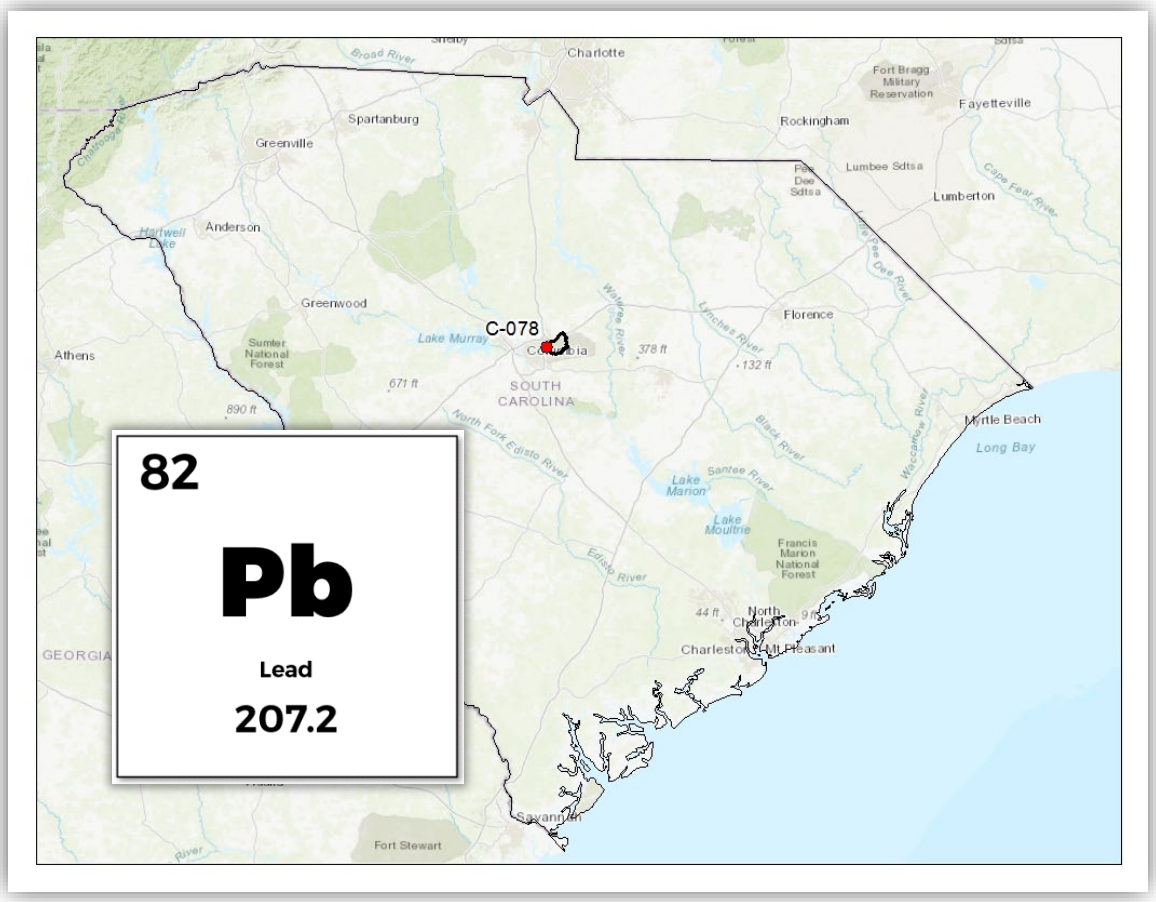
Total Maximum Daily Load Document

Gills Creek

Water Quality Monitoring Site C-078

Hydrologic Unit Code 030501100202

Total Lead



March 2024

Bureau of Water

SCDHEC Technical Document Number:

002-2024

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Abstract

Section 303(d) of the Clean Water Act (CWA) and EPA's *Water Quality Planning and Management* Regulations (40 CFR Part 130) require states to develop total maximum daily loads (TMDLs) for water bodies that are included on the §303(d) list of impaired waters. A TMDL is the maximum amount of pollutant a waterbody can assimilate while meeting water quality standards for the pollutant of concern. All TMDLs include a waste load allocation (WLA) for any National Pollutant Discharge Elimination System (NPDES)-permitted discharges, a load allocation (LA) for all nonpoint sources, and an explicit and/or implicit margin of safety (MOS). This report describes the development of a total lead TMDL for a lead-impaired water quality monitoring (WQM) site on Gills Creek: C-078. The watershed draining to C-078 is located in a developed area of Richland County and include parts of the City of Columbia and Fort Jackson Military Reservation.

Instream total lead concentrations were compared to sample specific calculated criteria to determine a percent reduction goal. A flow duration curve combined with instream lead concentrations was used to aid in the identification of sources. To achieve the target load of total lead for the TMDL watershed, a reduction of 62.9% at C-078 will be necessary.

For SCDOT and other NPDES MS4 permittees, compliance with terms and conditions of their NPDES permit is effective implementation of the WLA to the Maximum Extent Practicable (MEP) and demonstrates consistency with the assumptions and requirements of the TMDL. For existing and future NPDES construction and industrial stormwater permittees, compliance with terms and conditions of their permit is effective implementation of the WLA. In addition, for Fort Jackson, compliance with the terms of their Resource Conservation and Recovery Act (RCRA) permit will effectively implement this TMDL. Required load reductions in the LA portion of this TMDL can be implemented through voluntary measures and are eligible for CWA §319 grants.

The South Carolina Department of Health and Environmental Control (SCDHEC) recognizes that adaptive management and implementation of this TMDL might be needed to achieve the water quality standard and we are committed to targeting the load reductions to improve water quality in the Gills Creek Watershed. As additional data and/or information become available, the TMDL target and percent reduction goal will be modified accordingly.

Table Ab1. Total Maximum Daily Load for Total Lead for Gills Creek.

WQM Site	TMDL	MOS	WLA			LA	
			Continuous Point Source[1]	Intermittent Point Source % reduction goal[2, 3]	SCDOT % reduction goal[2, 3, 4]	Load	% reduction goal[2]
C-078	2.1 ug/L x Q x (5.39377×10^{-3})*	2.1 ug/L x Q x (5.39377×10^{-4})*	See Note 1	62.9%*	62.9%*	2.1 ug/L x Q x (4.85439×10^{-3})*	62.9%*
	0.24 LBS/DAY**	0.024 LBS/DAY**				0.22 LBS/DAY**	

*TMDL, MOS and LA loads are represented here as an equation which includes the total recoverable adjusted chronic lead criterion (CCCtra) of 2.1 ug/L, flow in cfs (Q), and a conversion factor. The CCCtra was derived using default hardness (25 mg/L) and default TSS (1 mg/L) (see Section 1.3). Percent reduction goals were determined by comparing instream total lead to sample specific criteria calculated using measured instream TSS and hardness (see Section 1.3 and 2.0). Permit writers may use measured instream TSS and hardness when developing permit limits when data are available. The unit conversion factor is expressed as (lb-sec-L)/(ug-day-ft^3).

**Calculated using default hardness (25 mg/L) and TSS (1 mg/L) and average daily flow at C-078 (1/1/2000 through 12/31/2022) = 21.9 cfs

1. There are no permitted continuous point source discharges of lead at this time. Future continuous discharges are required to meet the prescribed loading for the pollutant of concern. Future loadings will be developed based upon permitted flow and an allowable permitted maximum lead concentration.
2. Percent reduction goal is based on the maximum exceedance of the chronic lead water quality standard.
3. Percent reduction applies to all NPDES-permitted stormwater discharges, including current and future MS4, construction and industrial discharges covered under permits numbered SCS & SCR. Stormwater discharges are expressed as a percentage reduction due to the uncertain nature of stormwater discharge volumes and recurrence intervals. Stormwater discharges are required to meet percentage reduction or the existing instream standard for pollutant of concern in accordance with their NPDES Permit.
4. By implementing the best management practices that are prescribed in either the SCDOT annual SWMP or the SCDOT MS4 permit to address the pollutant of concern, SCDOT will comply with this TMDL and its applicable WLAs to the maximum extent practicable (MEP) as required by its MS4 permit.

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1.0 Introduction

1.1 Background

The federal *Clean Water Act (CWA)* directs each state to review the quality of its waters every two years to determine if water quality standards are being met. If it is determined that standards are not being met, the states are to list the impaired water body under §303(d) of the *CWA*. The listed sites are then given a priority ranking for restoration and the impairments are addressed by a Total Maximum Daily Load (40 CFR 130.31(a)) according to their rank.

A Total Maximum Daily Load document (TMDL) is a written plan and analysis to determine the maximum pollutant load a waterbody can receive and still meet applicable water quality standards. The TMDL process includes estimating pollutant loadings from all sources, linking these sources to their impacts on water quality, and allocation of pollutant loads to each source. All TMDLs include a waste load allocation (WLA) for all National Pollutant Discharge Elimination System (NPDES) permitted discharges, a load allocation (LA) for all unregulated nonpoint sources, and an explicit and/or implicit margin of safety (MOS).

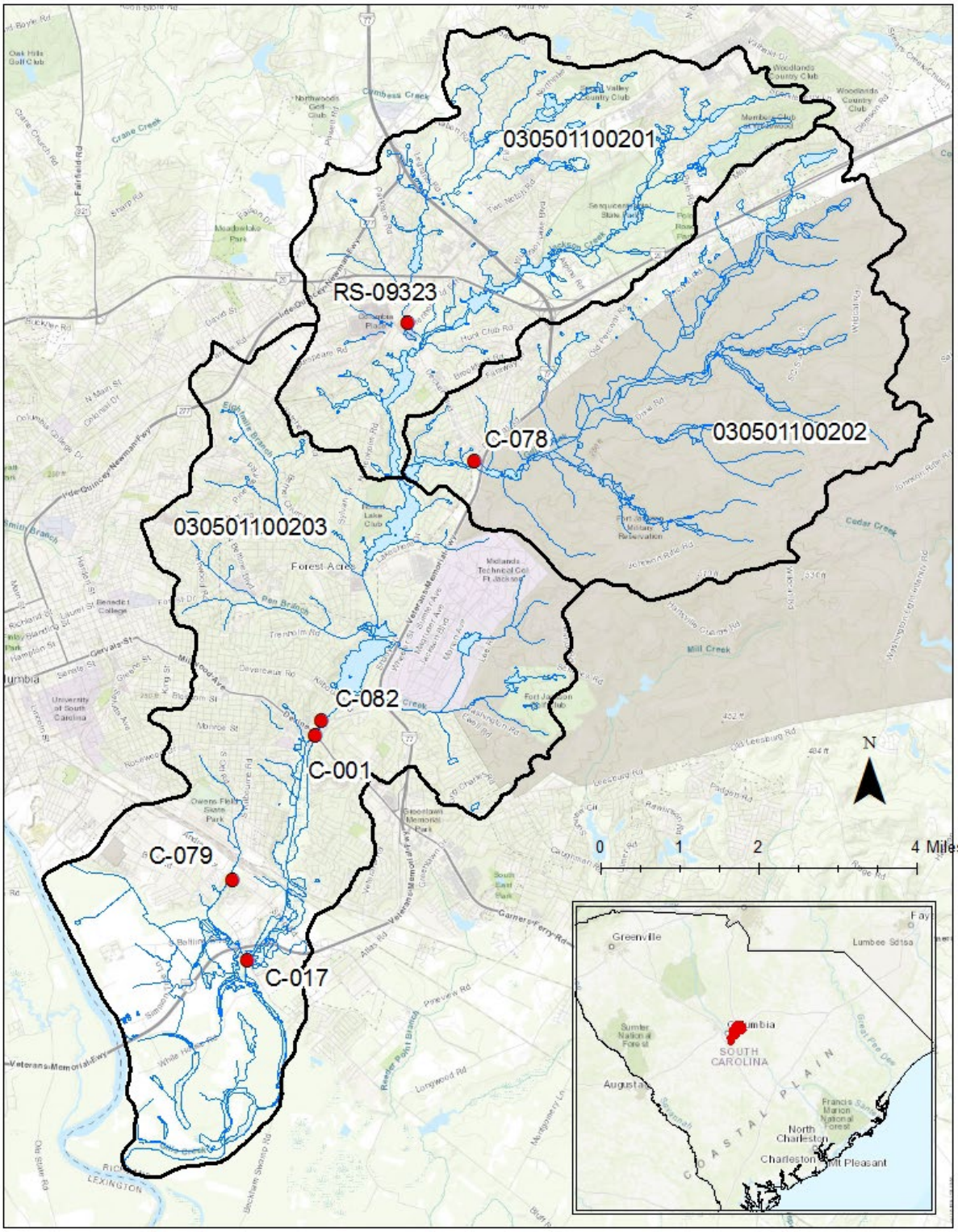
This document details the development of a lead TMDL for a water quality monitoring (WQM) site in the Gills Creek watershed: C-078. Site C-017 was prioritized for a lead TMDL development in the 2018 and the 2020-2022 combined Integrated Reports (IR) and a study was undertaken to examine the distribution of lead impairments in the entire Gills Creek watershed. Two years of intensive sampling revealed that C-017, C-079, and C-082 were not impaired. RS-09323 was sampled in 2019 and also found to be unimpaired (Table 1, Figure 1). The scope of the TMDL effort was narrowed to focus on C-078 because it is directly downstream of a known source of lead and it consistently violated the chronic total lead standard. Because the focus is on this upstream area, a TMDL was not developed for site C-001. It will be listed for lead on the draft 2024 303(d) list. Site C-017 will be delisted in the draft 2024 303(d) list due to standard attainment.

