-1
OEW-2
MW-21
MW-20
FORMER COVERED DRUM STORAGE AREA
MW-31
MW-33
MW-30
APPROXIMATE FORMER WEST SIDE DRUM STORAGE LOCATION
MW-12
Mc GARITY BUILDING
FORMER VDM CONDENSATE DRAIN LINE
EXISTING POND
MW-11
MW-26
R/W
MW-6
STORAGE BUILDING
MW-27
WAREHOUSE
FORMER HAZARDOUS WASTE STORAGE AREA & FORMER SLUDGE DRYING BED
FORMER VDM
FORMER WASTEWATER TREATMENT
CURRENT ELECTROPLATING SHOP
SUB STATION
MW-5
MW-38
MW-37
FAB SHOP
MW-15
FORMER FOUNDRY
MAIN MANUFACTURING BUILDING
CENTRAL AVENUE
GEORGIA AVENUE
ALUMINUM CUTTING & SANDBLASTING
MAINTENANCE SHOP
MW-1
OHU
SS
LEGEND
Property Line
Chain Link Fence
MW-11 Overburden Monitoring Well
MW-10 Bedrock Monitoring Well
TP-4 Temporary Piezometer
TOB Top of Embankment
EOP Edge of Pavement
VDM Vapor Degreasing Machine
N
NOTE:
SITE SURVEY UPDATED BY METRO ENGINEERING & SURVEYING – FEBRUARY 2012
0 70 140ft
Title
PROPERTY PLAN
Site
SOUTHERN STATES, LLC
Hampton, Georgia
EMA
Environmental Management Associates, LLC
Facility ID.
Figure
2

Title
GROUNDWATER ELEVATION MAP
OVERBURDEN - JUNE 8, 2017

Site
SOUTHERN STATES, LLC
Hampton, Georgia

EMA
Environmental Management Associates, LLC

Facility ID.

Figure
3

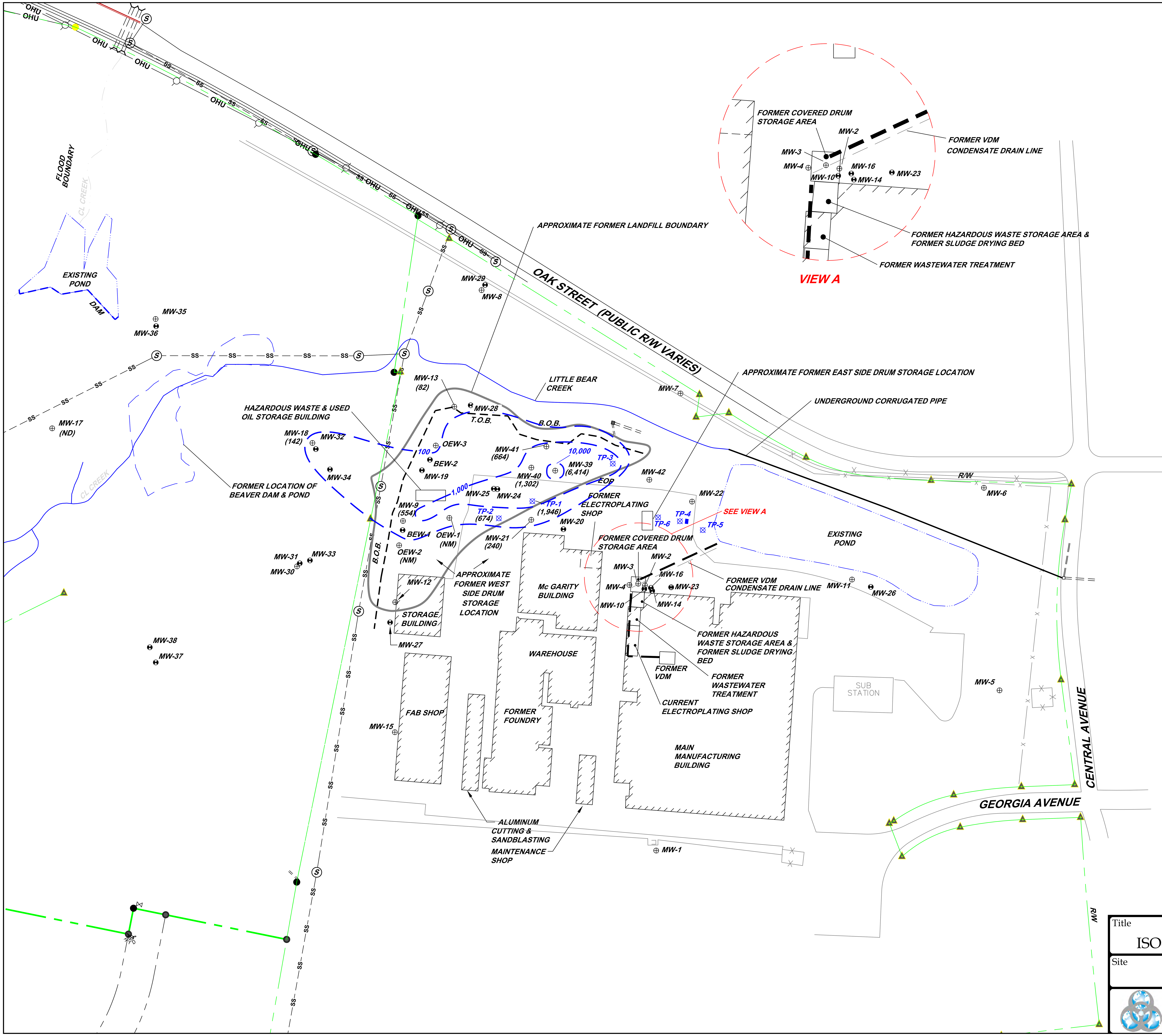
Title
GROUNDWATER ELEVATION MAP
BEDROCK - JUNE 8, 2017

Site
SOUTHERN STATES, LLC
Hampton, Georgia

EMA
Environmental Management Associates, LLC

Facility ID.

Figure
4



LEGEND

	Property Line
—x—x—	Chain Link Fence
MW-11	Overburden Monitoring Well
MW-10	Bedrock Monitoring Well
TP-4	Temporary Piezometer
TOB	Top of Embankment
EOP	Edge of Pavement
(91)	TOTAL VOC CONCENTRATION
100	TOTAL VOC CONCENTRATION CONTOUR

NOTE:
1.) SITE SURVEY UPDATED BY METRO ENGINEERING & SURVEYING – FEBRUARY 2012
2.) MW-32 IS BEDROCK WELL.

0 70 140FT

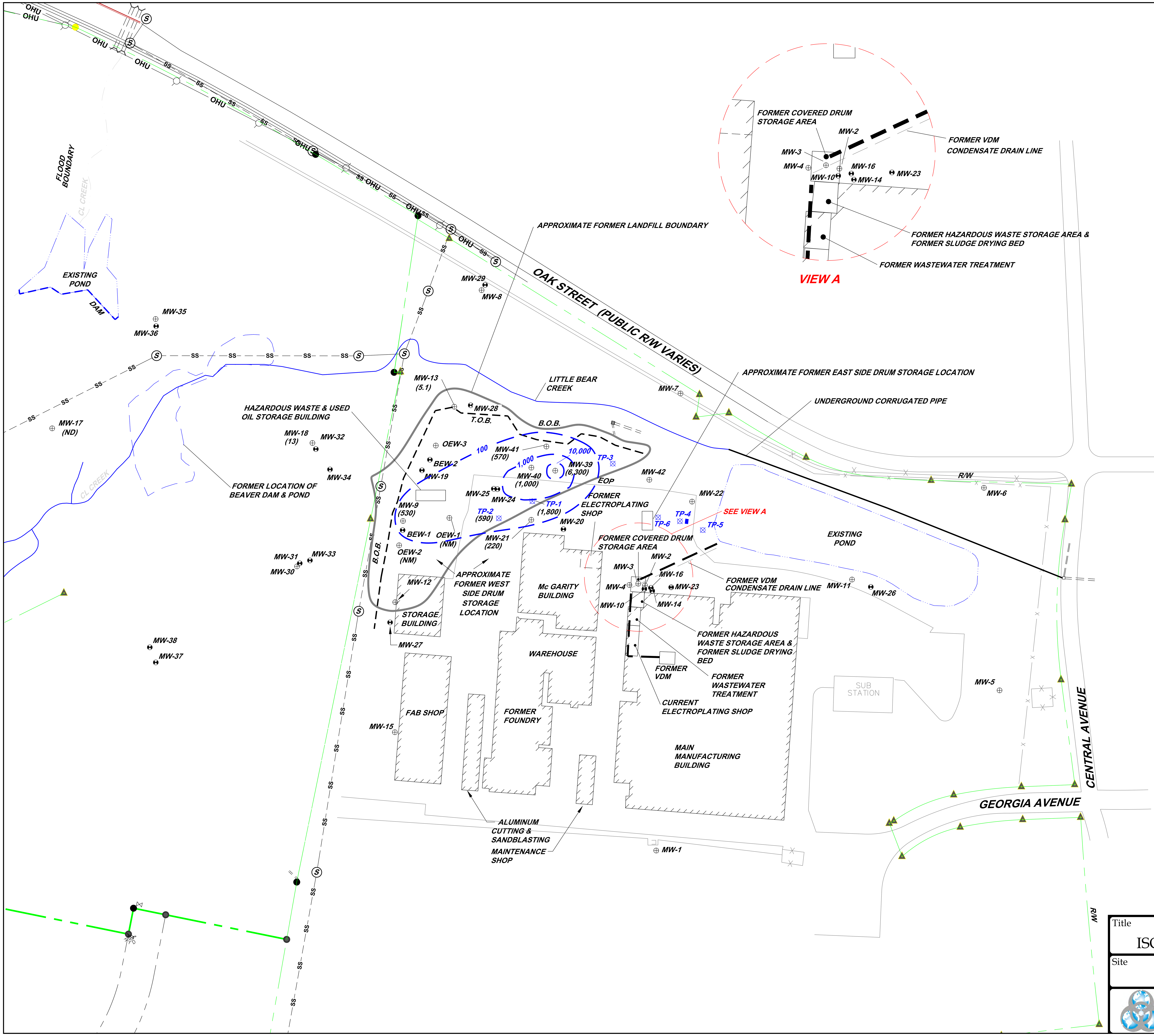
Title: OVERBURDEN TOTAL VOC ISO-CONCENTRATION CONTOURS - OCT 2017

Site: SOUTHERN STATES, LLC
Hampton, Georgia

EMA
Environmental Management Associates, LLC

Facility ID.

Figure 5



LEGEND

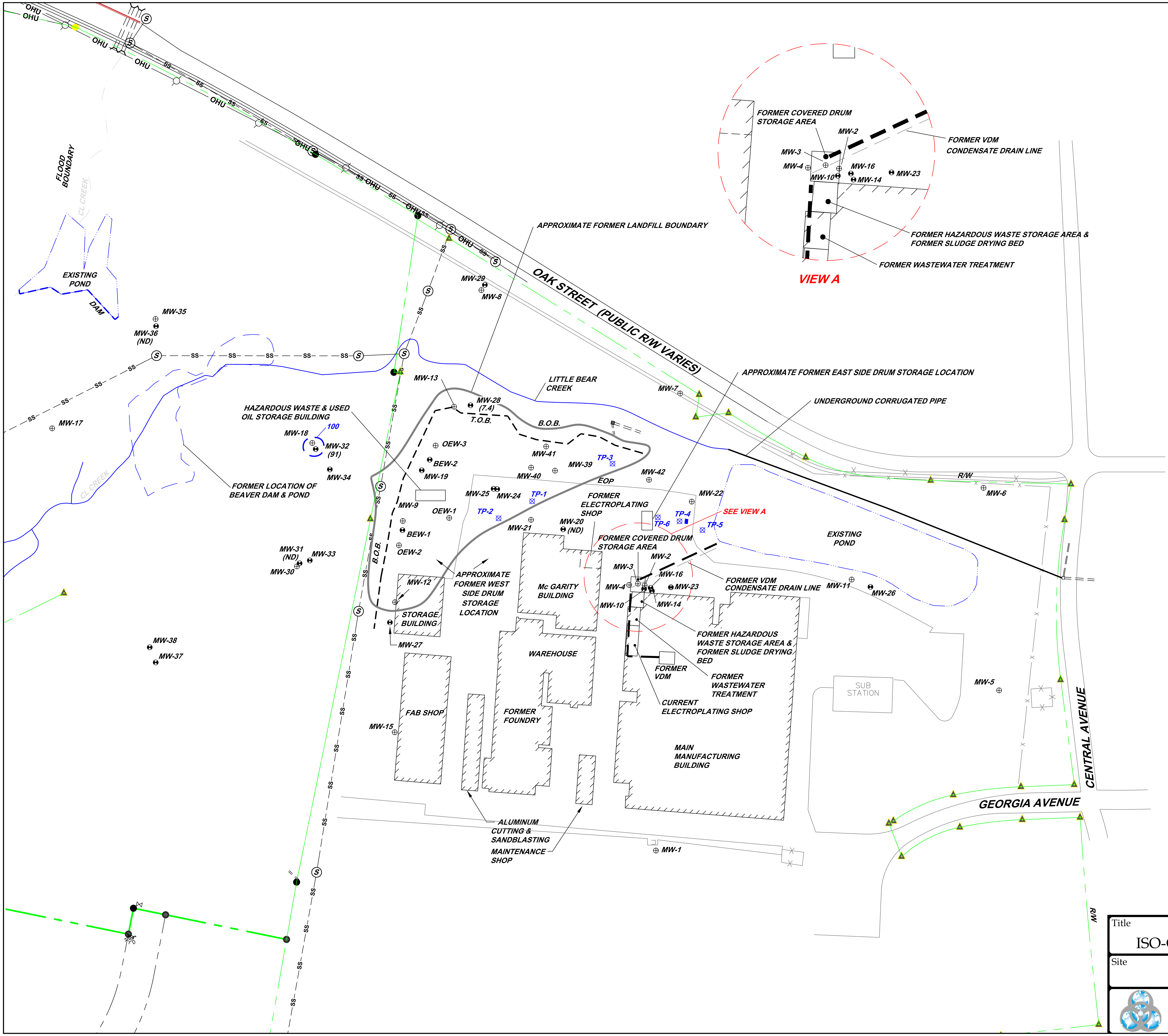
- Property Line
- Chain Link Fence
- MW-11 Overburden Monitoring Well
- MW-10 Bedrock Monitoring Well
- TP-4 Temporary Piezometer
- TOB Top of Embankment
- EOP Edge of Pavement
- (91) TCE CONCENTRATION
- 100 TCE CONCENTRATION CONTOUR

NOTE:
1.) SITE SURVEY UPDATED BY METRO ENGINEERING & SURVEYING – FEBRUARY 2012

2.) MW–32 IS BEDROCK WELL.

0 70 140FT

Title	OVERBURDEN TCE ISO-CONCENTRATION CONTOURS - OCT 2017
Site	SOUTHERN STATES, LLC Hampton, Georgia
EMA Environmental Management Associates, LLC	Facility ID.
Figure	6



LEGEND

- Property Line
- Chain Link Fence
- MW-11 Overburden Monitoring Well
- MW-10 Bedrock Monitoring Well
- TP-4 Temporary Piezometer
- TOB Top of Embankment
- EOP Edge of Pavement
- (91) TOTAL VOC CONCENTRATION
- 100 TOTAL VOC CONCENTRATION CONTOUR

NOTE:
1.) SITE SURVEY UPDATED BY METRO ENGINEERING & SURVEYING – FEBRUARY 2012

2.) MW–32 IS BEDROCK WELL.

0 70 140FT

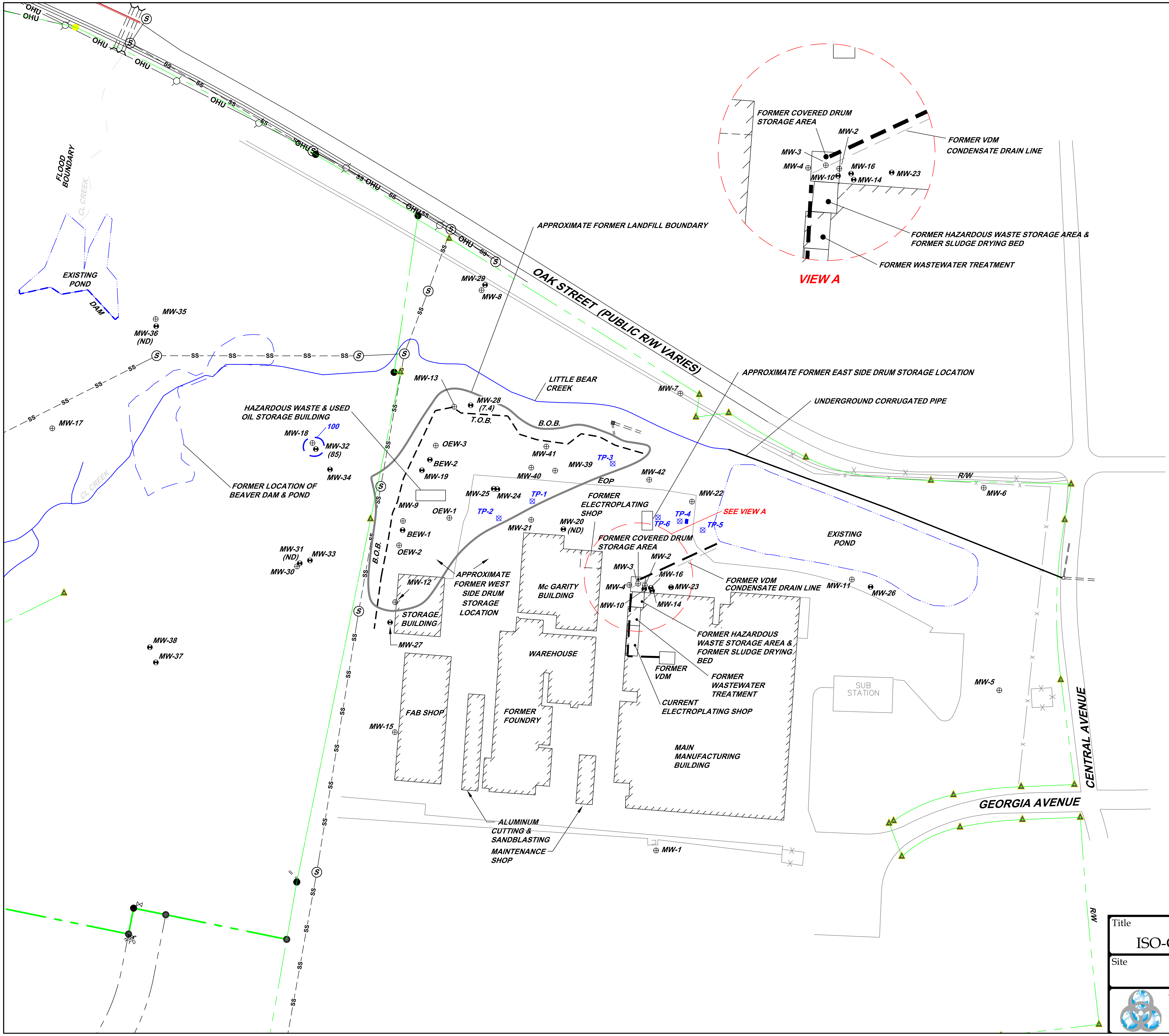
Title: BEDROCK TOTAL VOC ISO-CONCENTRATION CONTOURS - OCT 2017

Site: SOUTHERN STATES, LLC
Hampton, Georgia

EMA Environmental Management Associates, LLC

Facility ID.

Figure 7



LEGEND

	Property Line
	Chain Link Fence
MW-11	Overburden Monitoring Well
MW-10	Bedrock Monitoring Well
TP-4	Temporary Piezometer
TOB	Top of Embankment
EOP	Edge of Pavement
(91)	TCE CONCENTRATION
100	TCE CONCENTRATION CONTOUR

NOTE:
1.) SITE SURVEY UPDATED BY METRO ENGINEERING & SURVEYING – FEBRUARY 2012

2.) MW-32 IS BEDROCK WELL.

0 70 140FT

Title
BEDROCK TCE
ISO-CONCENTRATION CONTOURS - OCT 2017

Site
SOUTHERN STATES, LLC
Hampton, Georgia

EMA
Environmental Management Associates, LLC

Facility ID.

Figure
8

LOCATION SAMLE ID	TOTAL PCB RESULT mg/kg
3–N	0.65
3–S	0.33
3–E	0.48
3–W	0.41
3–BASE	0.44

LOCATION SAMLE ID	TOTAL PCB RESULT mg/kg
4–N	ND(0.04)
4–S	1.54
4–E	ND(0.44)
4–W	ND(0.43)
4–BASE	ND(0.43)

NOTE:
SITE SURVEY UPDATED BY METRO ENGINEERING & SURVEYING – FEBRUARY 2012

Title
LIMITED SOIL REMOVAL LOCATIONS & DATA

Site
SOUTHERN STATES, LLC
Hampton, Georgia

EMA
Environmental Management Associates, LLC

Facility ID.

Figure
9

TABLES

TABLE 1

SUMMARY OF GROUNDWATER ELEVATIONS
PERFORMANCE EVALUATION MONITORING WELLS
PERFORMANCE MONITORING
SOUTHERN STATES, LLC.
JUNE 8, 2017

Monitoring Well	*Reference Elevation (ft.)* [1]	*Depth to Groundwater (ft.)* [2]	*Groundwater Elevation (ft.)*
MW-9	856.50	17.97	838.53
MW-13	850.30	11.21	839.09
MW-17	833.71	8.10	825.61
MW-18	838.03	2.58	835.45
MW-19 [3]	850.81	11.65	839.16
MW-20 [3]	851.88	9.96	841.92
MW-21	851.32	10.32	841.00
MW-28 [3]	847.20	7.91	839.29
MW-31[3]	843.92	5.05	838.87
MW-32 [3]	838.86	3.08	835.78
MW-35	839.95	8.43	831.52
MW-36 [3]	838.97	7.61	831.36
MW-39	848.47	9.74	838.73
MW-40	851.86	13.17	838.69
MW-41	851.38	13.30	838.08
TP-1	850.44	10.20	840.24
TP-2	851.36	10.49	840.87

Notes:

[1] North Atlantic Vertical Datum in feet
[2] Feet below top of casing
[3] Bedrock Well
NM - Monitoring wells were not evaluated during this sample round

TABLE 2
SUMMARY OF DETECTED COMPOUNDS - PERFORMANCE MONITORING WELLS
SOUTHERN STATES, LLC.
HAMPTON, GEORGIA

Location ID:			***MW-9***	***MW-9***	***MW-9***	***MW-9***	***MW-9***	***MW-9***	***MW-9***	***MW-9***
Sample Name:			***MW-9***	***MW-9***	***MW-9***	***MW-9***	***MW-9***	***MW-9***	***MW-9***	***MW-9***
Sample Date:			***7/1/14***	***6/18/15***	***9/3/15***	***12/16/15***	***3/31/16***	***7/7/16***	***11/2/16***	***06/08/2017***
			Historic	***Baseline***	***Post-Injection #1***	***Pre-injection #2***	***Post-injection #2***	***Post-injection***	***Post-injection***	***Post-injection***
Parameters	***Units***	***Type 4 RRS***								
Volatile Organic Compounds										
1,1,1-Trichloroethane	ug/L	13600	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,1,2-Trichloroethane	ug/L	5	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,1-Dichloroethane	ug/L	4000	8.5	7.2	NS	6.4	5.5	5.6	7.4	5.0 U
1,1-Dichloroethene	ug/L	524	6.3	7.2	NS	6.4	5.7	5.0 U	7.1	5.0 U
1,4-Dioxane	ug/L	-	-	150 U	NS	150 U	150 U	150 U	150 U	150 U
Acetone	ug/L	45620	50 U	50 U	NS	50 U	50 U	50 U	50 U	50 U
Carbon tetrachloride	ug/L	10.2	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Chloroethane	ug/L	29200	10 U	10 U	NS	10 U	10 U	10 U	10 U	10 U
Chloroform (Trichloromethane)	ug/L	80	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
cis-1,2-Dichloroethene	ug/L	204	38	35	NS	29	24	30	37	24
Methyl tert butyl ether (MTBE)	ug/L	263	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Toluene	ug/L	5241	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
trans-1,2-Dichloroethene	ug/L	2044	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Trichloroethene	ug/L	5.24	**690**	**740**	NS	**810**	**720**	**810**	**840**	**530**
Vinyl chloride	ug/L	3.27	2.0 U	2.0 U	NS	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Tetrachloroethane	ug/L	98	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
					NS					
Total chlorinated VOCs	ug/L	NC	743	789	NS	852	755	846	892	554
MNA's										
Sulfide	mg/L									BDL (2)
Chloride	mg/L									20
Nitrate	mg/L									1.3
Sulfate	mg/L									4.5
Ethane	ug/L									BDL(9)
Ethene	ug/L									BDL(7)
Methane	ug/L									BDL(4)
Iron, Ferrous	mg/L									BDL(0.1)
Carbon dioxide	mg/L									75.3
Alkalinity	mg/L									41

Notes:
ug/L - micrograms per liter
mg/L - milligrams per liter
NC - No established criteria (remediation goal)
5.0 U - not detected at associated method reporting limit
100 UJ - estimated result reported below associated reporting limit
"--" Not analyzed
ND - not detected
230 - Above the Type 4 RRS
NS - Not sampled

TABLE 2
SUMMARY OF DETECTED COMPOUNDS - PERFORMANCE MONITORING WELLS
SOUTHERN STATES, LLC.
HAMPTON, GEORGIA

Location ID:			***MW-13***	***MW-13***	***MW-13***	***MW-13***	***MW-13***	***MW-13***	***MW-13***	***MW-13***	***MW-17***	***MW-17***
Sample Name:			***MW-13***	***MW-13***	***MW-13***	***MW-13***	***MW-13***	***MW-13***	***MW-13***	***MW-13***	***MW-17***	***MW-17***
Sample Date:			***7/2/14***	***6/18/15***	***9/3/15***	***12/16/15***	***3/31/16***	***7/7/16***	***11/2/16***	***6/8/2017***	***7/3/2014***	***6/8/2017***
			Historic	***Baseline***	***Post-Injection #1***	***Pre-injection #2***	***Post-injection #2***	***Post-injection***	***Post-injection***	***Post-injection***	***Historic***	***Post-injection***
Parameters	***Units***	***Type 4 RRS***										
Volatile Organic Compounds												
1,1,1-Trichloroethane	ug/L	13600	5.0 U	5.0 U	NS	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,1,2-Trichloroethane	ug/L	5	5.0 U	5.0 U	NS	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,1-Dichloroethane	ug/L	4000	11	8.1	NS	NS	7.6	5.6	5.0 U	5.1	5.0 U	5.0 U
1,1-Dichloroethene	ug/L	524	36	24	NS	NS	21	13	7.5	11	5.0 U	5.0 U
1,4-Dioxane	ug/L	-		150 U	NS	NS	150 U	150 U	150 U	150 U	-	150 U
Acetone	ug/L	45620	50 U	50 U	NS	NS	50 U	50 U	50 U	50 U	50 U	50 U
Carbon tetrachloride	ug/L	10.2	5.0 U	5.0 U	NS	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Chloroethane	ug/L	29200	10 U	10 U	NS	NS	10 U	10 U	10 U	10 U	10 U	10 U
Chloroform (Trichloromethane)	ug/L	80	5.0 U	5.0 U	NS	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
cis-1,2-Dichloroethene	ug/L	204	170	84	NS	NS	62	66	46	61	5.0 U	5.0 U
Methyl tert butyl ether (MTBE)	ug/L	263	5.0 U	5.0 U	NS	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Toluene	ug/L	5241	5.0 U	5.0 U	NS	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
trans-1,2-Dichloroethene	ug/L	2044	5.0 U	5.0 U	NS	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Trichloroethene	ug/L	5.24	**40**	**23**	NS	NS	**61**	**24**	5.0 U	5.0 U	5.0 U	5.0 U
Vinyl chloride	ug/L	3.27	2.0 U	4	NS	NS	**4**	**3.7**	**5.5**	**5.1**	5.0 U	5.0 U
Tetrachloroethane	ug/L	98	5.0 U	5.0U	NS	NS	5.0U	5.0U	5.0U	5.0U	5.0U	5.0U
					NS	NS						
Total chlorinated VOCs	ug/L	NC	262	143	NS	NS	156	112	59	82	ND	ND
MNA's												
Sulfide	mg/L									BDL(2)	NS	BDL(2)
Chloride	mg/L									17	NS	3.2
Nitrate	mg/L									BDL(0.25)	NS	BDL(0.25)
Sulfate	mg/L									28	NS	7.1
Ethane	ug/L									15	NS	BDL(9)
Ethene	ug/L									BDL(7)	NS	BDL(7)
Methane	ug/L									640	NS	330
Iron, Ferrous	mg/L									BDL(0.1)	NS	BDL(0.1)
Carbon dioxide	mg/L									249	NS	112
Alkalinity	mg/L									185	NS	40

Notes:
ug/L - micrograms per liter
mg/L - milligrams per liter
NC - No established criteria (remediation goal)
5.0 U - not detected at associated method reporting limit
100 UJ - estimated result reported below associated reporting limit
"--" Not analyzed
ND - not detected
230 - Above the Type 4 RRS
NS - Not sampled

TABLE 2
SUMMARY OF DETECTED COMPOUNDS - PERFORMANCE MONITORING WELLS
SOUTHERN STATES, LLC.
HAMPTON, GEORGIA

Location ID:			***MW-18***	***MW-18***	***MW-18***	***MW-18***	***MW-18***	***MW-18***	***MW-18***	***MW-18***	***MW-19***	***MW-19***	***MW-19***	***MW-20***	***MW-20***
Sample Name:			***MW-18***	***MW-18***	***MW-18***	***MW-18***	***MW-18***	***MW-18***	***MW-18***	***MW-18***	***MW-19***	***MW-19***	***MW-19***	***MW-20***	***MW-20***
Sample Date:			***7/2/14***	***6/18/15***	***9/3/15***	***12/16/15***	***3/31/16***	***7/7/16***	***11/2/16***	***6/8/2017***	***7/2/14***	***6/18/15***	***6/8/2017***	***7/1/2014***	***6/8/2017***
			Historic	***Baseline***	***Post-Injection #1***	***Pre-injection #2***	***Post-injection #2***	***Post-injection***	***Post-injection***	***Post-injection***	***Historic***	***Baseline***	***Post-Injection***	***Historic***	***Post-injection***
Parameters	***Units***	***Type 4 RRS***													
Volatile Organic Compounds															
1,1,1-Trichloroethane	ug/L	13600	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U
1,1,2-Trichloroethane	ug/L	5	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U
1,1-Dichloroethane	ug/L	4000	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	8.8	5.0 U
1,1-Dichloroethene	ug/L	524	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U
1,4-Dioxane	ug/L	-		150 U	150 U	NS	150 U	150 U	150 U	150 U		150 U	NS	-	150 U
Acetone	ug/L	45620	50 U	50 U	50 U	NS	50 U	50 U	50 U	50 U	50 U	50 U	NS	50 U	50 U
Carbon tetrachloride	ug/L	10.2	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U
Chloroethane	ug/L	29200	10 U	10 U	10 U	NS	10 U	10 U	10 U	10 U	10 U	10 U	NS	10 U	10 U
Chloroform (Trichloromethane)	ug/L	80	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U
cis-1,2-Dichloroethene	ug/L	204	120	72	77	NS	5.7	54	130	120	5.0 U	5.0 U	NS	5.0 U	5.0 U
Methyl tert butyl ether (MTBE)	ug/L	263	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U
Toluene	ug/L	5241	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U
trans-1,2-Dichloroethene	ug/L	2044	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U
Trichloroethene	ug/L	5.24	**26**	**22**	**14**	NS	5.0 U	**21**	**28**	**13**	**14**	**14**	NS	5.0 U	5.0 U
Vinyl chloride	ug/L	3.27	**20**	**12**	**14**	NS	5.0 U	**7**	**5.3**	**8.8**	2.0 U	2.0 U	NS	5.0 U	5.0 U
Tetrachloroethane	ug/L	98	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0U	5.0U
						NS									
Total chlorinated VOCs	ug/L	NC	166	106	105	NS	5.7	82	163	142	14	14		8.8	ND
MNA's															
Sulfide	mg/L									BDL(2)			NS	NS	BDL(2)
Chloride	mg/L									15				NS	13
Nitrate	mg/L									BDL(0.25)				NS	BDL(0.25)
Sulfate	mg/L									18				NS	4.2
Ethane	ug/L									BDL(9)				NS	BDL(9)
Ethene	ug/L									BDL(7)				NS	BDL(7)
Methane	ug/L									190				NS	56
Iron, Ferrous	mg/L									BDL(0.1)				NS	BDL(0.1)
Carbon dioxide	mg/L									163				NS	166
Alkalinity	mg/L									129				NS	167

Notes:
ug/L - micrograms per liter
mg/L - milligrams per liter
NC - No established criteria (remediation goal)
5.0 U - not detected at associated method reporting limit
100 UJ - estimated result reported below associated reporting limit
"--" Not analyzed
ND - not detected
230 - Above the Type 4 RRS
NS - Not sampled

TABLE 2
SUMMARY OF DETECTED COMPOUNDS - PERFORMANCE MONITORING WELLS
SOUTHERN STATES, LLC.
HAMPTON, GEORGIA

Location ID:			***MW-21***	***MW-21***	***MW-21***	***MW-21***	***MW-21***	***MW-21***	***MW-21***	***MW-21***	***MW-28***	***MW-28***	***MW-28***
Sample Name:			***MW-21***	***MW-21***	***MW-21***	***MW-21***	***MW-21***	***MW-21***	***MW-21***	***MW-21***	***MW-28***	***MW-28***	***MW-28***
Sample Date:			***7/1/14***	***6/18/15***	***9/3/15***	***12/16/15***	***3/31/16***	***7/7/16***	***11/2/16***	***6/8/2017***	***7/1/14***	***6/18/15***	***6/8/2017***
			Historic	***Baseline***	***Post-Injection #1***	***Pre-injection #2***	***Post-injection #2***	***Post-injection***	***Post-injection***	***Post-injection***	***Historic***	***Baseline***	***Post-injection***
Parameters	***Units***	***Type 4 RRS***											
Volatile Organic Compounds													
1,1,1-Trichloroethane	ug/L	13600	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,1,2-Trichloroethane	ug/L	5	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,1-Dichloroethane	ug/L	4000	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,1-Dichloroethene	ug/L	524	5.0 U	9.2	NS	6.8	12	5.4	22	13	5.0 U	5.0 U	5.0 U
1,4-Dioxane	ug/L	-		150 U	NS	150 U	150 U	150 U	150 U	150 U		150 U	150 U
Acetone	ug/L	45620	50 U	50 U	NS	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Carbon tetrachloride	ug/L	10.2	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Chloroethane	ug/L	29200	10 U	10 U	NS	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloroform (Trichloromethane)	ug/L	80	5.4	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
cis-1,2-Dichloroethene	ug/L	204	16	8.9	NS	6.7	5.0 U	5.0 U	7.2	7.2	5.0 U	5.0 U	5.0 U
Methyl tert butyl ether (MTBE)	ug/L	263	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Toluene	ug/L	5241	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
trans-1,2-Dichloroethene	ug/L	2044	5.0 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Trichloroethene	ug/L	5.24	**340**	**210**	NS	**160**	**210**	**100**	**250**	**220**	**16**	**15**	**7.4**
Vinyl chloride	ug/L	3.27	2.0 U	2.0 U	NS	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Tetrachloroethane	ug/L	98	5.0 U	5.0 U	NS	5.0U	5.0U	5.0U	5.0U	5.0U	5.0 U	5.0 U	5.0 U
					NS								
Total chlorinated VOCs	ug/L	NC	379	228	NS	174	232	105	279	240	16	15	7
MNA's													
Sulfide	mg/L									BDL(2)			BDL(2)
Chloride	mg/L									22			11
Nitrate	mg/L									4.2			1.1
Sulfate	mg/L									21			7.8
Ethane	ug/L									BDL(9)			BDL(9)
Ethene	ug/L									BDL(7)			BDL(7)
Methane	ug/L									8.5			BDL(4)
Iron, Ferrous	mg/L									BDL(0.1)			BDL(0.1)
Carbon dioxide	mg/L									65.6			54.1
Alkalinity	mg/L									34			33

Notes:
ug/L - micrograms per liter
mg/L - milligrams per liter
NC - No established criteria (remediation goal)
5.0 U - not detected at associated method reporting limit
100 UJ - estimated result reported below associated reporting limit
"--" Not analyzed
ND - not detected
230 - Above the Type 4 RRS
NS - Not sampled

TABLE 2
SUMMARY OF DETECTED COMPOUNDS - PERFORMANCE MONITORING WELLS
SOUTHERN STATES, LLC.
HAMPTON, GEORGIA

Location ID:			***MW-31***	***MW-31***	***MW-32***	***MW-32***	***MW-32***	***MW-32***	***MW-32***	***MW-32***	***MW-35***	***MW-35***	***MW-36***	***MW-36***
Sample Name:			***MW-31***	***MW-31***	***MW-32***	***MW-32***	***MW-32***	***MW-32***	***MW-32***	***MW-32***	***MW-35***	***MW-35***	***MW-36***	***MW-13***
Sample Date:			***6/18/15***	***6/8/2017***	***7/2/14***	***6/18/15***	***9/3/15***	***7/7/16***	***11/2/16***	***6/8/2017***	***7/3/14***	***6/8/2017***	***7/3/14***	***6/8/2017***
			Baseline	***Post-injection***	***Historic***	***Baseline***	***Post-Injection #1***	***Post-Injection***	***Post-Injection***	***Post-Injection***	***Historic***	***Post-injection***	***Historic***	***Post-injection***
Parameters	***Units***	***Type 4 RRS***												
Volatile Organic Compounds														
1,1,1-Trichloroethane	ug/L	13600	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U
1,1,2-Trichloroethane	ug/L	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U
1,1-Dichloroethane	ug/L	4000	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U
1,1-Dichloroethene	ug/L	524	5.0 U	5.0 U	5.8	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U
1,4-Dioxane	ug/L	-	150 U	150 U		150 U	150 U	150 U	150 U	150 U	150 U	NS	150 U	150 U
Acetone	ug/L	45620	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	NS	50 U	50 U
Carbon tetrachloride	ug/L	10.2	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U
Chloroethane	ug/L	29200	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	NS	10 U	10 U
Chloroform (Trichloromethane)	ug/L	80	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U
cis-1,2-Dichloroethene	ug/L	204	5.0 U	5.0 U	10	7.4	7.9	6.4	7.1	5.2	5.0 U	NS	5.0 U	5.0 U
Methyl tert butyl ether (MTBE)	ug/L	263	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U
Toluene	ug/L	5241	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U
trans-1,2-Dichloroethene	ug/L	2044	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NS	5.0 U	5.0 U
Trichloroethene	ug/L	5.24	**15**	5.0 U	**110**	**110**	**120**	**85**	**110**	**83**	5.0 U	NS	5.0 U	5.0 U
Vinyl chloride	ug/L	3.27	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	5.0 U	NS	5.0 U	2.0 U
Tetrachloroethane	ug/L	98	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0U	NS	5.0U	5.0U
Total chlorinated VOCs	ug/L	NC	15	ND	126	118	128	91	117	88	ND		ND	ND
MNA's														
Sulfide	mg/L			BDL(2)						BDL(2)				BDL(2)
Chloride	mg/L			16						13				3.6
Nitrate	mg/L			BDL(0.25)						1.1				0.36
Sulfate	mg/L			1.3						7.6				6.2
Ethane	ug/L			BDL(9)						BDL(9)		BDL(9)		BDL(9)
Ethene	ug/L			BDL(7)						BDL(7)		BDL97)		BDL(7)
Methane	ug/L			65						BDL(4)		54		BDL(4)
Iron, Ferrous	mg/L			BDL(0.1)						BDL(0.1)				BDL(0.1)
Carbon dioxide	mg/L			113						110				106
Alkalinity	mg/L			90						53				53

Notes:
ug/L - micrograms per liter
mg/L - milligrams per liter
NC - No established criteria (remediation goal)
5.0 U - not detected at associated method reporting limit
100 UJ - estimated result reported below associated reporting limit
"--" Not analyzed
ND - not detected
230 - Above the Type 4 RRS
NS - Not sampled

TABLE 2
SUMMARY OF DETECTED COMPOUNDS - PERFORMANCE MONITORING WELLS
SOUTHERN STATES, LLC.
HAMPTON, GEORGIA

Location ID:			***MW-39***	***MW-39***	***MW-39***	***MW-39***	***MW-39***	***MW-39***	***MW-39***	***MW-39***
Sample Name:			***MW-39***	***MW-39***	***MW-39***	***MW-39***	***MW-39***	***MW-39***	***MW-39***	***MW-39***
Sample Date:			***7/2/14***	***6/18/15***	***9/3/15***	***12/16/15***	***3/31/16***	***7/7/16***	***11/2/16***	***6/8/2017***
			Historic	***Baseline***	***Post-Injection #1***	***Pre-injection #2***	***Post-injection #2***	***Post-injection***	***Post-injection***	***Post-injection***
Parameters	***Units***	***Type 4 RRS***								
Volatile Organic Compounds										
1,1,1-Trichloroethane	ug/L	13600	25000 U	2500 U	25000 U	5000 U	500 U	500 U	500 U	5.0 U
1,1,2-Trichloroethane	ug/L	5	25000 U	2500 U	25000 U	5000 U	500 U	500 U	500 U	5.0 U
1,1-Dichloroethane	ug/L	4000	25000 U	2500 U	25000 U	5000 U	500 U	500 U	500 U	13
1,1-Dichloroethene	ug/L	524	25000 U	**4900**	25000 U	5000 U	500 U	500 U	500 U	53
1,4-Dioxane	ug/L	-		75000 U	750000 U	150000 U	15000 U	15000 U	15000 U	150 U
Acetone	ug/L	45620	50000 U	25000 U	50000 U	50000 U	5000 U	5000 U	5000 U	50 U
Carbon tetrachloride	ug/L	10.2	25000 U	2500 U	25000 U	5000 U	500 U	500 U	500 U	5.0 U
Chloroethane	ug/L	29200	25000 U	2500 U	25000 U	10000 U	1000 U	1000 U	1000 U	10 U
Chloroform (Trichloromethane)	ug/L	80	25000 U	2500 U	25000 U	5000 U	500 U	500 U	500 U	5.0 U
cis-1,2-Dichloroethene	ug/L	204	25000 U	2500 U	25000 U	5000 U	500 U	500 U	500 U	29
Methyl tert butyl ether (MTBE)	ug/L	263	25000 U	2500 U	25000 U	5000 U	500 U	500 U	500 U	5.0 U
Toluene	ug/L	5241	25000 U	2500 U	25000 U	5000 U	500 U	500 U	500 U	5.0 U
trans-1,2-Dichloroethene	ug/L	2044	25000 U	2500 U	25000 U	5000 U	500 U	500 U	500 U	5.0 U
Trichloroethene	ug/L	5.24	**200,000**	**210000**	**100,000**	**110000**	**19,000**	**8600**	**9800**	**6300**
Vinyl chloride	ug/L	3.27	10000 U	1000 U	10000 U	5000 U	500 U	500 U	500 U	2.0 U
Tetrachloroethane	ug/L	98	25000 U	2500 U	25000 U	5000 U	500 U	500 U	500 U	19
Total chlorinated VOCs	ug/L	NC	200,000	214,900	100,000	110,000	19,000	8600	9800	6414
MNA's										
Sulfide	mg/L									BDL(2)
Chloride	mg/L									14
Nitrate	mg/L									0.3
Sulfate	mg/L									110
Ethane	ug/L									BDL(9)
Ethene	ug/L									BDL(7)
Methane	ug/L									21
Iron, Ferrous	mg/L									BDL(0.1)
Carbon dioxide	mg/L									112
Alkalinity	mg/L									42

Notes:
ug/L - micrograms per liter
mg/L - milligrams per liter
NC - No established criteria (remediation goal)
5.0 U - not detected at associated method reporting limit
100 UJ - estimated result reported below associated reporting limit
"--" Not analyzed
ND - not detected
230 - Above the Type 4 RRS
NS - Not sampled

TABLE 2
SUMMARY OF DETECTED COMPOUNDS - PERFORMANCE MONITORING WELLS
SOUTHERN STATES, LLC.
HAMPTON, GEORGIA

Location ID:			***MW-40***	***MW-40***	***MW-40***	***MW-40***	***MW-40***	***MW-40***	***MW-40***	***MW-40***
Sample Name:			***MW-40***	***MW-40***	***MW-40***	***MW-40***	***MW-40***	***MW-40***	***MW-40***	***MW-40***
Sample Date:			***7/1/14***	***6/18/15***	***9/3/15***	***12/16/15***	***3/31/16***	***7/7/16***	***11/2/16***	***6/8/2017***
			Historic	***Baseline***	***Post-Injection #1***	***Pre-injection #2***	***Post-injection #2***	***Post-injection***	***Post-injection***	***Post-injection***
Parameters	***Units***	***Type 4 RRS***								
Volatile Organic Compounds										
1,1,1-Trichloroethane	ug/L	13600	5.0 U	5.0 U	250 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,1,2-Trichloroethane	ug/L	5	**16**	**23**	250 U	**6.1**	**14**	**7.1**	**8.4**	5.0 U
1,1-Dichloroethane	ug/L	4000	36	44	250 U	28	14	12	15	12
1,1-Dichloroethene	ug/L	524	42	61	250 U	38	61	5.0 U	5.1	5.0 U
1,4-Dioxane	ug/L	-		150 U	7500 U	150 U	150 U	150 U	150 U	150 U
Acetone	ug/L	45620	50 U	50 U	2500 U	50 U	50 U	50 U	50 U	50 U
Carbon tetrachloride	ug/L	10.2	5.0 U	5.0 U	250 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Chloroethane	ug/L	29200	10 U	10 U	500 U	10 U	10 U	10 U	10 U	10 U
Chloroform (Trichloromethane)	ug/L	80	5.0 U	5.0 U	250 U	5.0 U	5.3	5.0 U	5.0 U	5.0 U
cis-1,2-Dichloroethene	ug/L	204	**1500**	**1700**	**1600**	**720**	**250**	**230**	**330**	**210**
Methyl tert butyl ether (MTBE)	ug/L	263	5.0 U	5.0 U	250 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Toluene	ug/L	5241	5.0 U	5.0 U	250 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
trans-1,2-Dichloroethene	ug/L	2044	5.0 U	5.0 U	250 U	6.9	5.0 U	5.0 U	5.0 U	5.0 U
Trichloroethene	ug/L	5.24	**2100**	**3500**	**3200**	**5200**	**1500**	**950**	**900**	**1000**
Vinyl chloride	ug/L	3.27	**100**	**110**	**140**	**8.8**	**120**	**66**	**110**	**80**
Tetrachloroethane	ug/L	98	5.0 U	5.0 U	250 U	14	5.0 U	5.0 U	5.0 U	5.0 U
Total chlorinated VOCs	ug/L	NC	3794	5438	4940	6001	1964	1265	1369	1302
MNA's										
Sulfide	mg/L									BDL(2)
Chloride	mg/L									38
Nitrate	mg/L									BDL(0.25)
Sulfate	mg/L									53
Ethane	ug/L									BDL(9)
Ethene	ug/L									BDL(7)
Methane	ug/L									98
Iron, Ferrous	mg/L									0.814
Carbon dioxide	mg/L									106
Alkalinity	mg/L									16

Notes:
ug/L - micrograms per liter
mg/L - milligrams per liter
NC - No established criteria (remediation goal)
5.0 U - not detected at associated method reporting limit
100 UJ - estimated result reported below associated reporting limit
"--" Not analyzed
ND - not detected
230 - Above the Type 4 RRS
NS - Not sampled

