January 15, 2013

Mr. Lucas Berresford
Project Manager, State Remediation Section
Division of Site Assessment and Remediation
Bureau of Land and Waste Management
SCDHEC
2600 Bull Street
Columbia, Sc 29201

RE: Final Engineering Evaluation/Cost Analysis (EE/CA)
Congaree River Sediments
Columbia, South Carolina

Dear Mr. Berresford:

Please find enclosed one hardcopy and one CD of the Final Engineering Evaluation/Cost Analysis (EE/CA) for the Congaree River Sediments project located in Columbia, South Carolina. This Final EE/CA was prepared by South Carolina Electric and Gas Company (SCE&G) to evaluate potential options to address environmental impacts to a stretch of the Congaree River located in Columbia, South Carolina.

The Final EE/CA was revised based on SCDHEC comments to the Draft EE/CA received on December 17, 2012. The final EE/CA discusses the existing impacts and provides an evaluation of potential options using various criteria. Four alternatives were evaluated based on seven criteria (compliance with ARARs, protection of human health and the environment, short-term and long-term-effectiveness, reduction of toxicity, mobility or volume, implementability and cost). In summary, there exists sufficient information and data to provide justification to conduct a response action or non-time critical removal action. Appropriate actions may include those that eliminate pathway exposure (e.g., capping) or source removal (e.g., physical removal) or a combination thereof.

Alternative 4, Removal of Impacted Sediment with Off-Site Disposal has the greatest potential for achieving the remedial objectives, although at the highest capital cost. Additionally, Alternative 4 would likely be the most effective option, but also the most difficult to implement.

Should you have any questions or require additional information, please contact me at 919-819-2748. We would welcome an opportunity to discuss this report in further detail at your convenience. Thank you for your assistance with this project.

Sincerely,

Andrew R. Cantrell FOR

Robert M. Apple
Remediation Project Manager

cc: T. Effinger - SCANA (w/o enclosure)
R. Contrael - MTR

MTR
MANAGEMENT AND TECHNICAL RESOURCES, INC.

FINAL
ENGINEERING EVALUATION/COST ANALYSIS (EE/CA)

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

January 2013

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, South Carolina 29033

Prepared by:

Management and Technical Resources, Inc.

1600 COMMERCE CIRCLE • TRAFFORD, PA 15085-2423 PHONE (412) 829-9650 • FAX (412) 349-0350

EXECUTIVE SUMMARY

Project Background

This Engineering Evaluation/Cost Analysis (EE/CA) was prepared by South Carolina Electric and Gas Company (SCE&G) to evaluate potential options to address environmental impacts to a stretch of the Congaree River located in Columbia, South Carolina, as shown on Figure 1. The site, also referred to as the "project area", begins directly south of the Gervais Street Bridge, extends approximately 200-300 feet into the river from the eastern shoreline and approximately 2,000 feet downriver, towards the Blossom Street Bridge.

In June 2010, the occurrence of a tar-like material (TLM) within the Congaree River was reported to the South Carolina Department of Health and Environmental Control (SCDHEC). Three sediment samples were collected by SCDHEC at the approximate locations shown on Figure 2. Preliminary testing conducted on the material by SCDHEC and SCE&G indicated that the material may be attributable to the Huger Street former Manufactured Gas Plant (MGP) that was operated by predecessor companies of SCE&G beginning in the early 1900s and ending in the 1950s. The location of the former MGP and the general site location are shown on Figure 1.

SCE&G submitted a Project Delineation Report (PDR) [MTR, March 2012] to SCDHEC on March 23, 2012 and it was approved on April 23, 2012. The PDR presented the results of delineation activities that were completed to determine the extent of the TLM within the river. The overall findings consisted of:

- Defining numerous potential obstructions or metallic debris locations within the project area;
- Completing 244 sediment corings and soil borings using various investigation techniques with documented lithology and TLM observations;
- Collecting and analyzing 40 sediment and soil samples for constituents of interest (COI); and
- Determining the Congaree River bathymetry from the 1 to the 36 Line.

Figure 2 provides the general location of the project area. A complete summary of the delineation activities is provided in Appendix A.

TLM Description and Extent

The TLM located within the river sediments exhibits similar chemical and physical characteristics as coal tar, which is a by product of the manufactured gas plant (MGP) process. MGPs produced a flammable gas known as "town gas" that was utilized for heating, cooking and lighting purposes prior to the construction of interstate natural gas pipelines. The Huger Street former MGP site produced such gas and is located northeast of the project area. Figure 3 provides the location of the Huger Street former MGP site and the project area and illustrates the current conceptual site model (CSM) that depicts coal tar material originating at the Huger Street site and being discharged or released into the former stream channel that flows in a meandering southwesterly direction until it discharges into the Congaree River. The drainage ditch was present during the operation of the plant and was later converted into a 72-inch buried culvert pipe when that portion of the Huger Street property was backfilled to construct a bus maintenance facility.

Once the TLM entered the Congaree River, the river current acted as the transport mechanism and deposition occurred when TLM mass exceeded the water's buoyancy capacity. The TLM was most likely released and deposited on multiple occasions and the non-uniform river bottom and highly variable flow conditions dictated the location and thickness of the TLM observed during the investigation activities. More detailed information on the investigative portion of this project is provided in the PDR.

Streamlined Risk Evaluation

A streamlined risk evaluation is included within this EE/CA. The evaluation considered three general approaches for determining the risk associated with TLM-impacted sediment observed within the Congaree River that included:

- Potential human health risks;
- "Site-specific" risk assessment comparison; and
- Sediment Quality Guidelines (SQGs).

The potential human health risks are associated with direct contact of the TLM-impacted sediment. The TLM-impacted sediment within the Congaree River is presumed to be similar to or contains MGP constituents. Many of the constituents in the TLM samples collected by SCDHEC in June of 2010, exceed the EPA Region 9 Regional Screening Levels (RSLs) for residential soil [EPA - Region 9, May 2012]. In summary using this approach, if the TLM-impacted sediment existed on dry land, as surface soil, many potential constituents of concern (PCOCs) would exceed the residential standards.

A "site-specific" quantitative risk assessment was provided in the Huger Street Former Manufactured Gas Plant Remedial Investigation Report ([RI Report], MTR, May 2007. This risk assessment used various analytical soil, sediment, and surface water data collected from Unnamed Tributary # 1 (UT #1), located near the 72-inch culvert outfall. The basic assumption with this approach is that the various inputs used in developing the quantitative risk assessment in the RI Report are applicable to the Congaree River sediments. Therefore, based on the RI risk assessment, the outfall area sediments indicated that the cumulative 1×10^{-6} cancer risk was exceeded for the recreational user (1 to 6 year old child) using a benzo(a)pyrene exposure point concentration (EPC) of 3.1 mg/Kg. The TLM samples collected by SCDHEC in June 2010 all exceeded the 3.1 mg/Kg value for benzo(a)pyrene (please refer to Table 2 in the text). Therefore, it may be concluded that the cumulative 1×10^{-6} cancer risk would be exceeded for the Congaree River sediments containing TLM.

The EPA has established Ambient Water Quality Criteria (AWCQ) for water and Maximum Contaminant Levels (MCLs) for drinking water, however there are no national criteria or standards for chemical concentrations in sediment, only Sediment Quality Guidelines (SQGs). In order to gain a perspective on the known constituent concentrations of the existing Congaree River sediment samples containing TLM and potentially applicable sediment screening criteria, the following comparison was made.

Preliminary sediment screening values [based on the National Oceanic and Atmospheric Administration (NOAA), Screening Quick Reference Tables for Organics (SQuiRTS) in Freshwater Sediment] were used to provide a comparison of the existing Congaree River data for samples containing TLM. Using the NOAA data as preliminary screening values, it can be clearly demonstrated that the total PAH values from the Congaree River sediments within the project area exceed these arbitrary reference values by almost two orders of magnitude (Table 3).

Conclusions

Therefore, in summary, based on this streamlined risk evaluation, there exists sufficient information and data to provide justification to conduct a response action or non-time critical removal action. The EPA guidance for completing an EE/CA states "Where standards for one or more contaminants in a given medium are clearly exceeded a removal action is generally warranted, and further quantitative assessment that considers all chemicals, their potential additive effects, or additivity of multiple exposure pathways, are not generally necessary" (Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA, August 1993). Therefore, the exceedance of residential soil RSLs, site-specific risk assessment and sediment quality guidelines, suggest action is appropriate to safeguard human health and the environment. Appropriate actions may include those that eliminate pathway exposure (e.g., capping) or source removal (e.g., physical removal) or a combination thereof.

ARARs

The assessment of Applicable or Relevant and Appropriate Requirements (ARARs) is an integral part of the remediation process mandated under Section 121 (d) of CERCLA, as amended by SARA. ARARs are used to develop remedial action objectives (RAOs), determine the appropriate extent of site cleanup, and govern implementation and operation of the selected remedial action. EPA provides guidance on three categories of ARARs specific to the pollutant, location, or action, as discussed below:

- Chemical-specific requirements set health or risk-based concentration limits or ranges for specific substances in various environmental media. EPA's ARAR guidance stipulates that it may frequently be necessary to turn to constituent-specific advisory levels, such as carcinogenic potency factors or reference doses, to establish cleanup levels.
- Action-specific requirements are not constituent-specific, but specific to given remedial actions; they may specify acceptable methods that meet technology-based performance standards.
- Location-specific requirements set restrictions on activities according to characteristics of the site or its immediate environs (e.g., regulations pertaining to development in a 100-year floodplain).

For the Congaree River Project, potential ARARs have been considered and are summarized in Tables 4 through 6 in the text.

Removal Action Alternatives

As stated previously, the EE/CA guidance refers to a "removal action", which includes options other than physical removal (i.e., capping, or *in-situ* treatment). For this evaluation, the following "removal action" alternatives have been identified and analyzed:

- No Action;
- Monitoring and Institutional Controls;
- Sediment Capping and Institutional Controls; and
- Removal and Off-Site Disposal

The "No Action" alternative provides a baseline for comparison with the other alternatives and entails leaving the TLM impacted Congaree River sediments in their current state with no removal or mitigation activity.

"Monitoring and Institutional Controls" would consist of routinely evaluating the sediment conditions from within the impacted area and downstream of the contiguous TLM area. As envisioned, the sediment monitoring would be conducted annually for a period of 30 years. A sediment monitoring plan would be developed for review and approval by SCDHEC. Sample locations, evaluation and collection methods (successfully used for the delineation work) would be employed with annual reporting of results. Both, the physical thickness and chemical constituent concentration of the sediment would be evaluated. Installing institutional controls in the form of a shoreline fence and signage would provide an added measure of protection to human health. As envisioned, the fence would be installed along the shoreline for the entire length of the project area and signs would be placed on the fence to alert potential users that swimming, wading or other contact with the impacted sediment within the project area was not permitted. Signs would also be placed within the river upstream and downstream of the project area and near mid-river directly adjacent to the project area.

"Sediment Capping and Institutional Controls" entails placing a physical barrier in the form of an engineered capping system over the impacted sediment within the project area. The institutional controls (i.e., fence and signage) described above would also be a component of this alternative. The capping system would be designed to isolate the impacted sediments by providing a physical barrier on top of the sediment. The capping materials would most likely include geotextile fabric overlaid by readily available riprap stone. The cap would be designed to withstand routine flooding. Routine inspection of the cap and reporting would be performed on an annual basis. With this scenario, approximately 375,000 square feet of area would be capped. This barrier would isolate the impacted sediment and greatly reduce the potential for re-suspension and subsequent downstream movement of TLM. The barrier would also limit the potential for TLM contact by humans or aquatic organisms and the potential for flux of dissolved chemicals into the water column.

"Removal and Off-Site Disposal" would include physical removal of the TLM and impacted sediment (and debris) within the delineated area to the maximum extent practicable. As envisioned, implementation of this alternative would include completing the following major components:

- Conducting landside clearing and grading and site set-up activities;
- Installing a cofferdam of sufficient height to restrict river flow;
- Dewatering of the area to be excavated;
- Physically removing TLM-impacted sediment and debris using conventional equipment;
- Conditioning the sediment material for transportation to the landfill;
- Backfill as necessary; and
- Off-site disposal.

A combination of removal methodologies and equipment would most likely be required to successfully complete the project due to the varying thickness of sediment and changing bathymetric conditions within the project area. Assuming an approximate thickness of 2 feet of sediment over the entire project area results in approximately 40,000 tons of sediment requiring removal and off-site treatment or disposal. Standard excavation methods coupled with vacuum removal or other techniques would most likely be employed. A key component of this alternative would be the need to construct a cofferdam around the planned removal areas in order to isolate and dewater the areas prior to initiating the removal operations. Figure 10 provides a potential sediment removal scenario with an assumed cofferdam configuration. Given the magnitude of this alternative, it was assumed that it would likely be completed in multiple phases.

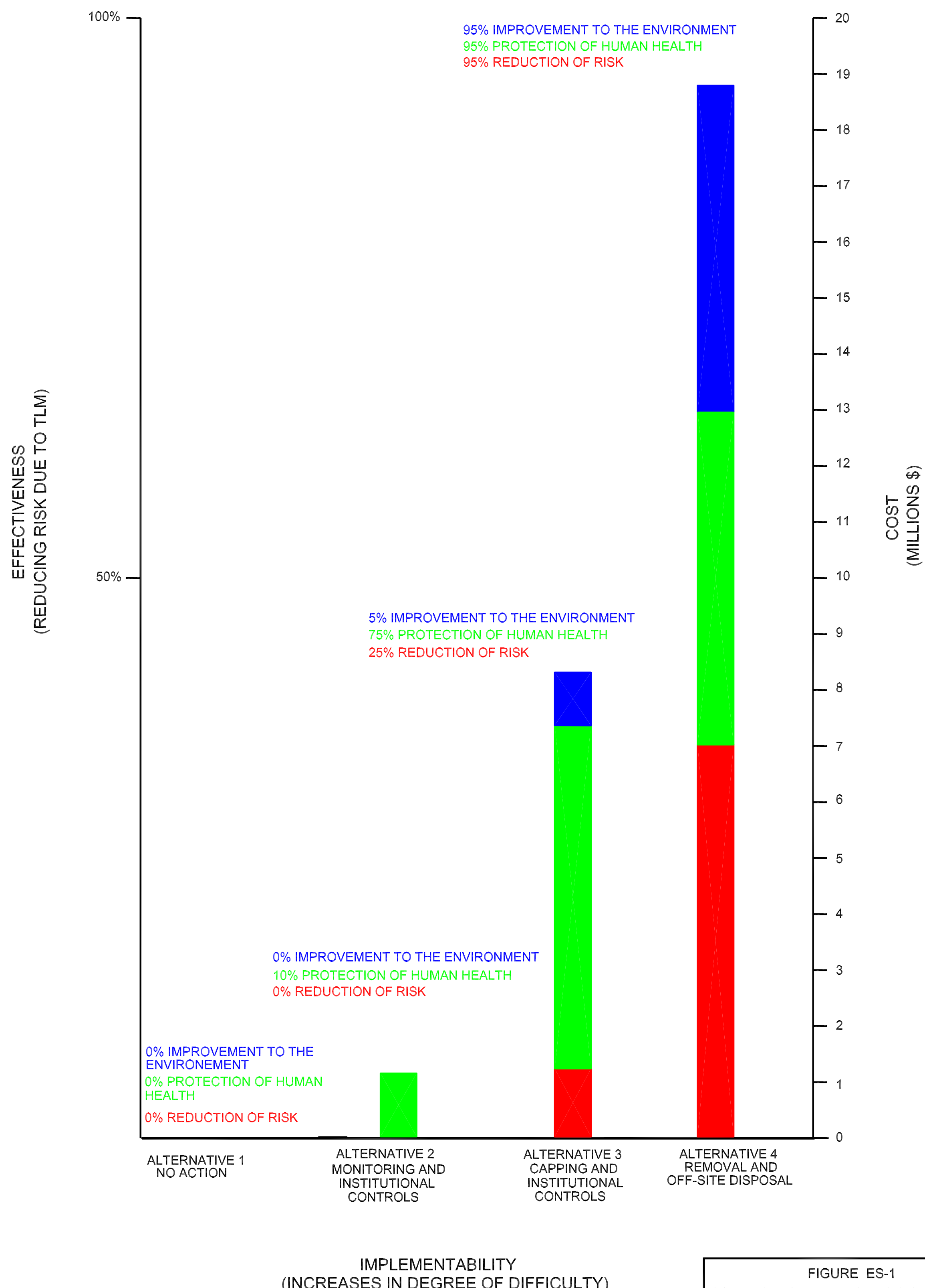
Comparison Analysis of Removal Action Alternatives

A comparative analysis of the four alternatives is provided in the text based on the following criteria:

- Protection of human health and the environment;
- Compliance with ARARs including the removal action objectives (RAOs);
- Short-term effectiveness;
- Long-term effectiveness;
- Reduction of toxicity, mobility and volume;
- Implementability; and
- Cost.

In summary, the four alternatives as described herein, evolved in a very linear fashion as the “no action” alternative is the least effective, easiest to implement and least expensive ($0). Conversely, Alternative 4, removal of TLM-impacted sediment with off-site disposal, is the most effective at achieving the stated removal action objectives (RAOs). However, Alternative 4 would be the most difficult alternative to implement and it would have the highest cost ($18,500,000).

Table ES-1 provides a visual depiction of each alternative with respect to its effectiveness, implementability and cost. Alternatives 2 and 3 offer increasing levels of effectiveness with a corresponding cost increase. Implementability, as defined by relative difficulty during implementation, increases uniformly for each alternative. For comparison purposes, an estimated percentage for each alternative in achieving certain RAOs (i.e., reduction of risk due to TLM, protection of human health, and improvement to the environment) was assumed.



NOTES:

TLM - TAR LIKE MATERIAL

% - ESTIMATED RELATIVE PERCENTAGE IN ACHIEVING SELECT REMEDIAL ACTION OBJECTIVES (RAOs)

FIGURE ES-1 SOUTH CAROLINA ELECTRIC & GAS COMPANY
EE/CA GRAPHICAL COMPARISON OF ALTERNATIVES
CONGAREE RIVER **COLUMBIA, SOUTH CAROLINA**
DATE: 5/15/12 **FILE NAME: ALTERNATIVES**
MANAGMENT AND TECHNICAL RESOURCES, INC.

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1.0 INTRODUCTION

1.1 Site Description and Background

For purposes of this Engineering Evaluation/Cost Analysis (EE/CA), the site is described as a stretch of the Congaree River located in Columbia, South Carolina, as shown on Figure 1. The Congaree River begins at the confluence of the Saluda River and the Broad River in Columbia, SC, near the Gervais Street Bridge. The site, also referred to as the "project area", begins directly south of the Gervais Street Bridge, extends approximately 200-300 feet into the river from the eastern shoreline and approximately 2,000 feet downriver towards the Blossom Street Bridge.

In June 2010, the occurrence of a tar-like material (TLM) within the Congaree River was reported to the South Carolina Department of Health and Environmental Control (SCDHEC). Three sediment samples were collected by SCDHEC at the approximate locations shown on Figure 2. Preliminary testing conducted on the material by SCDHEC and South Carolina Electric and Gas Company (SCE&G) indicated that the material may be attributable to the Huger Street former Manufactured Gas Plant (MGP) that was operated by predecessor companies of SCE&G beginning in the early 1900s and ending in the 1950's. The location of the former MGP and the general site location are shown on Figure 1.

SCE&G submitted a Project Delineation Report (PDR) [MTR, March 2012] to SCDHEC on March 23, 2012. SCDHEC approved the PDR on April 23, 2012. The PDR presented the results of delineation activities completed to determine the extent of the TLM within the river. The delineation work was completed in five separate phases over approximately 18 months. Overall, the delineation activities extended from the Gervais Street Bridge (referred to as the 1 Line) downriver approximately 9,050 feet to the area near the abandoned lock and dam (91.5 Line) as shown on Figure 7. A summary of the findings of the PDR is presented in Appendix A.

The focus of this EE/CA is the larger, contiguous, TLM-impacted area located upriver from the Blossom Street Bridge, as shown on the attached figures. Figure 2 provides the general location of the project area.

The delineation activities identified some additional, sporadic impacts that are located downriver from the project area. These impacts will be evaluated and addressed separately at a later date. A summary of the delineation activities and subsequent findings as they relate to the project area is provided in Section 1.4.

Consistent with the EE/CA guidance, the remainder of this section provides additional background information on various site-related issues that should be evaluated when considering a response action or non-time-critical removal action.

1.1.1 Demographics

In the general vicinity if the project area, the Congaree River flows along the western border of the City of Columbia and separates the City of Columbia from West Columbia. The project area is located along the eastern, City of Columbia side, of the river. Condominium/townhomes are located directly adjacent to the project area along Gist Street. The project area may be visible from these townhomes during the fall and winter months when foliage is not obscuring the views of the river. No other buildings or residential structures are located near the project area on the eastern shoreline. There is a river walkway near the northern boundary of the project area that extends under the Gervais Street Bridge. The Riverwalk Park and Amphitheater and the Three Rivers Greenway are located on the western shoreline of the Congaree River. The project area can be viewed from these locations and from the Gervais Street Bridge to the north.

A detailed table obtained from the U.S. Census Bureau website is included in Appendix B and provides the specific demographic data for the City of Columbia for the year 2010. The 2010 population for the City was 129,272, which is an increase of 11.2% from the year 2000. This population increase is slightly less than the South Carolina statewide average of 15.3% for the same time frame. Other pertinent data for the area, such as household income, homeownership rates and education levels for the City of Columbia residents is provided in the table in Appendix B.

1.1.2 Climate

The site climate may be characterized as humid subtropical (Newcome 2003). Summers tend to be hot and humid, average 80.5^{o} F, with temperatures rarely exceeding 100^{o} F. Conversely, the winters tend to be mild with an average temperature of 48.6^{o} F. July is usually the hottest month and January is typically the coldest month.

According to Newcome, the long-term average rainfall is 45 inches per year. Rainfall is well distributed throughout the year with the highest rainfall amounts (5.54 inches) falling in July and the lowest rainfall amounts (2.26 inches) falling in October. Snowfall is rare with no measurable snowfall occurring in 38 percent of the winters (USDA, 1978). The average relative humidity in the mid-afternoon is about 55 percent. Humidity is higher at night with the average at dawn being 90 percent (USDA, 1978).

1.1.3 Topography

The predominant topographic feature within the project area is the Congaree River itself, which is a broad shallow river with numerous bedrock assemblages that are visible above the water level at normal river flows. The river slope in the vicinity of the project area is approximately 2.10 feet/mile (USACOE, 1977). The river depth varies significantly in the project area due to the variability of the bedrock river bottom elevations. These bottom elevations fluctuate from an approximate high of 116 feet to approximately 105 feet. All elevations are referenced to NAVD ’88. Average river flow elevation is approximately 116 feet with an extreme variance of approximately 110 to 152 feet in elevation. Figure 2 provides the bathymetric contours for the river bottom and the topographic contours of the eastern shoreline.

The project area abuts the eastern shoreline, which rises sharply from the water’s edge in most places due to a steep bank that varies in height from approximately 5 to 20 feet depending on location. The ground slopes more gently to the east once the top of the riverbank is reached with an approximate 28 feet increase in land surface elevation over approximately 500 feet. Gist Street is the first paved land surface encountered to the east of the project area. The riverbank is forested in this area with vegetative cover consisting of various trees and tall native grasses and shrubs. The undergrowth is periodically maintained and trimmed in the vicinity of the wooden scenic overlook and river walkway (Figure 2) and is much thicker and overgrown further south.

Access to the river is provided by a partially paved access road, which extends from the intersection of Senate and Gist Streets to the river. The Senate Street alluvial fan, a key land feature in this area, is located at the end of the access road. The alluvial fan is a relatively flat portion of the project area that extends out into the river and appears to have developed over time. It will be the main access point during completion of future field activities unless another access point is constructed.

1.1.4 Surface Water Hydrology

The Congaree River is formed by the confluence of the Broad and Lower Saluda Rivers approximately 6,000 feet above the project area in the vicinity of the Timmerman/State Route 126 Bridge (Figure 1). The flow of the Lower Saluda River is largely influenced by the Saluda River Hydroelectric Dam, which is constructed on Lake Murray and located approximately 12 miles northwest of the site. The Broad River is located to the north east of the project area, with multiple dams constructed upriver from the Gervais Street Bridge. The flow of the Broad River is less regulated (or controlled) than the Lower Saluda and is more runoff dependant. The Lower Saluda is considered a South Carolina Scenic River from approximately 1 mile below the Lake Murray Dam to the confluence with the Broad River, or the beginning of the Congaree River.

Within the project area, the unnamed tributary that extends from the 72-inch culvert pipe located near the intersection of Gist and Gervais Streets (Figure 2) provides a discharge point for stormwater runoff from the City of Columbia. This stormwater conveyance services a large area northeast of the site and exhibits varying flows that are strongly dependent on recent precipitation amounts. Minimal flow is observed during extended dry periods, which suggests some groundwater infiltration into the stormwater system.

A United States Geologic Survey (USGS) river gage is located directly across the river from the project area. This gage measures the river's discharge in cubic feet per second (cfs) and the water column height in feet at the gage location. According to the USGS, the drainage area for the Congaree River at this gage location is 7,850 square miles and the gage height is 113.02 feet, based on NGVD '29 (or 112.25 based on NGVD '88). Appendix C provides a summary of the available information for this gage location taken from the USGS website. From the available data, the mean daily discharge rate varies from approximately 5,000 cubic feet to 16,000 cubic feet.

1.1.5 Geology

The geologic description is derived from subsurface information collected via corings and soil borings completed during the delineation phases as described in the PDR, and from the Final Draft Remedial Investigation Report (RI Report) for the Huger Street Former Manufactured Gas Plant Site (MTR, May 2007). This geologic discussion is limited to the Congaree River channel, shoreline, and eastern landside bank of the project area.

The site is situated in the Upper Coastal Plain Province and south of the Fall Line separating Cambrian Carolina Slate Belt crystalline rocks from unconsolidated sediments. Within the Congaree River, the geology consists of Quaternary unconsolidated sediments unconformably overlying Paleozoic crystalline bedrock (i.e., granite). The unconsolidated sediments are Quaternary in age and range in particle size from clays to boulders. Within the Congaree River and where higher velocities are encountered, coarser grained sediments are dominant and range in particle size from sand (generally fine to coarse) to boulders. Along the Congaree River shoreline and where lower current velocities exist, finer grained unconsolidated sediments are encountered and range in particle size from silts (and some clay) to fine sands with varying amounts of muscovite and naturally occurring vegetative organic material. The unconsolidated sediments within the project area may range in thickness from about 0.2 feet (K14) to 6.0 feet (O11) and can be absent when the granite bedrock is exposed. Underlying the unconsolidated sediment, or exposed as outcrops, is resistant granite (Columbia) of Paleozoic (Cambrian) age. The granite forms the base of the Congaree River, and through differential weathering and erosion, an irregular bottom has developed. The irregular bottom results in a number of bathymetric highs formed by outcrop exposures or boulder assemblages and are noted between the 2 to 4, 6.5 to 9.25, 13.75 to 16 and 18 to 20 Lines. The bathymetric lows, which likely represents less resistant granite and more conducive to erosion were noted between the 5 to 6.5, 9.25 to 13.75, and 16 to 18 Lines. The Congaree River bathymetry is shown on Figure 2.

The landside Congaree River bank was investigated with a total of 15 soil borings. These landside borings indicated the soil/sediments were unconsolidated, ranged in particle size from clay to gravels, displayed layering, and were approximately 12 feet (K5) to 27 feet (K16 and K17) thick. Generally, sediment thickness increased in the downriver direction, and is attributed to down cutting of the granite by the Congaree River. Direct push technology (DPT) drilling refusal was encountered in each soil boring and was interpreted to be indicative of the granite bedrock. The upper most sediments were generally found to range from clays to medium sands, were layered and based on findings presented in the RI Report, are interpreted to have been deposited by transgressive and regressive sequences and during the Tertiary period. Below the Tertiary sediments (at some soil boring locations) a gray silt overlies a sand and gravel layer and this sequence is interpreted to be analogous to the current day Congaree River shoreline (gray silt) and channel (sands and gravel).

Finally, the Senate Street alluvial fan is believed to have developed from upland erosion activities and/or possibly remnants of anthropogenic activities. Similarly, the sand bar is of unknown origin and may have developed naturally or via anthropogenic activities.

1.1.6 Hydrogeology

Groundwater was not investigated as part of the delineation activities and therefore, monitoring wells do not exist to assess a number of hydrogeologic characteristics (e.g., groundwater flow direction, hydraulic conductivity, etc.). Based on the landside soils borings, the saturated thickness in the unconsolidated sediments was found to range from about 2 to 9 feet. Given the hydrogeologic setting, it is expected that groundwater would generally flow from east to west towards the Congaree River, which would act as the discharge location.

1.1.7 Ecology

The ecology of the project area is diverse in terms of biological species. Many various birds, amphibians, mammals, fish, invertebrates and plants rely on the river habitat in the vicinity of the project area. SCE&G conducted a detailed Rare, Threatened and Endangered Species Assessment (Kleinschmidt, 2008) as part of the Saluda hydroelectric project relicensing process. This assessment extended to the upper portion of the Congaree River and included the project area. Review of this assessment and other information provided by the South Carolina Department of Natural Resources (SCDNR) Rare, Threatened and Endangered Species Inventory and the United States Fish and Wildlife Service (USFWS) Species Reports identified a number of federal and state threatened and endangered species, federal candidate species and species of concern.

Following review of the above listed information and taking into account the scale and scope of the potential removal action (the most intrusive remedial option to be evaluated herein), the list of species relevant to this project can be significantly refined. Table 1 provides a summary of these species. Of specific interest to this project are the Rafinesque's big-eared bat and the shortnose sturgeon, which are listed as state endangered species and state and federal endangered species, respectively. In addition, the Rocky Shoal's Spider Lily (RSSL) and five species of freshwater mussels are listed as federal species of concern.

The Rafinesque's big-eared bat's range includes the sandhills region and it is known to roost under I-beam and T-beam bridges. The Gervais Street Bridge may provide a roosting site for this bat. Migration of Lake Marion shortnose sturgeon up the Congaree River to the Gervais Street Bridge area has been previously documented by SCDNR. However, gillnet and D-net sampling was conducted in the upper Congaree River during the 2007 migratory season as part of the Shortnose Sturgeon Study Plan (Kleinschmidt, 2006) conducted during the hydroelectric plant relicensing. This sampling effort resulted in no captures of adult or juvenile shortnose sturgeon and no captures of egg or larval sturgeon (Kleinschmidt, 2008).

The RSSL is a perennial plant that inhabits rocky shoals or bedrock outcrops in large streams or rivers at or above the fall line (Kleinschmidt, 2008). It is found in large numbers directly upstream of the project area at the confluence of the Saluda and Broad Rivers. Some portions of the project area may exhibit favorable conditions for the occurrence of this plant. Finally, five species of freshwater mussels (Table 1) that are listed as federal species of concern were identified during implementation of the Freshwater Mussel Study Plan completed in support of the hydroelectric project relicensing. The mussel study area encompassed the project area.

1.2 Prior Removal Actions

Since discovery of the TLM in June 2010, investigative activities have been ongoing to determine the extent of impacts. The revised PDR was submitted to SCDHEC on March 23, 2012 and was approved on April 23, 2012. No removal action activities have taken place from within the Congaree River.

SCE&G has recently completed removal actions at three parcels of land (Parcel "A", Parcel "B" and Parcel "C") associated with the 1409 Huger Street site (Figure 3). Figure 4 shows the extent of excavation activities on Parcels "A" and "C". Both of these removal actions were conducted to address coal tar impacted material generated by the former manufactured gas plant operations. Removal activities for Parcel "B" were conducted to address the divestiture of the property as described below.

Parcel "A" was the location of the former manufactured gas plant and a suspected potential source of the TLM found in the Congaree River (as further described in Section 1.3). The Parcel "A" removal action was a large-scale remediation project that was initiated in November 2009 and successfully completed in June 2011 with SCDHEC oversight. During the course of the project, approximately 125,000 tons of MGP impacted soil and debris was excavated and properly disposed. Former MGP related structures such as the gasholder bases, retort house foundation and the gas works building were removed as were numerous large diameter tar filled pipes. Excavation operations extended downward to the top of the granite bedrock layer in many areas of the site and a 250 feet long section of the 72-inch buried storm drain pipe was removed and replaced in order to access impacted material located under the pipe. The completion of this project effectively removed all known and/or accessible source material from Parcel "A".

