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EXPLOSIVES SAFETY SUBMISSION  
MUNITIONS AND EXPLOSIVES OF CONCERN  
REMOVAL ACTION AND CONSTRUCTION  
SUPPORT  
CONGAREE RIVER PROJECT  
COLUMBIA, SOUTH CAROLINA

January 2021

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## Acronyms

ATF&E	Bureau of Alcohol, Tobacco, Firearms and Explosives
BEM	Buried Explosion Module
BGS	below ground surface
BIP	blown in place
CD	Cultural Debris
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CM	Conventional Munitions
CRP	Congaree River Project
CWM	Chemical
DDESB	Department of Defense Explosives Safety Board
DESC	Dominion Energy South Carolina, Inc.
DHEC	Department of Health and Environmental Control
DMM	Discarded Military Munitions
DoD	Department of Defense
EE/CA	Engineering Evaluation/Cost Assessment
EMM	Earth Moving Machinery
EOD	explosive ordnance disposal
ESS	Explosive Safety Submission
EZ	exclusion zone
IAW	In Accordance With
IDW	industrial derived waste
MDAS	Material Documented as Safe
MEC	Munitions and Explosives of Concern
MGFD	munitions with the greatest fragmentation distance
MGP	Manufactured Gas Plant
MPPEH	Material Potentially Presenting an Explosive Hazard
MRS	Munitions Response Site
MSD	Minimum Separation Distance
NEW	Net Explosive Weight
OE	Ordnance and Explosives
PM	Project Manager
QA	Quality Assurance
QC	quality control
QCM	Quality Control Manager
Q-D	Quantity Distance
RCWM	recovered chemical warfare materiel
SARA	Superfund Amendments and Reauthorization Act
SC	South Carolina
SCDHEC	South Carolina Department of Health and Environmental Control

SUXOS	Senior Unexploded Ordnance Supervisor
TLM	tar-like materials
USACE	U.S. Army Corps of Engineers
USAESCH	U.S. Army Engineering and Support Center Huntsville
UXO	Unexploded Ordnance
UXOSO	Unexploded Ordnance Safety Officer
VCC	Voluntary Cleanup Contract

## 1. Background

### 1.1. Site location

The CRP area is located on the Congaree River in Columbia, SC. The site, also referred to as the “project area”, begins directly south of the Gervais Street Bridge, extends approximately 200 feet into the river from the eastern shoreline and approximately 1,500 feet downriver, towards the Blossom Street Bridge. The MEC[also commonly referred to as Unexploded Ordnances (UXOs) intrusive activities will occur on eastern side of Congaree River between Gervais and Blossom Street Bridges, within the cofferdam and removal areas shown on the figures in Appendix A. Underwater intrusive activities will occur within the coffer dam footprints prior to their installation. See Appendix A for footprint of the coffer dam locations.

**Table 1-1**

Area	Total Acreage	Munitions Response Action	Institutional Controls
Water/Land Area	5.8	Surface and Subsurface to Depth of Dam Footprint and Construction Support	Fencing and Signage

### 1.2. Site Description:

#### 1.2.1. Terrain and Vegetation:

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 (USACE, 1977). The river depth varies significantly in the project area due to the variability of the bedrock river bottom elevations.

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. 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 and is much thicker and overgrown further south. The terrain and vegetation are not anticipated to hinder the field activities at the site.

Current 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.

### **1.2.2. Soil Condition:**

The landside Congaree Riverbank soil/sediments are unconsolidated, ranged in particle size from clay to gravels, displayed layering, and were approximately 12 feet to 27 feet thick. Generally, soil/sediment thickness increased in the downriver direction, and is attributed to down cutting of the granite by the Congaree River. The upper most soil/sediments were generally found to range from clays to medium sands. Below this is a gray silt that overlies a sand and gravel layer. The Congaree River and project area can be generalized by shoreline (gray silt) and channel (sands and gravel). It is not anticipated that soils and or tar-like materials (TLM) will impact detection equipment results.

### **1.3. Site History:**

In 1865, during the Civil War, MEC / UXO and other articles of war produced by the Confederacy were dumped into the Congaree River near the Gervais Street Bridge by Union forces under the direction of General Sherman. This activity took place during Sherman's occupation of Columbia.

Archeological investigations, conducted as late as 1980, recovered some MEC or Discarded Military Munitions (DMM) from the area as well as some other potentially historically significant artifacts. Specifically, this work was focused in and adjacent to the unnamed tributary that enters the river just south of the Gervais Street Bridge. Several MEC cannonballs were identified during this operation and properly disposed of by trained explosive ordnance disposal (EOD) personnel located at nearby Fort Jackson.

Due to the potential presence of MEC / UXOs within the project area, an additional reconnaissance and screening of the area in question was conducted as part of the investigative activities. Analysis of the survey data identified concentrations of anomalies with DMM potential in the immediate vicinity of the Senate Street landing and scatters extending into the river. A terrestrial magnetometer investigation of the unnamed tributary below the Gervais Street Bridge was also carried out and that investigation identified eight additional anomalies with a potential association with ordnance.