TABLE 2
SUMMARY OF DETECTED COMPOUNDS - PERFORMANCE MONITORING WELLS
SOUTHERN STATES, LLC.
HAMPTON, GEORGIA

Location ID:			***MW-41***	***MW-41***	***MW-41***	***MW-41***	***MW-41***	***MW-41***	***MW-41***	***MW-41***
Sample Name:			***MW-41***	***MW-41***	***MW-41***	***MW-41***	***MW-41***	***MW-41***	***MW-41***	***MW-41***
Sample Date:			***7/1/14***	***6/18/15***	***9/3/15***	***12/16/15***	***3/31/16***	***7/7/16***	***11/2/16***	***6/8/2017***
			Historic	***Baseline***	***Post-Injection #1***	***Pre-injection #2***	***Post-injection #2***	***Post-injection***	***Post-injection***	***Post-injection***
Parameters	***Units***	***Type 4 RRS***								
Volatile Organic Compounds										
1,1,1-Trichloroethane	ug/L	13600	5.0 U	250 U	250 U	NS	5.0 U	5.0 U	5.0 U	5.0 U
1,1,2-Trichloroethane	ug/L	5	5.0 U	250 U	250 U	NS	5.0 U	5.0 U	5.0 U	5.0 U
1,1-Dichloroethane	ug/L	4000	23	250 U	250 U	NS	16	9.7	13	6.1
1,1-Dichloroethene	ug/L	524	24	250 U	250 U	NS	24	10	17	5.0 U
1,4-Dioxane	ug/L	-		7500 U	7500 U	NS	150 U	150 U	150 U	150 U
Acetone	ug/L	45620	50 U	250 U	2500 U	NS	50 U	50 U	50 U	50 U
Carbon tetrachloride	ug/L	10.2	5.0 U	250 U	250 U	NS	5.0 U	5.0 U	5.0 U	5.0 U
Chloroethane	ug/L	29200	10 U	250 U	500 U	NS	10 U	10 U	10 U	10 U
Chloroform (Trichloromethane)	ug/L	80	5.0 U	250 U	250 U	NS	5.0 U	5.0 U	5.0 U	5.0 U
cis-1,2-Dichloroethene	ug/L	204	**880**	**670**	**690**	NS	200	170	180	85
Methyl tert butyl ether (MTBE)	ug/L	263	5.0 U	250 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U
Toluene	ug/L	5241	5.0 U	250 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U
trans-1,2-Dichloroethene	ug/L	2044	5.0 U	250 U	5.0 U	NS	5.0 U	5.0 U	5.0 U	5.0 U
Trichloroethene	ug/L	5.24	**2800**	**3500**	**4400**	NS	**2800**	**1800**	**1900**	**570**
Vinyl chloride	ug/L	3.27	**6.8**	100 U	100 U	NS	**4.2**	**3.8**	**4.4**	3.1
Tetrachloroethane	ug/L	98	7.3	250 U	250 U	NS	6.3	5.0 U	5.0 U	5.0 U
						NS				
Total chlorinated VOCs	ug/L	NC	3741	4170	5090	NS	3051	1994	2114	664
MNA's										
Sulfide	mg/L									BDL(2)
Chloride	mg/L									28
Nitrate	mg/L									0.93
Sulfate	mg/L									280
Ethane	ug/L									BDL(9)
Ethene	ug/L									BDL(7)
Methane	ug/L									35
Iron, Ferrous	mg/L									BDL(0.1)
Carbon dioxide	mg/L									53.7
Alkalinity	mg/L									42

Notes:
ug/L - micrograms per liter
mg/L - milligrams per liter
NC - No established criteria (remediation goal)
5.0 U - not detected at associated method reporting limit
100 UJ - estimated result reported below associated reporting limit
"--" Not analyzed
ND - not detected
230 - Above the Type 4 RRS
NS - Not sampled

TABLE 2
SUMMARY OF DETECTED COMPOUNDS - PERFORMANCE MONITORING WELLS
SOUTHERN STATES, LLC.
HAMPTON, GEORGIA

Location ID:			***TP-1***	***TP-1***	***TP-1***	***TP-1***	***TP-1***	***TP-1***	***TP-1***	***TP-1***
Sample Name:			***TP-1***	***TP-1***	***TP-1***	***TP-1***	***TP-1***	***TP-1***	***TP-1***	***TP-1***
Sample Date:			***7/1/14***	***6/18/15***	***9/3/15***	***12/16/15***	***3/31/16***	***7/7/16***	***11/2/16***	***6/8/2017***
			Historic	***Baseline***	***Post-Injection #1***	***Pre-injection #2***	***Post-injection #2***	***Post-injection***	***Post-injection***	***Post-injection***
Parameters	***Units***	***Type 4 RRS***								
Volatile Organic Compounds										
1,1,1-Trichloroethane	ug/L	13600	5.0 U	250 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,1,2-Trichloroethane	ug/L	5	**19**	250 U	**18**	**12**	**5.5**	**5.2**	**5.6**	**11**
1,1-Dichloroethane	ug/L	4000	7.5	250 U	7.8	6	5.3	5.0 U	5.0 U	5.5
1,1-Dichloroethene	ug/L	524	5.0 U	250 U	6.1	6.1	5.0 U	5.0 U	5.0 U	5.0 U
1,4-Dioxane	ug/L	-		7500 U	150 U	150 U	150 U	150 U	150 U	150 U
Acetone	ug/L	45620	50 U	250 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Carbon tetrachloride	ug/L	10.2	5.0 U	250 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Chloroethane	ug/L	29200	10 U	250 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloroform (Trichloromethane)	ug/L	80	26	250 U	24	17	15	9.2	6	15
cis-1,2-Dichloroethene	ug/L	204	110	250 U	110	87	69	55	140	110
Methyl tert butyl ether (MTBE)	ug/L	263	5.0 U	250 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Toluene	ug/L	5241	5.0 U	250 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
trans-1,2-Dichloroethene	ug/L	2044	5.0 U	250 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Trichloroethene	ug/L	5.24	**2400**	**2300**	**2300**	**1800**	**1000**	**1100**	**870**	**1800**
Vinyl chloride	ug/L	3.27	**3.8**	250 U	**3.3**	2.0 U	2.0 U	2.0 U	**8.8**	**4.2**
Tetrachloroethane	ug/L	98	5.0 U	250 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Total chlorinated VOCs	ug/L	NC	2566	2300	2469	1928	1095	1169	1030	1946
MNA's										
Sulfide	mg/L									BDL(2)
Chloride	mg/L									43
Nitrate	mg/L									9.9
Sulfate	mg/L									43
Ethane	ug/L									BDL(9)
Ethene	ug/L									BDL(7)
Methane	ug/L									27
Iron, Ferrous	mg/L									BDL(0.1)
Carbon dioxide	mg/L									22.8
Alkalinity	mg/L									BDL(3)

Notes:
ug/L - micrograms per liter
mg/L - milligrams per liter
NC - No established criteria (remediation goal)
5.0 U - not detected at associated method reporting limit
100 UJ - estimated result reported below associated reporting limit
"--" Not analyzed
ND - not detected
230 - Above the Type 4 RRS
NS - Not sampled

TABLE 2
SUMMARY OF DETECTED COMPOUNDS - PERFORMANCE MONITORING WELLS
SOUTHERN STATES, LLC.
HAMPTON, GEORGIA

Location ID:			***TP-2***	***TP-2***	***TP-2***	***TP-2***	***TP-2***	***TP-2***	***TP-2***	***TP-2***
Sample Name:			***TP-2***	***TP-2***	***TP-2***	***TP-2***	***TP-2***	***TP-2***	***TP-2***	***TP-2***
Sample Date:			***7/1/14 Historic***	***6/18/15 Baseline***	***9/3/15 Post-Injection #1***	***12/16/15 Pre-injection #2***	***3/31/16 Post-injection #2***	***7/7/16 Post-injection***	***11/2/16 Post-injection***	***6/8/2017 Post-injection***
Parameters	***Units***	***Type 4 RRS***								
Volatile Organic Compounds										
1,1,1-Trichloroethane	ug/L	13600	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,1,2-Trichloroethane	ug/L	5	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,1-Dichloroethane	ug/L	4000	16	16	13	12	11	10	14	9.8
1,1-Dichloroethene	ug/L	524	79	68	47	40	32	32	66	34
1,4-Dioxane	ug/L	-		150U	150 U	150 U	150 U	150 U	150 U	150 U
Acetone	ug/L	45620	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Carbon tetrachloride	ug/L	10.2	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Chloroethane	ug/L	29200	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloroform (Trichloromethane)	ug/L	80	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
cis-1,2-Dichloroethene	ug/L	204	43	46	48	41	37	39	36	31
Methyl tert butyl ether (MTBE)	ug/L	263	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Toluene	ug/L	5241	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
trans-1,2-Dichloroethene	ug/L	2044	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Trichloroethene	ug/L	5.24	**900**	**720**	**500**	**500**	**530**	**590**	**660**	**470**
Vinyl chloride	ug/L	3.27	**6.3**	**5.7**	**9.8**	**4.8**	**5.0**	3.2	**5.0**	**4.7**
Tetrachloroethane	ug/L	98	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Total chlorinated VOCs	ug/L	NC	1044	856	618	598	615	674	781	550
MNA's										
Sulfide	mg/L									BDL(2)
Chloride	mg/L									14
Nitrate	mg/L									0.99
Sulfate	mg/L									24
Ethane	ug/L									BDL(9)
Ethene	ug/L									BDL(7)
Methane	ug/L									16
Iron, Ferrous	mg/L									BDL(0.1)
Carbon dioxide	mg/L									115
Alkalinity	mg/L									16

Notes:
ug/L - micrograms per liter
mg/L - milligrams per liter
NC - No established criteria (remediation goal)
5.0 U - not detected at associated method reporting limit
100 UJ - estimated result reported below associated reporting limit
"--" Not analyzed
ND - not detected
230 - Above the Type 4 RRS
NS - Not sampled

APPENDIX A

GROUNDWATER PURGE FORMS

&

ANALYTICAL LABORATORY REPORTS

MONITORING WELL RECORD FOR LOW-FLOW PURGING

Project Data:

Project Name: Southern States LLC

Ref. No.:

Date: 6/8/13

Personnel: JT

Monitoring Well Data:

Well No.: MW-9

Measurement Point: TOC

Constructed Well Depth (ft): 35

Measured Well Depth (ft): 35

Depth of Sediment (ft): N/A

Screen Length (ft):

Depth to Pump Intake (ft)[1]: 30

Well Diameter, D (in): ~~8~~ 2

Well Screen Volume, V_S (mL):

Initial Depth to Water (ft): 17.57

Time	Pumping Rate (mL/min)	Depth to Water (ft)	Drawdown from Initial Water Level [2] (ft)	pH	Temperature °C	Conductivity [3] (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)
			Precision Required:	±0.1 Yνιτσ	±3%	±0.005 or 0.01	±10 mV	±10%	±10%
1200	50	17.57		6.18	21.28	0.173	153	1.55	10.8
1208		18.04		6.02	21.70	0.175	150	1.52	7.6
1214		18.08		5.93	21.40	0.173	158	1.50	8.4
1218		18.10		5.51	21.46	0.174	154	1.49	5.3
1220		18.20		5.57	21.50	0.173	153	1.50	7.4
1224		18.18		5.56	21.20	0.173	155	1.48	6.3
Sample ID:									
	VOCs								

Notes:

(1) The pump intake was placed at the well screen mid-point or at a minimum of 2 ft above any sediment accumulated at the well bottom.

(2) The drawdown from the initial water level should not exceed 0.33 ft. The pumping rate should not exceed 600 mL/min.

(3) For conductivity, the average value of three readings <1 mS/cm ±0.005 mS/cm or where conductivity >1 mS/cm ±0.01 mS/cm.

Purging will continue until stabilization is achieved or until 20 well screen volumes have been purged (unless purge water remains visually turbid and appears to be clearing, or unless stabilization parameters are varying slightly outside of the stabilization criteria and appear to be stabilizing)

MONITORING WELL RECORD FOR LOW-FLOW PURGING

Project Data:

Project Name: Southern States LLC

Ref. No.: 619

Date: 6/8/17

Personnel: [illegible]

BC

Monitoring Well Data:

Well No.: MW-13

Measurement Point: TOC

Constructed Well Depth (ft): 20.10

Measured Well Depth (ft): 20.10

Depth of Sediment (ft): N/A

Screen Length (ft):

Depth to Pump Intake (ft)(1): 15

Well Diameter, D (in): 2

Well Screen Volume, V_s (mL):

Initial Depth to Water (ft): 11.21

Time	Pumping Rate (mL/min)	Depth to Water (ft)	Drawdown from Initial Water Level (2) (ft)	pH	Temperature °C	Conductivity (3) (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)
			Precision Required (5):	±0.1 Yvιτσ	±3%	±0.005 or 0.01	±10 mV	±10%	±10%
1320	50	11.21		6.55	22.08	0.506	-14	1.24	17.4
1325		11.34		6.54	22.04	0.506	-23	1.16	18.9
1330		11.38		6.50	21.18	0.510	-18	1.13	14.2
1336		11.40		6.48	21.30	0.510	-20	1.10	18.8
1340		11.48		6.48	21.20	0.510	-21	1.08	21.2
1343		11.48		6.48	21.16	0.510	-22	1.12	16.4
Sample ID:	MW-13								
	VOCs * - Iron bacteria??								

1,1 DCA 5.1

1,1 DCE 11

cis 61—

VC 5.1

1,2 DCE 61—

Notes:

(1) The pump intake was placed at the well mid-screen or 2 ft above any sediment accumulated at the well bottom.

(2) The drawdown from the initial water level should not exceed 0.33 ft. The pumping rate should not exceed 600 mL/min.

(3) For conductivity, the average value of three readings <1 mS/cm ±0.005 mS/cm or where conductivity >1 mS/cm ±0.01 mS/cm.

Purging will continue until stabilization is achieved or until 20 well screen volumes have been purged (unless purge water remains visually turbid and appears to be clearing, or unless stabilization parameters are varying slightly outside of the stabilization criteria and appear to be stabilizing)

MONITORING WELL RECORD FOR LOW-FLOW PURGING

Project Data:

Project Name: Southern States LLC

Ref. No.:

Date: 6/8/17

Personnel:

Monitoring Well Data:

Well No.: MW-17

Measurement Point: TOC

Constructed Well Depth (ft): 16.80

Measured Well Depth (ft): 16.80

Depth of Sediment (ft): N/A

Screen Length (ft):

Depth to Pump Intake (ft)[1]: 15

Well Diameter, D (in): 2

Well Screen Volume, V_s (mL):

Initial Depth to Water (ft): 8.10

ND

Time	*Pumping Rate (mL/min)*	*Depth to Water (ft)*	*Drawdown from Initial Water Level [2] (ft)*	*pH*	*Temperature °C*	*Conductivity [3] (mS/cm)*	*ORP (mV)*	*DO (mg/L)*	*Turbidity (NTU)*
			Precision Required:	*±0.1 Yνιτσ*	*±3%*	*±0.005 or 0.01*	*±10 mV*	*±10%*	*±10%*
0830	50	8.10		6.47	15.68	0.169	-102	0.01	8.5
0835	↓	8.21		6.47	15.69	0.168	-104	0.02	5.5
0838	↓	8.24		6.47	15.60	0.168	-103	0.02	6.8
0845	↓	8.28		6.47	15.65	0.168	-104	0.02	5.5
Sample ID:	MW-17	DUP-0510							
	VOCs								

Notes:

(1) The pump intake was placed at the well mid-screen or 2 ft above any sediment accumulated at the well bottom.

(2) The drawdown from the initial water level should not exceed 0.33 ft. The pumping rate should not exceed 600 mL/min.

(3) For conductivity, the average value of three readings <1 mS/cm ±0.005 mS/cm or where conductivity >1 mS/cm ±0.01 mS/cm.

Purging will continue until stabilization is achieved or until 20 well screen volumes have been purged (unless purge water remains visually turbid and appears to be clearing, or unless stabilization parameters are varying slightly outside of the stabilization criteria and appear to be stabilizing)

MONITORING WELL RECORD FOR LOW-FLOW PURGING

Project Data:

Project Name: Southern States LLC

Ref. No.:

Date: 6/8/17

Personnel: J. Schwaller

Monitoring Well Data:

Well No.: MW-18

Measurement Point: TOC

Constructed Well Depth (ft): 15.00

Measured Well Depth (ft): 15.00

Depth of Sediment (ft): N/A

Screen Length (ft):

Depth to Pump Intake (ft)(1): 10

Well Diameter, D (in): 2

Well Screen Volume, V_s (mL):

Initial Depth to Water (ft): 2.58

cis - 120

Tri - 13

VC - 8.8

1,2 DCE 120

Time	*Pumping Rate (mL/min)*	*Depth to Water (ft)*	*Drawdown from Initial Water Level (2) (ft)*	*pH*	*Temperature °C*	*Conductivity (3) (mS/cm)*	*ORP (mV)*	*DO (mg/L)*	*Turbidity (NTU)*
			Precision Required:	*±0.1 Yνιτσ*	*±3%*	*±0.005 or 0.01*	*±10 mV*	*±10%*	*±10%*
1110	50	2.58		6.70	16.31	0.373	67	10.7	8.8
1113		2.64		6.73	16.40	0.374	66	10.4	8.1
1118		2.66		6.76	16.36	0.376	68	10.1	9.2
1122		2.70		6.74	16.41	0.376	65	10.6	8.4
1125		2.75		6.70	16.48	0.376	66	10.1	6.8
1130		2.76		6.70	16.48	0.376	64	10.2	6.4
Sample ID:	MW-18								
	VOCs								

Notes:

(1) The pump intake was placed at the well screen mid-point or 2 ft above any sediment accumulated at the well bottom.

(2) The drawdown from the initial water level should not exceed 0.33 ft. The pumping rate should not exceed 600 mL/min.

(3) For conductivity, the average value of three readings <1 mS/cm ±0.005 mS/cm or where conductivity >1 mS/cm ±0.01 mS/cm.

Purging will continue until stabilization is achieved or until 20 well screen volumes have been purged (unless purge water remains visually turbid and appears to be clearing, or unless stabilization parameters are varying slightly outside of the stabilization criteria and appear to be stabilizing)

MONITORING WELL RECORD FOR LOW-FLOW PURGING

Project Data:

Project Name: Southern States LLC

Ref. No.:

Date: 1/8/17

Personnel:

Monitoring Well Data:

Well No.: MW-19

Measurement Point: TOC

Constructed Well Depth (ft): 118.00

Measured Well Depth (ft): 118.00

Depth of Sediment (ft): N/A

Screen Length (ft):

Depth to Pump Intake (ft)(1): 114.5

Well Diameter, D (in): 2

Well Screen Volume, V_s (mL):

Initial Depth to Water (ft): 11.65

Time	*Pumping Rate (mL/min)*	*Depth to Water (ft)*	*Drawdown from Initial Water Level (2) (ft)*	*pH*	*Temperature °C*	*Conductivity (3) (mS/cm)*	*ORP (mV)*	*DO (mg/L)*	*Turbidity (NTU)*
			Precision Required:	*±0.1 Yvıτσ*	*±3%*	*±0.005 or 0.01*	*±10 mV*	*±10%*	*±10%*
1235	75	11.65		7.22	18.40	0.220	380	2.41	11.3
1240	↓	11.70		7.20	17.88	0.212	384	2.30	7.4
1243		11.74		7.13	17.80	0.208	416	2.20	6.9
1248		11.80		7.12	17.83	0.210	410	2.16	7.2
1306		11.82		7.12	17.80	0.210	408	2.18	8.1
1308		11.80		7.12	17.84	0.210	410	2.12	6.2
Sample ID:	MW-19								
	VOCs								

Notes:

(1) The pump intake was placed at the well mid-screen or approx.2 ft above any sediment accumulated at the well bottom.

(2) The drawdown from the initial water level should not exceed 0.33 ft. The pumping rate should not exceed 600 mL/min.

(3) For conductivity, the average value of three readings <1 mS/cm ±0.005 mS/cm or where conductivity >1 mS/cm ±0.01 mS/cm.

Purging will continue until stabilization is achieved or until 20 well screen volumes have been purged (unless purge water remains visually turbid and appears to be clearing, or unless stabilization parameters are varying slightly outside of the stabilization criteria and appear to be stabilizing)

MONITORING WELL RECORD FOR LOW-FLOW PURGING

Project Data:

Project Name: Southern States LLC
Ref. No.:

Date: 6-8-12
Personnel: B. Cortelloni

Monitoring Well Data:

Well No.: MW-20~~D~~
Measurement Point: TOC
Constructed Well Depth (ft): 81.00
Measured Well Depth (ft): 81.00
Depth of Sediment (ft): N/A

Screen Length (ft):
Depth to Pump Intake (ft)(1): 78
Well Diameter, D (in): 2
Well Screen Volume, V_s (mL):
Initial Depth to Water (ft): 9.96

ND

Time	Pumping Rate (mL/min)	Depth to Water (ft)	Drawdown from Initial Water Level (2) (ft)	pH	Temperature °C	Conductivity (3) (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)
			Precision Required:	±0.1 Yvιτσ	±3%	±0.005 or 0.01	±10 mV	±10%	±10%
10:15	100	9.51		6.30	22.21	0.324	209	0.79	8.6
10:25	"	10.20		6.95	21.89	0.322	178	0.89	7.2
10:35	75	10.11		7.03	21.85	0.321	115	0.07	2.0
10:43	"	10.~~0~~8		7.03	21.84	0.320	114	0.07	6.9
Sample ID:	MW-20								
	VOCs								

Notes:

(1) The pump intake was placed at the well mid-screen or 2 ft above any sediment accumulated at the well bottom.
(2) The drawdown from the initial water level should not exceed 0.33 ft. The pumping rate should not exceed 600 mL/min.
(3) For conductivity, the average value of three readings <1 mS/cm ±0.005 mS/cm or where conductivity >1 mS/cm ±0.01 mS/cm.
Purging will continue until stabilization is achieved or until 20 well screen volumes have been purged (unless purge water remains visually turbid and appears to be clearing, or unless stabilization parameters are varying slightly outside of the stabilization criteria and appear to be stabilizing)

MONITORING WELL RECORD FOR LOW-FLOW PURGING

Project Data:

Project Name: Southern States LLC

Ref. No.:

Date: 6-8-17

Personnel: B. Cortelloni

Monitoring Well Data:

Well No.: MW-21

Measurement Point: TOC

Constructed Well Depth (ft): 23.80

Measured Well Depth (ft): 23.80

Depth of Sediment (ft): N/A

Screen Length (ft):

Depth to Pump Intake (ft)[1]: 21

Well Diameter, D (in): 2

Well Screen Volume, V_s (mL):

Initial Depth to Water (ft): 10.32

1,1 DCE 13

Cis 7.2 -

Tri 220

1,2 DCE 7.2 -

Time	Pumping Rate (mL/min)	Depth to Water (ft)	Drawdown from Initial Water Level [2] (ft)	pH	Temperature °C	Conductivity [3] (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)
			Precision Required:	±0.1 Yvito	±3%	±0.005 or 0.01	±10 mV	±10%	±10%
10:52	100	10.72		5.84	21.81	0.255	170	0.00	10.9
11:03	"	10.48		5.82	21.79	0.245	168	0.00	9.1
11:10	"	10.50		5.80	21.56	0.241	167	0.00	6.24
11:15	"	10.49		5.81	21.78	0.241	166	0.00	8.20
Sample ID:	MW-21								
	VOCs								

Notes:

(1) The pump intake was placed at the well mid-screen or approx. 2 ft above any sediment accumulated at the well bottom.

(2) The drawdown from the initial water level should not exceed 0.33 ft. The pumping rate should not exceed 600 mL/min.

(3) For conductivity, the average value of three readings <1 mS/cm ±0.005 mS/cm or where conductivity >1 mS/cm ±0.01 mS/cm.

Purging will continue until stabilization is achieved or until 20 well screen volumes have been purged (unless purge water remains visually turbid and appears to be clearing, or unless stabilization parameters are varying slightly outside of the stabilization criteria and appear to be stabilizing)

MONITORING WELL RECORD FOR LOW-FLOW PURGING

Project Data:

Project Name: Southern States LLC

Ref. No.:

Date: 6/8/17

Personnel: J. Schwaller

Monitoring Well Data:

Well No.: MW-28

Measurement Point: TOC

Constructed Well Depth (ft): 78.00

Measured Well Depth (ft): 78.00

Depth of Sediment (ft): N/A

Screen Length (ft):

Depth to Pump Intake (ft)[1]: 75

Well Diameter, D (in): 2

Well Screen Volume, V_s (mL):

Initial Depth to Water (ft): 7.91

TLD 7.4

Time	Pumping Rate (mL/min)	Depth to Water (ft)	Drawdown from Initial Water Level [2] (ft)	pH	Temperature °C	Conductivity [3] (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)
			Precision Required:	±0.1 Yνιτσ	±3%	±0.005 or 0.01	±10 mV	±10%	±10%
1328	50	7.91		6.04	17.18	0.148	23	2.10	10.2
1333		8.04		5.94	17.70	0.140	68	2.02	11.2
1338		8.10		5.90	17.11	0.132	60	1.54	8.1
1345		8.18		5.89	17.44	0.130	62	1.76	6.2
1349		8.16		5.90	17.50	0.132	60	1.80	4.8
1400		8.15		5.90	17.48	0.131	64	1.88	4.2
Sample ID:	MW-28								
	VOCs								

Notes:

(1) The pump intake was placed at the well mid-screen or 2 ft above any sediment accumulated at the well bottom.

(2) The drawdown from the initial water level should not exceed 0.33 ft. The pumping rate should not exceed 600 mL/min.

(3) For conductivity, the average value of three readings <1 mS/cm ±0.005 mS/cm or where conductivity >1 mS/cm ±0.01 mS/cm.

Purging will continue until stabilization is achieved or until 20 well screen volumes have been purged (unless purge water remains visually turbid and appears to be clearing, or unless stabilization parameters are varying slightly outside of the stabilization criteria and appear to be stabilizing)

MONITORING WELL RECORD FOR LOW-FLOW PURGING

Project Data:

Project Name: Southern States LLC

Ref. No.:

Date: 6/8/17

Personnel: J. Schwaller

Monitoring Well Data:

Well No.: MW-31

Measurement Point: TOC

Constructed Well Depth (ft): 57.42

Measured Well Depth (ft): 57.42

Depth of Sediment (ft): N/A

Screen Length (ft):

Depth to Pump Intake (ft)(1): 53

Well Diameter, D (in): 2

Well Screen Volume, V_s (mL):

Initial Depth to Water (ft): 5.05

ND

Time	*Pumping Rate (mL/min)*	*Depth to Water (ft)*	*Drawdown from Initial Water Level (2) (ft)*	*pH*	*Temperature °C*	*Conductivity (3) (mS/cm)*	*ORP (mV)*	*DO (mg/L)*	*Turbidity (NTU)*
			Precision Required:	*±0.1 Yvitσ*	*±3%*	*±0.005 or 0.01*	*±10 mV*	*±10%*	*±10%*
1038	50	5.05		7.29	16.46	0.281	-187	3.28	10.4
1044		5.10		7.31	16.48	0.281	-190	3.25	8.8
1050		5.15		7.33	16.60	0.283	-205	3.20	8.8
1055		5.18		7.30	16.55	0.280	-206	3.16	8.2
1102		5.22		7.35	16.50	0.280	-203	3.19	7.4
Sample ID:	MW-31								
	VOCs								

Notes:

(1) The pump intake was placed at the well mid-screen or approx. 2 ft above any sediment accumulated at the well bottom.

(2) The drawdown from the initial water level should not exceed 0.33 ft. The pumping rate should not exceed 600 mL/min.

(3) For conductivity, the average value of three readings <1 mS/cm ±0.005 mS/cm or where conductivity >1 mS/cm ±0.01 mS/cm.

Purging will continue until stabilization is achieved or until 20 well screen volumes have been purged (unless purge water remains visually turbid and appears to be clearing, or unless stabilization parameters are varying slightly outside of the stabilization criteria and appear to be stabilizing)

MONITORING WELL RECORD FOR LOW-FLOW PURGING

Project Data:

Project Name: Southern States LLC

Ref. No.:

Date: 6/8/17

Personnel: J. Schwaller

Monitoring Well Data:

Well No.: MW-32

Measurement Point: TOC

Constructed Well Depth (ft): 57.00

Measured Well Depth (ft): 57.00

Depth of Sediment (ft): N/A

Screen Length (ft):

Depth to Pump Intake (ft)(1): 52

Well Diameter, D (in): 2

Well Screen Volume, V_s (mL):

Initial Depth to Water (ft): 3.08

Cis 5.2 —

Tns 83

1,2 DCE 5.2 —

Time	*Pumping Rate (mL/min)*	*Depth to Water (ft)*	*Drawdown from Initial Water Level (2) (ft)*	*pH*	*Temperature °C*	*Conductivity (3) (mS/cm)*	*ORP (mV)*	*DO (mg/L)*	*Turbidity (NTU)*
			Precision Required:	*±0.1 Yvιτσ*	*±3%*	*±0.005 or 0.01*	*±10 mV*	*±10%*	*±10%*
1118	50	3.08		6.23	16.90	0.214	119	1.78	3.8
1122		3.12		6.23	17.02	0.210	126	1.68	4.1
1128		3.20		6.20	11.88	0.208	129	0.51	5.2
1135		3.22		6.22	11.81	0.204	130	0.41	32
1138		3.18		6.22	16.80	0.204	131	0.43	6.1
1140		3.22		6.22	16.84	0.204	130	0.40	6.2
Sample ID:	MW-32								
	VOCs								

Notes:

(1) The pump intake was placed at the well mid-screen or 2 ft above any sediment accumulated at the well bottom.

(2) The drawdown from the initial water level should not exceed 0.33 ft. The pumping rate should not exceed 600 mL/min.

(3) For conductivity, the average value of three readings <1 mS/cm ±0.005 mS/cm or where conductivity >1 mS/cm ±0.01 mS/cm.

Purging will continue until stabilization is achieved or until 20 well screen volumes have been purged (unless purge water remains visually turbid and appears to be clearing, or unless stabilization parameters are varying slightly outside of the stabilization criteria and appear to be stabilizing)

MONITORING WELL RECORD FOR LOW-FLOW PURGING

Project Data:

Project Name: Southern States LLC

Ref. No.:

Date: 6/8/17

Personnel: J. Schwaller

Monitoring Well Data:

Well No.: MW-35

Measurement Point: TOC

Constructed Well Depth (ft):

Measured Well Depth (ft):

Depth of Sediment (ft): N/A

Screen Length (ft):

Depth to Pump Intake (ft)(1):

Well Diameter, D (in): 2

Well Screen Volume, V_s (mL):

Initial Depth to Water (ft): 8.43

Time	Pumping Rate (mL/min)	Depth to Water (ft)	Drawdown from Initial Water Level (2) (ft)	pH	Temperature °C	Conductivity (3) (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)
			Precision Required:	±0.1 Yνιτσ	±3%	±0.005 or 0.01	±10 mV	±10%	±10%
1002	35	8.43		5.74	18.17	0.265	48	0.18	4.8
1008	↓	8.55		5.73	18.04	0.262	49	0.15	7.5
1016	↓	8.51		5.73	18.00	0.262	48	0.16	5.8
Sample ID:	MW-35								
	VOCs								

Notes:

(1) The pump intake was placed at the well mid-screen or approx. 2 ft above any sediment accumulated at the well bottom.

(2) The drawdown from the initial water level should not exceed 0.33 ft. The pumping rate should not exceed 600 mL/min.

(3) For conductivity, the average value of three readings <1 mS/cm ±0.005 mS/cm or where conductivity >1 mS/cm ±0.01 mS/cm.

Purging will continue until stabilization is achieved or until 20 well screen volumes have been purged (unless purge water remains visually turbid and appears to be clearing, or unless stabilization parameters are varying slightly outside of the stabilization criteria and appear to be stabilizing)

MONITORING WELL RECORD FOR LOW-FLOW PURGING

Project Data:

Project Name: Southern States LLC

Ref. No.:

Date: 6/8/17

Personnel: J. Schwaller

ND

Monitoring Well Data:

Well No.: MW-36

Measurement Point: TOC

Constructed Well Depth (ft):

Measured Well Depth (ft): 35.34

Depth of Sediment (ft): N/A

Screen Length (ft):

Depth to Pump Intake (ft)[1]: 33

Well Diameter, D (in): 2

Well Screen Volume, V_s (mL):

Initial Depth to Water (ft): 7.61

Time	Pumping Rate (mL/min)	Depth to Water (ft)	Drawdown from Initial Water Level [2] (ft)	pH	Temperature °C	Conductivity [3] (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)
			Precision Required:	±0.1 Yνιτσ	±3%	±0.005 or 0.01	±10 mV	±10%	±10%
1006	50	7.61	Ø	6.77	17.25	0.141	23	1.28	5.8
1010		7.84		6.77	17.20	0.141	38	1.18	4.1
1012		7.90		6.78	17.13	0.140	40	1.19	3.4
1020		7.85		6.78	17.13	0.140	39	1.18	3.8
Sample ID:	MW-36								
	VOCs								

Notes:

(1) The pump intake was placed at the well mid-screen or approx. 2 ft above any sediment accumulated at the well bottom.

(2) The drawdown from the initial water level should not exceed 0.33 ft. The pumping rate should not exceed 600 mL/min.

(3) For conductivity, the average value of three readings <1 mS/cm ±0.005 mS/cm or where conductivity >1 mS/cm ±0.01 mS/cm.

Purging will continue until stabilization is achieved or until 20 well screen volumes have been purged (unless purge water remains visually turbid and appears to be clearing, or unless stabilization parameters are varying slightly outside of the stabilization criteria and appear to be stabilizing)

MONITORING WELL RECORD FOR LOW-FLOW PURGING

Project Data:

Project Name: Southern States LLC

Ref. No.:

Date: 6-8-17

Personnel: B. Cortelloni

Monitoring Well Data:

Well No.: MW-39

Measurement Point: TOC

Constructed Well Depth (ft): 32.00

Measured Well Depth (ft): 32.00

Depth of Sediment (ft): N/A

Screen Length (ft):

Depth to Pump Intake (ft)(1): 22

Well Diameter, D (in): 2

Well Screen Volume, V_s (mL):

Initial Depth to Water (ft): 9.74

Time	Pumping Rate (mL/min)	Depth to Water (ft)	Drawdown from Initial Water Level (2) (ft)	pH	Temperature °C	Conductivity (3) (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)
			Precision Required:	±0.1 Yνιτσ	±3%	±0.005 or 0.01	±10 mV	±10%	±10%
1308	50	9.74		5.21	23.90	0.472	230	1.63	14
1312	↓	10.24		4.22	25.48	0.264	312	0.11	7.2
1319		10.28		4.21	25.50	0.250	347	0.00	5.3
1324		10.32		4.20	25.58	0.249	350	"	.1
1330		10.16		4.20	25.50	0.248	351	0.00	5.2
Sample ID:	MW-39								
	VOCs								

1,1 DCA - 13
1,1 DCE 53
Cis 29
Tetra 19
TCE 6300
1,2 DCE 29

Notes:

(1) The pump intake was placed at the well screen mid-point or at approx. 2 ft above any sediment accumulated at the well bottom.

(2) The drawdown from the initial water level should not exceed 0.33 ft. The pumping rate should not exceed 600 mL/min.

(3) For conductivity, the average value of three readings <1 mS/cm ±0.005 mS/cm or where conductivity >1 mS/cm ±0.01 mS/cm.

Purging will continue until stabilization is achieved or until 20 well screen volumes have been purged (unless purge water remains visually turbid and appears to be clearing, or unless stabilization parameters are varying slightly outside of the stabilization criteria and appear to be stabilizing)

MONITORING WELL RECORD FOR LOW-FLOW PURGING

Project Data:

Project Name: Southern States LLC

Ref. No.:

Date: 6/8/17

Personnel: B. Cortelloni

Monitoring Well Data:

Well No.: MW-40

Measurement Point: TOC

Constructed Well Depth (ft): 32.00

Measured Well Depth (ft): 32.00

Depth of Sediment (ft): N/A

Screen Length (ft):

Depth to Pump Intake (ft)(1): 22

Well Diameter, D (in): 2

Well Screen Volume, V_s (mL):

Initial Depth to Water (ft): 13.17

Time	Pumping Rate (mL/min)	Depth to Water (ft)	Drawdown from Initial Water Level (2) (ft)	pH	Temperature °C	Conductivity (3) (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)
			Precision Required:	±0.1 Yvιτσ	±3%	±0.005 or 0.01	±10 mV	±10%	±10%
12:12	100	13.17		5.04	22.92	0.307	220	2.95	8.6
12:20	75	13.43		5.40	22.74	0.278	126	0.46	5.8
12:26	↓	13.36		5.42	22.60	0.275	120	0.40	6.2
12:33	↓	13.31		5.42	22.28	0.275	124	0.44	5.4
Sample ID:	MW-40								
	VOCs								

Notes:

(1) The pump intake was placed at the well screen mid-point or at approx. 2 ft above any sediment accumulated at the well bottom.

(2) The drawdown from the initial water level should not exceed 0.33 ft. The pumping rate should not exceed 600 mL/min.

(3) For conductivity, the average value of three readings <1 mS/cm ±0.005 mS/cm or where conductivity >1 mS/cm ±0.01 mS/cm.

Purging will continue until stabilization is achieved or until 20 well screen volumes have been purged (unless purge water remains visually turbid and appears to be clearing, or unless stabilization parameters are varying slightly outside of the stabilization criteria and appear to be stabilizing)

1,1 DCA 12

cis 210

TCE 1000

VC 80

1,2 DCE 210

MONITORING WELL RECORD FOR LOW-FLOW PURGING

Project Data:

Project Name: Southern States LLC

Ref. No.:

Date: 6-8-17

Personnel: B. Cortelloni

Monitoring Well Data:

Well No.: MW-41

Measurement Point: TOC

Constructed Well Depth (ft): 32.00

Measured Well Depth (ft): 32.00

Depth of Sediment (ft): N/A

Screen Length (ft):

Depth to Pump Intake (ft)[1]: 22

Well Diameter, D (in): 2

Well Screen Volume, V_s (mL):

Initial Depth to Water (ft): 13.30

1,1 DCA 6.1

Cis 85

TCE 570

VC 3.1

1,2 DCE 85

Time	Pumping Rate (mL/min)	Depth to Water (ft)	Drawdown from Initial Water Level [2] (ft)	pH	Temperature °C	Conductivity [3] (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)
			Precision Required:	±0.1 Yvιτσ	±3%	±0.005 or 0.01	±10 mV	±10%	±10%
12:38	100	13.30		5.84	22.00	0.681	180	2.94	9.3
12:46		13.40		5.80	21.84	0.682	176	2.90	9.2
12:51		13.48		5.83	22.08	0.670	180	2.93	8.6
		13.50		5.84	22.02	0.673	184	2.90	8.4
13:03	100	13.54		5.84	22.04	0.673	185	2.89	7.5
Sample ID:	MW-41								
	VOCs								

Notes:

(1) The pump intake was placed at the well screen mid-point or at approx. 2 ft above any sediment accumulated at the well bottom.

(2) The drawdown from the initial water level should not exceed 0.33 ft. The pumping rate should not exceed 600 mL/min.

(3) For conductivity, the average value of three readings <1 mS/cm ±0.005 mS/cm or where conductivity >1 mS/cm ±0.01 mS/cm.

Purging will continue until stabilization is achieved or until 20 well screen volumes have been purged (unless purge water remains visually turbid and appears to be clearing, or unless stabilization parameters are varying slightly outside of the stabilization criteria and appear to be stabilizing)

MONITORING WELL RECORD FOR LOW-FLOW PURGING

Project Data:

Project Name: Southern States LLC

Ref. No.:

Date: 6-8-17

Personnel: B. Cortelloni

Monitoring Well Data:

Well No.: TP-1

Measurement Point: TOC

Constructed Well Depth (ft): 22.40

Measured Well Depth (ft):

Depth of Sediment (ft): N/A

Screen Length (ft):

Depth to Pump Intake (ft)(1): 20

Well Diameter, D (in): 1

Well Screen Volume, V_S (mL):

Initial Depth to Water (ft): 10.20

Time	Pumping Rate (mL/min)	Depth to Water (ft)	Drawdown from Initial Water Level (2) (ft)	pH	Temperature °C	Conductivity (3) (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)
			Precision Required:	±0.1 Yνιτσ	±3%	±0.005 or 0.01	±10 mV	±10%	±10%
11:44	85	10.20		4.85	23.37	0.336	261	0.05	15.1
11:52		10.35		4.85	23.18	0.334	263	1.52	11.2
12:00		10.40		4.85	23.10	0.330	265	1.85	8.4
12:09		10.36		4.84	23.30	0.331	267	1.87	9.6
Sample ID:	TP-1								
	VOCs								

1,1,2 TCA 11
1,1 DCA 5.5
CHLOROFORM 15
CIS 110 –
VC 4.2
1,2 DCE 110 –
TCE 1800

Notes:

(1) The pump intake was placed at the well mid-screen at approx.2 ft above any sediment accumulated at the well bottom.

(2) The drawdown from the initial water level should not exceed 0.33 ft. The pumping rate should not exceed 600 mL/min.

(3) For conductivity, the average value of three readings <1 mS/cm ±0.005 mS/cm or where conductivity >1 mS/cm ±0.01 mS/cm.

Purging will continue until stabilization is achieved or until 20 well screen volumes have been purged (unless purge water remains visually turbid and appears to be clearing, or unless stabilization parameters are varying slightly outside of the stabilization criteria and appear to be stabilizing)

MONITORING WELL RECORD FOR LOW-FLOW PURGING

Project Data:

Project Name: Southern States LLC

Ref. No.:

Date: 6-8-17

Personnel: B. Cortelloni

Monitoring Well Data:

Well No.: TP-2

Measurement Point: TOC

Constructed Well Depth (ft): 30.00

Measured Well Depth (ft): 30.00

Depth of Sediment (ft): N/A

Screen Length (ft):

Depth to Pump Intake (ft)(1): 25

Well Diameter, D (in): 2

Well Screen Volume, V_s (mL):

Initial Depth to Water (ft): 10.49

Time	*Pumping Rate (mL/min)*	*Depth to Water (ft)*	*Drawdown from Initial Water Level (2) (ft)*	*pH*	*Temperature °C*	*Conductivity (3) (mS/cm)*	*ORP (mV)*	*DO (mg/L)*	*Turbidity (NTU)*
			Precision Required:	*±0.1 Yvιτσ*	*±3%*	*±0.005 or 0.01*	*±10 mV*	*±10%*	*±10%*
11:21	50	10.49		5.63	22.72	0.184	193	0.49	3.33
11:29	↓	10.53		5.45	23.40	0.127	206	1.61	4.8
11:34		10.62		5.42	23.12	0.126	204	1.02	5.1
11:41		10.66		5.43	23.38	0.125	205	1.03	5.0
Sample ID:	TP-2								
	VOCs								

Notes:

(1) The pump intake was placed at the well mid-screen or 2 ft above any sediment accumulated at the well bottom.

(2) The drawdown from the initial water level should not exceed 0.33 ft. The pumping rate should not exceed 600 mL/min.

(3) For conductivity, the average value of three readings <1 mS/cm ±0.005 mS/cm or where conductivity >1 mS/cm ±0.01 mS/cm.