Parcel "B" is located south of Washington Street and is contiguous with the former Kline Steel Property. Parcel "B" is 1.11 acres in size and was not known to contain any MGP operations. The property was utilized by SCE&G, and subsequently the Columbia Area Rural Transit Authority (CARTA), for the temporary storage of disabled buses that were scavenged for parts. In December 2005, SCANA submitted a Remedial Investigation Work Plan (RIWP) to investigate surface and subsurface soil quality at Parcel "B". The RIWP was approved by SCDHEC and was implemented and completed on December 13, 2005. Analytical results and recommendations for limited soil removal activities were provided to SCDHEC in February 2006. SCDHEC concurred that the soils appeared to be adequately characterized based on the soil investigation and that a Removal Action Plan (RAP) for Parcel "B" should be prepared to address the impacted soil associated with this parcel. A RAP that addressed the excavation, management and disposal of visually stained surface soil was submitted to SCDHEC on May 31, 2006. SCDHEC prepared an "Action Memo", which was mailed to neighboring property owners and published in The State newspaper in early September 2006. The first phase of the removal action activities was completed during the week of September 11, 2006 and the second phase was completed during the week of October 30, 2006. A total of 951.71 tons of soil and 23.47 tons of debris were removed from the site during implementation of the RAP. Confirmation soil samples illustrated achievement of residential and industrial PRGs at Parcel "B". SCDHEC provided concurrence on February 2, 2007 that no restrictions would be required on soil for future use of Parcel "B". SC&EG subsequently divested the property to the developers of the former Kline Steel property.

Parcel "C" is located across Williams Street from Parcel "A" (Figure 3) and is the current location of an SCE&G electrical substation. TLM was identified at ground surface at Parcel "C" in the summer of 2010. Subsequent investigative activities confirmed that the TLM was associated with a buried concrete structure located near the center of the site. The remedial investigation activities occurred from March through June 2012. The Parcel "C" removal action was conducted in September and October 2012 in order to remove the relatively small buried concrete structure that contained tar-like material and resulted in the excavation and offsite disposal of approximately 1,100 tons of impacted material. This removal action was very limited in scale in comparison to the Parcel "A" project and was focused on an isolated occurrence of TLM that was confirmed to be associated with the buried concrete structure. No connection between the Parcel "C" TLM and the TLM found in the river is known at this time.

1.3 Source, Nature, and Extent of Contamination

The TLM located within the river sediments exhibits similar chemical and physical characteristics as coal tar, which is a by product of the manufactured gas plant (MGP) process. MGPs produced a flammable gas known as "town gas" that was utilized for heating, cooking and lighting purposes prior to the construction of interstate natural gas pipelines. As described above in Section 1.2, the Huger Street former MGP site produced such gas and is located northeast of the project area. Figure 3 provides the location of the Huger Street former MGP site and the project area and illustrates the current conceptual site model (CSM). The current CSM depicts the coal tar material originating at the Huger Street site and being discharged or released into the former stream channel that flowed in a meandering southwesterly direction until it discharged into the Congaree River at the Unnamed Tributary (UT #1) located directly south of the Gervais Street Bridge. The drainage ditch was present during the operation of the plant and was later channeled into a 72-inch buried culvert pipe when that portion of the Huger Street property was filled to construct a bus maintenance facility. An aerial photograph from 1935 (Figure 5) shows the MGP and the former stream channel as well as other potentially pertinent features from the immediate area.

Construction of the Huger Street MGP was completed in 1906. It operated from 1906 to approximately 1954. As a result, potential intermittent discharges of coal tar may have occurred during this time frame. The culvert pipe was installed on the southern portion of the Huger Street property in the late 1960s prior to construction of the bus maintenance garage, which was in place in 1970. The remainder of the pipe, which extends down to Gervais Street was installed in segments from approximately 1963 to 1964. The portion from Gervais Street to the outfall is an arched brick structure and was most likely constructed in the 1800s.

In 2005 and 2007, SCE&G conducted video inspections of the accessible portions of the culvert pipe to determine if coal tar was entering the pipe at some location or if residual evidence of coal tar impacts were present. Figure 4 shows the approximate location of the former stream channel, which was taken from various City of Columbia drawings and the approximate current location of the culvert pipe. The portions of the pipe that were inspected are also shown on Figure 4. No evidence of coal tar impacts were noted in the concrete pipe. Wipe samples were collected from several locations within the concrete pipe and the analytical results were non-detect. Black staining was observed on the floor and sidewalls of the brick portion underneath Gervais Street. As a result, it can be surmised that discharges of coal tar did not occur after the culvert pipe was installed and most likely occurred well before 1969.

During the operational timeframe of the MGP, it is believed that TLM was introduced into UT #1 from the former MGP site and then flowed downstream and discharged to the Congaree River at the confluence (Figure 3). Once the TLM entered the Congaree River, the river current acted as the transport mechanism and deposition occurred when TLM mass exceeded the water's buoyancy capacity. The TLM was most likely released and deposited on multiple occasions and the non-uniform river bottom and highly variable flow conditions dictated the location and thickness of the TLM observed during the investigation activities.

The following sections provide a brief description of the investigative activities and their findings in order to provide the necessary background information to discuss the potential response actions as described herein. More detailed information on the investigative portion of this project is provided in the PDR.

1.4 Delineation Activities

SCDHEC began investigating the area of the river around the Senate Street Extension, south of the Gervais Street Bridge, to assess the presence or absence of the TLM in June 2010. Three sediment samples (S-1 through S-3) were collected in the vicinity of an "alluvial fan" or mounded sand area and the approximate locations are shown on Figure 2.

Further reconnaissance of the area was conducted in July 2010 to gain a better understanding of the potential TLM presence and extent. This reconnaissance was conducted by wading in the accessible areas in and around the alluvial fan. It became apparent following completion of these initial reconnaissance activities that the TLM extended outside of the readily wadeable areas near the shoreline and the alluvial fan and a plan to conduct additional investigation activities was developed and subsequently approved by SCDHEC. The Delineation Work Plan (DWP) was submitted on September 16, 2010 and approved on September 24, 2011.

A number of different delineation activities and investigative techniques were utilized to determine the presence or absence TLM within the river sediment and subsurface soil samples. The actual investigative technique employed was dictated by physical factors encountered in the river that included:

- The water level;
- The velocity of river current; and
- The sample location with respect to boulder fields and access limitations (or other obstructions).

1.4.1 Sampling Locations and Techniques

Generally, a sampling grid was established beginning at the Gervais Street Bridge and extending southward. During the various phases of work, the sampling pattern evolved and was dependent upon the findings of the previous phase of work. In general, delineation points were labeled with an alphanumeric designation representing the grid node location.

The bathymetry and river flow variances in the study area necessitated the use of a variety of sampling techniques in order to collect the sediment and soil samples. A pontoon boat was equipped with a DPT drill (Geoprobe 420M) and was used to obtain core samples when river conditions (lower current and general absence of boulders) were suitable for navigation. In other areas, vibra-core drilling was conducted by joining together two john boats and mounting the vibra-core equipment and tripod between the two boats.

A gas-powered jackhammer was modified to drive macrocore sampling barrels and was used at some locations where access by the boats was precluded by boulders or shallow water. Other areas where boat access was limited were investigated by wading and examining the sediment with shovels and hand tools. Finally, the Congaree River shoreline was investigated and sampled utilizing a track mounted DPT unit.

The specific details pertaining to the various technologies and techniques utilized to collect samples during the investigative phase of this project are provided in the PDR. Each portion of the project area presented its own challenges to sample collection and the most suitable techniques were utilized in each area.

Overall, a total of 244 sediment corings and soil borings were completed at the locations shown on Figures 6A, 6B and 7. Once collected the various samples were processed and lithologically described and intervals with visual or olfactory observations were determined. Descriptors of these observations included:

- TLM;
- Other weathered material (OWM); or
- TLM fragments.

Other weathered material (OWM) refers to a substance encountered that has the physical appearance of a cinder-like material, notably different than TLM. Similar to TLM fragments, OWM is not interpreted to be widespread.

1.4.2 Sample Collection for Laboratory Analyses

The three preliminary investigation samples (S-1 through S-3) split with SCDHEC were analyzed by META Environmental, Inc. of Watertown, Massachusetts. The analytical results from these samples are discussed in Section 1.7.

A total of 40 delineation samples (32 sediment and eight soil samples) were collected for laboratory analyses of total benzene, toluene, ethylbenzene, and total xylenes (BTEX) and polynuclear aromatic hydrocarbons (PAHs). The analytical parameters were specified in the approved DWP and were selected for delineation purposes since these parameters are representative indicators of MGP constituents. Shealy Environmental Services, Inc. of West Columbia analyzed the BTEX samples by EPA Method 8260B and PAH samples by EPA Method 8270D. The locations and analytical results from these delineation samples are provided in Appendix A, along with a brief discussion of the findings.

Representative samples of the sediment corings and soil borings were collected for laboratory analyses. Soil samples from soil borings located on top of the Congaree River bank, were collected at deeper intervals that were believed to be laterally equivalent in bottom elevation of the Congaree River.

1.5 Overall Findings

The overall objective of the delineation activities was to define the extent of TLM within the Congaree River. The use of sensory observations (visual and olfactory) proved to yield the most conclusive evidentiary data to determine the presence or absence of TLM. The readily identifiable characteristics of TLM included:

- A distinctive odor that differs from naturally occurring sediment;
- A distinctive color (black) that generally differs from coarser grained sediments observed in the Congaree River;
- A tendency to be highly weathered with a consistency ranging from near solid to taffy-like. [Occasionally less viscous TLM was noted, displaying a more “fluid like” appearance, and was generally found in deeper sediment that was less likely exposed to weathering]; and
- When contacted, tends to stain and is fairly resistant to removal.

Sediment samples were also collected for laboratory analysis to augment and confirm the visual and olfactory observations. Originally, the objective for analyzing sediment samples was to provide confirmation of the absence of TLM at the delineation boundary locations. As the delineation activities expanded downriver and the spatial extent of the project area increased, the analytical objective evolved into obtaining data at logical and representative sampling locations. As a result, some of these down river sampling locations may have contained TLM or TLM fragments.

Based on the delineation work, the overall findings consist of:

- Defined numerous potential obstructions or metallic debris locations within the project area;
- Completing 244 sediment corings and soil borings (Figures 6A, 6B and 7) using various investigation techniques with documented lithology and TLM observations;
- Collecting and analyzing 40 sediment and soil samples for constituents of interest (COI); and
- Determining the Congaree River bathymetry from the 1 to 36 Lines.

Based on the activities discussed above, the following summary is provided.

1.6 TLM Extent

The majority of the TLM was identified in the area from the Gervais Street Bridge to approximately 2,000 feet downriver. This is the TLM that is the focus of this EE/CA and this general area is referred to as the project area. The project area is depicted on Figures 2 and 3. Several other smaller areas of TLM occurrence were identified downriver from the Blossom Street Bridge. These areas are not included in this EE/CA. For informational purposes, they are discussed in Appendix A and will be further evaluated at a later date.

The spatial extent of TLM is characterized as either “continuous” or “discontinuous” and the distinction is determined by the continuity of the visual TLM observations. In summary, the following characterizes the spatial extent:

- River hydraulics and bathymetry likely influenced deposition and spatial extent.
- TLM (2 to 4 Lines): TLM was noted on the alluvial fan at the confluence of UT #1 at one boring located along the shoreline of the Congaree River. The horizontal extent is assumed to be continuous from the alluvial fan, along the shoreline to the 4 Line. TLM thickness was found to range from approximately 0.25 to 1.1 feet. Investigation points further west in the Congaree River did not indicate the presence of TLM.
- Continuous TLM (4 to 18 Lines): Extending from north to south (downriver direction), from the 4 to 18 Lines. Continuous TLM is characterized by the visual presence of TLM at multiple contiguous or near-contiguous investigative points. Within the continuous TLM area, it is possible that the spatial continuity of TLM may be disrupted. The western boundary extends approximately 200 feet into the Congaree River and inflects eastward near the 18 Line. The eastern boundary may be characterized by the shoreline.
- The vertical thickness of TLM can be variable and is likely influenced by sediment thickness, the amount of TLM present during deposition, and river hydraulics.
- Discontinuous TLM (34, 36, 47, 49, and 53 Lines): Noted at several locations below the Blossom Street Bridge. Discontinuous TLM is sporadic in occurrence and is characterized by limited spatial continuity. The discontinuous TLM thickness may range from 0.2 to 1.5 feet. These locations are described further in Appendix A and will be addressed at a later date.
- For both the continuous and discontinuous TLM areas, the TLM exhibits similar physical characteristics that generally includes a highly viscous and taffy-like consistency, typically has sediment as part of the matrix, and has a distinct tar-like odor. Some less viscous TLM was encountered between the 4 and 18 Lines and is generally found below the highly weathered TLM.
- An apparent transition zone is noted at the 19 Line and likely represents the end of continuous TLM.

In addition, other observations noted while completing the fieldwork included TLM fragments and OWM. TLM fragments represent that fraction of TLM that was likely eroded (by fluvial action) from the continuous TLM area, transported downstream, and deposited. When encountered, the quantity of TLM fragments were typically limited, did not exhibit spatial continuity, and tended to have a more solidified consistency. Therefore, TLM fragments were noted when observed but are not considered to have spatial continuity or aerial extent.

1.7 Analytical Results for Samples Containing TLM

During the course of the project delineation activities a total of 40 sediment and soil samples were collected for laboratory analysis. A discussion of the project delineation sediment and soil analytical results is provided in Appendix A. Since the delineation samples were generally collected at visually clean areas (to confirm the absence of TLM), the constituent concentrations would be anticipated to be much lower or non-existent compared to sediment obviously impacted with TLM. This EE/CA addresses the occurrence of TLM within the project area. Therefore, only the analytical data from the original samples (known to contain TLM) are considered to be representative of the actual concentration of the constituents within the TLM.

Table 2 provides the SCDHEC and SCE&G preliminary analytical results that were used to assess the initial TLM, when first noted in June 2010. The S-1 through S-3 samples were collected in a stretch of the Congaree River where TLM was noted and TLM was present in the sample submitted for analysis. As a result, these three samples exhibited the highest concentrations of COI from the entire study area. Total BTEX concentrations ranged from 11.2 mg/Kg to 389 mg/Kg and total PAH ranged from 1,704 mg/Kg to 9,429 mg/Kg. These sample results are discussed further below.

1.8 Streamlined Risk Evaluation

This streamlined risk evaluation considers three general approaches for evaluating the TLM-impacted sediment observed within the Congaree River. The three approaches include:

- Potential human health risks;
- “Site-specific” risk assessment comparison; and
- Sediment Quality Guidelines (SQGs).

1.8.1 Potential Human Health Risks

Potential human health risks are associated with direct contact of the TLM-impacted sediment. These risks are summarized in the material safety data sheet (MSDS) for coal tar provided in Appendix D. The TLM-impacted sediment within the Congaree River is presumed to be similar to or contains MGP constituents that were evaluated previously in the RI Report. The risk assessment from the RI Report compared the soil analytical data to EPA Region 9 regional screening levels (RSLs) for residential soil. Using a similar approach, Table 2 provides a comparison of the RSLs (EPA - Region 9, May 2012) for soil with the TLM data obtained from samples collected by SCDHEC in June of 2010. Many of the constituents in the TLM samples exceed the residential soil RSLs. It should be noted that only the initial, obvious TLM-containing samples are presented in Table 2. The analytical data obtained during the delineation was not included in Table 2 because the samples were (in general) intended to confirm the absence of potential constituents of concern (PCOCs), when visual TLM was not observed. [The delineation sample analytical results are provided and compared to RSLs in Appendix A.] In summary using this approach, if the TLM-impacted sediment existed on dry land, as surface soil, many constituents would exceed the residential standards.

1.8.2 "Site-Specific" Risk Assessment Comparison

A "site-specific" quantitative risk assessment was provided in the RI Report that used various analytical data collected from UT #1, near the 72-inch culvert outfall. The risk assessment considered soil, sediment, and surface water data. It is assumed that the various inputs used in developing the quantitative risk assessment in the RI Report are applicable to the Congaree River sediments. Those assumptions included:

- **Receptors** – recreational user (conservatively using a child age 1 to 6 years old), construction worker, and utility worker.
- **Exposure** – dermal, ingestion, etc.
- **Intake Assumptions** – the receptors' intake assumptions (i.e., activity, duration, etc.).
- **Toxicity Characteristics** – the toxicity characteristics for benzo(a)pyrene were used since it has the lowest residential soil RSL and was a primary driver for risk in the RI Report.
- **Exposure Point Concentration** – the benzo(a)pyrene exposure point concentration (EPC) was 3.1 mg/Kg.

In summary, based on the RI risk assessment, the outfall area sediments indicated that the cumulative 1×10^{-6} cancer risk was exceeded for the recreational user (1 to 6 years old) using a benzo(a)pyrene EPC of 3.1 mg/Kg. The TLM samples collected by SCDHEC in June 2010 all exceeded the 3.1 mg/Kg value for benzo(a)pyrene (please refer to Table 2). Therefore, it may be concluded that the cumulative 1×10^{-6} cancer risk would be exceeded for the Congaree River sediments containing TLM.

1.8.3 Sediment Quality Guidelines (SQGs)

The EPA has established Ambient Water Quality Criteria (AWCQ) for water and Maximum Contaminant Levels (MCLs) for drinking water, however there are no national criteria or standards for chemical concentrations in sediment, only Sediment Quality Guidelines (SQGs). In order to gain a perspective on the known constituent concentrations of the existing Congaree River sediment samples containing TLM and potentially applicable sediment screening criteria, the following comparison was made.

Based on the National Oceanic and Atmospheric Administration (NOAA), Screening Quick Reference Tables for Organics (SQuiRTS) in Freshwater Sediment; the most conservative number for total polynuclear-aromatic hydrocarbons (total PAHs) is 264.1 ppb while the highest screening number is 100,000 ppb (all concentrations are based on a dry weight). In general, these sediment screening values are based on the cumulative toxicity effects to aquatic life, calculated using various approaches and techniques. As a point of departure, Table 3 provides a comparison of the existing Congaree River data for samples containing TLM with these screening values and clearly demonstrates that the total PAH values from the Congaree River sediments within the project area exceed these arbitrary reference values by almost two orders of magnitude.

In summary, based on this streamlined risk evaluation, there exists sufficient information and data to provide justification to conduct a response action or a non-time critical removal action. It should also be noted that Tables 2 and 3 were developed for screening purposes only and do not represent or constitute clean-up criteria or levels.

1.8.4 Conclusion

The EPA guidance for completing an EE/CA states "Where standards for one or more contaminants in a given medium are clearly exceeded a removal action is generally warranted, and further quantitative assessment that considers all chemicals, their potential additive effects, or additivity of multiple exposure pathways, are not generally necessary" (Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA, August 1993). Therefore, the exceedance of residential soil RSLs, site-specific risk assessment and sediment quality guidelines, suggests action is appropriate to safeguard human health and the environment. Appropriate actions may include those that eliminate pathway exposure (e.g., capping) or source removal (e.g., physical removal) or a combination thereof.

2.0 IDENTIFICATION OF REMOVAL ACTION OBJECTIVES

Completion of the investigative activities has determined the approximate extent of the TLM in the Congaree River sediments. SCE&G plans to address the contiguous TLM and mitigate the potential impacts to human health and the environment. It should be noted that the EE/CA guidance refers to "removal action" to address site impacts. A "removal" action typically includes a "physical" removal of impacted material, but the terminology also can include other options such as containment or capping, or treating impacted material *in-situ*, or in-place. These options are discussed in the next section and evaluated with respect to their ability to satisfy the "removal" action objectives provided below and the Applicable or Relevant and Appropriate Requirements (ARARs) identified in Section 2.1. The specific goals and objectives of the "removal" action include:

- Reduce or eliminate the potential for human health or environmental impacts related to the TLM identified in the project area;
- Physically remove, treat or isolate TLM and TLM-containing sediment and river bottom debris from within the project area to the extent practicable;
- Prevent re-suspension and downstream migration of impacted material into currently un-impacted areas;
- Reduce the potential for flux of dissolved constituents into the water column;
- Conduct activities in a manner that reduces impacts to the river resources and habitat;
- Utilize the best available techniques and equipment based on the actual conditions encountered in the project area;
- Restore the project area as close to it's original pre-remediation conditions as practicable; and
- Safely conduct the scope of work with as minimal of an impact on the surrounding community and river environment as practicable.

2.1 Identification of Applicable or Relevant and Appropriate Requirements

The assessment of ARARs is an integral part of the remediation process mandated under Section 121 (d) of CERCLA, as amended by SARA. ARARs are used to develop remedial action objectives (RAOs), determine the appropriate extent of site cleanup, and govern implementation and operation of the selected remedial action. Specifically, the preamble of CERCLA states, the purpose of the law is "to provide for liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and the cleanup of inactive hazardous waste disposal sites". Remedial actions that “cleanup” hazardous substances at CERLCA sites must comply with state and federal standards and criteria that are legally applicable to the substance, pollutant, or contaminant; or that are relevant and appropriate under the circumstances [42 U.S.C. 9621(d)(2)(A)].

Section 300.430(f)(1)(i) of the National Contingency Plan (NCP) provides the criteria for selecting a remedial alternative. One of these criteria states that “overall protection of human health and the environment and compliance with ARARs (unless a specific ARAR is waived) are threshold requirements that each alternative must meet in order to be eligible for selection”. An alternative that does not meet an ARAR under federal environmental or state environmental or facility citing laws may be selected under the following circumstances [Section 300.430(f)(1)(ii)(C)]:

- The alternative is an interim measure and will become part of a total remedial action that will attain the applicable or relevant and appropriate federal or state requirement;
- Compliance with the requirement will result in greater risk to human health and the environment than other alternatives;
- Compliance with the requirement is technically impracticable from an engineering perspective;
- The alternative will attain a standard of performance that is equivalent to that required under the otherwise applicable standard, requirements, or limitation through use of another method or approach; or
- With respect to a state requirement, the state has not consistently applied, or demonstrated the intention to consistently apply, the promulgated requirement in similar circumstances at other remedial actions within the state;

Other federal and state advisory criteria, or guidance, as appropriate, may be considered in formulating the remedial action [Section 300.400(g)(3)]. In determining whether compliance with ARARs is practicable, the lead agency may consider appropriate factors, including:

1. The urgency of the situation; and
2. The scope of the remedial action to be conducted.

It should be noted that manufactured gas plant waste is exempt from the toxic characteristic regulations as specified in 40 CFR 261.24(a).

2.1.1 Definition of ARARs

According to NCP regulations (40 CFR 300.400(g)), a requirement may be either “applicable” or “relevant and appropriate” to a remedial action, but not both. These terms are defined below:

- Applicable requirements are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility citing laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site" [40 CFR 300.5].
- Relevant and appropriate requirements are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental, state environmental, or facility citing laws that, while not 'applicable' to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site" [40 CFR 300.5].

Once a federal or state law has been classified as applicable or relevant and appropriate its requirements must be distinguished between substantive and administrative. “Substantive” requirements are “those requirements that pertain directly to actions or conditions in the environment. “Administrative” requirements are “those mechanisms that facilitate the implementation of the substantive requirements of a statue or regulation”. Compliance with administrative requirements is not mandated for on-site actions (USEPA, 1988). For example, CERCLA specifically exempts on-site actions from federal, state and local permitting requirements [42 U.S.C. 9621(e)(1)]. Furthermore, only those State requirements that are more stringent than Federal requirements are ARAR [40 C.F.R. 300.5]. "More stringent" would also include those state laws or programs that have no federal counterpart as "they add to the Federal law requirements that are specific to the environmental conditions in the State" (USEPA, 1988). State requirements, however, must be adopted by formal means (i.e., promulgated) and applied universally through the state (i.e., not just to Superfund sites, but to all circumstances addressed in the requirement) [42 U.S.C. 9621(d)(2)(C)(iii)(I)].

2.1.2 To-Be-Considered Criteria

In addition, the NCP identifies a third category of guidance, termed “information to-be-considered” (TBC). The TBC category “consists of advisories, criteria, or guidance that were developed by EPA, other federal agencies, or states that may be useful in developing CERCLA remedies” [40 CFR 300.400(g)(3)]. Because these are not promulgated requirements, TBCs do not have the status of ARARs. However, these guidelines may be used when they are necessary to ensure protection of public health and the environment. If ARARs do not address a particular circumstance at a CERCLA site, then TBCs can be used to establish remedial guidelines or targets.

2.1.3 Types of ARARs

CERCLA remedial actions may trigger several different types of requirements or ARARs. EPA provides guidance on three categories of ARARs specific to the pollutant, location, or action, as discussed below:

- Chemical-specific requirements set health or risk-based concentration limits or ranges for specific substances in various environmental media. If a given constituent has more than one such requirement, the more stringent ARAR should be met. Because some media have no promulgated constituent-specific ARARs or have relatively few constituents covered by such pre-established requirements, EPA's ARAR guidance stipulates that it may frequently be necessary to turn to constituent-specific advisory levels, such as carcinogenic potency factors or reference doses, to establish cleanup levels.

- Action-specific requirements set controls or restrictions on specific activities related to the management of hazardous substances (e.g., Resource Conservation and Recovery Act [RCRA] standards for design and operation of hazardous waste management facilities). These requirements are not constituent-specific, but specific to given remedial actions; they may specify acceptable methods that meet technology-based performance standards.
- Location-specific requirements set restrictions on activities according to characteristics of the site or its immediate environs (e.g., regulations pertaining to development in a 100-year floodplain). These requirements may apply if the CERCLA site is located in such a restricted area.

2.1.4 Chemical-Specific ARARs and TBC Guidance

Neither the federal government nor South Carolina has promulgated constituent-specific standards, requirements, criteria, and/or limitations that are applicable or relevant and appropriate for sediment at the site. TBC guidance includes advisories that have not been promulgated and thus are not enforceable. When compiling constituent-specific criteria, TBCs are useful where ARARs do not exist for a specific constituent, or where such ARARs are not sufficient to be protective. The constituent-specific TBC guidance associated with this project was developed by comparing the sediment analytical results from the delineation activities to the residential soil RSLs and NOAA's quick reference tables. Tables 2 and 3 provide the delineation sample results and compare the results to the above criteria. Chemical-specific ARARs are provided in Table 4.

2.1.5 Action-Specific ARARs

Action-specific ARARs are promulgated state or federal laws that set controls or restrictions on activities related to the management of hazardous materials. The alternatives, except "no action", will require "actions" to transpire in the course of successfully instituting the alternative and may be controlled or restricted by action-specific ARARs. Potential action-specific ARARs are presented in Table 5. Hazardous waste regulations are not included in Table 5, since manufactured gas plant waste is exempt from the Toxic Characteristic regulation as specified in 40 CFR 261.24(a).

2.1.6 Location-Specific ARARs

Remedial action alternatives may be restricted or precluded by federal, state, or facility laws based on its location within a site or its immediate environment. Location specific ARARs are designed to protect the local area from potentially damaging remedial actions. An example of this would be the Endangered Species Act, which requires action to conserve endangered species and critical habitat. Or the Clean Water Act, which regulates dredging and filling operations within the waters of the United States. Location-specific ARARs for this project are listed in Table 6.

3.0 IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION ALTERNATIVES

For this evaluation, the following "removal action" alternatives have been identified and analyzed:

- No Action;
- Monitoring and Institutional Controls;
- Sediment capping and institutional controls; and

- Removal and Off-Site Disposal.

As stated previously, the EE/CA guidance refers to a “removal action”, which includes options other than physical removal (i.e., capping, or *in-situ* treatment). Each option is discussed in detail below and a comparative analysis is presented in Section 4.0.

The remedial alternatives retained for evaluation are identified in Table 7 and described in detail in this section, using the following criteria:

- Overall protection of human health and the environment;
- Compliance with applicable or relevant and appropriate requirements (ARARs);
- Short-term effectiveness;
- Long-term effectiveness;
- Reduction of toxicity, mobility or volume;
- Implementability; and
- Cost.

Each alternative is evaluated independently in this section. A comparative analysis using the same criteria follows in Section 4.0. A summary of the alternatives evaluation is presented in Table 8. Detailed cost estimates for the remedial alternatives are presented in Tables 9-12, and a cost summary for all four alternatives is included in Table 13. The estimates are based on the alternative descriptions and assumptions provided in this section.

3.1 Alternative 1 – “No Action”

The “No Action” alternative provides a baseline for comparison with the other alternatives and entails leaving the TLM-impacted Congaree River sediments in their current state with no removal or mitigation activity.

Overall Protection of Human Health and the Environment

Potential human health impacts arising from contact with the TLM would remain, as would the potential for continued environmental impacts and transport of the TLM downriver to currently un-impacted areas. As a result, this alternative is considered not effective with respect to protection of human health and the environment.

Compliance With ARARs

Because invasive field activities would not occur under this alternative, action-specific and location-specific ARARs (such as the Endangered Species Act) would not apply. However, compliance with the chemical specific ARARs associated with the impacted sediments would not be achieved. This alternative would also not achieve the removal action objectives presented in Section 2.0. The overall acceptability of this alternative is fair regarding this criterion.

Short-Term Effectiveness

The "No Action" alternative would provide no initial positive improvement with regard to environmental impacts within the project area nor would it effectively limit the immediate potential for downstream migration of TLM. However, the "No Action" alternative would also not impact current land uses and would have no short-term impact on the surrounding community from noise or vehicle/equipment movement during implementation. This alternative would present no danger or exposure to project site workers since no fieldwork would be completed. In addition, short-term negative impacts to aquatic resources such as endangered species or sensitive aquatic habitat associated with intrusive remediation activities would also not be a factor. The overall acceptability of this alternative is moderate regarding this criterion.

Long-Term Effectiveness

In the long-term the "No Action" alternative has the potential to adversely impact future land uses along the shoreline adjacent to the project area by reducing riverfront property values and development options due to the continued presence of the TLM. The potential for expansion of the TLM occurrence beyond the currently identified extent is also a long-term concern. Continued risk to human health and the environment would remain for a significant time frame with this alternative. This alternative is low in acceptability for this criterion.

Reduction of Toxicity, Mobility or Volume

The "No Action" alternative would not reduce the toxicity, mobility or volume of the TLM. It is important to note that naturally occurring weathering processes would slowly reduce the toxicity of the TLM over time. With this alternative, the TLM and impacted sediment would remain in place with the potential for further downstream migration to currently unimpacted areas. As a result, the acceptability of this criterion is low.

Implementability

The technical aspect of this alternative would be readily implementable. However, this alternative will most likely not be acceptable to SCDHEC and other project stakeholders.

Cost

There would be no cost associated with the "No Action" alternative (Table 9).

3.2 Alternative 2 – "Monitoring and Institutional Controls"

This alternative would include two basic components:

- Monitoring; and
- Institutional Controls.

The monitoring would consist of routinely evaluating the sediment conditions from within the impacted area and downstream of the contiguous TLM area. As envisioned, the sediment monitoring would be conducted annually for a period of 30 years. A sediment monitoring plan would be developed for review and approval by SCDHEC. Sample locations, evaluation and collection methods (successfully used for the delineation work) would be employed with annual reporting of results. Both, the physical thickness and chemical constituent concentration of the sediment would be evaluated. Yearly data would be compared and contrasted to determine any changes in the extent of impacts over time and any constituent concentration changes within the TLM area. It is envisioned that constituent levels would be decreasing via natural processes, which would be monitored [monitored natural attenuation (MNA)]. This alternative would result in identifying changing conditions and potential downstream migration of TLM, should it occur. For the purposes of this EE/CA, a monitoring program that includes one sediment sampling/monitoring event per year will be assumed for cost evaluation purposes.

Installing institutional controls in the form of a shoreline fence and signage would provide an added measure of protection to human health. As envisioned, the fence would be installed along the shoreline for the entire length of the project area and signs would be placed on the fence to alert potential users that swimming, wading or other contact with the impacted sediment within the project area was not permitted. Signs would also be placed within the river upstream and downstream of the project area and near mid river directly adjacent to the project area. These signs would notify people within the river that access to the project area was prohibited. Figure 8 provides a potential fence and sign placement scenario.