In June 2010, the occurrence of a TLM within the Congaree River was reported to the South Carolina Department of Health and Environmental Control (SCDHEC). Preliminary sample results conducted on the material by SCDHEC and Dominion Energy South Carolina, Inc. (DESC) indicated that the TLM had similar chemical and physical characteristics as coal tar, a by-product of Manufactured Gas Operations, which were common in cities from the late 1800s until the 1950s. Additional research found that the most likely source of the TLM was a former Manufactured Gas Plant (MGP) located northeast of the river at 1409 Huger Street that operated from about 1906 until the mid-1950s prior to the existence of environmental regulations and permitting. Later this was the location of the city bus terminal until 2008.

DESC had previously entered into a Voluntary Cleanup Contract (VCC) with DHEC in August

2002 to conduct environmental assessment and cleanup activities at the former Huger Street MGP site. DESC has worked proactively and cooperatively with DHEC under its existing VCC to determine the extent of TLM in the Congaree River and to develop a plan for cleanup..

To address the presence of TLM within the river, a Stakeholder-Developed Modified Removal Action was developed and submitted to SCDHEC in December 2018. Two areas within the river, along the eastern shoreline, were proposed for removal of impacted sediment. The TLM-impacted sediment varies in thickness from a few inches to approximately 6 feet thick in some areas. The current total estimate of sediment requiring removal is approximately 11,675 cubic yards. The total project area within the river, including cofferdam footprints and removal areas, is estimated to be 5.8 acres. Sediment removal from within the water area will occur after coffer dams are installed and water has been removed. Intrusive Dive removal operations of metallic anomalies will be conducted prior to installation of the coffer dams.

The removal of MEC /UXO from the project area and assisting in the segregation and disposal of impacted sediment removed by DESC covered under this work plan is intended to protect worker safety and environment.

#### **1.4. Current and Future Land Use:**

Current land use for the project area is public (the Congaree River), with private property adjacent along the eastern shoreline. The future land use is expected to be the same (Congaree River waterway).

#### **1.5. Project Area:**

The site, also referred to as the “project area”, begins directly south of the Gervais Street Bridge, extends approximately 200 feet into the river from the eastern shoreline and approximately 1,500 feet downriver, towards the Blossom Street Bridge. The MEC intrusive activities will occur on eastern side of Congaree River between Gervais and Blossom Street Bridges, within the cofferdam and removal areas shown on the figures in Appendix A. Underwater intrusive activities will also occur within the coffer dam footprint prior to their installation. See Appendix A for footprint of the coffer dam location.

##### **1.5.1. General:**

This ESS covers the munitions response actions in support of cofferdam installations and removal of impacted sediment within the Congaree River. The area to be swept for Material Potentially Presenting an Explosive Hazard (MPPEH) consists of approximately 5.8 acres within the Congaree River. A shallow dive operation (covered in a separately submitted Dive Operation Plan) will be performed to remove any potential MEC within the coffer dam footprints prior to construction needed to dewater the sediment areas containing TLM.

MEC items determined acceptable to move will be hand carried out of the water. Any MEC deemed safe to move may be dragged out of the stream by essential personnel using rope or cable that is suitable for moving the MEC items remotely. Non-essential personnel must be separated from the operation 3060 ft, or by the K24 of 29 ft and must be protected by shields or barricades designed to defeat hazardous fragments until the MEC item has been dragged to the location where it will be blown in place.



Once the coffer dams have been constructed and water removed from within a sweep for MPPEH will be performed prior to excavation of TLM material.

This area will be cleared of all surface MPPEH regardless of size (excluding small arms ammunition .50 caliber and below not visually detectable) and subsurface ferrous metal items (including MPPEH) 10 in “cannonball” or greater, to a depth of 11 times the item diameter up to one meter below ground surface (BGS). It is not anticipated that Conventional Munitions (CM) will be encountered during operations. The Senior Unexploded Ordnance Supervisor (SUXOS) and Unexploded Ordnance Safety Officer (UXOSO) will ensure all personnel are fully trained of the associated hazards and fully aware of the procedures to be followed when MEC operations commence.

### **1.5.2. History and Characterization Data Analysis:**

Site History and previous characterization data is presented above in Site History section 1.2.

### **1.5.3. Selected Munitions Response Actions:**

In order to support the removal of TLM from the project area a “mag and dig” type removal action has been selected to remove the MEC prior to cofferdam installation and sediment/soil excavation. There will be no underwater removal of sediments prior to dewatering. A shallow wading/dive operation to sweep the area of the coffer dam footprint will be performed prior to coffer dam installation and is covered under a separate dive operations plan. Stand-by construction support will also be performed during sediment/soil excavation.

#### **1.5.3.1. Land Use Controls**

No permanent land use controls are being proposed. Currently there are signs announcing that no swimming is allowed in the area of the TLM. Prior to field activities the operations area will be fenced, and signs posted to keep public out for safety and protection of civil war era antiquities. Temporary fencing to prevent unauthorized access to the site will be put up and maintained during the entire removal action project.

**1.6. Reason for Munitions and Explosives of Concern (MEC):**

In 1865, during the Civil War, MEC and other articles of war produced by the Confederacy were dumped into the Congaree River near the Gervais Street Bridge by Union forces under the direction of General Sherman.