Purging will continue until stabilization is achieved or until 20 well screen volumes have been purged (unless purge water remains visually turbid and appears to be clearing, or unless stabilization parameters are varying slightly outside of the stabilization criteria and appear to be stabilizing)

1,1 DCA 9.8

1,1 DCE 34

C,S 31 –

TCE 470

1,2 DCE 31 –

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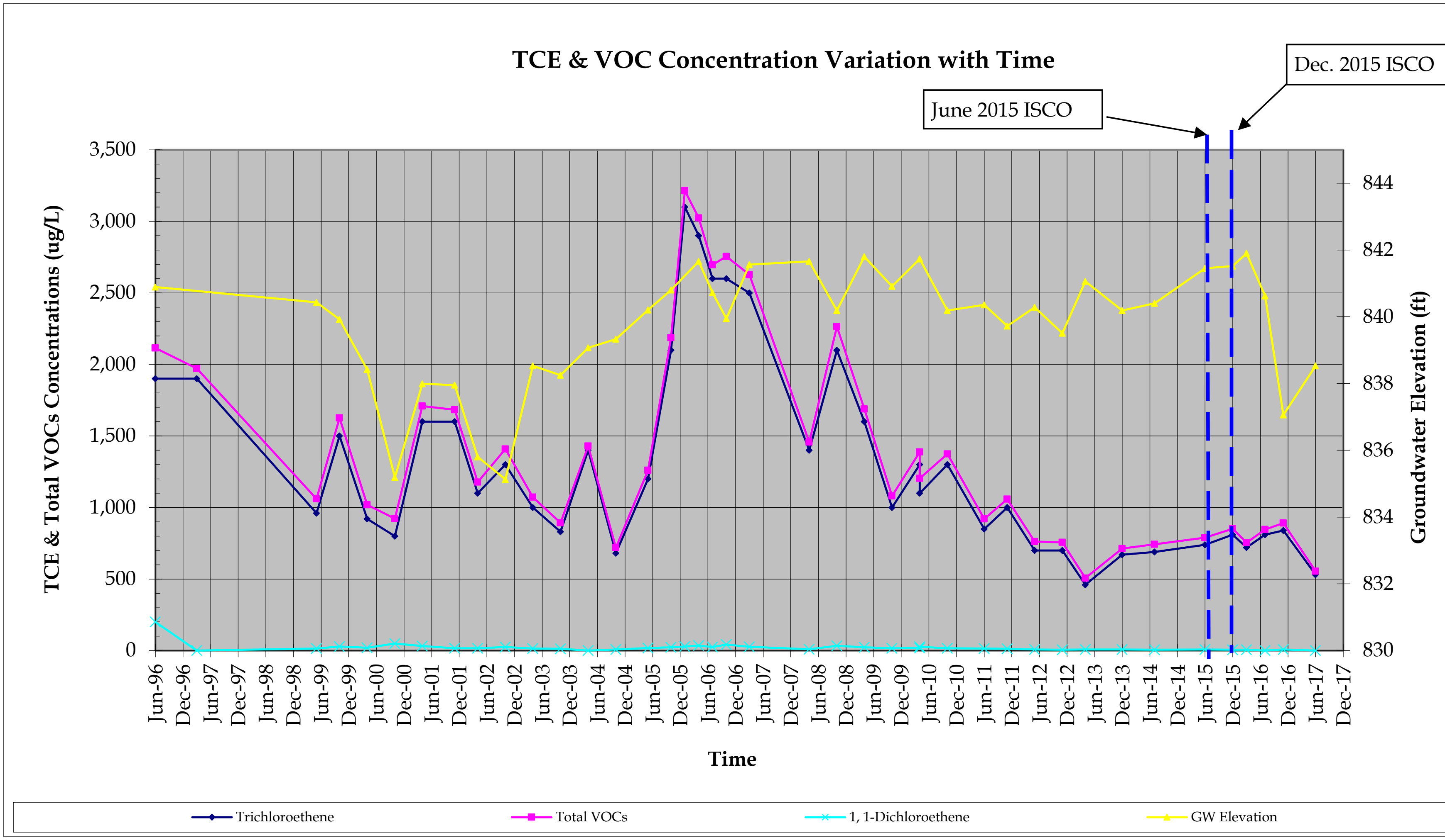
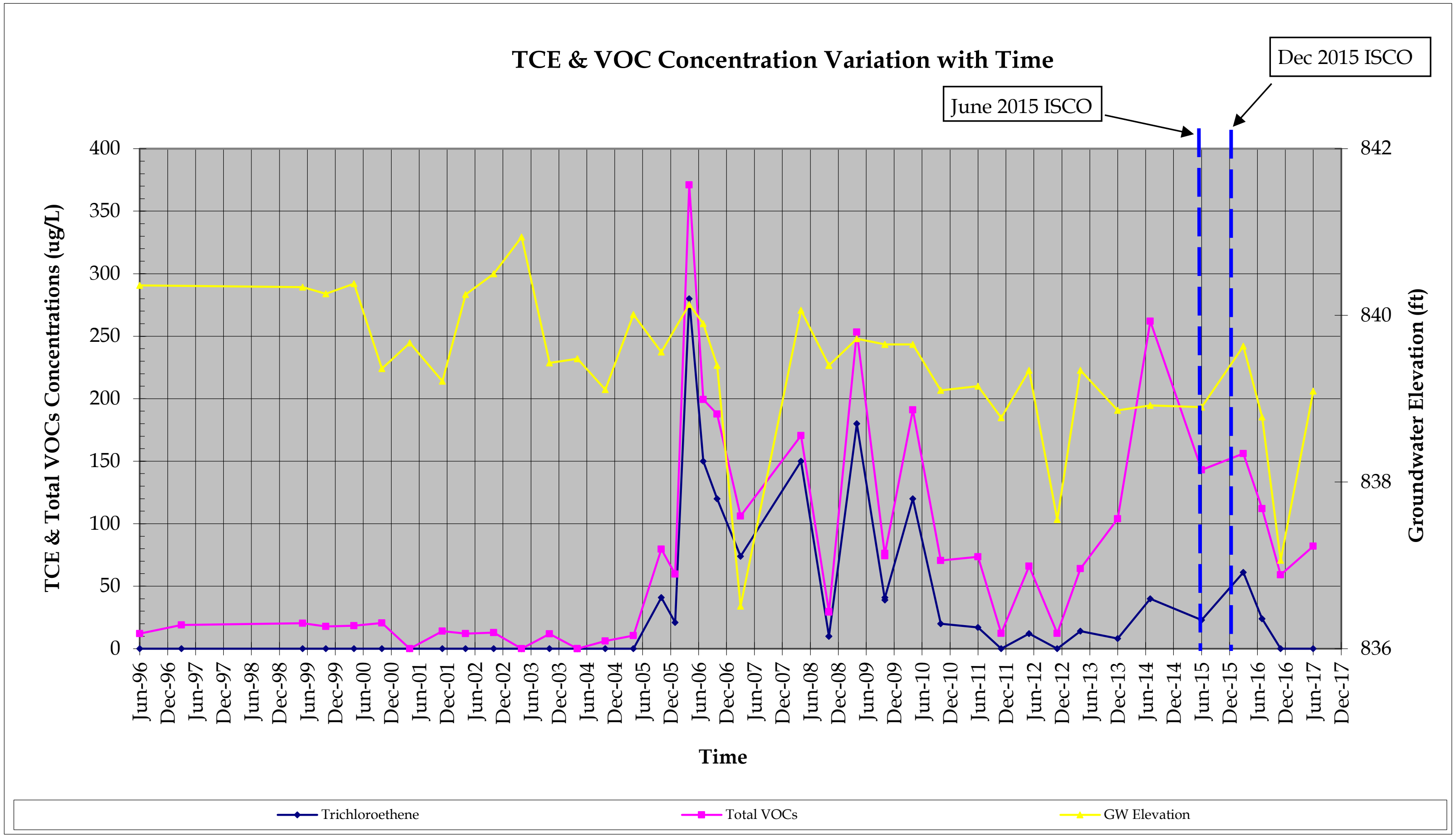
APPENDIX B

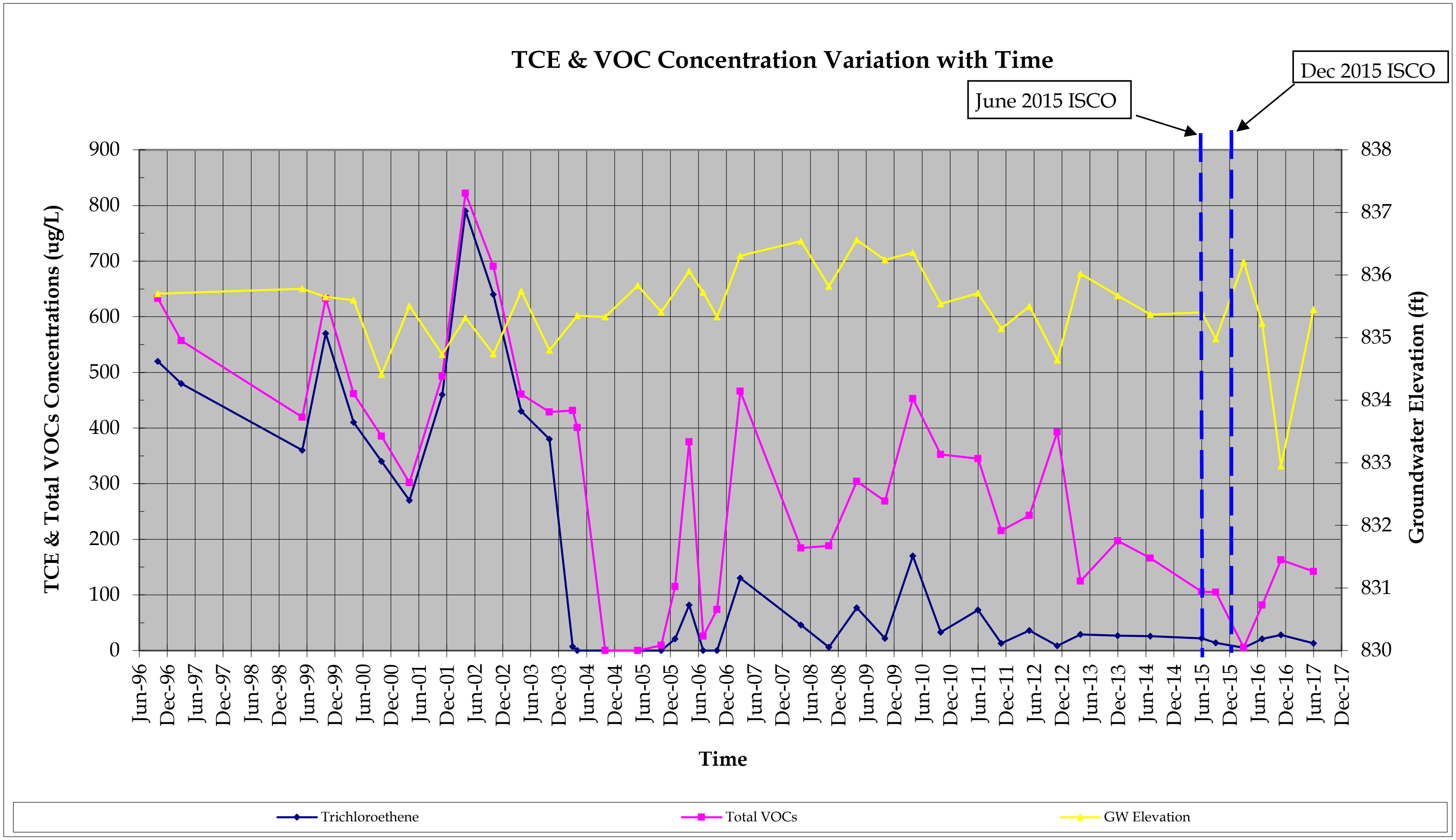
TOTAL VOC TREND GRAPHS FOR SELECT PERFORMANCE MONITORING WELLS



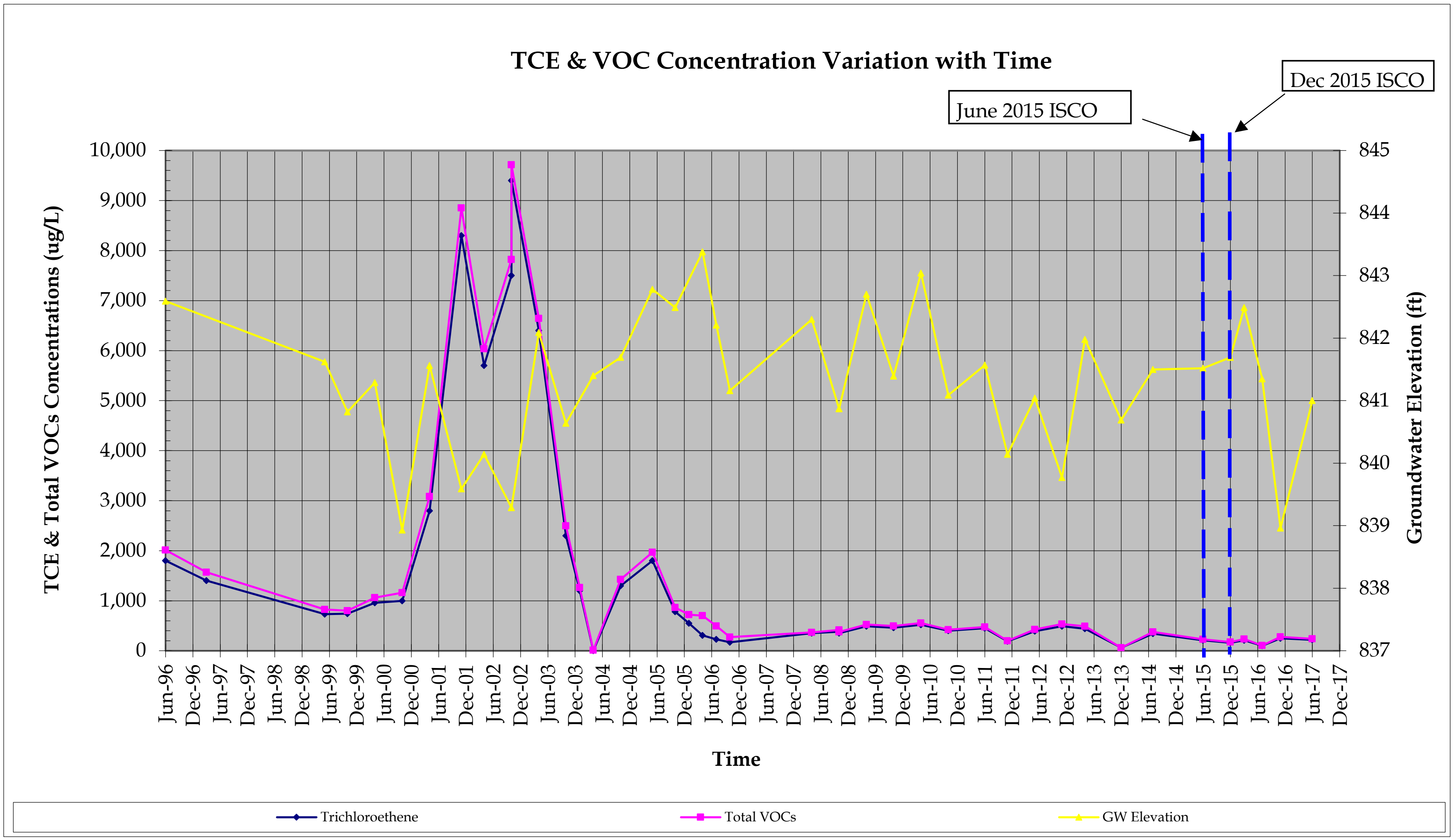
ORGANIC CONCENTRATIONS AT MW-9
OVERBURDEN MONITORING WELL
SOUTHERN STATES, LLC
Hampton, Georgia



ORGANIC CONCENTRATIONS AT MW-13
OVERBURDEN MONITORING WELL
SOUTHERN STATES, LLC
Hampton, Georgia



ORGANIC CONCENTRATIONS AT MW-18
OVERBURDEN MONITORING WELL
SOUTHERN STATES, LLC
Hampton, Georgia

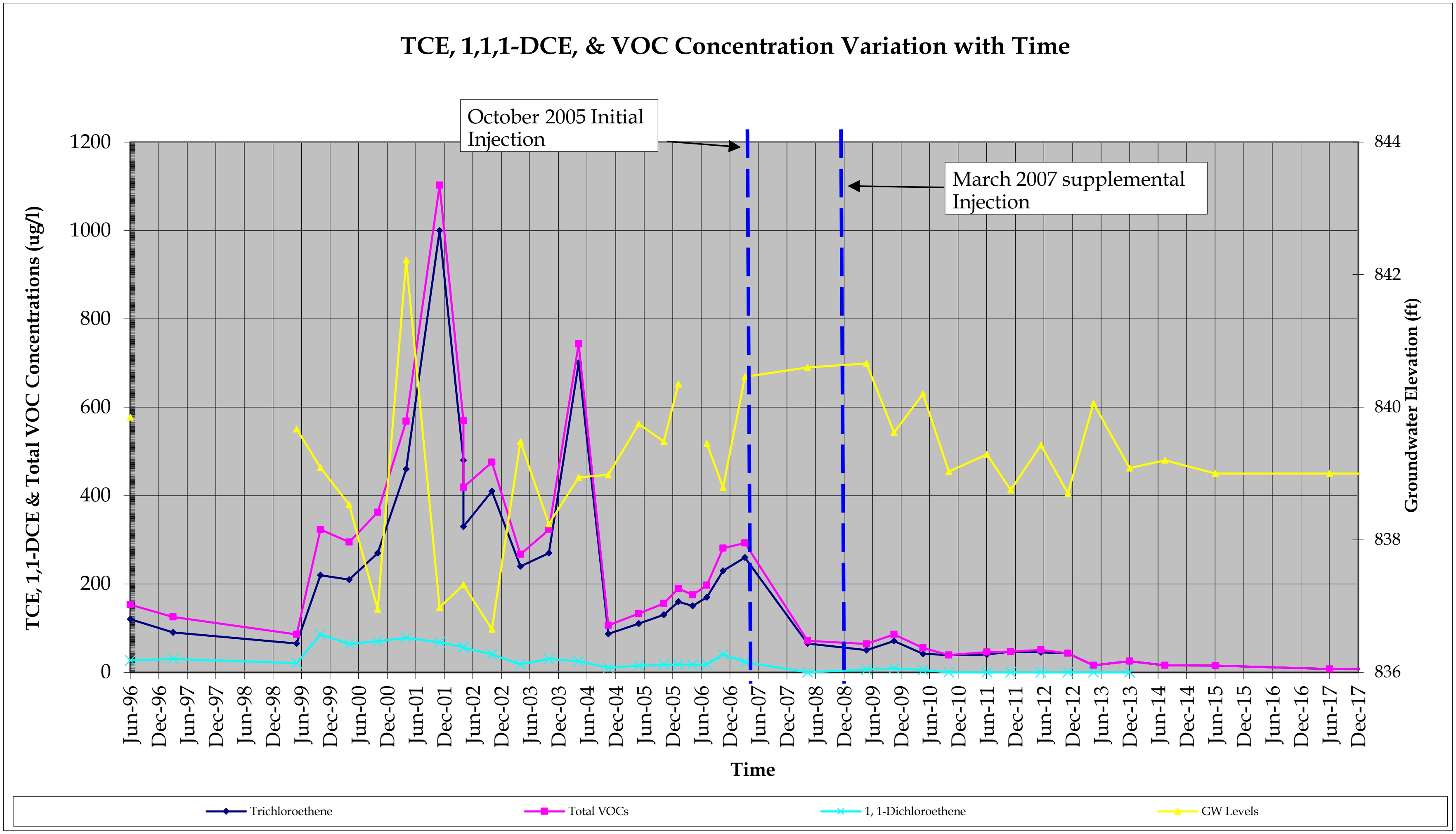


ORGANIC CONCENTRATIONS AT MW-21

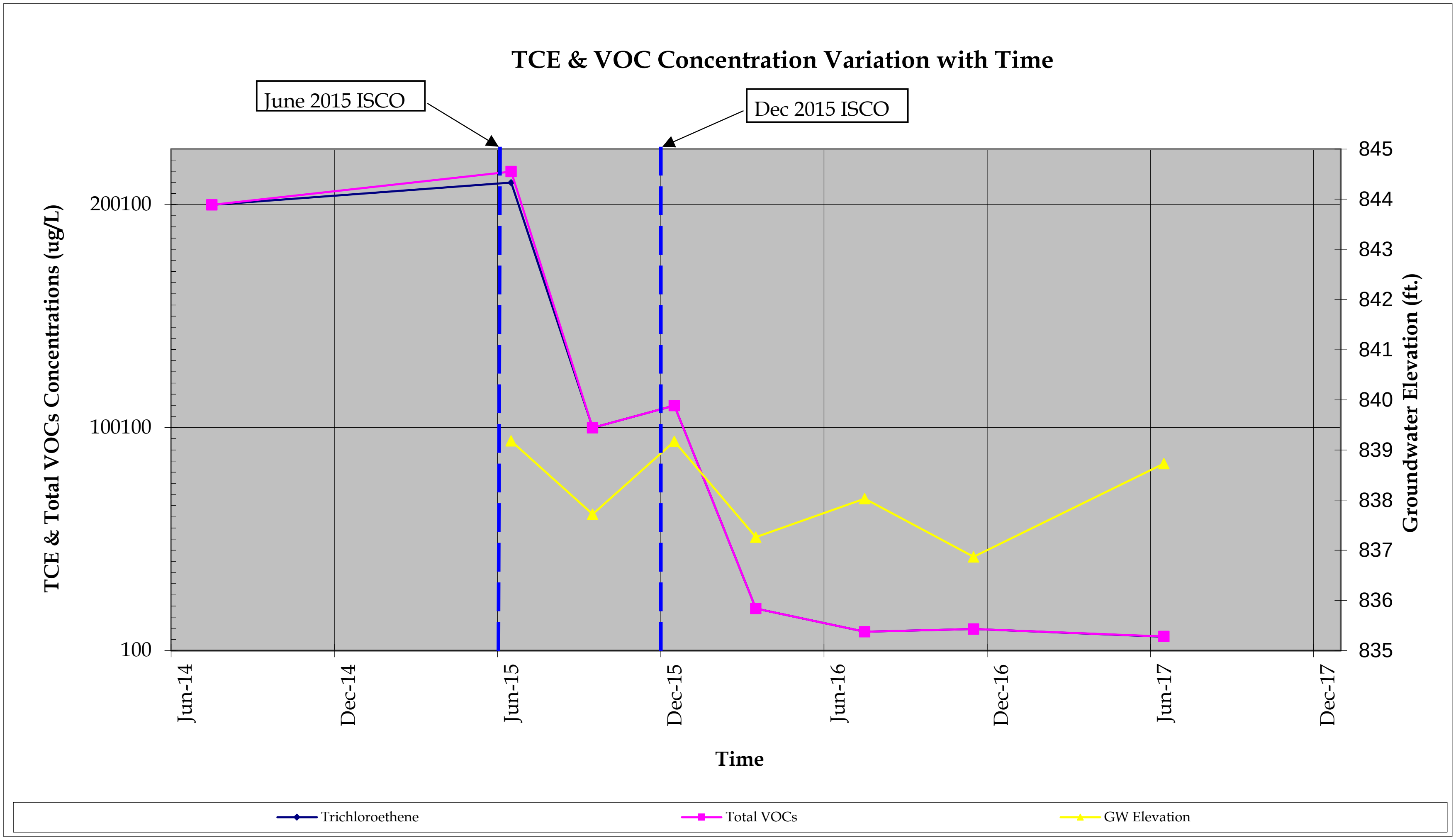
OVERBURDEN MONITORING WELL

SOUTHERN STATES, LLC

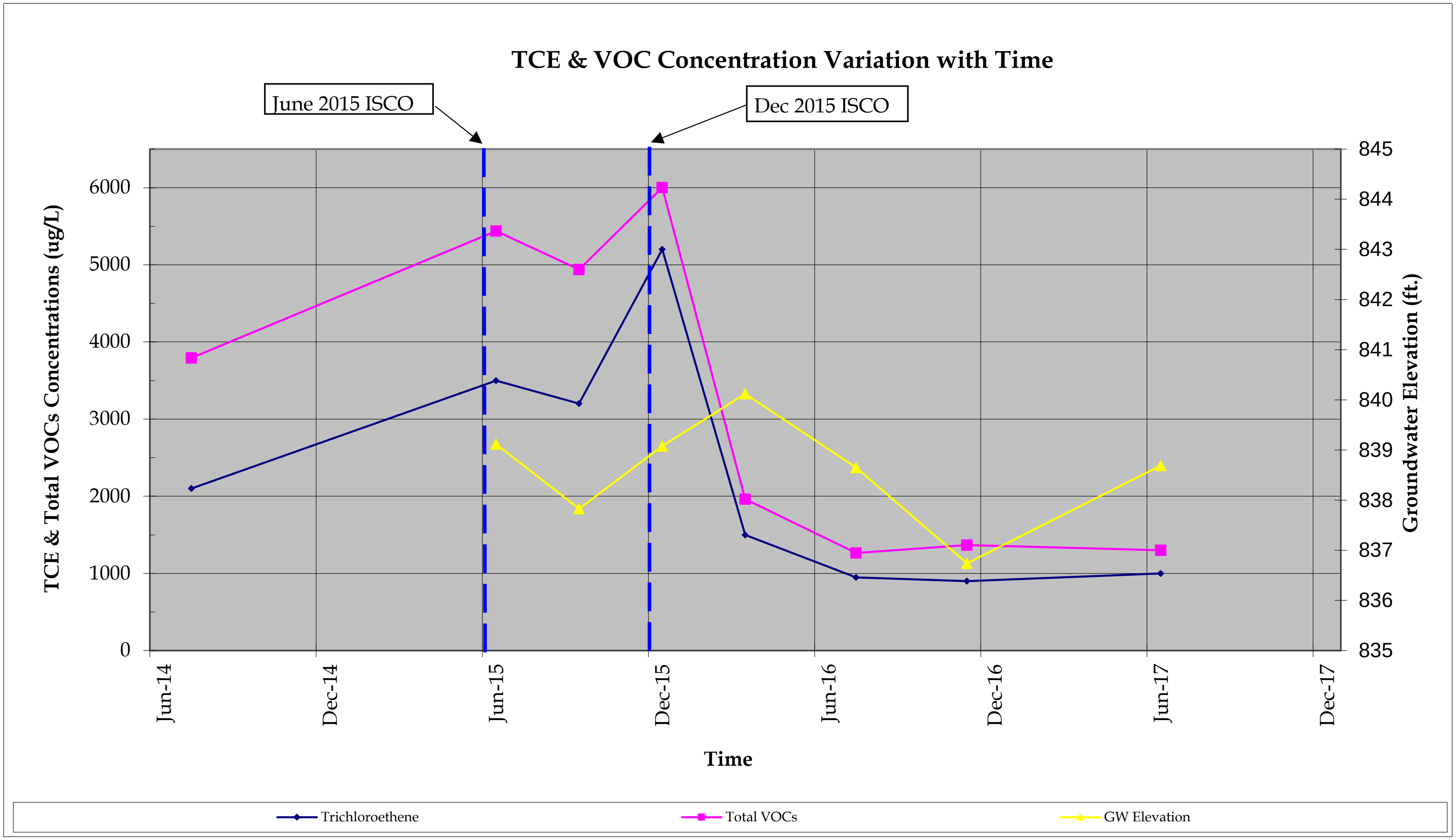
Hampton, Georgia



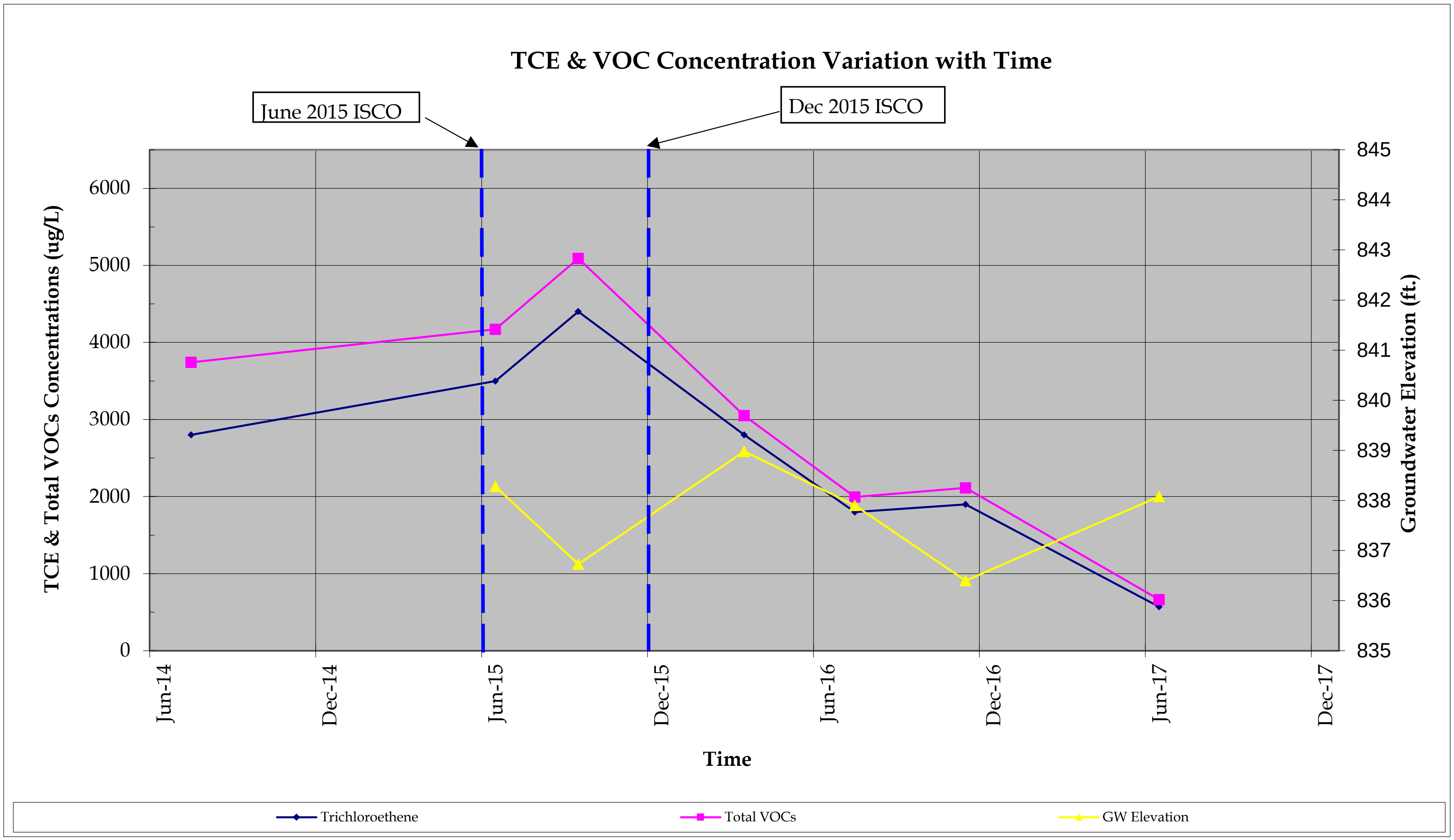
ORGANIC CONCENTRATIONS AT MW-28
BEDROCK MONITORING WELL
SOUTHERN STATES, LLC
Hampton, Georgia



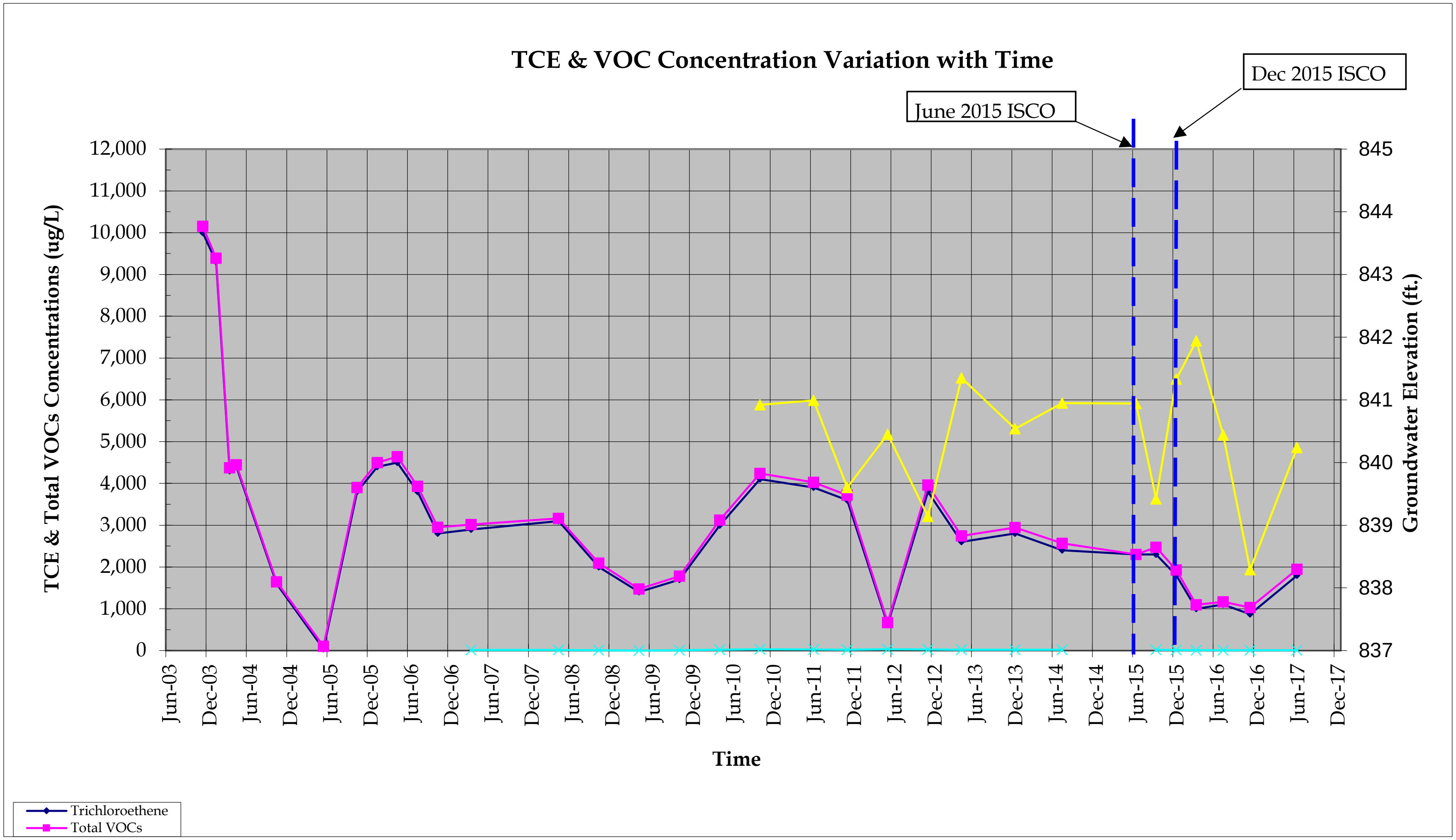
ORGANIC CONCENTRATIONS AT MW-39
OVERBURDEN MONITORING WELL
SOUTHERN STATES, LLC
Hampton, Georgia



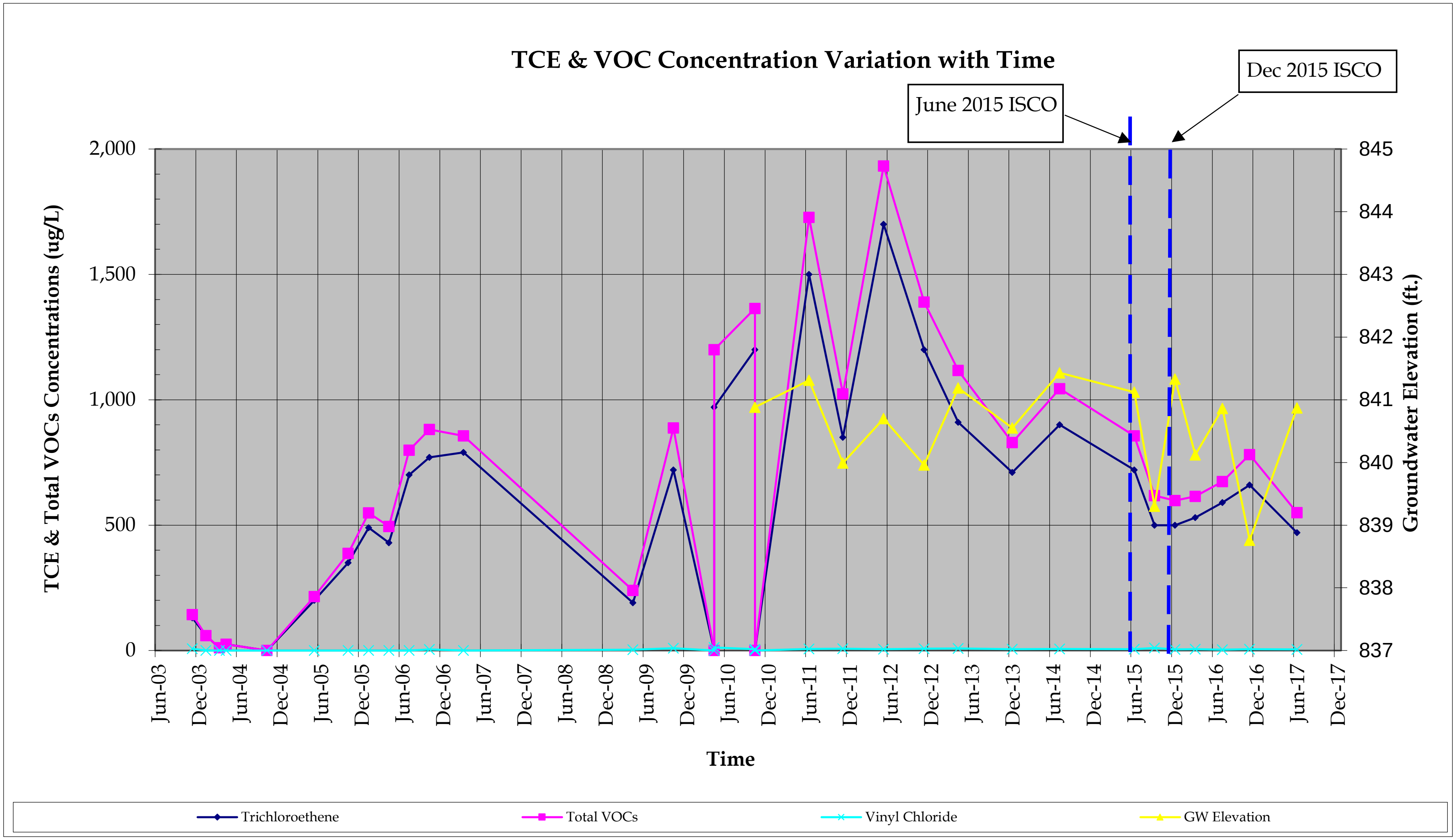
ORGANIC CONCENTRATIONS AT MW-40
OVERBURDEN MONITORING WELL
SOUTHERN STATES, LLC
Hampton, Georgia



ORGANIC CONCENTRATIONS AT MW-41
OVERBURDEN MONITORING WELL
SOUTHERN STATES, LLC
Hampton, Georgia



ORGANIC CONCENTRATIONS AT TP-1
OVERBURDEN MONITORING WELL
SOUTHERN STATES, LLC
Hampton, Georgia



ORGANIC CONCENTRATIONS AT TP-2
OVERBURDEN MONITORING WELL
SOUTHERN STATES, LLC
Hampton, Georgia

APPENDIX C

GROUNDWATER FATE & TRANSPORT REPORT

FATE & TRANSPORT MODELING REPORT
Southern States, LLC
30 Georgia Avenue, Hampton, Georgia

SITE BACKGROUND

SSL began manufacturing operations at the Hampton, GA location in 1940. SSL manufactures high-voltage electrical switches and fuses at its 30-acre manufacturing facility located in Hampton, Georgia. In 1986, SSL conducted a focused groundwater investigation to determine the impact from an existing wastewater sludge impoundment. The results of this and subsequent investigations identified a release of select VOCs had occurred at the Property. In December 1989, SSL and the Georgia Environmental Protection Division (EPD) entered into a Consent Order (Order), No. EPD-HW-529. The Property was listed on the Hazardous Site Inventory on June 30, 1997 as Site No. 10141.

Since 1986, the Property has been the subject of a number of investigations which identified the presence of volatile organic compounds in the soil and groundwater. The primary COC above the Type 4 RRS at the Site is TCE with resulting daughter products. A minor COC above the Type 4 RRS has been identified as 1,1,2-TCA.

EMA prepared the VRPAP and submitted to EPD on October 30, 2014. EPD approved the VRPAP with conditions and comments in two letters dated April 10, 2015.

In an effort to expedite remediation and reduce hot-spot or suspected source area concentrations, EMA conducted two formal injections (June 2015 and January 2016) of an in-situ chemical oxidation (ISCO) reagent (PeroxyChem's (formerly FMC Corporation) Klozur® sodium persulfate mixed with an alkaline activator (sodium hydroxide) to form sulfate and hydroxyl radicals). The injections were intended to reduce the existing groundwater contamination to levels at or below the Type 4 RRS proposed in the VRP. ISCO application was performed at three specific areas identified on Figure 3 (attached) with the following rationale:

Treatment Area	*Rationale*
Zone A – MW-39	suspected source zone (~ 200,000 μg/L TCE);
Zone B – TP-1 / TP-2	lateral impact area (~ 2,000 μg/L TCE); and
Zone C – MW-18	pilot study to determine saprolite/shallow bedrock treatment effectiveness on MW-32 (shallow bedrock well suspected to be connected to overburden).

CONTAMINANTS OF CONCERN

The maximum concentration of TCE observed at the Site was discovered in March 2011 at monitoring well MW-39 located within the area of the former on-site landfill. The concentration was initially observed at 180,000 µg/L and has been observed at a maximum of 290,000 µg/L in April 2011. The most recent concentration in June 2017 was 6,300 µg/L.

The maximum concentration of 1,1,2-TCA has been observed at TP-1 at 32 µg/L in October 2010. The most recent monitoring in June 2017 indicates a concentration of 11 µg/L.

BIOCHLOR FATE AND TRANSPORT MODEL

BIOCHLOR is a screening model that simulates fate and transport of dissolved chlorinated solvents in groundwater. The software, programmed in the Microsoft™ Excel spreadsheet environment and based on the Domenico analytical solute transport model, has the ability to simulate 1-D advection, 3-D dispersion, linear adsorption, and biotransformation via reductive dechlorination (the dominant biotransformation process at most chlorinated solvent sites). Dissolved solvent degradation is assumed to follow a sequential first order decay process.

BIOCHLOR includes three different model types:

1. Solute transport without decay;
2. Solute transport with biotransformation modeled as a sequential first-order decay process; and
3. Solute transport with biotransformation modeled as a sequential first-order decay process with 2 different reaction zones (i.e., each zone has a different set of rate coefficient values).

For the Southern States Site anaeorobic dechlorination has been observed to be occurring (Corrective Action Plan, CRA, 2005). Therefore, sequential first-order decay has been utilized for this model to determine contaminant fate and transport. However, to be conservative, worst case presentations of solute transport without decay using the No

Degradation output are discussed. As such, sensitivity analysis, although desired, is not necessary.

The objective of constructing the models is to determine the concentration and time frame when dissolved phase TCE, cis-DCE, VC, or 1,1,2-TCA (using 1-dimensional model) in groundwater reaches the nearest hypothetical drinking water receptor or the Point of Exposure (POE). The POE for the site is located 1000 feet downgradient from the edge of the contaminant plume identified by monitoring well MW-18. The Point of Demonstration (POD) monitoring well is MW-17.

Attached figures from previous reports and this VRP Progress Report are included for review and assistance:

- Figure 3 – Treatment Zone location Map;
- Figure 6 – Groundwater TCE Concentration Contour Map – June 2017;
- Figure 6 – Groundwater TCE Concentration Contour Map – July 2014;

Model Construction Assumptions:

The models are constructed with the following assumptions to construct as near a conservative prediction as could be expected. Please note, all data used for the initial baseline model and calibration model utilize pre-remediation data. The model input data is presented in the attached table.

- The models are constructed to initially mimic pre-remediation characteristics and to then predict the effects of the remaining contamination at the site since groundwater remediation by in-situ chemical oxidation in 2015;
- TCE is the primary contaminant;
- Only the overburden groundwater aquifer is modeled;
- A simulation time, defined as period of time since the expected contaminant release date, has been defined as 45 years to mimic the approximate time period from the suspected release (1970);
- Anaerobic dechlorination is assumed be occurring due to the presence of daughter products and other favorable indicators and based on CRA's treatability studies;
- Sections 1, 2, 3 - All Advection and Adsorption parameters are either site specific or acceptable Georgia peer reviewed literature values used for

modeling, the hydraulic conductivity value is based on the geometric mean of nine overburden monitoring well tests performed by GeoSciences, Inc.;

- Section 4 -Biotransformation rates are consistent with BIOCHLOR literature values and are not minimum or maximum expected values;
- Section 5 - General Parameters include an initial simulation time of 45 years from “release” to pre-remediation data collected in 2015, a model width of 125 feet, and initial modeled length of 1368 feet (368 feet from the suspected source area MW-39 to the contaminant plume edge MW-18 plus 1000 feet to the hypothetical downgradient drinking water receptor);
- Section 6 - Source Data is using a continuous single planar source as a most conservative option. Source thickness of 25 feet – (maximum groundwater table thickness to bedrock at MW-39), source area width of 50 feet, and the baseline TCE concentration observed is 210 mg/L.
- Section 7 - Field Data entered from July 2014 and June 2015 – calibration runs tested with both data sets prior to remediation with downgradient monitoring wells MW-40, MW-18, and MW-17;
- Section 8 – Post Remediation Data - June 2017 data set.

Models Included

1. Baseline Model – a best-fit attempt using field data baseline data and literature data. All contaminant concentrations data collected prior to any groundwater remediation activities. Models Baseline D1 and Baseline D2 represent field data collected in July 2014 and June 2015. The model utilizing the June 2015 data set is likely the most representative of site conditions;
2. Asymptotic Plume – using the best fit model Baseline June 2015 data set, a No Degradation model was run into the future to determine when the plume would no longer migrate. It was determined that at year 350 the plume would become stable. The year 300, 350, and 400 output is presented.
3. Maximum Acceptable Contaminant Concentration – a No Degradation model was attempted to be constructed by varying the source concentration to demonstrate the acceptable maximum concentration level (Type IV 5.24 ug/L) at monitoring well locations MW-18 and MW-17. A source concentration of 200 ug/L was the maximum at which MW-18 reached approximately 0.00524 ug/L. No reasonable maximum source concentration was able to be determined at which MW-17 exceeded 0.00525 ug/L.source

4. <u>Post –Remediation + 100 years</u> - Model to determine concentration at point of exposure 1,000′ from edge of plume after 100 years using the current source area concentration of 6.3 mg/L; and

5. <u>ACL+100 years</u> – Model to determine a conservative ACL which would be the maximum concentration allowed at the source area before Type I RRS for TCE (0.005 mg/L), cis-DCE (0.07 mg/L), VC (0.002 mg/L) or 1,1,2-TCA (0.005 mg/L) is exceeded at the hypothetical downgradient drinking water receptor located 1,000 feet from the edge of the existing plume after 100 years.

   TCE – 50 mg/L;

   cis-DCE – 10 mg/L; and

   VC – 8 mg/L

6. <u>ACL+ 500 years</u> – Model to show when the contaminant plume becomes asymptotic:

   TCE – 350 years;

   cis-DCE – 350 years; and

   VC – 350 years

<u>Model(s) Summation / Discussion</u>

- The June 2015 data set appeared to be the best fit data for calibration. Please note, that due to high TCE concentrations at MW-39, some daughter products may have been masked initially;
- TCE plume migration using the No Degradation output is asymptotic at approximately 350 years;
- The TCE Type 4 RRS compliance is achieved at monitoring well MW-18 when the source concentration is 0.2 mg/L; a reasonable source concentration value was not able to be determined for the Type 1 or 4 RRS for monitoring well MW-17; MW-40 was not tested as this well is located only 40 feet from the suspected source area and would not present meaningful data;
- Using the existing source concentration of 6.3 ug/L at monitoring well MW-39, the Type 1 or 4 RRS is never exceeded at the POE at 100 years for TCE, cis-DCE, or VC;
- The following ACLs were developed assuming the highest source concentrations at MW-39 where the Type 1 RRS would not be exceeded at the theoretical POE at 100 years using the No Degradation output:

- TCE – 50 mg/L;
- cis-DCE – 10 mg/L; and
- VC – 8 mg/L

Models using the proposed ACLs were then run 500 years into the future to determine when the plume length is greatest and reached asymptotic characteristics (350 years)

1-D FATE AND TRANSPORT MODEL

As BIOCHLOR does not specifically model 1,1,2-TCA which currently exceeds the Type 4 RRS at TP-1, a one-dimensional fate and transport model historically used in the EPD USTM Program was utilized. The model is a simple mathematical advection and retarded prediction model. The model inputs are identical for the BIOCHLOR model with the exception of the K_{OC} value which was 166 mg/L (Valsaraj et al. 1999) and solute half life of 0.15 year (Tosata et al. 1991). The model input and output are presented are attached.

For 1,1,2-TCA at the highest historical concentration of 32 μg/L, the contamination never reaches the POE. Subsequently, the current concentration of 11 μg/L does not reach the POE at any time.

The ACL developed assuming the highest source concentrations at TP-1 where the Type 1 RRS would not be exceeded at the POE is conservatively estimated at 15 mg/L.

Southern States, LLC, Georgia
Input Parameters for BIOCHLOR v.2.2 (Newell et al., 2000, 2002)

Input Parameter	Symbol	Initial	Adjusted Calibration	Unit	Initial Value Data Source /
		Value	Value		Adjusted Value Justification
1. ADVECTION					
Seepage velocity or	**Vs**	10.7	10.7	ft/yr	Calculated in BIOCHLOR spreadsheet
Hydraulic conductivity	**K**	2.82E-04	2.82E-04	cm/sec	Geosciences, Inc. slug test data, 1992 (Geomean)
Hydraulic gradient	**i**	0.011	0.011	ft/ft	Calculated from contours through source area
Porosity	**n**	0.3	0.3	dim. less	Estimated value for Georgia soils (EPD)
2. DISPERSION					
Longitudinal dispersivity	**alpha x**	7.06	7.06	ft	Estimated plume length - Calculated in BIOCHLOR spreadsheet Option 3
Transverse dispersivity	**alpha y**	0.1	0.1	ft	Calculated in BIOCHLOR spreadsheet
Vertical dispersivity	**alpha z**	1.00E-99	1.00E-99	ft	Calculated in BIOCHLOR spreadsheet
3. ADSORPTION					
Retardation Factor	**R**	1.65	1.65	dim.less	Calculated in BIOCHLOR spreadsheet
or Soil Bulk Density	**rho**	1.5	1.5	kg/L	From EPD USTMPT CAP-A Guidance Figure 5
Partition Coefficient	**Koc**			L/kg	PCE-426, TCE-130, DCE-125, VC-30, ETH-302
Fraction Organic Carbon	**foc**	0.001	0.001	dim.less	EPD's default value at 0.1%
4. BIOTRANSFORMATION					
ZONE 1					
1st Order Decay Coefficient or	**lamda**	**t-half**	**t-half**	year	
Solute half-life					
PCE - TCE				year	
TCE-DCE	0.396/0.396	1.75	1.75	year	Conservative end of Biochlor guidance values
DCE-VC	0.707/0.707	0.98	0.98	year	Conservative end of Biochlor guidance values
VC-ETH	0.99/1.733	0.7	0.4	year	Conservative end of Biochlor guidance values

Southern States, LLC, Georgia
Input Parameters for BIOCHLOR v.2.2 (Newell et al., 2000, 2002)

Input Parameter	Symbol	Value	Adjusted Value	Unit	Remarks
5. GENERAL					
Model Area Length		1,368	1,368	ft	Site Map (From Source Area MW-39 to theoretical DW receptor
					located 1,000 feet from edge of plume delineated by MW-18)
Model Area Width		125	125	ft	Estimated from isoconcentration contour
Simulation TIme		45	45	yr	Estimated from conservative time of probable release (1970-2015)
6. SOURCE DATA					
Source Thickness in Sat. Zone		25	25	ft	Thickness of groundwater to bedrock at source area
Source Option		Continuous-Single Planar			
Source area width		50	50	ft	
PCE concentration at source		-	-	mg/L	
TCE concentration at source		210		mg/L	Highest concentration at source MW-39 (June 2015 monitoring event)
DCE concentration at source		4.9		mg/L	Highest concentration at source MW-39 (June 2015 monitoring event)
VC concentration at source		0.1		mg/L	Highest concentration at source MW-39 (June 2015 monitoring event)
Ethene concentration at source				mg/L	
7. BASELINE FIELD DATA FOR	**TCE Conc.**	**c-DCE Conc.**	**VC Conc.**	**Distance from**	
COMPARISON	(mg/L)	(mg/L)	(mg/L)	**source (ft)**	
	July 2014 / June 2015	**July 2014 / June 2015**	**July 2014 / June 2015**		
MW-39	**200 / 210**	**- / 4.9**		**0**	
MW-40	**2.1 / 3.5**	**1.542 / 1.761**	0.005 / 0.005	**40**	
MW-18	**0.026 / 0.022**	**0.120 / 0.072**	0.02 / 0/012	**368**	
MW-17	ND (0.005)	ND (0.005)	ND (0.002)	763	
8. POST - REMEDIATION DATA	**TCE Conc.**	**c-DCE Conc.**	**VC Conc.**	**Distance from**	
	(mg/L)	(mg/L)	(mg/L)	**source (ft)**	
	June 2017	**June 2017**	**June 2017**		
MW-39	**6.3**	**0.082**	0.002	**0**	
MW-40	**1.0**	**0.222**	0.08	**40**	
MW-18	**0.013**	**0.12**	0.0088	**368**	
MW-17	0.005	0.005	0.002	763	

TABLE 3.2

ESTIMATED HDYRAULIC CONDUCTIVITY VALUES
SOUTHERN STATES, INC.
SEPTEMBER 1992

	Hydraulic Conductivity	
	Falling Head *cm/sec* [2]	*Rising Head* *cm/sec*
Overburden Monitoring Wells [1]		
MW-2	6.61×10^{-4}	5.43×10^{-4}
MW-4	6.44×10^{-4}	4.20×10^{-4}
MW-7	7.93×10^{-5}	6.82×10^{-5}
MW-8	3.61×10^{-4}	2.60×10^{-4}
MW-9	3.98×10^{-4}	2.91×10^{-4}
MW-11	4.73×10^{-5}	5.89×10^{-5}
MW-13	--	4.58×10^{-4}
MW-15	5.11×10^{-4}	4.27×10^{-4}
MW-18	5.18×10^{-4}	5.39×10^{-4}
Bedrock Monitoring Wells [3]		
MW-16	2.2×10^{-4}	1.5×10^{-4}
MW-27	1.09×10^{-6}	1.43×10^{-6}

Notes:

(1) Overburden monitoring well testing conducted by GeoSciences, Inc.

(2) cm/sec - centimeters per second

(3) Bedrock monitoring well testing conducted by CRA.