Table 1. WQM sites in Gills Creek watershed sampled for lead

Stream Name	WQM Site	Description	Number of Pb Samples Exceeding Criteria	Year(s) with Complete Pb Data*
Gills Creek	C-078	Gills Creek at Percival Road	22/24	1/2021-12/2022
Gills Creek	C-001	Gills Ck at bridge on US 76 (Garners Ferry Road)	2/24	1/2021-12/2022
Gills Creek	C-082	Gills Creek at Fort Jackson Blvd	0/11	2/2022-12/2022
Gills Creek	C-017	Gills Ck at SC 48 (Bluff Road)	4/20 (historical) 1/36 (current)	1/2011-12/2019 1/2020-12/2022
Lightwood Knot Branch	RS-09323	Lightwood Knot Branch at Trenholm Rd Extension	0/4	2019
Unnamed Trib to Gills Creek	C-079	Unnamed Trib at Plowden Road	0/24	1/2021-12/2022

*Complete data are total lead samples with corresponding TSS and hardness samples.

Figure 1. WQM sites in Gills Creek watershed sampled for lead



1.2 Watershed Description

Impaired site C-078 is in the northeastern part of Gills Creek watershed (hydrologic unit code (HUC) 0305011002) and its drainage area lies entirely within Richland County. The drainage area of C-078 is roughly congruent with HUC 030501100202 and measures approximately 22 square miles. Flow in Gills Creek originates in a suburban residential area in the upper northeastern part of this subwatershed. The stream is dammed in several places near the headwaters, forming small ponds or lakes that are surrounded by homes. The creek then flows under Interstate 20 and onto Fort Jackson Military Reservation (the Fort, Fort Jackson). Approximately 77% of the subwatershed lies within the boundary of the Fort. This area of the Fort is undeveloped, although parts of it are used as munitions ranges. Gills Creek is dammed to form Boyden Arbor Pond at the western boundary of the Fort. Outflow from the dam exits the Fort, flows under Interstate 77 and into Rockyford Lake. Sampling site C-078 is located just upstream of Rockyford Lake (Figure 2).

This watershed is in the Sandhills Region of the Southeastern USA Plains ecoregion. This region has excessively drained, infertile, strongly acidic sandy soils (Pleming, 2016). Streamflow tends to be consistent due to the presence of ample groundwater storage and the infiltration capacity of the sandy soil. The geology of this subwatershed consists of micaceous, kaolinitic sands, with dense lenses of clay. The sand is generally course to granular in size (SCDNR, 2022). Most of this subwatershed is forested (57%) with a modest amount of development (26.4%) (Table 2, Figure 3).

Figure 2. Aerial imagery of the area draining to C-078

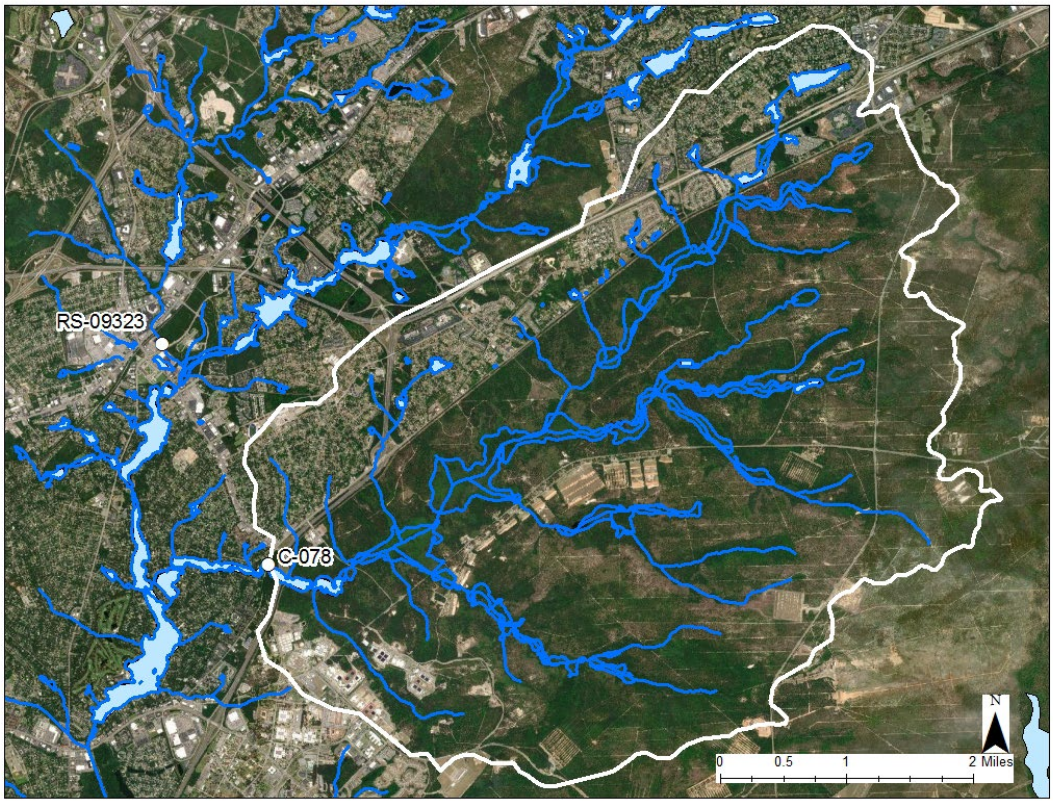
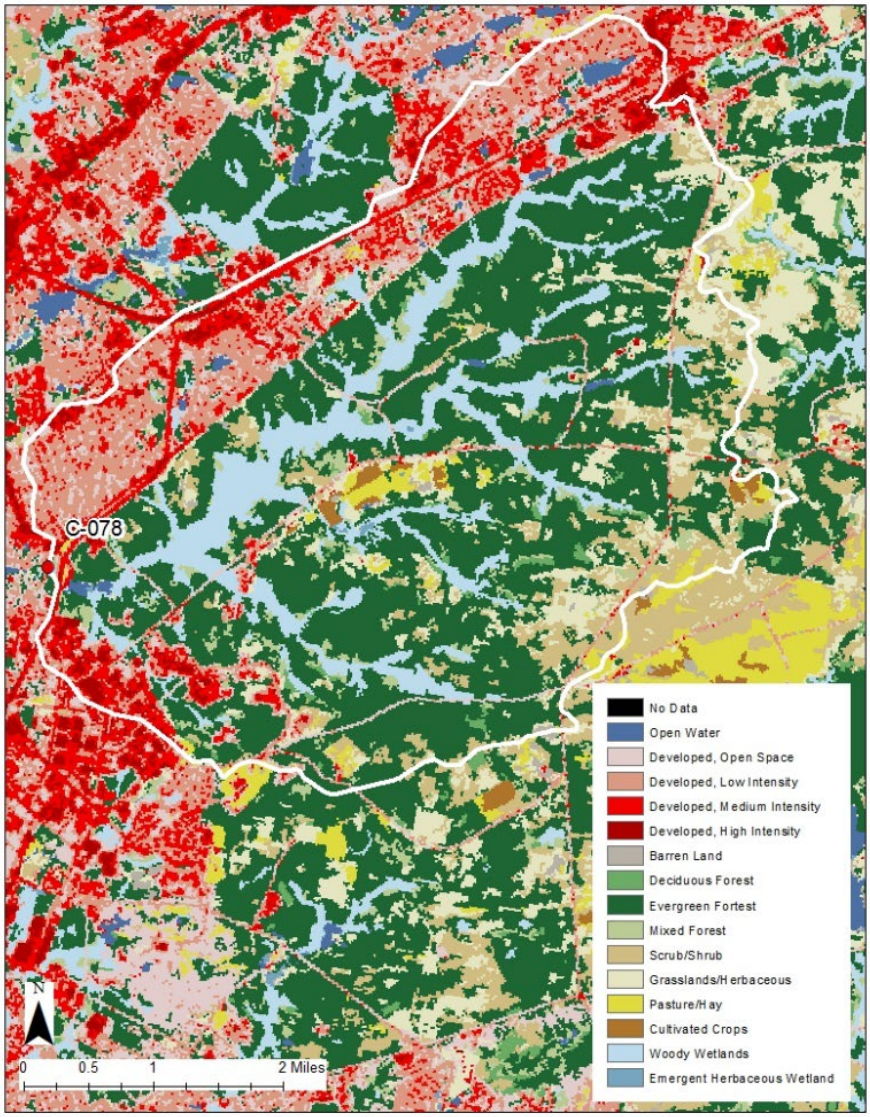


Table 2. Land use in C-078 watershed

Description	Square Miles	Percent of Total
Open Water	0.2	0.9
Developed Open Space	1.2	5.5
Developed Low Intensity	2.8	12.6
Developed Medium Intensity	1.5	6.8
Developed High Intensity	0.3	1.5
Barren	0.1	0.3
Deciduous Forest	0.2	0.8
Evergreen Forest	9.2	41.4
Mixed Forest	0.6	2.9
Shrub/Scrub	1.4	6.3
Grassland/Herbaceous	1.7	7.5
Pasture/Hay	0.3	1.3
Cultivated Crops	0.1	0.5
Woody Wetlands	2.5	11.5
Emergent Herbaceous Wetlands	0.0	0.1
Total	22.1	100.0

(National Land Cover Database (NLCD, 2019)

Figure 3. Land use in C-078 watershed (NLCD, 2019)



1.3 Water Quality Standard

Gills Creek is classified as Freshwater (FW), which is defined as follows in South Carolina Regulation 61-68 (South Carolina Department of Health and Environmental Control (SCDHEC), 2022):

"Freshwaters are suitable for primary and secondary contact recreation and as a source for drinking water supply after conventional treatment in accordance with the requirements of the Department. Suitable for fishing and the survival and propagation of a balanced aquatic community of fauna and flora. Suitable also for industrial and agricultural uses".