Overall Protection of Human Health and the Environment

Installation of the institutional controls would provide a modest level of protection against human exposure by providing notification of the presence of TLM in the river. However, sign notification and physically restricting the area by providing a barrier fence will not eliminate the potential for human health impacts. This alternative would do nothing to address exposure issues associated with the benthic organisms, fish or other aquatic or terrestrial animals. There would be no measurable improvement to the environment, other that what occurs naturally. Environmental impacts and potential for transport of the TLM downriver to currently un-impacted areas would continue. The long-term monitoring component of this alternative would serve as a means to detect this migration, should it occur. This alternative is considered fair with respect to protection of human health and the environment.

Compliance With ARARs

The limited field activities associated with the sign and fence installation would not be impacted by the action-specific and location-specific ARARs (such as the Endangered Species Act). However, compliance with the chemical-specific ARARs associated with the impacted sediments would not be achieved. This alternative would also not achieve the removal action objectives presented in Section 2.0. The overall acceptability of this alternative is fair regarding this criterion.

Short-Term Effectiveness

This alternative would impact current land uses by restricting access to the project area for commerce or recreational purposes. The access restriction would reduce but not eliminate the potential for human contact with the TLM impacted sediment. This alternative would also provide no initial positive improvement with regard to environmental impacts within the project area nor would it effectively limit the immediate potential for downstream migration of TLM.

Implementation of this alternative would have no short-term impact on the surrounding community from noise or vehicle/equipment movement. Short-term, negative impacts to aquatic resources such as endangered species or sensitive aquatic habitat within the river and the TLM-impacted area would also not be a concern. The risk of danger to on-site remediation workers would be minimal due to the relatively short duration and limited intrusive activities associated with the fence and sign installations. It is assumed that implementation of this alternative can be completed in a single construction season.

The overall acceptability of this alternative is fair regarding this criterion.

Long-Term Effectiveness

This alternative would also most likely adversely impact future land use along the shoreline adjacent to the project area by reducing riverfront property values and future development options due to the presence of the TLM, and the access restrictions.

The potential for expansion of the TLM occurrence beyond the currently identified extent is also a long-term concern. Yearly monitoring would provide a means to detect potential TLM migration. Continued risk to human health and the environment would remain for a significant time frame with this alternative. This acceptability of this alternative is low for this criterion.

Reduction of Toxicity, Mobility or Volume

Restriction of access to the project area would reduce the potential for human exposure to the TLM but it would not reduce the toxicity of the substance. Reduction in the mobility or volume of the TLM would also not be accomplished by this alternative. The TLM and impacted sediment would remain in place with the potential for further downstream migration to currently unimpacted areas. Yearly monitoring would provide a means to detect potential TLM migration. The overall acceptability of this criterion is low.

Implementability

The technical aspects of this alternative would be readily implementable because they include sign and fence installation (although the shoreline terrain may prove challenging) and sediment monitoring activities. Flood conditions would have minimal impact and likely only result in minor maintenance issues. However, this alternative will most likely not be acceptable to SCDHEC and other stakeholders such as the adjacent landowners.

Cost

The present-worth cost associated with fence and sign installation and annual sediment monitoring is estimated to approximately $675,000 (Table 10). Annual inspection and reporting would be included and an allowance for annual maintenance fence/sign maintenance has been provided in the cost estimate.

3.3 Alternative 3 – "Sediment Capping and Institutional Controls"

This alternative entails the placement of a physical barrier in the form of an engineered capping system over the impacted sediment within the project area. The monitoring and institutional controls (i.e., fence and signage) described in Alternative 2 would also be a component of this alternative. The capping system would be designed to isolate the impacted sediments by providing a physical barrier on top of the sediment. It would also be designed to withstand routine flooding. Routine inspection of the cap and reporting would be performed on an annual basis. Figure 9 provides a potential sediment capping scenario. With this scenario, approximately 371,501 square feet of area would be capped. This barrier would isolate the impacted sediment and greatly reduce the potential for re-suspension and subsequent downstream movement of TLM. The barrier would also limit the potential for TLM contact by humans or aquatic organisms and the potential for flux of dissolved chemicals into the water column.

The capping materials would most likely include geotextile fabric overlaid by readily available riprap stone. The actual riprap material would be a hard, sound, dense quarry or fieldstone that is durable and resistant to weathering. The riprap would be placed from the eastern shoreline using heavy equipment such as excavators, cranes or draglines. As envisioned, the geotextile and riprap material would be placed during low to normal river flow periods. Divers would assist with temporarily deploying the geotextile in the deeper water and then the riprap would be placed to the intended thickness. Some material may be placed by hand at certain locations. A floating silt curtain would be deployed around the work area in an attempt to contain sediment that is dislodged during completion of the cap installation activities. Real-time total suspended solids (TSS) monitoring would be conducted to ensure that construction activities did not significantly increase TSS concentrations in the river, outside of the work area. Once the cap was in place, a period of monitoring would be required to ensure that the cap remains intact and that further downstream movement of impacted material does not occur.

The general sequence of activities would include deployment of the silt curtain surrounding a designated work area, installation and anchoring of the geotextile material and placement of the riprap. The riprap would be transferred from the shore to its final destination by a crane or other heavy equipment or a small boat would be utilized to carry the materials to the current work area for individual placement by divers.

Field implementation of this alternative would require limited land based construction activities on the eastern shoreline to improve access to the project area for personnel, equipment and delivery of capping materials. These construction activities would include clearing and grading operations in the area of the Senate Street alluvial fan and the current asphalt access road. Access road and shoreline improvements would be necessary to allow delivery and staging of the capping materials prior to deployment. Grading along the shoreline of the project area may also be required depending on the capping material placement method. A project compound with an office trailer and associated electrical power and utilities would be required and temporary fencing would also be installed to restrict access to the work areas by unauthorized personnel.

Once installed, the sediment cap would be periodically monitored for an assumed minimum of five years to ensure the continued integrity of the cap. An annual maintenance and repair cost for a five-year period has been included in the estimate. Sediment sampling and analysis downriver of the project area would also continue for this same period (30-years) as Alternative 2 to monitor for downstream migration of the TLM into previously un-impacted areas.

Overall Protection of Human Health and the Environment

Placement of the sediment cap would greatly reduce the potential for human health or environmental impacts by isolating the impacted material and preventing re-suspension and downstream movement. Installation of the institutional controls (signs and fencing) would also provide an added measure of human health protection by notifying potential users of the presence of the TLM and restricting access to the area. Continued periodic monitoring of the cap and the areas downstream of the project area would provide a methodology for detecting any issues with regard to cap integrity or downstream migration of the TLM.

Since the TLM would still be in place and in contact with the river water, this alternative would somewhat reduce, but not eliminate, the potential for flux of dissolved chemicals into the water column. Due to the significant reduction in the potential for contact and/or re-suspension and migration of the TLM this alternative is considered good with respect to protection of human health and the environment.

Compliance With ARARs

This alternative would be effective in satisfying the majority of the removal action goals. However, it would not satisfy the goal of restoring the project area to its “natural” conditions because the cap materials would be left in place for perpetuity. Installation of the cap would raise the riverbed elevation by approximately 12-16 inches based on the thickness of the capping material. As a result, the project area benthic habitat and bathymetric characteristics would be altered and a significant portion of the capping materials would be visible from the shore and the Gervais Street Bridge during low water levels. The riprap would not necessarily be detrimental to the overall habitat quality of the project area as it is naturally occurring rock, but the capping materials may not be considered esthetically pleasing, and may be detrimental to the overall use and enjoyment of the river at the installed locations.

Cap placement would also not satisfy the removal action goal of eliminating the potential for flux of dissolved chemicals into the water column. The cap would reduce contact of the TLM with the water column and significantly reduce the potential for re-suspension, but the effect on flux would most likely be minimal.

The placement of the cap and the associated intrusive activities would also be subject to the location-specific and action-specific ARARs, such as construction related permitting requirements and potential issues relating to sensitive habitats, etc. Satisfaction of these ARARs is not expected to be an issue and would be ensured through agency consultation during the planning and permitting process.

Finally, compliance with the chemical specific ARARs associated with the impacted sediments would not be achieved since the TLM would be left in place. As a result, the overall acceptability of this alternative is fair regarding this criterion.

Short-Term Effectiveness

This alternative would result in a temporary increase in traffic into and away from the site during implementation, with the deliveries of the capping materials and other equipment and supplies. However, the extra traffic is not expected to have a significant impact on the local community. Construction related noise impacts would also most likely be minimal. Real-time TSS monitoring would be conducted to ensure that construction activities did not significantly increase TSS concentrations in the river, outside of the work area.

Land-based construction activities would have a relatively small footprint and would be contained in the vegetated area located directly east of the project area. These construction activities would include the truck and heavy equipment movements. Once the cap installation activities are completed the land-based area would be restored to its original condition and as a result this component of the project would present very little, if any, negative short-term impacts.

The risk of danger to on-site remediation workers would be greater than the previous two alternatives. Added risk factors include hand placement of the geotextile and the riprap in some areas, work within the river with varying depths and current levels, work around heavy equipment and the increased complexity of the overall project. This alternative would also require significantly more man-hours than the previous alternatives but is still expected to be completed in one construction season.

Short-term impacts to sensitive species resulting from cap installation activities are anticipated to be minimal since the project area does not encompass the entire width of the river and as a result would not present an impediment to the movement of sensitive fish species. In addition, the portion of the project area located near the Gervais Street Bridge is relatively small and is not expected to disrupt bat roosting under the structure to a significant degree. The cap placement would however alter the habitat that is currently in place and potentially utilized by the RSSL and the freshwater mussels species of concern.

Once installed, the cap, combined with the monitoring and institutional controls, would be immediately effective in reducing, but not entirely eliminating, the potential for human contact and re-suspension and downstream movement of the TLM. This benefit would be achieved with relatively minimal negative short-term effects on the surrounding community and aquatic resources. As a result, this alternative is considered good regarding this criterion.

Long-Term Effectiveness

The cap would effectively limit the potential for future contact with the TLM by humans and other aquatic and terrestrial organisms. The long-term monitoring of the cap and downstream areas would also ensure that downstream migration of TLM does not become an issue in the future. As a result, the long-term effectiveness of the cap with regard to these items is considered good. However, the permanence of the cap and its long-term effect on the visual aesthetic of the project area and the views of the river from the adjacent shoreline would most likely be viewed as a negative attribute for this alternative. This, coupled with the permanent access restrictions, would impact current and future land uses by restricting access to the project area for commerce or recreational purposes. These factors may have the cumulative effect of reducing long-term riverfront property values and future development. In fact, this alternative may have a more negative effect on the long-term property values than the previous two alternatives because of the visual presence of the cap.

The effectiveness of reducing contact with the TLM combined with the potential reduction in aesthetic value, access and property values result in an overall rating of fair for this criterion.

Reduction of Toxicity, Mobility or Volume

Placement of the cap would be highly effective in reducing the mobility of the TLM. The geotextile and riprap would cover and hold the TLM in place and significantly reduce the potential for re-suspension and downstream movement. Routine downstream monitoring would also provide a means to detect and address TLM migration, should it occur. Placement of the cap would also reduce, but not eliminate, the potential for flux of dissolved chemicals into the water column.

Reduction in toxicity and volume would not be achieved by this alternative. The only reduction would be seen through natural attenuation over time. As a result, this alternative is considered fair with respect to this criterion.

Implementability

The technical aspects of this alternative would be readily implementable, however the highly variable bathymetric contours of the project area would present some challenges with respect to placement of the riprap. The skilled labor, capping materials and installation equipment are readily available. It is assumed that implementation of this alternative can be completed in a single construction season. However, this alternative may not be acceptable to certain project stakeholders such as the adjacent landowners due to the perceived negative impact on property values and river aesthetics.

Cost

Costs associated with this alternative are provided in Table 11. The projected present cost of this alternative is approximately $7.7 million dollars and includes the installation of the cap and the monitoring, sampling and reporting activities.

3.4 Alternative 4 – "Removal of the Impacted Sediment With Off-Site Disposal"

This alternative includes removal of the TLM and impacted sediment (and debris) within the delineated area to the extent practicable. As envisioned, implementation of this alternative would include completing the following major components:

- Conducting landside clearing, grading and site setup activities;
- Installing a cofferdam of sufficient height to restrict river flow;
- Dewatering of the area to be excavated;
- Physically removing TLM-impacted sediment and debris using conventional equipment;
- Conditioning the sediment material for transportation to the landfill;
- Backfill as necessary; and
- Off-site disposal.

A combination of removal methodologies and equipment would most likely be required to successfully complete the project due to the varying thickness of sediment and changing bathymetric conditions within the project area. Assuming an approximate thickness of 2 feet of sediment over the entire project area results in approximately 40,000 tons of sediment requiring removal and off-site treatment or disposal. Standard excavation methods coupled with vacuum removal or other techniques would most likely be employed. A key component of this alternative would be the need to construct a cofferdam around the planned removal areas in order to isolate and dewater the areas prior to initiating the removal operations. Figure 10 provides a potential sediment removal scenario with an assumed cofferdam configuration.

Once removed, the sediment would likely require drying or solidification prior to transporting the material to the disposal facility. Following completion of impacted material removal, the river bottom would be restored to its approximate original conditions by the placement of imported fill sand or rock as may be required and the cofferdam would be removed, potentially reused as fill or erosion protection. Real-time TSS monitoring would be conducted during all intrusive activities to ensure that construction activities did not significantly increase TSS concentrations in the river. This scenario would most likely be completed over multiple construction seasons or phases due to the complexity of the operations. As envisioned, each construction phase (for actual work in the river) would begin in May and end by October of each year based upon historical periods of peak river flow. This construction schedule should minimize potential impacts on spawning migrations for threatened and/or endangered species.

Similar to Alternative 3, this option would require land-based construction activities on the eastern shoreline to improve access to the project area for personnel, equipment and material transportation trucks. This alternative would most likely require more land area adjacent to the river than Alternative 3 and as a result, would require more disturbance of the shoreline riparian habitat. These construction activities would include clearing and grading operations in the area of the Senate Street alluvial fan and along the eastern shoreline and significant improvement of the current asphalt access road. A project compound with an office trailer and associated electrical power and utilities would be required and temporary fencing would also be installed to restrict access to the work areas by unauthorized personnel.

Overall Protection of Human Health and the Environment

This alternative would effectively eliminate the potential for human health or environmental impacts related to the presently delineated extent of TLM. This alternative would also eliminate the future potential for downstream migration of the TLM to previously un-impacted areas. As a result this alternative would be considered to be very effective with respect to protection of human health and the environment.

Compliance With ARARs

This alternative would satisfy all of the removal action objectives and the chemical-specific ARARs. Physically removing the TLM and impacted sediment would temporarily alter the river substrate within the project area, but this would be mitigated to the extent practicable by restoring the project area to its previous natural conditions. Additionally, specific habitat restoration and rehabilitation activities may be included in the site restoration efforts through consultation with agency experts. As a result, the final restored project area may exhibit enhanced habitat attributes with respect to certain sensitive species' requirements as compared to current undisturbed conditions. These factors combined with agency involvement in the planning process would mitigate potential issues associated with the location-specific ARARs such as the Endangered Species Act. Action-specific ARARs such as construction related permits would be obtained and compliance assured through agency consultation during the planning and work plan development process.

This alternative is considered very good with respect to this criterion.

Short-Term Effectiveness

The alternative, because it provides for removal of the TLM would produce significant short-term benefits such as the immediate elimination of the potential for human or environmental exposure. However, this alternative is also the most intrusive and the most disruptive. This alternative presents the highest risk for catastrophic loss, should the cofferdam fail or be overtopped during implementation. The multi-phase construction season (assumed to be a six-month period over three years) makes this the longest alternative to implement.

This alternative would require the largest landside support area and would most likely generate the largest volume of truck traffic into and away from the area. Stabilization of the excavated sediment would either be completed on the landside directly adjacent to the project area, at the chosen disposal/treatment facility or at SCE&G's property located on Huger Street. In either event, transportation of impacted material away from the project area and importation of cofferdam materials and backfill material to the project area would be required. These activities would result in increased truck traffic in the immediate vicinity of the site during completion of the project. There would be significant truck traffic in the project area. However, the multi-phase approach would spread the increased activity over a larger time frame and most likely lessen the potential effect on the local community.

Land-based construction activities would have a larger footprint and be more complex than the capping alternative. Land-based activities would include material stabilization and loadout, backfill and cofferdam material storage, heavy equipment operations, water management and office areas. Similar to the capping alternative, the majority of these activities would occur in the vegetated area located directly east of the project area. Again, the multiple construction phases are expected to reduce these impacts and spread them over a larger time frame. In addition, reconstruction of the landside area following completion of the removal action would further mitigate the negative impacts. Construction related noise would also be present with this alternative. Mitigation of noise related impacts would be a priority if this alternative is chosen and noise mitigation procedures would be included in the work plan. As a result, construction noise impacts are expected to be managed appropriately so as to not affect the surrounding community. Odors from the excavation and handling of TLM-impacted sediment is also a short-term concern that can be managed with the appropriate engineering controls (i.e., foam masking agent, conducting the work in a temporary structure, etc.).

Since this alternative requires construction of a cofferdam, dewatering of the project area and physical removal of the impacted sediment, it would have the greatest short-term impact on the river’s aquatic resources and habitat. These short-term impacts would include limiting access to the project area for sensitive species and temporary removal of habitat. From a broader perspective of the river, the actual project area is relatively small in comparison to the entire river and only extends approximately 250 feet into the river. As a result, limitations on the upstream or downstream movement of aquatic organisms and spawning/migrating fish are expected to be minimal. In addition, the portion of the project area located near the Gervais Street Bridge is relatively small and is not expected to disrupt bat roosting under the structure to a significant degree. The removal action would however remove the habitat that is currently in place and potentially utilized by the RSSL and the freshwater mussels species of concern. Reconstruction of the project area following removal of the TLM with special attention directed toward habitat restoration and improvement is expected to mitigate these short-term effects. Real-time TSS monitoring would also be conducted to ensure that construction activities did not significantly increase TSS concentrations in the river, outside of the work area. The multi-phase approach with removal of the cofferdam for each phase is also expected to minimize the overall short-term impact to aquatic resources.

The risk of danger to on-site remediation workers would most likely be the highest for this alternative due to the complexity and duration of the removal operations. The increase in activities, project components and equipment movements would serve to correspondingly increase the short-term risk.

The overall level of disruption, complexity and duration of this alternative combined with its high level of effectiveness with respect to removing the potential for human health or future environmental impacts results in a fair rating for this criterion.

Long-Term Effectiveness

Removal of the TLM would be most acceptable alternative from a long-term effectiveness perspective because the potential for further human health or environmental impacts would be reduced or eliminated. Depending on the relative success of the removal action, no permanent access restrictions would be placed on the project area and as a result no potential for future property devaluation would be present.

The project area would be accessible by the general public and could be utilized for recreation and commerce. Restoration of the project area following removal of the TLM would reestablish or improve the habitat characteristics and aesthetics and future monitoring would not be required. As a result, this alternative is considered very good with respect to this criterion.

Reduction of Toxicity, Mobility or Volume

Similar to the long-term effectiveness criterion, the removal alternative is the most favorable alternative with respect to the reduction of toxicity, mobility and volume. To the extent practicable, it is the only alternative that addresses the toxicity, mobility and volume of the TLM. Removal and proper disposal of the TLM would substantially address all three of these factors. As a result, this alternative is considered very good with respect to this criterion.

Implementability

From a permitting and planning perspective, this alternative is also the most difficult to implement. It would require a significant amount of agency, stakeholder and local community interaction to develop the appropriate plans and acquire the necessary permits to complete.

Although complicated and time consuming, this alternative is readily implementable due to the availability of technology, equipment, labor and materials. In addition, once the removal activities are completed and the project area is restored to its approximate pre-removal conditions, no remnants of the remediation work would be visible and no institutional controls would most likely be required. As a result, this alternative would most likely be the most acceptable to SCDHEC, local stakeholders and adjacent property owners.

Cost

Finally, this alternative is also expected to be the most expensive with a present cost of approximately 18.5 million dollars. A cost estimate breakdown is provided on Table 12.

4.0 COMPARATIVE ANALYSIS

Each remedial alternative for the Congaree River Site was evaluated using the seven evaluation criteria identified in Section 3.0. This section presents a comparative analysis of the alternatives using the same seven criteria. The comparative analysis is summarized in Table 14. The alternatives are ranked qualitatively in Table 15.

4.1 Protection of Human Health and the Environment

Alternatives 1 and 2 are the least effective options with regard to protection of human health and the environment. This is because both alternatives leave the TLM in place. Alternative 2 is slightly more protective of human health since the institutional controls would restrict access to the project area and reduce, but not eliminate, the potential for human exposure. Also, the long-term monitoring component of Alternative 2 would provide an added measure of protection for the environment since it would serve as a means to detect downstream migration of the TLM.

Alternative 3 consists of placing an engineered cap (geotextile fabric and riprap) over top of the TLM-impacted area. Institutional controls described in Alternative 2, that include installing a fence with signs, would also be completed. The placement of the engineered cap along with the institutional controls provided in Alternative 3 would significantly increase the level of human health and environmental protection because it would isolate the TLM from both human and animal contact and significantly reduce the potential for re-suspension and downstream migration. Installation of institutional controls would further restrict human access to the project area and provide an additional layer of protection. Cap placement would also reduce but not eliminate the potential for flux of dissolved phase constituents with the water column.

The most effective alternative with respect to human health and the environment is Alternative 4. Alternative 4 includes the physical removal and off-site disposal of the TLM followed by restoration of the project area to its approximate original conditions. This alternative requires the construction of a cofferdam, dewatering of the project area and landside improvements. By physically removing the TLM, this alternative would greatly reduce or eliminate the potential for future human health exposure and environmental impacts. Post removal, it would also reduce or eliminate the potential for re-suspension and downstream migration of the TLM and for flux of dissolved constituents with surface water.

4.2 Compliance with ARARs

As described in Section 2.1.3, the ARARs associated with this project are grouped into three categories. The chemical-specific ARARs provide requirements based on health or risk-based concentration limits such as the concentrations of the TLM-related constituents in sediment. The action-specific ARARs provide requirements based on completion of certain activities, such as conducting an environmental remediation project. Finally, the location-specific ARARs provide guidance based on the physical setting or specific characteristics of the site, such as removal operations within a river. It is important to note that when comparing the four alternatives outlined in this EE/CA with respect to the various ARARs only the chemical-specific ARARs would not be met by some of the alternatives. The action and location-specific ARARs would either not apply to some alternatives or would be satisfied by conducting the appropriate pre-planning, permitting and agency coordination activities.

The chemical-specific ARARs would not be satisfied by the first three alternatives because the TLM would be left in place within the river. The institutional controls, monitoring or installation of the cap would not reduce the chemical concentrations currently present within the sediment. Alternative 4 would physically remove the TLM to the extent practicable and significantly reduce the potential for exceedance of the associated chemical-specific criteria. As a result, Alternative 4 is the only alternative with the potential to satisfy the chemical-specific ARARs.

The action-specific ARARs would not apply to Alternative 1 since no activities would be conducted. In addition, the limited scope of activities associated with the institutional controls and monitoring proposed in Alternative 2 would also most likely not trigger action-specific ARARs. Since the scope of activities increases significantly with Alternatives 3 and 4 the action-specific ARARs would be applicable to these alternatives. Alternative 3 and 4 both require work within the river and construction and operation of landside support facilities. Alternative 4 would most likely require a much larger landside support area and is an overall more complex alternative. However, both alternatives would most likely require satisfaction of similar ARARs. These would be satisfied through completion of the required pre-planning, agency coordination and permitting activities.

A similar scenario is seen with respect to the location-specific ARARs. These ARARs would not be applicable to Alternatives 1 and 2 since no intrusive activities would occur. Alternatives 3 and 4 would be subject to very similar location-specific ARARs, which would be satisfied through completion of the appropriate planning and permitting steps.

Following review of the above information, only Alternative 4 provides for the overall satisfaction of all of the ARARs. It would satisfy the chemical-specific ARARs through removal of the TLM from the river. The action-specific and location-specific ARARs would apply to the project but compliance would be assured through completion of the appropriate planning and coordination activities.

4.3 Short-Term Effectiveness

Since no field activities would occur with Alternative 1, "No-Action", this alternative would have no potential for adverse short-term impacts on the local community, environment or remediation workers. This alternative would also not produce any positive short-term effects.

Alternative 2 requires some field activity associated with sign and fence installation and completion of the periodic monitoring events. These activities would pose a minimal risk to the remediation workers responsible for conducting the activities. The fence, signs and access restrictions implemented as part of Alternative 2 would most likely produce a short-term negative impact on use of the resource within the project area and property values adjacent to the project area. However, limiting access to the project area would result in a short-term reduction in the potential for human health impacts as a result of contact with the TLM. No other positive short-term impacts would result from Alternative 2.

For Alternative 3, project related activities would increase significantly over the first two alternatives. As a result, short-term impacts to the surrounding community would increase in the form of additional truck movements within the community and the potential for construction related noise. These impacts are expected to be minimal. The health and safety of remediation personnel during implementation of this alternative would be similar to other construction projects completed within a river environment. The use of experienced, qualified contractors would reduce the potential for safety related issues.

Short-term impacts to sensitive species resulting from cap installation activities are expected to be minimal since the project area does not encompass the entire width of the river and as a result, would not present an impediment to the movement of sensitive fish species. In addition, the portion of the project area located near the Gervais Street Bridge is relatively small and is not expected to disrupt bat roosting activities to a significant degree. The cap placement would however alter the habitat that is currently in place and potentially utilized by the RSSL and the freshwater mussels species of concern.

Alternative 3 land-based support zone activities would also require some clearing and grading and access road improvements in the vicinity of the Senate Street alluvial fan. These activities are not expected to cause any negligible negative short-term impacts.

Placement of the cap and the institutional controls would have a positive short-term impact with respect to reducing the potential for human or animal contact with the TLM. After installation, it would also significantly reduce the potential for re-suspension and downstream migration of the TLM. During installation, this alternative has the potential to disturb existing TLM, which may create some temporary adverse effects. The short-term negative impacts associated with the access restrictions and property values would still be present with this alternative and the presence of the cap may reduce the visual aesthetic appeal of the area, as well.

Alternative 4 has the greatest potential for short-term impacts to the local area due to the increase in vehicle traffic associated with transport of cofferdam components, impacted material and backfill/restoration materials. The vehicle traffic impacts are expected to be relatively minor and the multiple-phase approach to implementation would spread out the activity over a longer time frame and potentially mitigate some of the impacts. This alternative would also most likely require more significant landside clearing, grading and access road improvements. The landside footprint for this alternative is expected to be much larger than Alternative 3. However, through proper planning and post-removal action site restoration the landside activities are expected to not pose a significant short-term impact. Odor control will be a short-term issue associated with this alternative. However, engineering controls will mitigate the impact.

Alternative 4 is also the most complicated and would require the longest implementation period. As a result, it most likely has the highest potential for safety issues during implementation. Similar to Alternative 3, the use of experienced, qualified contractors would reduce the potential for safety-related issues.

Alternative 4 would also present the greatest short-term impacts on the river habitat since the removal areas would remain dewatered for long periods and the benthic habitat would be physically removed. However, similar to Alternative 3, these impacts are expected to be minimal due to the size of the project area in relation to the river as a whole. Fish and other aquatic organism movement through the area would not be impeded and the relatively small area of activity near the bridge is not expected to disrupt bat roosting efforts under the structure. The removal action would most likely temporarily impact any freshwater mussels and potentially any RSSLs located within the removal area. These impacts would be somewhat mitigated by the final restoration efforts and potential for habitat improvement during restoration.

On the positive side, the short-term impact of removing the TLM from the river would immediately eliminate the potential for human and animal contact and the potential for re-suspension and downstream migration. Overall, the minimal short-term potential negative impacts associated with Alternative 4 are overshadowed by the positive attributes of the removal action coupled with the site and habitat restoration efforts.

4.4 Long-Term Effectiveness

Alternative 1 has no positive long-term benefits since the TLM would remain in the river. Alternative 2 provides for an increase in protection of human health by the addition of the institutional controls and an increase in environmental protectiveness from the long-term monitoring program. The institutional controls would restrict access to the project area, which would reduce but not eliminate the potential for future human contact with the TLM. The long-term monitoring would provide a means for detecting downstream migration of the TLM to previously unimpacted areas.

The negative long-term aspects associated with Alternative 2 include impacts to adjacent property owners and recreational and commercial end users of the resource due to the continued presence of the TLM, the access restrictions and the potential reduction in property values and limited future development options. Long-term potential for flux of dissolved phase constituents with the water column would also remain with Alternative 2.

Alternative 3 provides a significant increase in long-term human health and environmental protection due to the cap placement, institutional controls and monitoring. The cap would effectively isolate the TLM, which would reduce the potential for human and animal contact and re-suspension and downstream migration. However, the placement of the cap may reduce the aesthetic qualities of the project area and would forever alter the habitat characteristics. In addition, the cap aesthetics combined with the access restrictions would serve to increase the potential negative impact on adjacent property values and future use options when compared to Alternative 2.

Alternative 4 provides the greatest long-term benefit by removing the TLM and restoring the project area to the approximate original conditions. TLM removal would eliminate the potential for future human or animal contact and for downstream migration. The overall long-term impact on sensitive species and habitat is expected to be minimal with this alternative. In fact, it most likely presents the best long-term scenario for sensitive species since improvements may be planned as part of the reconstruction and restoration efforts following consultation with habitat experts.

Finally, this alternative presents the best scenario for future property values and development options since removal of the TLM would eliminate the need for access restrictions. The restoration efforts would also ensure that the long-term esthetic value of the project area is not degraded. As a result, Alternative 4 is the best alternative from a long-term effectiveness perspective.

4.5 Reduction of Toxicity, Mobility or Volume

Alternatives 1 and 2 provide no reduction in toxicity, mobility or volume since the TLM would be left in place. The long-term monitoring component of Alternative 2 would provide a means to detect if the TLM is actually mobile and migrating to previously unimpacted areas. Alternative 3 would significantly reduce the mobility of the TLM by the placement of the cap and would also provide the long-term monitoring component. However, Alternative 3 would not reduce the toxicity or volume of the TLM and the TLM would be present underneath, which may allow for continued flux of dissolved phase constituents with the water column.

In comparison, Alternative 4 would effectively eliminate issues pertaining to all three components of this criterion through removal of the TLM from the project area. However, the potential for mobility of TLM would be greatly increased during the removal action while the cofferdam is being constructed or if the cofferdam is overtopped during the excavation process. As an added benefit, reduction in toxicity of the removed TLM material may occur as a result of conditioning or solidifying the saturated sediment prior to transporting to the landfill. As a result, Alternative 4 it is the best alternative with respect to reduction of toxicity, mobility and volume of the TLM.

4.6 Implementability

All four alternatives are readily implementable. The materials, equipment, personnel and expertise are available to successfully complete any of the alternatives. However, the alternatives do differ significantly in their level of effort and overall complexity. Alternatives 1 and 2 are the least complex and Alternative 4 is the most complex and difficult to implement. This is due to the construction of the cofferdam, dewatering, removal and restoration components. Alternative 4 would also require the most detailed plans and the most time for work plan development and implementation. The multiple construction phases and long-term nature of Alternative 4 also increases the overall complexity of this option. Alternative 3 is less complex and would require less planning and less time to complete than Alternative 4.

From a permitting perspective, the degree of difficulty in obtaining the potentially applicable permits increases for each alternative. The “No Action” alternative would not require a permit. The institutional controls associated with Alternative 2 may involve obtaining a U.S. Army Corps of Engineers (USACE) permit. Alternatives 3 and 4 would likely involve obtaining a USACE permit. The construction of a cofferdam and the proposed dredging associated with Alternative 4 would likely trigger the need for a General Permit with the USACE.