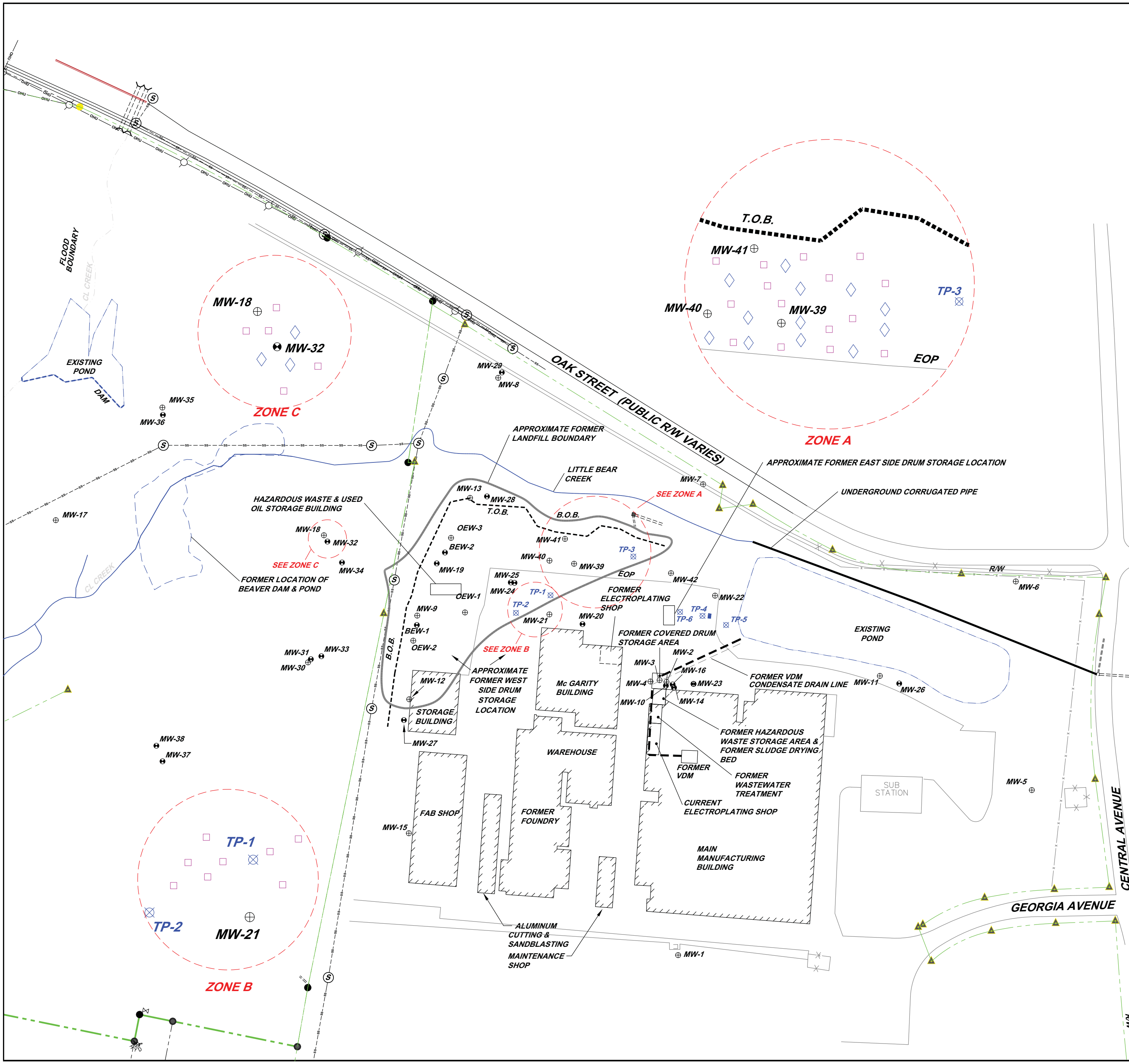
GEOSCIENCES, INC. - 1992 CORREECTIVE ACTION RPORT
SUMMARY OF SLUG TEST DATA

6.61E-04
5.43E-04
6.44E-04
4.20E-04
7.93E-05
6.82E-05
3.61E-04
2.60E-04
3.98E-04
2.91E-04
4.73E-05
5.89E-05
4.58E-04
5.11E-04
4.27E-04
5.18E-04
5.39E-04
2.82E-04 GEOMEAN

FIGURE 3 - TREATMENT ZONE LOCATION

FIGURE 6 – GROUNDWATER TCE CONCENTRATION CONTOUR MAP – JUNE 2014

FIGURE 6 – GROUNDWATER TCE CONCENTRATION CONTOUR MAP – JUNE 2017



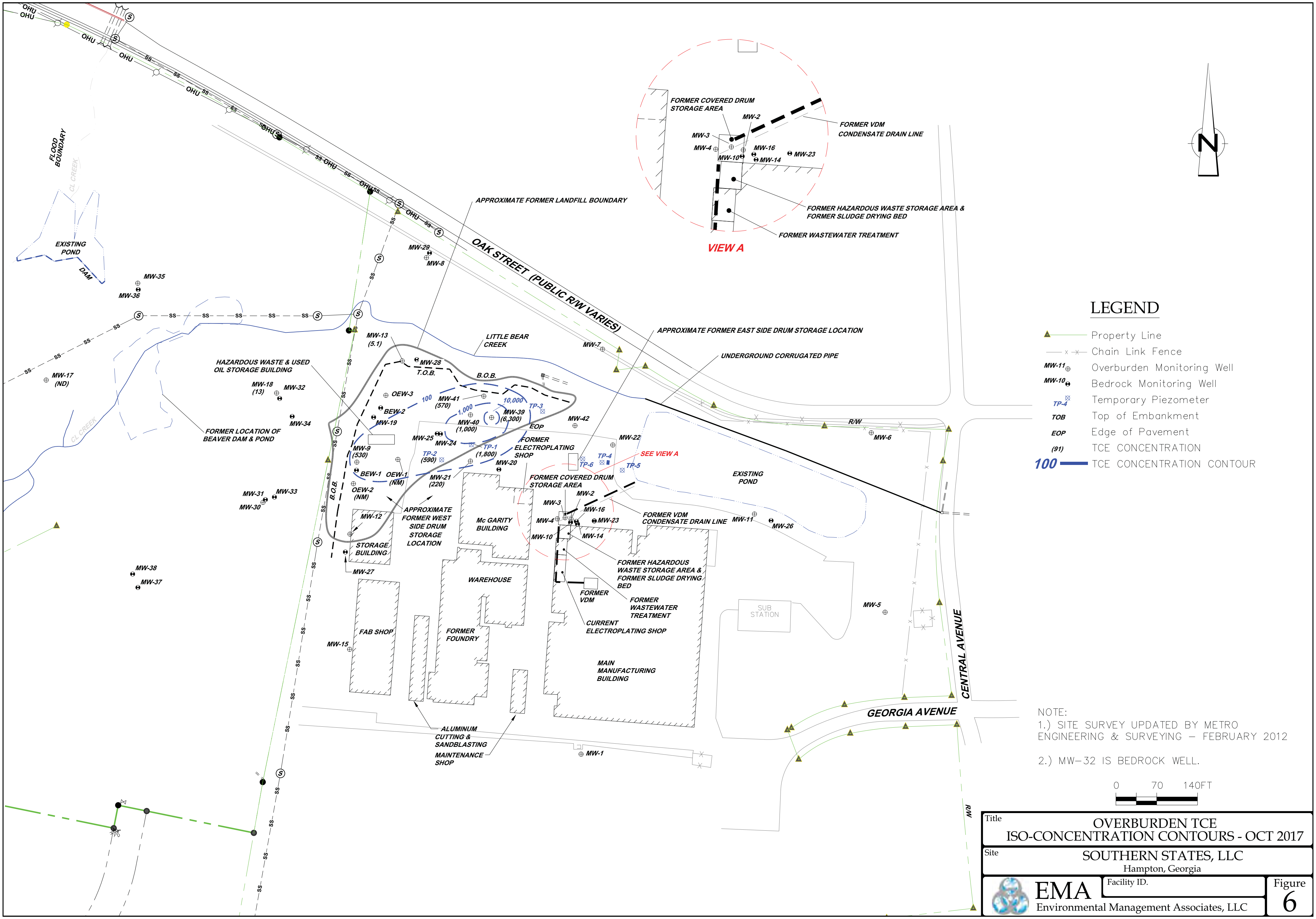
Title
TREATMENT ZONE LOCATION MAP

Site
SOUTHERN STATES, LLC
Hampton, Georgia

EMA
Environmental Management Associates, LLC

Facility ID.

Figure
3



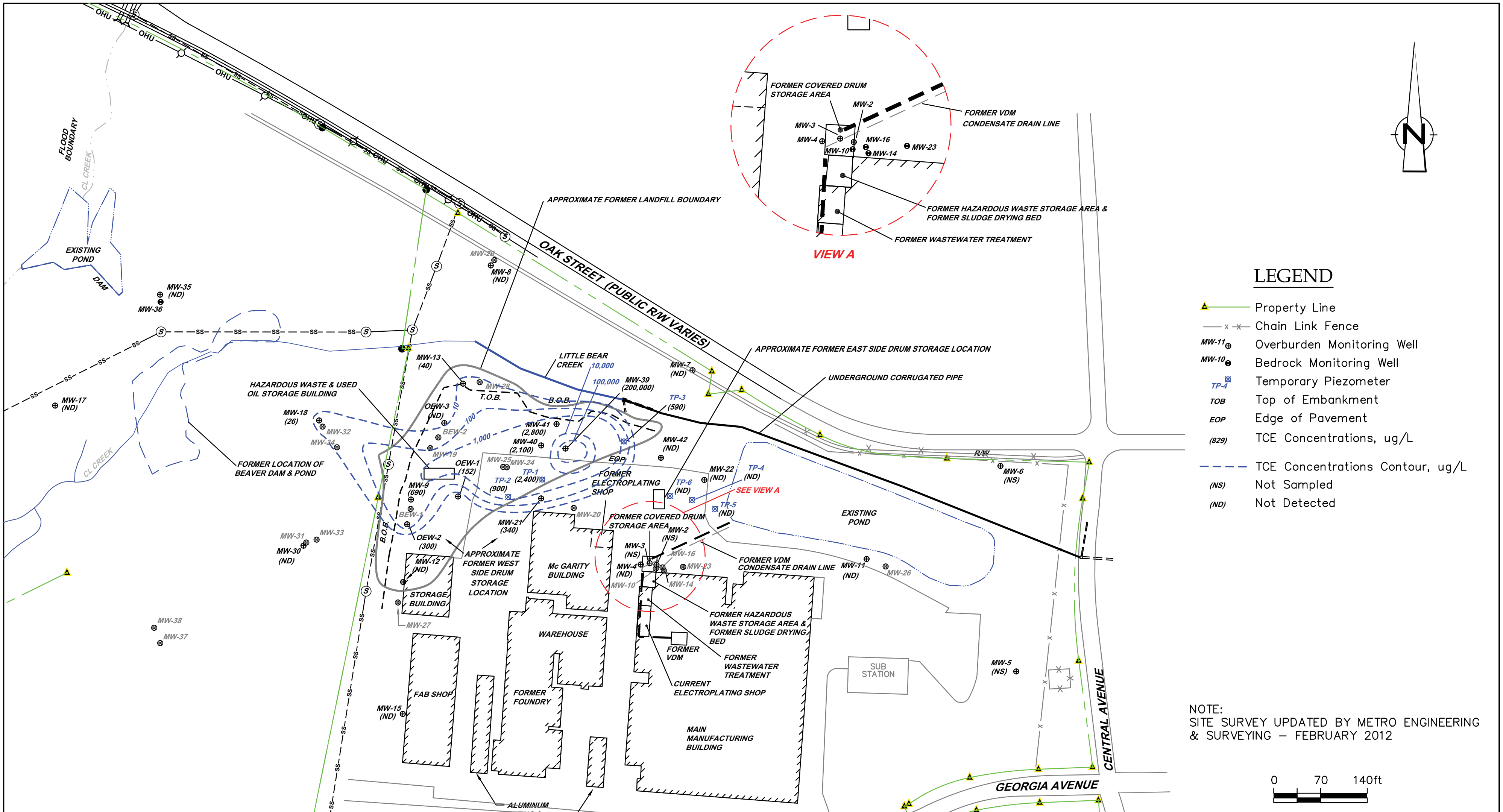
Title: OVERBURDEN TCE ISO-CONCENTRATION CONTOURS - OCT 2017

Site: SOUTHERN STATES, LLC
Hampton, Georgia

EMA
Environmental Management Associates, LLC

Facility ID.

Figure 6



Title
TCE CONCENTRATION
CONTOURS OVERBURDEN - JULY 2014

Site
SOUTHERN STATES, LLC
Hampton, Georgia

EMA
Environmental Management Associates, LLC

Facility ID.

Figure
6

BASELINE MODELS

JULY 2014

JUNE 2015

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Southern States
Baseline - July 2014
Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 cells. Press Enter, then C
(To restore formulas, hit "Restore Formulas" button)
Variable* → Data used directly in model.

Test if Biotransformation is Occurring → Natural Attenuation Screening Protocol

TYPE OF CHLORINATED SOLVENT: Ethenes ◉ Ethanes ○

1. ADVECTION

Seepage Velocity*	Vs	10.7	(ft/yr)
or			
Hydraulic Conductivity	K	2.8E-04	(cm/sec)
Hydraulic Gradient	i	0.011	(ft/ft)
Effective Porosity	n	0.3	(-)

2. DISPERSION

Alpha x*	7.0649	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	1.E-99	(-)

Calc. Alpha x

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.5	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc			
PCE	426	(L/kg)	3.13	(-)
TCE	130	(L/kg)	1.65	(-)
DCE	125	(L/kg)	1.63	(-)
VC	30	(L/kg)	1.15	(-)
ETH	302	(L/kg)	2.51	(-)
Common R (used in model)* =			**1.65**	

4. BIOTRANSFORMATION

-1st Order Decay Coefficient*

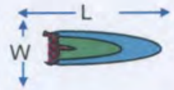
Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	3.465	0.20	0.79
TCE → DCE	0.396	1.75	0.74
DCE → VC	0.707	0.98	0.64
VC → ETH	0.990	0.70	0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	45	(yr)
Modeled Area Width*	125	(ft)
Modeled Area Length*	1368	(ft)
Zone 1 Length*	1368	(ft)
Zone 2 Length*	0	(ft)



Zone 2= L - Zone 1

6. SOURCE DATA

TYPE: Continuous Single Planar

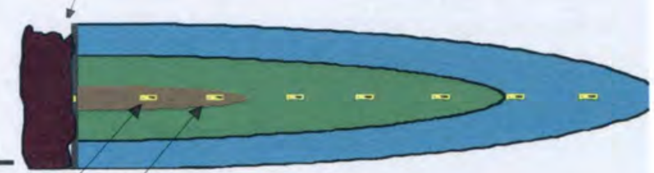
Source Options

Source Thickness in Sat. Zone* 25 (ft)

Y1
Width* (ft) 50

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE		0
TCE	200.0	0
DCE		0
VC		0
ETH		0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

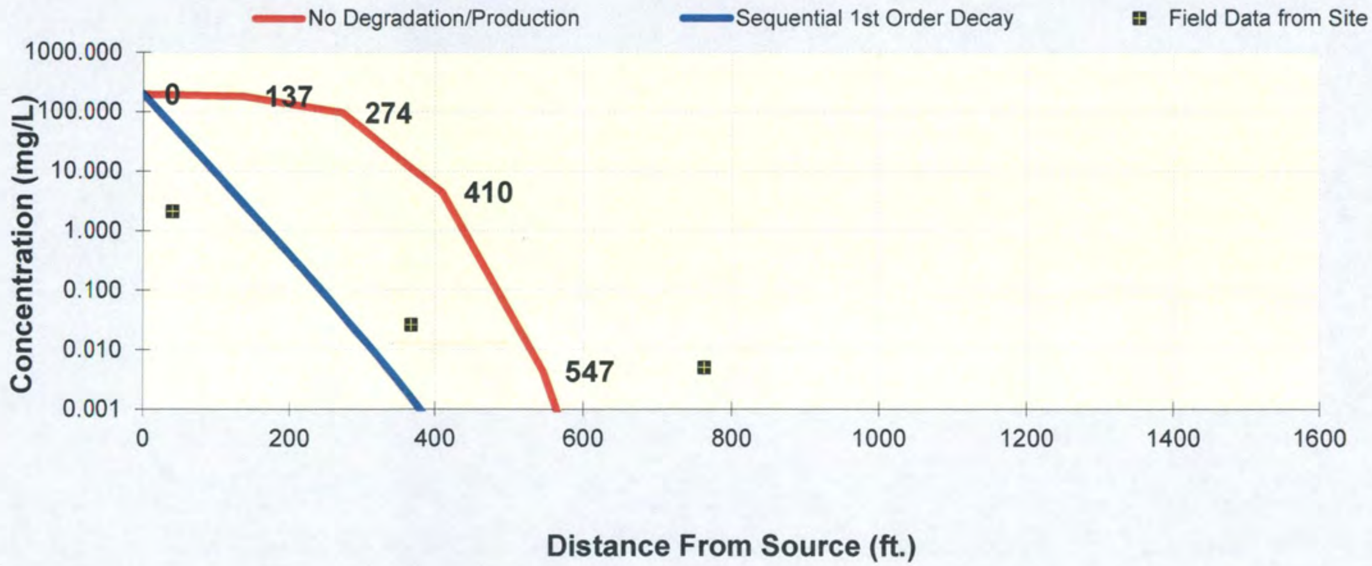
PCE Conc. (mg/L)											
TCE Conc. (mg/L)	2.1	.026	.005								
DCE Conc. (mg/L)	1.542	.12	.005								
VC Conc. (mg/L)	0.0	.02	.002								
ETH Conc. (mg/L)											
Distance from Source (ft)	40	368	763								
Date Data Collected	~~2017~~ 2014										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore | RESET | *SEE OUTPUT* | Paste

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

TCE	Distance from Source (ft)										
	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	200.000	184.694	97.391	4.532	0.004	0.000	0.000	0.000	0.000	0.000	0.000
Biotransformation	199.9999	2.876	0.038	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Monitoring Well Locations (ft)										
	40	368	763								
Field Data from Site	2.100	0.026	0.005								



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time: 45.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

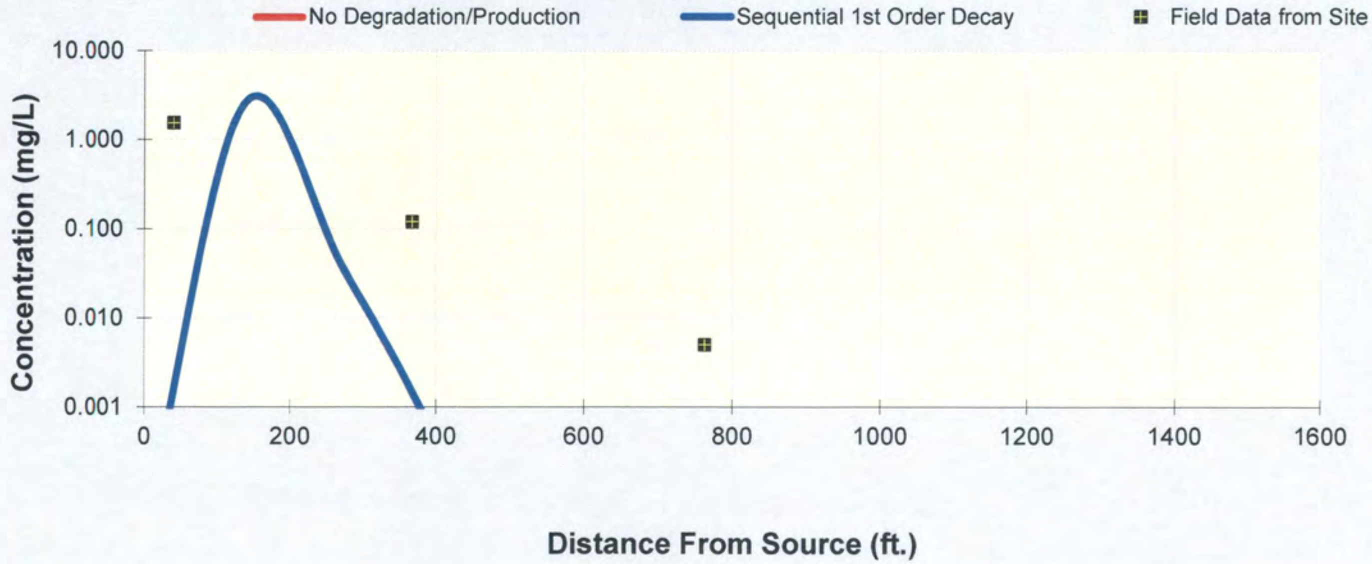
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

DCE	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biotransformation	0.0000	2.488	0.035	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Monitoring Well Locations (ft)

	40	368	763								
Field Data from Site	1.542	0.120	0.005								



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

45.0 Years

Log ⟺ Linear

Return to Input

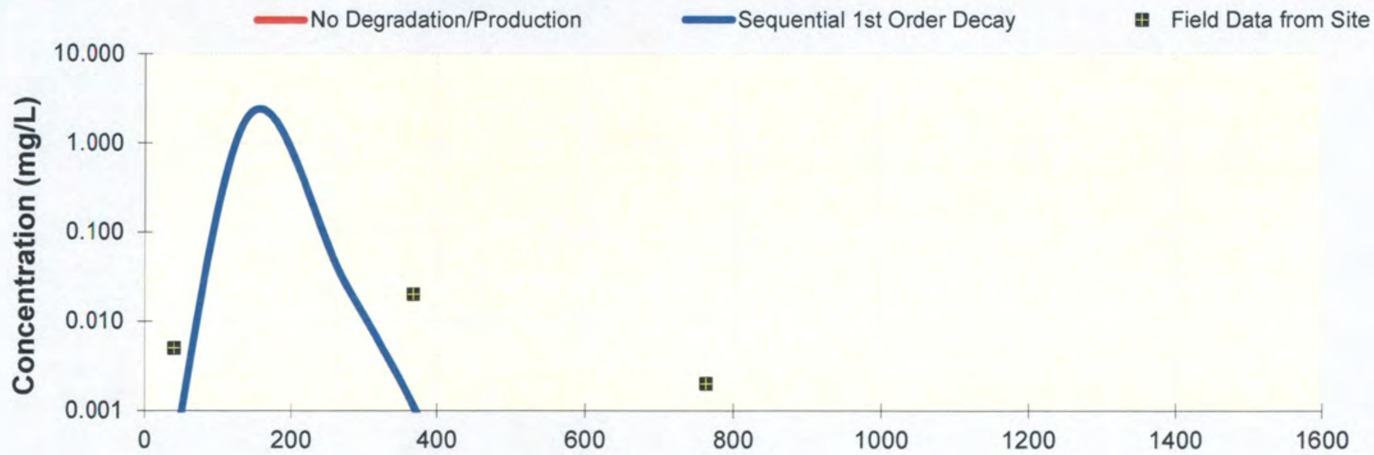
To All

To Array

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

VC	Distance from Source (ft)										
	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biotransformation	0.0000	1.756	0.027	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	Monitoring Well Locations (ft)										
	40	368	763								
Field Data from Site	0.005	0.020	0.002								



Distance From Source (ft.)

See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

45.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Southern States
Baseline - June 2015
Run Name

Data Input Instructions:
115 → 1. Enter value directly....or
or 0.02 → 2. Calculate by filling in gray cells. Press Enter, then C
(To restore formulas, hit "Restore Formulas" button)
Variable* → Data used directly in model.

Test if Biotransformation is Occurring → Natural Attenuation Screening Protocol

TYPE OF CHLORINATED SOLVENT: Ethenes ◉ Ethanes ○

1. ADVECTION

Seepage Velocity*	Vs	10.7	(ft/yr)
or			
Hydraulic Conductivity	K	2.8E-04	(cm/sec)
Hydraulic Gradient	i	0.011	(ft/ft)
Effective Porosity	n	0.3	(-)

2. DISPERSION

Alpha x*	7.0649	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	1.E-99	(-)

Calc. Alpha x

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.5	(kg/L)
FractionOrganicCarbon, foc	1.0E-3	(-)

Partition Coefficient	Koc		R	
PCE	426	(L/kg)	3.13	(-)
TCE	130	(L/kg)	1.65	(-)
DCE	125	(L/kg)	1.63	(-)
VC	30	(L/kg)	1.15	(-)
ETH	302	(L/kg)	2.51	(-)

Common R (used in model)* = 1.65

4. BIOTRANSFORMATION -1st Order Decay Coefficient*

Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	3.465	0.20	0.79
TCE → DCE	0.396	1.75	0.74
DCE → VC	0.707	0.98	0.64
VC → ETH	1.733	0.40	0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	45	(yr)
Modeled Area Width*	125	(ft)
Modeled Area Length*	1368	(ft)
Zone 1 Length*	1368	(ft)
Zone 2 Length*	0	(ft)

Zone 2= L - Zone 1

6. SOURCE DATA TYPE: Continuous Single Planar

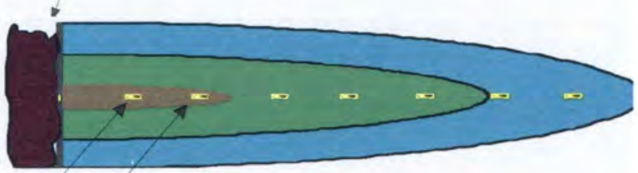
Source Options

Source Thickness in Sat. Zone* 25 (ft)

Y1
Width* (ft) 50

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE		0
TCE	210.0	0
DCE	4.9	0
VC	.1	0
ETH		0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)											
TCE Conc. (mg/L)	3.5	.022	.005								
DCE Conc. (mg/L)	1.761	.072	.005								
VC Conc. (mg/L)	0.1	.012	.002								
ETH Conc. (mg/L)											
Distance from Source (ft)	40	368	763								
Date Data Collected	~~2017~~ 2015										

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | Help | Restore | RESET | SEE OUTPUT | Paste

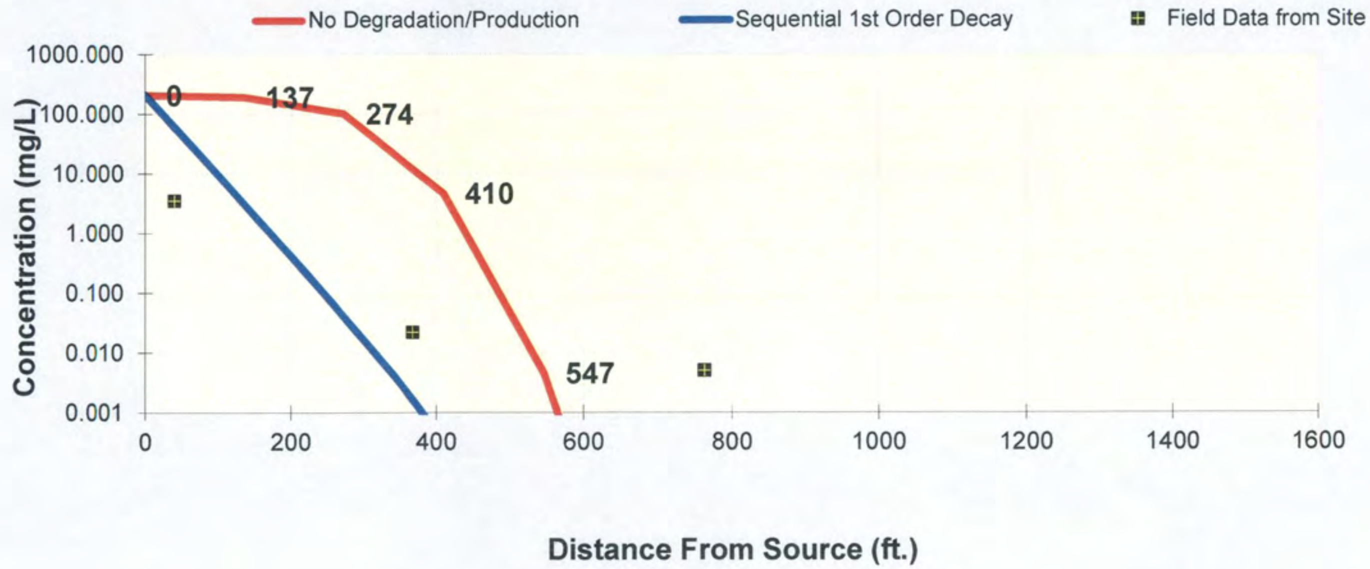
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

TCE	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	210.000	193.929	102.260	4.758	0.005	0.000	0.000	0.000	0.000	0.000	0.000
Biotransformation	209.9999	3.020	0.040	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Monitoring Well Locations (ft)

	40	368	763								
Field Data from Site	3.500	0.022	0.005								



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

45.0 Years

Log ⟺ Linear

Return to Input

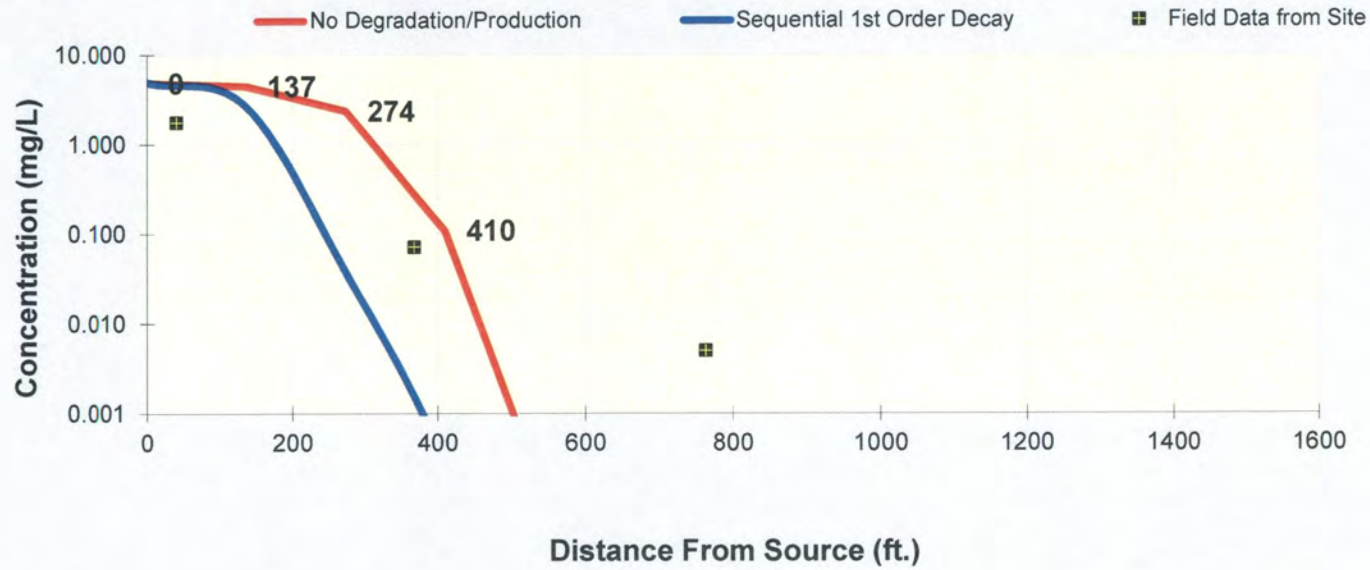
To All

To Array

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

DCE	Distance from Source (ft)										
	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	4.900	4.525	2.386	0.111	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biotransformation	4.9000	2.618	0.037	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	Monitoring Well Locations (ft)										
	40	368	763								
Field Data from Site	1.761	0.072	0.005								



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

45.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

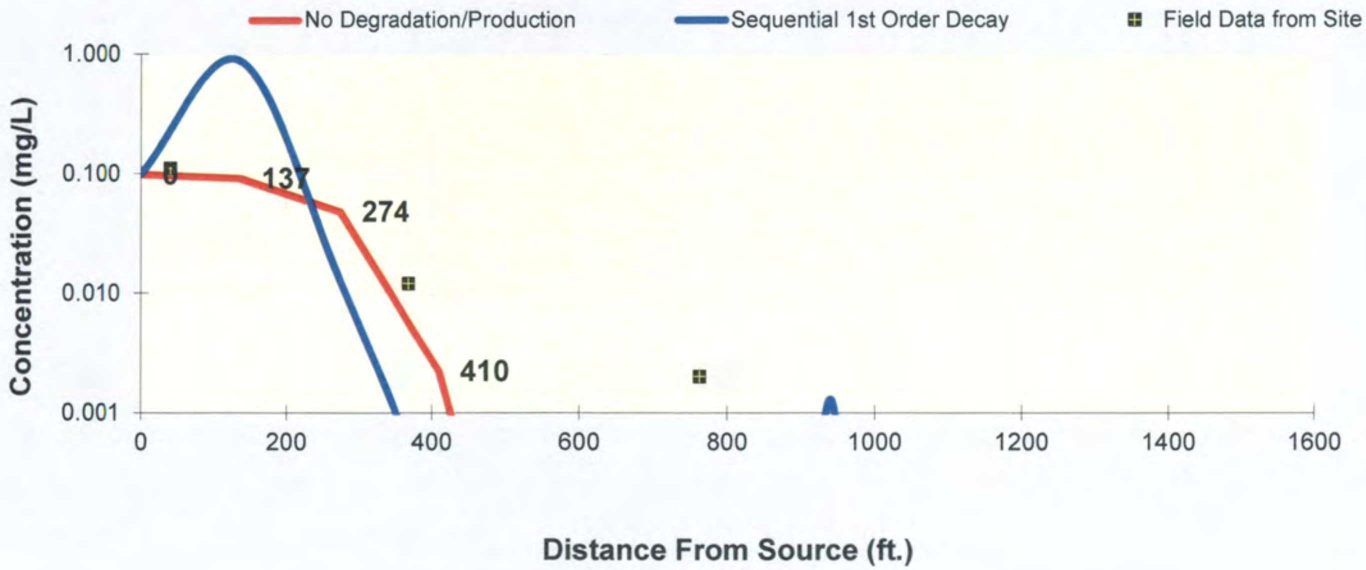
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

VC	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	0.100	0.092	0.049	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biotransformation	0.1000	0.871	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Monitoring Well Locations (ft)

	40	368	763								
Field Data from Site	0.110	0.012	0.002								



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

45.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

ASYMPTOTIC PLUME

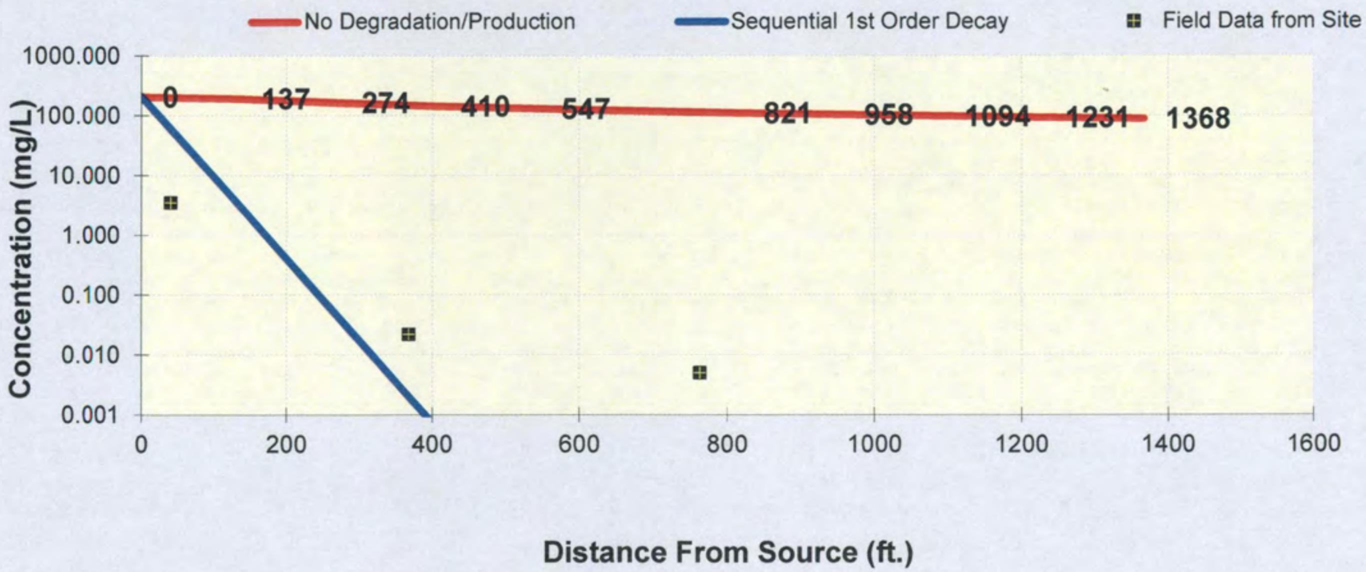
350 YEARS WITH NO DEGRADATION

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

TCE

Distance from Source (ft)	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	210.000	194.848	167.254	147.170	132.592	121.526	112.793	105.686	99.762	94.727	90.360
Biotransformation	209.9999	3.020	0.040	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Monitoring Well Locations (ft)	40	368	763								
Field Data from Site	3.500	0.022	0.005								



See PCE

See TCE

See DCE

See VC

See ETH

Replay

Time:

300.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

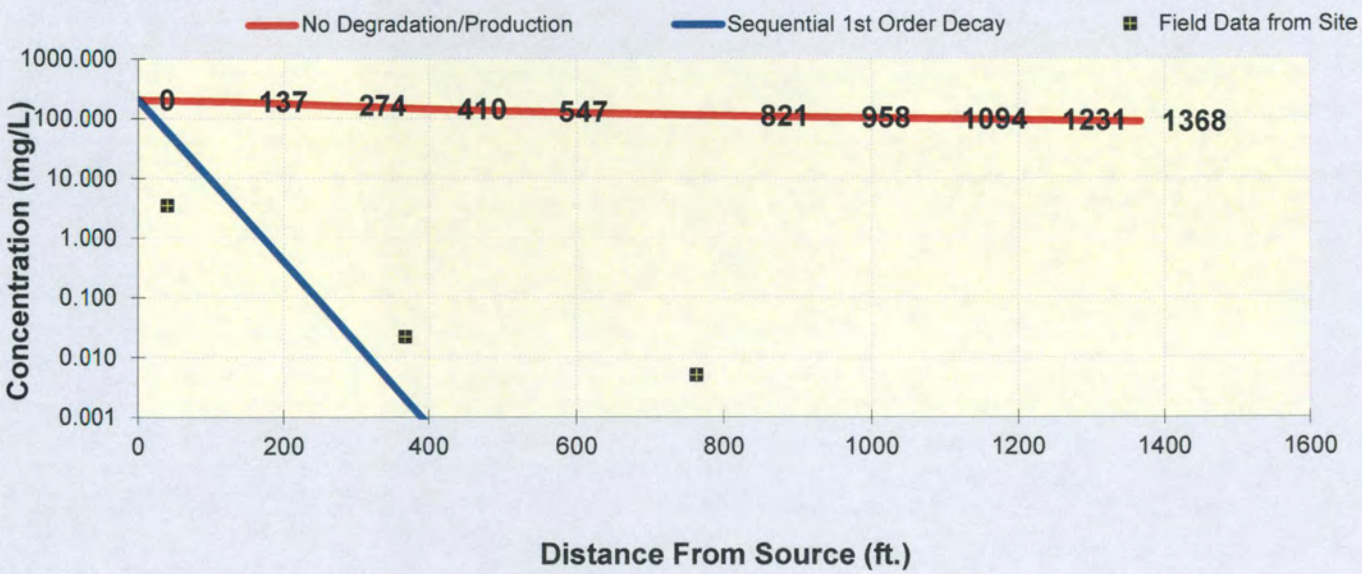
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

TCE	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	210.000	194.848	167.254	147.170	132.592	121.526	112.793	105.686	99.762	94.728	90.382
Biotransformation	209.9999	3.020	0.040	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Monitoring Well Locations (ft)

	40	368	763								
Field Data from Site	3.500	0.022	0.005								



See PCE

See TCE

See DCE

See VC

See ETH

Replay

Time:

350.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

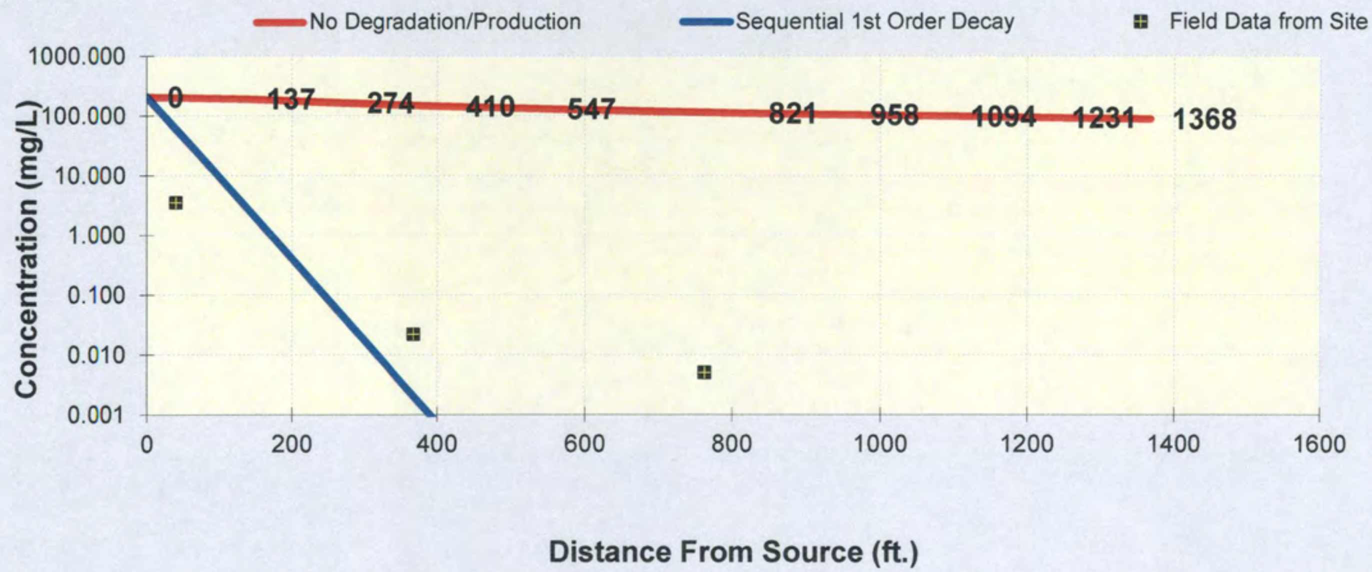
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

TCE	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	210.000	194.848	167.254	147.170	132.592	121.526	112.793	105.686	99.762	94.728	90.382
Biotransformation	209.9999	3.020	0.040	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Monitoring Well Locations (ft)

	40	368	763								
Field Data from Site	3.500	0.022	0.005								



See PCE

See TCE

See DCE

See VC

See ETH

Replay

Time:

400.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

TYPE IV RRS MET AT MAXIMUM SOURCE CONCENTRATION

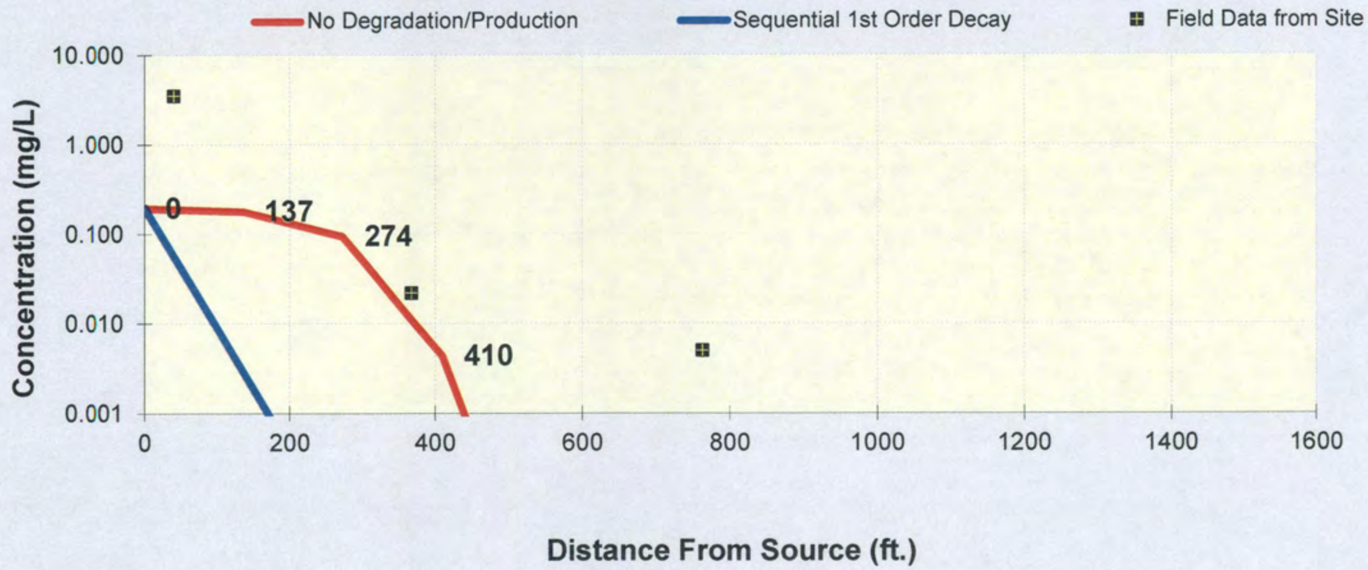
MW-18 AT 368′ FROM SOURCE – SOURCE - 0.2 MG/L

MW-17 AT 763′ FROM SOURCE – SOURCE -NOT DETERMINED

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

TCE	Distance from Source (ft)										
	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	0.200	0.185	0.097	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biotransformation	0.2000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	Monitoring Well Locations (ft)										
	40	368	763								
Field Data from Site	3.500	0.022	0.005								



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

45.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

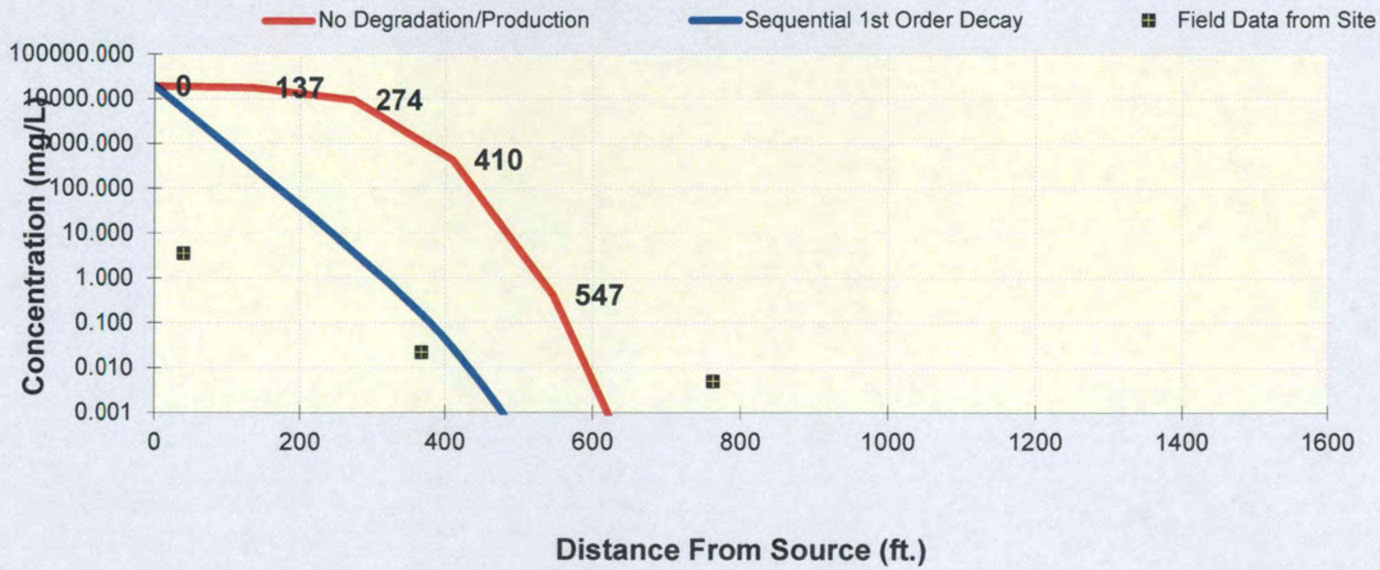
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

TCE	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	20000.000	18469.396	9739.068	453.152	0.438	0.000	0.000	0.000	0.000	0.000	0.000
Biotransformation	##########	287.612	3.778	0.028	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Monitoring Well Locations (ft)

	40	368	763								
Field Data from Site	3.500	0.022	0.005								



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

45.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

POST REMEDIATION PLUS 100 YEARS

POE DOES NOT EXCEED MCL

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Southern States
POST-REMED +100 YRS
Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 2. Calculate by filling in gray
0.02 cells. Press Enter, then C
(To restore formulas, hit "Restore Formulas" button)
Variable* → Data used directly in model.