Lead is a priority toxic pollutant and the water quality standard for the protection of freshwater aquatic life is included in the Appendix of South Carolina Regulation 61-68 (2023):

Lead:

Criterion maximum concentration (CMC or acute) 14 ug/L

Criterion continuous concentration (CCC or chronic) 0.54 ug/L

These criteria are expressed in terms of total lead, they are hardness dependant and were calculated using a default hardness value of 25 mg/L.

SCDHEC (the Department) samples for and reports total lead (C_{total}). Lead toxicity is influenced by the hardness of the water and by solids partitioning, with free rather than adsorbed lead being the fraction available to aquatic life. Regulation 61-68 E.14.d(3) states that to "appropriately evaluate the ambient water quality for the bioavailability of the dissolved portion of hardness dependent metals, the Department may utilize a federally approved methodology to predict the dissolved fraction or partitioning coefficient in determining compliance with water quality standards established in this regulation."

To determine if sample results exceed the criteria, the Department calculates a sample specific dissolved criterion ($CCC_{dissolved}$) for each instream total lead result using instream hardness measured concurrently with the metal sample following the guidance in Prothro, 1993, and USEPA, 1996. To account for solids partitioning, the Department adjusts the $CCC_{dissolved}$ using a sample specific instream total suspended solids (TSS) concentration, with the result being the total recoverable adjusted CCC (or CCC_{tra}) (Prothro, 1993, SCDHEC, 2020a, USEPA, 1996).

The following describes the calculation of sample specific chronic criteria using hardness and TSS for lead:

$$CCC_{dissolved} = \exp\{m_c * [\ln(\text{hardness})] + b_c\} (CF)$$

where:

$$CF = 1.46203 - [(\ln(\text{hardness}) (0.145712)]$$

$$m_c = 1.273$$

$$b_c = -4.705$$

$$CCC_{tra} = CCC_{dissolved} * [1 + (K_p * TSS * 10E\text{-}6)]$$

where:

$$K_p = K_{po} * (TSS)^a$$

$$K_{po} = 2.08E+6$$

$$a = -0.8$$

Definitions:

CF: freshwater conversion factor (chronic)

m_c and b_c: empirical hardness coefficients for lead

ln: natural log

K_{po}: calculated default metal specific partitioning coefficient

a: constant for lead

The total lead result measured instream is then compared to the calculated CCC_{tra} to determine if a violation of the standard has occurred.

No violations of the CMC for lead have occurred so only the CCC is considered in this analysis. The CCC is the more restrictive of the two, so meeting this criterion will also protect against acute toxicity.

2.0 Water Quality Assessment

A three-year window is used for assessing toxics for IR listing purposes. Metals data are typically collected quarterly. If more than one violation of the standard has occurred at a WQM site in the three-year assessment period then the water is considered to be impaired. R. 61-68 and SCDHEC's assessment methodology allow for the use of default values for hardness and TSS (25 mg/L and 1 mg/L, respectively) to calculate criteria when actual measurements are not available. However, as described in the assessment methodology, criteria calculated with defaults are not used in determining listing status. If a WQM site is determined to be in violation of the standard based on criteria calculated with default values, the site is categorized as a "water of concern". This site will be resampled until sufficient data are gathered to calculate sample specific criteria and determine its status (SCDHEC IR, 2022). Each total lead data point included in this TMDL analysis had a sample specific criterion calculated for it using TSS and hardness values determined from the same stream sample used to measure total lead.

Preliminary to the TMDL commencement, a study (Gills Creek Lead Study) was designed to gather more lead data from the watershed and to help identify any patterns and potential sources of the lead. Sampling locations were added to the watershed and all sites were sampled monthly, rather than the usual quarterly schedule for metals sampling. All but one of these sites (C-082) were sampled for two years (Figure 1).

C-078 was established as part of the Gills Creek Lead Study, the location being chosen to capture drainage from Fort Jackson. Total lead, TSS and hardness along with field data were collected monthly here from January 2021 through December 2022. Twenty two out of 24 samples exceeded sample-specific criteria for lead at this location. This site was assigned a TMDL load, a LA for nonpoint sources and a percent reduction goal (PRG).

The lead impairment at C-078 did not result in listing in the 2022 IR because the special study data were outside the assessment window for 2022. It will however be considered impaired in the assessment for the draft 2024 IR. Summary data for this WQM site may be found in Table 3.

Table 3. Summary data for C-078

WQM Site	CCC_{tra} Range*	Minimum Measured Total Lead ug/L	Average** Measured Total Lead ug/L	Maximum Measured Total Lead (ug/L)	Exceeding Criteria/Total Samples
C-078	2.1-3.0	2.0 (DL)	4.6	7.0	22/24

*Criteria calculated using sample specific TSS and hardness.

** Averages calculated using 2.0 ug/L for samples measuring < the detection limit of 2.0 ug/L (DL).

3.0 Source Assessment

Lead is a naturally occurring toxic metal that has been in use by humans for at least 2000 years. Widespread use has resulted in widespread environmental contamination leading to public and environmental health problems throughout many parts of the world. Sources of contamination range from mining, smelting, metals processing, waste incineration, ammunition manufacturing and waste, to recycling activities involving lead-containing materials. Currently, 86% of lead used worldwide is used in the manufacture of batteries (Garside, M. 2022).

Human health impacts of lead toxicity include hypertension, renal failure, fetal abnormalities or death, and neurological damage. Children are especially vulnerable to the toxic effects of lead and can suffer permanent damage to the nervous system leading to life-long behavioral difficulties and learning problems (WHO, 2022).

Lead is toxic to all aquatic life. Excess lead in the aquatic environment can affect plants, vertebrates, and invertebrates. In animals, lead toxicity may manifest as growth disturbances, anemia, neurotoxicity, immune and reproductive dysfunction, and premature death. It may bioaccumulate leading to increased exposures for animals feeding higher in the food chain and for nonaquatic animals feeding in and around lead-contaminated waters. Lead is also deleterious to aquatic plant life and can cause reduced photosynthesis, mitosis, water absorption, and ultimately growth inhibition. Plant life may accumulate lead and become a source for organisms that consume it (USFWS, 1988, Ju-Wook Lee, 2019).

Anthropogenic sources of lead in the Environment:

Because lead is persistent in the environment, sources may be current and on-going or historical. Much of the lead found in the developed environment originated from air emissions. Exhaust from leaded gasoline-fueled vehicles was a major source of environmental lead until it was phased out in 1973 and then fully banned in 1996. This action eliminated thousands of tons of lead from the atmosphere (EPA, 1996). However, soils that were contaminated during the era of widespread use of leaded fuel are still present in the environment, particularly in urban areas. Air emissions of lead continue from sources such as coal-fired power plants, metals processing, waste incineration and battery manufacturing. Once deposited, lead binds tightly to organic materials which can make it less likely to bioaccumulate in aquatic food chains than other toxics but its persistence in soils and stream sediment can lead to an ongoing cycle of binding, release, resuspension, and transport (NRC, 2000).

Some types of ammunition are manufactured with lead and this can be a source of lead deposited to the environment. Lead shot was used historically in hunting waterfowl which resulted in direct deposition of lead to waterways and poisoning of wildlife. It was phased out for hunting waterfowl beginning in 1987 and a ban was established nationwide in 1991 (USFWS, 2022). Lead-containing ammunition is still used elsewhere, however and may contribute to environmental contamination (Arnemo, 2016).

Many other sources of lead in the environment exist. Lead based paint was ubiquitous in residential settings until it was phased out in 1978. Dust and paint chips from lead-based paints may still contaminate homes and the soil surrounding them. Lead-containing paint is still used in some

applications, including bridge and overpass paint which can contain up to 50% lead by weight (ATSDR, 2019). Lead water pipes and lead solder, pesticides, lead-contaminated superfund sites, and the historical use of lead tanks in phosphate fertilizer manufacture can also be sources.

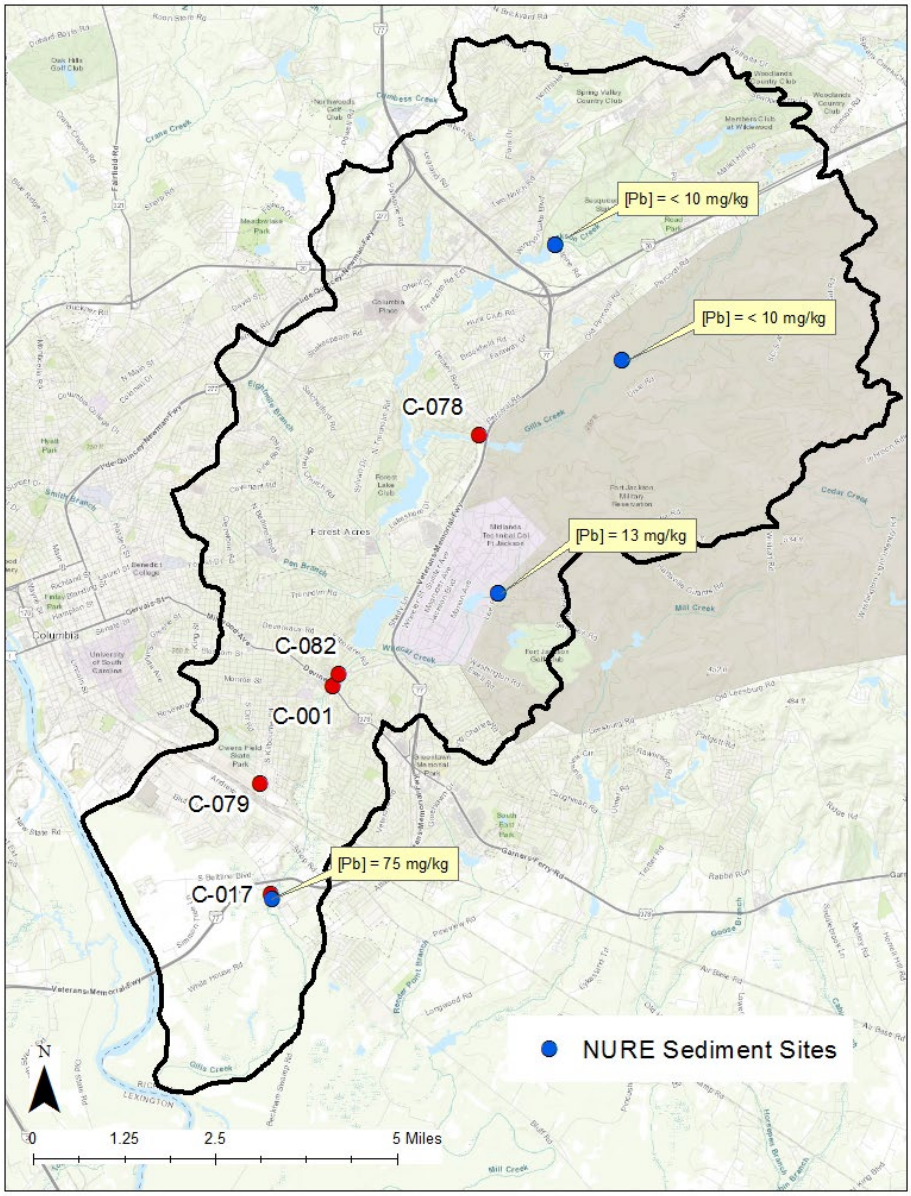
Geogenic Sources of Lead in the Environment:

A possible source of lead in the aquatic environment is the presence of naturally occurring, or geogenic lead. The abundance of lead in the environment varies from place to place depending on the geology of the location. It is released from rocks as they weather and can be transported through fluvial processes. From 2007 to 2010, the U.S. Geological Survey (USGS) collected soil samples from randomly selected sites across the US for various chemical constituents, including lead. The mean lead concentration of soils found in South Carolina was 14.4 mg/kg which is lower than the national average of 19 mg/kg. In general, lead concentrations tend to be higher in the western US (USGS, 1984; USEPA, 2022). South Carolina does not have any major sources of lead ore, but geologic lead does occur in granitic rocks and to a lesser extent in sedimentary rocks, which may be found in the Piedmont region of the state. The geology of the Gills Creek watershed does not suggest the likelihood of significant quantities of geogenic lead, but there may have been some fluvial transport from the Piedmont to the Coastal Plain that could affect the lower part of the watershed near the confluence of Gills Creek with the Congaree River. (SCDNR, 2019).