Acceptability of the alternatives to SCDHEC and project stakeholders such as adjacent landowners and conservation groups would also vary. Alternatives 1 and 2 would most likely not be acceptable to SCDHEC and project stakeholders because the potential for continued human health and environmental issues would remain within the project area, as would the access restrictions. Alternative 3 may be acceptable from a human health and environmental standpoint but may pose some issues with local stakeholders due to access restrictions, property devaluation and reduction in the aesthetic appeal of the project area. Alternative 4 would be the most intrusive with the highest cost but it will likely be the most acceptable to both SCDHEC and the various project stakeholders.

It is important to note that Alternatives 3 and 4 would require access to the landside property along the eastern shoreline. Permission to utilize this property for material staging and other activities and approval to modify this property through clearing, grading and access road improvements is critical to the implementation of either of these alternatives. The shallow depth of the river precludes access to the project area from the riverside with a barge or another large, deep drafting vessel. As a result, access to the project area from the eastern shoreline via the Senate Street access road is imperative since this would be the primary access during project implementation.

4.7 Cost

The cost estimates and assumptions for the four alternatives are summarized in Table 13. The cost for each alternative increases in accordance with the alternative’s inherent complexity, duration and level of planning required for successful completion. Alternative 4 is the highest cost alternative (approximately 18.5 million dollars) with Alternative 3 being a somewhat distant second. Alternative 4 benefits from the elimination of post implementation monitoring but exhibits higher implementation costs. The extended monitoring period (30 years) associated with Alternatives 1 and 2 adds to their respective costs, but their respective implementation costs are lower.

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TABLES

TABLE 1

FEDERAL AND STATE THREATENED AND ENDANGERED SPECIES

Congaree River Sediments
Columbia, South Carolina

Common Name	Scientific Name	Federal Status[1]	State Status[2]
Mammals			
Rafinesque's Big-Eared Bat	*Corynorhinus Rafinesquii*	N/A	E
Fish			
Atlantic Sturgeon	*Acipenser Oxyrhynchus*	C	N/A
Robust Redhorse Sucker	*Moxostoma Robustum*	SOC	N/A
Shortnose Sturgeon	*Acipenser Brevirostrum*	E	E
Plants			
Rocky Shoal's Spider-Lily	*Hymenocallis Coronaria*	SOC	N/A
Freshwater Mussels			
Roanoke Slabshell	*Elliptio Roanokensis*	SOC	N/A
Yellow Lampmussel	*Lampsilis Cariosa*	SOC	N/A
Carolina Slabshell	*Elliptio Congaraea*	SOC	N/A
Carolina Lance	*Elliptio Angustata*	SOC	N/A
Fatmucket	*Lampsilis Splendida*	SOC	N/A

Notes:
N/A - Not Applicable
1 - Federal Status - E (listed as Endangered under ESA [Endangered Species Act]); C (Candidate for Federal listing); SOC (Federal Species of Concern).
2 - State Status - E (State-listed as Endangered).

TABLE 2

RESIDENTIAL SCREENING LEVELS (SOIL) VS TLM-IMPACTED SEDIMENT ANALYTICAL RESULTS

Congaree River Sediments
Columbia, South Carolina

General Area		Preliminary - Near the Alluvial Fan and Sand Bar						
Source		SCE&G	SCE&G	SCDHEC	SCE&G	SCDHEC	SCE&G	SCDHEC
(Line) Location of Sample	Residential	S-1	S-1 Dup	S-1	S-2	S-2	S-3	S-3
Date Sampled	Soil	6/28/2010	6/28/2010	6/28/2010	6/28/2010	6/28/2010	6/28/2010	6/28/2010
Sample Interval (feet brb)	RSL	NR	NR	NR	NR	NR	NR	NR
Parameters								
Volatiles (mg/Kg)								
1,2,4-Trimethylbenzene	62	90.2 B	52 B	NA	4.31 B	NA	49.9 B	NA
1,3,5-Trimethylbenzene	780	28.8 B	16.6 B	NA	1.84 B	NA	16 B	NA
Benzene	1.1	43.9 B	22.1 B	16	1.22 B	0.97	17 B	8
Ethylbenzene	5.4	214 B	124 B	150	6.64 B	10	113 B	90
Isopropylbenzene	--	22.2	12.8	14	1.25	2.2	12.5	8
p-Isopropyltoluene	--	11.7	6.78	NA	0.965	NA	6.67	NA
Styrene	6300	11.7 B	4.04 B	5.7 U	0.807 B	0.35 U	9.44 B	3.2 U
Toluene	5000	6.43 B	1.47 B	5.7 U	0.555 B	0.35 U	4.33 B	3.2 U
Total Xylenes	630	124.3 B	74.5 B	79	2.773	4.1	26.42	19
Semi-Volatiles (mg/Kg)								
1-Methylnaphthalene	16	1,170 EB	666 B	NA	134 B	NA	792 B	NA
2-Methylnaphthalene	230	1,870 EB	1,070 EB	1,700	231 B	400	1,320 EB	1,200
Acenaphthene	3400	644	371	730	194	380	642	740
Acenaphthylene	--	146	72	170	10.5	44 U	85.8	100
Anthracene	17000	385	222	450	142	300	355	430
Benz(a)anthracene	0.15	270	154	340	40.2	130	207	290
Benzo(a)pyrene	0.015	320 B	179 B	380	60 B	130	232 B	310
Benzo(b)fluoranthene	0.15	123 B	70.9 B	220	29.1 B	110	92.3 B	180
Benzo(g,h,i)perylene	--	159 B	89.5 B	140 U	27.1 B	47	115 B	110
Benzo(j/k)fluoranthene	1.5	153 B	84.8 B	140 U	38 B	44 U	117 B	94
Biphenyl	--	302 B	172 B	300	33.3 B	64	209 B	220
Chrysene	15	287	163	340	54.1	110	216	280
Dibenz(a,h)anthracene	0.015	47	26.1	140 U	7.8	44 U	33	82 U
Fluoranthene	2300	417	244	530	145	320	350	480
Fluorene	2300	405	229	490	98.8	220	336	420
Indeno(1,2,3-cd)pyrene	0.15	116	65.1	140 U	23.6	44 U	84.6	82 U
Naphthalene	3.6	3,710 EB	2,140 EB	3,100	291 B	470	2,240 EB	2,000
Phenanthrene	--	1,510 E	869	1,600	365	710	1,250 E	1,400
Pyrene	1700	737 B	432 B	900	178 B	380	607 B	800
Totals (mg/Kg)								
Total BTEX	--	389	222	245	11.2	15.1	160.8	117.0
Total PAH	--	9,429	5,411	9,250	1,704	3,307	6,963	7,634

Notes:

Samples were collected and split between SCDHEC and SCE&G for independent analysis.

EPA Region 9, Residential Soil Regional Screening Levels (RSL), Summary Table, May 2012. Carcinogenic risk 1 x 10^{-6} and noncarcinogenic HQ = 1.

[shaded box] Exceeds screening values.

B - Analyte detected in the blank.

E - Estimate, result detected above calibration range.

NA - Not analyzed

NR - Not recorded

U - Indicates that the constituent was not detected at the reported detection limit.

TABLE 3

SEDIMENT SCREENING VALUES VS TLM-IMPACTED SEDIMENT ANALYTICAL RESULTS

Congaree River Sediments
Columbia, South Carolina

General Area		Preliminary - Near the Alluvial Fan and Sand Bar						
Source		SCE&G	SCE&G	SCDHEC	SCE&G	SCDHEC	SCE&G	SCDHEC
(Line) Location of Sample	Sediment Screening Values	S-1	S-1 Dup	S-1	S-2	S-2	S-3	S-3
Date Sampled		6/28/2010	6/28/2010	6/28/2010	6/28/2010	6/28/2010	6/28/2010	6/28/2010
Sample Interval (feet brb)		NR	NR	NR	NR	NR	NR	NR
Totals (mg/Kg)								
Total BTEX	--	389	222	245	11.2	15.1	160.8	117.0
Total PAH	.264 - 100	9,429	5,411	9,250	1,704	3,307	6,963	7,634

Notes:

Samples were collected and split between SCDHEC and SCE&G for independent analysis.

NR - Not recorded

Sediment Screening Values - NOAA Screening Quick Reference Tables, or SQuiRTs; Hyalella TEL - Threshold Effects Level

.264 - Based on EPA Assessment and Remediation of Contaminated Sediments (ARCS) 1994.

100 - Based on the EQp approach using current ambient water quality criteria (AWQC) CCC.

[shaded] Exceeds screening values.

TABLE 4

CHEMICAL-SPECIFIC ARARs AND TBCs

Congaree River Sediments
Columbia, South Carolina

Potential ARAR/TBC[1]	Law/Regulation	Brief Description	ARAR/TBC Status
Safe Drinking Water Act (SDWA)	National and State Primary Drinking Water Standards Maximum Contaminant Levels (MCLs) 40 CFR 141 SCC 61-58	Establishes health-based standards for public drinking water systems	TBC - Used in determining groundwater cleanup levels
Huger Street Site-Specific Risk Assessment		Used to quantify risks associated with constituents of interest in various site media	TBC - Compared to acceptable risk levels
NOAA SQuiRTS		Compare sediment analytical to sediment quality guidelines	TBC - Compare to sediment quality guidelines to identify impacts
EPA Region 9 RSLs		Compare sediment analytical to residential screening levels for surface soil	TBC - Compare to residential screening levels to identify potentially impacted material
Water Classifications and Standards	SCC 61-68	Establishes rules for the management and protection of the quality of South Carolina surface and groundwater	ARAR - Applicable to surface water quality work in the river

Notes:

(1) - ARAR - Applicable Relevent and Appropriate Requirement.
TBC - To Be Considered

TABLE 5

ACTION-SPECIFIC ARARs AND TBCs

Congaree River Sediments
Columbia, South Carolina

Potential ARAR/TBC[(1)]	Law/Regulation	Brief Discription	ARAR/TBC Status
Land Disturbance	The Stormwater Management and Sediment Reduction Act SCC 48-14	Requirements for preparing a stormwater management and sediment control plan for land disturbance activities.	ARAR - Relevant and appropriate to excavation and backfilling activities.
	Standards for Stormwater Management and Sediment Reduction SCC 72-300 thru 72-316	Requirements for stormwater management and sediment control measures and permitting related to land disturbance activities.	ARAR - Applicable to excavation and backfilling activities if land disturbance is greater than 1 acre.
Stormwater Discharge	The National Pollutant Discharge Elimination System 40 CFR 122.26, 122.41 and 122.48 SCC 61-9.122	Requirements ensure that stormwater discharges from remedial action activities do not violate surface water quality standards. Also, establishes standards for permit compliance, system operations and maintenance, monitoring and recordkeeping, and reporting.	ARAR - Applicable to the substantive requirements of the permit program for stormwater discharge during remedial activities.
Clean Water Act	Section 404	Establishes a program to regulate the discharge of dredged and fill material into wetlands and other "waters of the United States".	ARAR - Applicable to excavation and backfilling during remedial activities.
Fugitive Air Emissions	Control of Fugitive Particulate Matter SCC 61-62.6 40 CFR 50.7	Requires reasonable precautions be implemented to prevent particulate matter from fugitive dust and emission from becoming airborne. Prohibits the discharge of visible dust emissions beyond the lot line of the property.	ARAR - Applicable to the excavation, backfilling and vehicle movement activities that may generate fugitive dust during remedial activities.
Imported Fire Ant Regulations	7 CFR 301.81	Requires a certification that materials shipped from quarantined areas are free of fire ants	ARAR - Applicable to the transportation of excavated soil

TABLE 5

ACTION-SPECIFIC ARARs AND TBCs

Congaree River Sediments
Columbia, South Carolina

Potential ARAR/TBC[(1)]	Law/Regulation	Brief Discription	ARAR/TBC Status
Off-site Disposal of Solid Waste	Solid Waste Management: Construction, Demolition and Land-Clearing Debris Landfills SCC 61-107.11	Establishes minimum standards for the site selection, design, operation, and closure of construction, demolition and land-clearing debris landfills.	ARAR - Relevant and appropriate for selecting and off-site landfill for the disposal of demolition and debris generated from remediation activities.
	Solid Waste Management: Industrial Waste Landfills SCC 61-107.6	Establishes minimum standards for the site selection, design, operation, and closure of industrial soil waste landfills.	ARAR - Relevant and appropriate for selecting and off-site landfill for the disposal of impacted excavated soil and debris.
	Solid Waste Management: Off-site Treatment of Contaminated Soil SCC 61-107.18	Establishes minimum standards for the procedures, documentation, and other requirements which must be met for the proper site selection, design, operation, and closure of facilities treating contaminated soil and soil-like materials, herein after referred to as soil, which is not hazardous waste as defined by Resource Conservation and Recovery Act (RCRA), Public Law 94-580, and R.61-79, Hazardous Waste Management Regulations promulgated pursuant to the South Carolina Hazardous Waste Management Act, (SCHWMA), as amended, S.C. Code Ann. Section 44-56-10 et seq., and that has been excavated and is being treated off-site.	ARAR - Relevant and appropriate for selecting and off-site low-temperature thermal desorption treatment facility for impacted excavated soil.

Notes:

(1) - ARAR - Applicable Relevent and Appropriate Requirement
TBC - To Be Considered

TABLE 6

LOCATION-SPECIFIC ARARs AND TBCs

Congaree River Sediments
Columbia, South Carolina

Potential ARAR/TBC[1]	Law/Regulation	Brief Description	ARAR/TBC Status
National Historical Preservation Act	16 USC Section 469 36 CFR 65 40 CFR 6301	Action to recover and preserve artifacts in an area where actions may cause irreparable harm, loss or destruction of significant artifacts.	ARAR - Applicable due to the potential for historical artifacts located in and near the river, and/or historical property in the vicinity of the project area.
Endangered Species Act 1973	16 USC Section 1531-1544	Action to conserve threatened and endangered plants and animals and the habitats in which they are found.	ARAR - Applicable due to the endangered species and habitats located in and near the river.
Protection of Wetlands	Executive Order No. 1190 In furtherance of the National Environmental Policy Act of 1969, as amended (42 USC 4321 et seq.)	Action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the naturan and beneficial values of wetlands.	ARAR - Applicable due to the presence of wetlands located near the river.
Floodplain Management	Executive Order No. 11988 In furtherance of the National Environmental Policy Act of 1969, as amended (42 USC 4321 et seq.)	Action to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains.	ARAR - Applicable due to the presence of floodplains associated with the river.
Riffle and Pool Complexes	40 CFR Part 230 Sec 230.45 Guidelines for Specification of Disposal Sites for Dredged or Fill Material	Discharge of dredge or fill material can eliminate riffle and pool areas by displacement, hydrologic modification, or sedimentation.	ARAR - Applicable activities can affect riffle and pool areas and may reduce stream habitat diversity.
South Carolina Underwater Antiquities Act of 1991	Article 5, Chapter 7, Title 54, Code of Laws of South Carolina, 1976	Submerged historical archeological properties.	ARAR - Applicable due to the potential presence of archeological items in the project area.

Notes:

(1) - ARAR - Applicable Relevent and Appropriate Requirement.
TBC - To Be Considered

TABLE 7

REMOVAL ACTION ALTERNATIVES

Congaree River Sediments
Columbia, South Carolina

	Alternative Description
1	**No Action -** retained as a baseline for comparison with other alternatives. The TLM would be left in place.
2	**Monitoring and Institutional Controls -** The TLM would be left in place and access restrictions would be established by the installation of signs and a chain link fence along the shoreline. Yearly monitoring of sediment conditions within and downstream of the project area in order to detect potential migration of the TLM.
3	**Sediment Capping and Institutional Controls -** The TLM would be left in place and an engineered cap would be installed that would include geotextile and rip rap placed over top of the TLM. Institutional controls and monitoring similar to Alternative 2 would be included.
4	**Removal of the Impacted Sediment With Off-Site Disposal -** The TLM would be physically removed from the river. This would include construction of a cofferdam and dewatering of the project area in order to access the TLM and sediments.

TABLE 8

REMOVAL ALTERNATIVES EVALUATION

Congaree River Sediments
Columbia, South Carolina

Criteria	**Alternative 1** **No Action**	**Alternative 2** **Monitoring and Institutional Controls**	**Alternative 3** **Sediment Capping and Institutional Controls**	**Alternative 4*** **Removal of the Impacted Sediment With Off-Site Disposal**
Overall Protection of Human Health and the Environment	• TLM impacted sediment is not addressed and all present concerns would remain	• Provides modest level of protection for human health due tc access restrictions (signs and barrier fence), reduces but does not eliminate potential for human contact • No improvement to the environment. Monitoring will detect downstream migration.	• Greatly reduce the potential for human health and environmental impacts by isolating the TLM and preventing re-suspension and downstream movement • Access restrictions would provide an added measure of protection • Would reduce but not eliminate flux	• Eliminates potential for human health and environmental impacts related to TLM • Eliminates potential for downstream migration of TLM
Compliance with ARARs	• No activities involved so no action-specific or location-specific ARARs apply • Removal action goals would not be achieved and chemical-specific ARARs would not be satisfied	• No action-specific or location-specific ARARs apply • Removal action goals would not be achieved and chemical-specific ARARs would not be satisfied	• Would satisfy the majority of removal action objectives except site restoration and flux objectives • Subject to location-specific and action-specific ARARs that would be satisfied during planning and permitting process, chemical-specific ARARs would not be satisfied	• Would satify all removal action objectives and chemical-specific ARARs • Subject to location-specific and action-specific ARARs that would be satisfied during planning and permitting process.
Short-Term Effectiveness	• No positive short-term effects regarding the TLM and the potential for human health or environmental issues • No negative effects on aquatic resources, surrounding community or use of the river • No potential for remediation worker safety issues	• Restricts access to project area for commerce or recreational purposes. • Modest initial human health protection from access restriction • No community impacts and risk to remediation workers is low • No short-term impacts to aquatic resources or habitat	• Minimal increase in traffic and construction related noise • Land-based construction activities for support area and river access, which will be restored at end of project • More man-hours and increased risk for remediation workers minimal environmental impact except habitat alteration • Immediate decrease in human health and environmental impacts and potential for downstream migration of TLM, potential for flux decreased significantly but not eliminated	• Immediate elimination of human health and environmental concerns • Most intrusive and disruptive with the highest risk for catastrophic loss and remediation worker safety issues • Longest duration, requires largest landside support area an the largest increase in truck traffic and noise • Habitat impacts in project area mitigated by site restoration and potential habitat improvement
Long-Term Effectiveness and Permanence	• Will not provide adequate long-term protection of human health or the environment • May negatively impact future property values and development options for adjacent land owners	• Potential for expansion of TLM beyond the currently extent, yearly monitoring would detect expansion • Would restrict long-term use of the resource and may negatively impact adjacent property values and developme options	• Provides adequate long-term protection for human health and the environment, potential for flux remains • Permanent cap will change aesthetic of the project area and coupled with access restrictions may negatively impact future adjacent property values and development options	• Eliminates long-term human health and environmental impacts and the potential for downstream TLM migration • No long-term monitoring or access restrictions required, no negative impacts to property values or future development options and site restoration will potentially improve habitat
Reduction of Toxicity, Mobility or Volume	• No reduction in toxicity, except through natural processes • Volume and mobility would remain unchanged	• Access restrictions would reduce the potential for exposure but not the toxicity of the TLM, volume and mobility would not be reduced • Monitoring would detect future migration of TLM	• Significant reduction in the potential for mobility but no reduction in toxicity or volume • Potential for flux remains	• Completely addresses toxicity, volume and mobility of TLM
Implementability	• No technical constraints to implementation • Most likely unacceptable to SCDHEC and other stakeholders	• No technical constraints to implementation • Most likely unacceptable to SCDHEC and other stakeholders	• Technical aspects are readily implementable • Change in river aesthetics and negative impact on property values may be unacceptable to some stakeholders	• Technical aspects are readily implementable but the most complex and will require the longest time to complete • Most complicated and time consuming from a planning and permitting perspective
Cost	• Capital costs $0 • Annual costs $0 • Estimated total costs $0	• Capital costs $147,085 • Annual costs $34,500 • Estimated total costs (30 years) $677,000	• Capital costs $6,885,913 • Annual costs $45,000 • Estimated total costs (30 years) $7,681,000	• Capital costs $18,529,089 • Annual costs $0 • Estimated total costs (15 years) $18,529,089

Note:
* For comparison purposes of this evaluation, removal of the TLM assumes that the total volume of impacted material can be removed. The intent of the alternative is to remove TLM to the maximum extent practicable.

TABLE 9

ALTERNATIVE 1 - NO ACTION
DETAILED COST ESTIMATE

Congaree River Sediments
Columbia, South Carolina

CAPITAL COST

	Unit	Quantity	Unit Cost	Total
Equipment	Lump Sum	--	--	$0
Construction	Lump Sum	--	--	$0
TOTAL CAPITAL COST				$0
TOTAL ANNUAL OPERATION AND MAINTENANCE COST				$0
PRESENT WORTH COST				$0
			Interest Rate	5%
			Term (years)	30

TABLE 10

ALTERNATIVE 2 - MONITORING AND INSTITUTIONAL CONTROLS
DETAILED COST ESTIMATE

Congaree River Sediments
Columbia, South Carolina

CAPITAL COST

	Unit	Quantity	Unit Cost	Total
Construction				
Chain Link Fence Installation	Linear Feet	2100	$20	$42,000
Sign Installation	Per Sign	210	$50	$10,500
Engineering				
Design	Lump Sum	1	$20,000	$20,000
Construction Management	Week	4	$6,350	$25,400
Permits and Approvals	Lump Sum	1	$5,000	$5,000
Surveying	Lump Sum	1	$5,000	$5,000
Sediment Monitoring Plan	Lump Sum	1	$20,000	$20,000
Capital Cost Subtotal				$127,900
Contingency (15% of Capital Costs)				$19,185
Total Capital Cost				$147,085

ANNUAL OPERATION AND MAINTENANCE COSTS

	Unit	Quantity	Unit Cost	Total
Yearly Fence and Sign Maintenance	Per Year	1	$5,000	$5,000
Yearly Sediment Monitoring - Physical Movement Only (no analytical)	Per Year	1	$15,000	$15,000
Reporting and Project Management	Per Year	1	$10,000	$10,000
Annual Cost Subtotal				$30,000
Contingency (15% of Capital Costs)				$4,500
Total Annual Cost				$34,500

TOTAL CAPITAL COST	$147,085
TOTAL ANNUAL OPERATION AND MAINTENANCE COST	$34,500
PRESENT WORTH COST	$677,000

Interest Rate	5%
Term (years)	30

TABLE 11

ALTERNATIVE 3 - SEDIMENT CAPPING AND INSTITUTIONAL CONTROLS
DETAILED COST ESTIMATE

Congaree River Sediments
Columbia, South Carolina

CAPITAL COST

	Unit	Quantity	Unit Cost	Total
Construction				
Mobilization/Demobilization	Lump Sum	1	$10,000	$10,000
Landside Clearing and Grading, Site Operations	Lump Sum	1	$75,000	$75,000
Site Security	Per Month	9	$14,000	$126,000
Silt Curtain and Absorbent Boom	Linear Feet	1600	$60	$96,000
Geotextile Material	Square Feet	375,000	$0.11	$41,250
Placement of Geotextile Material	Square Feet	375,000	$2.00	$750,000
Purchase and Delivery of Riprap Material	Ton	32,000	$50.00	$1,600,000
Placement of Riprap Material	Ton	32,000	$75	$2,400,000
Site Restoration	Lump Sum	1	$50,000	$50,000
Chain Link Fence Installation	Linear Feet	2100	$20	$42,000
Sign Installation	Per Sign	210	$50	$10,500
Surveying	Lump Sum	4	$2,500	$10,000
Engineering				
Engineering and Design	Lump Sum	1	$60,000	$60,000
Work Plan Development	Lump Sum	1	$40,000	$40,000
Contractor Procurement	Lump Sum	1	$30,000	$30,000
Preplanning, Permits and Approvals	Lump Sum	1	$50,000	$50,000
Field Oversight	Lump Sum	1	$307,000	$307,000
Project Management and Office Support	Lump Sum	1	$250,000	$250,000
Post Implementation Reporting	Lump Sum	1	$40,000	$40,000
Capital Cost Subtotal				$5,987,750
Contingency (15% of Capital Costs)				$898,163
Total Capital Cost				$6,885,913

ANNUAL OPERATION AND MAINTENANCE COSTS

	Unit	Quantity	Unit Cost	Total
Yearly Fence and Sign Maintenance	Per Year	1	$5,000	$5,000
Yearly Sediment and Cap Monitoring (includes analytical)	Per Year	1	$25,000	$25,000
Annual Reporting and Project Management	Per Year	1	$15,000	$15,000
Annual Cost Subtotal				$45,000
Contingency (15% of Capital Costs)				$6,750
Total Annual Cost				$51,750

TOTAL CAPITAL COST	$6,885,913
TOTAL ANNUAL OPERATION AND MAINTENANCE COST	$51,750
PRESENT WORTH COST	$7,681,000
Interest Rate	5%
Term (years)	30

Note:

1. Capping area square footage (approximately 1,850 ft. long by 200 ft. wide) based on capped area as presented on Figure 7.

TABLE 12

ALTERNATIVE 4 - REMOVAL OF IMPACTED SEDIMENT WITH OFF-SITE DISPOSAL
DETAILED COST ESTIMATE

Congaree River Sediments
Columbia, South Carolina

CAPITAL COST

	Unit	Quantity	Unit Cost	Total
Construction				
Mobilization/Demobilization	Lump Sum	3	$165,000	$495,000
Landside Clearing and Grading, Site Operations	Lump Sum	1	$250,000	$250,000
Site Security	Per Month	27	$14,000	$378,000
Temporary Fence and Gates	Lump Sum	1	$100,000	$100,000
Install/Remove Cofferdam	Lump Sum	1	$3,400,000	$3,400,000
Metal Anomalies, Screening/Removal	Lump Sum	3	$1,000,000	$3,000,000
Sediment Removal via Excavation	Tons	20,000	$15	$300,000
Sediment Removal via Vacuuming	Tons	20,000	$50	$1,000,000
Sediment Dewatering, Stabilization, Management	Tons	40,000	$30	$1,200,000
Water Management, Filtering, Disposal	Lump Sum	1	$405,000	$405,000
Sediment Transportation to Disposal Facility	Tons	40,000	$15	$600,000
Sediment Disposal	Tons	40,000	$23	$920,000
Metallic Debris Disposal	Each	500	$1,000	$500,000
Archeological Support	Each	1	$1,300,000	$1,300,000
Final Bedrock Surface Cleaning	Square Feet	327,711	$0.60	$196,627
River Bed Restoration	Tons	40,000	$10	$400,000
Landside Site Restoration	Lump Sum	1	$100,000	$100,000
Demobilization	Lump Sum	3	$50,000	$150,000
Surveying	Lump Sum	1	$50,000	$50,000
Engineering				
Engineering and Design Cofferdam	Lump Sum	1	$150,000	$150,000
Permits, Work Plan Development	Lump Sum	1	$500,000	$500,000
Archeologist Planning/Preparations	Lump Sum	1	$500,000	$500,000
Contractor Procurement	Lump Sum	1	$25,000	$25,000
Preplanning, Permits and Approvals	Lump Sum	1	$150,000	$150,000
Field Oversight	Lump Sum	1	$500,000	$500,000
Project Management and Office Support	Lump Sum	1	$200,000	$200,000
Post Implementation Reporting	Lump Sum	1	$75,000	$75,000
Capital Cost Subtotal				$16,844,627
Contingency (10% of Capital Costs)				$1,684,463
Total Capital Cost				$18,529,089

ANNUAL OPERATION AND MAINTENANCE COSTS

	Unit	Quantity	Unit Cost	Total
Yearly Sediment Monitoring	Per Year	0	$20,000	$0
Annual Reporting and Project Management	Per Year	0	$10,000	$0
Annual Cost Subtotal				$0
Contingency (15% of Capital Costs)				$0
Total Annual Cost				$0

TOTAL CAPITAL COST	$18,529,089
TOTAL ANNUAL OPERATION AND MAINTENANCE COST	$0
PRESENT WORTH COST	$18,529,000
Interest Rate	5%
Term (years)	5

Notes:
1. Three (3) separate construction phases are assumed.
2. Excavation tonnage is an estimate based on the extent of the TLM area as shown on Figure 10 (327,711 sq. ft.) and an assumed sediment thickness of 2 feet plus a 10% contingency. A tons per cubic yard conversion of 1.5 was utilized.
3. Cofferdam installation and removal cost estimate provided by Paul C. Rizzo and Associates, Inc.,

TABLE 13

DETAILED COST COMPARISON

Congaree River Sediments
Columbia, South Carolina

	Description	Capital Cost	Annual Operation & Maintenance Cost	Present Worth Cost	Assumed Duration
Alternative 1	No Action	$0	$0	$0	-
Alternative 2	Monitoring and Institutional Controls	$147,085	$34,500	$677,000	30 Years
Alternative 3	Capping and Institutional Controls	$6,885,913	$45,000	$7,681,000	30 Years
Alternative 4	Removal and Off-site Disposal	$18,529,089	$0	$18,529,000	-

TABLE 14

COMPARATIVE ANALYSIS OF ALTERNATIVES

Congaree River Sediments
Columbia, South Carolina

Criteria	**Alternative 1** **No Action**	**Alternative 2** **Monitoring and Institutional Controls**	**Alternative 3** **Sediment Capping and Institutional Controls**	**Alternative 4** **Removal of the Impacted Sediment With Off-Site Disposal**
Overall Protection of Human Health and the Environment	Least protective	Minimal increase in human health protection due to access restriction and no increase in protection of the environment	Significant increase in protection of human health and the environment and reduction of the potential for downstream migration of TLM	Eliminates human health and environmental concerns
Compliance with ARARs	No activities involved, action and location specific ARARs do not apply, chemical ARARs and remedial action objectives not satisfied	No activities involved, action and location specific ARARs do not apply, chemical ARARs and remedial action objectives not satisfied	Action and location specific ARARs would apply but would be addressed, chemical specific ARARs not satisfied, removal action objectives met except restoration and elimination of flux	Action and location specific ARARs would apply but would be addressed, chemical specific ARARs would be satisfied and all removal action objectives would be met
Short-Term Effectiveness	Community and remediation workers not effected; no adverse environmental effects; no benefits to impacted area	Community, remediation worker impacts are acceptable; short-term reduction in potential for human exposure, no positive or negative environmental impacts	Increased short-term impacts due to truck traffic, noise, and land-based construction activities, immediately effective in reducing human health and environmental concerns	Greatest short-term impacts due to truck traffic, noise and land-based construction, longest duration, most intrusive, more short-term habitat impact
Long-Term Effectiveness and Permanence	Least effective long-term	Access restriction reduces chance for long-term human exposure, no reduction in environmental impact, may reduce adjacen proerty values and development options	Significant reduction in human health and environmental concerns, permanent habitat alteration and impact on property values and land use, potential for flux still exits	Eliminates long term human health and environmental concerns, habitat restoration and enhancement, no access restrictions or property devaluation
Reduction of Toxicity, Mobility or Volume through Treatment	No reduction except through natural processes	No reduction except through natural processes	Toxicity and volume not reduced, mobility significantly reduced	Total elimination of issues relating to toxicity, mobility and volume
Implementability	Easiest to implement technically, although most likely unacceptable to SCDHEC	Readily implementable technically, although most likely not acceptable to SCDHEC and other stakeholders	Implementable, but increase in complexity, duration and construction worker safety over Alternatives 1 and 2	Implementable, but most complex, longest, most intrusive and highest in construction worker risk and risk for catastrophic failure
Cost	No cost	Lowest cost alternative, excluding no action	Mid-range cost alternative	Highest cost
Overall Summary	Unacceptable because protective measures are not included	Unacceptable due to continued risk to human health and the environment, potential for downstream migration, access restrictions and property devaluation	Viable approach, although permanence of cap would forever alter habitat and aesthetics, access restrictions would still apply and property devaluation would be most severe	Viable approach, most aggressive and intrusive and would have the greatest short-term impact but would result in the most complete solution that would not restrict future access and devalue adjacent properties

Note:
* For comparison purposes of this evaluation, removal of the TLM assumes that the total volume of impacted material can be removed. The intent of the alternative is to remove TLM to the maximum extent practicable.