Test if Biotransformation is Occurring → Natural Attenuation Screening Protocol

TYPE OF CHLORINATED SOLVENT: ◉ Ethenes ○ Ethanes

1. ADVECTION

Seepage Velocity*	Vs	10.7	(ft/yr)
or			
Hydraulic Conductivity	K	2.8E-04	(cm/sec)
Hydraulic Gradient	i	0.011	(ft/ft)
Effective Porosity	n	0.3	(-)

2. DISPERSION

Alpha x*	7.0649	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	1.E-99	(-)

Calc. Alpha x

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.5	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc		R	
PCE	426	(L/kg)	3.13	(-)
TCE	130	(L/kg)	1.65	(-)
DCE	125	(L/kg)	1.63	(-)
VC	30	(L/kg)	1.15	(-)
ETH	302	(L/kg)	2.51	(-)
Common R (used in model)* =			**1.65**	

4. BIOTRANSFORMATION

-1st Order Decay Coefficient*

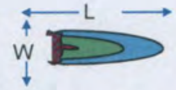
Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	3.465	0.20	0.79
TCE → DCE	0.396	1.75	0.74
DCE → VC	0.707	0.98	0.64
VC → ETH	1.733	0.40	0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	147	(yr)
Modeled Area Width*	125	(ft)
Modeled Area Length*	1368	(ft)
Zone 1 Length*	1368	(ft)
Zone 2 Length*	0	(ft)



Zone 2= L - Zone 1

6. SOURCE DATA

TYPE: Continuous Single Planar

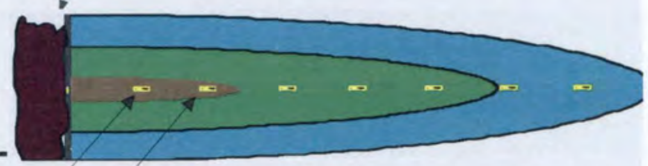
Source Options

Source Thickness in Sat. Zone* 25 (ft)

Width* (ft) Y1: 50

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE		0
TCE	6.3	0
DCE	.082	0
VC	.002	0
ETH		0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)											
TCE Conc. (mg/L)	1.0	.013	.005								
DCE Conc. (mg/L)	.222	.12	.005								
VC Conc. (mg/L)	0.1	.009	.002								
ETH Conc. (mg/L)											
Distance from Source (ft)	40	368	763								
Date Data Collected	2017										

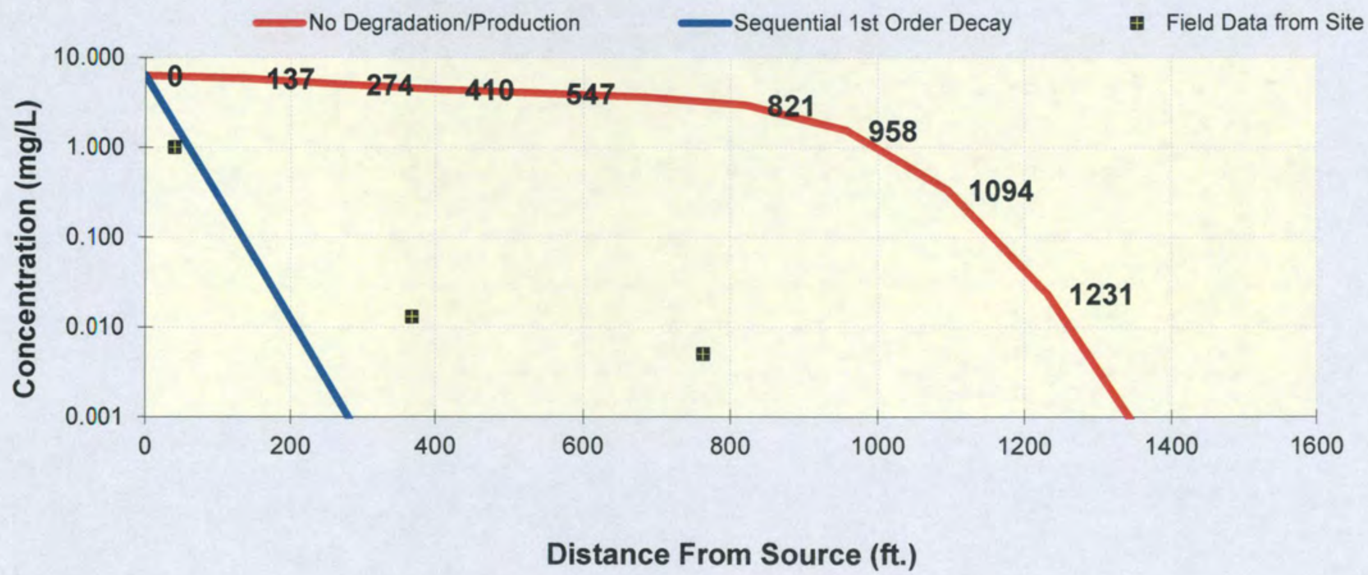
8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore | RESET | *SEE OUTPUT* | Paste

SOUTHERN STATES
POST REMEDIATION PLUS 100 YEARS

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

TCE	Distance from Source (ft)										
	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	6.300	5.845	5.018	4.415	3.977	3.609	2.954	1.536	0.334	0.024	0.000
Biotransformation	6.3000	0.091	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Monitoring Well Locations (ft)										
	40	368	763								
Field Data from Site	1.000	0.013	0.005								



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

147.0 Years

Log ⟺ Linear

Return to Input

To All

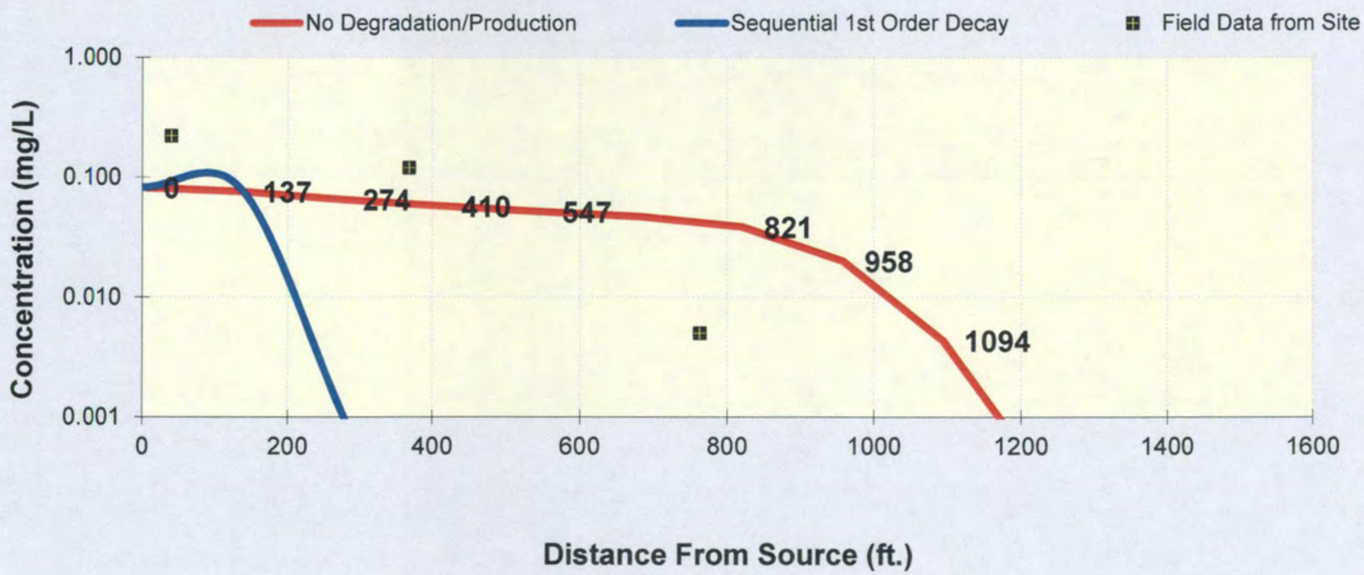
To Array

SOUTHERN STATES
POST REMEDIATION PLUS 100 YEARS

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

DCE	Distance from Source (ft)										
	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	0.082	0.076	0.065	0.057	0.052	0.047	0.038	0.020	0.004	0.000	0.000
Biotransformation	0.0820	0.078	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	Monitoring Well Locations (ft)										
	40	368	763								
Field Data from Site	0.222	0.120	0.005								



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

147.0 Years

Log ⟺ Linear

Return to Input

To All

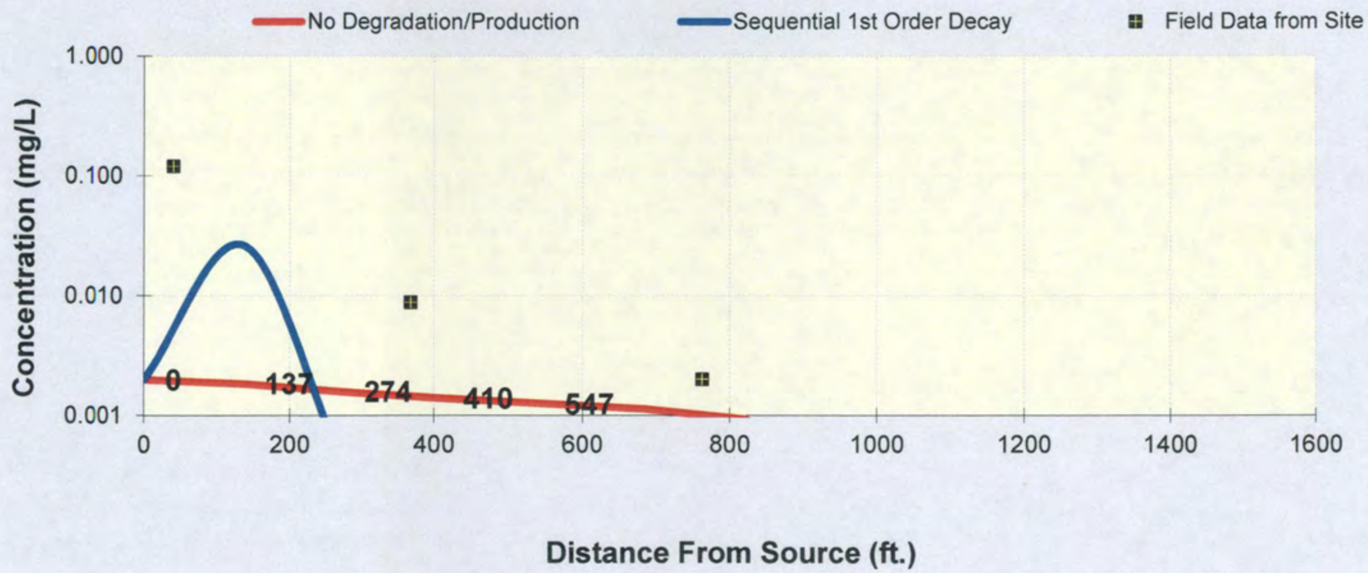
To Array

SOUTHERN STATES
POST REMEDIATION PLUS 100 YEARS

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

VC	Distance from Source (ft)										
	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000
Biotransformation	0.0020	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	Monitoring Well Locations (ft)										
	40	368	763								
Field Data from Site	0.120	0.009	0.002								



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

147.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

ACL PLUS 100 YEARS

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Southern States
ACL +100 YRS
Run Name

Data Input Instructions:

115 → 1. Enter value directly....or
or 0.02 → 2. Calculate by filling in gray cells. Press Enter, then C
(To restore formulas, hit "Restore Formulas" button)
Variable* → Data used directly in model.

Test if Biotransformation is Occurring → Natural Attenuation Screening Protocol

TYPE OF CHLORINATED SOLVENT: Ethenes ◉ Ethanes ○

1. ADVECTION

Seepage Velocity*	Vs	10.7	(ft/yr)
or			
Hydraulic Conductivity	K	2.8E-04	(cm/sec)
Hydraulic Gradient	i	0.011	(ft/ft)
Effective Porosity	n	0.3	(-)

2. DISPERSION

Alpha x*	7.0649	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	1.E-99	(-)

Calc. Alpha x

3. ADSORPTION

Retardation Factor* → R
or

Soil Bulk Density, rho	1.5	(kg/L)		
FractionOrganicCarbon, foc	1.0E-3	(-)		
Partition Coefficient	Koc			
PCE	426	(L/kg)	3.13	(-)
TCE	130	(L/kg)	1.65	(-)
DCE	125	(L/kg)	1.63	(-)
VC	30	(L/kg)	1.15	(-)
ETH	302	(L/kg)	2.51	(-)

Common R (used in model)* = 1.65

4. BIOTRANSFORMATION -1st Order Decay Coefficient*

Zone 1	λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	3.465	0.20	0.79
TCE → DCE	0.396	1.75	0.74
DCE → VC	0.707	0.98	0.64
VC → ETH	1.733	0.40	0.45

Zone 2	λ (1/yr)	half-life (yrs)
PCE → TCE	0.000	
TCE → DCE	0.000	
DCE → VC	0.000	
VC → ETH	0.000	

λ HELP

5. GENERAL

Simulation Time*	147	(yr)
Modeled Area Width*	125	(ft)
Modeled Area Length*	1368	(ft)
Zone 1 Length*	1368	(ft)
Zone 2 Length*	0	(ft)

L W
Zone 2= L - Zone 1

6. SOURCE DATA TYPE: Continuous Single Planar

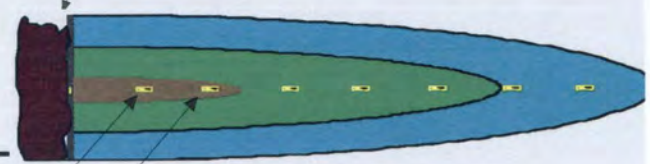
Source Options

Source Thickness in Sat. Zone* 25 (ft)

Width* (ft) Y1: 50

Conc. (mg/L)*	C1	k_s* (1/yr)
PCE		0
TCE	50.0	0
DCE	10.0	0
VC	8.0	0
ETH		0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)			
TCE Conc. (mg/L)	1.0	.013	.005
DCE Conc. (mg/L)	.222	.12	.005
VC Conc. (mg/L)	0.1	.009	.002
ETH Conc. (mg/L)			
Distance from Source (ft)	40	368	763
Date Data Collected	2017		

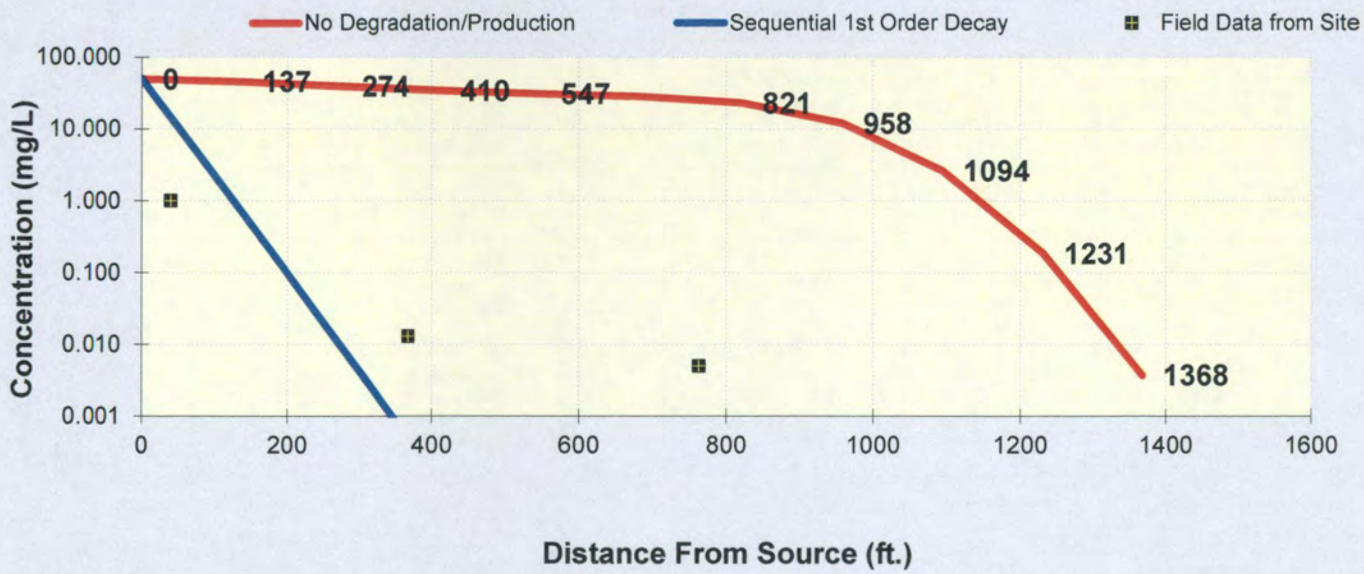
8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | Help | Restore | RESET | SEE OUTPUT | Paste

SOUTHERN STATES
ACL PLUS 100 YEARS

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

TCE	Distance from Source (ft)										
	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	50.000	46.392	39.822	35.040	31.562	28.640	23.442	12.194	2.654	0.187	0.004
Biotransformation	50.0000	0.719	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Monitoring Well Locations (ft)										
	40	368	763								
Field Data from Site	1.000	0.013	0.005								



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:
147.0 Years

Log ⟺ Linear

Return to Input

To All

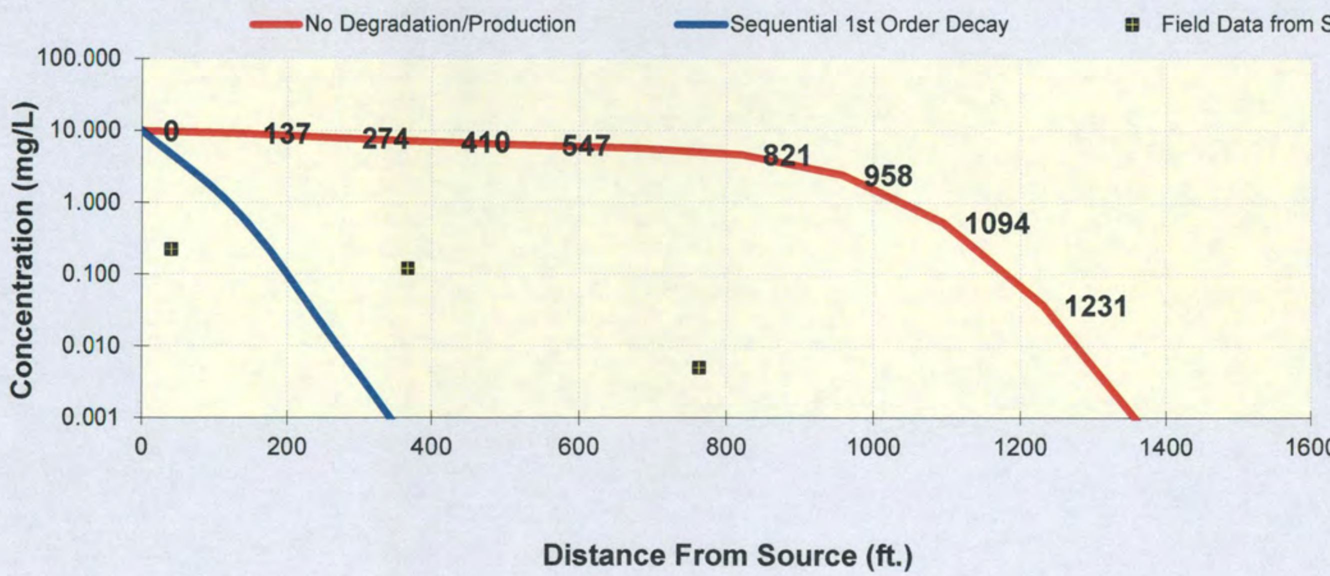
To Array

SOUTHERN STATES
ACL PLUS 100 YEARS

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

DCE	Distance from Source (ft)										
	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	10.000	9.278	7.964	7.008	6.312	5.728	4.688	2.439	0.531	0.037	0.001
Biotransformation	10.0000	0.633	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	Monitoring Well Locations (ft)										
	40	368	763								
Field Data from Site	0.222	0.120	0.005								



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:
147.0 Years

Log ⟺ Linear

Return to Input

To All

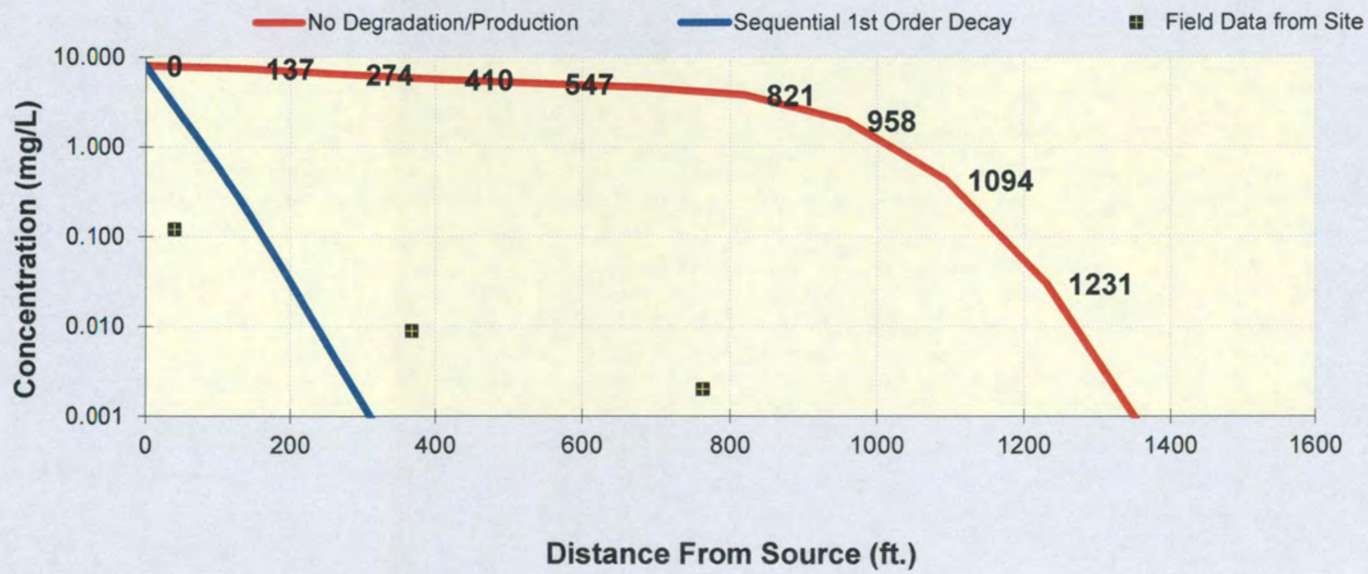
To Array

SOUTHERN STATES
ACL PLUS 100 YEARS

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

VC	Distance from Source (ft)										
	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	8.000	7.423	6.372	5.606	5.050	4.582	3.751	1.951	0.425	0.030	0.001
Biotransformation	8.0000	0.212	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	Monitoring Well Locations (ft)										
	40	368	763								
Field Data from Site	0.120	0.009	0.002								



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

147.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

ACL PLUS 500 YEARS

ASYMPTOTIC PLUME USING NO DEGRADATION

TCE – 350 YEARS

CIS-DCE – 350 YEARS;

VC – 350 YEARS

SOUTHERN STATES
ACL PLUS 500 YEARS

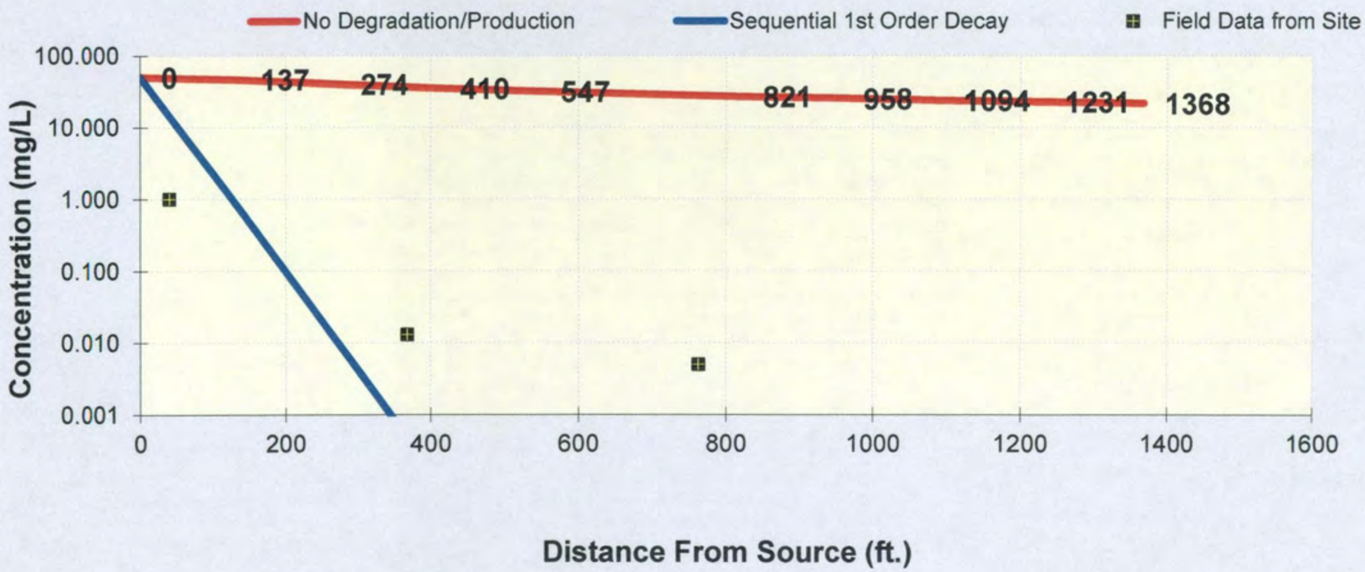
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

TCE	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	50.000	46.392	39.822	35.040	31.570	28.935	26.856	25.163	23.753	22.554	21.514
Biotransformation	50.0000	0.719	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Monitoring Well Locations (ft)

	40	368	763								
Field Data from Site	1.000	0.013	0.005								



See PCE

See TCE

See DCE

See VC

See ETH

Replay

Time:

300.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

SOUTHERN STATES
ACL PLUS 500 YEARS

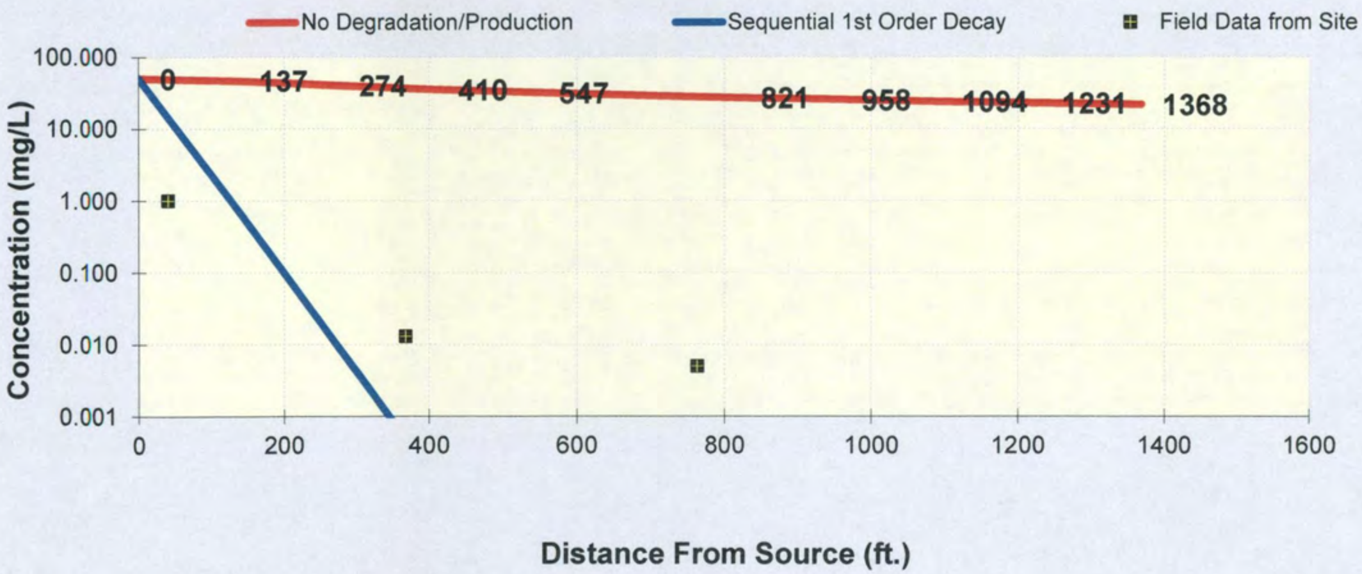
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

TCE	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	50.000	46.392	39.822	35.040	31.570	28.935	26.856	25.163	23.753	22.554	21.520
Biotransformation	50.0000	0.719	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Monitoring Well Locations (ft)

	40	368	763								
Field Data from Site	1.000	0.013	0.005								



See PCE

See TCE

See DCE

See VC

See ETH

Replay

Time:

350.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

SOUTHERN STATES
ACL PLUS 500 YEARS

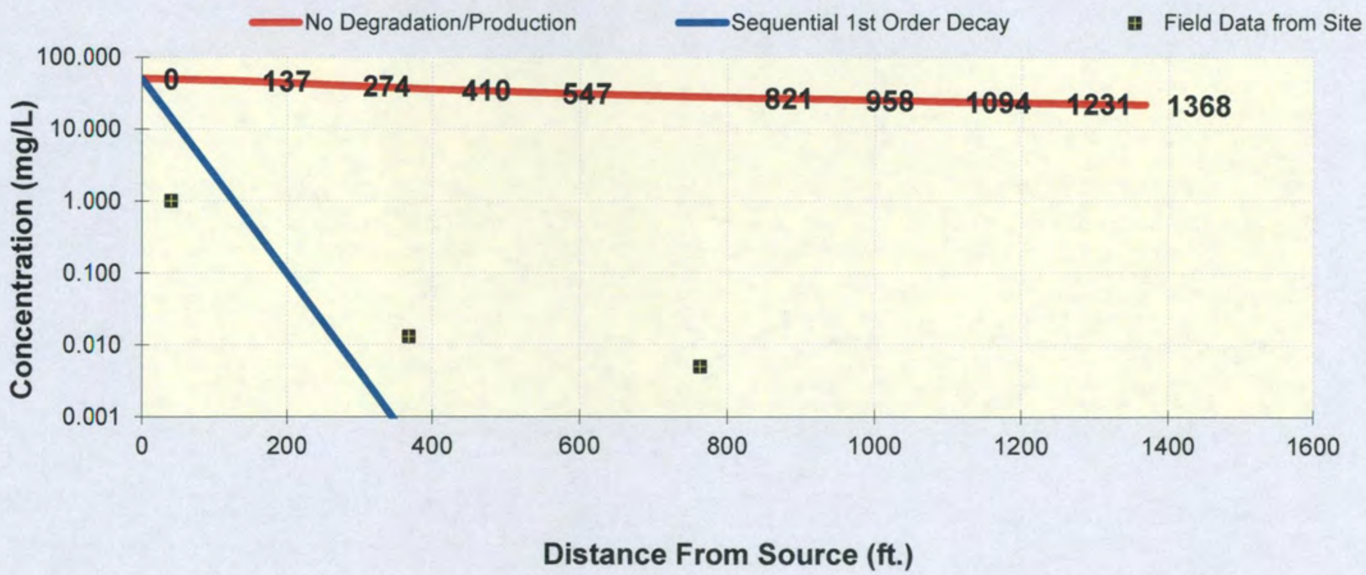
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

TCE	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	50.000	46.392	39.822	35.040	31.570	28.935	26.856	25.163	23.753	22.554	21.520
Biotransformation	50.0000	0.719	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Monitoring Well Locations (ft)

	40	368	763								
Field Data from Site	1.000	0.013	0.005								



See PCE

See TCE

See DCE

See VC

See ETH

Replay

Time:

400.0 Years

Log ⟺ Linear

Return to Input

To All

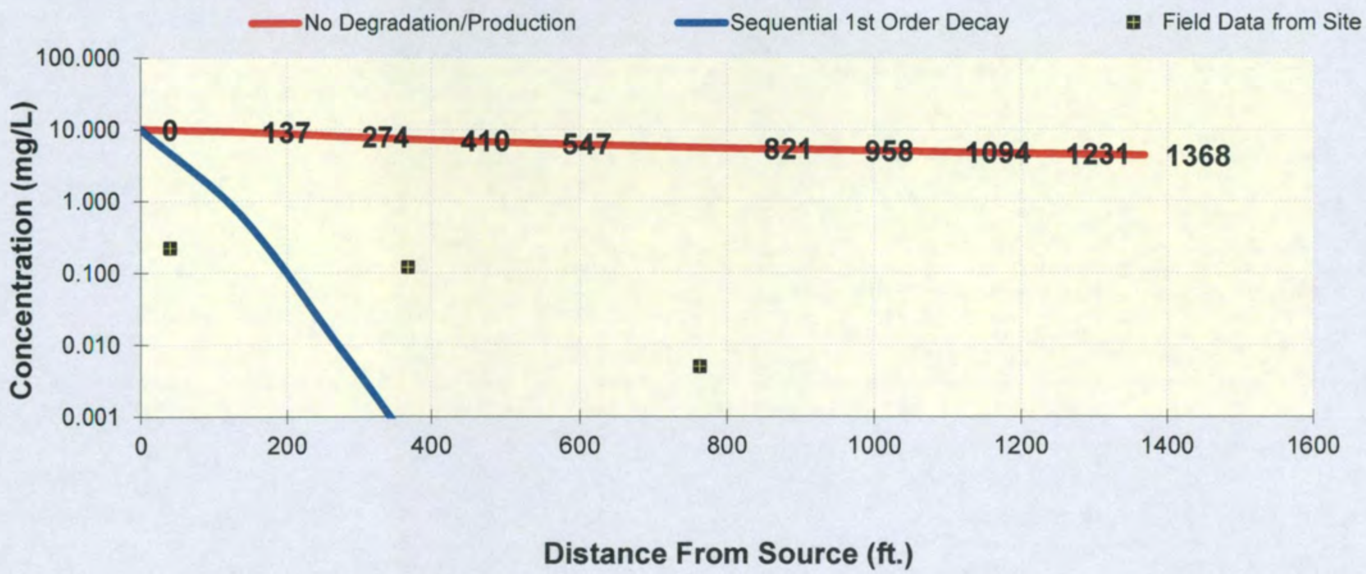
To Array

SOUTHERN STATES
ACL PLUS 500 YEARS

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

	Distance from Source (ft)										
DCE	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	10.000	9.278	7.964	7.008	6.314	5.787	5.371	5.033	4.751	4.511	4.303
Biotransformation	10.0000	0.633	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	Monitoring Well Locations (ft)										
	40	368	763								
Field Data from Site	0.222	0.120	0.005								



See PCE

See TCE

See DCE

See VC

See ETH

Replay

Time:

300.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

SOUTHERN STATES
ACL PLUS 500 YEARS

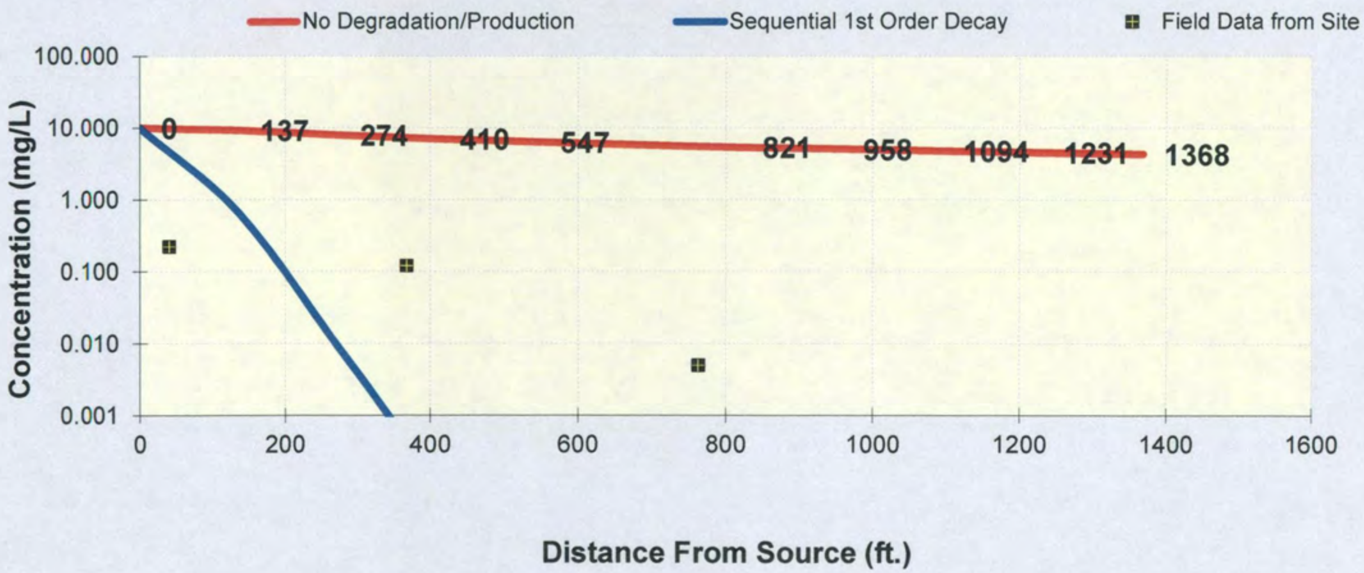
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

DCE	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	10.000	9.278	7.964	7.008	6.314	5.787	5.371	5.033	4.751	4.511	4.304
Biotransformation	10.0000	0.633	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Monitoring Well Locations (ft)

	40	368	763								
Field Data from Site	0.222	0.120	0.005								



See PCE

See TCE

See DCE

See VC

See ETH

Replay

Time:

350.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

SOUTHERN STATES
ACL PLUS 500 YEARS

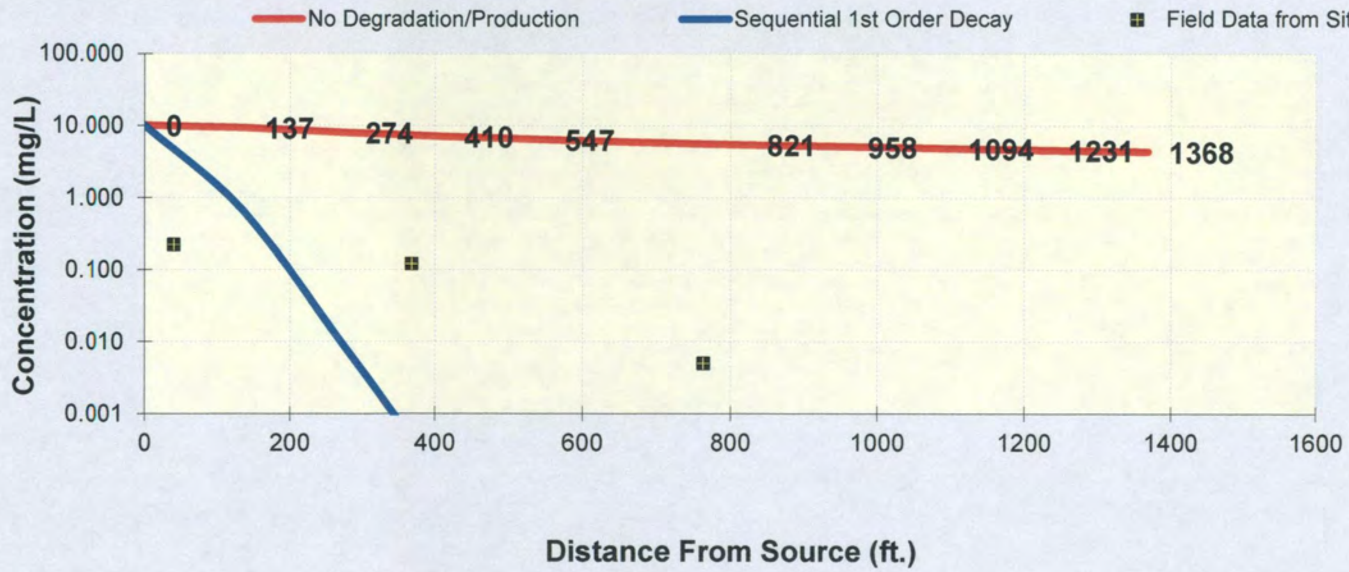
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

DCE	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	10.000	9.278	7.964	7.008	6.314	5.787	5.371	5.033	4.751	4.511	4.304
Biotransformation	10.0000	0.633	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Monitoring Well Locations (ft)

	40	368	763								
Field Data from Site	0.222	0.120	0.005								



See PCE

See TCE

See DCE

See VC

See ETH

Replay

Time:

400.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

SOUTHERN STATES
ACL PLUS 500 YEARS

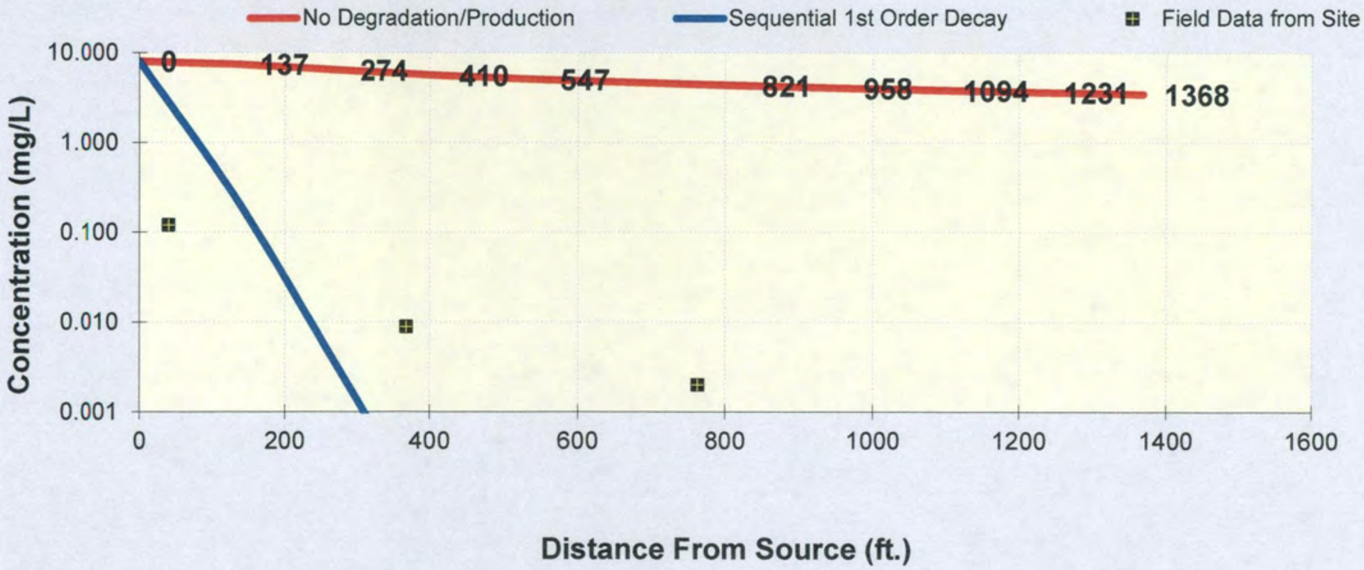
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

VC	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	8.000	7.423	6.372	5.606	5.051	4.630	4.297	4.026	3.800	3.609	3.442
Biotransformation	8.0000	0.212	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Monitoring Well Locations (ft)

	40	368	763								
Field Data from Site	0.120	0.009	0.002								



See PCE

See TCE

See DCE

See VC

See ETH

Replay

Time:

300.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

SOUTHERN STATES
ACL PLUS 500 YEARS

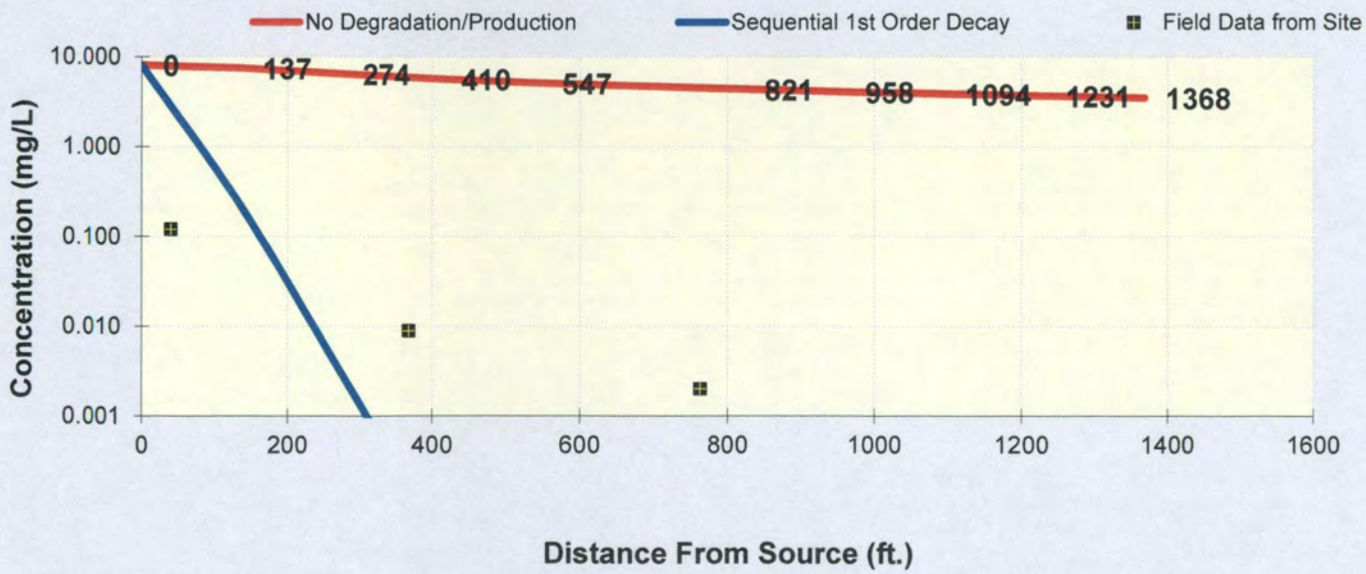
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

VC	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	8.000	7.423	6.372	5.606	5.051	4.630	4.297	4.026	3.800	3.609	3.443
Biotransformation	8.0000	0.212	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Monitoring Well Locations (ft)

	40	368	763								
Field Data from Site	0.120	0.009	0.002								



See PCE

See TCE

See DCE

See VC

See ETH

Replay

Time:
350.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

SOUTHERN STATES
ACL PLUS 500 YEARS

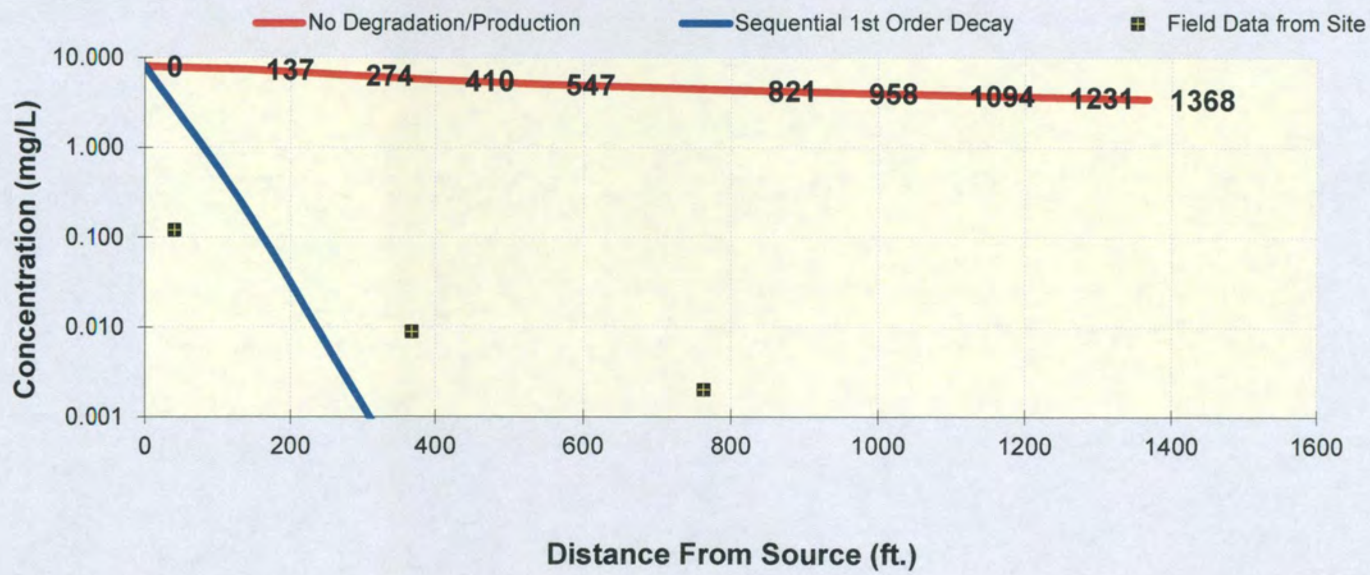
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

VC	0	137	274	410	547	684	821	958	1094	1231	1368
No Degradation	8.000	7.423	6.372	5.606	5.051	4.630	4.297	4.026	3.800	3.609	3.443
Biotransformation	8.0000	0.212	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Monitoring Well Locations (ft)

	40	368	763								
Field Data from Site	0.120	0.009	0.002								



See PCE

See TCE

See DCE

See VC

See ETH

Replay

Time:

400.0 Years

Log ⟺ Linear

Return to Input

To All

To Array

1-DIMENSIONAL MODEL FOR 1,1,2-TCA

Table A-1. Input Parameters for a One-Dimensional Fate and Transport Model

Facility Identification: **Facility ID. Southern States, LLC** **Contaminant: 1,1,2-TCA**