The lead concentrations determined by the USGS study represent geogenic lead with the addition of impacts from anthropogenic sources, without differentiating between the two sources. It is not possible to separate the contributions of the two sources without isotopic analysis (Kong, 2018). For this reason, these data would not be applicable to determining sources in specific urban areas such as the one under consideration in this document but may instead be used to characterize background lead in more remote areas.

In the 1970s, the National Uranium Resource Evaluation was initiated by the Atomic Energy Agency (now the Department of Energy). The goal was to identify uranium resources (and other elements) across the United States. Funding for this project was eliminated approximately ten years after it began. Data from this study is now managed by USGS and has been made available on line: https://mrdata.usgs.gov/metadata/nurehssr.faq.html. As part of this study, there were four stream sediment sampling sites in the Gills Creek watershed (Figure 4). The sites in the upper part of the watershed measured less than the detection limit for the analytical methodology used. These data represent a snapshot in time and cannot necessarily be attributed specifically to either geogenic or anthropogenic lead, but the fact that the less intensively developed upper part of the watershed had less lead in stream sediments than the segment of Gills Creek downstream of Columbia would lead one to assume that the higher concentrations were attributable to human activities.

Figure 4. NURE sampling sites



3.1 Point Sources

Point sources are defined in the CWA as pollutant loads discharged from a discernable, confined, and discrete conveyance, such as a pipe, ditch, channel, tunnel, conduit, or container. These may originate from municipal wastewater treatment plants, industrial waste treatment facilities, or regulated storm water discharges. Point sources can also include pollutant loads contributed by tributaries to the main receiving stream or river. Point sources can be further broken down into continuous and intermittent.

3.1.1 Continuous Point Sources

Continuous point sources are discharges from facilities permitted to produce a continuous discharge to a waterbody from a discrete conveyance as described above. There are no continuous point source discharges upstream of C-078.

3.1.2 Intermittent Point Sources

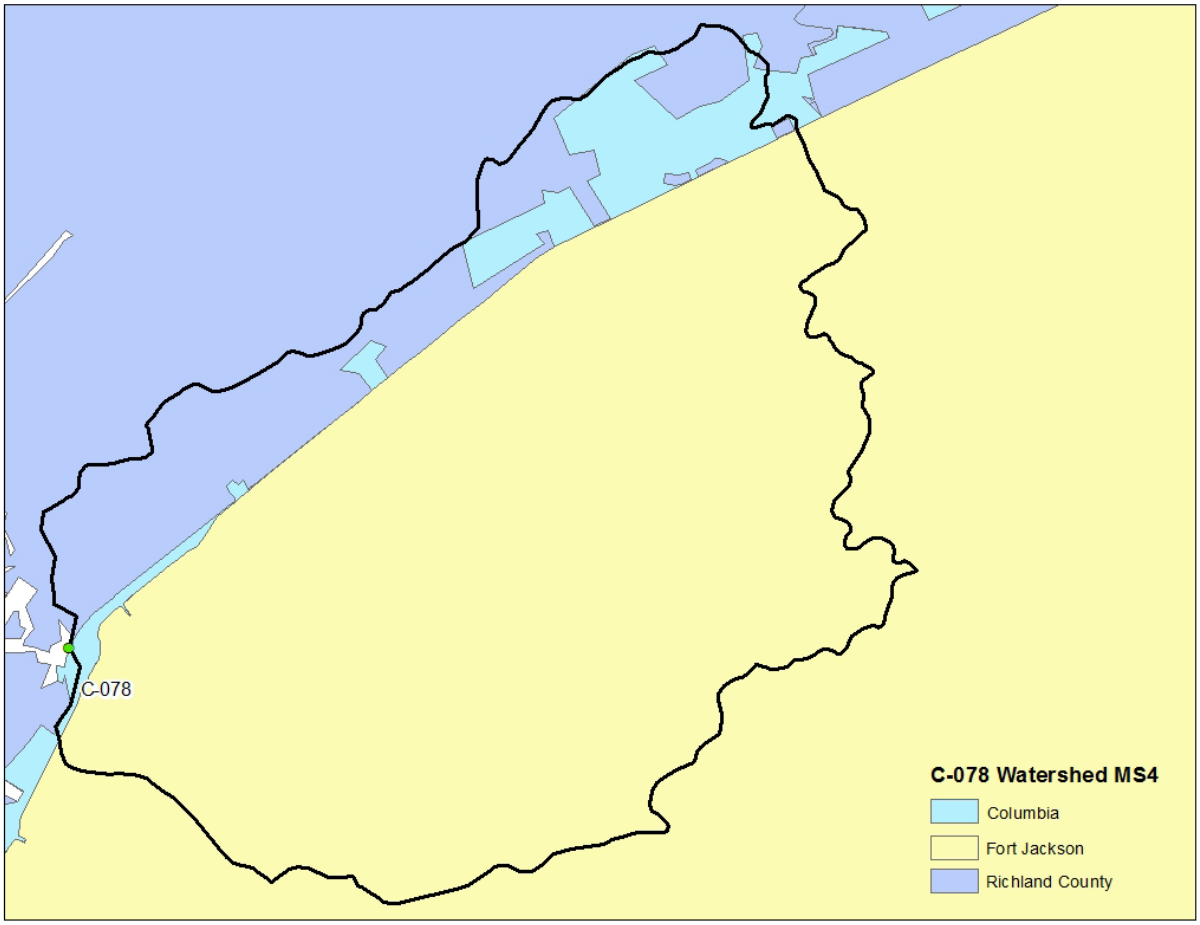
Intermittent point sources are point sources that discharge from a pipe or similar conveyance, but the discharge is not continuous. All NPDES-permitted stormwater discharges are considered to be intermittent point sources because their effluent flow is dependent on rainfall and may range from no flow to large amounts of flow in the space of a day. Municipal separate stormwater systems (MS4s) are permitted to discharge stormwater runoff from roadway drainage systems, ditches, and storm drains to waterways. Due to the tendency for lead to bind to soil particles, regulated MS4 entities have the potential to be a source of metals entering waterways through the transport of particulates in stormwater runoff in the delineated drainage area used in the development of this TMDL. As such, they may be subject to the WLA portion of the TMDL. A high percentage of developed land within a watershed suggests the potential for impacts from intermittent point sources (as well as other sources).

NPDES-permitted stormwater discharges that may be subject to this TMDL include current and future MS4s, construction and industrial discharges covered under permit numbers beginning with SCS and SCR and regulated under SC *Water Pollution Control Permits* Regulation R61-9, §122.26(b)(4), (7),(14) - (21) (SCDHEC, 2019). There are four MS4 jurisdictions in the C-078 watershed (Table 4, Figure 5). Fort Jackson's MS4 permit covers the urbanized area within the Fort.

Table 4. Permitted MS4s in the TMDL watershed

County	Area Covered	Responsible Party	Description	Implementing Party	NPDES	Urbanized Area Name
Richland	Incorporated and Unincorporated Areas	Richland County	Medium MS4	County-Richland	SCS400001	Richland County
Richland	Military Base	Fort Jackson	Small MS4	Fort Jackson	SCR037901	Military Base
Richland Lexington	Columbia	Columbia	Medium MS4	City-Columbia	SCS790001	Columbia, SC
All	Statewide	SCDOT	Large MS4	SCDOT	SCS040001	

Figure 5. MS4s areas of responsibility in C-078 watershed



In addition to the MS4 permit coverage depicted in Figure 5, the South Carolina Department of Transportation (SCDOT) operates under NPDES MS4 Permit SCS040001 which covers the entire state. SCDOT owns and operates facilities and roads within the watershed. However, the Department recognizes that SCDOT is not a traditional MS4 in that it does not possess statutory taxing or enforcement powers. SCDOT does not regulate land use or zoning, issue building or development permits. Based on information available at the time of this TMDL development there are no SCDOT facilities in the TMDL drainage area.

The Department acknowledges that progress with the assumptions and requirements of this TMDL by MS4s is expected to take one or more permit iteration. Progress towards achieving the WLA reduction for the TMDL may constitute MS4 compliance with its stormwater management plan, provided the Maximum Extent Possible (MEP) definition is met, even where the numeric percent reduction may not be achieved in the interim.

More information on the MS4 program may be found on SCDHEC's MS4 website:

https://scdhec.gov/bow/stormwater/stormwater-municipal-storm-sewer-systems-ms4s/municipal-separate-storm-sewer-systems-ms4s

Industrial facilities that have the potential to cause or contribute to a violation of a water quality standard due to storm water discharge are covered by the NPDES Storm Water Industrial General Permit (SCR000000). Sectors with benchmarks for lead in their stormwater include G (metal mining), M (auto salvage yards), N (scrap recycling facilities) and Q (water transportation facilities). The benchmark limits if followed will protect ambient waters from contamination. Fort Jackson holds an industrial stormwater permit for a recycling facility in sector N (SCR001898). In this facility, the recyclables are "source separated" which means that they are separated by type when received. This eliminates the requirement for benchmark monitoring. Facilities in other sectors may contribute lead to the environment, such as those in sector Y (rubber, miscellaneous plastic products and miscellaneous manufacturing industries). These facilities may use lead in their processes, but their permit does not necessarily include a lead benchmark.

Construction activities are usually covered by the NPDES Storm Water Construction General Permit SCR100000. Where construction has the potential to affect the water quality of a water body with a TMDL, the Storm Water Pollution Prevention Plan (SWPPP) for the site must address any pollutants of concern and adhere to any waste load allocations in the TMDL.

There may be other stormwater discharges present in the watershed that are not covered under permits numbered SCS and SCR. These discharges are not subject to the WLA portion of the TMDL but are instead assigned LA reductions.

3.2 Nonpoint Sources

Nonpoint source pollution is defined as pollution that is not released through pipes but instead originates from multiple sources over a wide area. Air deposition may contaminate surfaces with lead and runoff from these areas may pick up lead-contaminated particulates which are subsequently deposited in waterways (see 3.2.1). Runoff from lead-contaminated legacy waste sites or illegal dumping may be a nonpoint source of lead.

3.2.1 Air Sources

Air deposition can be a source of lead in the aquatic environment. Pollutants in ambient air are dispersed by advection and diffusion and their ultimate fate depends on many factors. Variations in wind speed and direction, atmospheric stability, characteristics of the emitting stack, local terrain, and particle size all influence the distribution of lead emitted to the atmosphere. These uncertainties mean that not all lead found in the environment had a local origin and that it may be difficult to determine the source. In general, pollutants emitted to air are unlikely to travel farther than 10 km with the notable exceptions of dioxins, furans, and mercury. The highest concentrations of lead deposition originating from air sources are typically found in the direction of prevailing winds (NRC, 2000).