TABLE 15

REMOVAL ACTION ALTERNATIVES SUMMARY

Congaree River Sediments
Columbia, South Carolina

Criteria	Alternative 1 No Action	Alternative 2 Monitoring and Institutional Controls	Alternative 3 Sediment Capping and Institutional Controls	Alternative 4 Removal of the Impacted Sediment With Off-Site Disposal
Overall Protection of Human Health and the Environment	⊗	○	◐	●
Compliance with ARARs	⊗	○	◐	●
Short-Term Effectiveness	○	○	○	⊗
Long-Term Effectiveness and Permanence	⊗	○	◐	●
Reduction of Toxicity, Mobility or Volume through Treatment	⊗	⊗	◐	●
Implementability	●	◐	○	⊗
Cost	●	◐	○	⊗
Overall Summary	⊗	○	◐	●

Legend:
- ⊗ - least acceptable
- ○ - fair to moderate acceptability
- ◐ - moderate to good acceptability
- ● - most acceptable

FIGURES

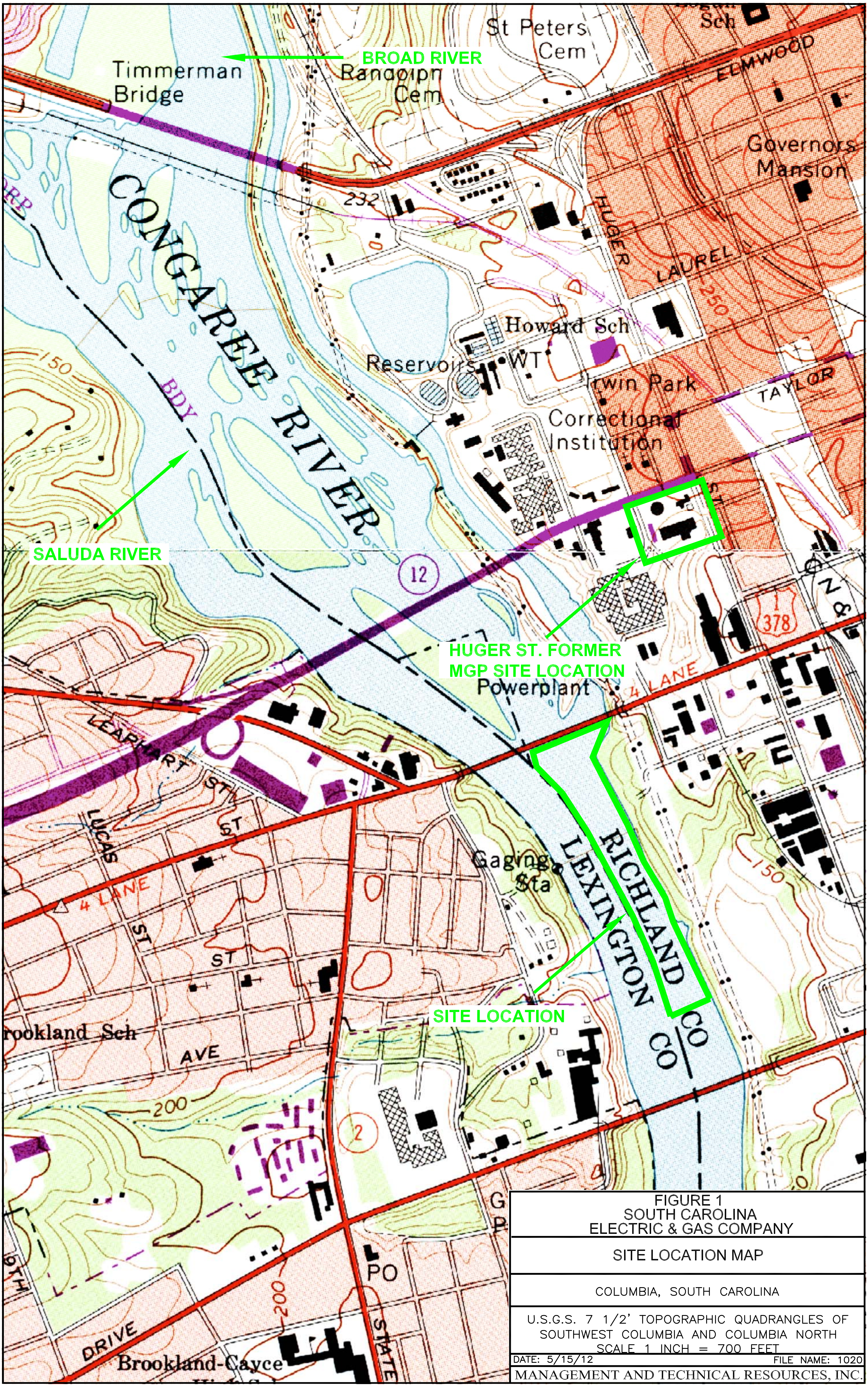


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

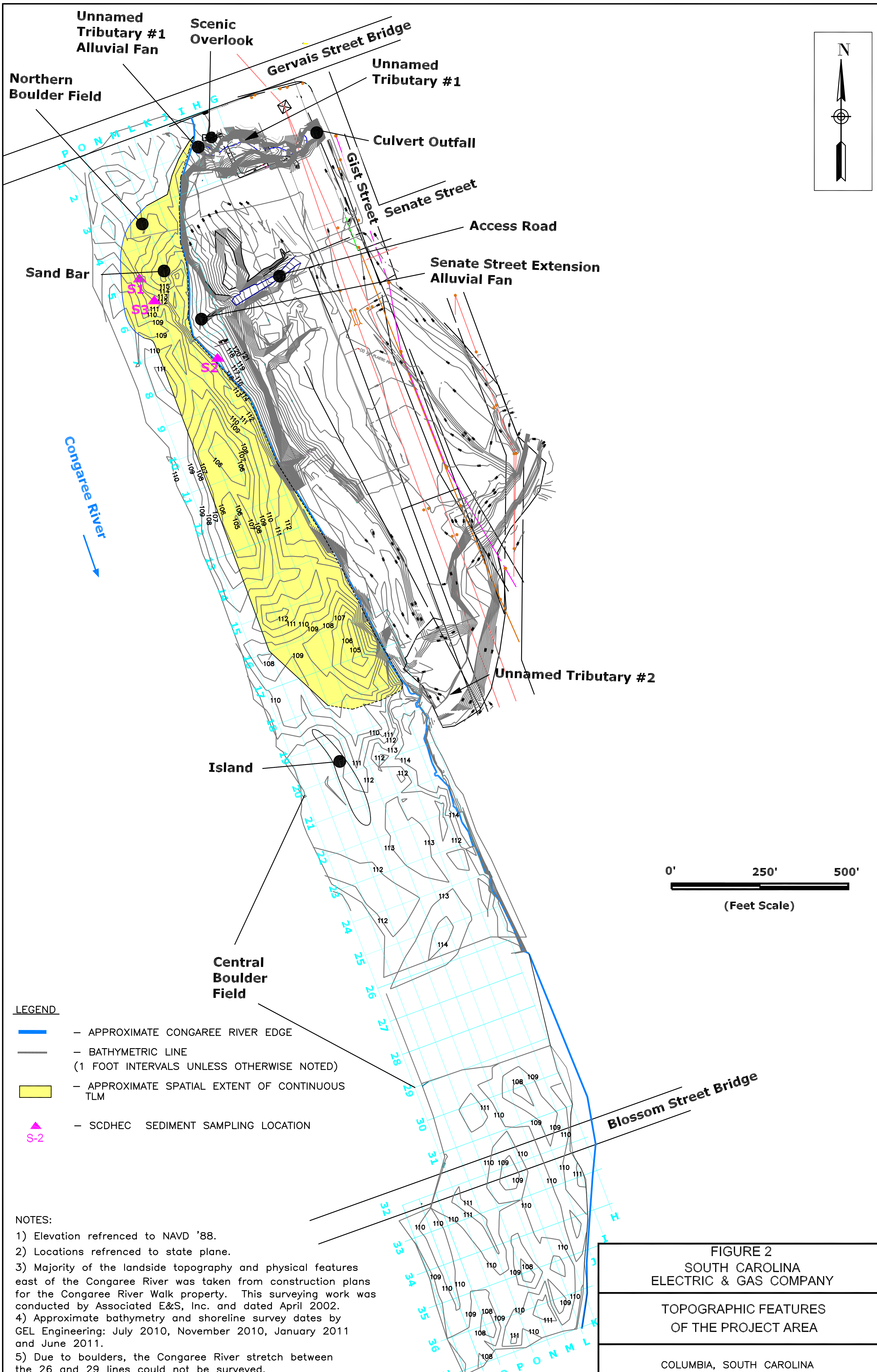
SITE LOCATION MAP

COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF SOUTHWEST COLUMBIA AND COLUMBIA NORTH
SCALE 1 INCH = 700 FEET

DATE: 5/15/12 FILE NAME: 1020

MANAGEMENT AND TECHNICAL RESOURCES, INC.



LEGEND

- APPROXIMATE CONGAREE RIVER EDGE
- BATHYMETRIC LINE (1 FOOT INTERVALS UNLESS OTHERWISE NOTED)
- APPROXIMATE SPATIAL EXTENT OF CONTINUOUS TLM
- S-2 — SCDHEC SEDIMENT SAMPLING LOCATION

NOTES:

1) Elevation refrenced to NAVD '88.
2) Locations refrenced to state plane.
3) Majority of the landside topography and physical features east of the Congaree River was taken from construction plans for the Congaree River Walk property. This surveying work was conducted by Associated E&S, Inc. and dated April 2002.
4) Approximate bathymetry and shoreline survey dates by GEL Engineering: July 2010, November 2010, January 2011 and June 2011.
5) Due to boulders, the Congaree River stretch between the 26 and 29 lines could not be surveyed.

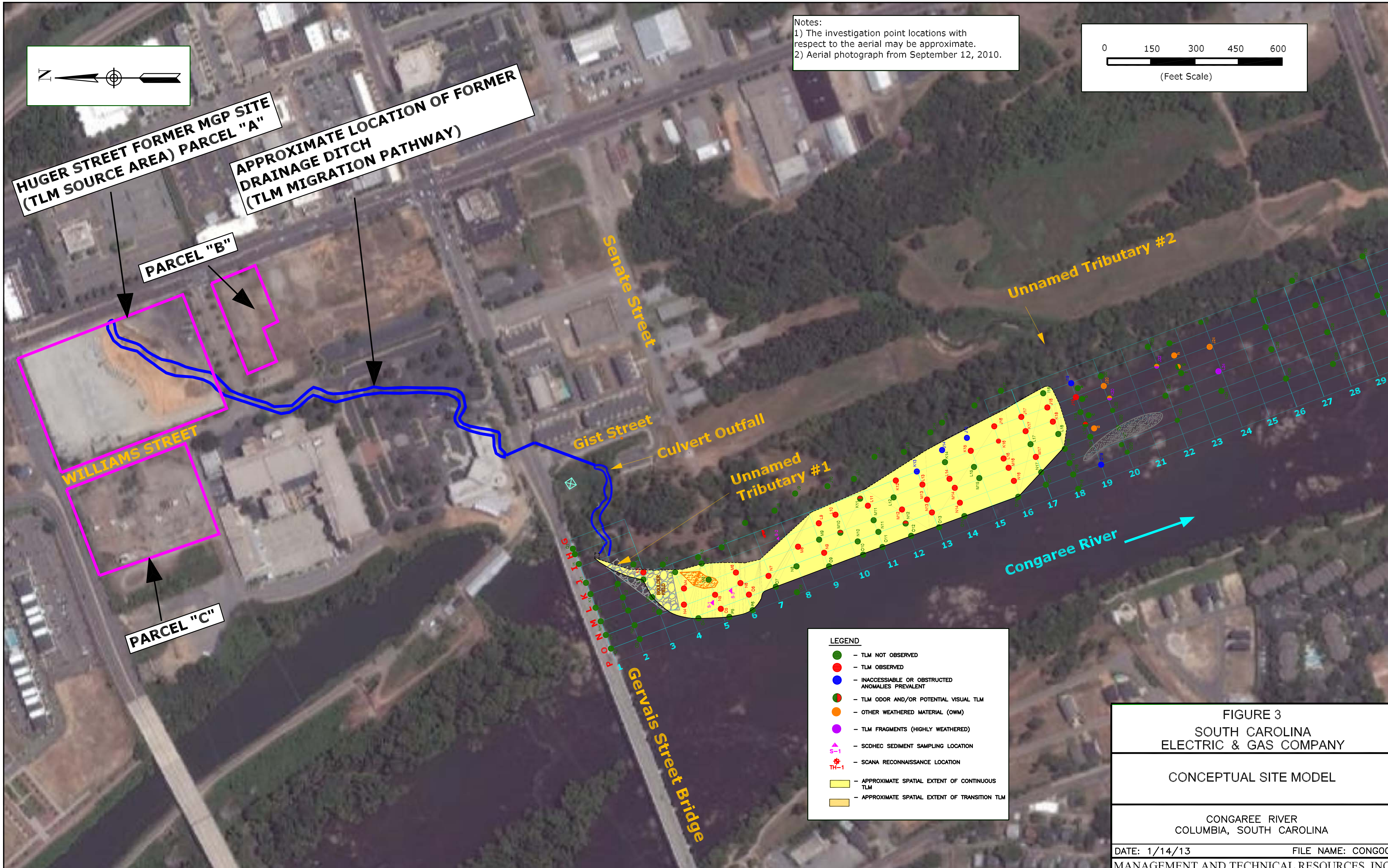
FIGURE 2
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

TOPOGRAPHIC FEATURES OF THE PROJECT AREA

COLUMBIA, SOUTH CAROLINA

DATE: 5/17/12 FILE NAME: 1021

MANAGEMENT AND TECHNICAL RESOURCES, INC.


N
HUGER STREET FORMER MGP SITE
(TLM SOURCE AREA) PARCEL "A"
APPROXIMATE LOCATION OF FORMER
DRAINAGE DITCH
(TLM MIGRATION PATHWAY)
PARCEL "B"
PARCEL "C"
WILLIAMS STREET
Senate Street
Gist Street
Culvert Outfall
Unnamed Tributary #1
Unnamed Tributary #2
Congaree River
Gervais Street Bridge
Notes:
1) The investigation point locations with respect to the aerial may be approximate.
2) Aerial photograph from September 12, 2010.
0 150 300 450 600
(Feet Scale)
LEGEND
– TLM NOT OBSERVED
– TLM OBSERVED
– INACCESSIABLE OR OBSTRUCTED ANOMALIES PREVALENT
– TLM ODOR AND/OR POTENTIAL VISUAL TLM
– OTHER WEATHERED MATERIAL (OWM)
– TLM FRAGMENTS (HIGHLY WEATHERED)
S-1 – SCDHEC SEDIMENT SAMPLING LOCATION
TH-1 – SCANA RECONNAISSANCE LOCATION
– APPROXIMATE SPATIAL EXTENT OF CONTINUOUS TLM
– APPROXIMATE SPATIAL EXTENT OF TRANSITION TLM
FIGURE 3
SOUTH CAROLINA
ELECTRIC & GAS COMPANY
CONCEPTUAL SITE MODEL
CONGAREE RIVER
COLUMBIA, SOUTH CAROLINA
DATE: 1/14/13
FILE NAME: CONG005
MANAGEMENT AND TECHNICAL RESOURCES, INC.

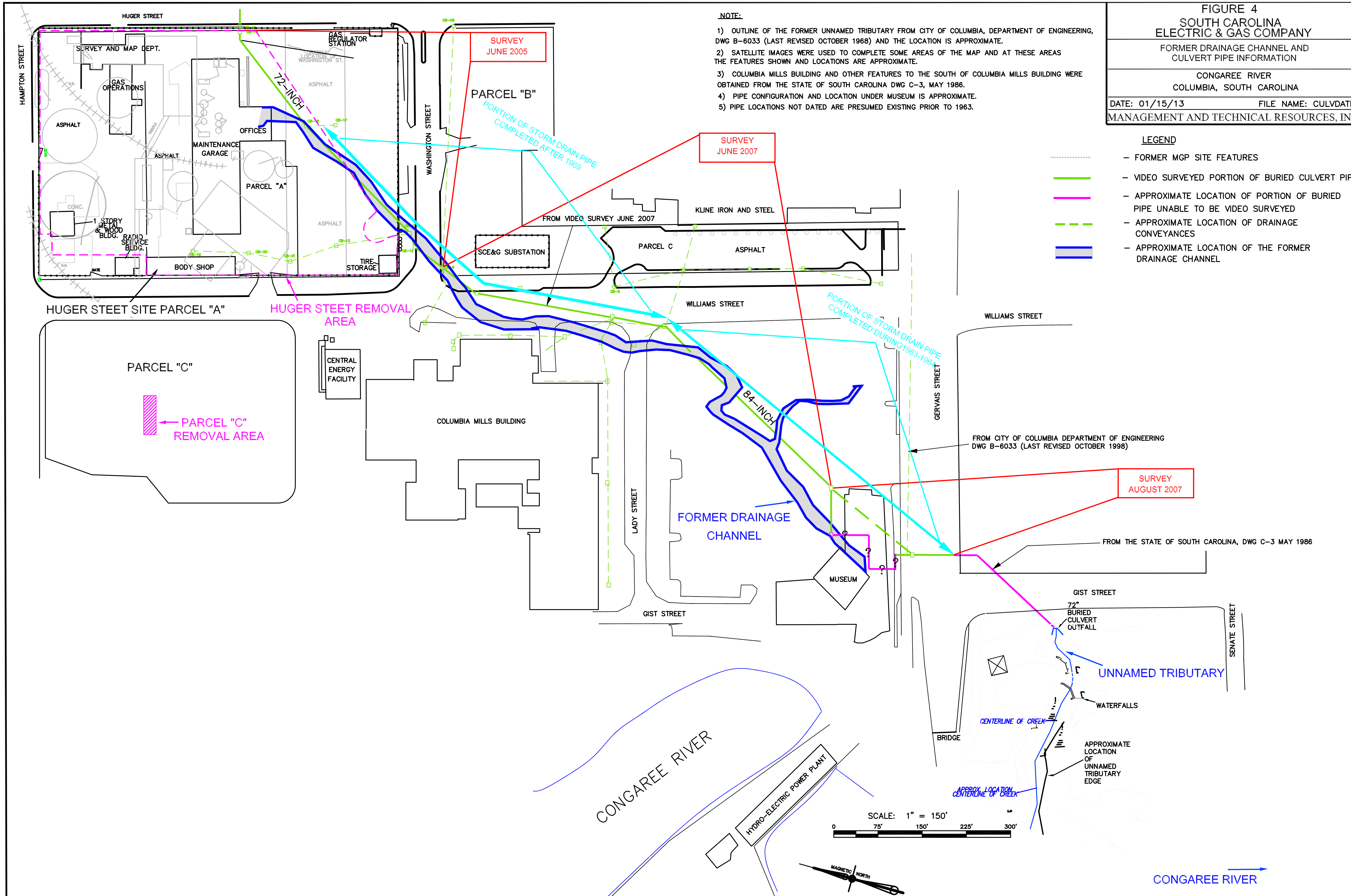
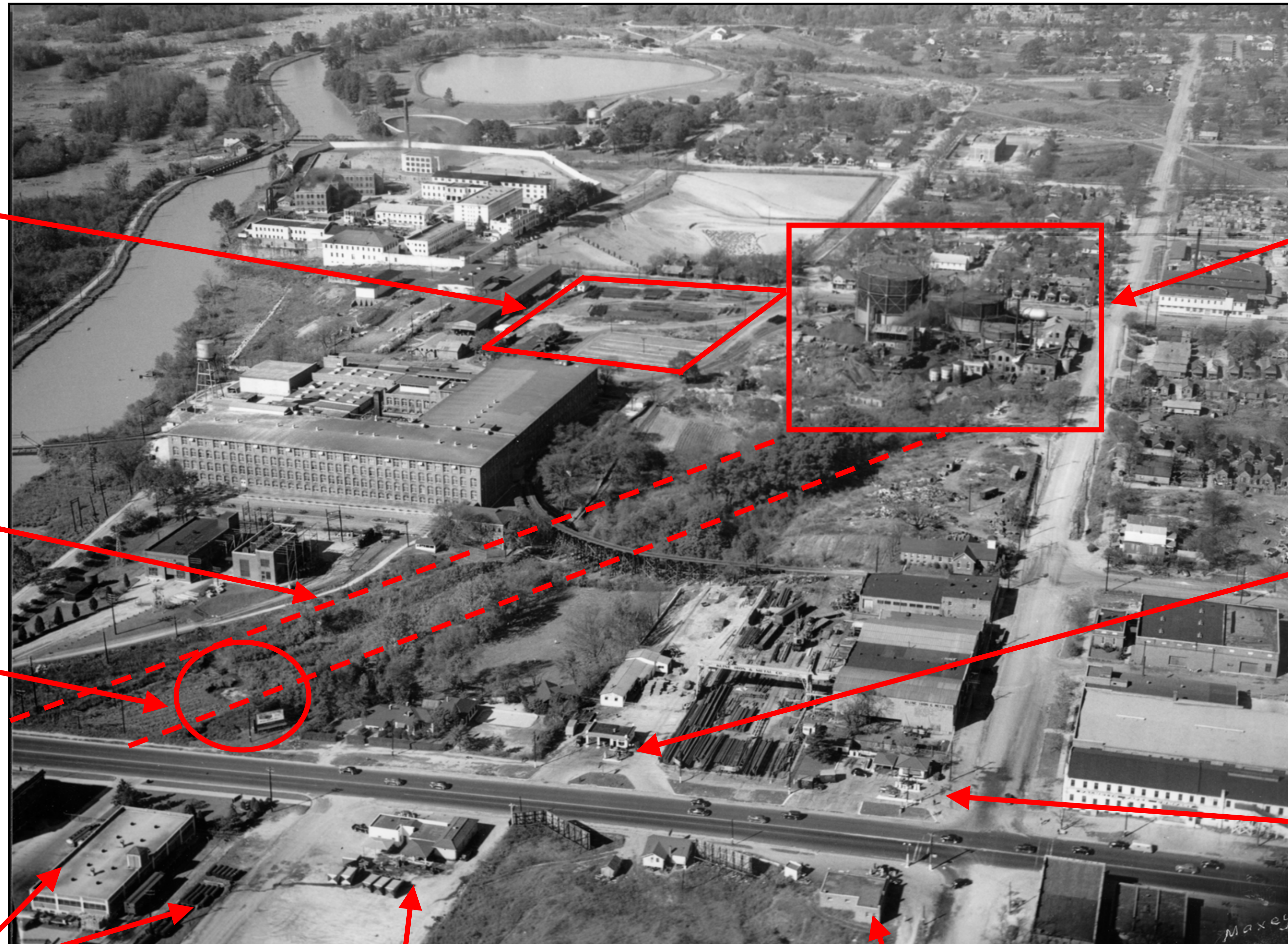
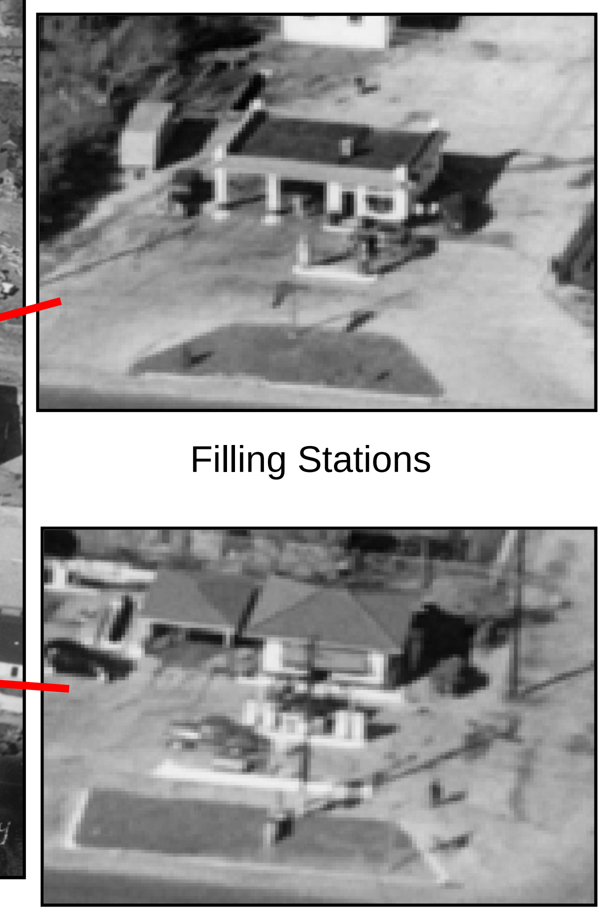


FIGURE 4
SOUTH CAROLINA ELECTRIC & GAS COMPANY
FORMER DRAINAGE CHANNEL AND CULVERT PIPE INFORMATION
CONGAREE RIVER
COLUMBIA, SOUTH CAROLINA
DATE: 01/15/13
FILE NAME: CULVDATES
MANAGEMENT AND TECHNICAL RESOURCES, INC.
NOTE:
1) OUTLINE OF THE FORMER UNNAMED TRIBUTARY FROM CITY OF COLUMBIA, DEPARTMENT OF ENGINEERING, DWG B-6033 (LAST REVISED OCTOBER 1968) AND THE LOCATION IS APPROXIMATE.
2) SATELLITE IMAGES WERE USED TO COMPLETE SOME AREAS OF THE MAP AND AT THESE AREAS THE FEATURES SHOWN AND LOCATIONS ARE APPROXIMATE.
3) COLUMBIA MILLS BUILDING AND OTHER FEATURES TO THE SOUTH OF COLUMBIA MILLS BUILDING WERE OBTAINED FROM THE STATE OF SOUTH CAROLINA DWG C-3, MAY 1986.
4) PIPE CONFIGURATION AND LOCATION UNDER MUSEUM IS APPROXIMATE.
5) PIPE LOCATIONS NOT DATED ARE PRESUMED EXISTING PRIOR TO 1963.
LEGEND
– FORMER MGP SITE FEATURES
– VIDEO SURVEYED PORTION OF BURIED CULVERT PIPE
– APPROXIMATE LOCATION OF PORTION OF BURIED PIPE UNABLE TO BE VIDEO SURVEYED
– APPROXIMATE LOCATION OF DRAINAGE CONVEYANCES
– APPROXIMATE LOCATION OF THE FORMER DRAINAGE CHANNEL
HUGER STREET
HAMPTON STREET
SURVEY AND MAP DEPT.
GAS OPERATIONS
ASPHALT
OFFICES
MAINTENANCE GARAGE
PARCEL "A"
1 STORY METAL & WOOD BLDG.
RADIO SERVICE BLDG.
BODY SHOP
TIRE STORAGE
GAS REGULATOR STATION
72-INCH
HUGER STEET SITE PARCEL "A"
HUGER STEET REMOVAL AREA
SURVEY JUNE 2005
PARCEL "B"
WASHINGTON STREET
PORTION OF STORM DRAIN PIPE COMPLETED AFTER 1969
SURVEY JUNE 2007
FROM VIDEO SURVEY JUNE 2007
KLINE IRON AND STEEL
SCE&G SUBSTATION
PARCEL C
WILLIAMS STREET
PORTION OF STORM DRAIN PIPE COMPLETED DURING 1963-1964
GERVAIS STREET
PARCEL "C"
PARCEL "C" REMOVAL AREA
CENTRAL ENERGY FACILITY
COLUMBIA MILLS BUILDING
84-INCH
LADY STREET
FORMER DRAINAGE CHANNEL
FROM CITY OF COLUMBIA DEPARTMENT OF ENGINEERING DWG B-6033 (LAST REVISED OCTOBER 1998)
SURVEY AUGUST 2007
FROM THE STATE OF SOUTH CAROLINA, DWG C-3 MAY 1986
MUSEUM
GIST STREET
72" BURIED CULVERT OUTFALL
SENATE STREET
UNNAMED TRIBUTARY
WATERFALLS
CENTERLINE OF CREEK
BRIDGE
APPROXIMATE LOCATION OF UNNAMED TRIBUTARY EDGE
APPROX. LOCATION CENTERLINE OF CREEK
CONGAREE RIVER
HYDRO-ELECTRIC POWER PLANT
SCALE: 1" = 150'
0 75' 150' 225' 300'
MAGNETIC NORTH
CONGAREE RIVER





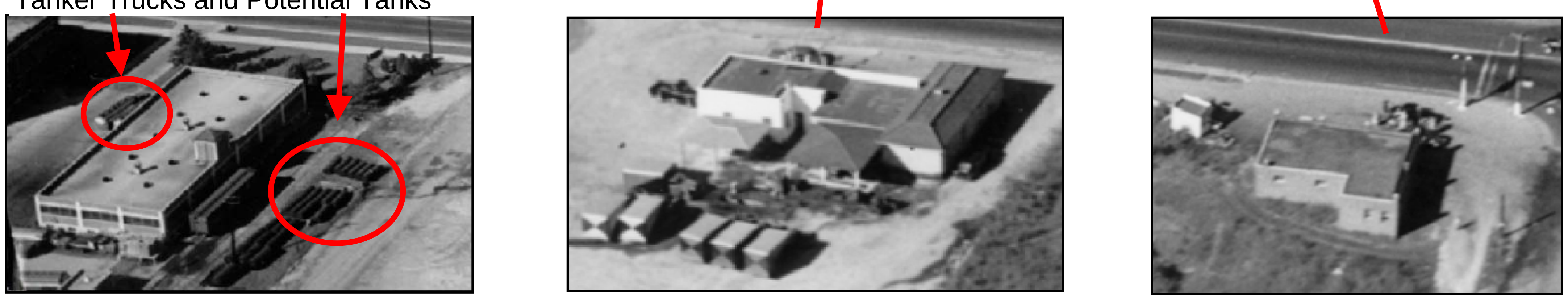
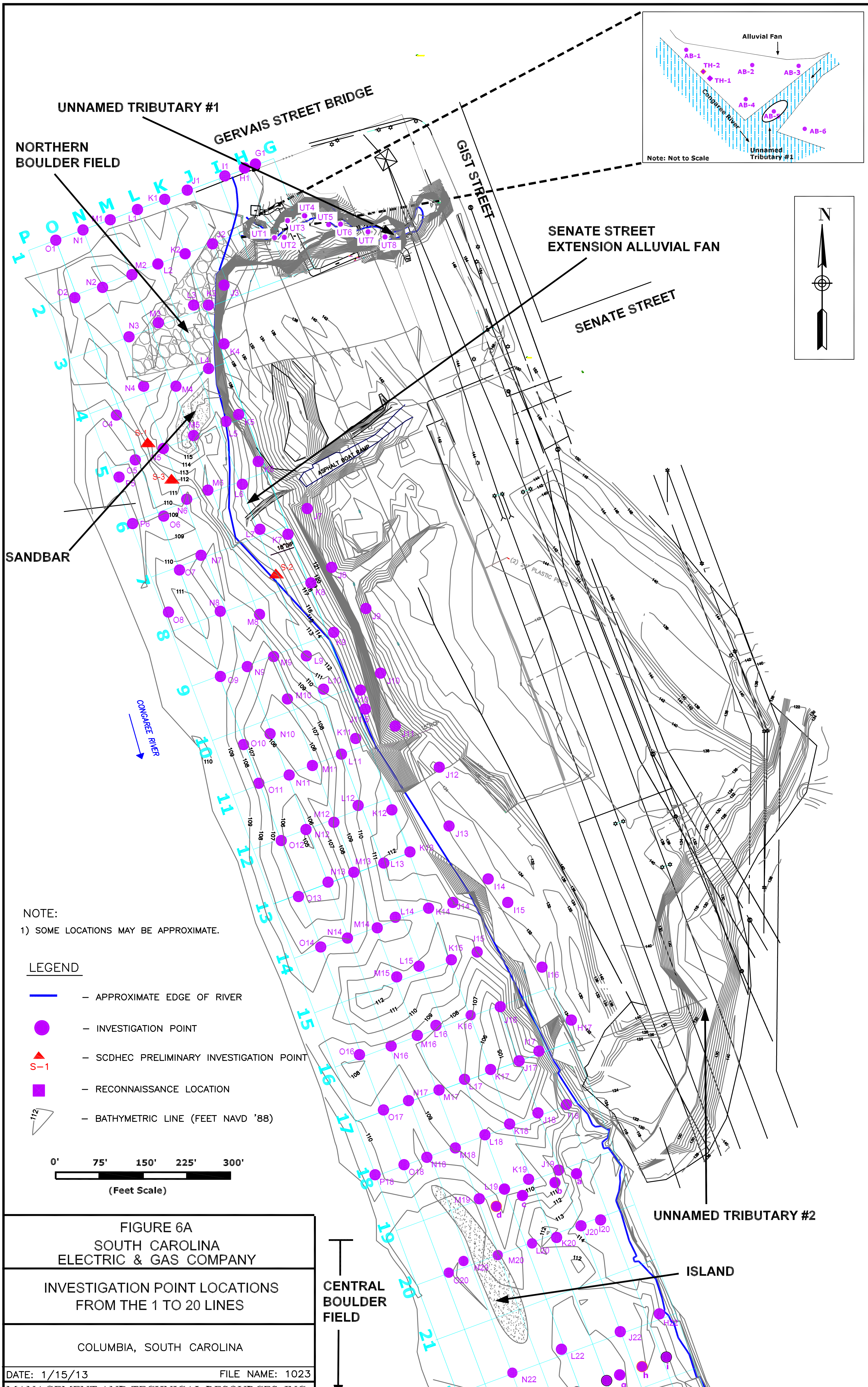


FIGURE 5 SOUTH CAROLINA ELECTRIC & GAS COMPANY	
1935 HISTORICAL AERIAL PHOTOGRAPH	
COLUMBIA, SOUTH CAROLINA	
DATE: 5/4/09	FILE NAME: Hist. Fig.
MANAGEMENT AND TECHNICAL RESOURCES, INC.	