Input Parameter	Symbol	Value	Unit	Remarks
1. HYDROGEOLOGY				
Hydraulic Conductivity	**K**	0.000282	cm/sec	From slug tests (choose the highest)
Hydraulic Gradient	**i**	0.011	ft/ft	Estimated from groundwater table contours
Effective Porosity	n_e	0.3	unitless	Laboratory-measured or reference
Groundwater Velocity	v_w	0.029	ft/day	Calculated advective seepage velocity
Contaminant Velocity	v_c	0.016	ft/day	Calculated retarded contaminant velocity
2. SORPTION				
Retardation Factor	**R**	1.830	unitless	Calculated retardation factor
Bulk Density of Dry Soil	ρ	1.5	g/cm^3	Laboratory- measured
Partitioning Coefficient	K_{oc}	166	cm^3/g	Valsaraj et al. (1999)
Fraction Organic Carbon	f_{oc}	0.001	unitless	Lab.- measured of clean soil (or default?)
Distribution Coefficient	K_d	0.166	cm^3/g	Calculated (See below)
3. DEGRADATION				
Solute Half-life	$t_{1/2}$	0.15	years	(Tosato et al. 1991)
1st Order Decay Coeff.	λ	4.62	1/year	Converted from half-life value
4. RECEPTOR				
Distance to Receptor	**L**	1368	ft	Distance to a receptor, e.g., a domestic well
Time to Reach Receptor, **T**	T_{adv}	127.87	years	Calculated advective travel time
	T_{ret}	234.00	years	Calculated retarded travel time
Initial Concentration	C_0	32	µg/l	Highest historical concentration
Predicted Concentration (adv.)	$C_{t\,(adv)}$	0.00	µg/l	Calculated (See below, Item 5.3)
Predicted Concentration (ret.)	$C_{t\,(ret.)}$	#NUM!	µg/l	Calculated (See below, Item 5.3)

5. CALCULATIONS Parameter	Formula			Results
1. Hydrology	$v_w = K \cdot i/n_e$		ft/day	0.029
	$v_c = v_w/R$		ft/day	0.016
2. Sorption	$K_d = K_{oc} \cdot f_{oc}$		cm^3/g	0.166
	$R = 1 + K_d \cdot \rho/n_e$		unitless	1.830
3. Degradation	$C_t = C_o \cdot e^{-\lambda T}$		µg/l	(See below and Tables A-2 and A-3)
	$\lambda = 0.693/t_{1/2}$		1/year	4.62
e = 2.7183	$\lambda \cdot T_{adv}$		unitless	590.7656
	$\lambda \cdot T_{ret}$		unitless	1081.1011
4. Receptor:	$T_{adv} = L/v_w$		years	127.87
	$T_{ret} = L/v_c$		years	234.00
Calculated Parameters	v_w		**ft/year**	**10.698**
	v_c		**ft/year**	**5.846**
Predicted Advective Concentr.	$C_{t\,(adv)}$ =	**0.00**	**µg/l**	(See also Tables A-2 and A-3 for predicted
Predicted Retarded Concentr.	$C_{t\,(ret)}$ =	**#NUM!**	**µg/l**	time to reach MCL)

Table A-2. Advective Travel Distance and Predicted Concentration

Calculated groundwater velocity v_w =	10.698	ft/year
Initial concentration C_0 =	32.00	µg/l
Travel time to reach receptor T_{adv} =	127.87	years
Distance to receptor L =	1368.00	ft
Predicted concentr. at receptor Ct $_{(adv)}$ =	**0.00**	**µg/l**

Date	Half life [years]	Elapsed Time Since Release [yrs]	Travel Distance [ft]	Predicted Concentr. [µg/l]
	0.15	0	0.00	32.0
		0.15	1.60	16.0
		0.3	3.21	8.0
		0.45	4.81	4.0
		0.6	6.42	2.0
		0.75	8.02	1.0
		0.9	9.63	0.5
		1.05	11.23	0.3
		1.2	12.84	0.1
		1.35	14.44	0.1
		1.5	16.05	0.0
		1.65	17.65	0.0
		1.8	19.26	0.0
		1.95	20.86	0.0

Table A-3. Retarded Travel Distance and Predicted Concentration

Calculated benzene velocity v_c =	5.846	ft/year
Initial concentration C_0 =	32.00	µg/l
Travel time to reach receptor T_{ret} =	234.00	years
Distance to receptor L =	1,368.00	ft
Predicted concentr. at receptor Ct $_{(ret)}$ =	**#NUM!**	**µg/l**

Date	Half life [years]	Elapsed Time Since Release [yrs]	Travel Distance [ft]	Predicted Concentr. [µg/l]
	0.15	0	0.00	32.0
		0.15	0.88	16.0
		0.3	1.75	8.0
		0.45	2.63	4.0
		0.6	3.51	2.0
		0.75	4.38	1.0
		0.9	5.26	0.5
		1.05	6.14	0.3
		1.2	7.02	0.1
		1.35	7.89	0.1
		1.5	8.77	0.0
		1.65	9.65	0.0
		1.8	10.52	0.0
		1.95	11.40	0.0

Table A-1. Input Parameters for a One-Dimensional Fate and Transport Model

Facility Identification: Facility ID. Southern States, LLC Contaminant: 1,1,2-TCA

Input Parameter	Symbol	Value	Unit	Remarks
1. HYDROGEOLOGY				
Hydraulic Conductivity	**K**	0.000282	cm/sec	From slug tests (choose the highest)
Hydraulic Gradient	**i**	0.011	ft/ft	Estimated from groundwater table contours
Effective Porosity	n_e	0.3	unitless	Laboratory-measured or reference
Groundwater Velocity	v_w	0.029	ft/day	Calculated advective seepage velocity
Contaminant Velocity	v_c	0.016	ft/day	Calculated retarded contaminant velocity
2. SORPTION				
Retardation Factor	**R**	1.830	unitless	Calculated retardation factor
Bulk Density of Dry Soil	ρ	1.5	g/cm^3	Laboratory- measured
Partitioning Coefficient	K_{oc}	166	cm^3/g	Valsaraj et al. (1999)
Fraction Organic Carbon	f_{oc}	0.001	unitless	Lab.- measured of clean soil (or default?)
Distribution Coefficient	K_d	0.166	cm^3/g	Calculated (See below)
3. DEGRADATION				
Solute Half-life	$t_{1/2}$	0.15	years	(Tosato et al. 1991)
1st Order Decay Coeff.	λ	4.62	1/year	Converted from half-life value
4. RECEPTOR				
Distance to Receptor	**L**	1368	ft	Distance to a receptor, e.g., a domestic well
Time to Reach Receptor, **T**	T_{adv}	127.87	years	Calculated advective travel time
	T_{ret}	234.00	years	Calculated retarded travel time
Initial Concentration	C_0	11	μg/l	June 2017 concentration
Predicted Concentration (adv.)	$C_{t\ (adv)}$	0.00	μg/l	Calculated (See below, Item 5.3)
Predicted Concentration (ret.)	$C_{t\ (ret.)}$	#NUM!	μg/l	Calculated (See below, Item 5.3)

5. CALCULATIONS Parameter	Formula		Results
1. Hydrology	$v_w = K \cdot i/n_e$	ft/day	0.029
	$v_c = v_w/R$	ft/day	0.016
2. Sorption	$K_d = K_{oc} \cdot f_{oc}$	cm^3/g	0.166
	$R = 1 + K_d \cdot \rho/n_e$	unitless	1.830
3. Degradation	$C_t = C_o \cdot e^{-\lambda T}$	μg/l	(See below and Tables A-2 and A-3)
	$\lambda = 0.693/t_{1/2}$	1/year	4.62
e = 2.7183	$\lambda \cdot T_{adv}$	unitless	590.7656
	$\lambda \cdot T_{ret}$	unitless	1081.1011
4. Receptor:	$T_{adv} = L/v_w$	years	127.87
	$T_{ret} = L/v_c$	years	234.00
Calculated Parameters	v_w	**ft/year**	**10.698**
	v_c	**ft/year**	**5.846**
Predicted Advective Concentr.	$C_{t\ (adv)}$ = **0.00**	**μg/l**	(See also Tables A-2 and A-3 for predicted
Predicted Retarded Concentr.	$C_{t\ (ret)}$ = **#NUM!**	**μg/l**	time to reach MCL)

Table A-2. Advective Travel Distance and Predicted Concentration

Calculated groundwater velocity v_w =	10.698	ft/year
Initial concentration C_0 =	11.00	µg/l
Travel time to reach receptor T_{adv} =	127.87	years
Distance to receptor L =	1368.00	ft
Predicted concentr. at receptor Ct $_{(adv)}$ =	**0.00**	**µg/l**

Date	Half life [years]	Elapsed Time Since Release [yrs]	Travel Distance [ft]	Predicted Concentr. [µg/l]
	0.15	0	0.00	11.0
		0.15	1.60	5.5
		0.3	3.21	2.8
		0.45	4.81	1.4
		0.6	6.42	0.7
		0.75	8.02	0.3
		0.9	9.63	0.2
		1.05	11.23	0.1
		1.2	12.84	0.0
		1.35	14.44	0.0
		1.5	16.05	0.0
		1.65	17.65	0.0
		1.8	19.26	0.0
		1.95	20.86	0.0

Table A-3. Retarded Travel Distance and Predicted Concentration

Calculated benzene velocity v_c =	5.846	ft/year
Initial concentration C_0 =	11.00	µg/l
Travel time to reach receptor T_{ret} =	234.00	years
Distance to receptor L =	1,368.00	ft
Predicted concentr. at receptor Ct $_{(ret)}$ =	**#NUM!**	**µg/l**

Date	Half life [years]	Elapsed Time Since Release [yrs]	Travel Distance [ft]	Predicted Concentr. [µg/l]
	0.15	0	0.00	11.0
		0.15	0.88	5.5
		0.3	1.75	2.8
		0.45	2.63	1.4
		0.6	3.51	0.7
		0.75	4.38	0.3
		0.9	5.26	0.2
		1.05	6.14	0.1
		1.2	7.02	0.0
		1.35	7.89	0.0
		1.5	8.77	0.0
		1.65	9.65	0.0
		1.8	10.52	0.0
		1.95	11.40	0.0

APPENDIX D
SOIL DISPOSAL MANIFEST

WASTE MANIFEST | 770-946-4562

5. Generator's Name and Mailing Address
Southern States, LLC
30 Georgia Avenue
Hampton, GA 30228

Generator's Phone: 770-946-4562

Generator's Site Address (if different than mailing address)
Southern States, LLC
30 Georgia Avenue
Hampton, GA 30228

6. Transporter 1 Company Name
A-1-Con LLC
U.S. EPA ID Number

7. Transporter 2 Company Name
U.S. EPA ID Number

8. Designated Facility Name and Site Address
Eagle Point Landfill
8880 Old Federal Road
Ball Ground, GA 30107
U.S. EPA ID Number

Facility's Phone: 770-781-2721

9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1. Non-Regulated (Waste Soil) Approval # AEP 17051	03	CTB	Est 4500	P
2.				
3.				
4.				

13. Special Handling Instructions and Additional Information

TEI PROJECT No 17.04.001

14. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offeror's Printed/Typed Name: On behalf of SSL Brandon Savage | Signature | Month 06 | Day 26

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit: Date leaving U.S.:

Transporter Signature (for exports only):

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Brandon Savage | Signature | Month 06 | Day 26

Transporter 2 Printed/Typed Name | Signature | Month | Day

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator) | U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator) | Month

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name | Signature | Month

GENERATOR'S/SHIPPER'S

169-BLC-O 5 11977 (Rev. 9/09)

APPENDIX E

SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT

Prepared for

EMA, LLC
5262 Belle Wood Court, Suite A
Buford, Georgia 30518

SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT

SOUTHERN STATES, LLC
30 Georgia Avenue
Hampton, Georgia
HSI #10141

Prepared by

Geosyntec consultants

engineers | scientists | innovators

1255 Roberts Boulevard, Suite 200
Kennesaw, Georgia 30144

Project Number GZ6268

October 2017

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LIST OF ABBREVIATIONS AND ACRONYMS

BERA	Baseline Ecological Risk Assessment
COPEC	Constituent of Potential Ecological Concern
CSM	Conceptual Site Model
DQO	Data Quality Objectives
DFI	Daily Food Ingestion
DSI	Daily Soil Ingestion
Eco-SSL	EPA Ecological Soil Screening Level
EPA	United States Environmental Protection Agency
EPD	Georgia Environmental Protection Division
EMA	Environmental Management Associates, LLC
EPC	Exposure Point Concentration
ERAGS	Ecological Risk Assessment Guidance for Superfund
ESV	Ecological Screening Value
ft-bgs	Foot/Feet Below Ground Surface
HQ	Hazard Quotient
HSI	Hazardous Site Inventory
HSRA	Hazardous Site Response Act
LOAEL	Lowest Observed Adverse Effect Level
MDL	Method Detection Limit
mg/kg	Milligram(s) per Kilogram
NOAEL	No Observed Adverse Effect Level
PCB	Polychlorinated Biphenyl
RG	Remedial Goal
SLERA	Screening Level Ecological Risk Assessment
SMDP	Scientific Management Decision Point

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SS	Southern States, LLC
SVOC	Semi-Volatile Organic Compound
TDI	Total Daily Intake
TRV	Toxicity Reference Value
VOC	Volatile Organic Compound
VRP	Georgia EPD Voluntary Remediation Program
VRPA	Voluntary Remediation Plan and Application

1. INTRODUCTION

1.1 Overview

This report presents the screening-level ecological risk assessment (SLERA) for the Southern States, LLC (SS) site in Hampton, Georgia. This assessment was conducted in accordance with several guidance documents from the United States Environmental Protection Agency (EPA) including, *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessment* (EcoRAGS) (EPA, 1997); *Region 4 Ecological Risk Assessment Supplemental Guidance* (EPA, 2015a). Compliance with these guidance documents generally serves to meet the Georgia Environmental Protection Division (EPD) requirements for ecological risk assessment.

The EPA ecological risk assessment paradigm includes eight general steps (EPA, 1997):

Step 1 - Screening-Level Problem Formulation and Effects Evaluation;

Step 2 - Screening-Level Exposure Estimate and Risk Calculation;

Step 3 - Baseline Problem Formulation;

Step 4 - Study Design and DQO Process;

Step 5 - Verification of Field Sampling Design;

Step 6 - Site Investigation and Data Analysis;

Step 7 - Risk Characterization; and

Step 8 - Risk Management.

This eight-step ERA process is illustrated on **Figure 1**. Steps 1 and 2 comprise the SLERA, which evaluates the potential risks to wildlife exposed to chemical constituents by providing a conservative estimate of the risks that may exist for wildlife, and incorporating uncertainty in a precautionary (i.e., highly conservative) manner. The purpose of the SLERA is to indicate either: 1) that there is a high probability that there are no ecologically significant risks for wildlife; or 2) to indicate the need for remediation and/or additional ERA-related activities (EPA, 2001, 2015a). Step 3 is the initial step of the baseline ecological risk assessment (BERA) and it is often split into Step 3A – screening refinements, and Step 3B – baseline problem formulation. A BERA is more complex than a SLERA and typically incorporates more realistic wildlife exposure information. Only those wildlife receptors and constituents that the SLERA identifies as posing potential risks are carried forward to a BERA.

The ERA process produces a series of clearly defined scientific management decision points (SMDPs), as illustrated on **Figure 1** (EPA, 1997). The SMDPs represent critical steps in the process where ecological risk management decision-making occurs. The EPA risk assessment model provides for the first SMDP either after Step 2 or as part of Step 3A, with a second SMDP after the completion of Step 3B. Generally, the following types of decisions are typically considered at the SMDPs:

- whether the available information is adequate to conclude that ecological risks are negligible and, therefore, there is no need for any further action on the basis of ecological risk;
- whether the available information is not adequate to make a decision at this point, and the ecological risk assessment process will continue; or
- whether the available information indicates a potential for adverse ecological effects, and a more thorough assessment (or remediation) is warranted.

This report presents Steps 1 through 3A of the EPA's ERAGS process.

1.2 Site Background Information

The information on the site history and investigation activities is excerpted primarily from the SS Voluntary Remediation Plan and Application (VRPA) submitted to EPD (EMA, 2014). Readers are referred to that document for more detailed information.

SS manufactures high-voltage electrical switches and fuses at its 30-acre manufacturing facility located in Hampton, Georgia (**Figure 2**). SS also owns two adjacent undeveloped parcels to the west of the facility that together occupy an additional 48 acres. Manufacturing operations at the at the SS facility began in 1940. In 1986, SS conducted a focused groundwater investigation to determine the impact from an existing wastewater sludge impoundment. The results of this and subsequent investigations identified that a release of several volatile organic compounds (VOCs) had occurred at the property. Multiple environmental investigations have taken place at the site since 1986, which have identified the presence of VOCs in the soil and groundwater. The property was listed on the HSI on June 30, 1997 as Site No. 10141.

The soil and groundwater data collected since 1986 during various investigations of the SS property has been utilized to identify the constituents of concern (COC) for soil and groundwater. HSRA Type 1 Risk Reduction Standards (RRS) for soils have been derived for the delineation of COCs and for the evaluation of corrective action options for soil. HSRA Type1, 3, and 4 RRS for groundwater have been derived for delineation of groundwater impacts.

1.2.1 Groundwater

Several investigations and assessments have been conducted at the SS property to determine the source(s) of the groundwater contamination. Review of the investigations, aerial photography, and historic research did not reveal any definitive conclusions regarding source(s).

The investigations performed to date appear to eliminate all previously suspected operational sources including the fill material in the former landfill. The depth of the landfilled materials extends to approximately 6 feet to 14 feet below ground surface (ft-bgs). The groundwater contamination consisting predominantly of trichloroethylene (TCE) beneath the former landfill was most likely caused by historic (pre-1970's when the facility began to eliminate the use of TCE) disposal practices and prior to placement of the fill material. Review of historic aerial photographs indicates the development of the landfill sometime between 1950 and 1958 with potential drainage ditches observed in the 1971 aerial photo. The former landfill was closed (non-operational) in 1980.

Corrective action for the property has focused on the groundwater that has been impacted by chlorinated VOCs, primarily TCE, 1,1,2-trichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, and vinyl chloride. Remediation at the property has included both pump and treat and chemical injections to enhance biodegradation.

1.2.2 Former Landfill

The presence of soil COCs was historically investigated primarily in order to understand the potential source(s) of the COC in groundwater. In general, soil impacts associated with VOCs, metals, cyanide, and polychlorinated biphenyls (PCBs) have been investigated and delineated. The only COC remaining in soil in excess of the HSRA RRS Type 1 is PCBs.

PCBs have been historically detected in shallow soils in certain areas of the former landfill to a depth of approximately 3 ft-bgs as shown in **Figure 3**. No known use of

PCB-containing oil other than historic transformers for on-site power distribution has been identified. No information has been identified that explains the presence of PCBs (EMA, 2014). There appears to have been historical migration of PCBs from the former landfill to the sediments of Little Bear Creek, which is a highly channelized stream that runs underground via a corrugated pipe from beyond the eastern boundary of the SS property at Central Avenue. The creek emerges from the corrugated pipe near the northeastern corner of the former landfill and runs adjacent to its northern side (**Figure 3**).

1.2.3 Western Portion of the SS Property

As described above, the SS property includes two undeveloped parcels located to the west of the facility that occupy approximately 48 additional acres. Historically, beavers created dams along Little Bear Creek forming a small shallow pond (former Beaver Pond) as illustrated on **Figure 3**. The area of the former Beaver Pond expanded and contracted to some extent in response to varying amounts of precipitation. In late 2012, the beavers and the dams were removed, thus allowing the pond to naturally drain. PCBs were detected at concentrations above ecological screening levels in sediment samples collected from Little Bear Creek adjacent to, and downstream of the former landfill; however, the contamination does not extend off-site (**Figure 4**). PCBs have also been detected in samples collected within the footprint of the former Beaver Pond on the SS property (**Figure 5**). The presence of the PCBs is most likely related to the transport of impacted soil/sediment from the area of the former landfill. The scope of this SLERA is to evaluate the PCBs detected in soil and sediment samples, primarily from the undeveloped portions of the SS property.

It is noted that only the sample locations “1”, SED-1, “2”, SED-2, SED-3, SED-5, SED-6, SED-7, SED-8, are considered “true” sediment sample locations. All other samples with “SED” in the sample name were collected within the footprint of the former Beaver Pond before it was drained, and are more appropriately considered soil samples.

1.3 <u>Report Organization</u>

The remainder of this document is organized as follows:

- Section 2 – Screening-Level Problem Formulation and Ecological Effects Evaluation (Step 1);
- Section 3 – Screening-Level Exposure Estimate and Risk Calculation (Step 2);

- Section 4 – Problem Formulation – Screening Refinements (Step 3A);
- Section 5 –Uncertainty Characterization;
- Section 6 – Conclusions and Recommendations; and
- Section 7 – References.

2. SCREENING-LEVEL PROBLEM FORMULATION AND ECOLOGICAL EFFECTS EVALUATION (STEP 1)

Step 1 of the SLERA involves the screening-level problem formulation and ecological effects evaluation. Step 1 is presented in Section 2.1 (screening-level problem formulation) and Section 2.2 (screening-level ecological effects evaluation).

The objective of Step 1 is to determine if viable ecological habitat exists for ecological receptors to have direct exposure or food chain exposure to site-related constituents. In this step, the environmental surroundings, receptor species/assemblages, habitat/cover types, and relevant environmental and biotic transfer mechanisms related to the site are evaluated and described. This section also describes the selection of preliminary assessment and measurement endpoints.

2.1 Screening-Level Problem Formulation

2.1.1 Ecological Characterization

The ecological characterization aims to describe typical flora, fauna, and potential protected species on, or in the immediate vicinity of the site, and to identify potential receptors and exposure pathways for inclusion in a preliminary conceptual site model (CSM). This characterization is based on a field survey conducted on February 15, 2017 by Geosyntec biologists. This section generally describes the site as well as areas "off-site" that are beyond the facility fence line, but within an approximate ½-mile radius. **Figure 6** shows the cover types and land uses within this area based on information National Land Cover Database (Homer et al., 2015). Within this area, cover types in order of percent coverage include: disturbed/developed areas, forested areas, agricultural areas, herbaceous and scrub/shrub areas, and wetland and surface water features. These general cover types are described in more detail below.

The operational portions of SS facility are located on the 30-acre parcel identified on **Figure 6**. The facility is mostly covered by pavement, or parking area or otherwise engineered, low-permeability surfaces (e.g., concrete), and buildings associated with industrial operations. Areas of maintained landscaping border the facility, but these are relatively small and non-contiguous. These physical alterations of the natural landscape have resulted in the presence of sparse and degraded habitat for ecological receptors. The facility does not represent quality terrestrial habitat as it lacks natural vegetative cover, structure, and diversity and is unlikely to ever have substantial vegetative cover due to ongoing maintenance activities. Disturbance from vehicles, facility operations, and mowing have and will continue to disturb wildlife and cause animals to seek less frequently disturbed areas. In turn, the lack of natural refuge (i.e., vegetative cover) and food/prey base results in a site that is not suitable for populations of upper trophic level receptors.

SS also owns two adjacent undeveloped parcels to the west of the facility that together occupy an additional 48 acres (**Figure 6**). These undeveloped parcels support a mix of hardwood/pine forest, scrub/shrub, and wetland/surface water cover types. The majority of the undeveloped parcels is covered by a fairly dense woodland with a canopy comprised primarily of oaks and pine, with an understory that includes saplings of dogwood, sweetgum, and red maple. Other plant species observed in the understory and shrub layer included Chinese privet, American holly, greenbrier, wax myrtle, poison ivy, and Virginia creeper. The scrub/shrub habitat areas are located along the fringe of Little Bear Creek and the area associated with the former Beaver Pond. The intermittent Little Bear Creek flows from east to west across the undeveloped parcels, running through the former Beaver Pond area. The dam was breached in 2012, but the area is still bordered by a fringe of weedy colonizing vegetation including cord grass and lamp rush. No fish were observed during the site visit, but plant personnel indicate that minnows and tadpoles are sometimes present in the creek.

Developed Areas

This cover type classification comprises approximately 71% of the area within ½ mile of the facility and consists of the Southern States facility itself, home sites, railroad tracks, and roads (**Figure 6**). The land use data also indicates "hay/pasture" areas, but upon closer inspection of the aerial photograph reveals that these are also developed areas and not agricultural in nature. These areas are characterized by man-made "improvements" such as filling, mowing, paving, construction, or other anthropogenic perturbations. The vegetative land cover in these areas consists of turf grasses such as Bermuda and fescue. These areas are considered to provide relatively low quality ecological habitat.

Forested Areas

The Piedmont mesic forest is the principal vegetation community in the vicinity of the facility comprising approximately 24% of the area within a ½ mile radius (**Figure 6**). Only the forested areas in the immediate vicinity of the facility were observed. These were generally mixed hardwood/pine forests (white oak, shortleaf pine) with minimal understory at the time of observation.

Mammals utilizing this habitat likely include whitetail deer, raccoon, grey squirrel, fox squirrel, red fox, gray fox, striped skunk, opossum, and eastern cottontail. Characteristic birds of mixed hardwoods include the pileated, red-bellied woodpecker, blue jay, American robin, eastern bobwhite quail, Carolina wren, and northern cardinal. The mixed hardwood forest community is likely to provide habitat for a number of amphibian and reptile species (Edwards et al., 2013).

Surface Water Features

Approximately 1% of the area within an approximately ½ mile radius of the site is comprised of surface water features including ponds, streams and drainage features. Drainage in the general vicinity of the facility is primarily to the west with the direction of the streamflow of Little Bear Creek. The intermittent drainage to the north flows most of the year but does dry occasionally according to plant personnel. Drainage from the surrounding area comes into the creek from the north via a culvert near the northwest corner of the SS property.

To the west of the facility, the Little Bear Creek flows to an area that was previously a ponded area created by beavers. The dam was breached in 2012, but remnants of the former Beaver Pond habitat remain. The area is bordered by a fringe of weedy colonizing vegetation including cord grass and soft rush. No fish were observed but plant personnel indicate that minnows and tadpoles are sometimes observed.

There is also a ~2-acre fire protection pond located on the parcel with the SS facility. This pond is surrounded by mowed/landscaped vegetation. The ecological reconnaissance did not include a direct observation of this pond.

Threatened and Endangered Species

Information was obtained from the Georgia Department of Natural Resources' (DNR) *Georgia Rare Natural Element Data Portal* regarding the occurrence of protected species (i.e., threatened or endangered) within Henry County and the Hampton, GA Southeast quarter quad. No occurrences were listed for the quarter-quad. Henry County has several listings as shown in the table below.

Species	Habitat
Cyprinella xaenura (Altamaha Shiner)	Medium-sized to large streams in runs or pools over sand to gravel substrate
Elimia mutabilis (Oak Elimia)	shoals in medium sized rivers
Haliaeetus leucocephalus (Bald Eagle)	Edges of lakes and large rivers; seacoasts
Lampropeltis calligaster rhombomaculata (Mole Kingsnake)	Georgia habitat information not available
Micropterus cataractae (Shoal Bass)	Large river, shoal and fluvial specialist
Tyto alba (Barn owl)	Nests in large hollow trees in areas with extensive pasture, grassland, marsh or other open habitats.
Amphianthus pusillus (Pool Sprite, Snorkelwort)	Vernal pools on granite outcrops
Cypripedium acute (Pink Ladyslipper)	Upland oak-hickory-pine forests; piney woods
Sedum pusillum (Granite Stonecrop Puck's Orpine)	Granite outcrops, often in mats of Hedwigia moss under *Juniperus virginiana*

Based on the habitat encountered, none of these rare species would be expected to be found at the SS site.

Components of the ecological CSM are discussed in the subsections below, and diagrammatically presented in **Figure 7**. Using this information, likely categories of receptors with anticipated complete exposure pathways are identified and assessment endpoints for ecological evaluation are selected.

2.1.2 Identification of Potentially Complete Exposure Pathways

A complete exposure pathway is one in which constituents can be traced or expected to travel from the source to a receptor that can be affected by the constituents (EPA, 1997). Therefore, a constituent source, its release, and migration from the source along an exposure route to a receptor must be demonstrated before a potentially complete exposure pathway can be identified. In the absence of body burden data to document constituent movement through the ecosystem, the pathways of constituent migration and interaction with receptors can only be inferred and extrapolated. Given the incomplete knowledge of the actual pathways, the pathways are considered "potentially complete" at this stage of the assessment.

Primary Sources and Release Mechanisms

As described in Section 1.2 and previous reports (EMA, 2014, 2015, 2016, 2017a, 2017b), soil impact due to VOCs, metals, cyanide, and PCBs have been investigated and delineated. The only COC remaining in soil in excess of the HSRA RRS Type 1 is limited to PCBs. No known use of PCB-containing oil other than historic transformers for on-site power distribution has been identified. The presence of the PCBs in the sediment samples from Little Bear Creek and the soil samples in the area of the former Beaver Pond are likely related to migration from the former landfill and subsequent sediment transport. The surface water within Little Bear Creek is free from detectable levels of VOCs and PCBs.

Ecological Exposure Media

Based on the sources and releases mechanisms summarized above, the primary contaminated medium is sediment and soils that were once inundated by the beaver pond. The ecological exposure potential for each of these media is discussed below.

- Sediment. Sediments in Little Bear Creek support plants, invertebrates and forage fish that may serve as food/prey and attract upper trophic level receptors. Therefore, there are several potentially complete exposure pathways by which ecological receptors could be directly or indirectly exposed to COCs in sediments. Sediment samples collected within Little Bear Creek have indicated the presence of PCBs (**Figure 4**). The location of the sediment sample with the highest detected concentrations of PCBs (SED-3) was excavated in May 2017 (**Figure 8**).

- Soil. Soils in the and the vicinity of Little Bear Creek and the non-operational areas of the SS property that were formerly inundated by the Beaver Pond support plants and invertebrates that may serve as food/prey and attract upper trophic level receptors. Several soil samples within these areas have indicated the presence of PCBs (**Figure 5**). The location of the soil sample with the highest detected concentrations of PCBs (SED-4) was excavated in May 2017 (**Figure 8**).

- Surface water. There have been no detectable concentrations of PCBs in surface water in the on-site pond or in Little Bear Creek. This medium is not evaluated further in the SLERA.

- Groundwater. Direct contact with groundwater represents an incomplete exposure pathway for ecological receptors. Therefore, this medium is not evaluated further in the SLERA.

Ecological Receptors and Exposure Routes

Specific species of ecological receptors are not identified for the SLERA. Rather, broad categories of receptors classes are identified to allow evaluation of potentially complete exposure pathways. These receptors are assumed to be directly exposed to constituents in soil/sediment via incidental ingestion and dermal contact/absorption. In addition to these direct uptake mechanisms, ecological receptors are also assumed to be exposed via the consumption of food/prey items that have bioaccumulated constituents. Detailed analysis of soil-based exposure pathways in terrestrial species by has documented generally negligible exposures of wildlife species via inhalation and dermal pathways, relative to direct ingestion and dietary pathways (EPA, 2005).

The table below and the CSM in shown on **Figure 7** illustrate the potentially complete exposure pathways that will be evaluated in the SLERA.

Identification of Potentially Complete Exposure Pathways

Organism	Possible Exposure Routes
Benthic Plants/Invertebrates	Ingestion, surface contact, food web
Terrestrial Plants/Invertebrates	Direct exposure, ingestion
Upper Trophic Level Birds and Mammals	Direct exposure, ingestion, food web

2.1.3 Identification of Generic Assessment Endpoints

An assessment endpoint is defined as "an explicit expression of the environmental value to be protected, operationally defined as an ecological entity and its attributes" (EPA, 1998). Because not all organisms or ecosystem features can be studied, regulatory agencies and other risk managers must choose from among many candidate endpoints. The selection of assessment endpoints depends on knowledge of the site, knowledge about the constituents released (including ecotoxicological properties and concentrations that cause adverse impacts), and understanding of the values that will drive risk management decision-making (EPA, 2003).

"For the SLERA, assessment endpoints are any adverse effects on ecological receptors, where receptors are plant and animal populations and communities, habitats, and sensitive environments. Many of the ecotoxicity screening values are based on generic assessment endpoints (e.g., protection of aquatic communities from changes in structure or function) and are assumed to be widely applicable to sites around the United States" (EPA, 1997).

At the SS site, the selected assessment endpoints include:

- protection of terrestrial and benthic invertebrates from direct exposure to COPECs in soil/sediment;
- protection of terrestrial plants communities from direct exposure to COPECs in soil/sediment; and
- protection of upper trophic level receptors (e.g., birds and mammals) from direct and indirect exposure to COPECs in soil/sediment.

These species are important at this site for a number of reasons. The benthic communities and plants provide a critical ecological service as the base of the ecological food web. Many middle to upper trophic level terrestrial and avian omnivores and carnivores, serve important roles in regulating the populations of other species through their grazing or predatory activities.

The primary ecological attributes that are to be protected are abundance and diversity of populations of predatory birds and mammals and the ecological services provided by other organisms in the vicinity of the site including small mammals, plants, invertebrates, reptiles and amphibians.

Although populations of herpetofauna are valued ecological entities, the current state-of-the-art techniques of risk assessment are insufficient to adequately incorporate herpetofauna in risk analysis with acceptable levels of uncertainty, particularly at the screening level (Sparling et al., 2000).

2.1.4 Measurement Endpoints

Measures of effects (also known as measurement endpoints) are measurable biological responses to a stressor that can be related to the valued characteristic chosen as the assessment endpoint (EPA 1997, 1998, 2003). Sometimes, the assessment endpoint encompasses multiple species or species that are difficult to evaluate efficiently. In these cases, the measurement endpoints are different from the assessment endpoint, but can be used to make inferences about risks to the assessment endpoints.

The SLERA evaluates site media based on screening criteria that are protective of terrestrial invertebrates, benthic invertebrates, and terrestrial plants, as these organisms are the base of the food web in the vicinity of the site that supports upper trophic level avian and mammalian wildlife. The measurement endpoints are evaluated in the SLERA through the use of screening hazard quotients (HQs). The screening HQ is the ratio of a constituent concentration to an associated ecotoxicity screening value (ESV). The measurement endpoints primarily assess potential effects in invertebrates, but are also likely to provide a fairly conservative, albeit indirect, assessment of potential adverse effects to upper trophic level receptors.

Representative wildlife receptors must also be identified in order to perform necessary SLERA exposure estimates and risk calculations. These species are generally selected based on consideration of presence at the site as well as known or suspected sensitivity and exposure to the site-related constituents (EPA, 1997).

2.2 Screening-Level Ecological Effects Evaluation

The screening-level ecological effects evaluation involves the identification of appropriate ESVs for each medium. ESVs are constituent concentrations in environmental media below which there is negligible risk to receptors exposed to those media. This SLERA uses ESVs recommended by EPA Region 4 (2015a).

2.2.1 Soil Screening Values

The soil ESVs are primarily derived to protect soil-dwelling terrestrial invertebrates. ESVs for PCBs in mg/kg is soil include:

- 0.33 mg/kg – EPA Region 4 PCB (sum) wildlife-based ESV;
- 0.33 mg/kg – EPA Region 4 PCB (sum) soil invertebrate ESV; and
- 40 mg/kg – EPA Region 4 PCB (sum) terrestrial plant ESV.

2.2.2 Sediment Screening Values

The sediment ESVs are primarily derived to protect organisms that live and feed in direct contact with sediment (i.e., sediment benthos). ESVs for PCBs in sediment include:

- 0.0598 mg/kg – EPA Region 4 Total PCBs benthic invertebrate ESV based on threshold effects concentration (TEC); and
- 0.014 mg/kg – EPA Region 4 Total PCBs wildlife-based ESV[1].

[1] The wildlife-based sediment ESV of 0.014 mg/kg is used here instead of the 0.00033 mg/kg value reported in Table 2a of EPA (2015a) based on personal communication with Sharon Thoms, EPA Region 4 ecological risk assessor. According to Ms. Thoms, the 0.00033 mg/kg value is incorrect, and the value of 0.014 mg/kg is recommended for data screening.

3. SCREENING-LEVEL EXPOSURE ESTIMATE AND RISK CALCULATION (STEP 2)

This section describes the SLERA dataset and the results of the screening-level risk characterization. This section includes the components of Step 2 of the EPA ERAGS process (1997).

3.1 SLERA Dataset

As described in Section 1.2, the multiple environmental investigations have been conducted at the site, resulting in a robust dataset of surface soil and sediment samples. Sampling data used in this SLERA are from samples collected during the investigations and remediation collected and summarized EMA in the VRP application and subsequent VRP progress reports (EMA, 2014, 2015, 2016, 2017a, 2017b).

The complete dataset for Total PCBs in soil and sediment are presented in **Table 1**. The concentration of total PCBs in each sample was calculated as the sum of the detected concentrations of Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260. Non-detect Aroclor concentrations were treated as zeros in the Total PCB calculations. The table indicates which samples are "true" sediment (i.e., collected within Little Bear Creek) and which are soil (i.e., areas formerly inundated or adjacent to the former Beaver Pond). The table also indicates which samples were excavated during the recent remedial activities as well as the confirmation samples collected to verify that concentrations of PCBs in the excavation sidewall and bottoms were below the Type 1 RRS.

The dataset evaluated in the SLERA includes surficial (defined as ≤1 ft-bgs) sediment samples from Little Bear Creek and the fire protection pond (**Figure 4**), and the surficial (≤1 ft-bgs) soil samples collected from non-operational areas of the SS property (**Figure 5**). The samples collected from locations SED-3 and SED-4 were excluded because these locations that were removed during the 2017 excavation. The 2017 confirmation samples were also excluded from the evaluation as they were collected at depths >1 ft-bgs.

3.2 Screening-Level Exposure/Hazard Estimates

The maximum concentrations detected in each medium were used in Step 2 of the SLERA as part of the evaluation of potential direct toxicity. At this stage, screening-level HQs were calculated for soil and sediment by dividing the maximum detected concentration of total PCBs in each medium by the lowest ESV for the medium, as follows.

$$HQ = \frac{\text{Maximum Detected Concentration}}{\text{Lowest ESV}}$$

Table 2 provides summary statistics and the screening-level HQ results for the sediment dataset. PCBs were detected in 3 of the 10 sediment samples retained in the SLERA dataset (i.e., 33%). All of the detects exceeded the EPA Region 4 sediment ESV of 0.014 mg/kg. A HQ of 55 was calculated by dividing the maximum detected sediment concentration of 0.765 mg/kg by the sediment ESV.

Table 3 provides summary statistics and the screening-level HQ results for the soil dataset. PCBs were detected in 8 of the 16 soil samples retained in the SLERA dataset (i.e., 50%). Five of the detects exceeded the EPA Region 4 sediment ESV of 0.014 mg/kg. A HQ of 4 was calculated by dividing the maximum detected sediment concentration of 1.31 mg/kg by the EPA Region 4 soil ESV.

Table 5 provides summary statistics and the screening-level HQ results for the combined soil/sediment dataset. PCBs were detected in 11 of the 26 soil samples retained in the SLERA dataset (i.e., 42%). A HQ of 94 was calculated by dividing the maximum detected soil concentration of 1.31 mg/kg by the EPA Region 4 sediment ESV.

4. PROBLEM FORMULATION - SCREENING REFINEMENTS (STEP 3A)

This section presents a refinement of the screening-level HQs that were calculated for PCBs detected in soil and sediment samples collected at the SS site based on a food-chain modeling approach. This is process is generally considered Step 3A of the EPA ERAGS process (1997, 2001, 2015a)

4.1 Refinement Process

The PCBs in soil and sediment identified in the SLERA are further evaluated in Step 3A using receptor-specific food chain models. The food chain models combine measured and modeled PCB concentrations with receptor-specific life history data to calculate an total daily intake (TDI) for two receptors representing the avian and mammalian invertivore feeding guilds. TDIs are compared to dietary toxicity reference doses (TRVs) to yield a HQ as follows:

$$HQ = \frac{TDI}{TRV}$$

If the value of an HQ is less than or equal to 1, likelihood of an adverse effect in an exposed receptor is judged to be minimal, particularly when the toxicity benchmark is based on a no-observed adverse effects level (NOAEL). If a HQ exceeds 1, the likelihood of an adverse effect in an exposed receptor increases, particularly when the toxicity benchmark is based on a lowest-observed adverse effects level (LOAEL).

The HQ is not truly a measure of “risk”, that is, a probability that an adverse effect will occur (Tannenbaum 2002 and 2005). When interpreting HQ results for non-endangered receptors, the assessment endpoint is usually based on the sustainability of exposed populations, and adverse effects to some individuals in a population may be acceptable if the population is expected to remain healthy and stable (Suter et al., 2005). In these cases, the potential for population-level effects might be characterized by quantifying the fraction of all individuals that have HQ values greater than 1, and by the magnitude of the exceedances. The fraction of the population that must have HQ values below a value of 1 for the population to remain stable depends on the species being evaluated and on the toxicological endpoint underlying the toxicity benchmark. Consequently, reliable characterization of the impact of a chemical stressor on an exposed population risk requires knowledge of population size, birth rates, and death rates, as well as immigration and emigration rates.

Because this type of detailed knowledge of population dynamics is generally not available on a site-specific basis, extrapolation from a distribution of potential individual effects to a characterization of population-level effects is generally uncertain. If only a small portion of the exposed population has HQ values that exceed 1, some individuals may be impacted, but population-level effects are not likely to occur. As the fraction of the population with HQ values above 1 increases, and as the magnitude of the exceedances increases, the potential for population-level effects also increases.

4.2 Receptors Evaluated

Potential ecological risks associated with PCBs in soil and sediment at the SS site were evaluated by comparing exposure and effects levels for the American woodcock (*Scolopax minor*) and the short-tailed shrew (*Blarina carolinensis*). Based on the type of habitat present primarily in the undeveloped parcels that comprise the western portion of the SS property, these two receptors are representative of feeding guilds that are likely to have the highest exposure to PCBs in soil and sediment.

- American woodcock – This receptor represents the avian invertivore guild, feeding primarily on earthworms and soil dwelling insects by probing in the dirt. Because of this feeding strategy, this species may also have significant contaminant intakes from the ingestion of soil.

- Short-tailed shrew – This receptor represents small invertivorous mammals, feeding primarily on earthworms, insects, and other invertebrates.

Although both of these receptors are expected to be found primarily in terrestrial upland habitat, they also provide a conservative evaluation of semi-aquatic receptors potentially foraging in Little Bear Creek. As discussed below, because of the relative similarity of PCB detections in the soil and sediment datasets, and the intermittent nature inundated sediments in Little Bear Creek these two datasets are combined into a single soil/sediment dataset for the purposes of food chain modeling.

The food chain evaluation of the soil/sediment dataset in this manner is conservative in the sense that it is anticipated that the estimated exposures and HQs for terrestrial apex predators, which have substantially larger foraging ranges, are likely to be significantly lower than those estimated for the mid-trophic level receptors evaluated in this assessment.

4.3 Exposure Estimates

4.3.1 PCB Exposure Point Concentrations in Soil/Sediment

For the food chain modeling, the exposure point concentration (EPC) for PCBs in soil/sediment was based on the 95% upper confidence limit (95% UCL) on the arithmetic mean concentration in the combined soil/sediment dataset described in Section 3.1. The combined soil/sediment dataset was selected for the food chain modeling because of the intermittent nature inundated sediments in Little Bear Creek and the relative similarity of PCB detections in the individual soil and sediment datasets[2]. The 95% UCL was calculated using EPA's ProUCL software, version 5.1 (EPA 2015b). The EPC for PCBs in soil/sediment is shown in **Table 5**. The ProUCL input and output files are provided in **Attachment B**.

4.3.2 Estimation of Concentrations in Earthworms

The concentration of PCBs in soil dwelling invertebrates were estimated from the 95% UCL for PCBs in the combined soil/sediment dataset using the regression-based equation for bioaccumulation of PCBs in earthworm tissues from Sample et al. (1998) shown below:

$$C_{invert} = \mathrm{e}^{[1.36 \times ln(C_{soil/sediment}) + 1.41]}$$

where:

- C_{invert} = PCB concentration in earthworm/invertebrate
- $C_{soil/sediment}$ = PCB concentration in soil/sediment

The EPC for PCBs in earthworms and soil-dwelling invertebrates is shown in **Table 5**.

[2] Combined soil/sediment dataset – Kaplan-Meier (KM) mean: 0.273 mg/kg, 95% UCL: 0.412 mg/kg; soil dataset – KM mean: 0.322 mg/kg, 95% UCL: 0.529 mg/kg; sediment dataset – KM mean: 0.208 mg/kg, 95% UCL: 0.413 mg/kg. The full output from the ProUCL v5.1 software is provided in Attachment B.

4.3.3 Food Chain Intake Calculation

Dietary intakes for the American woodcock and the short-tailed shrew were calculated using the equation below from EPA's *Ecological Soil Screening Level (Eco-SSL) Guidance* (EPA, 2007).

$$\text{TDI} = \text{DFI} \times \left[\left(EPC_{soil/sed} \times DSI\right) + \left(EPC_{invert} \times F_{invert}\right)\right] \times \text{AUF}$$

where:

- TDI = Total daily intake of PCBs (mg/kg body weight-day)
- DFI = Daily food ingestion (kg/day, dry weight)
- $EPC_{soil/sediment}$ = Concentration of PCBs in soil (mg/kg, dry weight)
- DSI = Daily soil ingestion as a fraction of food intake (kg soil/kg food)
- EPC_{invert} = Concentration of PCBs in invertebrates (mg/kg, dry weight)
- F_{invert} = Fraction of inverts in receptor diet (unitless)
- AUF = Area use factor (unitless)

The receptor-specific exposure parameters used in the TDI equation above are presented in **Table 6**. The daily food ingestion rates and daily soil ingestion rates for the American woodcock and short-tailed shrew were taken from the EPA (2007). In addition, all dietary items consumed by the receptor are assumed to come from the site (i.e., an AUF of 1).

4.4 Effects Estimates

The screening refinement process evaluates potential effects to upper trophic level receptors from exposure to constituents via food chain exposures using dietary TRVs, which represent a daily dietary intake below which adverse effects are not expected to occur.

4.4.1 Bird TRVs

The TRVs used to evaluate potential risk to birds come from a study that evaluated the effects of Aroclor 1254 on reproductive success in ring-necked pheasants (*Phasianus colchicus*) by Dahlgren et al. (1972), as summarized by Sample et al. (1996). The Dahlgren study was selected from among several avian toxicity studies of PCBs because of the relative similarities in dietary preferences and physiology between pheasant and the American woodcock, compared with the avian species used in other PCB toxicity studies. The Dahlgren study identified a chronic LOAEL of 1.8 mg/day based significantly reduced egg hatchability at the lowest dose tested. A chronic NOAEL of 0.18 mg/kg was estimated by dividing the LOAEL by a LOAEL-NOAEL uncertainty factor of 10. The NOAEL and LOAEL TRVs used to evaluate potential risk to birds in this assessment are presented in **Table 7**.

4.4.2 Mammal TRVs

The TRVs used to evaluate potential risk to mammals come from a study that evaluated the effects of Aroclor 1254 on reproductive and developmental success in oldfield mice (*Permyscus poliontus*) by McCoy et al. (1995), as summarized by Sample et al. (1996). The McCoy study was selected from among several mammalian toxicity studies of PCBs because it was one of the few chronic feeding studies conducted with a terrestrial mammal. The McCoy study identified a chronic LOAEL of 0.68 mg/day based on reductions in the number of litters, reduced pup body weights, and pup survival. A chronic NOAEL of 0.068 mg/kg was estimated by dividing the LOAEL by a LOAEL-NOAEL uncertainty factor of 10. The NOAEL and LOAEL TRVs used to evaluate potential risk to mammals in this assessment are presented in **Table 7**.

4.5 Screening Refinement Results

This screening refinement assessment evaluated exposure of avian and mammalian wildlife receptors by calculating total daily intakes of PCBs and comparisons of these calculated intakes with NOAEL and LOAEL TRVs to generate HQs. The receptors were assumed to be exposed to constituents via ingestion of earthworms and other soil dwelling invertebrates, as well as incidental ingestion of soil/sediment while foraging. This information is summarized on **Table 8** and **Table 9** for the American woodcock and the short-tailed shrew, respectively. The NOAEL and LOAEL HQ estimates for these receptors are also summarized below.

Receptors	NOAEL HQ	LOAEL HQ
American woodcock	2	0.2
Short-tailed shrew	4	0.4

The NOAEL HQ results exceeding 1 suggest that individual animals in the avian and insectivore feeding guilds could potentially experience adverse effects on growth or reproductive success due to exposure to PCBs in the soil/sediment present in the non-operational areas of the SS property. However, the LOAEL HQs for avian and mammalian receptors were below 1. In addition, given the uncertainties associated with the HQ methodology, predominantly skewing the outcome in a conservative manner, it is unlikely that local populations of these or similar receptors are at risk from exposures at the SS site.

4.6 Ecological Remedial Goals

Because the NOAEL HQs exceeded 1 for the receptors selected to represent the avian and mammalian insectivore feeding guilds, a decision was made to develop and present ecological risk-based remedial goals (RGs) to support informed environmental management decision-making under the VRP process.

The remedial goals were calculated using an iterative forward calculation approach with the existing food chain models such that the soil EPCs for total PCBs were adjusted until a HQ of 1 was achieved. This information is presented on **Table 10** and summarized in the table below.

Receptors	**NOAEL-Based Remedial Goal** (mg/kg)	**LOAEL-Based Remedial Goal** (mg/kg)
American woodcock	0.39	2.1
Short-tailed shrew	0.19	1.1

It should be noted that the 95% UCL for PCBs in the remaining surface soil/sediment at the SS site (0.41 mg/kg) is already below the LOAEL-based remedial goals for both avian and mammalian receptors.