To identify possible air sources of lead, the Toxic Release Inventory (TRI) (EPA TRI Toxics Tracker) and Title V records were examined. Facilities reporting to TRI are large facilities involved in manufacturing, metals mining, power generation, chemical manufacturing, and hazardous waste treatment. Facilities are required to report annual discharges to air, water, and land. Air emissions are also reported to SCDHEC as part of Title V operating permit requirements. Title V facilities are major sources with the

potential to emit 100 tons per year of any criteria pollutant or 10 tons per year or more of any single hazardous air pollutant or 25 tons per year of more than one hazardous air pollutant. Major sources may also report to TRI, so some facilities are represented in both TRI and Title V tables and figures. An area that included the Gills Creek HUC 10 and a 20-mile zone around the watershed boundary was included. A 20-mile buffer was chosen to account for the uncertainty in how far lead may travel through air, soil, and water after release. Figures 6 and 7 illustrate the locations of facilities that reported lead releases to air in this zone. Tables summarizing average yearly emissions from 2018 through 2020 are found in Appendix A.

Facilities reporting more than 10 pounds of lead emitted to the atmosphere/year (for any or all of 2018-2020) in the vicinity of the impaired sites include Owens Steel, CMC Steel, Dominion (SCE&G) Wateree Station, International Paper, and Fort Jackson. Prevailing winds in this area tend to be from the southwest and to a lesser extent the northeast (https://www.wcc.nrcs.usda.gov/ftpref/downloads/climate/windrose/), so it is less likely that those facilities to the southeast of the watershed (International Paper and Dominion Wateree Station) are contributing lead to the watershed.

Figure 6. Facilities reporting air lead emissions to TRI within 20 miles of Gills Creek watershed boundary

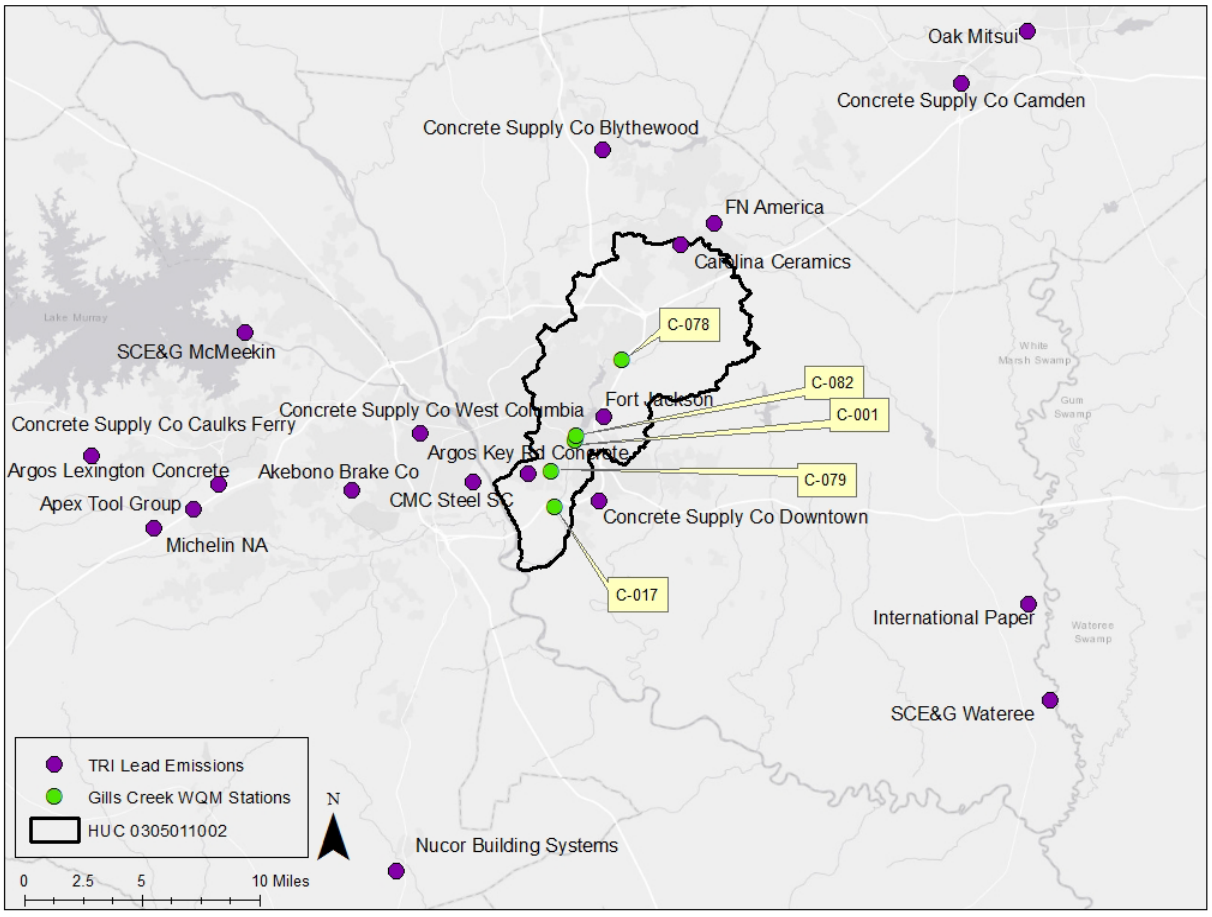
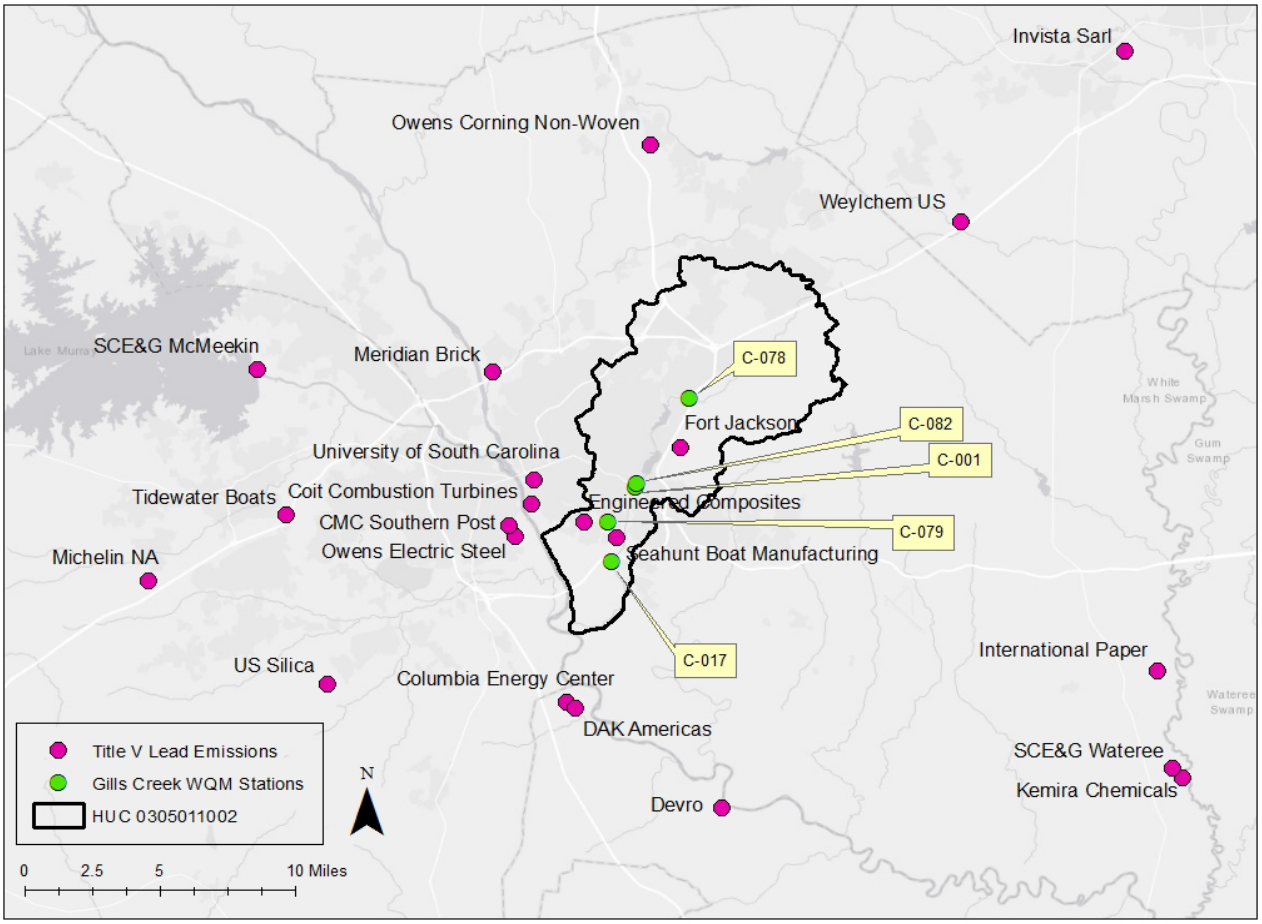


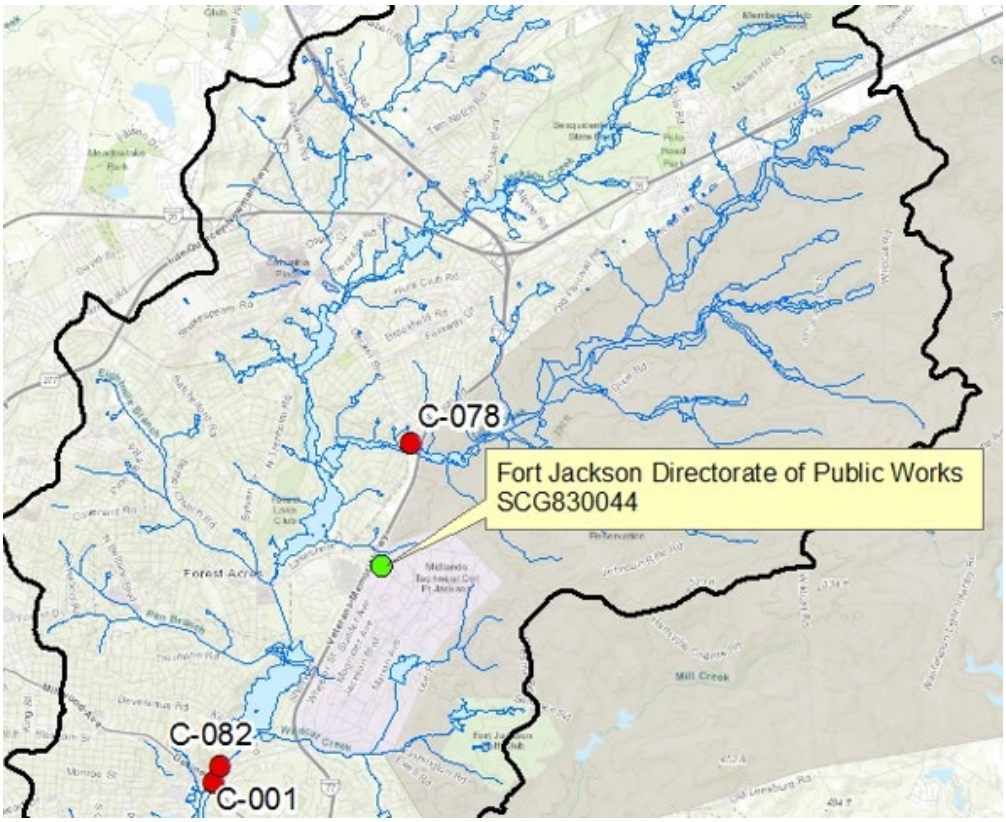
Figure 7. Title V facilities reporting air lead emissions within 20 miles of the Gills Creek watershed boundary



3.2.2 Groundwater Sources

Contaminated groundwater may be a source of lead in streams if the water table is shallow enough to provide recharge to the stream during low flow conditions. Groundwater may become contaminated with lead through leaking underground storage tanks or from leachate from legacy waste sites. There is one groundwater remediation site (SCG830044) present near the TMDL watershed, although the discharge is downstream of the TMDL site (Figure 8). The groundwater at this site is being treated for petroleum contamination. The permit includes total lead limits that are protective of the stream. These limits were violated 6 times during 2018 and once in 2020, but no violations have been reported since then. See Appendix A for discharge monitoring reporting (DMR) data for this site.