NOTE:
1) SOME LOCATIONS MAY BE APPROXIMATE.

LEGEND

- APPROXIMATE EDGE OF RIVER
- INVESTIGATION POINT
- SCDHEC PRELIMINARY INVESTIGATION POINT (S-1)
- RECONNAISSANCE LOCATION
- BATHYMETRIC LINE (FEET NAVD '88)

0' 75' 150' 225' 300'
(Feet Scale)

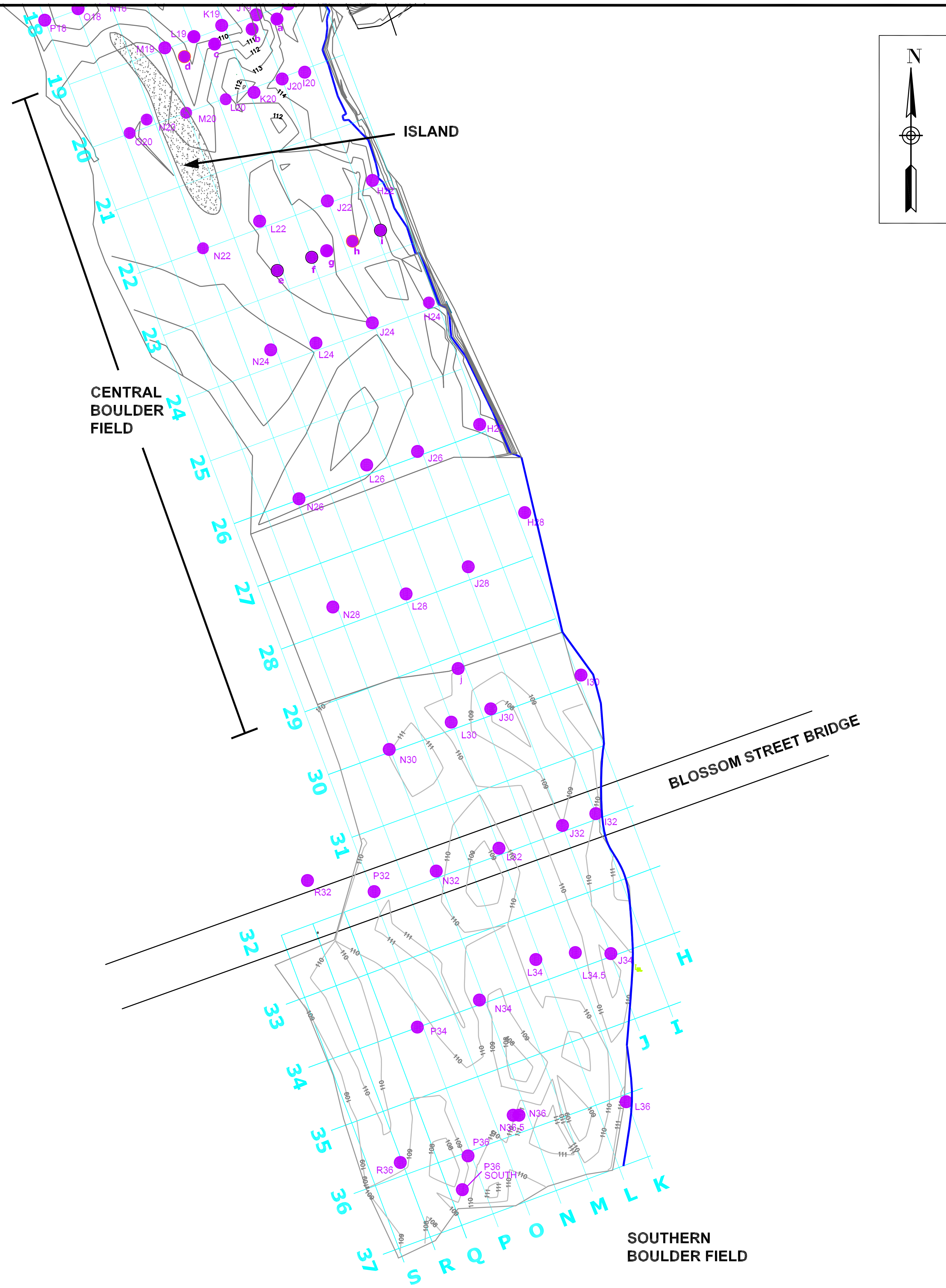
FIGURE 6A
SOUTH CAROLINA ELECTRIC & GAS COMPANY

INVESTIGATION POINT LOCATIONS FROM THE 1 TO 20 LINES

COLUMBIA, SOUTH CAROLINA

DATE: 1/15/13 FILE NAME: 1023

MANAGEMENT AND TECHNICAL RESOURCES, INC.



LEGEND

— APPROXIMATE EDGE OF RIVER

— INVESTIGATION POINT

— BATHYMETRIC LINE (FEET NAVD '88)

0' 75' 150' 225' 300'

(Feet Scale)

NOTE:

1) SOME LOCATIONS MAY BE APPROXIMATE.

FIGURE 6B

SOUTH CAROLINA
ELECTRIC & GAS COMPANY

INVESTIGATION POINT LOCATIONS
FROM THE 26 TO 36 LINES

COLUMBIA, SOUTH CAROLINA

DATE: 1/15/13 FILE NAME: 1024

MANAGEMENT AND TECHNICAL RESOURCES, INC.

FIGURE 7
SOUTH CAROLINA ELECTRIC & GAS COMPANY

INVESTIGATION LOCATIONS FROM THE 36 TO 91.5 LINES

COLUMBIA, SOUTH CAROLINA

DATE: 1/15/13 FILE NAME: 1025

MANAGEMENT AND TECHNICAL RESOURCES, INC.

LEGEND
- INVESTIGATION LOCATION
- TRANSECT LINE

0 200 400 600 800 (Feet Scale)

Notes:
1) Some locations may be approximate.
2) Aerial photograph from September 12, 2010.

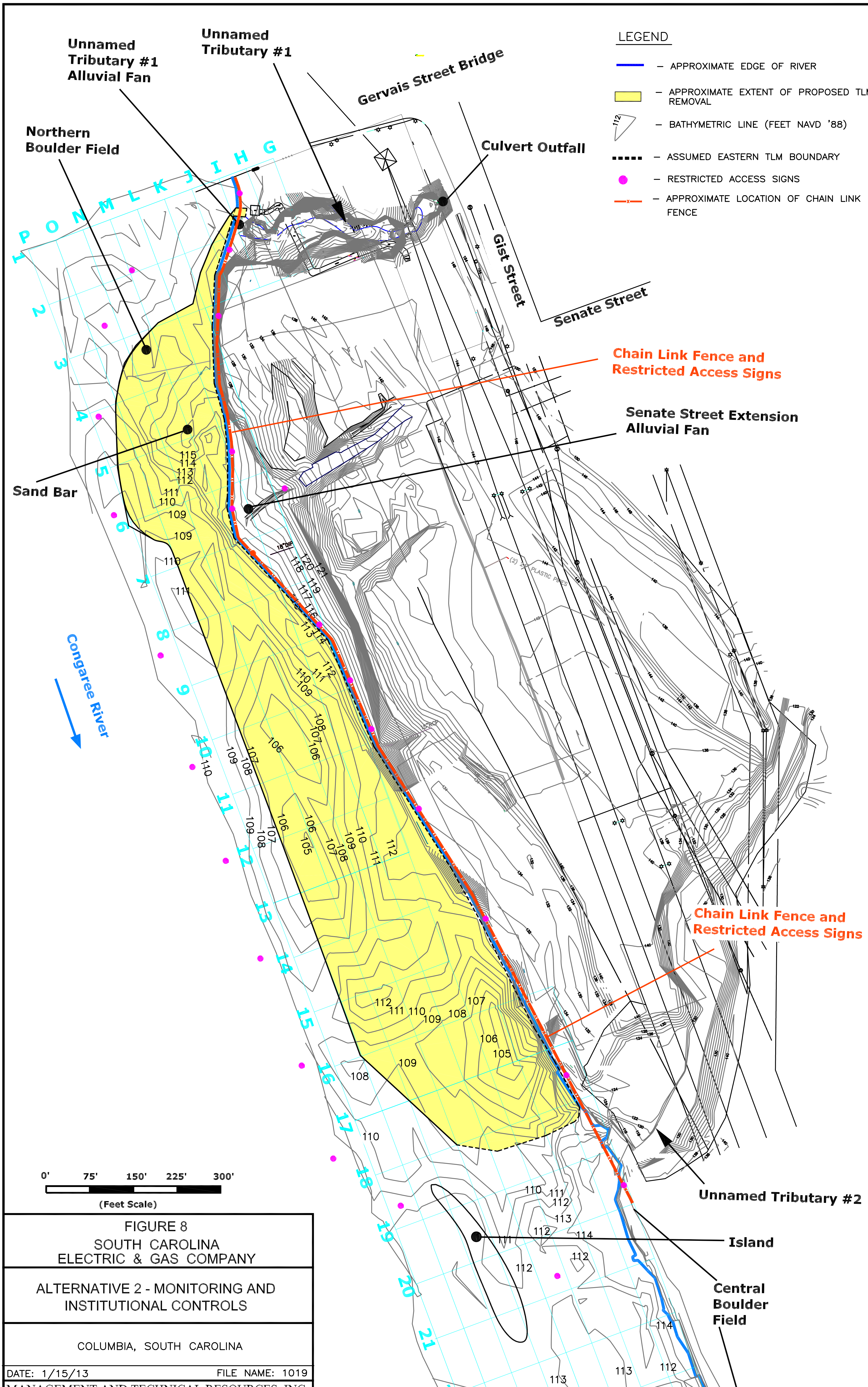


FIGURE 8

SOUTH CAROLINA ELECTRIC & GAS COMPANY

ALTERNATIVE 2 - MONITORING AND INSTITUTIONAL CONTROLS

COLUMBIA, SOUTH CAROLINA

DATE: 1/15/13 FILE NAME: 1019

MANAGEMENT AND TECHNICAL RESOURCES, INC.

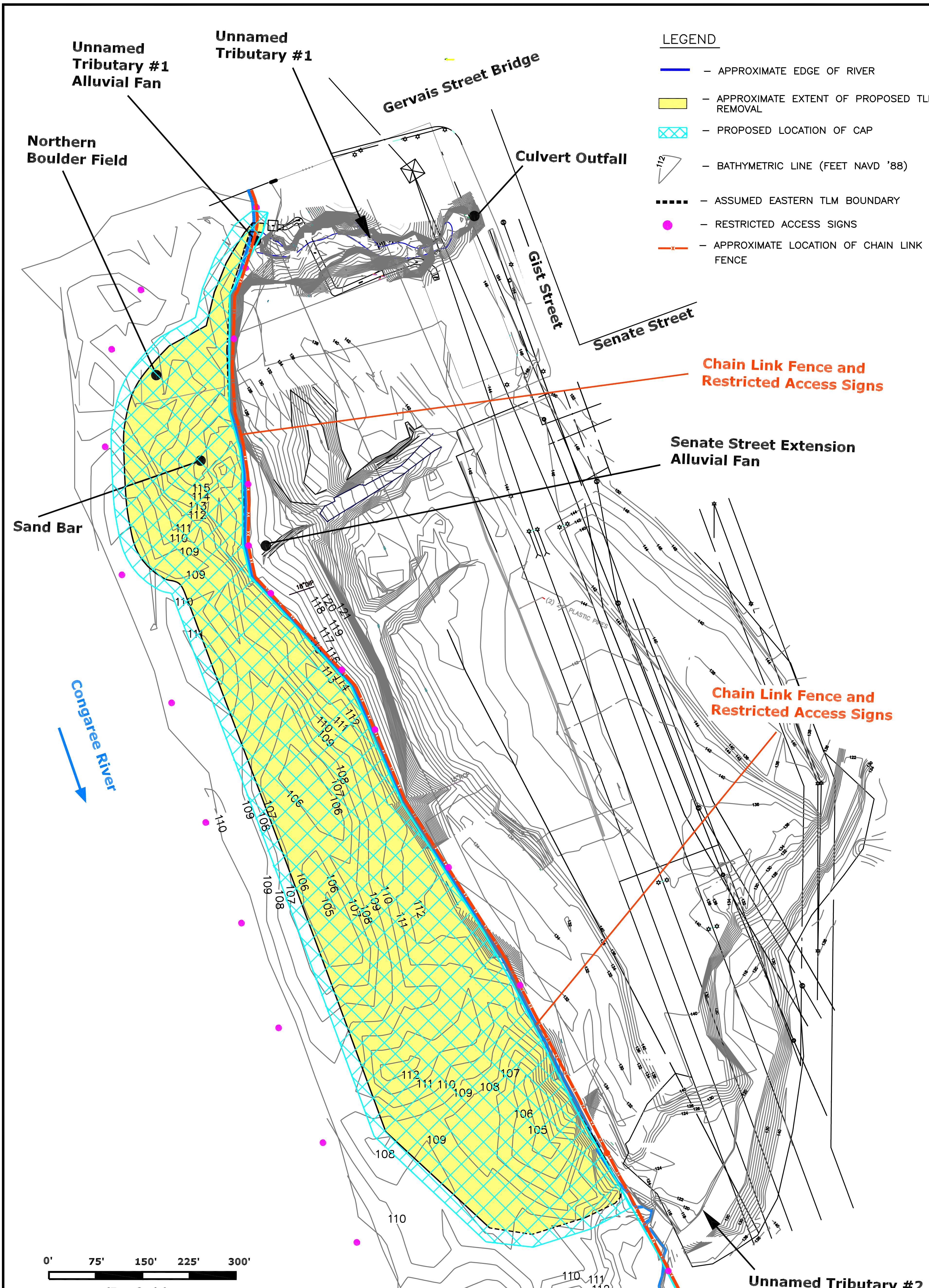


FIGURE 9
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

ALTERNATIVE 3 - SEDIMENT CAP
WITH INSTITUTIONAL CONTROLS

COLUMBIA, SOUTH CAROLINA

DATE: 1/15/13 FILE NAME: 1026

MANAGEMENT AND TECHNICAL RESOURCES, INC.

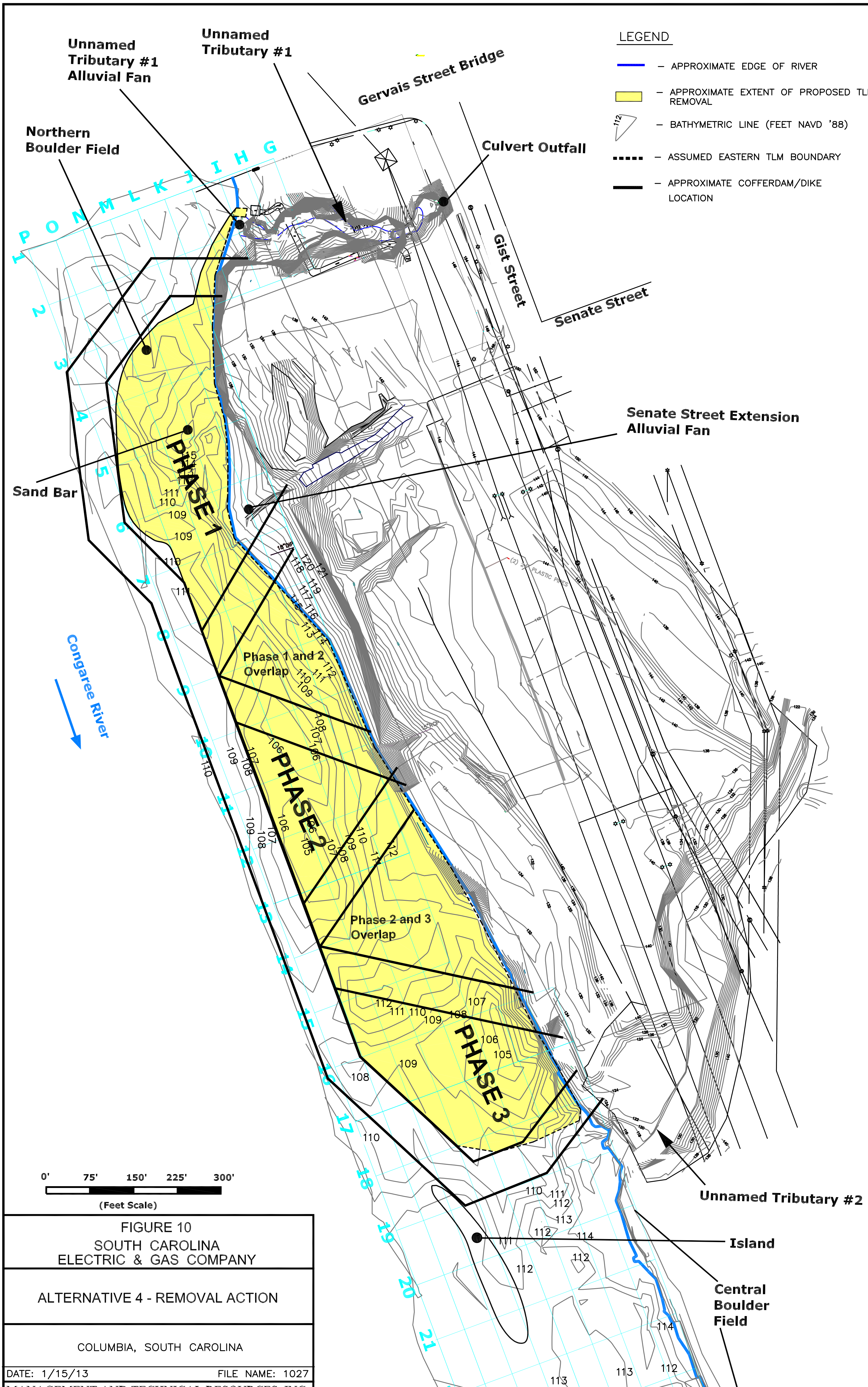


FIGURE 10
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

ALTERNATIVE 4 - REMOVAL ACTION

COLUMBIA, SOUTH CAROLINA

DATE: 1/15/13 FILE NAME: 1027

MANAGEMENT AND TECHNICAL RESOURCES, INC.

APPENDIX A

PROJECT DELINEATION REPORT SUMMARY

SUMMARY OF OBSERVATIONS AND ANALYTICAL RESULTS FROM THE PROJECT DELINEATION ACTIVITIES

This summary includes a synopsis of information taken from the Project Delineation Report (PDR) [MTR, March 2012] and is intended to provide a brief overview of investigative findings for areas located outside of the specific EE/CA project area. The EE/CA "project area" is defined as the portion of the Congaree River beginning directly south of the Gervais Street Bridge, and extending approximately 200-300 feet into the river from the eastern shoreline and approximately 2,000 feet downriver towards the Blossom Street Bridge. This area is the location of the majority of tar-like material (TLM) impacts and is the focus of the EE/CA. The specific findings of the PDR pertinent to this area are summarized in Section 1.5 of the EE/CA and described in detail in the PDR.

This summary provides the observational and analytical findings of the delineation activities for the entire investigation area, from the Gervais Street Bridge to the abandoned lock and dam as shown on Figures A-1 and A-2. Sporadic observations of TLM and some elevated constituent concentrations were identified to a lesser degree in isolated areas outside of the EE/CA project area (Figure A-3). This summary is intended to provide all relevant information on these areas. The impacts discussed in this summary will be addressed at a later date.

TLM OCCURRENCE OUTSIDE OF THE EE/CA PROJECT AREA

<u>19 Line South to the 36 Line</u>

The southern or downstream edge of the EE/CA project area is approximately located between the 19 and the 20 Line (Figure A-1). This portion of the river is characterized by the general absence of TLM with the exception of L34, N34, N36, and N36.5 grid nodes, as shown on Figure A-1. An isolated and discontinuous apparent deposit of TLM was found at these grid node locations.

In addition, there were sporadic occurrences of TLM fragments and other weathered material (OWM) from lines 19 to 32. The source of OWM is not known. The TLM fragments are believed to have originated up river were transported down river via scouring and re-deposited. Some TLM-like odors were noted in sediment samples generally located along the shoreline.

<u>36 Line South to the 91.5 Line</u>

This area includes the stretch of the Congaree River below the 36 Line and south to just up river of the abandoned lock and dam at the 91.5 Line (Figure A-2). Because of the extended length of the delineation area, these reference lines are considered approximate.

A total of seven locations (CR2/CR28, and CR18-CR23) of discontinuous TLM "deposits" were noted in the southern boulder field and between the 47 and 53 Lines (Figure A-2). The TLM deposits were highly weathered, spongy under foot, or were "solidified" (CR2/CR28).

TLM-like odors were noted in one shoreline sample (CR-10). Some TLM fragments were also observed at a few locations, likely emanating from upriver TLM scouring, transport and deposition.

Review of this information suggests that a total of four general areas of TLM were identified downriver of the EE/CA project area. These four areas are shown on Figure A-3.

ANALYTICAL RESULTS

The sediment and soil analytical results are provided on Tables A-1 through A-7 (organized by river area) and shown spatially on Figures A-1 and A-2.

A total of 40 sediment and soil samples were collected for laboratory analysis. The primary objective for collecting the samples was to provide laboratory data to confirm the visual observations. Initially, a sample was collected at a perimeter location where visual observations indicated the absence of TLM. As the various phases of delineation progressed down river, samples were collected at locations that were logical and feasible.

The following sections discuss the sediment analytical results, which have been segregated into various areas based on TLM observations. It should be noted that the Congaree River receives runoff from the City of Columbia and intuitively it could be expected that analytical data discussed below may include contributions from other potential sources. The constituents of interest (COI) for the TLM (benzene and various polynuclear aromatic hydrocarbons [PAHs]) are common to road materials (i.e., asphalt), petroleum-based products from motor vehicles, and a host of other non-point source materials. No allocation from other anthropogenic source was attempted.

Preliminary Results and Samples Containing TLM

Table A-1 provides the SCDHEC and SCE&G preliminary analytical results that were used to assess the initial TLM, when first noted in June 2010. The S-1 through S-3 samples were collected in a stretch of the river where TLM was noted and TLM was present in the sample submitted for analysis. As a result, these three samples exhibited the highest concentrations of COI from the entire study area. For comparison purposes, Table A-1 also includes three additional sediment samples that contained TLM (with one sample collected at the 19 Line and two samples collected at the 36 Line). Only the sample from N36.5 yielded comparable results. Based on visual observations, the sample collected from the 19 Line indicated staining and blebs whereas the more highly weathered TLM was present in the N36.5 sample and may explain the difference in the analytical results between these two locations.

Congaree River: 1 to 3 Lines

Three sediment samples (I1, K1, and M1) were collected at the 1 Line, which is located at the Gervais Street Bridge and upriver from where the TLM was first observed. One sample was collected from the western boundary along the 2 Line (O2) and one sample (L3) from within the northern boulder field. The 1 Line and O2 samples indicated non-detect results and provide a northern boundary and start of the western boundary of the TLM Area (Table A-2 and Figure A-1). TLM (odors or visual) was not observed in the L3 sediment sample but reconnaissance in July 2010 indicated a slight gray sheen at some locations in the northern boulder field and may help explain the analytical results from L3.

Western Boundary – Mid-Point Congaree River: 3 to 19 Lines

A total of eight sediment samples were collected along a "north-south" trending Line (L-P Lines), along the western boundary where TLM was generally absent, on approximately 300-foot centers, and along the length of the Congaree River to the 19 Line (Figure A-2 and Table A-3). Sediment samples were collected along this western boundary since the Phase I and Phase II activities suggested the presence of TLM was diminishing below the 18 to the 19 Line. The vast majority of the analytical results indicated COI were not detected and the relatively low level concentration of COI detected at O14 (some BTEX constituents) and L19 (some PAH constituents) may be attributed to general quality of the river sediments from non-point sources and/or residual impacts from TLM. Visual observations of the sediment indicate an absence of TLM except at O14 where a bleb was noted on the acetate liner (absent in three sediment cores). No PAHs were detected. Therefore, the analytical data coupled with visual observations were used to define the western extent of TLM.

Eastern Boundary – Congaree River Shoreline: 1 to 19 Lines

The eastern Congaree River sediments are characterized as finer grained silts and clays and can contain various amounts of naturally organic material. On many occasions, TLM-like odors were noted in these sediments although visual TLM was absent. It is believed that the organic matter acts to adsorb TLM COI and the environment may be oxygen limited, which slows attenuation. In addition, because these sediments have a low hydraulic conductivity due to their particle size and are located along the shoreline, flushing is reduced, which will also serve to further reduce attenuative processes. Therefore, the constituents concentrations observed in the sediment samples collected along the eastern shoreline are not unexpected.

Table A-4 provides the results. In general, COI were detected with PAHs typically yielding higher concentrations than BTEX. Three of the samples (L7, K8, J11.5) were non-detect for BTEX and one sample (I17) indicated very low levels of BTEX. Total PAHs ranged from 3.78 mg/Kg (J11.5) to 630.1 mg/Kg (I17).

Top of Congaree River Eastern Bank: 1 to 19 Lines

A total of five soil samples were collected from soil borings drilled on the top of the Congaree River bank. The soil samples were collected from depth intervals that were believed to be similar to the level of the Congaree River sediments. Table A-5 provides the soil analytical results and indicates COI were not detected.

In the Congaree River: 19 to 36 Lines

A total of nine sediment samples were collected from the 19 to the 36 Line. [From the approximate 4 to 19 Lines, a high density of TLM bearing sediments were noted and based on reconnaissance activities it appeared that TLM diminishes below the 19 Line.] Therefore, the purpose of the sediment samples collected between the 19 and 36 Lines was to provide analytical data to support visual observations.

Eight of the nine sediment samples collected indicated BTEX was not detected. Minimal BTEX concentrations were present in sample L24 (Table A-6). Three samples, M20, L30, and P36 showed PAHs were not detected whereas the remaining six samples (K19, I20, K20, H24, L24, and I30) indicated the presence of PAH, with total PAH concentrations ranging from 3.5 mg/Kg (I20) to 27.5 mg/Kg (K19) as noted on Table A-6.

Sample K19 is located at the transitional line and along a line segment where TLM was visually noted and therefore the analytical results would not be unexpected. A very faint odor was noted as well as TLM and OWM fragments at the K20 location and these observations may confirm the analytical results. Samples I20, H24 and I30 were collected along the shoreline and only very slight TLM odors were noted; no visual TLM was observed. Factors potentially contributing to the presence of TLM COI in silty material comprising the shoreline samples were discussed previously. I20 was collected near the shoreline. And finally, a TLM fragment was noted adjacent to sediment comprising the L24 sample. The fragment was not included in the sample but was in close proximity and therefore was included in the recorded observations.

Within the Congaree River: Below the 36 to 80 Lines

A total of eight sediment samples were collected below the 36 to 80 Lines (Figure A-2 and Table A-7). Analytical results from the eight sediment samples indicated BTEX was not detected. Six (CR4, CR7, CR9, AM70, AQ70, and AK80) of the eight PAH analytical results indicated PAHs were not detected. Low-level PAH concentrations were detected in CR-1 and Y57 with total PAHs of 1.53 mg/Kg and 0.98 mg/Kg, respectively.

TABLE A-1

RESIDENTIAL SCREENING LEVELS (SOIL) VS TLM-IMPACTED SEDIMENT ANALYTICAL RESULTS

Congaree River Sediments
Columbia, South Carolina

General Area		Preliminary - Near the Alluvial Fan and Sand Bar				
Source	Residential Soil RSL	SCE&G	SCE&G	SCDHEC	SCE&G	SCDHEC
(Line) Location of Sample		S-1	S-1 Dup	S-1	S-2	S-2
Date Sampled		6/28/2010	6/28/2010	6/28/2010	6/28/2010	6/28/2010
Sample Interval (feet brb)		NR	NR	NR	NR	NR
Parameters						
Volatiles (mg/Kg)						
1,2,4-Trimethylbenzene	62	90.2 B	52 B	NA	4.31 B	NA
1,3,5-Trimethylbenzene	780	28.8 B	16.6 B	NA	1.84 B	NA
Benzene	1.1	43.9 B	22.1 B	16	1.22 B	0.97
Ethylbenzene	5.4	214 B	124 B	150	6.64 B	10
Isopropylbenzene	--	22.2	12.8	14	1.25	2.2
p-Isopropyltoluene	--	11.7	6.78	NA	0.965	NA
Styrene	6300	11.7 B	4.04 B	5.7 U	0.807 B	0.35 U
Toluene	5000	6.43 B	1.47 B	5.7 U	0.555 B	0.35 U
Total Xylenes	630	124.3 B	74.5 B	79	2.773	4.1
Semi-Volatiles (mg/Kg)						
1-Methylnaphthalene	16	1,170 EB	666 B	NA	134 B	NA
2-Methylnaphthalene	230	1,870 EB	1,070 EB	1,700	231 B	400
Acenaphthene	3400	644	371	730	194	380
Acenaphthylene	--	146	72	170	10.5	44 U
Anthracene	17000	385	222	450	142	300
Benz(a)anthracene	0.15	270	154	340	40.2	130
Benzo(a)pyrene	0.015	320 B	179 B	380	60 B	130
Benzo(b)fluoranthene	0.15	123 B	70.9 B	220	29.1 B	110
Benzo(g,h,i)perylene	--	159 B	89.5 B	140 U	27.1 B	47
Benzo(k)fluoranthene	1.5	153 B	84.8 B	140 U	38 B	44 U
Biphenyl	--	302 B	172 B	300	33.3 B	64
Chrysene	15	287	163	340	54.1	110
Dibenz(a,h)anthracene	0.015	47	26.1	140 U	7.8	44 U
Fluoranthene	2300	417	244	530	145	320
Fluorene	2300	405	229	490	98.8	220
Indeno(1,2,3-cd)pyrene	0.15	116	65.1	140 U	23.6	44 U
Naphthalene	3.6	3,710 EB	2,140 EB	3,100	291 B	470
Phenanthrene	--	1,510 E	869	1,600	365	710
Pyrene	1700	737 B	432 B	900	178 B	380
Totals (mg/Kg)						
Total BTEX	--	389	222	245	11.2	15.1
Total PAH	--	9,429	5,411	9,250	1,704	3,307

Notes:

Samples were collected and split between SCDHEC and SCE&G for independent analysis.

EPA Region 9, Residential Soil Regional Screening Levels (RSL), Summary Table, May 2012. Carcinogenic risk 1×10^{-6} and noncarcinogenic HQ = 1.

[shaded box] Exceeds screening values.

B - Analyte detected in the blank.

E - Estimate, result detected above calibration range.

J - Indicates an estimated value.

NA - Not analyzed

NR - Not recorded

U - Indicates that the constituent was not detected at the reported detection limit.

TABLE A-1 (CONT.)