5. UNCERTAINTY CHARACTERIZATION

Uncertainty can be introduced into an ERA at every step in the process, as information of varying quality is gathered from diverse sources in order to be integrated into a complex framework. Uncertainty in an ERA is "the imperfect knowledge concerning the present or future state of the system under consideration; a component of risk resulting from imperfect knowledge of the degree of hazard or of its spatial and temporal distribution" (EPA, 1997). The SLERA is designed to provide estimates of the potential risks that may exist for wildlife and it incorporates uncertainty in a conservative (i.e., precautionary) manner. The ecological food chain modeling conducted in Step 3A of the Problem Formulation, while retaining a fundamentally conservative approach, is intended to more realistically evaluate potential ecological effects from PCBs in environmental media at the site to upper-trophic level receptors to support informed environmental management decision-making.

- Soil/Sediment Dataset. The PCB analytical data used in this assessment come from a combination of sediment and soil samples collected over multiple phases of investigation. Some of the samples originally identified as "sediment" were collected from the former Beaver Pond that was drained in 2012. The media present at most of these sample locations is more appropriately characterized as soil. There are also a number of samples of media that that can be characterized as "true" sediment (i.e., collected within Little Bear Creek and inundated with surface water for extended periods of time). The soil and sediment datasets were evaluated separately in the SLERA, but were combined into a single soil/sediment dataset for the food chain modeling conducted in the Step 3A screening refinements. This was done based on the intermittent nature of inundated sediments in Little Bear Creek, the relative similarity of PCB detections in the individual soil and sediment datasets, and the relative similarity of food chain modeling approaches for mid-tropic level terrestrial and semi-aquatic receptors. Separate evaluations of the soil and sediment datasets would not change the conclusions of this assessment.

- PCB Concentrations. The concentration of "total" PCBs in each sample was calculated as the sum of the detected concentrations of Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260. Non-detect Aroclor concentrations were treated as zeros in the Total PCB calculations. This treatment of the non-detect results could potentially underestimate total PCB concentrations, but since positive detections were limited to just a few Aroclors (primarily 1248, 1254, and 1260) the potential for underestimation is considered to be minimal.

- Generic ESVs to Estimate Effect: PCBs were identified as a preliminary COPEC in the SLERA based on comparisons of the maximum concentrations in soil and sediment to generic ESVs recommended for risk-based screening by EPA Region 4. This comparison inherently assumes that there is a potential for adverse ecological effects to occur at constituent concentrations greater than the ESV. However, ESVs are highly conservative to ensure that the potential for ecological effects is not overlooked. In the environment, species sensitivities can vary substantially, and constituents are often present in less bioavailable forms (e.g., weathered organic compounds).

- Food Chain Modeling and HQ methodology: Food chain modeling involves the use of multiple conservative assumptions that are used to compensate for uncertainties and to ensure the protectiveness of the overall assessment. These layers of conservative assumptions tend to skew the assessment to overestimate receptor exposure and potential risk. While it is consistent with standard practice for the conduct of most site-specific ERAs, the use of HQs as a metric to evaluate ecological risk is not without criticism (Tannenbaum 2003, 2005, and 2007). These criticisms contend that elevated HQs are meaningless in the context of ecological exposures at sites where the contaminants of interest were released years to decades prior to conducting the ERA because the local ecology will almost certainly have adapted to the existing environmental conditions.

- Soil/Sediment EPCs: The use of EPA's ProUCL software to calculate UCLs on the mean concentration likely results in an overestimation of exposure through direct contact with soil and sediment, and to modeled concentrations in biota. This is because of the high percentage of non-detects in the dataset combined with modest size of the dataset. The conservative statistical algorithms employed by the ProUCL software results in UCL concentrations that are substantially higher than the arithmetic mean concentration. The use of the UCL as the EPC to represent exposures in the risk assessment likely overestimates receptor exposures and risks.

- Dietary preferences: Dietary preferences affect exposure estimates because different food types would have different levels of PCBs. Dietary preferences used in this assessment were conservatively limited to earthworms/soil dwelling invertebrates that are in direct contact with soil/sediment and have the highest potential for PCB uptake. These concentrations are assumed to be generally representative of prey items ingested by wildlife, when in fact, most avian and mammalian receptors feed on a much wider variety of prey, most of which would tend to accumulate PCBs to a lesser extent than the earthworms/soil dwelling invertebrates considered in this assessment. This assumption likely leads to an overestimation of potential risks to wildlife receptors.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 SLERA/Screening Refinement Summary

This SLERA was prepared in support the VRP process at the SS site located in Hampton, Georgia. During the course of the environmental investigations at the site, PCBs were detected in shallow soils in certain areas of the former landfill to a depth of approximately 3 ft-bgs. No known use of PCB-containing oil other than historic transformers for on-site power distribution has been identified and no information has been identified that explains the presence of PCBs (EMA, 2014). There appears to have been historical migration of PCBs from the former landfill to the sediments of Little Bear Creek, which is a highly channelized stream that runs underground via a corrugated pipe from beyond the eastern boundary of the SS property at Central Avenue. The creek emerges from the corrugated pipe near the northeastern corner of the former landfill and runs adjacent to its northern side. The creek flows to the west onto the two undeveloped parcels that are also owned by SS.

The operational area of the SS property is characterized by highly disturbed habitat due to the dominance of man-made surfaces and structures. However, a limited amount of viable habitat exists in the undeveloped parcels to the west of the SS facility. Historically, beavers created dams along Little Bear Creek forming a shallow beaver pond on one of the undeveloped parcels on the SS property. The area of the former Beaver Pond expanded and contracted to some extent over time in response to varying amounts of precipitation. The beavers and the dams were removed from the creek in 2012, thus allowing the pond to naturally drain. PCBs were detected at concentrations above ecological screening levels in sediment samples collected from Little Bear Creek and in samples collected within the footprint of the former Beaver Pond. The presence of the PCBs is most likely related to the transport of impacted soil/sediment from the area of the former landfill. The PCB impacts do not extend off-site.

PCBs were identified as a COPEC in the SLERA based on comparisons of the maximum concentrations in soil and sediment to the default EPA Region 4 ESVs. Potential ecological risks from soil and sediment exposure were expressed as an HQ calculated as the ratio of sample concentrations to literature-derived screening levels. The calculated maximum HQ for PCBs exceeded the EPA threshold HQ value of 1.

The PCBs in soil and sediment identified in the SLERA were further evaluated in Step 3A using receptor-specific food chain models for avian and mammalian invertivores that combined measured and modeled PCB concentrations with receptor-specific exposure factors to calculate a TDI for these. The TDIs were compared to dietary NOAEL and LOAEL TRVs to yield the HQ estimates below.

Receptors	**NOAEL HQ**	**LOAEL HQ**
American woodcock	2	0.2
Short-tailed shrew	4	0.4

Although the LOAEL HQs are below 1 for both avian and mammalian receptors, the ecological RGs below were developed to support informed management decision-making under the VRP process.

Receptors	**NOAEL-Based Remedial Goal** (mg/kg)	**LOAEL-Based Remedial Goal** (mg/kg)
American woodcock	0.39	2.1
Short-tailed shrew	0.19	1.1

Consistent with the LOAEL HQs less than 1, the 95% UCL for total PCBs in the surface soil/sediment dataset at the SS site (0.41 mg/kg) is below the LOAEL-based remedial goals for both avian and mammalian receptors

6.2 Scientific Management Decision Point

SMDPs represent critical steps in the ecological risk assessment process where risk management decision-making occurs. The first SMDP in the ERA process typically occurs at the end of Step 2 or Step 3A (EPA 2001). The purpose of the flexibility of the first SMDP is so that additional evaluation of risks can occur, and reporting can be streamlined into a single report. Generally, one of the following conclusions is reached at this SMDP (EPA, 1997):

- there is adequate information to conclude that ecological risks are negligible and therefore no need for remediation on the basis of ecological risk;

- the information is not adequate to make a decision at this point, and the ecological risk assessment process will continue to Step 3 (or 3B); or
- the information indicates a potential for adverse ecological effects, and a more thorough assessment is warranted.

Based on the elevated screening-level HQs calculated by comparing maximum detected PCB concentrations to default ESVs in Step 2, it was decided to further evaluate the PCB impacts using a limited number of food chain models in Step 3A. This portion of the Problem Formulation step is designed to more realistically identify the nature and extent of ecological risks in order to support informed environmental management decision-making (EPA, 1997, 2001).

The results of the food chain modeling indicate that the overall risks to populations of both birds and mammals are low, particularly considering the limited spatial extent of COPEC concentrations that exceed the food chain-based ecological RGs. In addition, the relatively disturbed characteristics of the habitat in the areas most affected by the contamination, and the conservative nature of the food chain calculation support the use of LOAEL-based RGs for remedial decision making.

As detailed in the October 2017 VRP Progress Report for the SS site (EMA, 2017b), the two locations with the highest detected concentrations of PCBs (SED-3 and SED-4) were excavated in May 2017. The PCB concentrations in samples from these two locations were excluded from the SLERA and Step 3A screening refinements. The 95% UCL for PCBs in the combined soil/sediment dataset is below the most conservative LOAEL RG based for invertivorous mammals (1.1 mg/kg)[3]. Based on these considerations, the potential for ecological risks at the SS site have been adequately mitigated and it is not necessary to advance the ecological risk assessment beyond Step 3A.

[3] The PCB 95% UCLs in the individual soil and sediment datasets are also below the LOAEL RG for terrestrial mammals.

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TABLES

TABLE 1
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
SOIL AND SEDIMENT PCB DATA
Southern States, Hampton, GA

Sample ID		Sample Date	Depth (inches)	Total PCB Concentration(1)	Detection Limit	Units	Evaluated in SLERA(2)
Sediment Samples							
SED	SED-1	1/12/2012	0-6	ND	0.04	mg/kg	YES
SED	1	9/2/2015	0-6	ND	0.038	mg/kg	YES
SED	1	9/2/2015	12	ND	0.038	mg/kg	YES
SED	1	9/2/2015	24	ND	0.038	mg/kg	NO
SED	SED-2	1/12/2012	0-6	0.28	--	mg/kg	YES
SED	2	9/2/2015	0-6	0.765	--	mg/kg	YES
SED	2	9/2/2015	12	0.768	--	mg/kg	YES
SED	2	9/2/2015	24	0.731	--	mg/kg	NO
SED	SED-5	1/12/2012	0-6	ND	0.04	mg/kg	YES
SED	SED-6	1/12/2012	0-6	ND	0.04	mg/kg	YES
SED	SED-7	2/2/2012	0-6	ND	0.046	mg/kg	YES
SED	SED-8	3/30/2012	0-6	ND	0.04	mg/kg	YES
Soil Samples							
SOIL	SL-1TC	3/7/1994	0-6	ND	0.04	mg/kg	YES
SOIL	SL-2TC	3/7/1994	0-6	ND	0.04	mg/kg	YES
SOIL	SL-3TC	3/7/1994	0-6	ND	0.04	mg/kg	YES
SOIL	SL-4TC	3/7/1994	0-6	ND	0.04	mg/kg	YES
SOIL	SED-3E	2/2/2012	0-6	0.12	--	mg/kg	YES
SOIL	SED-3S	2/2/2012	0-6	0.018	--	mg/kg	YES
SOIL	SED-3N	2/2/2012	0-6	1.31	--	mg/kg	YES
SOIL	SED-3N-3	3/30/2012	36	ND	0.044	mg/kg	NO
SOIL	SED-9	3/30/2012	0-6	ND	0.052	mg/kg	YES
SOIL	SED-10	3/30/2012	0-6	1.14	--	mg/kg	YES
SOIL	SED-11	3/30/2012	0-6	ND	0.04	mg/kg	YES
SOIL	SED-12	3/30/2012	0-6	ND	0.042	mg/kg	YES
SOIL	SED-13	3/30/2012	0-6	0.644	--	mg/kg	YES
SOIL	SED-14	3/30/2012	0-6	0.23	--	mg/kg	YES
SOIL	POND-N	2/12/2012	0-6	ND	0.05	mg/kg	YES
SOIL	POND-M	2/12/2012	0-6	0.57	--	mg/kg	YES
SOIL	POND-S	2/12/2012	0-6	0.98	--	mg/kg	YES
Excavated Samples(3)							
SED	SED-3	1/12/2012	0-6	0.73	--	mg/kg	NO
SED	SED-3-12	2/2/2012	12	1.81	--	mg/kg	NO
SED	SED-3-3	3/30/2012	36	0.58	--	mg/kg	NO
SOIL	SED-4	1/12/2012	0-6	1.99	--	mg/kg	NO
SOIL	SED-4-12	2/12/2012	12	13.2	--	mg/kg	NO
SOIL	SED-4-3	3/30/2012	36	ND	0.04	mg/kg	NO
Confirmation Samples							
SOIL	3-N	6/1/2017	12-24	0.65	--	mg/kg	NO
SOIL	3-S	6/1/2017	12-24	0.33	--	mg/kg	NO
SOIL	3-E	6/1/2017	12-24	0.48	--	mg/kg	NO
SOIL	3-W	6/1/2017	12-24	0.41	--	mg/kg	NO
SOIL	3-B	6/1/2017	36	0.44	--	mg/kg	NO
SOIL	4-N	6/1/2017	12-24	ND	0.04	mg/kg	NO
SOIL	4-S	6/1/2017	12-24	1.54	--	mg/kg	NO
SOIL	4-E	6/1/2017	12-24	ND	0.044	mg/kg	NO
SOIL	4-W	6/1/2017	12-24	ND	0.043	mg/kg	NO
SOIL	4-B	6/1/2017	36	ND	0.043	mg/kg	NO

Notes:

(1) Total PCBs = Aroclor 1016 + Aroclor 1221 + Aroclor 1232 + Aroclor 1242 + Aroclor 1248 + Aroclor 1254 + Aroclor 1260. Detects only.

(2) Only the samples labeled "YES" are quantitatively evaluated in the SLERA and screening refinement process.

(3) Soil in the area of sample locations SED-3 and SED-4 was excavated in May 2017.

Shading indicates sanples excluded from evaluation in the SLERA and screening refinement process.

Definitions:

ND = Not Detected

TABLE 2
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
PCB SCREENING
SEDIMENT DATASET (0 to 1 ft bgs)
Southern States Site, Hampton, Georgia

CAS No.	Constituent	Detection Frequency	Range of Detection Limits (mg/kg)	Maximum Detected Concentration (mg/kg)	Location of Maximum	95% UCL[1] (mg/kg)	Sediment ESV[2] (mg/kg)		Screening HQ[3]	Exceedance Frequency	Preliminary COPEC?	Rationale[4]
1336-36-3	Total PCBs [5]	3/10	0.038 - 0.046	0.765	Location 2	0.413	0.014	R4 Wildlife ESV	55	3/10	Yes	HQ>1

Notes:

(1) 95% UCL calculated using EPA's ProUCL v5.1 software. Value shown is based on the 95% KM (t) UCL method. See Attachment B.

(2) Value shown is the lowest ecological screening value (ESV) for sediment from EPA Region 4 guidance (2015).

(3) Screening hazard quotient (HQ) equals the maximum detected concentration divided by the ESV.

(4) Rationale codes for selection or exclusion as COPEC:

Selection	*Exclusion*
HQ > 1	HQ ≤ 1

(5) Total PCBs = Aroclor 1016 + Aroclor 1221 + Aroclor 1232 + Aroclor 1242 + Aroclor 1248 + Aroclor 1254 + Aroclor 1260. Detects only.

Definitions:

ft bgs = Feet below ground surface
mg/kg = Milligrams per kilogram
EPC = Exposure point concentration
ESV = Ecological screening values
COPEC = Constituent of potential ecological concern
HQ = Hazard quotient
PCB = Polychlorinated biphenyl

TABLE 3
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
PCB SCREENING
SOIL DATASET (0 to 1 ft bgs)
Southern States Site, Hampton, Georgia

CAS No.	Constituent	Detection Frequency	Range of Detection Limits (mg/kg)	Maximum Detected Concentration (mg/kg)	Location of Maximum	95% UCL(1) (mg/kg)	Sediment ESV(2) (mg/kg)		Screening HQ(3)	Exceedance Frequency	Preliminary COPEC?	Rationale(4)
1336-36-3	Total PCBs (5)	8/16	0.04 - 0.052	1.31	SED-3N	0.529	0.33	Region 4 Wildlife ESV	4	5/16	Yes	HQ>1

Notes:

(1) 95% UCL calculated using EPA's ProUCL v5.1 software. Value shown is based on the 95% KM (t) UCL method. See Attachment B.

(2) Value shown is the lowest ecological screening value (ESV) for soil from EPA Region 4 guidance (2015) UCL = 0.529

(3) Screening hazard quotient (HQ) equals the maximum detected concentration divided by the ESV.

(4) Rationale codes for selection or exclusion as COPEC:

Selection	*Exclusion*
HQ > 1	HQ ≤ 1

(5) Total PCBs = Aroclor 1016 + Aroclor 1221 + Aroclor 1232 + Aroclor 1242 + Aroclor 1248 + Aroclor 1254 + Aroclor 1260. Detects only.

Definitions:

ft bgs = Feet below ground surface
mg/kg = Milligrams per kilogram
EPC = Exposure point concentration
ESV = Ecological screening values
COPEC = Constituent of potential ecological concern
HQ = Hazard quotient
PCB = Polychlorinated biphenyl

TABLE 4
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
PCB SCREENING
COMBINED SOIL AND SEDIMENT DATASET (0 to 1 ft bgs)
Southern States Site, Hampton, Georgia

CAS No.	Constituent	Detection Frequency	Range of Detection Limits (mg/kg)	Maximum Detected Concentration (mg/kg)	Location of Maximum	95% UCL(1) (mg/kg)	Sediment ESV(2) (mg/kg)		Screening HQ(3)	Exceedance Frequency	Preliminary COPEC?	Rationale(4)
1336-36-3	Total PCBs (5)	11/26	0.038 - 0.052	1.31	SED-3N	0.412	0.014	Region 4 Wildlife ESV	94	11/26	Yes	HQ>1

Notes:

(1) 95% UCL calculated using EPA's ProUCL v5.1 software. Value shown is based on the 95% KM (t) UCL method. See Attachment B.

(2) Value shown is the lowest ecological screening value (ESV) for soil or sediment from EPA Region 4 guidance (2015).

(3) Screening hazard quotient (HQ) equals the maximum detected concentration divided by the ESV.

(4) Rationale codes for selection or exclusion as COPEC:

Selection	*Exclusion*
HQ > 1	HQ ≤ 1

(5) Total PCBs = Aroclor 1016 + Aroclor 1221 + Aroclor 1232 + Aroclor 1242 + Aroclor 1248 + Aroclor 1254 + Aroclor 1260. Detects only.

Definitions:

ft bgs = Feet below ground surface
mg/kg = Milligrams per kilogram
EPC = Exposure point concentration
ESV = Ecological screening values
COPEC = Constituent of potential ecological concern
HQ = Hazard quotient
PCB = Polychlorinated biphenyl

TABLE 5
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
FOOD CHAIN EXPOSURE POINT CONCENTRATIONS SUMMARY
Southern States Site, Hampton, Georgia

CAS No.	Constituent	Soil-to-Invertebrate Uptake Equation/ Factor[1]	Exposure Point Concentrations[2]	
			Soil/Sed (mg/kg)	Earthworm (mg/kg-dw)
1336-36-3	Total PCBs [3]	C_{invert} = e^[1.36 x ln(C_{soil}) + 1.4]	0.412	1.21

Notes:

(1) Regression uptake equation (dry weight basis) used to estimate PCB body burden in earthworms/invertebrates from Sample et al. 1998.

(2) EPC is the 95% upper confidence limit (95% UCL) on the mean concentration of total PCBs in the combined soil/sediment dataset. The earthworm/invertebrate EPC is modeled from the soil EPC.

(4) Total PCBs = Aroclor 1016 + Aroclor 1221 + Aroclor 1232 + Aroclor 1242 + Aroclor 1248 + Aroclor 1254 + Aroclor 1260. Detects only.

Definitions:

mg/kg-dw = Milligrams per kilogram dry weight
Csoil = Measured concentration in soil/sediment
C_{invert} = Modeled concentration in earthworm
PCB = Polychlorinated biphenyl

Reference:

Sample, BE, Suter, GW, Beauchamp, JJ, Efroymson, RA. 1999. Literature-derived bioaccumulation models for earthworms: development and validation. Environmental Toxicology and Chemistry, 18(9): 2110-2120.

TABLE 6
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
EXPOSURE PARAMATERS USED IN FOOD CHAIN CALCULATIONS
Southern States Site, Hampton, Georgia

Exposure Information	Units	Soils / Sediment	
		American Woodcock (*Scolopax minor*)	**Short-Tailed Shrew** (*Blarina brevicauda*)
Feeding Guild		Invertivorous bird	Invertivorous mammal
Dietary Breakdown(1)			
Earthworms/Invertebrates	fraction	1	1
Daily Food Ingestion(2)	kg food (dw)/kg bw-day	0.214	0.209
Daily Soil Ingestion(3)	kg soil/kg food	0.164	0.03
AUF(4)	fraction	1	1

Notes:

American Woodcock
(1) Diet = Assumed to eat 100% invertebrates.
(2) Daily Food Ingestion (DFI) = Average high-end dry-weight food intake rate for American woodcocks (EPA, 2007; Table 1).
(3) Daily Incidental Soil Ingestion (DSI) = 90th percentile estimates of soil ingestion as as a fraction of the dietary food ingestion rate (EPA, 2007; Table 3).
(4) Area Use Factor (AUF) = Assumed to be 100% for the SLERA.

Short-Tailed Shrew
(1) Diet = Assumed to eat 100% invertebrates.
(2) Daily Food Ingestion (DFI) = Average high-end dry-weight food intake rate for the short-tailed shrew (EPA, 2007; Table 1).
(3) Daily Incidental Soil Ingestion (DSI) = 90th percentile estimates of soil ingestion as as a fraction of the dietary food ingestion rate (EPA, 2007; Table 3).
(4) Area Use Factor (AUF) = Assumed to be 100% for the SLERA.

Notes:

EPA. 2007. Guidance for Developing Eco-SSLs, Attachment 4-1 Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs. Updated April.

TABLE 7
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
TOXICITY REFERENCE VALUES
Southern States Site, Hampton, Georgia

CAS No.	Constituent	Animal Class	NOAEL TRV (mg/kg bw/day)	LOAEL TRV (mg/kg bw/day)	Test Species	Endpoint	Source
1336-36-3	Total PCBs (Aroclor 1254 as surrogate)	Birds	0.18	1.8	Ringed-necked pheasant	LOAEL - hatching success	Dahlgren et al. (1972) per Sample et al. (1996)
		Mammals	0.068	0.68	Oldfield mouse	LOAEL - reproductive success (↓# litters, ↓BW, ↓pup survival)	McCoy et al. (1995) per Sample et al. (1996)

Definitions:
NOAEL = No Observed Adverse Effect Leve
LOAEL = Lowest Observed Adverse Effect Leve
TRV = Toxicity Reference Value
PCB = Polychlorinated biphenyl
mg/kg bw/day = milligrams per kilogram body weight per day
-- = no value available

TRV Sources :

McCoy, G, Finlay, MF, Rhone, A, James, K, and Cobb, GP. 1995. Chronic polychlorinated biphenyls exposure on three generations of oldfield mice (Permyscus polionotus): effects on reproduction, growth, and body residues. *Archives of Environmental Contamination and Toxicology* , 28: 431-435.

Dahlgren, RB, Linder, RL, and Carlson, CW. 1972. Polychlorinated biphenyls: their effects on penned pheasants*Environmental Health Perspectives* , 1: 89-101.

Sample, BE, Opresko DM, Suter, GW. 1996. Toxicological benchmarks for wildlife. 1996 revision. ES/ERM-86/R3. Office of Environmental Management, US Department of Energy, Washington, DC.

TABLE 8
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
HAZARD QUOTIENTS - INVERTIVOROUS BIRDS
Southern States Site, Hampton, Georgia

Representative Species: Woodcock (*Scolopax minor*)

CAS No.	Constituent	Soil/Sediment EPC(1) mg/kg dw	Invertebrate Tissue EPC(2) mg/kg dw	TDI(3) mg/kg-day	NOAEL TRV mg/kg-day	LOAEL TRV mg/kg-day	NOAEL HQ(4) (unitless)	LOAEL HQ(4) (unitless)
1336-36-3	Total PCBs (5)	0.412	1.21	0.274	0.18	1.8	2	0.2

Notes:
(1) Soil/Sediment is the 95% upper confidence limit on the mean (UCL) recommended by ProUCL (see Table 5). Earthworm EPC is calculated from the UCL soil concentration.
(2) Regression uptake equation (dry weight basis) used to estimate PCB body burden in worms/invertebrates from Sample et al. 1998 (see Table 5).
(3) $TDI = DFI \times [(EPC_{soil/sed} \times DSI) + (EPC_{invert} \times F_{invert})] \times AUF$
Where:

DFI =	0.214	kg food (dw) / kg bw-day
DSI =	0.164	kg soil / kg food
F_{invert} =	1	unitless
AUF =	1	unitless

(4) HQ = TDI/TRV
(5) Total PCBs = Aroclor 1016 + Aroclor 1221 + Aroclor 1232 + Aroclor 1242 + Aroclor 1248 + Aroclor 1254 + Aroclor 1260. Detects only.

Definitions:
AUF = Area Use Factor
DFI = Daily Food Ingestion
DSI = Daily Soil Ingestion
EPC = Exposure Point Concentration
F_{invert} = Fraction of invertebrates in diet
NOAEL = No Observable Adverse Effects Level
LOAEL = Lowest Observable Adverse Effects Level
TDI = Total Daily Intake
TRV =Toxicity Reference Value
HQ = Hazard Quotient
mg/kg = milligram per kilogram
-- = value not available/calculated

TABLE 9
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
HAZARD QUOTIENTS - INVERTIVOROUS MAMMALS
Southern States Site, Hampton, Georgia

Representative Species: Short-Tailed Shrew (*Blarina brevicauda*)

CAS No.	Constituent	Soil/Sediment EPC(1) mg/kg dw	Invertebrate Tissue EPC(2) mg/kg dw	TDI(3) mg/kg-day	NOAEL TRV mg/kg-day	LOAEL TRV mg/kg-day	NOAEL HQ(4) (unitless)	LOAEL HQ(4) (unitless)
1336-36-3	Total PCBs (5)	0.412	1.21	0.256	0.068	0.68	4	0.4

Notes:
(1) Soil/Sediment is the 95% upper confidence limit on the mean (UCL) recommended by ProUCL (see Table 5). Earthworm EPC is calculated from the UCL soil concentration.
(2) Regression uptake equation (dry weight basis) used to estimate PCB body burden in worms/invertebrates from Sample et al. 1998 (see Table 5).
(3) $ADD = DFI \times [(EPC_{soil/sed} \times DSI) + (EPC_{invert} \times F_{invert})] \times AUF$
Where:

DFI =	0.209	kg food (dw) / kg bw-day
DSI =	0.03	kg soil / kg food
F_{invert} =	1	unitless
AUF =	1	unitless

(4) HQ = ADD/TRV
HQ > 1
(5) Total PCBs = Aroclor 1016 + Aroclor 1221 + Aroclor 1232 + Aroclor 1242 + Aroclor 1248 + Aroclor 1254 + Aroclor 1260. Detects only.

Definitions:
AUF = Area Use Factor
DFI = Daily Food Ingestion
DSI = Daily Soil Ingestion
EPC = Exposure Point Concentration
F_{invert} = Fraction of invertebrates in diet
NOAEL = No Observable Adverse Effects Level
LOAEL = Lowest Observable Adverse Effects Level
TDI = Total Daily Intake
TRV =Toxicity Reference Value
HQ = Hazard Quotient
mg/kg = milligram per kilogram
-- = value not available/calculated

TABLE 10
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT
ECOLOGICAL SOIL / SEDIMENT REMEDIATION LEVELS
Southern States Site, Hampton, Georgia

Representative Species: Woodcock (*Scolopax minor*)

CAS No.	Constituent	Soil/Sed NOAEL RL(1) mg/kg dw	Soil/Sed LOAEL RL(1) mg/kg dw	Invert Tissue NOAEL EPC(2) mg/kg dw	Invert Tissue LOAEL EPC(2) mg/kg dw	NOAEL TDI(3) mg/kg-day	LOAEL TDI(3) mg/kg-day	NOAEL HQ(4) (unitless)	LOAEL HQ(4) (unitless)
1336-36-3	Total PCBs (5)	**0.39**	**2.1**	1.14	11.24	0.257	2.478	1	1

Representative Species: Short-Tailed Shrew (*Blarina brevicauda*)

CAS No.	Constituent	Soil/Sed NOAEL RL(1) mg/kg dw	Soil/Sed LOAEL RL(1) mg/kg dw	Invert Tissue NOAEL EPC(2) mg/kg dw	Invert Tissue LOAEL EPC(2) mg/kg dw	NOAEL TDI(3) mg/kg-day	LOAEL TDI(3) mg/kg-day	NOAEL HQ(4) (unitless)	LOAEL HQ(4) (unitless)
1336-36-3	Total PCBs (5)	**0.19**	**1.1**	0.43	4.38	0.098	0.974	1	1

Notes:

(1) NOAEL- and LOAEL-based remediation levels (RLs) for soil/sediment. Values shown were derived by iteratively imputing values until the respective HQs equal 1, when rounded to one significant figure.

(2) Regression uptake equation (dry weight basis) used to estimate PCB body burden in worms/invertebrates from Sample et al. 1998 (see Table 5).

(3) TDI = DFI × [($EPC_{soil/sed}$ × DSI) + (EPC_{invert} × F_{invert})] × AUF

American Woodcock Parameters

DFI =	0.214	kg food (dw) / kg bw-day
DSI =	0.164	kg soil / kg food
F_{invert} =	1	unitless
AUF =	1	unitless
NOAEL TRV =	0.18	mg/kg-day
LOAEL TRV =	1.8	mg/kg-day

Short-Tailed Shrew Parameters

DFI =	0.209	kg food (dw) / kg bw-day
DSI =	0.03	kg soil / kg food
F_{invert} =	1	unitless
AUF =	1	unitless
NOAEL TRV =	0.068	mg/kg-day
LOAEL TRV =	0.68	mg/kg-day

(4) Target NOAEL and LOAEL HQs - interatively calculated based on the soil/sediment RL to until they equal 1, when rounded to one significant figure.

(5) Total PCBs = Aroclor 1016 + Aroclor 1221 + Aroclor 1232 + Aroclor 1242 + Aroclor 1248 + Aroclor 1254 + Aroclor 1260. Detects only.

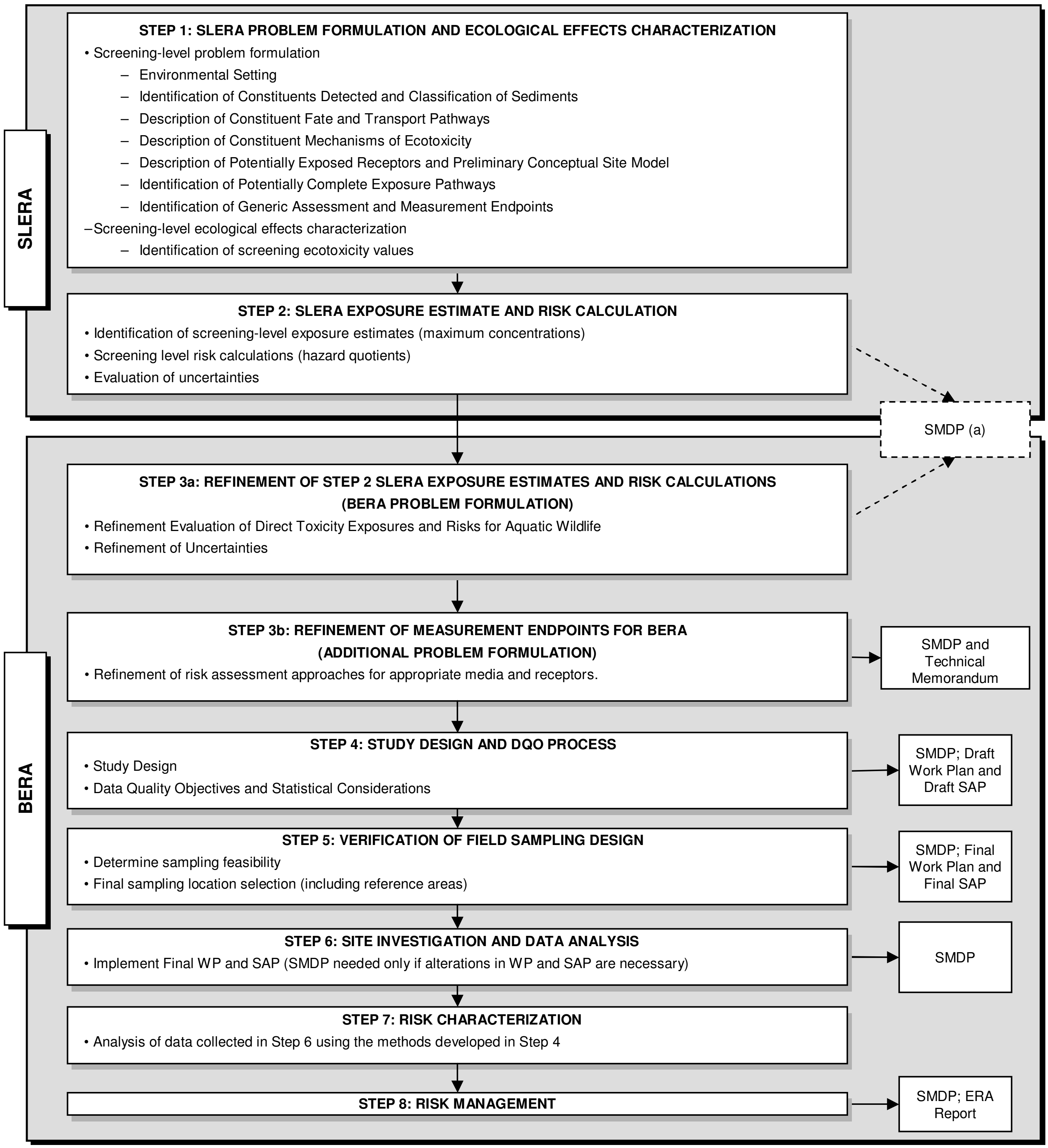
Definitions:

AUF = Area Use Factor
DFI = Daily Food Ingestion
DSI = Daily Soil Ingestion
EPC = Exposure Point Concentration
F_{invert} = Fraction of invertebrates in diet
NOAEL = No Observable Adverse Effects Leve
LOAEL = Lowest Observable Adverse Effects Level
TDI = Total Daily Intake
TRV =Toxicity Reference Value
HQ = Hazard Quotient
mg/kg = milligram per kilogram
-- = value not available/calculated

FIGURES

Figure 1

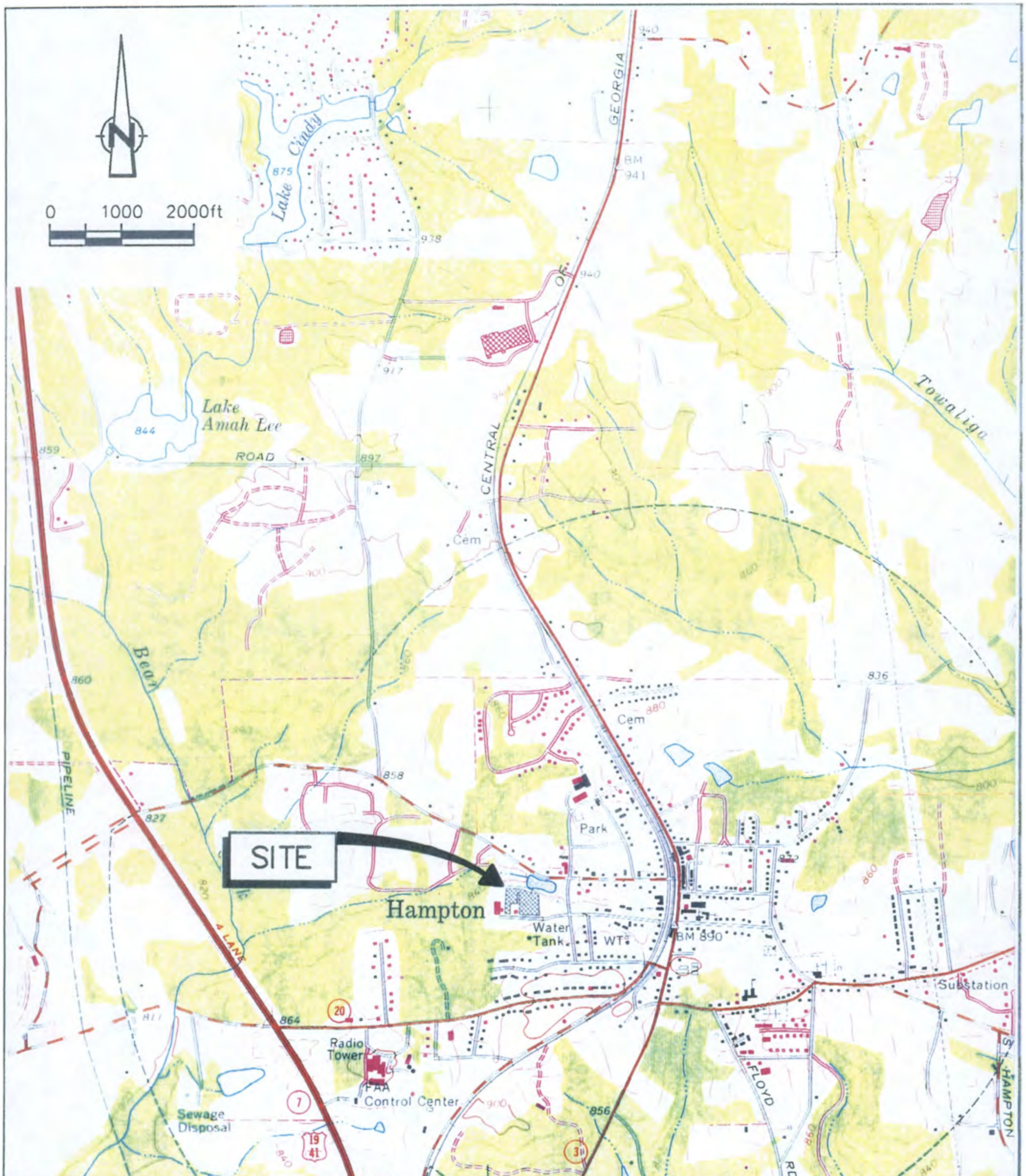
USEPA Expanded Eight-Step Ecological Risk Assessment Process



Notes:

(a)	SMDP occurs EITHER after Step 2 or after Step 3a.	SMDP	Scientific Management Decision Point.
COPCs	Constituents of Potential Concern.	SW/SD	Surface water and sediment.
DQO	Data Quality Objectives.	WP	Work Plan.
GW	Groundwater.	BERA	Baseline ERA.
SAP	Sampling and Analysis Plan.	SLERA	Screening-level ERA.

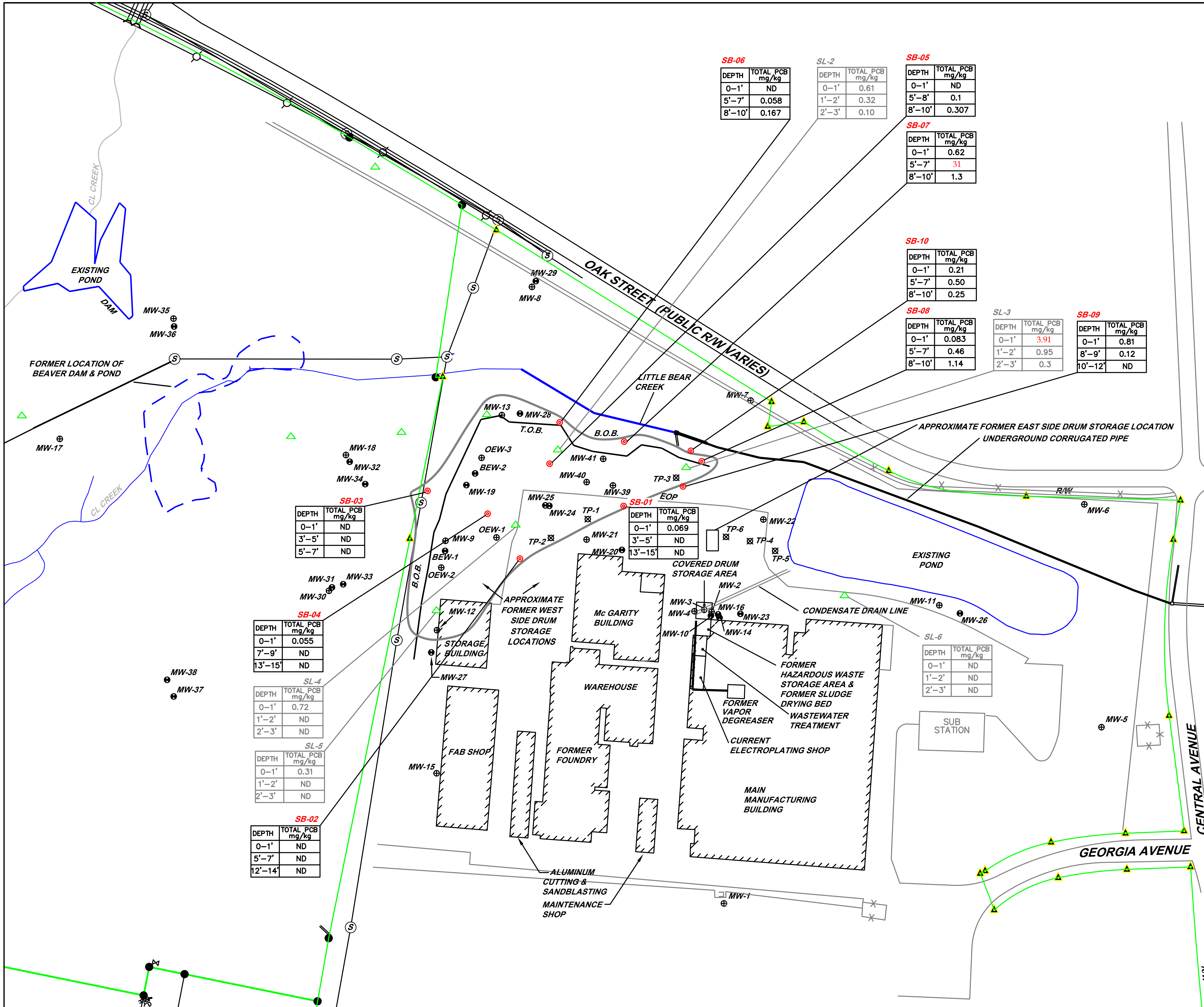
Source: Adapted from USEPA, 1997 and 2000a.



SOURCE: USGS QUADRANGLE;
HAMPTON, GEORGIA

FIGURE 2

LOCATION MAP
SOUTHERN STATES SITE
Hampton, Georgia



SB-06

DEPTH	TOTAL PCB mg/kg
0–1'	ND
5'–7'	0.058
8'–10'	0.167

SL-2

DEPTH	TOTAL PCB mg/kg
0–1'	0.61
1'–2'	0.32
2'–3'	0.10

SB-05

DEPTH	TOTAL PCB mg/kg
0–1'	ND
5'–8'	0.1
8'–10'	0.307

SB-07

DEPTH	TOTAL PCB mg/kg
0–1'	0.62
5'–7'	31
8'–10'	1.3

SB-10

DEPTH	TOTAL PCB mg/kg
0–1'	0.21
5'–7'	0.50
8'–10'	0.25

SB-08

DEPTH	TOTAL PCB mg/kg
0–1'	0.083
5'–7'	0.46
8'–10'	1.14

SL-3

DEPTH	TOTAL PCB mg/kg
0–1'	3.91
1'–2'	0.95
2'–3'	0.3

SB-09

DEPTH	TOTAL PCB mg/kg
0–1'	0.81
8'–9'	0.12
10'–12'	ND

SB-03

DEPTH	TOTAL PCB mg/kg
0–1'	ND
3'–5'	ND
5'–7'	ND

SB-01

DEPTH	TOTAL PCB mg/kg
0–1'	0.069
3'–5'	ND
13'–15'	ND

SB-04

DEPTH	TOTAL PCB mg/kg
0–1'	0.055
7'–9'	ND
13'–15'	ND

SL-4

DEPTH	TOTAL PCB mg/kg
0–1'	0.72
1'–2'	ND
2'–3'	ND

SL-5

DEPTH	TOTAL PCB mg/kg
0–1'	0.31
1'–2'	ND
2'–3'	ND

SB-02

DEPTH	TOTAL PCB mg/kg
0–1'	ND
5'–7'	ND
12'–14'	ND

SL-6

DEPTH	TOTAL PCB mg/kg
0–1'	ND
1'–2'	ND
2'–3'	ND

N

LEGEND

- Property Line
- Chain Link Fence
- MW-11 Overburden Monitoring Well
- MW-10 Bedrock Monitoring Well
- TP-4 Temporary Piezometer
- TOB Top of Embankment
- EOP Edge of Pavement
- SL-1TC Historic Soil Borings
- SB-01 EMA Soil Borings, April 2014
- 0.12 Soil Sample Concentration in mg/kg
- ND Not Detected

NOTES:
1.) SITE SURVEY UPDATED BY METRO ENGINEERING & SURVEYING – FEBRUARY 2012
2.) BOLD FONT INDICATES CONCENTRATION EXCEEDING TYPE 1 RRS.

0 70 140ft

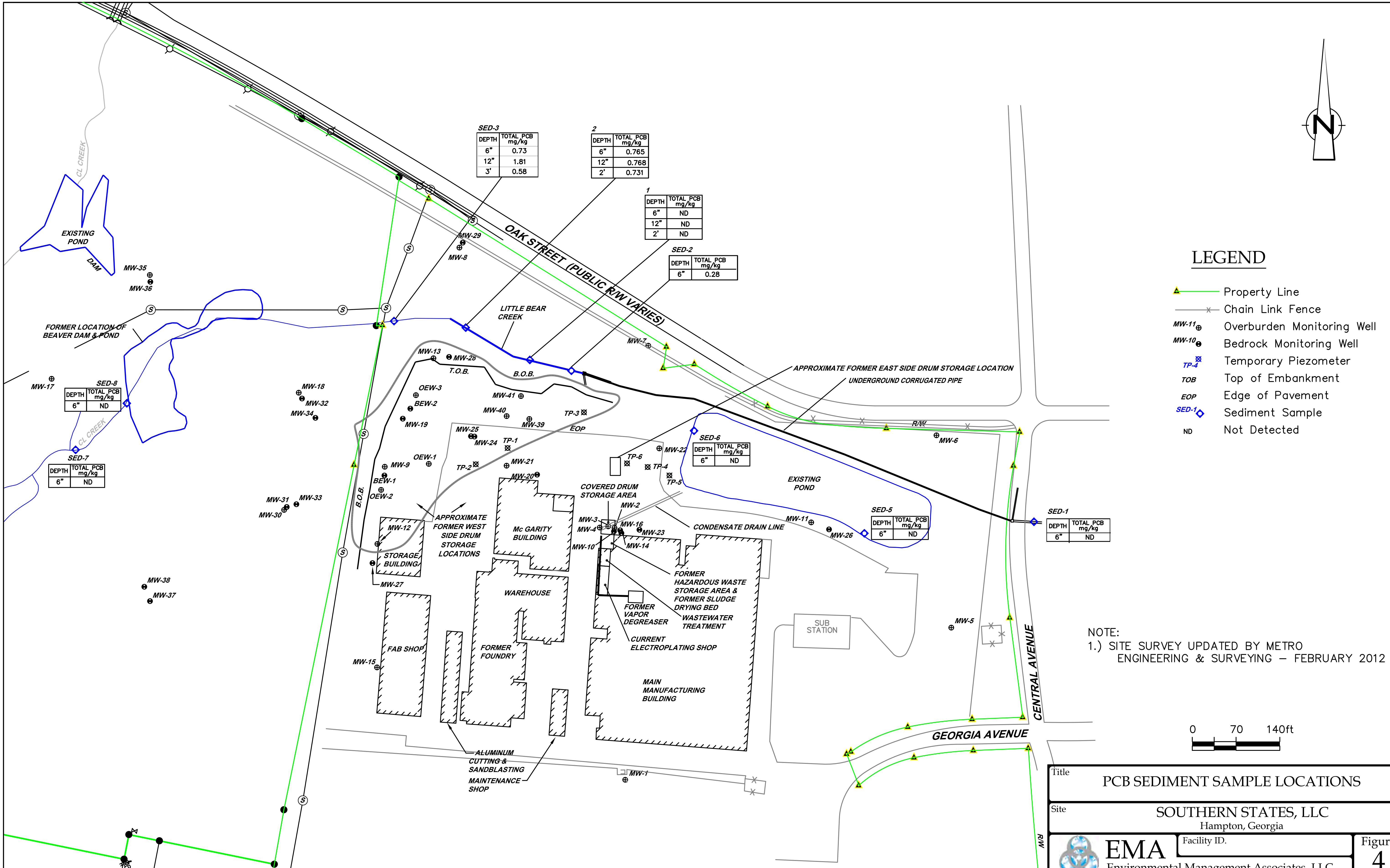
Title PCB SOIL SAMPLES - OPERATIONAL AREAS

Site SOUTHERN STATES, LLC
Hampton, Georgia

EMA
Environmental Management Associates, LLC

Facility ID.