Figure 8. Location of groundwater remediation site



USGS has conducted groundwater sampling in the past at various locations in and around the Gills Creek watershed using wells varying from 8.6 feet to 54 feet deep. Data from USGS groundwater sampling locations were available for some dates between 2005 through 2016. While acknowledging that the state does not have a water quality standard for lead in groundwater, an attempt was made to analyze these samples for levels that would be considered an exceedance if they were found in surface waters and could thus be a source. The groundwater samples were filtered prior to analysis, so solids partitioning need not be considered in calculating a sample specific criterion. Figures 9 and 10 illustrate the locations of the USGS groundwater sampling sites in relationship to the watershed and surface water sampling locations. In Figure 9, the sites shown in red violated the chronic surface water quality standard for total lead at least once.

Of the wells in the watershed that had elevated lead levels all but RIC-572 (located outside of the watershed) had lower levels (below the surface water quality standard) when retested after the first sampling (RIC-559 and RIC-729 were not resampled). Because of this, it seems unlikely that these aquifers are contributing directly to lead in surface water. Figure 10 shows the lead status after the most recent sampling at each of the sites. A summary of the data and calculations may be found in Appendix A.

Figure 9. Location of USGS groundwater monitoring wells with lead data and status

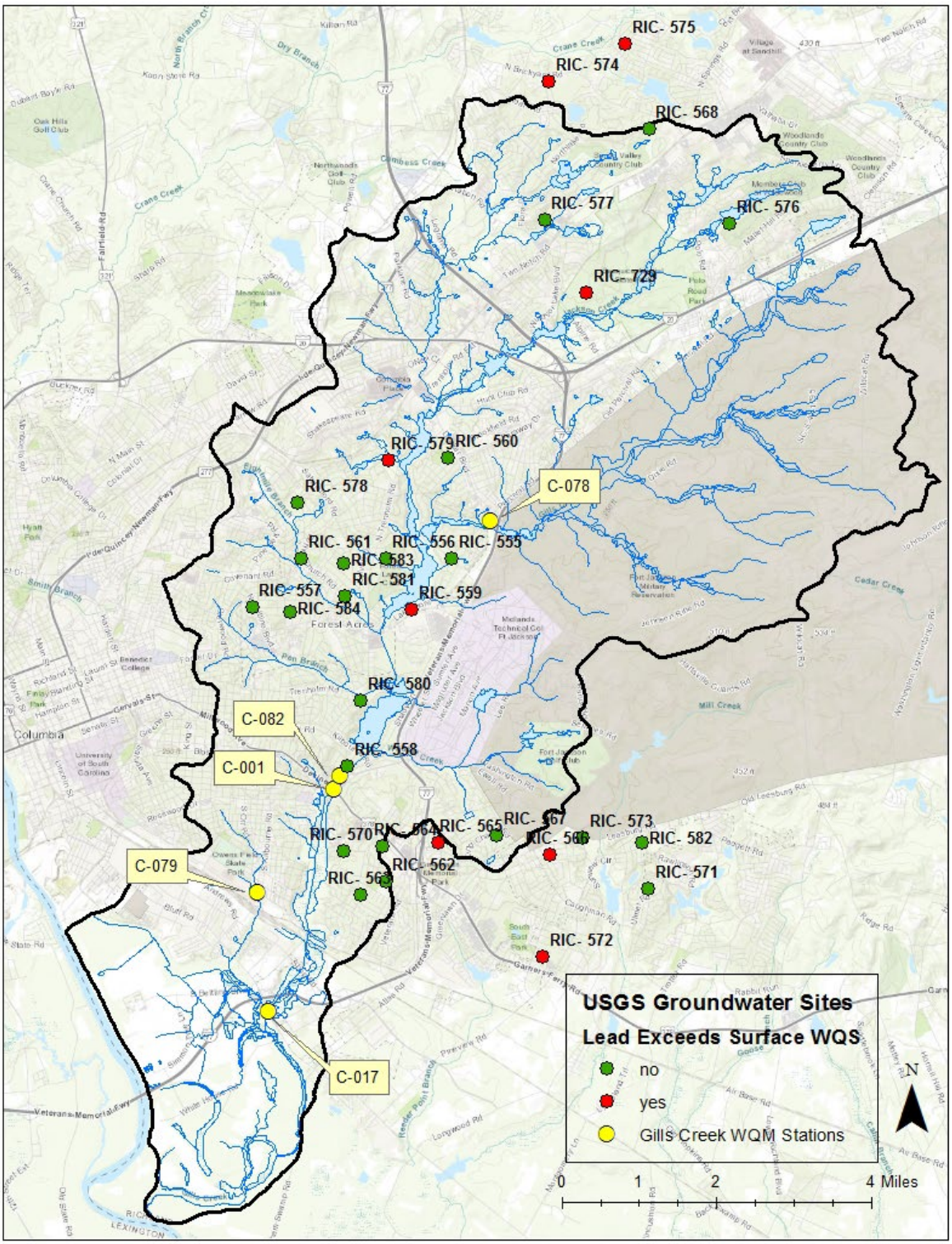
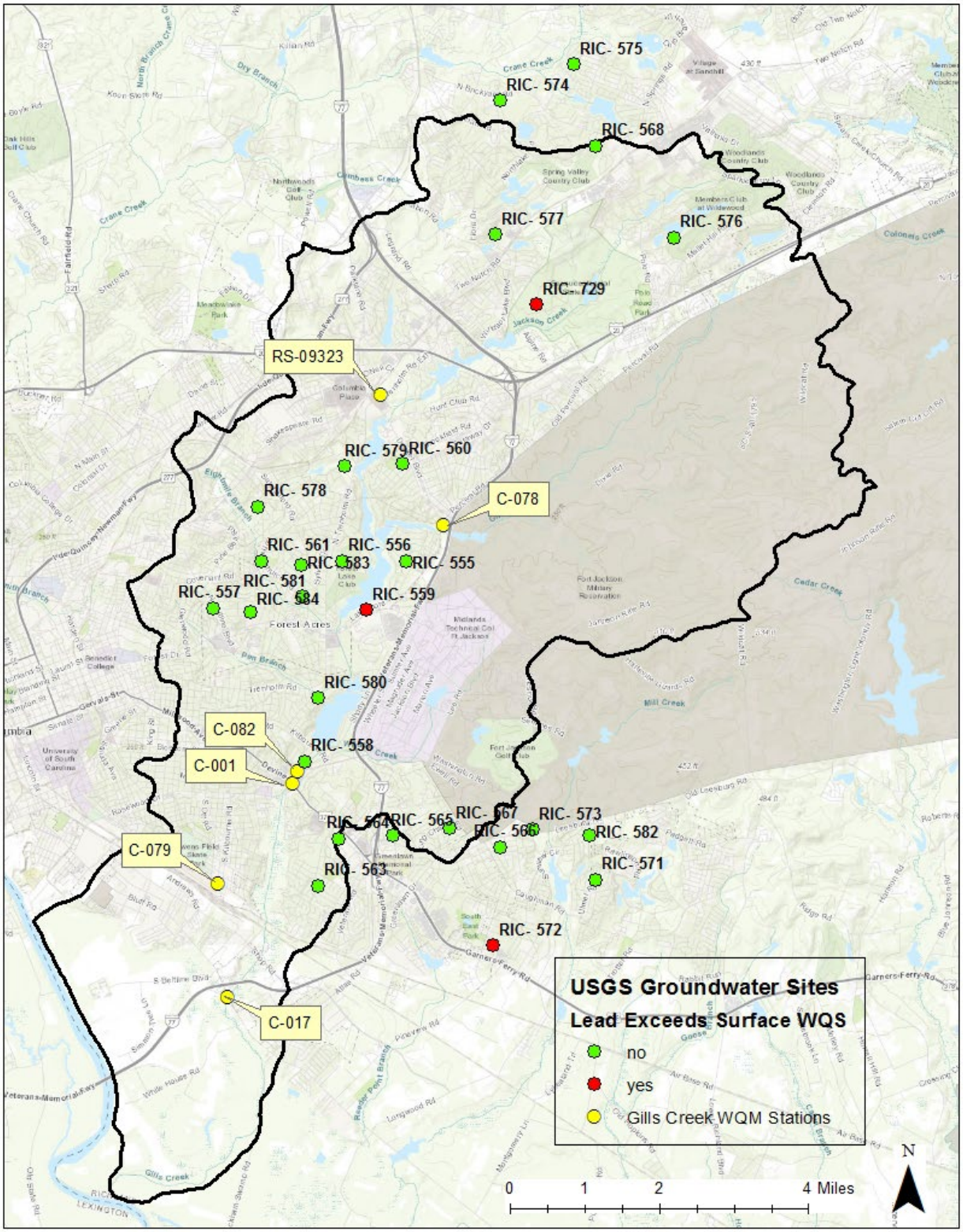


Figure 10. Status of Groundwater monitoring wells after most recent sampling



3.2.3 CERCLA/Superfund Sites

The Comprehensive Environmental Response, Compensation, and Liability Act, otherwise known as CERCLA or Superfund, was developed to provide funding for the cleanup of abandoned or uncontrolled hazardous waste sites. Lead-contaminated sites may be covered under this act. At this time, there are no known lead contaminated CERCLA sites in the TMDL watershed.

3.2.4 Department of Defense Operational Ranges

The majority of subwatershed C-078 (approximately 77%) is occupied by Fort Jackson. While much of the area of the Fort that is drained by Gills Creek appears to be undeveloped, part of it is used as small arms munitions ranges and this use dates back at least to the 1940s (Figure 11). Lead, antimony, copper, and zinc are the primary metals that are associated with small arms ammunition and these may contaminate the environment of munitions ranges and have the potential to migrate off site. The Operational Range Assessment Program (ORAP, https://denix.osd.mil/orap/) assesses munitions ranges, determining if there is release of munitions constituents off the range site that may prove a risk to human health or the environment. Sampling conducted in 2013 as part of ORAP found elevated lead levels in Boyden Arbor Pond and upstream of the pond in Gills Creek. The outflow from the dam on Boyden Arbor Pond is located approximately 700 feet upstream of C-078 (Figure 12).

The study conducted by DHEC in 2021 through 2022 also points to the likelihood of lead contamination at C-078 flowing from Boyden Arbor Pond on Fort Jackson. Most (92%) of the samples from C-078 violated the water quality standard for lead.

As a result of the ORAP sampling, Boyden Arbor Pond was added to the Fort Jackson Resource Conservation and Recovery Act (RCRA) permit. RCRA gives EPA the authority to manage the generation, transport, treatment, and the storage and disposal of hazardous waste. A RCRA Facility Investigation Work Plan was submitted to SCDHEC in May 2022 and conditionally approved July 2022. This study will further characterize the lead contamination outside the boundary of the firing ranges. Upon review of the results of this study, DHEC will determine if a Corrective Measures Study is required.