RESIDENTIAL SCREENING LEVELS (SOIL) VS TLM-IMPACTED SEDIMENT ANALYTICAL RESULTS

Congaree River Sediments
Columbia, South Carolina

General Area		Preliminary (Cont.)		Delineation - Various in River		
Source	Residential Soil RSL	SCE&G	SCDHEC	SCE&G	SCE&G	SCE&G
(Line) Location of Sample		S-3	S-3	J19	N36	N36.5
Date Sampled		6/28/2010	6/28/2010	2/22/2011	7/19/2011	7/19/2011
Sample Interval (feet brb)		NR	NR	0 - 2.0	0 - 0.5	0 - 0.5
Parameters						
Volatiles (mg/Kg)						
1,2,4-Trimethylbenzene	62	49.9 B	NA	NA	NA	NA
1,3,5-Trimethylbenzene	780	16 B	NA	NA	NA	NA
Benzene	1.1	17 B	8	0.037 U	0.005 U	0.067 J
Ethylbenzene	5.4	113 B	90	2.2	0.005 U	4.7
Isopropylbenzene	--	12.5	8	NA	NA	NA
p-Isopropyltoluene	--	6.67	NA	NA	NA	NA
Styrene	6300	9.44 B	3.2 U	NA	NA	NA
Toluene	5000	4.33 B	3.2 U	0.0081	0.005 U	0.19 J
Total Xylenes	630	26.42	19	0.19	0.005 U	1.7
Semi-Volatiles (mg/Kg)						
1-Methylnaphthalene	16	792 B	NA	NA	NA	NA
2-Methylnaphthalene	230	1,320 EB	1,200	NA	NA	NA
Acenaphthene	3400	642	740	58	3.1	660
Acenaphthylene	--	85.8	100	4.5	0.94 J	1.6 UJ
Anthracene	17000	355	430	41	6.2	460
Benz(a)anthracene	0.15	207	290	29	7.7	370
Benzo(a)pyrene	0.015	232 B	310	34	8.2	390
Benzo(b)fluoranthene	0.15	92.3 B	180	18	7.9	320
Benzo(g,h,i)perylene	--	115 B	110	9.5	3.2	150
Benzo(k)fluoranthene	1.5	117 B	94	0.42 UJ	0.40 UJ	3.4 UJ
Biphenyl	--	209 B	220	NA	NA	NA
Chrysene	15	216	280	34	8.6	360
Dibenz(a,h)anthracene	0.015	33	82 U	2.4	0.40 UJ	33 J
Fluoranthene	2300	350	480	51	13.0	590
Fluorene	2300	336	420	35	3.7	450
Indeno(1,2,3-cd)pyrene	0.15	84.6	82 U	7.2	2.5	97
Naphthalene	3.6	2,240 EB	2,000	82	0.40 UJ	690
Phenanthrene	--	1,250 E	1,400	150	19.0	1,800
Pyrene	1700	607 B	800	92	23.0	1,000
Totals (mg/Kg)						
Total BTEX	--	160.8	117.0	2.4	0.005 U	6.7
Total PAH	--	6,963	7,634	647.6	107.0	7,370

Notes:

Samples were collected and split between SCDHEC and SCE&G for independent analysis.

EPA Region 9, Residential Soil Regional Screening Levels (RSL), Summary Table, May 2012. Carcinogenic risk 1×10^{-6} and noncarcinogenic HQ = 1.

[shaded box] Exceeds screening values.

B - Analyte detected in the blank.

E - Estimate, result detected above calibration range.

J - Indicates an estimated value.

NA - Not analyzed

NR - Not recorded

U - Indicates that the constituent was not detected at the reported detection limit.

TABLE A-2

SEDIMENT ANALYTICAL RESULTS
CONGAREE RIVER: 1 TO 3 LINES

Congaree River Sediments
Columbia, South Carolina

General Area		Gervais Street Bridge			Northern Boulder Field	
Line Location of Sample	Residential Soil RSL[5]	1 Line			2 Line	3 Line
Sample Identification		I1	K1	M1	O2	L3
Date Sampled		10/6/2010	10/6/2010	10/6/2010	10/6/2010	10/7/2010
Sample Interval (feet brb)[1]		0 - 0.5	0 - 0.25	0 - 1.0	0 - 0.5	0 - 0.25
Parameters						
Volatiles (mg/Kg)						
Benzene	1.1	0.005 U[2]	0.005 U	0.005 U	0.0046 U	0.0048 U
Ethylbenzene	5.4	0.005 U	0.005 U	0.005 U	0.0046 U	0.0048 U
Toluene	5000	0.005 U	0.005 U	0.005 U	0.0046 U	0.0048 U
Total Xylenes	630	0.005 U	0.005 U	0.005 U	0.0046 U	0.0048 U
Semi-Volatiles (mg/Kg)[3]						
Acenaphthene	3400	0.41 U	0.39 U	0.41 U	0.37 U	0.39 U
Acenaphthylene	--	0.41 U	0.39 U	0.41 U	0.37 U	0.39 U
Anthracene	17000	0.41 U	0.39 U	0.41 U	0.37 U	0.39 U
Benzo(a)anthracene	0.15	0.41 U	0.39 U	0.41 U	0.37 U	0.39 U
Benzo(a)pyrene	0.015	0.41 U	0.39 U	0.41 U	0.37 U	0.91
Benzo(b)fluoranthene	0.15	0.41 U	0.39 U	0.41 U	0.37 U	0.92
Benzo(g,h,i)perylene	--	0.41 U	0.39 U	0.41 U	0.37 U	0.60
Benzo(k)fluoranthene	1.5	0.41 U	0.39 U	0.41 U	0.37 U	0.39 U
Chrysene	15	0.41 U	0.39 U	0.41 U	0.37 U	0.67
Dibenz(a,h)anthracene	0.015	0.41 U	0.39 U	0.41 U	0.37 U	0.39 U
Fluoranthene	2300	0.41 U	0.39 U	0.41 U	0.37 U	0.95
Fluorene	2300	0.41 U	0.39 U	0.41 U	0.37 U	0.39 U
Indeno(1,2,3-cd)pyrene	0.15	0.41 U	0.39 U	0.41 U	0.37 U	0.45
Naphthalene	3.6	0.41 U	0.39 U	0.41 U	0.37 U	0.39 U
Phenanthrene	--	0.41 U	0.39 U	0.41 U	0.37 U	0.39 U
Pyrene	1700	0.41 U	0.39 U	0.41 U	0.37 U	1.10
Totals (mg/Kg)[4]						
Total BTEX	--	0.005 U	0.005 U	0.005 U	0.0046 U	0.0048 U
Total PAH	--	0.41 U	0.39 U	0.41 U	0.37 U	5.6

Notes:

(1) brb - below river bottom. Interval is based on depth from top of sediment to refusal.

(2) U - Indicates the consitutent was not detected at the reported detection limit.

(3) The semi-volatiles analyzed were polynuclear aromatic hydrocarbons.

(4) Total BTEX and total PAH includes only detected results.

(5) EPA Region 9, Residential Soil Regional Screening Levels (RSL), Summary Table, May 2012. Carcinogenic risk 1 x 10^{-6} and noncarcinogenic HQ = 1.

[shaded box] Indicates constituent RSL was exceeded.

The laboratory may have reported some results between the method detection limit (MDL) and reporting limit (RL). For purposes of this reporting, the results are shown at the RL.

TABLE A-3

SEDIMENT ANALYTICAL RESULTS
WESTERN BOUNDARY - MID-POINT CONGAREE RIVER: 3 TO 19 LINES

Congaree River Sediments
Columbia, South Carolina

General Area	Residential Soil RSL[5]	Mid-Congaree River					
Line Location of Sample		5 Line	8 Line	11 Line	14 Line	17 Line	19 Line
Sample Identification		P5	O8	O11	O14	O17	L19
Date Sampled		10/4/2010	10/04/2010	10/4/2010	10/5/2010	2/23/2011	2/22/2011
Sample Interval (feet brb)[1]		0 - 1.1	0 - 1.1	0 - 6	0 - 0.7	0 - 1.4	0 - 0.5
Parameters							
Volatiles (mg/Kg)							
Benzene	1.1	0.0054 U[2]	0.0049 U	0.0052 U	0.0048 U	0.0055 U	0.0051 U
Ethylbenzene	5.4	0.0054 U	0.0049 U	0.0052 U	0.0055	0.0055 U	0.0051 U
Toluene	5000	0.0054 U	0.0049 U	0.0052 U	0.0048 U	0.0055 U	0.0051 U
Total Xylenes	630	0.0054 U	0.0049 U	0.0052 U	0.0057	0.0055 U	0.0051 U
Semi-Volatiles (mg/Kg)[3]							
Acenaphthene	3400	0.36 U	0.35 U	0.36 U	0.35 U	0.37 U	0.37 U
Acenaphthylene	--	0.36 U	0.35 U	0.36 U	0.35 U	0.37 U	0.37 U
Anthracene	17000	0.36 U	0.35 U	0.36 U	0.35 U	0.37 U	0.37 U
Benzo(a)anthracene	0.15	0.36 U	0.35 U	0.36 U	0.35 U	0.37 U	0.37 U
Benzo(a)pyrene	0.015	0.36 U	0.35 U	0.36 U	0.35 U	0.37 U	0.37 U
Benzo(b)fluoranthene	0.15	0.36 U	0.35 U	0.36 U	0.35 U	0.37 U	0.37 U
Benzo(g,h,i)perylene	--	0.36 U	0.35 U	0.36 U	0.35 U	0.37 U	0.37 U
Benzo(k)fluoranthene	1.5	0.36 U	0.35 U	0.36 U	0.35 U	0.37 U	0.37 U
Chrysene	15	0.36 U	0.35 U	0.36 U	0.35 U	0.37 U	0.37 U
Dibenz(a,h)anthracene	0.015	0.36 U	0.35 U	0.36 U	0.35 U	0.37 U	0.37 U
Fluoranthene	2300	0.36 U	0.35 U	0.36 U	0.35 U	0.37 U	0.45
Fluorene	2300	0.36 U	0.35 U	0.36 U	0.35 U	0.37 U	0.37 U
Indeno(1,2,3-cd)pyrene	0.15	0.36 U	0.35 U	0.36 U	0.35 U	0.37 U	0.37 U
Naphthalene	3.6	0.36 U	0.35 U	0.36 U	0.35 U	0.37 U	0.37 U
Phenanthrene	--	0.36 U	0.35 U	0.36 U	0.35 U	0.37 U	0.94
Pyrene	1700	0.36 U	0.35 U	0.36 U	0.35 U	0.37 U	0.75
Totals (mg/Kg)[4]							
Total BTEX	--	0.0054 U	0.0049 U	0.0052 U	0.0112	0.0055 U	0.0051 U
Total PAH	--	0.36 U	0.35 U	0.36 U	0.35 U	0.37 U	2.1

Notes:

(1) brb - below river bottom. Interval is based on depth from top of sediment to refusal.

(2) U - Indicates the consitutent was not detected at the reported detection limit.

(3) The semi-volatiles analyzed were polynuclear aromatic hydrocarbons.

(4) Total BTEX and total PAH includes only detected results.

(5) EPA Region 9, Residential Soil Regional Screening Levels (RSL), Summary Table, May 2012. Carcinogenic risk 1 x 10^{-6} and noncarcinogenic HQ = 1.

[shaded box] Indicates constituent RSL was exceeded.

The laboratory may have reported some results between the method detection limit (MDL) and reporting limit (RL). For purposes of this reporting, the results are shown at the RL.

TABLE A-4

SEDIMENT ANALYTCIAL RESULTS
EASTERN BOUNDARY - CONGAREE RIVER SHORELINE: 1 TO 19 LINES

Congaree River Sediments
Columbia, South Carolina

General Area	Residential Soil RSL[5]	Eastern Shoreline			
Line Location of Sample		7 Line	8 Line	11 Line	17 Line
Sample Identification		L7	K8	J11.5	I17
Date Sampled		2/1/2012	2/1/2012	2/1/2012	2/23/2011
Sample Interval (feet brb)[1]		0 - 1.55	0 - 5.1	0 - 5.25	0 - 2.8
Parameters					
Volatiles (mg/Kg)					
Benzene	1.1	0.0076 U	0.0060 U	0.0097 U	0.0084 U
Ethylbenzene	5.4	0.0076 U	0.0060 U	0.0097 U	0.0084 U
Toluene	5000	0.0076 U	0.0060 U	0.0097 U	0.0084 U
Total Xylenes	630	0.0076 U	0.0060 U	0.0097 U	0.058
Semi-Volatiles (mg/Kg)[3]					
Acenaphthene	3400	0.41 U	3.7	0.52 U	59
Acenaphthylene	--	0.41 U	0.89	0.52 U	4.7
Anthracene	17000	0.41 U	1.2	0.52 U	65
Benzo(a)anthracene	0.15	0.68	4.3	0.56	28
Benzo(a)pyrene	0.015	0.86	4.7	1.0	27
Benzo(b)fluoranthene	0.15	0.79	4.2	0.97	17
Benzo(g,h,i)perylene	--	0.50	1.9	0.60	7.4
Benzo(k)fluoranthene	1.5	0.41 U	1.6	0.52 U	6.6
Chrysene	15	0.70	4.0	0.52 U	26
Dibenz(a,h)anthracene	0.015	0.41 U	0.44	0.52 U	1.8
Fluoranthene	2300	0.95	8.2	0.52 U	76
Fluorene	2300	0.41 U	2.4	0.52 U	37
Indeno(1,2,3-cd)pyrene	0.15	0.41 U	1.5	0.52 U	6.8
Naphthalene	3.6	0.41 U	0.41 U	0.52 U	0.79
Phenanthrene	--	0.41 U	9.8	0.52 U	170
Pyrene	1700	1.4	9.1	0.65	97
Totals (mg/Kg)[4]					
Total BTEX	--	0.0076 U	0.0060 U	0.0097 U	0.058
Total PAH	--	5.88	57.93	3.78	630.1

Notes:

(1) brb - below river bottom. Interval is based on depth from top of sediment to refusal.

(2) U - Indicates the consitutent was not detected at the reported detection limit.

(3) The semi-volatiles analyzed were polynuclear aromatic hydrocarbons.

(4) Total BTEX and total PAH includes only detected results.

(5) EPA Region 9, Residential Soil Regional Screening Levels (RSL), Summary Table, May 2012. Carcinogenic risk 1 x 10^6 and noncarcinogenic HQ = 1.

[shaded box] Indicates constituent RSL was exceeded.

The laboratory may have reported some results between the method detection limit (MDL) and reporting limit (RL). For purposes of this reporting, the results are shown at the RL.

TABLE A-5

SOIL ANALYTICAL RESULTS
TOP OF THE CONGAREE RIVER EASTERN BANK: 1 TO 19 LINES

Congaree River Sediments
Columbia, South Carolina

General Area		Top of the Congaree River Eastern Bank				
Line Location of Sample	Residential Soil RSL[5]	4 Line	8 Line	11 Line	14 Line	17 Line
Sample Identification		K4	J8	J11	I14	H17
Date Sampled		7/28/2011	7/27/2011	7/27/2011	7/27/2011	7/28/2011
Sample Interval (feet bgs)[1]		12 - 14	20 - 23	17 - 21	17.5 - 22	22 - 26
Parameters						
Volatiles (mg/Kg)						
Benzene	1.1	0.006 U[2]	0.005 U	0.006 U	0.006 U	0.006 U
Ethylbenzene	5.4	0.006 U	0.005 U	0.006 U	0.006 U	0.006 U
Toluene	5000	0.006 U	0.005 U	0.006 U	0.006 U	0.006 U
Total Xylenes	630	0.006 U	0.005 U	0.006 U	0.006 U	0.006 U
Semi-Volatiles (mg/Kg)[3]						
Acenaphthene	3400	0.38 U	0.37 U	0.51 U	0.46 U	0.44 U
Acenaphthylene	--	0.38 U	0.37 U	0.51 U	0.46 U	0.44 U
Anthracene	17000	0.38 U	0.37 U	0.51 U	0.46 U	0.44 U
Benzo(a)anthracene	0.15	0.38 U	0.37 U	0.51 U	0.46 U	0.44 U
Benzo(a)pyrene	0.015	0.38 U	0.37 U	0.51 U	0.46 U	0.44 U
Benzo(b)fluoranthene	0.15	0.38 U	0.37 U	0.51 U	0.46 U	0.44 U
Benzo(g,h,i)perylene	--	0.38 U	0.37 U	0.51 U	0.46 U	0.44 U
Benzo(k)fluoranthene	1.5	0.38 U	0.37 U	0.51 U	0.46 U	0.44 U
Chrysene	15	0.38 U	0.37 U	0.51 U	0.46 U	0.44 U
Dibenz(a,h)anthracene	0.015	0.38 U	0.37 U	0.51 U	0.46 U	0.44 U
Fluoranthene	2300	0.38 U	0.37 U	0.51 U	0.46 U	0.44 U
Fluorene	2300	0.38 U	0.37 U	0.51 U	0.46 U	0.44 U
Indeno(1,2,3-cd)pyrene	0.15	0.38 U	0.37 U	0.51 U	0.46 U	0.44 U
Naphthalene	3.6	0.38 U	0.37 U	0.51 U	0.46 U	0.44 U
Phenanthrene	--	0.38 U	0.37 U	0.51 U	0.46 U	0.44 U
Pyrene	1700	0.38 U	0.37 U	0.51 U	0.46 U	0.44 U
Totals (mg/Kg)[4]						
Total BTEX	--	0.006 U	0.005 U	0.006 U	0.006 U	0.006 U
Total PAH	--	0.38 U	0.37 U	0.51 U	0.46 U	0.44 U

Notes:

(1) brb - below river bottom. Interval is based on depth from top of sediment to refusal.

(2) U - Indicates the consitutent was not detected at the reported detection limit.

(3) The semi-volatiles analyzed were polynuclear aromatic hydrocarbons.

(4) Total BTEX and total PAH includes only detected results.

(5) EPA Region 9, Residential Soil Regional Screening Levels (RSL), Summary Table, May 2012. Carcinogenic risk 1 x 10^{-6} and noncarcinogenic HQ = 1.

[shaded box] Indicates constituent RSL was exceeded.

The laboratory may have reported some results between the method detection limit (MDL) and reporting limit (RL). For purposes of this reporting, the results are shown at the RL.

TABLE A-6

SEDIMENT ANALYTICAL RESULTS
IN THE CONGAREE RIVER: 19 TO 36 LINES

Congaree River Sediments
Columbia, South Carolina

General Area		In the Congaree River								
Line Location of Sample	Residential Soil RSL[(5)]	K Line	20 Line			24 Line		30 Line		36 Line
Sample Identification		K19	I20	K20	M20	H24	L24	I30	L30	P36
Date Sampled		2/22/2011	7/21/2011	7/21/2011	7/21/2011	7/20/2011	7/20/2011	7/20/2011	7/20/2011	7/19/11
Sample Interval (feet brb)[(1)]		0 - 0.6	0 - 0.6	0 - 0.7	0 - 0.8	0 - 0.7	0 - 0.5	0 - 1.0	0 - 0.7	0 - 0.5
Parameters										
Volatiles (mg/Kg)										
Benzene	1.1	0.0052 U[(2)]	0.005 U	0.005 U	0.005 U	0.005 U	0.009	0.006 U	0.005 U	0.004 U
Ethylbenzene	5.4	0.0052 U	0.005 U	0.005 U	0.005 U	0.005 U	0.062	0.006 U	0.005 U	0.004 U
Toluene	5000	0.0052 U	0.005 U	0.005 U	0.005 U	0.005 U	0.009	0.006 U	0.005 U	0.004 U
Total Xylenes	630	0.0052 U	0.005 U	0.005 U	0.005 U	0.005 U	0.026	0.006 U	0.005 U	0.004 U
Semi-Volatiles (mg/Kg)[(3)]										
Acenaphthene	3400	0.89	0.38 U	0.40 U	0.39 U	0.41 U	0.43 U	0.47 U	0.36 U	0.38 U
Acenaphthylene	--	0.41	0.38 U	0.40 U	0.39 U	0.41 U	0.43 U	0.47 U	0.36 U	0.38 U
Anthracene	17000	1.8	0.38 U	0.40 U	0.39 U	0.41 U	0.43	0.47 U	0.36 U	0.38 U
Benzo(a)anthracene	0.15	1.9	0.39	0.83	0.39 U	0.57	1.10	0.47	0.36 U	0.38 U
Benzo(a)pyrene	0.015	1.9	0.38 U	0.92	0.39 U	0.71	1.30	0.59	0.36 U	0.38 U
Benzo(b)fluoranthene	0.15	1.4	0.63	0.74	0.39 U	0.92	1.30	0.85	0.36 U	0.38 U
Benzo(g,h,i)perylene	--	0.65	0.38 U	0.40 U	0.39 U	0.41 U	0.61	0.47 U	0.36 U	0.38 U
Benzo(k)fluoranthene	1.5	0.54	0.38 U	0.40 U	0.39 U	0.41 U	0.43 U	0.47 U	0.36 U	0.38 U
Chrysene	15	2.1	0.42	0.77	0.39 U	0.72	1.30	0.64	0.36 U	0.38 U
Dibenz(a,h)anthracene	0.015	0.42	0.38 U	0.40 U	0.39 U	0.41 U	0.43 U	0.47 U	0.36 U	0.38 U
Fluoranthene	2300	3.6	0.77	1.20	0.39 U	1.00	1.60	0.90	0.36 U	0.38 U
Fluorene	2300	0.81	0.38 U	0.40 U	0.39 U	0.41 U	0.43 U	0.47 U	0.36 U	0.38 U
Indeno(1,2,3-cd)pyrene	0.15	0.5	0.38 U	0.40 U	0.39 U	0.41 U	0.46	0.47 U	0.36 U	0.38 U
Naphthalene	3.6	0.34 U	0.38 U	0.40 U	0.39 U	0.41 U	0.43 U	0.47 U	0.48	0.38 U
Phenanthrene	--	4.8	0.49	0.49	0.39 U	0.65	1.70	0.71	0.36 U	0.38 U
Pyrene	1700	5.8	0.77	1.70	0.39 U	1.40	3.00	1.10	0.36 U	0.38 U
Totals (mg/Kg)[(4)]										
Total BTEX	--	0.0052 U	0.005 U	0.005 U	0.005 U	0.005 U	0.11	0.006 U	0.005 U	0.004 U
Total PAH	--	27.5	3.5	6.7	0.39 U	6.0	12.8	5.3	0.48	0.38 U

Notes:

(1) brb - below river bottom. Interval is based on depth from top of sediment to refusal.

(2) U - Indicates the consitutent was not detected at the reported detection limit.

(3) The semi-volatiles analyzed were polynuclear aromatic hydrocarbons.

(4) Total BTEX and total PAH includes only detected results.

(5) EPA Region 9, Residential Soil Regional Screening Levels (RSL), Summary Table, May 2012. Carcinogenic risk 1 x 10^{-6} and noncarcinogenic HQ = 1.

Indicates constituent RSL was exceec Indicates constituent RSL was exceeded.

The laboratory may have reported some results between the method detection limit (MDL) and reporting limit (RL). For purposes of this reporting, the results are shown at the RL.

TABLE A-7

SEDIMENT ANALYTICAL RESULTS
WITHIN THE CONGAREE RIVER BELOW THE 36 TO 80 LINES

Congaree River Sediments
Columbia, South Carolina

General Area	Residential Soil RSL(5)	South of Blossom Street Bridge to South of Railroad Trestles							
Line Location of Sample		45 Line	57 Line		63 Line	64 Line	70 Line		80 Line
Sample Identification		CR1	CR4	Y57	CR7	CR9	AM70	AQ70	AK80
Date Sampled		8/10/2011	8/10/2011	1/12/2012	8/10/2011	8/10/2011	1/10/2012	1/20/2012	1/10/2012
Sample Interval (feet brb)(1)		0 - 1.5	0 - 1.0	0 - 0.7	0 - 0.5	0 - 0.75	0 - 3.0	0 - 0.75	0 - 2.5
Parameters									
Volatiles (mg/Kg)									
Benzene	1.1	0.008 U(2)	0.009 U	0.0052 U	0.008 U	0.009 U	0.0054 U	0.0051 U	0.0056 U
Ethylbenzene	5.4	0.008 U	0.009 U	0.0052 U	0.008 U	0.009 U	0.0054 U	0.0051 U	0.0056 U
Toluene	5000	0.008 U	0.009 U	0.0052 U	0.008 U	0.009 U	0.0054 U	0.0051 U	0.0056 U
Total Xylenes	630	0.008 U	0.009 U	0.0052 U	0.008 U	0.009 U	0.0054 U	0.0051 U	0.0056 U
Semi-Volatiles (mg/Kg)(3)									
Acenaphthene	3400	0.40 U	0.40 U	0.36 U	0.40 U	0.37 U	0.37 U	0.35 U	0.36 U
Acenaphthylene	--	0.40 U	0.40 U	0.36 U	0.40 U	0.37 U	0.37 U	0.35 U	0.36 U
Anthracene	17000	0.40 U	0.40 U	0.36 U	0.40 U	0.37 U	0.37 U	0.35 U	0.36 U
Benzo(a)anthracene	0.15	0.40 U	0.40 U	0.36 U	0.40 U	0.37 U	0.37 U	0.35 U	0.36 U
Benzo(a)pyrene	0.015	0.40 U	0.40 U	0.36 U	0.40 U	0.37 U	0.37 U	0.35 U	0.36 U
Benzo(b)fluoranthene	0.15	0.41	0.40 U	0.36 U	0.40 U	0.37 U	0.37 U	0.35 U	0.36 U
Benzo(g,h,i)perylene	--	0.40 U	0.40 U	0.36 U	0.40 U	0.37 U	0.37 U	0.35 U	0.36 U
Benzo(k)fluoranthene	1.5	0.40 U	0.40 U	0.36 U	0.40 U	0.37 U	0.37 U	0.35 U	0.36 U
Chrysene	15	0.40 U	0.40 U	0.36 U	0.40 U	0.37 U	0.37 U	0.35 U	0.36 U
Dibenz(a,h)anthracene	0.015	0.40 U	0.40 U	0.36 U	0.40 U	0.37 U	0.37 U	0.35 U	0.36 U
Fluoranthene	2300	0.64	0.40 U	0.36	0.40 U	0.37 U	0.37 U	0.35 U	0.36 U
Fluorene	2300	0.40 U	0.40 U	0.36 U	0.40 U	0.37 U	0.37 U	0.35 U	0.36 U
Indeno(1,2,3-cd)pyrene	0.15	0.40 U	0.40 U	0.36 U	0.40 U	0.37 U	0.37 U	0.35 U	0.36 U
Naphthalene	3.6	0.40 U	0.40 U	0.36 U	0.40 U	0.37 U	0.37 U	0.35 U	0.36 U
Phenanthrene	--	0.40 U	0.40 U	0.36 U	0.40 U	0.37 U	0.37 U	0.35 U	0.36 U
Pyrene	1700	0.48	0.40 U	0.62	0.40 U	0.37 U	0.37 U	0.35 U	0.36 U
Totals (mg/Kg)(4)									
Total BTEX	--	0.008 U	0.009 U	0.0052 U	0.008 U	0.009 U	0.0054 U	0.0051 U	0.0056 U
Total PAH	--	1.53	0.40 U	0.98	0.40 U	0.37 U	0.37 U	0.35 U	0.36 U

Notes:

(1) brb - below river bottom. Interval is based on depth from top of sediment to refusal.

(2) U - Indicates the consitutent was not detected at the reported detection limit.

(3) The semi-volatiles analyzed were polynuclear aromatic hydrocarbons.

(4) Total BTEX and total PAH includes only detected results.

(5) EPA Region 9, Residential Soil Regional Screening Levels (RSL), Summary Table, May 2012. Carcinogenic risk 1 x 10 $^{-6}$ and noncarcinogenic HQ = 1.

Indicates constituent RSL was ex Indicates constituent RSL was exceeded.

The laboratory may have reported some results between the method detection limit (MDL) and reporting limit (RL). For purposes of this reporting, the results are shown at the RL.

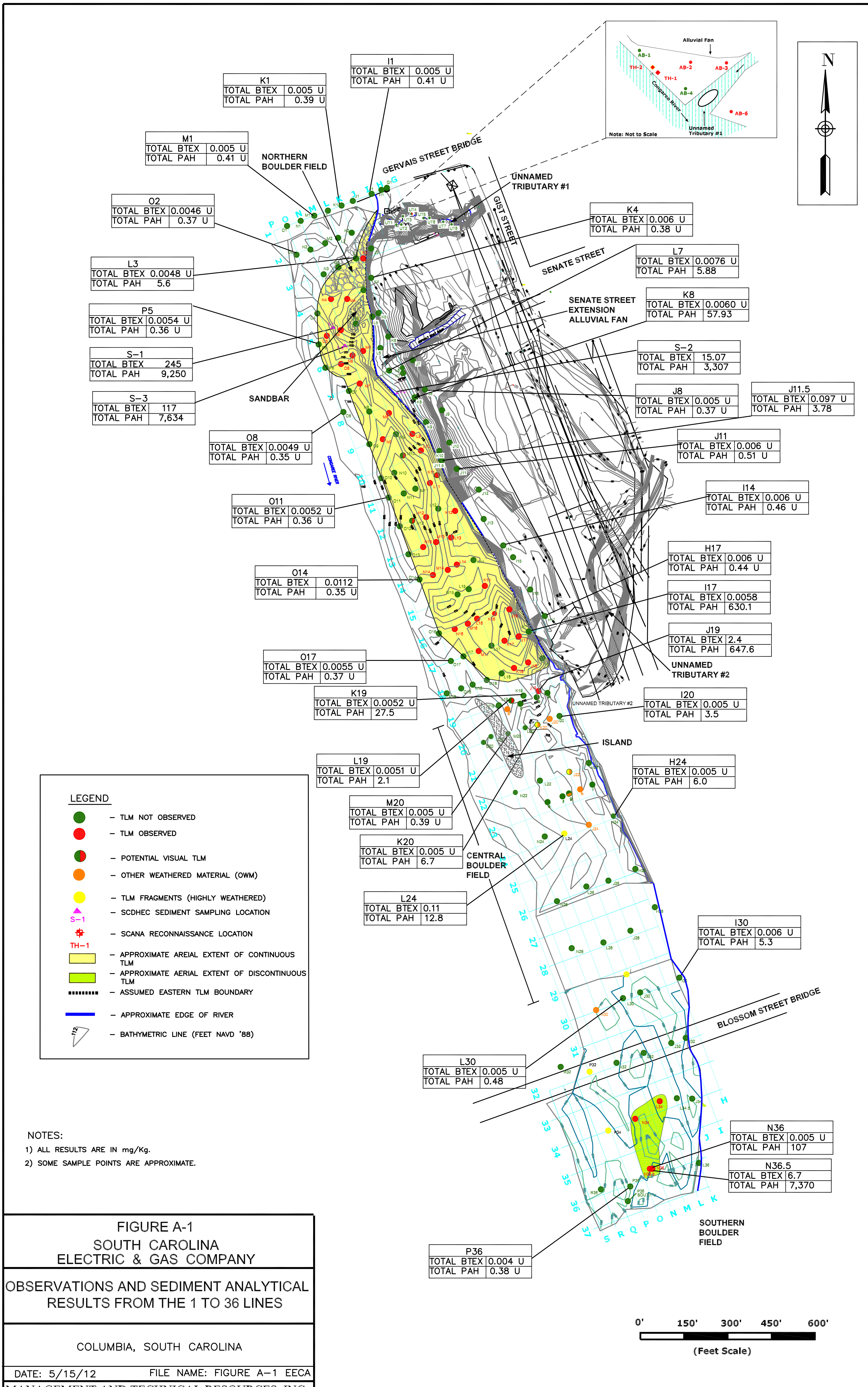


FIGURE A-1

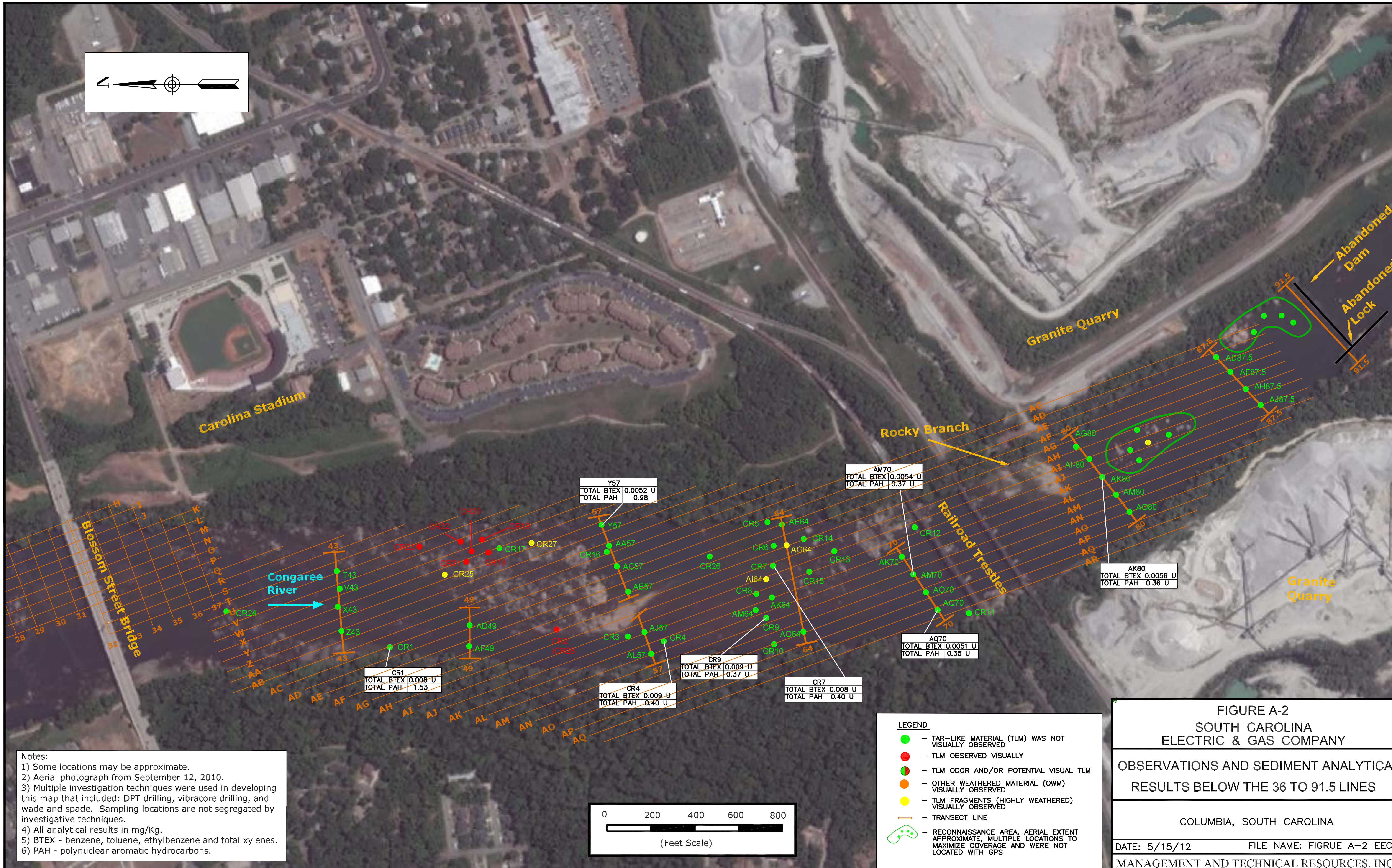
SOUTH CAROLINA ELECTRIC & GAS COMPANY

OBSERVATIONS AND SEDIMENT ANALYTICAL RESULTS FROM THE 1 TO 36 LINES

COLUMBIA, SOUTH CAROLINA

DATE: 5/15/12 FILE NAME: FIGURE A–1 EECA

MANAGEMENT AND TECHNICAL RESOURCES, INC.