**1.7. Type of MEC:**

Based on historical information primarily from an Inventory of Stores Captured in Columbia, SC document dated February 17, 1865, MEC / UXO items of interest that could potentially be encountered are identified below. The historical list contained a more general nomenclature than that used in the DoD Fragmentation database of today. The list below is taken directly in name from the 1865 document.

- Case shot, fixed, 12 pounder gun
- Fuse-shell, fixed, 12 pounder gun
- Grape, 12 pounder gun
- Canister, fixed, 12 pounder gun
- Shot, fixed, 6 pounder gun
- Case, fixed, 6 pounder gun
- Fuse-shell, fixed, 6 pounder gun
- Canister, fixed, 6 pounder gun
- Shot, fixed, 24 pounder gun
- Shell, fixed, 24 pounder gun
- Canister, fixed, 24 pounder gun
- Shell, fixed, 8 inch
- Shot and shell, not fixed, 8 inch
- Shot and shell, not fixed, 8 inch
- Shot and shell, not fixed, 10 inch

According to historical information for Columbia, SC inventory, a variety of other munitions were identified as having been used or stored at the site. No information found to date associates any other munitions with the project site. Therefore, the 10 in “cannonball” shell has been selected as the munitions with the greatest fragmentation distance (MGFD) for the project.

Table 2-1 Type and Depth of MEC Recovered

MRS Name or Other Identifier	MEC Recovered	MAX Depth of MEC recovered during site investigation	MAX Geophysical Detection Depth BGS
Congaree River Project	Cannonball (reported historically)	No intrusive activities were conducted during the site investigation. Only a geophysical survey was performed to detect anomalies.	10-inch cannonball can be detected at approximately 11X diameter below ground surface this results in 110 inches BGS.

## 2. Maps

Figure A-1 in appendix A shows a map of the site in relation to the surrounding area. Figure A-3 shows proposed magazine location in regard to MEC clearance within the river. Figure A-2 is a map that shows the area with the Quantity Distance (Q-D) arcs that will be used during the MEC removal action in the area.

## 3. Explosive Safety Quantity -Distance

### 3.1. Munitions with Greatest Fragmentation Distance (MGFD):

The 10 inch cannonball was chosen as the Munitions with the Greatest Fragmentation Distance (MGFD) for the project area is based on the historical documentation and manifests dating to the relocation of the ordnance items from the a nearby ammunition storage area to the river by soldiers. Additionally, previous Archeological investigations recovered MEC from the river area that correlated with the above MGFD munitions type. This MGFD is the same for both intrusive dive and land operations.

See Appendix B for Fragmentation Data Sheets.

See Table 3-1 for Minimum Separation Distances. Quantity-Distance (Q-D) arcs are shown in Appendix A on Figure A-3.

Table 3-1								
Minimum Separation Distances (MSD)								
Area	MEC	MSD (ft) <sup>1</sup>						
		For Unintentional Detonations			For Intentional Detonations			
		Team Separation Distance (K40)	Hazardous Fragment Distance (HFD)		Without Engineering Controls	Using Sandbag Mitigation <sup>2</sup>	Using Double sandbag Mitigation <sup>2</sup>	Using Water Mitigation <sup>2</sup>
Project area	10" Cannonball	48	237		3060	220	Not Permitted	275
Notes:								
<sup>1</sup> See Appendix B for calculation sheets documenting MSDs. Note the NEW for the MGFD based on the HFD is the maximum NEW that may be collected at a collection point								
<sup>2</sup> See Appendix B for required sandbag thickness (HNC-ED-CS-S-98-7) and water containment system (HNC-ED-CS-S-00-3).								
<sup>3</sup> MSD for sandbag mitigation per DDESB memo "Revision of DDESB Approval for Use of Sandbags for Mitigation of Fragmentation and Blast Effects Resulting from the Intentional Detonation of Munitions" dated 22 May 2014.								

### 3.2. MEC Area(s):

The MSD restrictions from MEC areas to non-essential personnel will be applied during all MEC operations. The MSD for the project is presented in Table 3-1. Preliminary site work such as surveying, laying grid lanes and anomaly avoidance do not require the establishment of an MSD for Q-D purposes. Essential personnel are defined as those on-site contractor and personnel required to participate in the MEC removal, along with those approved and authorized visitors.

All other personnel are non-essential personnel. The outer boundaries of the MSD arcs are depicted on the Q-D map in Figure A-3. The team separation distance at this site will be the K40 overpressure distance shown in Table 3-1. Positive control of the exclusion zone (EZ) based on the MSD will be maintained at all times that MEC operations are being conducted. Prior to beginning MEC operations, the contractor will ensure that there are no non-essential personnel within the EZ and the contractor will ensure that the EZ remains clear of non-essential personnel throughout the MEC operations.

Only UXO-qualified personnel (see DDESB Technical Paper 18 for definitions) will perform MEC Construction Support and Removal Activities. Activities will be accomplished in accordance with the procedures detailed in USACE Engineering Manual (EM) 385-1-97 (including Change 1 and Errata sheets 1 through 6), “Explosives Safety and Health Requirements Manual”. The UXO personnel will clear all excavation locations to ensure there is no intentional physical contact with MEC during removal/excavation operations.