Figure 11. Location of C-078 relative to Boyden Arbor Pond and munitions ranges

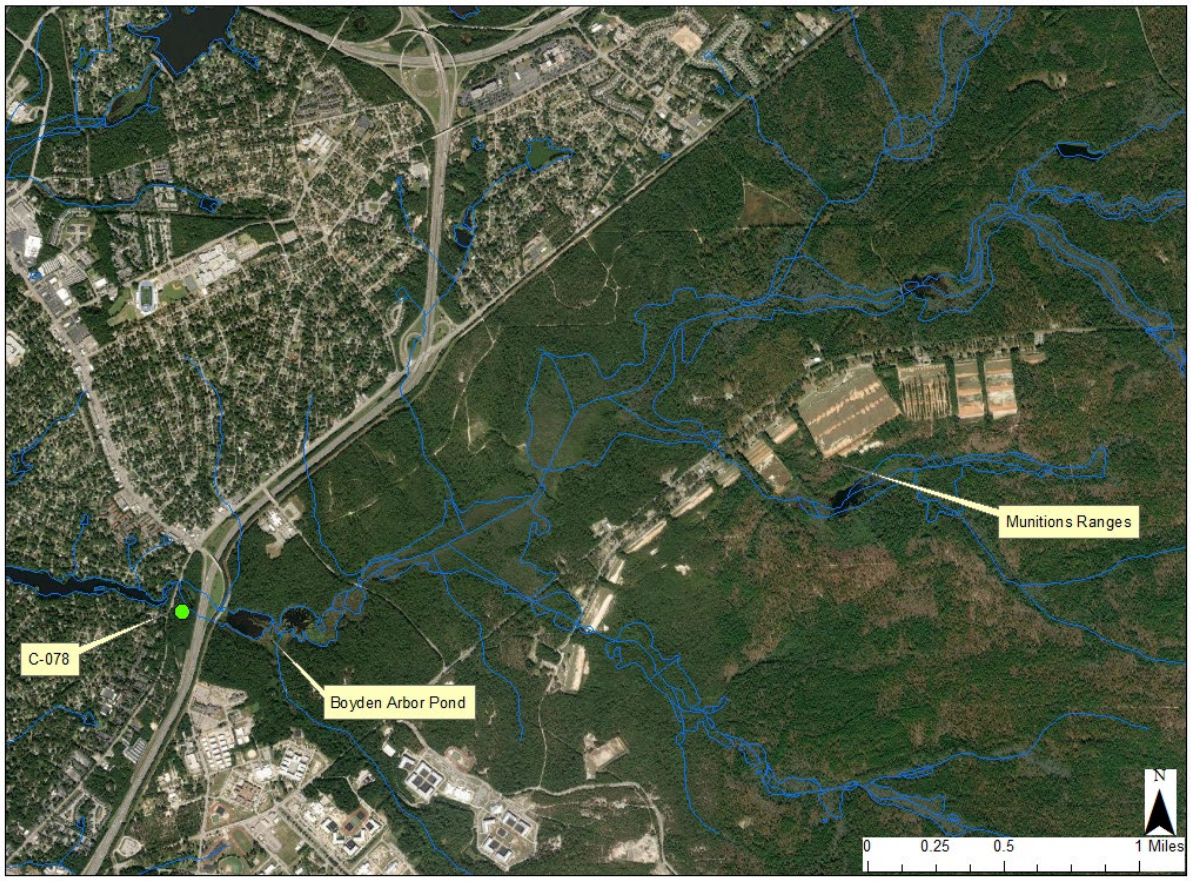
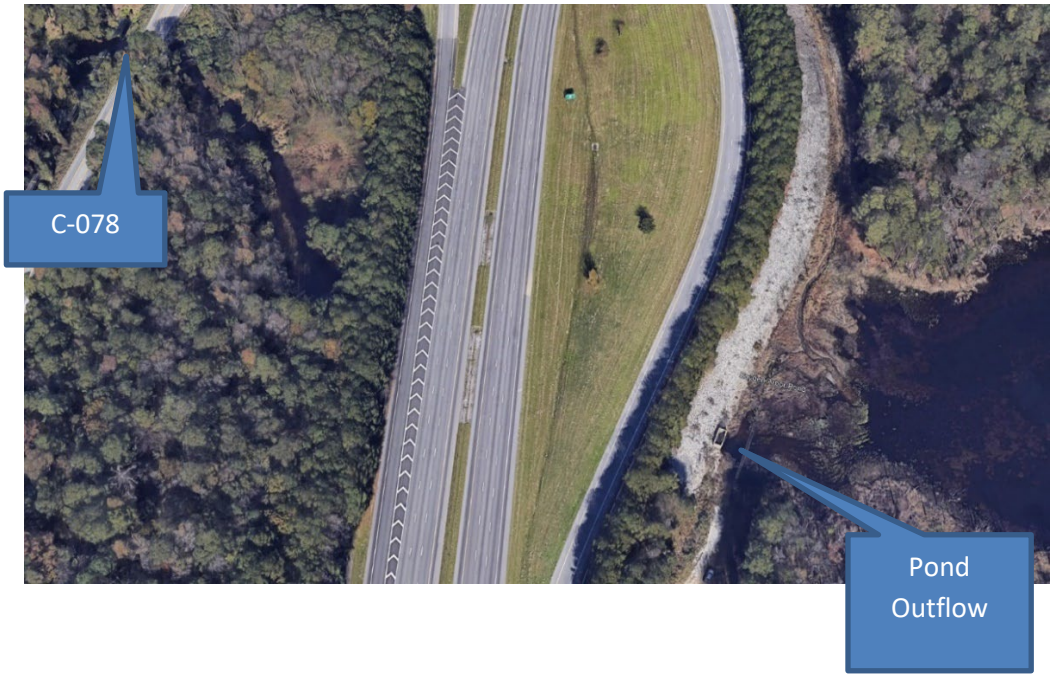


Figure 12. Boyden Arbor Pond outflow and C-078



4.0 Concentration/Flow-Duration Curve

A flow duration curve was used in this TMDL analysis to associate measured concentrations of instream lead with defined flow regimes. Associating pollutant exceedances with particular flow conditions can assist in source assessment, with exceedances during low flow conditions being more likely associated with point-sources and during high flow conditions with nonpoint sources (Table 5) (USEPA 2007, Bonta and Cleland 2003). A flow-duration curve was created for C-078 and the site's lead data were plotted on the same graph. The flow range with the highest percent reduction required was identified and potential sources were considered based on these ranges.

Table 5. Likelihood of contribution of various sources for flow duration categories

Potential Source	Flow Duration Category				
	High	Moist	Midrange	Dry	Low
Point Sources				MEDIUM	HIGH
Riparian Areas		HIGH	HIGH	HIGH	
Impervious stormwater runoff		HIGH	HIGH	HIGH	
Upland stormwater runoff	HIGH	HIGH	MEDIUM		
Bank erosion	HIGH	MEDIUM			

Adapted from USEPA 2007, 841-B-07-006 Table 4-1

Developing a flow-duration curve requires an adequate period of record for stream flow data. Fortunately, Gills Creek has a USGS gauge approximately 100 feet downstream from C-001 (USGS 02169570 Gills Creek at Columbia). Discharge data have been collected at this gauge since 1966. Data from January 1, 2000, through 2022 were used for the curve in this analysis. This period of record includes various weather conditions, including both periods of drought and extreme flooding. Omitting older data ensures that the flows in the curve reflect modern climactic conditions and recognizes the fact that climate change has likely altered flow in area streams over the decades.

The drainage area for the WQM site was delineated using USGS topographic maps and ArcGIS. Flow at the impaired WQM site was estimated based on the ratio of the WQM site drainage area to the drainage area of the USGS gauge. For example, 02169570 records flow from 59.6 square miles. The drainage area for C-078 is 22.1 square miles, or 37% of the drainage area at 02169570. Daily mean flows at the gauge were multiplied by .356 to arrive at an estimated flow at C-078 (Table 6).

Table 6. Drainage area statistics

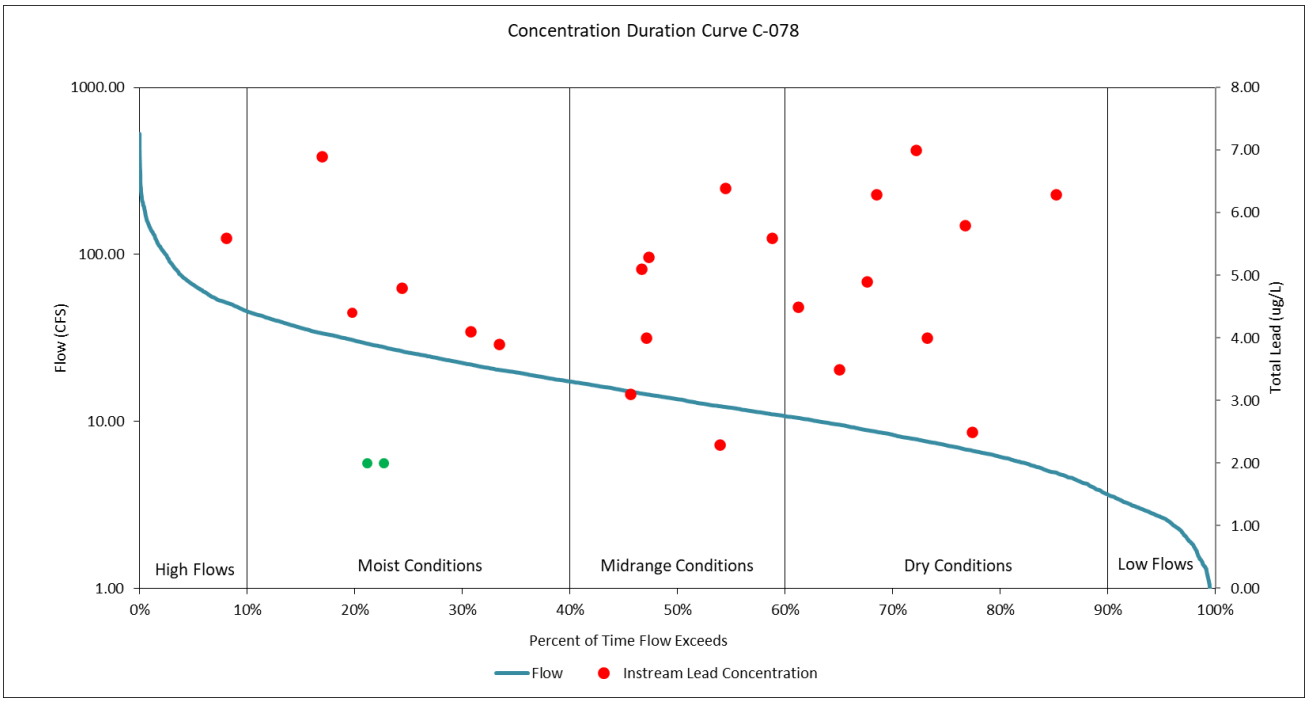
Site	Area (square miles)	Ratio Used to Estimate Flow at WQM Sites
USGS Gauge 02169570	59.6	
C-078	22.1	22.1/59.6 = 0.37

A flow duration curve was created by ranking daily average stream flows from highest to lowest and calculating the probability of occurrence (presented as a percentage or duration interval), where zero corresponds to the highest flow. The duration interval is used to determine the percentage of time a given

flow is achieved or exceeded, based on the period of record. The flow duration curve was divided into five hydrologic condition categories (High Flows, Moist Conditions, Midrange, Dry Conditions and Low Flows).