Notes:
1) Some locations may be approximate.
2) Aerial photograph from September 12, 2010.
3) Multiple investigation techniques were used in developing this map that included: DPT drilling, vibracore drilling, and wade and spade. Sampling locations are not segregated by investigative techniques.
4) All analytical results in mg/Kg.
5) BTEX - benzene, toluene, ethylbenzene and total xylenes.
6) PAH - polynuclear aromatic hydrocarbons.

LEGEND
- TAR–LIKE MATERIAL (TLM) WAS NOT VISUALLY OBSERVED
- TLM OBSERVED VISUALLY
- TLM ODOR AND/OR POTENTIAL VISUAL TLM
- OTHER WEATHERED MATERIAL (OWM) VISUALLY OBSERVED
- TLM FRAGMENTS (HIGHLY WEATHERED) VISUALLY OBSERVED
- TRANSECT LINE
- RECONNAISSANCE AREA, AERIAL EXTENT APPROXIMATE, MULTIPLE LOCATIONS TO MAXIMIZE COVERAGE AND WERE NOT LOCATED WITH GPS

FIGURE A-2
SOUTH CAROLINA ELECTRIC & GAS COMPANY

OBSERVATIONS AND SEDIMENT ANALYTICAL RESULTS BELOW THE 36 TO 91.5 LINES

COLUMBIA, SOUTH CAROLINA

DATE: 5/15/12 FILE NAME: FIGRUE A–2 EECA

MANAGEMENT AND TECHNICAL RESOURCES, INC.

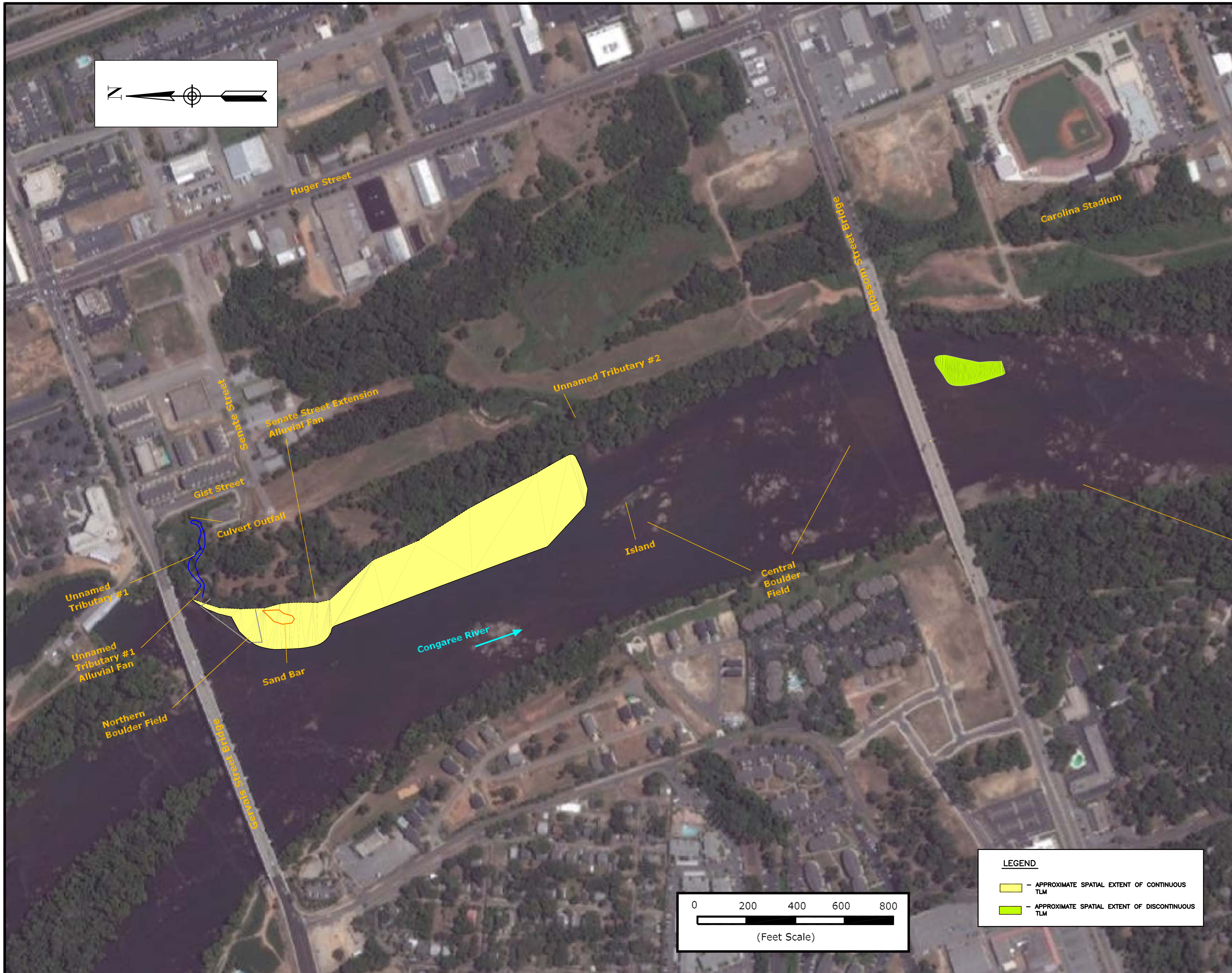


FIGURE A-3
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

TLM EXTENT AND SPATIAL DISTRIBUTION
IN THE CONGAREE RIVER

COLUMBIA, SOUTH CAROLINA

DATE: 5/17/12 FILE NAME: FIGURE A–3 EECA

MANAGEMENT AND TECHNICAL RESOURCES, INC.

APPENDIX B

2010 DEMOGRAPHIC DATA FOR THE CITY OF COLUMBIA

State & County QuickFacts

Columbia (city), South Carolina

People QuickFacts	Columbia	South Carolina
Population, 2011 estimate	NA	4,679,230
Population, 2010	129,272	4,625,364
Population, percent change, 2000 to 2010	11.2%	15.3%
Population, 2000	116,278	4,012,012
Persons under 5 years, percent, 2010	5.4%	6.5%
Persons under 18 years, percent, 2010	17.0%	23.4%
Persons 65 years and over, percent, 2010	8.7%	13.7%
Female persons, percent, 2010	48.5%	51.4%
White persons, percent, 2010 (a)	51.7%	66.2%
Black persons, percent, 2010 (a)	42.2%	27.9%
American Indian and Alaska Native persons, percent, 2010 (a)	0.3%	0.4%
Asian persons, percent, 2010 (a)	2.2%	1.3%
Native Hawaiian and Other Pacific Islander, percent, 2010 (a)	0.1%	0.1%
Persons reporting two or more races, percent, 2010	2.0%	1.7%
Persons of Hispanic or Latino origin, percent, 2010 (b)	4.3%	5.1%
White persons not Hispanic, percent, 2010	49.6%	64.1%
Living in same house 1 year & over, 2006-2010	64.1%	84.3%
Foreign born persons, percent, 2006-2010	5.0%	4.7%
Language other than English spoken at home, pct age 5+, 2006-2010	8.2%	6.6%
High school graduates, percent of persons age 25+, 2006-2010	85.0%	83.0%
Bachelor's degree or higher, pct of persons age 25+, 2006-2010	39.0%	24.0%
Mean travel time to work (minutes), workers age 16+, 2006-2010	17.6	23.2
Housing units, 2010	52,471	2,137,683
Homeownership rate, 2006-2010	47.2%	69.9%
Housing units in multi-unit structures, percent, 2006-2010	42.1%	17.4%
Median value of owner-occupied housing units, 2006-2010	$156,100	$134,100
Households, 2006-2010	46,575	1,741,994
Persons per household, 2006-2010	2.16	2.51
Per capita money income in past 12 months (2010 dollars) 2006-2010	$24,221	$23,443
Median household income 2006-2010	$38,272	$43,939
Persons below poverty level, percent, 2006-2010	22.0%	16.4%

Business QuickFacts	Columbia	South Carolina
Total number of firms, 2007	12,783	360,397
Black-owned firms, percent, 2007	19.4%	12.1%
American Indian- and Alaska Native-owned firms, percent, 2007	F	0.5%
Asian-owned firms, percent, 2007	2.3%	1.8%
Native Hawaiian and Other Pacific Islander-owned firms, percent, 2007	F	0.1%
Hispanic-owned firms, percent, 2007	1.1%	1.7%
Women-owned firms, percent, 2007	24.2%	27.6%
Manufacturers shipments, 2007 ($1000)	D	93,977,455
Merchant wholesaler sales, 2007 ($1000)	1,448,968	40,498,047
Retail sales, 2007 ($1000)	2,720,157	54,298,410
Retail sales per capita, 2007	$21,595	$12,273
Accommodation and food services sales, 2007 ($1000)	495,965	8,383,463

Geography QuickFacts	Columbia	South Carolina
Land area in square miles, 2010	132.21	30,060.70
Persons per square mile, 2010	977.8	153.9
FIPS Code	16000	45
Counties		

Population estimates for counties will be available in April, 2012 and for cities in June, 2012.

(a) Includes persons reporting only one race.
(b) Hispanics may be of any race, so also are included in applicable race categories.

D: Suppressed to avoid disclosure of confidential information
F: Fewer than 100 firms
FN: Footnote on this item for this area in place of data
NA: Not available
S: Suppressed; does not meet publication standards
X: Not applicable
Z: Value greater than zero but less than half unit of measure shown

Source U.S. Census Bureau: State and County QuickFacts. Data derived from Population Estimates, American Community Survey, Census of Population and Housing, County Business Patterns, Economic Census, Survey of Business Owners, Building Permits, Consolidated Federal Funds Report, Census of Governments
Last Revised: Tuesday, 31-Jan-2012 17:25:40 EST

APPENDIX C

USGS RIVER GAGE DATA

USGS science for a changing world

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National Water Information System: Web Interface

USGS Water Resources

Data Category: Site Information
Geographic Area: United States
GO

News updated April, 2012

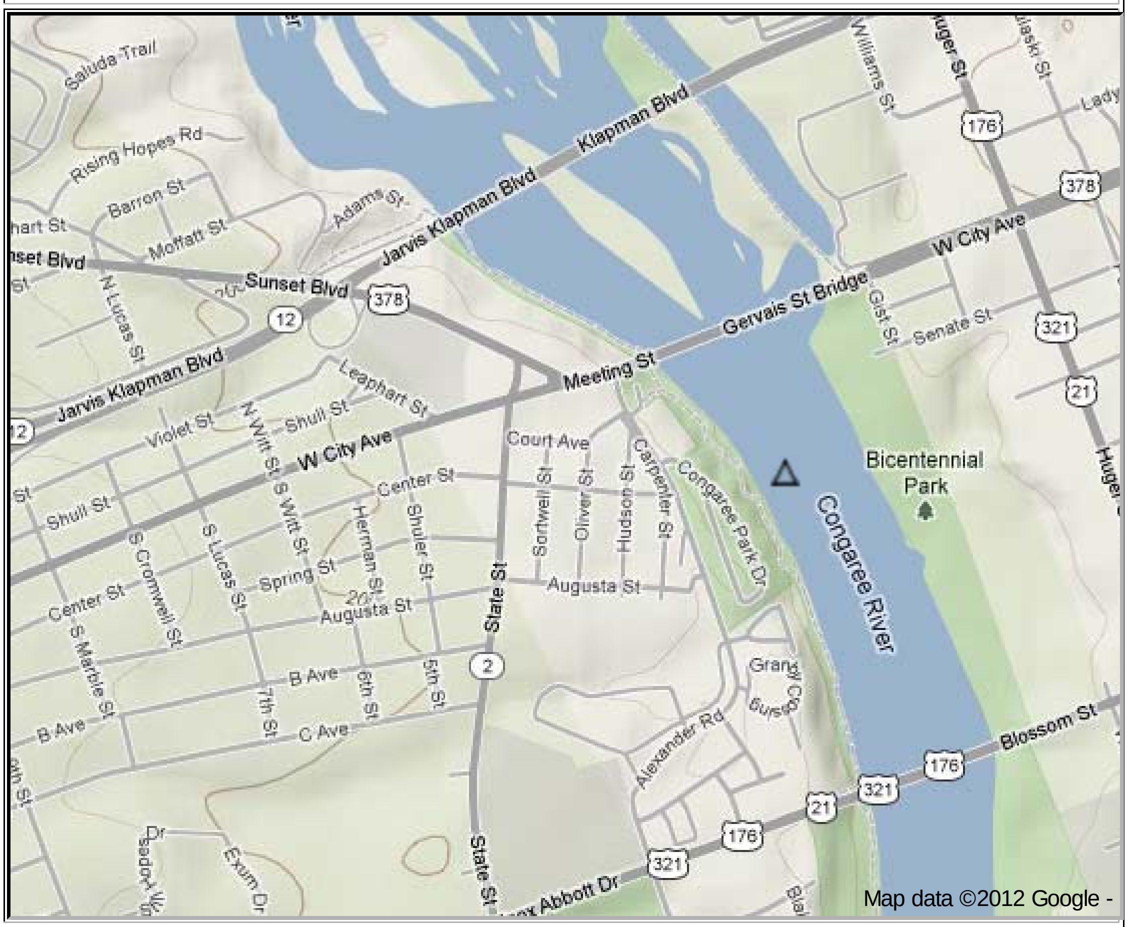
Site Map for the Nation

USGS 02169500 CONGAREE RIVER AT COLUMBIA, SC

Available data for this site Location map GO

Lexington County, South Carolina
Hydrologic Unit Code 03050110
Latitude 33°59'35", Longitude 81°03'00" NAD27
Drainage area 7,850 square miles
Gage datum 113.02 feet above NGVD29

Location of the site in South Carolina.



** References to non-U.S. Department of the Interior (DOI) products do not constitute an endorsement by the DOI. By viewing the Google Maps API on this web site the user agrees to these TERMS of Service set forth by Google.*

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National Water Information System: Web Interface

USGS Water Resources

Data Category: Surface Water | Geographic Area: South Carolina | GO

News updated April, 2012

USGS Surface-Water Daily Statistics for South Carolina

ALL DATA COLLECTED BY THE SOUTH CAROLINA WATER SCIENCE CENTER ARE REPORTED IN EASTERN STANDARD TIME

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The statistics generated from this site are based on approved daily-mean data and may not match those published by the USGS in official publications. The user is responsible for assessment and use of statistics from this site. For more details on why the statistics may not match, click here.

USGS 02169500 CONGAREE RIVER AT COLUMBIA, SC

Available data for this site Time-series: Daily statistics GO

Lexington County, South Carolina
Hydrologic Unit Code 03050110
Latitude 33°59'35", Longitude 81°03'00" NAD27
Drainage area 7,850 square miles
Gage datum 113.02 feet above NGVD29

Output formats
HTML table of all data
Tab-separated data
Reselect output format

00060, Discharge, cubic feet per second,												
Day of month	**Mean of daily mean values for each day for 71 - 72 years of record in, cfs (Calculation Period 1939-10-01 -> 2011-09-30)**											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1	9,140	10,300	12,600	15,800	9,190	7,120	5,840	6,320	5,770	6,990	6,000	8,480
2	9,750	10,300	13,800	15,300	8,570	7,010	5,490	6,320	5,450	8,040	6,080	7,960
3	10,100	12,100	15,200	13,500	8,490	7,010	5,770	6,100	5,200	7,440	6,430	7,920
4	10,100	13,700	15,300	11,800	8,820	6,980	5,030	5,960	5,940	6,820	6,920	8,000
5	10,200	13,600	14,400	11,500	8,760	6,790	5,110	6,060	5,740	6,610	6,680	7,710
6	10,300	13,400	14,400	11,100	8,670	7,000	5,810	5,890	5,810	6,880	6,460	7,870
7	10,600	13,500	15,100	11,800	8,590	7,200	6,210	6,250	5,910	6,770	5,950	8,480
8	11,300	14,000	15,700	12,700	8,590	6,710	6,460	6,140	6,580	6,580	6,160	8,730
9	11,200	12,900	14,900	13,500	8,660	7,270	7,230	6,310	7,110	7,320	6,560	8,940
10	11,400	11,800	13,400	13,600	8,160	7,100	7,260	5,790	7,150	8,330	6,310	8,410
11	12,000	11,200	11,400	12,400	7,330	6,850	6,820	5,810	6,840	8,610	6,370	8,170
12	12,300	11,500	10,800	11,900	6,840	6,770	6,660	5,900	5,680	7,580	7,250	9,150
13	11,800	11,200	11,800	11,600	6,870	6,600	6,460	5,960	5,490	6,720	8,000	10,000
14	11,300	11,700	13,200	11,700	6,970	6,570	6,550	6,480	5,390	7,020	7,900	10,200
15	11,000	12,600	13,700	11,300	7,290	6,720	6,630	6,360	5,950	7,300	7,130	9,050
16	10,800	12,800	13,400	11,800	7,320	7,410	6,870	7,500	6,180	7,020	6,590	9,040
17	11,400	12,800	13,200	11,600	7,490	7,270	6,950	7,530	6,380	7,100	6,240	9,610
18	11,200	13,500	13,600	10,700	7,080	6,890	7,000	7,150	6,910	7,020	6,110	9,130
19	11,700	13,600	13,900	10,700	6,830	6,610	6,840	7,780	6,890	6,590	6,270	8,730
20	12,400	12,700	14,100	10,400	6,890	6,400	6,320	7,350	6,890	6,010	6,720	8,250
21	12,200	11,700	14,500	9,540	6,690	6,300	6,330	6,620	5,930	5,680	6,990	7,890
22	12,800	11,800	15,100	8,810	6,920	6,760	6,260	5,930	5,700	5,680	6,800	7,980
23	12,600	12,600	13,900	8,470	7,460	7,280	6,300	5,850	5,240	5,940	7,080	8,110
24	12,100	13,100	13,100	8,430	7,610	6,870	6,340	6,440	5,340	6,270	7,230	7,520
25	12,300	12,900	13,700	8,150	7,310	6,020	5,990	6,720	5,400	6,280	7,030	7,530
26	12,700	12,500	14,200	8,430	6,790	6,230	5,860	6,920	5,280	6,220	6,970	8,990
27	12,600	12,500	13,200	8,430	6,610	6,530	6,050	6,720	5,470	6,240	7,540	10,200
28	12,200	12,700	12,900	8,750	6,590	6,160	5,710	6,870	5,520	6,220	7,480	9,360
29	12,000	12,100	14,000	8,670	7,120	6,320	5,920	7,720	5,690	5,830	8,010	9,080
30	11,600		15,300	9,000	7,630	5,990	5,950	8,490	6,150	5,820	8,570	9,610
31	11,100		15,900		7,710		5,900	7,330		5,710		9,620

National Water Information System: Web Interface

News updated April, 2012

Peak Streamflow for South Carolina

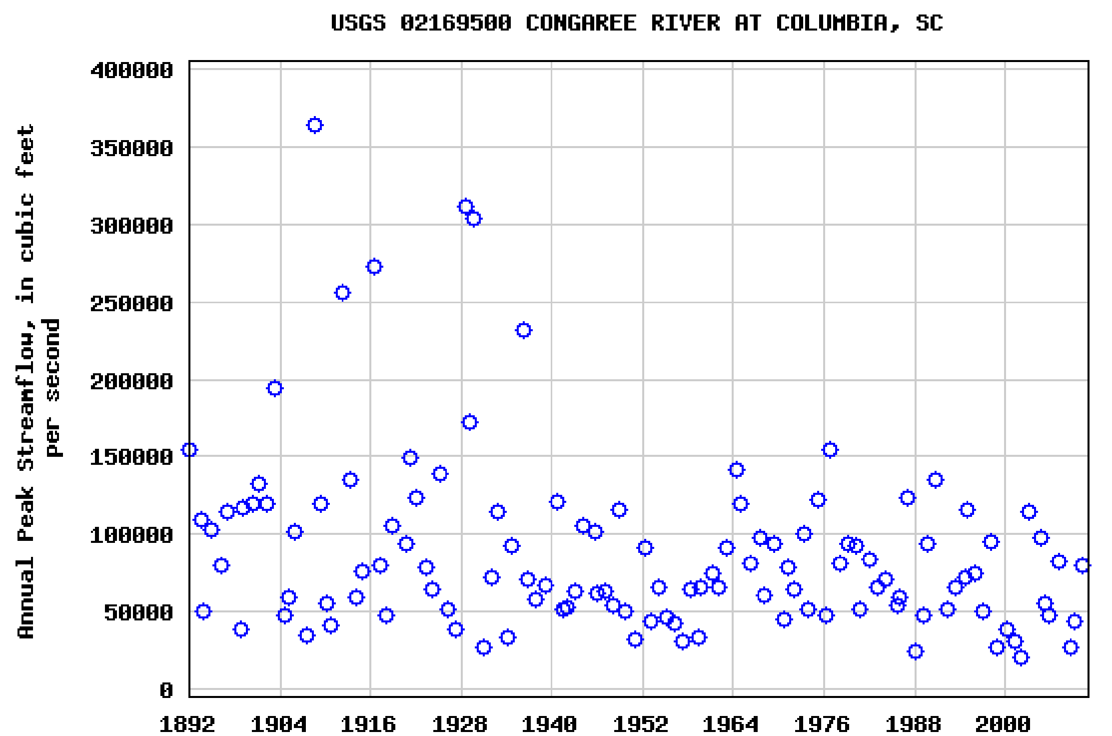
ALL DATA COLLECTED BY THE SOUTH CAROLINA WATER SCIENCE CENTER ARE REPORTED IN EASTERN STANDARD TIME

NEW **Real-time text and e-mail alerts now available!**

USGS 02169500 CONGAREE RIVER AT COLUMBIA, SC

Available data for this site Surface-water: Peak streamflow GO

Lexington County, South Carolina Hydrologic Unit Code 03050110 Latitude 33°59'35", Longitude 81°03'00" NAD27 Drainage area 7,850 square miles Gage datum 113.02 feet above NGVD29	**Output formats** Table Graph Tab-separated file peakfq (watstore) format Reselect output format



Download a presentation-quality graph

USGS Surface-Water Annual Statistics for South Carolina

ALL DATA COLLECTED BY THE SOUTH CAROLINA WATER SCIENCE CENTER ARE REPORTED IN EASTERN STANDARD TIME

NEW Real-time text and e-mail alerts now available!

The statistics generated from this site are based on approved daily-mean data and may not match those published by the USGS in official publications. The user is responsible for assessment and use of statistics from this site. For more details on why the statistics may not match, click here.

USGS 02169500 CONGAREE RIVER AT COLUMBIA, SC

Available data for this site Time-series: Annual statistics GO

Lexington County, South Carolina
Hydrologic Unit Code 03050110
Latitude 33°59'35", Longitude 81°03'00" NAD27
Drainage area 7,850 square miles
Gage datum 113.02 feet above NGVD29

Output formats
- HTML table of all data
- Tab-separated data
- Reselect output format

Water Year	00060, Discharge, cubic feet per second
1940	5,244
1941	6,328
1942	7,602
1943	9,404
1944	9,717
1945	7,444

Water Year	00060, Discharge, cubic feet per second
1946	10,200
1947	7,568
1948	11,510
1949	12,910
1950	8,437
1951	6,295
1952	9,130
1953	7,104
1954	6,266
1955	4,677
1956	5,094
1957	5,695
1958	11,890
1959	7,570
1960	14,330
1961	10,500
1962	10,850
1963	8,936
1964	13,000
1965	15,130
1966	7,887
1967	8,131
1968	9,159
1969	9,720
1970	7,100
1971	10,390
1972	11,850
1973	14,540
1974	9,648
1975	13,320
1976	9,852

Water Year	00060, Discharge, cubic feet per second
1977	11,630
1978	9,205
1979	10,240
1980	10,880
1981	5,272
1982	8,683
1983	10,130
1984	12,160
1985	5,967
1986	6,366
1987	9,365
1989	6,988
1990	10,040
1991	11,640
1992	6,744
1993	13,940
1994	7,856
1995	10,940
1996	10,180
1997	8,077
1998	12,250
1999	4,975
2000	4,637
2001	3,601
2002	3,245
2003	13,820
2004	6,464
2005	8,405
2006	5,320
2007	5,680
2008	2,592

Water Year	00060, Discharge, cubic feet per second
2009	5,486
2010	9,514
2011	3,447
** No Incomplete data have been used for statistical calculation	

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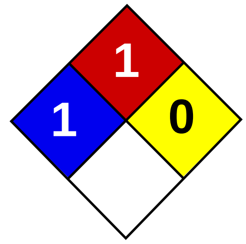
U.S. Department of the Interior | U.S. Geological Survey
Title: Surface Water data for South Carolina: USGS Surface-Water Annual Statistics
URL: http://nwis.waterdata.usgs.gov/sc/nwis/annual?

Page Contact Information: South Carolina Water Data Support Team
Page Last Modified: 2012-05-16 09:43:41 EDT
1.13 0.63 nadww01

APPENDIX D

MSDS FOR COAL TAR



Health	1
Fire	1
Reactivity	0
Personal Protection	A

Material Safety Data Sheet
Coal tar MSDS

Section 1: Chemical Product and Company Identification

Product Name: Coal tar

Catalog Codes: SLC1108

CAS#: 8007-45-2

RTECS: GF8600000

TSCA: TSCA 8(b) inventory: Coal tar

CI#: Not available.

Synonym: Estar; Lavatar; Zetar; Tar, coal; Pixalbol; Tar, coking; coke oven emissions

Chemical Name: Coal Tar

Chemical Formula: Not available.

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Coal tar	8007-45-2	100

Toxicological Data on Ingredients: Coal tar LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified 1 (Proven for human.) by IARC, 1 (Clear evidence; known carcinogen) by NTP. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to skin. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: CLOSED CUP: 96°C (204.8°F).

Flammable Limits: Not available.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances:
Slightly flammable to flammable in presence of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: On ignition it burns with reddish, luminous, and very sooty flame.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not breathe gas/ fumes/ vapor/spray. Wear suitable protective clothing. If you feel unwell, seek medical attention and show the label when possible. Keep away from incompatibles such as oxidizing agents.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection: Safety glasses. Lab coat.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Viscous liquid.)

Odor: Tar-like; naphthalene-like

Taste: Sharp burning.

Molecular Weight: Not available.

Color: Black

pH (1% soln/water): Not applicable.

Boiling Point: 66°C (150.8°F)

Melting Point: Not available.

Critical Temperature: Not available.

Specific Gravity: 1.2 (Water = 1)

Vapor Pressure: <0.1 kPa (@ 20°C)

Vapor Density: >1 (Air = 1)

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, acetone.

Solubility:
Partially soluble in methanol, diethyl ether, acetone. Insoluble in cold water, hot water. Soluble in benzene, nitrobenzene. Partly dissolves in alcohol, chloroform, carbon disulfide, petroleum ether, sodium hydroxide solution, hexane

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Not considered to be corrosive for metals and glass.

Special Remarks on Reactivity:

It reacts violently with strong oxidizers such as liquid chlorine, sodium or potassium hypochlorite, nitric acid and peroxides.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 1 (Proven for human.) by IARC, 1 (Clear evidence; known carcinogen.) by NTP.
MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. May cause damage to the following organs: skin.

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May affect genetic material (mutagenic). May cause cancer

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: It can cause skin irritation. Existing skin disorders (e.g. eczema) may be aggravated by exposure to this material. Eyes: It can cause eye irritation. Inhalation: Inhalation of mist or vapor can irritate the respiratory tract. Ingestion: Ingestion can cause severe gastrointestinal tract irriation with nausea, vomiting. It may also affect behavior/ central nervous system and cause central nervous system depression. Aspiration can cause lung inflammation and damage.
Chronic Potential Health Effects: Skin: Prolonged or repeated exposure to coal tar may cause irritation and dermatitis (including acne), melanosis, or photosensitization dermatitis. Eyes: Repeated or prolonged exposure may cause eye damage. Inhalation: Prolonged or repeated inhalation may contribute to gallbladder disease, pneumonitis, and pulmonary vessel thrombosis.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: Not available.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: No DOT per N50 Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Coal tar California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Coal tar (listed as coke oven emissions New York release reporting list: Coal tar Rhode Island RTK hazardous substances: Coal tar Pennsylvania RTK: Coal tar Massachusetts RTK: Coal tar California Director's List of Hazardous Substances: Coal tar TSCA 8(b) inventory: Coal tar

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): Classification not yet available

DSCL (EEC):
R45- May cause cancer. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

- **Health Hazard:** 1
- **Fire Hazard:** 1
- **Reactivity:** 0
- **Personal Protection:** a

National Fire Protection Association (U.S.A.):

- **Health:** 1
- **Flammability:** 1
- **Reactivity:** 0
- **Specific hazard:**

Protective Equipment:
Not applicable. Lab coat. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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