Any occupied buildings or public roadways in the MSD areas during MEC operations will be evacuated and/or roadways blocked to prevent non-essential personnel from entering during the conduct of MEC operations. In addition, spotters may be used to stop work when non-essential personnel enter the MSD on a roadway during the conduct of MEC operations.

### **3.3. Demolition Explosives:**

#### **3.3.1. Delivery on As-Needed Basis:**

Donor explosives will be stored in an on-site type 2 ATF&E explosives magazine. This action is to mitigate the need for an afterhours guard. Should a magazine not be used, explosives will be provided by a local vendor on an as-needed basis. MEC will be marked and guarded until disposal is accomplished”.

#### **3.3.2. Explosive Storage Magazines:**

Due to the fact that on-going explosives needs might be present on the project, an on-site magazine to store commercial explosives will be utilized on this project. Commercial explosives will be stored in the un-barricaded type II ATF&E explosives magazine with an attached lockable cap box. The explosives will be used only for disposal of any MEC items recovered during operations and will be stored IAW DoD 6055.09-M, DA Pam 385-64 and any other local regulations. TITAN will maintain constant control the sited explosive storage magazine. Positioning of the magazine will be IAW DDESB 6055.09-M, EP 1110-1-18 and Section 55.206 of ATRP 5400.7. The closest occupied structure relative to the explosives magazine is 700 ft and nearest public road is 850 ft. The Magazine will be secured by the erection of a temporary fence that will be 8 to 10 ft in height and has one locked entry point. The maximum Net Explosive Weight (NEW) that will be stored will be less than 31 lbs. IAW DoD 6055.09-M Section V3.E3.1.2.1.1.5.1 it has been determined that the Public Transportation Route Distance (PTRD) for the proposed magazine location has no public road access. The traffic for the area of the magazine is less than 400 car/rail passengers per day, and less than 80 ship passengers per

day. Therefore, no Minimum Fragment Distance (MFD) is required for public traffic route (PTR) distance (DA PAM 385-64 Section 5-5, and DoD 6055.09-M Section C9.4.1.2.1.1.5.3). Inhabited Building Distance exclusion for the magazine is 200 ft, this is based on a NEW of less than 31 lbs IAW DoD 6055.09-M table V3. E3.T2.

These commercial explosives will have assigned DOD hazard division/storage compatibility groups (HD/SCG) and will be stored in accordance with DOD 6055.09-M, DA Pam 385-64 and any local regulations.

### **3.4. Planned or Established Demolition Areas:**

Demolition area planned for this project is to be located within the fenced open area to be located far enough away from road and inhabited buildings as not to include them within 220 ft of the demolition area.

### **3.5. Footprint Areas:**

#### **3.5.1. Blow-in-place:**

If a MPPEH is unacceptable-to-move it will be blown in place (BIP) on both land or water removal operations. BIP procedures will be conducted within each grid. All disposal activities will be performed by Technical Paper (TP)-18, "Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel" revision 1, 24 June 2020 qualified UXO personnel within the MRS. Please see table 3-1 for minimum separation distances for BIP procedures.

If it is determined that an item is acceptable to move, then the MPPEH will be consolidated on land and a consolidated demolition shot will be performed IAW TP-18 as stated above.

#### **3.5.2. Collection Points:**

Collection points are those areas used to temporarily accumulate MEC pending destruction at the end of the day using consolidated shots. MEC items at collection points must be laid out as shown in "Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites". The maximum net explosive weight (NEW) at a collection point will be limited such that the K40 overpressure distance for the total NEW does not exceed the HFD for the area (see Table 3-1, footnote 1). The SUXOS and UXOSO are the authoritative individuals for this project to determine if items are acceptable to move.

#### **3.5.3. In-Grid Consolidated Shots:**

If determined acceptable to move by the SUXOS and UXOSO, consolidating multiple MEC within the MRS is anticipated for this project. US Army Engineering and Support Center, publication "Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites", dated March 2000 will be used and a copy of this report will be available on site. The maximum net explosive weight (NEW) for a consolidated shot will be limited such that the K328 overpressure distance for the total NEW (including donor charges) does not exceed the MFD-H for the intentional detonation."

### **3.6. Maximum Credible Event (MCE):**

This section is not applicable to this project; no explosive soil, CWM, or explosives contaminated facilities are expected.

### **4. Start Date:**

The start date for field activities will be coordinated with SCDHEC and DESC.

### **5. MEC Migration:**

MEC migration potential within the Congaree River is not expected to be significant. To facilitate removal operations, given the seasonal time constraints for work within the river, MEC clearance of the cofferdam footprints may be completed in advance of contractor mobilization for the construction and removal activities.

### **6. Detection Equipment and Response Techniques:**

#### **6.1. Removal Depth:**

The removal depths for MRS 1 and 2 Land / Water subsurface clearance of MEC, MPPEH, and any ferrous metal items as shown in table 1-1. The removal depth is two feet. However, anomaly signals will be followed until they are resolved.