Figure 3



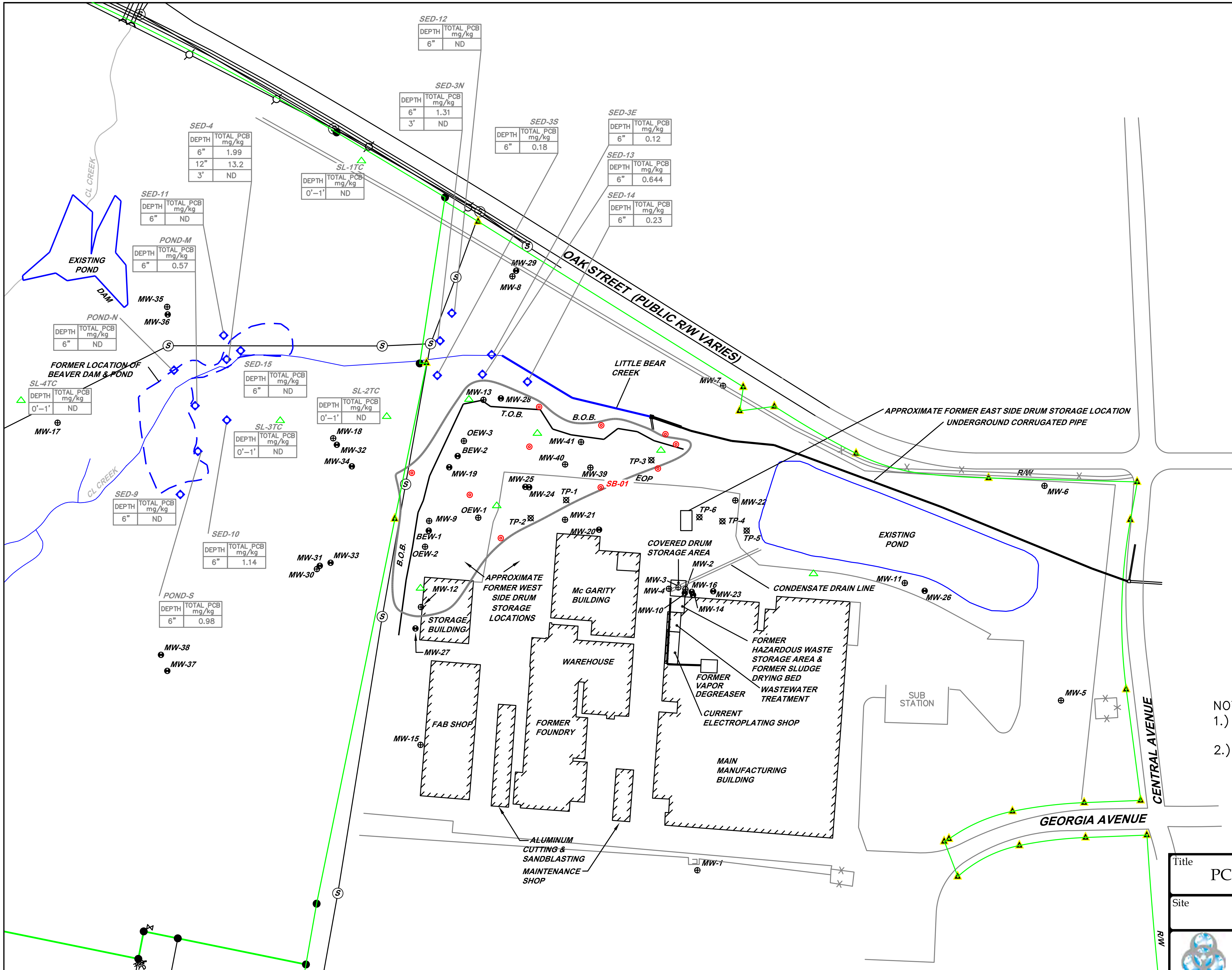
Title
PCB SEDIMENT SAMPLE LOCATIONS

Site
SOUTHERN STATES, LLC
Hampton, Georgia

EMA
Environmental Management Associates, LLC

Facility ID.

Figure
4



LEGEND

	Property Line
	Chain Link Fence
MW-11	Overburden Monitoring Well
MW-10	Bedrock Monitoring Well
TP-4	Temporary Piezometer
TOB	Top of Embankment
EOP	Edge of Pavement
SED-1	Soil Sample
SL-1TC	Historic Soil Borings
SB-01	EMA Soil Borings, April 2014
0.12	Soil Sample Concentration in mg/kg
ND	Not Detected

NOTES:
1.) SITE SURVEY UPDATED BY METRO ENGINEERING & SURVEYING – FEBRUARY 2012
2.) BOLD FONT INDICATES CONCENTRATION EXCEEDING TYPE 1 RRS.

0 70 140ft

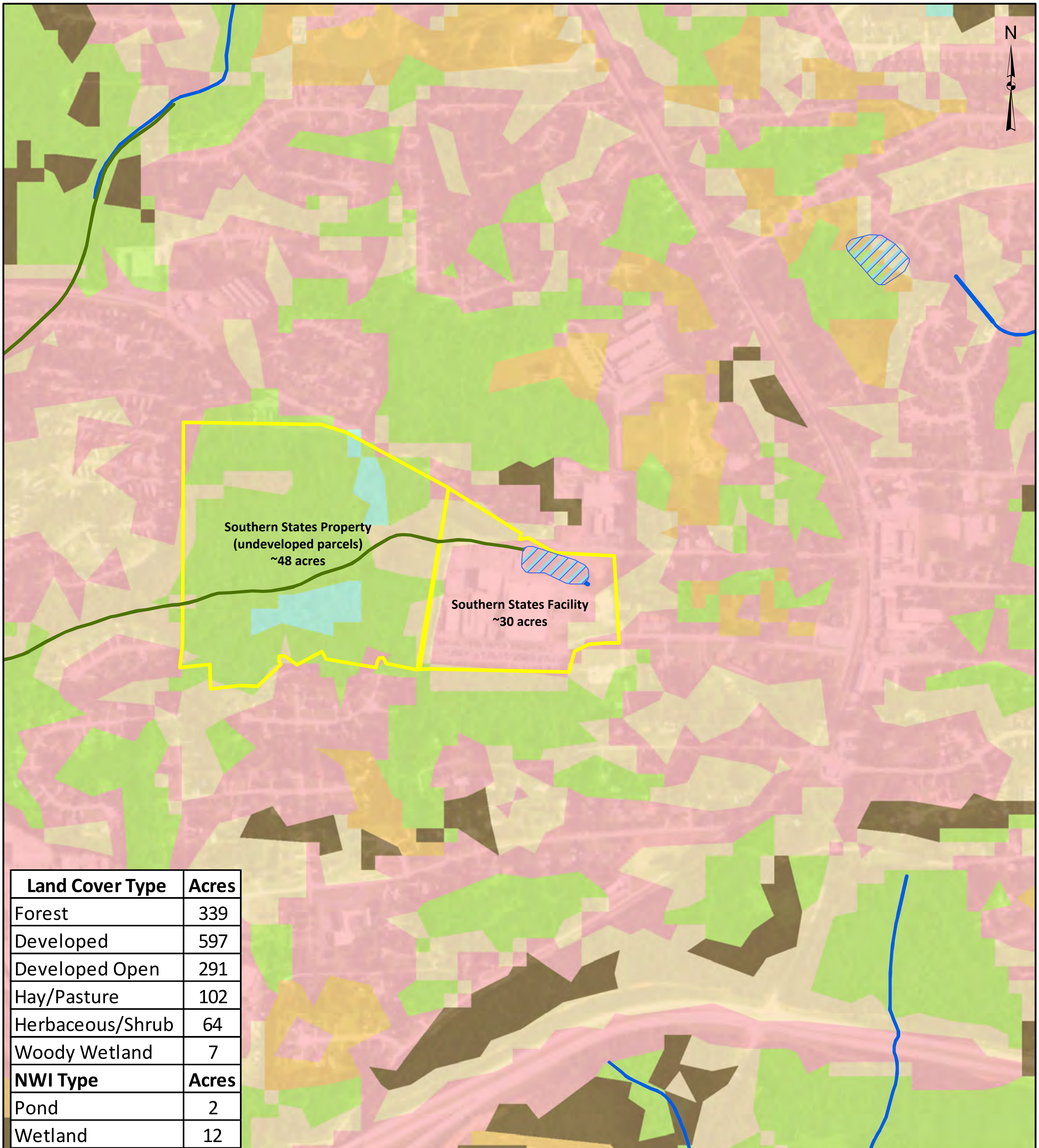
Title
PCB SOIL SAMPLES INCLUDED IN SLERA

Site
SOUTHERN STATES, LLC
Hampton, Georgia

EMA
Environmental Management Associates, LLC

Facility ID.

Figure
5



Land Cover Type	Acres
Forest	339
Developed	597
Developed Open	291
Hay/Pasture	102
Herbaceous/Shrub	64
Woody Wetland	7
NWI Type	**Acres**
Pond	2
Wetland	12

Site

NWI

Freshwater Wetland

Freshwater Pond

Riverine

Land Cover

Developed

Developed Open Space

Forest

Hay/Pasture

Herbaceous/Shrub

Woody Wetlands

Source:
Arieal: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Land Cover: The National Land Cover Database 2011
NWI: U.S. Fish & Wildlife Service National Wetland Inventory

0 1,160 Feet

Near Site Cover Types and Land Use

SOUTHERN STATES, LLC
Hampton, Georgia

Geosyntec
consultants

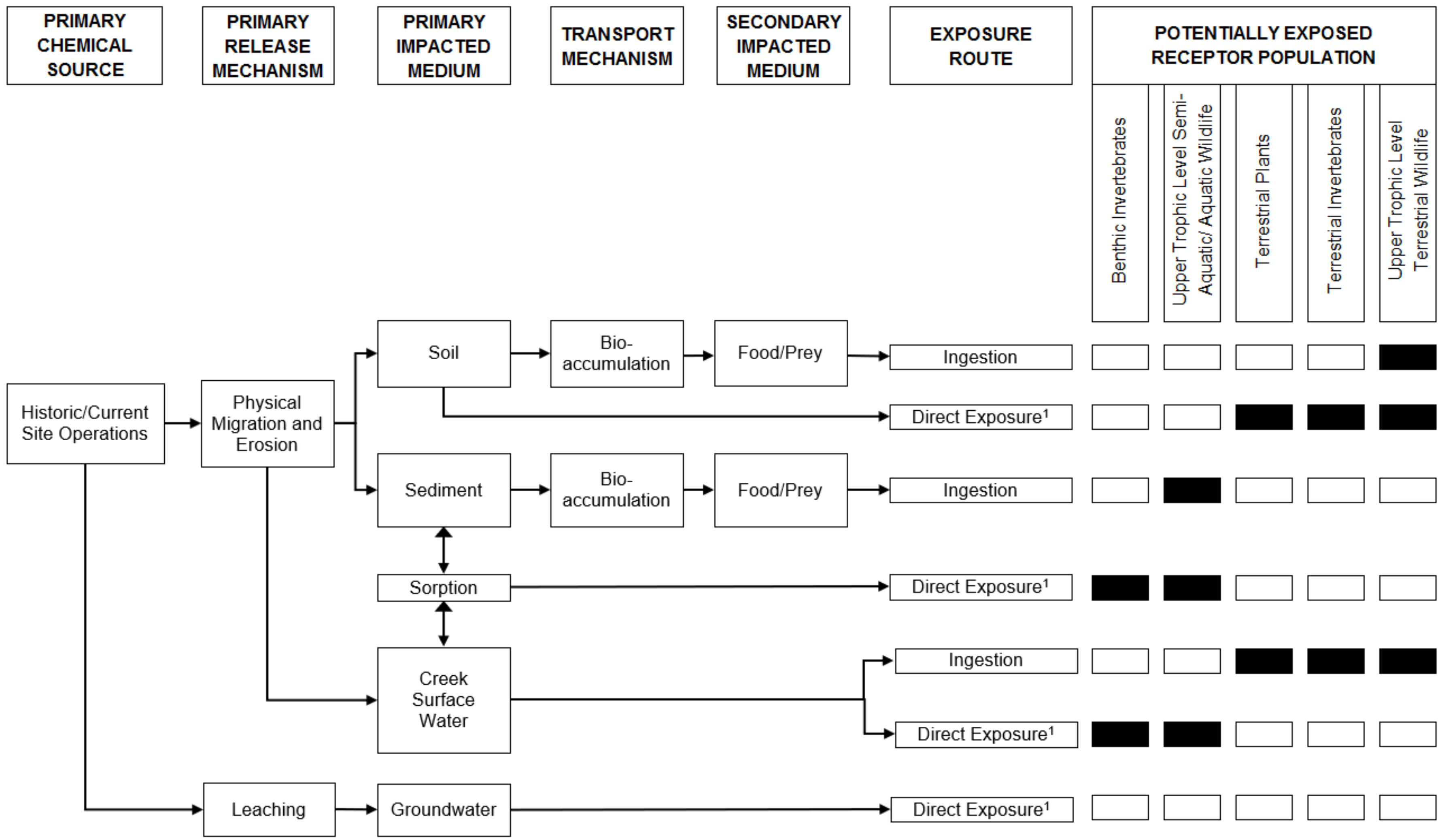
Figure

6

Kennesaw, Georgia

October 2017

\\Aro-01\prj1$\S\Southern States\GIS\mxd\Fig4_Landuse.mxd 10/23/2017 10:28:37 AM



NOTES:

■ Potentially complete exposure pathway for quantitative evaluation

□ Incomplete or insignificant exposure pathway (not quantitatively evaluated)

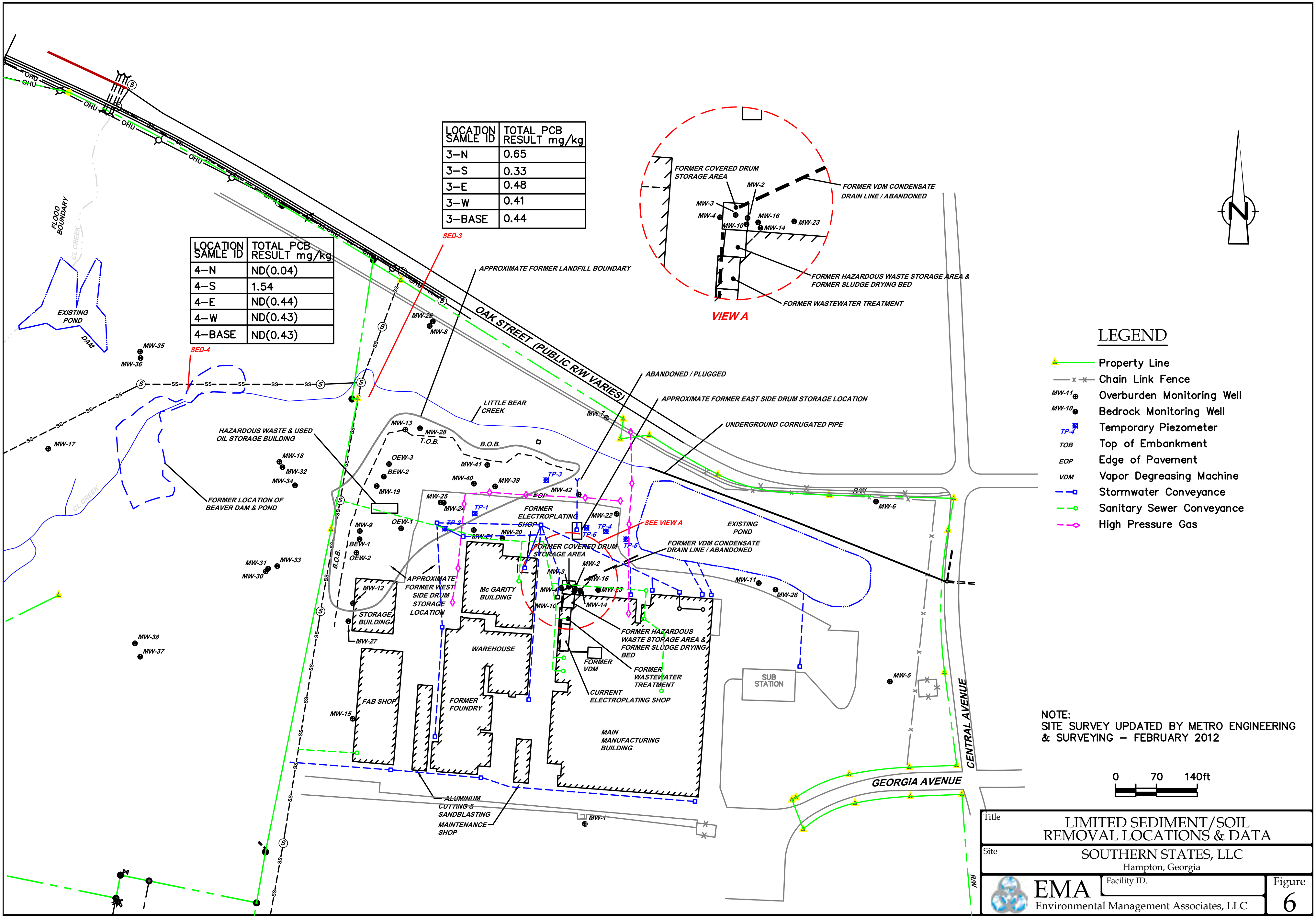
Ecological Conceptual Site Model

SOUTHERN STATES, LLC
Hampton, Georgia

Geosyntec consultants
Atlanta, Georgia

October 2017

Figure 7



LOCATION SAMLE ID	TOTAL PCB RESULT mg/kg
3–N	0.65
3–S	0.33
3–E	0.48
3–W	0.41
3–BASE	0.44

LOCATION SAMLE ID	TOTAL PCB RESULT mg/kg
4–N	ND(0.04)
4–S	1.54
4–E	ND(0.44)
4–W	ND(0.43)
4–BASE	ND(0.43)

LEGEND

- Property Line
- Chain Link Fence
- MW-11 Overburden Monitoring Well
- MW-10 Bedrock Monitoring Well
- TP-4 Temporary Piezometer
- TOB Top of Embankment
- EOP Edge of Pavement
- VDM Vapor Degreasing Machine
- Stormwater Conveyance
- Sanitary Sewer Conveyance
- High Pressure Gas

NOTE:
SITE SURVEY UPDATED BY METRO ENGINEERING & SURVEYING – FEBRUARY 2012

Title: LIMITED SEDIMENT/SOIL REMOVAL LOCATIONS & DATA

Site: SOUTHERN STATES, LLC
Hampton, Georgia

EMA
Environmental Management Associates, LLC

Facility ID.

Figure 6

ATTACHMENT A

Ecological Characterization

CHECKLIST FOR ECOLOGICAL ASSESSMENT

I. SITE DESCRIPTION

1. **Site Name:** Southern States, LLC (SS)
   Location: 30 Georgia Ave, Hampton, GA
   County: Henry
   City: Hampton (~30 miles sout of Atlanta)
   State: GA

2. **Latitude/Longitude:** 33° 23′ 10″ N, 84° 17′ 22″ W

3. **What is the approximate area of the site?** The SS site is 34.8 acres; this Ecological Assessment evaluated the site and the 0.5 mile radius surrounding the site.

4. **Is this the first site visit? If no, attach trip report of previous site visit(s) if available. Date(s) of previous site visits.** First ecological characterization visit

5. **Please attach to the checklist USGS topographic maps of the site, if available.** Not available

6. **Are aerial or other site photographs available? If yes, please attach any available photo(s) to the site map at the conclusion of this section.** Please see attached cover types map.

7. **The land use on the site is:**
   ________ **% Urban**
   ________ **% Rural**
   ________ **% Residential**
   __100__ **% Industrial ___%light _X__%heavy** (mowed turfgrass, urban/developed)
   ________ **% Agricultural crops**_____________________________________
   ________ **% Recreational**
   ________ **% Undisturbed**
   ________ **% Other (describe)**

   The area surrounding the site is (0.5 mile radius):
   ________**% Urban**
   ________**% Rural**
   ___70_ _**% Residential**
   __10____**% Industrial __X__%light ___%heavy** (mowed turfgrass, urban/developed)
   ________**% Agricultural crops**_____________________________________
   ________**% Recreational**
   __20____**% Undisturbed**
   ________**% Other (describe)** (disturbed vegetation, drainage systems, borrow pits)

8. **Has any movement of soil taken place at the site? If yes, please identify the most likely cause of this disturbance.**
________ Agricultural Use
________ Heavy Equipment
________ Mining
________ Natural Events
________ Erosion
________ Other

Please describe ____

9. **Do any potentially sensitive environmental areas exist adjacent to or in proximity to the site, e.g., Federal and State parks, National and State monuments, wetlands, prairie potholes?** The Federal Aviation Administration holds an easement along the western edge of the facility. Little Bear Creek runs to the north of the property, across the easement, through an old beaver pond, and into the forested area to the west.

10. **What type of facility is located at the site?** Various building and storage areas where Southern States operates a manufacturing facility where it produces high voltage electrical switches and fuses for the power industry

11. **What are the suspected contaminants of concern at the site? If known, what are the maximum concentration levels?** Please see attached report.

12. **Check any potential routes of off-site migration of contaminants observed at the site.**

Swales X	**Depressions**	**Drainage ditches** X
Run Offs X	**Windblown particles** X	**Vehicular traffic**

13. **If known, what is the approximate depth to the water table?** 7-12 ft bgs.

14. **Is the direction of surface runoff apparent from the site observations? If yes, to which of the following does the runoff discharge? Indicate all that apply.**
Surface water X **Groundwater** X **Sewer** **Collection impoundment**

15. **Is there a navigable waterbody or tributary to a navigable waterbody?** Little Bear Creek

16. **Is there a waterbody anywhere on or in the vicinity of the site? If yes, also complete Section III: Aquatic Habitat Checklist - Non-Flowing Systems and/or Section IV: Aquatic Habitat Checklist - Flowing Systems.** Yes

17. **Is there evidence of flooding? Wetland and flood plains are not always obvious; do not answer "no" without confirming information. If yes, complete Section V: Wetland Habitat Checklist.** Yes

18. **If a field guide was used to aide any of the identification, please provide a reference. Also estimate the time spent identifying fauna. [Use a blank sheet if additional space is needed for text.]** Site visit lasted about 5 hours, fauna and fauna were identified whenever observed during this time. Used:
– Field Guide to the Birds (Eastern Region - North America), National Audubon Society, 1994.
– Field Guide to the Southeastern States, Alden and Nelson, 1999.
– Field Guide to North American Trees (Eastern Region), National Audubon Society, 1996.
– Field Guide to Mammals, National Audubon Society, 1996.

19. Are any threatened and/or endangered species (plant or animal) known to inhabit the area of the site? If yes, you are required to verify this information with the U.S. Fish and Wildlife Service. If species' identities are known, please list them next.

No. No species were reported on the Hampton, GA SE quarter quad. Henry County includes several listed species. Habitat for these species in unlikely to be found at the site:

<u>ANIMALS</u>

- Cyprinella xaenura (Altamaha Shiner), Habitat: Medium-sized to large streams in runs or pools over sand to gravel substrate
- Elimia mutabilis (Oak Elimia), Habitat: shoals in medium sized rivers
- Haliaeetus leucocephalus (Bald Eagle), Habitat: Edges of lakes and large rivers; seacoasts
- Lampropeltis calligaster rhombomaculata (Mole Kingsnake), Habitat: Georgia habitat information not available
- Micropterus cataractae (Shoal Bass), Habitat: Large river, shoal and fluvial specialist
- Tyto alba (Barn owl), Habitat: Nests in large hollow trees or old buildings (paticularly cement silos) in areas with extensive pasture or grassland or other open habitats such as marsh.

<u>PLANTS</u>

- Amphianthus pusillus (Pool Sprite, Snorkelwort), Habitat: Vernal pools on granite outcrops
- Cypripedium acaule (Pink Ladyslipper), Habitat: Upland oak-hickory-pine forests; piney woods
- Sedum pusillum (Granite Stonecrop, Puck's Orpine), Habitat: Granite outcrops, often in mats of Hedwigia moss under Juniperus virginiana

20. Record weather conditions at the time this checklist was prepared:

Date: 15 February 2017
Temperature 50s **Normal daily high temperature** 56
Wind (direction/speed) none
Precipitation (rain, snow) early morning thunderstorms
Cloud cover Mostly cloudy

SUMMARY OF OBSERVATIONS AND SITE SETTING

See Section II and III of Ecological Characterization report

Completed By: Cristin Krachon **Affiliation** Geosyntec Consultants
Additional Preparers
Site Manager Chris Saranko, Geosyntec Consultants
Date March 1, 2017

II. TERRESTRIAL HABITAT CHECKLIST

IIA. WOODED

1. **Are there any wooded areas at the site? If no, go to Section IIB: Shrub/Scrub** Yes

2. **What percentage or area of the site is wooded? (% acres). Indicate the wooded area on the site map which is attached to a copy of this checklist. Please identify what information was used to determine the wooded area of the site.** Wooded areas are present at the site. Precise estimates were not prepared but are easily noted on the aerial photograph.


3. **What is the dominant type of vegetation in the wooded area? (Circle one: Evergreen/Deciduous/Mixed) Provide a photograph if available.**
Dominant plant, if known: Majority of wooded habitats are hard wood/pine mesic forests (magnolia above)

4. **What is the predominant size of the trees at the site? Use diameter at breast height.**
0-6 in **6-12 in** X **>12 in**

5. **Specify type of understory present, if known. Provide a photograph, if available.** Difficult to identify in winter.

IIB SHRUB/SCRUB

1. **Is shrub/scrub vegetation present at the site? If no, go to Section IIC: Open Field.** Yes

2. **What Percentage of the site is covered by shrub/scrub vegetation? (% acres). Indicate the areas of shrub/scrub on the site map. Please identify what information was used to determine this area.** Scrub/Shrub habitat areas are present at the site. Precise estimates were not prepared but were found a long the fringe of Little Bear Creek as well as the former beaver pond area.

3. **What is the dominant type of shrub/scrub vegetation, if known? Provide a photograph, if available.** Disturbed shrub vegetation included grasses,.

4. **What is the approximate average height of the scrub/shrub vegetation?**
   0-2 ft. **2-5 ft.** X **>5 ft.**

5. **Based on site observations, how dense is the scrub/shrub vegetation?**
   Dense X **Patchy** **Sparse**

IIC. OPEN FIELD

1. **Are there open (bare, barren) field areas present at the site? If yes, please indicate the type below** Yes
   Prairie/plains **Savannah** **Old field** **Other** X **(**mowed turfgrass)

2. **What percentage of the site is open field? (% acres). Indicate the open fields on the site map.** With the exception of the concrete/paved areas and a few shrubs, the entire site is open field. Within the 0.5 mile radius study area, 9.9% (48.7 acres) of the area is vegetated by open fields. Information was determined by site visits and calculation from a map digitized following site visits.

3. **What is/are the dominant plant(s)? Provide a photograph, if available.**
   Various weed/grasses in the FAA easement.

4. **What is the approximate average height of the dominant plant?** 3 inches

5. **Describe the vegetation cover:** **Dense** **Sparse** **Patchy**
varies considerably


IID. MISCELLANEOUS

1. **Are other types of terrestrial habitats present at the site, other that woods, scrub/shrub and open field? If yes, identify and describe them below.** No

2. **Describe the terrestrial miscellaneous habitat(s) and identify these area(s) on the site map.**

3. **What observations, if any, were made at the site regarding the presence and/or absence of insects, fish, birds, mammals, etc.?** Observations of wildlife during the site visit were limited to squirrels and a hawk. Site personell indicated other wildlife observed includes hawks, raccoons, muskrats, a fox, snakes. Minnow sand tadpoles have been observed in Little Bear Creek.

4. **Review the questions in Section I to determine if any additional habitat checklists should be completed for this site.**

IIIA. AQUATIC HABITAT CHECKLIST - NON-FLOWING SYSTEMS

Note: Aquatic systems are often associated with wetland habitats. Please refer to Section V, Wetland Habitat Checklist.

1. **What type of open-water, non-flowing system is present at the site?** Intermittent creek. It is "usually" flowing, but does dry up from time to time.
   Natural (pond, lake) Former beaver pond area
   Artificially created (lagoon, reservoir, canal, impoundment) Large ponded area on the NE part of site was not observed.

2. **If known, what is the name(s) of the waterbody(ies) on or adjacent to the site?** Little Bear Creek

3. **If a waterbody is present, what are its known uses (e.g.: recreation, navigation, etc.)?** No known uses for intermittent stream.

4. **What is the approximate size of the waterbody(ies)?** **acre(s).** n/a

5. **Is any aquatic vegetation present? If yes, identify the type of vegetation present if know.** Please see attached species list.

Emergent X **Submergent** X **Floating**

6. **If known, what is the depth of the water?**

Less than 6 inches with some deeper spots perhaps 2-ft.

7. **What is the general composition of the substrate? Check all that apply:**

Bedrock	**Sand (coarse)**	**Muck (fine/black)** X
Boulder (>10 in)	**Silt (fine)**	**Debris** X
Cobble (2.5-10 in)	**Marl (shells)**	**Detritus** X
Gravel (0.1-2.5 in)	**Clay (slick)**	**Concrete**
Other (specify)		

8. **What is the source of water in the waterbody?**

River/Stream/Creek X	**Groundwater**	**other (specify)**
Industrial discharge	**Surface runoff** X	

9. **Is there a discharge from the site to the waterbody? If yes, please describe this discharge and its path.** Yes, surface water and runoff from the site discharge to the creek and beaver pond area.

10. **Is there a discharge from the waterbody? If yes, and the information is available, identify from the list below the environment into which the waterbody discharges.**

River/Stream/Creek	**Yes**	**onsite**	**offsite X**	**Distance**
Groundwater		**onsite**	**offsite**	
Wetland		**onsite**	**offsite**	**Distance**
Impoundment		**onsite**	**offsite**	

11. **Identify any field measurements and observations of water quality that were made. For those parameters for which data were collected provide the measurement and the units of measure below:** None

Area
Depth (average)
Temperature (depth of the water at which the reading was taken)
pH
Dissolved oxygen
Salinity

Turbidity (clear, slightly turbid, turbid, opaque) (Secchi disk depth)
other (specify)

12. **Describe observed color and area of coloration.** Generally clear

13. **Mark the open-water, non-flowing system on the site map attached to this checklist.**

14. **What observations, if any, were made at the waterbody regarding the presence and/or absence of benthic macroinvertebrates, fish, birds, mammals, etc.?** None.

AQUATIC HABITAT CHECKLIST - FLOWING SYSTEMS

Note: Aquatic systems are often associated with wetland habitats. Please refer to Section V, Wetland Habitat Checklist.

1. **What type(s) of flowing water system(s) is (are) present at the site?**

River	**Stream**	**Creek**
Dry wash	**Arroyo**	**Brook**
Artificially created X (ditch, canal, etc.)	**Intermittent Stream** X	**Channeling**
	Other (specify)	

2. **If known, what is the name of the waterbody?** Little Bear Creek

3. **For natural systems, are there any indicators of physical alteration (e.g., channeling, debris, etc.)? If yes, please describe indicators that were observed.** Some of swales and ditches are man-made and function to transport stormwater runoff.

4. **What is the general composition of the substrate? Check all that apply.**

Bedrock	**Sand (coarse)** X	**Muck (fine/black)**
Boulder (>10 in)	**Silt (fine)**	**Debris** X
Cobble (2.5-10 in)	**Marl (shells)**	**Detritus** X
Gravel (0.1-2.5 in)	**Clay (slick)**	**Concrete**
Other (specify)		

5. **What is the condition of the bank(e.g., height, slope, extent of vegetative cover)?** Ditch and swale banks are generally gradual and well-vegetated with wetland plants, or weedy species.

6. **Is the system influenced by tides? What information was used to make this determination?** No.

7. **Is the flow intermittent? If yes, please note the information that was used in making this determination.** It flows most of the year but has been know to dry up "from time to time" in the summer.

8. **Is there a discharge from the site to the waterbody? If yes, please describe the discharge and its path.** Stormwater runoff discharges into ditches and swales.

9. **Is there a discharge from the waterbody? If yes, and the information is available, please identify what waterbody discharges to and whether the discharge is on site or off site.** The creek runs through the former beaver pond area and discharges off site.

10. **Identify any field measurements and observations of water quality that were made. For those parameters for which data were collected, provide the measurement and the units of**

measure in the appropriate space below: None
Width (ft.)
Depth (ft.)
Velocity)specific units)
Temperature (depth of the water at which the reading was taken)
pH
Dissolved oxygen
Salinity
Turbidity (clear, slightly turbid, turbid, opaque) (Secchi disk depth)
other (specify)

11. **Describe observed color and area of coloration.** Clear.

12. **Is any aquatic vegetation present? If yes, please identify the type of vegetation present, if known.**
Emergent X **Subemergent** X **Floating**


13. **Mark the flowing water system on the attached site map.** Please see attached cover types map.

15. **What observations were made at the waterbody regarding the presence and/or absence of benthic macroinvertebrates, fish, birds, mammals, etc.?** No fish or invertebrates were observed.

ATTACHMENT A

ProUCL Files

Table B-1
PCB Data for EPC Calculations in ProUCL
Southern States Site, Hampton, Georgia

Medium	Sample ID	PCB	d_PCB	In SLERA?
SED	SED-1	0.04	0	YES
SED	1	0.038	0	YES
SED	1	0.038	0	YES
SED	SED-2	0.28	1	YES
SED	2	0.765	1	YES
SED	2	0.768	1	YES
SED	SED-5	0.04	0	YES
SED	SED-6	0.04	0	YES
SED	SED-7	0.046	0	YES
SED	SED-8	0.04	0	YES
SOIL	SL-1TC	0.04	0	YES
SOIL	SL-2TC	0.04	0	YES
SOIL	SL-3TC	0.04	0	YES
SOIL	SL-4TC	0.04	0	YES
SOIL	SED-3E	0.12	1	YES
SOIL	SED-3S	0.018	1	YES
SOIL	SED-3N	1.31	1	YES
SOIL	SED-9	0.052	0	YES
SOIL	SED-10	1.14	1	YES
SOIL	SED-11	0.04	0	YES
SOIL	SED-12	0.042	0	YES
SOIL	SED-13	0.644	1	YES
SOIL	SED-14	0.23	1	YES
SOIL	POND-N	0.05	0	YES
SOIL	POND-M	0.57	1	YES
SOIL	POND-S	0.98	1	YES

Table B-2
ProUCL Input Datasets
Southern States Site, Hampton, Georgia

Soil/SedCominedPCBs	d_Soil/SedCominedPCBs	SedimentPCBs	d_SedimentPCBs	SoilPCBs	d_SoilPCBs
0.04	0	0.04	0	0.04	0
0.038	0	0.038	0	0.04	0
0.038	0	0.038	0	0.04	0
0.28	1	0.28	1	0.04	0
0.765	1	0.765	1	0.12	1
0.768	1	0.768	1	0.018	1
0.04	0	0.04	0	1.31	1
0.04	0	0.04	0	0.052	0
0.046	0	0.046	0	1.14	1
0.04	0	0.04	0	0.04	0
0.04	0			0.042	0
0.04	0			0.644	1
0.04	0			0.23	1
0.04	0			0.05	0
0.12	1			0.57	1
0.018	1			0.98	1
1.31	1				
0.052	0				
1.14	1				
0.04	0				
0.042	0				
0.644	1				
0.23	1				
0.05	0				
0.57	1				
0.98	1				

Table B-3
ProUCL Output
Southern States Site, Hampton, Georgia

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.110/26/2017 8:53:47 PM
From File	Southern States UCL Data_a.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Soil/SedCominedPCBs

General Statistics

Total Number of Observations	26	Number of Distinct Observations	17
Number of Detects	11	Number of Non-Detects	15
Number of Distinct Detects	11	Number of Distinct Non-Detects	6
Minimum Detect	0.018	Minimum Non-Detect	0.038
Maximum Detect	1.31	Maximum Non-Detect	0.052
Variance Detects	0.18	Percent Non-Detects	57.69%
Mean Detects	0.62	SD Detects	0.425
Median Detects	0.644	CV Detects	0.684
Skewness Detects	0.124	Kurtosis Detects	-1.075
Mean of Logged Detects	-0.912	SD of Logged Detects	1.265

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.959	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.152	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.273	KM Standard Error of Mean	0.0817
KM SD	0.397	95% KM (BCA) UCL	0.412
95% KM (t) UCL	0.412	95% KM (Percentile Bootstrap) UCL	0.409
95% KM (z) UCL	0.407	95% KM Bootstrap t UCL	0.433
90% KM Chebyshev UCL	0.518	95% KM Chebyshev UCL	0.629
97.5% KM Chebyshev UCL	0.783	99% KM Chebyshev UCL	1.086

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.439	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.746	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.217	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.261	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.291	k star (bias corrected MLE)	1
Theta hat (MLE)	0.481	Theta star (bias corrected MLE)	0.621
nu hat (MLE)	28.4	nu star (bias corrected)	21.99
Mean (detects)	0.62		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.279
Maximum	1.31	Median	0.0297
SD	0.402	CV	1.44
k hat (MLE)	0.436	k star (bias corrected MLE)	0.411
Theta hat (MLE)	0.642	Theta star (bias corrected MLE)	0.68
nu hat (MLE)	22.65	nu star (bias corrected)	21.37
Adjusted Level of Significance (β)	0.0398		
Approximate Chi Square Value (21.37, α)	11.87	Adjusted Chi Square Value (21.37, β)	11.4
95% Gamma Approximate UCL (use when n>=50)	0.503	95% Gamma Adjusted UCL (use when n<50)	0.524

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.273	SD (KM)	0.397
Variance (KM)	0.158	SE of Mean (KM)	0.0817
k hat (KM)	0.472	k star (KM)	0.443
nu hat (KM)	24.52	nu star (KM)	23.03
theta hat (KM)	0.579	theta star (KM)	0.616
80% gamma percentile (KM)	0.445	90% gamma percentile (KM)	0.756
95% gamma percentile (KM)	1.094	99% gamma percentile (KM)	1.935

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (23.03, α)	13.11	Adjusted Chi Square Value (23.03, β)	12.62
95% Gamma Approximate KM-UCL (use when n>=50)	0.479	95% Gamma Adjusted KM-UCL (use when n<50)	0.498

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.828	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.245	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.284	Mean in Log Scale	-2.434
SD in Original Scale	0.398	SD in Log Scale	1.672
95% t UCL (assumes normality of ROS data)	0.418	95% Percentile Bootstrap UCL	0.409
95% BCA Bootstrap UCL	0.45	95% Bootstrap t UCL	0.467
95% H-UCL (Log ROS)	1.137		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.704	KM Geo Mean	0.067
KM SD (logged)	1.723	95% Critical H Value (KM-Log)	3.562
KM Standard Error of Mean (logged)	0.354	95% H-UCL (KM -Log)	1.009
KM SD (logged)	1.723	95% Critical H Value (KM-Log)	3.562
KM Standard Error of Mean (logged)	0.354		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.275	Mean in Log Scale	-2.621
SD in Original Scale	0.404	SD in Log Scale	1.695
95% t UCL (Assumes normality)	0.41	95% H-Stat UCL	1.007

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.412

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Sediment PCBs

General Statistics

Total Number of Observations	10	Number of Distinct Observations	6
Number of Detects	3	Number of Non-Detects	7
Number of Distinct Detects	3	Number of Distinct Non-Detects	3
Minimum Detect	0.28	Minimum Non-Detect	0.038
Maximum Detect	0.768	Maximum Non-Detect	0.046
Variance Detects	0.0789	Percent Non-Detects	70%
Mean Detects	0.604	SD Detects	0.281
Median Detects	0.765	CV Detects	0.465
Skewness Detects	-1.732	Kurtosis Detects	N/A
Mean of Logged Detects	-0.602	SD of Logged Detects	0.581

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.755	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.767	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.383	Lilliefors GOF Test
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.208	KM Standard Error of Mean	0.112
KM SD	0.288	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.413	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.392	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.543	95% KM Chebyshev UCL	0.695
97.5% KM Chebyshev UCL	0.905	99% KM Chebyshev UCL	1.319

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	5.264	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.115	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	31.59	nu star (bias corrected)	N/A
Mean (detects)	0.604		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.194
Maximum	0.768	Median	0.01
SD	0.313	CV	1.616
k hat (MLE)	0.415	k star (bias corrected MLE)	0.357
Theta hat (MLE)	0.467	Theta star (bias corrected MLE)	0.543
nu hat (MLE)	8.302	nu star (bias corrected)	7.145
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (7.14, α)	2.25	Adjusted Chi Square Value (7.14, β)	1.804
95% Gamma Approximate UCL (use when n>=50)	0.615	95% Gamma Adjusted UCL (use when n<50)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.208	SD (KM)	0.288
Variance (KM)	0.0831	SE of Mean (KM)	0.112
k hat (KM)	0.52	k star (KM)	0.431
nu hat (KM)	10.4	nu star (KM)	8.612
theta hat (KM)	0.4	theta star (KM)	0.483
80% gamma percentile (KM)	0.338	90% gamma percentile (KM)	0.579
95% gamma percentile (KM)	0.842	99% gamma percentile (KM)	1.497

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (8.61, α)	3.094	Adjusted Chi Square Value (8.61, β)	2.548
95% Gamma Approximate KM-UCL (use when n>=50)	0.579	95% Gamma Adjusted KM-UCL (use when n<50)	0.703

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.753	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.384	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.238	Mean in Log Scale	-2.037
SD in Original Scale	0.288	SD in Log Scale	1.129
95% t UCL (assumes normality of ROS data)	0.404	95% Percentile Bootstrap UCL	0.387
95% BCA Bootstrap UCL	0.438	95% Bootstrap t UCL	0.751
95% H-UCL (Log ROS)	0.879		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.47	KM Geo Mean	0.0846
KM SD (logged)	1.25	95% Critical H Value (KM-Log)	3.64
KM Standard Error of Mean (logged)	0.484	95% H-UCL (KM -Log)	0.843
KM SD (logged)	1.25	95% Critical H Value (KM-Log)	3.64
KM Standard Error of Mean (logged)	0.484		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.195	Mean in Log Scale	-2.915
SD in Original Scale	0.312	SD in Log Scale	1.621
95% t UCL (Assumes normality)	0.376	95% H-Stat UCL	2.277

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.413

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Soil PCBs

General Statistics

Total Number of Observations	16	Number of Distinct Observations	12
Number of Detects	8	Number of Non-Detects	8
Number of Distinct Detects	8	Number of Distinct Non-Detects	4
Minimum Detect	0.018	Minimum Non-Detect	0.04
Maximum Detect	1.31	Maximum Non-Detect	0.052
Variance Detects	0.235	Percent Non-Detects	50%
Mean Detects	0.627	SD Detects	0.485
Median Detects	0.607	CV Detects	0.773
Skewness Detects	0.136	Kurtosis Detects	-1.596
Mean of Logged Detects	-1.029	SD of Logged Detects	1.46

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.168	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.322	KM Standard Error of Mean	0.118
KM SD	0.442	95% KM (BCA) UCL	0.536
95% KM (t) UCL	0.529	95% KM (Percentile Bootstrap) UCL	0.521
95% KM (z) UCL	0.517	95% KM Bootstrap t UCL	0.574
90% KM Chebyshev UCL	0.677	95% KM Chebyshev UCL	0.837
97.5% KM Chebyshev UCL	1.06	99% KM Chebyshev UCL	1.497

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.362	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.735	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.22	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.301	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.026	k star (bias corrected MLE)	0.725
Theta hat (MLE)	0.611	Theta star (bias corrected MLE)	0.865
nu hat (MLE)	16.41	nu star (bias corrected)	11.59
Mean (detects)	0.627		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.325
Maximum	1.31	Median	0.0633
SD	0.455	CV	1.403
k hat (MLE)	0.426	k star (bias corrected MLE)	0.388
Theta hat (MLE)	0.761	Theta star (bias corrected MLE)	0.836
nu hat (MLE)	13.65	nu star (bias corrected)	12.42
Adjusted Level of Significance (β)	0.0335		
Approximate Chi Square Value (12.42, α)	5.505	Adjusted Chi Square Value (12.42, β)	4.99
95% Gamma Approximate UCL (use when n>=50)	0.732	95% Gamma Adjusted UCL (use when n<50)	0.808

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.322	SD (KM)	0.442
Variance (KM)	0.195	SE of Mean (KM)	0.118
k hat (KM)	0.532	k star (KM)	0.474
nu hat (KM)	17.02	nu star (KM)	15.16
theta hat (KM)	0.606	theta star (KM)	0.68
80% gamma percentile (KM)	0.528	90% gamma percentile (KM)	0.882
95% gamma percentile (KM)	1.262	99% gamma percentile (KM)	2.202

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (15.16, α)	7.373	Adjusted Chi Square Value (15.16, β)	6.762
95% Gamma Approximate KM-UCL (use when n>=50)	0.663	95% Gamma Adjusted KM-UCL (use when n<50)	0.722

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.852	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.25	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.328	Mean in Log Scale	-2.388
SD in Original Scale	0.452	SD in Log Scale	1.803
95% t UCL (assumes normality of ROS data)	0.526	95% Percentile Bootstrap UCL	0.517
95% BCA Bootstrap UCL	0.551	95% Bootstrap t UCL	0.575
95% H-UCL (Log ROS)	3.143		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.523	KM Geo Mean	0.0802
KM SD (logged)	1.779	95% Critical H Value (KM-Log)	4.055
KM Standard Error of Mean (logged)	0.476	95% H-UCL (KM -Log)	2.517
KM SD (logged)	1.779	95% Critical H Value (KM-Log)	4.055
KM Standard Error of Mean (logged)	0.476		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.324	Mean in Log Scale	-2.437
SD in Original Scale	0.455	SD in Log Scale	1.765
95% t UCL (Assumes normality)	0.523	95% H-Stat UCL	2.606

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.529

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

APPENDIX F

UPDATED MILESTONE SCHEDULE

MILESTONE SCHEDULE
SOUTHERN STATES, LLC
30 GEORGIA AVENUE
HAMPTON, GEORGIA

First Year - 2015

	April 2015				May 2015				June 2015				July 2015				August 2015				September 2015				October 2015				November 2015				December 2015				January 2016				February 2016				March 2016			
Month After Enrollment				0				1				2				3				4				5				6				7				8				9				10				11
Corrective Action Activity	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*
VRPAP Approval		√																																														
ISCO injection (Dec 2015 / Jan 2016 - split event)																																																
Groundwater Sampling																																																
Semiannual Progress Report																										√																						

Second Year - 2016 / Third Year - 2017

	April 2016				May 2016				June 2016				July 2016				August 2016				September 2016				October 2016				November 2016				December 2016				January 2017				February 2017				March 2017			
Month After Enrollment				12				13				14				15				16				17				18				19				20				21				22				23
Corrective Action Activity	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*
Semi-Annual Groundwater Sampling																																																
Groundwater Modeling /Cleanup goals																																																
Semiannual Progress Reports		√																								√																						

Third Year - 2017 / Fourth Year - 2018

	April 2017				May 2017				June 2017				July 2017				August 2017				September 2017				October 2017				November 2017				December 2017				January 2018				February 2018				March 2018			
Month After Enrollment				24				25				26				27				28				29				30				31				32				33				34				35
Corrective Action Activity	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*
Semi-Annual Groundwater Sampling (MNA)																																																
Updated CSM		√																																														
Ecological Risk Assessment Report																																																
Limited Soil Removal (SED-3 & SED-4 location)																																																
Limited Capping																																																
Semiannual Progress Reports		√																								√																						

Fourth Year - 2018 / Fifth Year - 2019

	April 2019				May 2019				June 2019				July 2019				August 2019				September 2019				October 2019				November 2019				December 2019				January 2020				February 2020				March 2020			
Month After Enrollment				36				37				38				39				40				41				42				43				44				45				46				47
Corrective Action Activity	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*
Semi-Annual Groundwater Sampling (MNA)																																																
Updated CSM		√																																														
Ecological Risk Assessment Report																																																
Limited Soil Removal (SED-3 & SED-4 location)																																																
Limited Capping																																																
Semiannual Progress Reports		√																								√																						
Voluntary Compliance Status Report*																																																

* - A VCSR will be submitted within 60 months of enrollment or May 2021.

APPENDIX G

SUMMARY OF PROFESSIONAL GEOLOGIST EFFORT

PG OVERSIGHT SUMMARY
SOUTHERN STATES, LLC
HAMPTON, GEORGIA

	Units	Unit Cost	
PG Summary Time	Hours	$140	Sub-total
4/16/17 – 5/31/17	0	$140	$0
6/1/17 - 6/30/17	10	$140	$1,400
7/1/17 - 7/31/17	10	$140	$1,400
8/1/17 - 8/31/17	0	$140	$0
9/1/17 - 9/30/17	30	$140	$4,200
10/1/17 – 10/15/17	30	$140	$4,200