#### **6.2. Detection Equipment:**

The possible detectors for this project include but are not limited to Schondstedt 52-CX and an all metals detector (White's). All of these instruments have similar detection characteristics and can be expected to consistently detect the MEC items shown in Table 2-1 at their expected depths.

##### **6.2.1. Analog Mag and Flag using Flux-Gate Magnetic Gradiometers:**

The Flux-Gate Magnetic Gradiometers that will be utilized will be the Schondstedt 52-CX and an all metals detector (White Spectrum XLT).

##### **6.2.2. Analog Mag and Flag using Electromagnetic Induction:**

Approved detectors for this project include the AN-PSS 12, White XLT, Fisher, Garrett, and MineLabs Explorer. All of these instruments have similar detection characteristics. However, unlike the other classes of instruments, they may only be used for targets less than 24 inches deep. The CEHNC MM-CX or SCDHEC may approve other similar geophysical instruments.

#### **6.3. Sweep Procedures:**

Each UXO Technician will demonstrate proficiency with the handheld geophysical device before site activities begin. The site will be divided into grids and search lanes will be used to sweep for MEC. See work plan for more information on sweep procedures.

#### **6.4. Exclusion Zone Control:**

Positive control of the exclusion zone (EZ) based on the MSD will be maintained at all times that MEC operations are being conducted. Prior to beginning MEC operations, TITAN will ensure that there are no nonessential personnel within the EZ and the contractor will ensure that, the EZ remains clear of non-essential personnel throughout the MEC operations. This will include barricading access roads as necessary and displaying appropriate signage indicating explosive operations at barricade points and personnel to facilitate the halting of traffic and pedestrians.

#### **6.5. Intrusive Investigation:**

Non-Mechanized MEC removal and identification of anomalies will be performed using the criteria and procedures outlined below. Only TP 18 qualified personnel will perform excavation and investigation of anomalies. To gain access to a subsurface anomaly, excavation will be initiated to the side of the anomaly and will not be conducted directly over the anomaly until such time as the depth of the anomaly can be ascertained. Earth Moving Machinery (EMM) excavation of the soil overburden may be performed for anomalies for the purpose of removing overburden. However, the EMM will not be used within 12 inches directly over the anomaly. Additional excavation will be conducted with care using small hand tools only. A detailed accounting of all MEC located at each site will be made and maintained by the Senior UXO Supervisor (SUXOS). A log entry will be made for each MEC item indicating the item's identity, its explosive hazards, location (x, y, and z measurements) and final disposition. All munitions debris excavated during this investigation will be removed from the site

#### **6.6. Quality Control and Quality Assurance:**

Upon conclusion of the removal activities in each grid within each area, the UXO Quality Control Specialist (UXOQCS) will conduct a surface and subsurface quality control (QC) inspection. Lots that pass the QC inspection will be submitted to the USAESCH for Quality Assurance (QA) inspection per the Quality Assurance Surveillance Plan. Any non-conformance to contractual requirements will be documented and reported in writing to the Senior Unexploded Ordnance Supervisor (SUXOS), Quality Control Manager (QCM), and Project Manager (PM). The SUXOS will be responsible for the field remediation of the non-conformance.

#### **6.7. Equipment Tests:**

See section 6.3 Sweep Procedures for information regarding equipment tests.

### **7. Disposition Techniques:**

#### **7.1. Demolition Operations:**

If disposal activities are required, they will be performed by personnel qualified in accordance with TP 18 within the MRS. The MSDs for intentional detonations are shown in Table 3-1 and Q-D Arcs are shown on Figure A-3.

### **7.1.1. Methods of Disposal:**

- A. If disposal activities are required, they will be performed by qualified UXO personnel within the MRS. The MSDs for intentional detonations are shown in Table 3-1 and Q-D Arcs are shown on Figure A-2.
- B. MEC will be marked and guarded, if necessary, until disposal is accomplished.
- C. All explosive operations will follow the procedures outlined in TM 60A-1-1-31 and EM 385-1-97, Explosives Safety and Health Requirements Manual, demolition operations will be performed daily, or items properly guarded until operations can be conducted.

The magazine location chosen for this effort is located within a fenced open area. It has controlled access. All gates are to be locked at all times when not under supervision. The nearest improved public road is approximately 850 feet away. The nearest inhabited building is 700 feet away.

### **7.2. Explosive Storage, Accountability, and Transportation:**

TITAN does not anticipate generating any hazardous waste that will require off-site transportation, treatment, storage, or disposal. MEC and/or MPPEH will be destroyed on-site and resulting scrap will be certified as Material Documented as Safe (MDAS) and turned over to a recycler for smelting before it is released to the public. Non-hazardous, CD and municipal waste generated during this project will be transported to a municipal landfill for disposal.

### **7.3. Engineering Controls:**

Sandbags (HNC-ED-CS-S-98-7, HNC Safety Advisory dated 7 November 2011, the DDESB Memorandum “Clarifications Regarding Use of Sandbags for Mitigation of Fragmentation and Blast Effects due to Intentional Detonation of Munitions”, Nov. 29 2010, and DDESB Memorandum “Revision of DDESB Approval for Use of Sandbag Mitigation of Fragmentation and Blast Effects Resulting from the Intentional Detonation of Munitions”, May 22 2014) or Water Mitigation (HNC-ED-CS-S-00-3) may be used to reduce the intentional detonation MSD. Tamping (single or multiple items) may be used in accordance with DDESB Technical Paper 16 and the Buried Explosion Module (version 6.3.2.). These reports will be on site for all mitigation methods used.

### **7.4. Scrap Procedures:**

#### **7.4.1. Inspection and Certification:**

MPPEH procedures will be IAW DoDI 4140.62 and EM 200-1-15. All Material Potentially Presenting an Explosive Hazard (MPPEH) will be assessed and its explosives safety status determined and documented prior to transfer to a third party for disposal recycling or preservation. Prior to release to the public, MPPEH will be documented by authorized and technically qualified personnel as Material Documented as Safe (MDAS) after a 100% inspection and an independent 100% re-inspection to determine that it is safe from an explosives safety perspective. A DD Form 1348-1A will be completed for all munitions debris and range- related debris to be transferred for final disposition and certified by the USXQCS & SUXOS.



#### **7.4.2. DD Form 1348-1A:**

Upon completion of all removal activities, TITAN will complete a DD Form 1348-1A IAW EM 200-1-15 that will include the following statement regarding to processed MDAS & IDW materials:

"This certifies and verifies that the materials listed have been 100 percent inspected and to the best of our knowledge and belief, are inert / or free of explosive or related material."

#### **7.5. Alternative Disposal Techniques:**

TITAN does not anticipate transporting any MEC / UXO items off-site for disposal. If items are required to be demilitarized offsite, TITAN will report this to the DESC on-site representative and implement TITAN's explosive safety measures to secure. TITAN in conjunction with DESC will contact Richland County bomb squad at (803) 576-3000 for assistance. If Richland County Sheriff's Department cannot respond TITAN in combination with DESC will request Richland County Sheriff's Department to contact the South Carolina State Law Enforcement Division (SLED) for assistance with the item. If SLED cannot support TITAN and DESC will call for SLED to contact U.S. Military EOD to assist with demilitarization of the item.

### **8. Environmental, Ecological or Cultural Consideration:**

Cofferdam construction activities will be conducted around the short nosed sturgeon spawn season. DESC will determine when the area is safe to work in prior to giving notice to proceed of TITAN site work. In the event that any environmental, ecological, or cultural considerations arise during project performance, project activities or affected portions of project activities will immediately cease and the Project SUXOS, PM, DESC and Government Representatives will be immediately notified. Project activities will not commence in project affected areas until the contractor is notified to proceed in a manner determined appropriate.

### **9. Technical Support:**

#### **9.1. Military Support:**

No chemical warfare materiel (CWM) is suspected at this site. However, if suspected CWM is encountered at the project site, all work will immediately cease. All project personnel will withdraw along identified, cleared paths upwind from the discovery. The senior UXO person on site will designate a two-person team to secure the area and prevent unauthorized access. This team will position themselves as far upwind as possible while still maintaining visual contact and control of the area. The senior UXO person on site following evacuation will immediately notify the PM who will immediately coordinate with DESC and Government Project Representatives to contact and facilitate military control and Explosive Ordnance Disposal (EOD) response. The contractor will maintain control of the site until control is relinquished to the military.

Additionally, local law enforcement will be contacted of the discovery. If the item is RCWM or has an unknown liquid filler, the on-site DESC representative will notify the Chemical Warfare Design Center (CWM-DC) at the CEHNC by calling the 24/7 telephone number at 256-895-1180.

#### **9.2. Contractor:**

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All on-site UXO Personnel will meet the required training and minimum experience required by DDESB TP 18.

## **10. Residual Risk Management:**

### **10.1. LUC:**

No permanent land use controls are being proposed. Temporary fencing to prevent unauthorized access to the site will be put up and maintained during the entire removal action project.

### **10.2. Long-Term Management:**

Any long-term management is the responsibility of DESC or other stakeholders related to the project.

## **11. UXO Safety Education Program:**

TITAN has not been contracted to perform any UXO Safety education program outside daily safety briefings that is utilized to make other site personnel aware of hazards presented by Unexploded Ordnance and the proper procedures in notifying TITAN if evidence of UXO is discovered. Others will conduct all other education program material and training/education to public.

## **12. Stakeholder Involvement:**

This project was coordinated with, SCDHEC, DESC, and other project stakeholders. All agencies will remain active in the final planning and response stages of the project as required, to include Work Plan review and final approval, progress review and schedule adjustments as required to accommodate construction schedules, EZ establishment and control support as necessary, unplanned environmental, emergency as necessary, and final report review, comment, and acceptance.


## **13. Contingencies:**

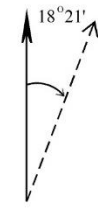
Contingency plan for dealing with MEC / UXO items that are requiring to be demilitarized offsite, TITAN will report this to the DESC on-site representative and implement TITAN's explosive safety measures to secure. TITAN in conjunction with DESC will contact Richland County bomb squad at (803) 576-3000 for assistance. If Richland County Sheriff's Department cannot respond TITAN in combination with DESC will request Richland County Sheriff's Department to contact the South Carolina State Law Enforcement Division (SLED) for assistance with the item. If SLED cannot support TITAN and DESC will call for SLED to contact U.S. Military EOD to assist with demilitarization of the item.

Appendix A  
Maps

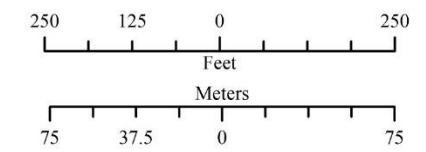


**Legend**

 Extent of Proposed TLM Removal



NAD 1983 StatePlane South Carolina (Feet)  
Data Provided By:  
Apex Companies, LLC




Location Map:  
Fort Benning, GA

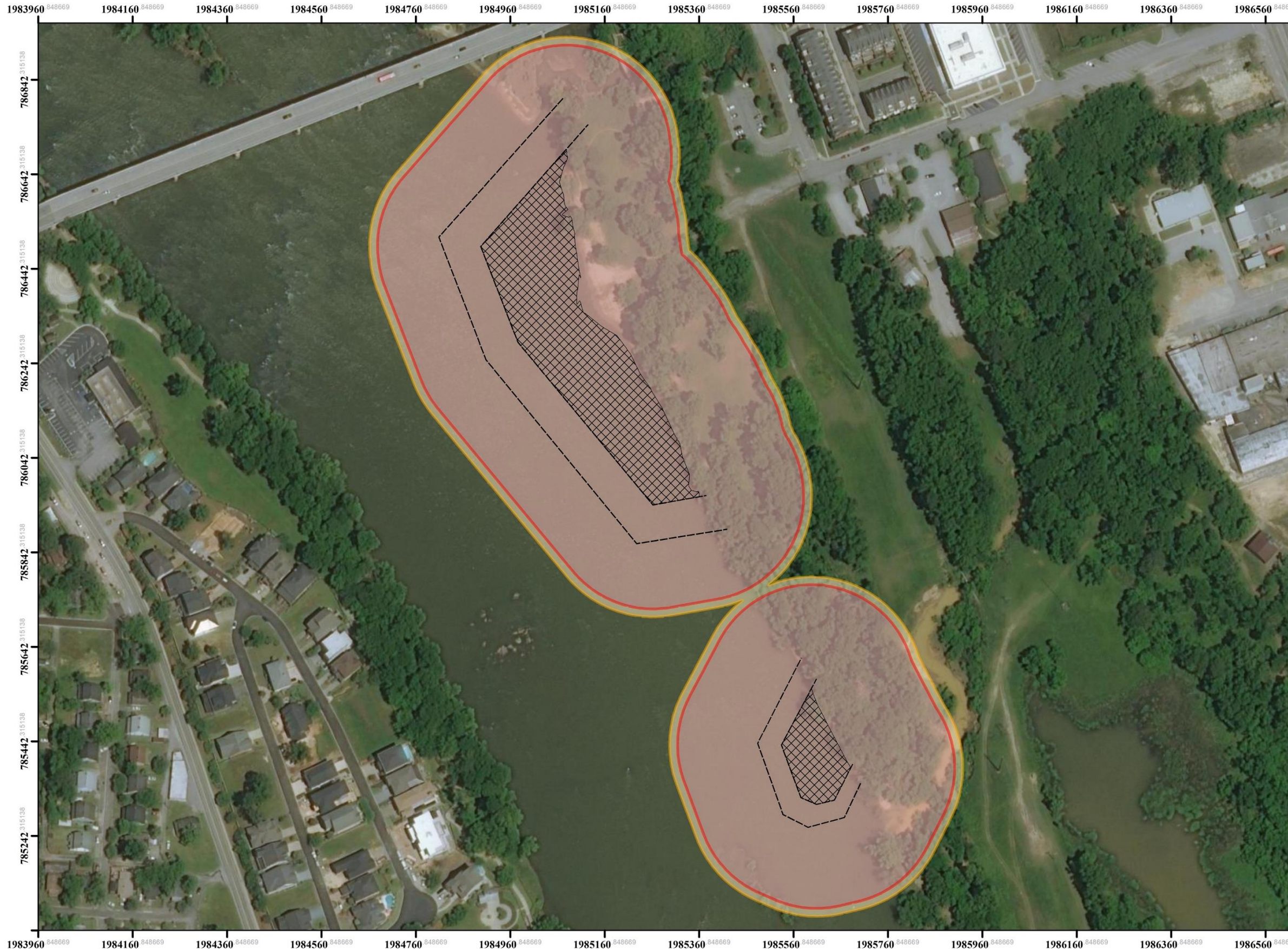


**FIGURE A-1  
SITE LOCAITON  
CONGAREE RIVER PROJECT  
COLUMBIA, SOUTH CAROLINA**

Prepared For:  
Apex Companies, LLC

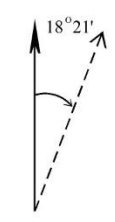
Prepared By:  
TITAN Associates Group inc. 

DRAWN	VERIFIED	APPROVED
M. Norris	T. Leonard	
DATE	FILE	
01/8/2021	A-1 Site Location.mxd	
PAGE #	SCALE	
A-1	1 inch = 250 feet	

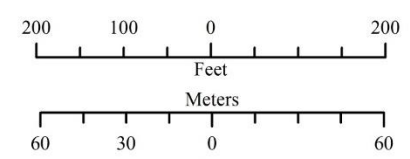


**Legend**

- Proposed Cofferdam Location
- ▣ Extent of Proposed TLM Removal
- Utilization of Engineering controls will provide the following:
- ▣ Sand Bag Mitigation  
Minimum Safe Distance of 220 ft
- ▣ Hazardous Fragmentation  
Distance 237 ft



NAD 1983 StatePlane South Carolina (Feet)  
Data Provided By:  
Apex Companies, LLC



Location Map:  
Fort Benning, GA



**FIGURE A-2  
INTENTIONAL  
DETONATION DISTANCES  
CONGAREE RIVER PROJECT  
COLUMBIA, SOUTH CAROLINA**

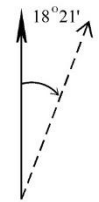
Prepared For:  
Apex Companies, LLC

Prepared By:  
TITAN Associates Group inc.

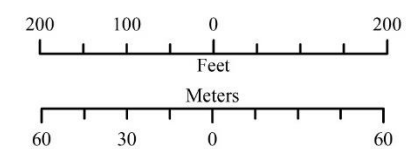
DRAWN M. Norris	VERIFIED T. Leonard	APPROVED
DATE 01/8/2021	FILE A-2 Arcs new.mxd	
PAGE # A-2	SCALE 1 inch = 200 feet	



- Legend**
- Magazine
  - Proposed Cofferdam Location
  - ▨ Extent of Proposed TLM Removal
  - PTRD-Low 75 ft  
(31 Lbs Net Explosive Weight)
  - PTRD-Medium 120 ft  
(31 Lbs Net Explosive Weight)
  - IBD/PTRD-High 200 ft  
(31 Lbs Net Explosive Weight)



NAD 1983 StatePlane South Carolina (Feet)  
Data Provided By:  
Apex Companies, LLC



Location Map:  
Fort Benning, GA



**FIGURE A-3  
MEC STORAGE MAGAZINE  
PROPOSED LOCATION  
CONGAREE RIVER PROJECT  
COLUMBIA, SOUTH CAROLINA**

Prepared For:  
Apex Companies, LLC

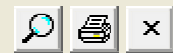
Prepared By:  
TITAN Associates Group inc.

DRAWN M. Norris	VERIFIED T. Leonard	APPROVED
DATE 01/08/2021	FILE A-3 Magazine.mxd	
PAGE # A-3	SCALE 1 inch = 200 feet	

Appendix B  
MSD Calculation Sheets

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# Fragmentation Data Review Form



Database Revision Date 8/21/2014

Category:

Munition:

Case Material:

Fragmentation Method:

Secondary Database Category:

Munition Case Classification:

DODIC:

Date Record Created:

Record Created By:

Last Date Record Updated:

Individual Last Updated Record:

Date Record Retired:

## Munition Information and Fragmentation Characteristics

Explosive Type:

Explosive Weight (lb):

Diameter (in):

Cylindrical Case Weight (lb):

Maximum Fragment Weight (Intentional) (lb):

Design Fragment Weight (95% (Unintentional) (lb):

Critical Fragment Velocity (fps):

## Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):

MFD-H [Maximum Fragment Distance, Horizontal] (ft):

MFD-V [Maximum Fragment Distance, Vertical] (ft):

## Overpressure Distances

TNT Equivalent (Pressure):

TNT Equivalent Weight - Pressure (lbs):

Unbarricaded Intraline Distance (3.5 psi), K18 Distance:

Public Traffic Route Distance (2.3 psi); K24 Distance:

Inhabited Building Distance (1.2 psi), K40 Distance:

Intentional MSD (0.0655 psi), K328 Distance:

Note: Per V5.E3.2.2.1 of DoD 6055.09-M the minimum sited K328 distance may be no smaller than 200 ft.

## Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):

TNT Equivalent Weight - Impulse (lbs):

Kinetic Energy  $10^6$  (lb-ft<sup>2</sup>/s<sup>2</sup>):

### Single Sandbag Mitigation

Required Wall & Roof Thickness (in):

Expected Max. Throw Distance (ft):

Minimum Separation Distance (ft):

### Double Sandbag Mitigation

Required Wall & Roof Thickness (in):

Expected Max. Throw Distance (ft):

Minimum Separation Distance (ft):

### Water Mitigation

Minimum Separation Distance (ft):

Water Containment System:

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

## Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	12.80	7.40
Mild Steel:	2.21	1.23
Hard Steel:	1.81	1.01
Aluminum:	4.07	2.36
LEXAN:	11.35	7.93
Plexi-glass:	9.75	6.06
Bullet Resist Glass:	9.20	5.43

## Item Notes

The TNT equivalency for black powder rounds has been updated from 0.4 to 0.43 to agree with Rev 4 of TP 16. This has resulted in minor changes in values.