Figure 13 illustrates the concentration / flow duration curve for C-078. Individual total lead concentrations are plotted against the flow duration interval corresponding to stream conditions occurring when they were collected. The red markers indicate samples that violated the sample specific water quality standard; the green markers represent samples that did not exceed the standard. Samples recorded as less than the DL were graphed as the DL (2 ug/L). There were no samples collected during low flow conditions.

Figure 13. Concentration/Flow duration curve



5.0 Development of the Total Daily Maximum Load

A TMDL for a given pollutant and water body is comprised of the sum of individual waste load allocations (WLAs) for point sources, and load allocations (LAs) for both nonpoint sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicit or explicit, to account for the uncertainty in the relationship between pollutant loads and the quality of the receiving water body. Conceptually, this definition is represented by the equation:

$$TMDL = \sum WLAs + \sum LAs + MOS$$

The TMDL is the total amount of pollutant that can be assimilated by the receiving water body while still achieving compliance with the WQS. In TMDL development, allowable loadings from all pollutant sources that cumulatively amount to no more than the TMDL must be established and this provides the basis to establish water quality-based controls.

Because the toxicity of lead is a function of TSS and hardness, this TMDL is expressed as an equation using the default hardness value (25 mg/L as described in R. 61-68) and the load is expressed using default hardness and TSS and average daily flow at the impaired site (Table 9).

5.1 Percent Reduction Goals

To calculate the PRG, each instream total lead measurement for the WQM site was compared to its sample specific criterion by calculating a percent difference as follows:

{(Total Instream Lead – Sample Specific Criterion)/Total Instream Lead} * 100 = Percent Difference

The sample collected 9/27/2022 had the highest PRG which was calculated as follows:

{(7.0 ug/L – 2.6 ug/L)/7.0 ug/L} * 100 = 62.9%

The maximum percent difference was defined as the PRG. The PRG is displayed in Table 7, along with the flow regime in which the highest percent difference occurred. Data are tabulated in Appendix C.

Table 7. Percent reduction goal

WQM Site	Percent Reduction Goal	Flow Period
C-078	62.9%	Dry Conditions

The highest percent differences at C-078 were found during “dry conditions”. Exceedances during dry conditions may indicate a point source of the pollutant and stormwater contribution from impervious surfaces occurring after an extended dry period (Table 5). The nearly consistent occurrence of exceedances across all flow conditions suggests that the area draining to C-078 is acting as a continuous source of lead. There was no apparent relationship between stream flow and total lead concentrations at this site and a slight positive correlation between rain and total lead concentration (Figures 14, 15 and Table 8).

Figure 14. Relationship between flow and lead concentration

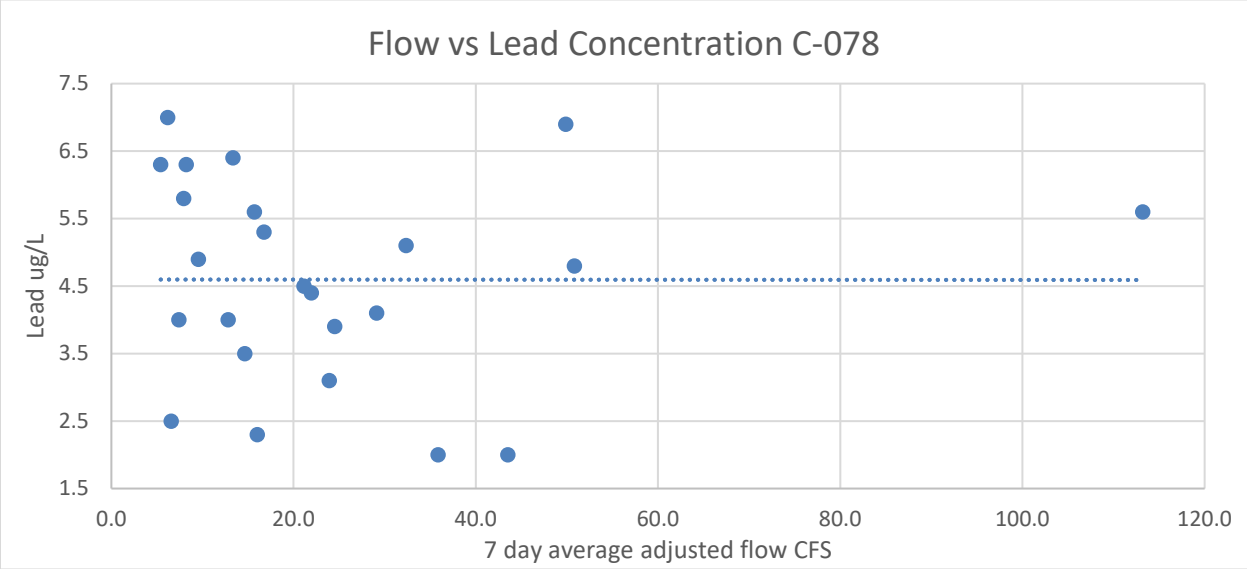


Figure 15. Relationship between rain and lead concentration

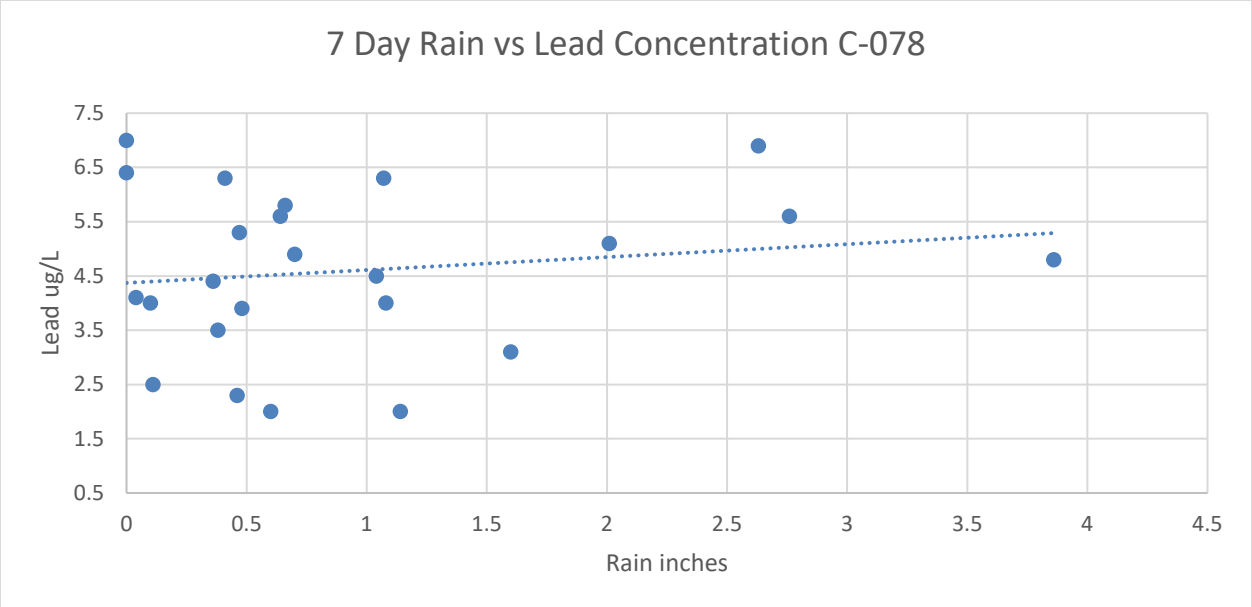


Table 8. Correlation coefficients for rain and flow vs lead

Relationship	Correlation Coefficient
Flow vs Lead at C-078	-0.009
Rain vs Lead at C-078	0.16

5.2 Waste Load Allocation

The waste load allocation (WLA) is the portion of the TMDL allocated to NPDES-permitted point sources.

5.2.1 Continuous Point Sources

There are no continuous point sources permitted to discharge lead in the watershed at this time. Any new continuous point source discharge limits will be based on permitted flow, critical stream flow, and the criteria for lead determined using either default values or in stream TSS and hardness as described in SC R. 61-68 and 61-9.

5.2.2 Intermittent Point Sources

Intermittent point sources include all NPDES-permitted stormwater discharges, including current and future MS4s, construction and industrial stormwater discharges covered under permits numbered SCS000000 and SCR100000 regulated under SC *Water Pollution Control Permits* Regulation 122.26(b)(14) and (15). As discussed in section 3.1.2, stormwater in areas of the TMDL watershed is regulated by three separate MS4 permits.

Waste load allocations for stormwater discharges are expressed as a percentage reduction instead of a numeric loading due to the uncertain nature of stormwater discharge volumes and recurrence intervals. All current and future stormwater discharges are required to target the percentage reduction goals or the existing instream standard for the pollutant of concern. Compliance with terms and conditions of existing and future NPDES permits (including all construction, industrial, and MS4) will effectively implement the WLA and demonstrate consistency with the assumptions and requirements of the TMDL.

The percent reduction goal for intermittent point sources is 62.9% (Table 7).

5.3 Load Allocation

The Load Allocation applies to nonpoint sources of lead and is expressed both as a load and as a percent reduction goal. The load allocation is calculated as the difference between the target load under the critical condition and the point source WLA:

0.24 lbs/day (TMDL) – 0.024 lbs/day (MOS) – 0 lbs/day (WLA) = 0.22 lbs/day (LA)

There may be other unregulated stormwater discharges located in the TMDL watershed that are subject to the LA components of this TMDL. At such time that the referenced entities, or other future unregulated entities become regulated NPDES MS4 entities and are subject to applicable provisions of SC Regulation 61-68D, they will be required to meet load reductions prescribed in the WLA component of the TMDL. This also applies to future discharges associated with industrial and construction activities that will be subject to SC R. 61-9 122.26(b)(14) and (15) (SCDHEC 2011).

5.3.1 Boyden Arbor Pond

The outflow from Boyden Arbor Pond does not fit neatly into the standard categories typically seen in TMDL tables. The lead in the pond is likely the result of ordnance-related contaminants migrating from the munitions ranges upstream via nonpoint source means, subject to the LA. Fort Jackson is covered by

an MS4 permit, and some lead in the pond may have arrived there through stormwater conveyances which then makes it subject to the WLA. Ultimately, it would appear to be subject to both, and the LA load and the percent reduction goal at C-078 should be used to guide TMDL implementation efforts at this site.

5.4 Seasonal Variability

Federal regulations require that TMDLs consider the seasonal variability in watershed loading. Seasonal variations in lead loading that may occur in the Gills Creek watershed are accounted for by using multi-year hydrological and water quality sampling data sets and by examining the differences in exceedances that occurred during different hydrologic conditions.

5.5 Margin of Safety

The margin of safety (MOS) may be explicit and/or implicit. The explicit margin of safety is 10% of the TMDL. This is a conservative MOS that will help mitigate uncertainty in measurements of total lead and the calculation of sample specific standards that vary from sample to sample as conditions in the stream change. The MOS is the difference between the TMDL and the sum of the WLA and LA. An implicit margin of safety is included by choosing the maximum exceedance to calculate the percent reduction goal and using the DL for total lead when measurements were less than the DL.

5.6 TMDL

TMDLs are usually expressed as a mass load (e.g., pounds per day). Because the criteria for lead are dependent on hardness and TSS which vary from sample to sample and site to site, this TMDL is expressed as total recoverable lead in pounds/day, both as an equation using the chronic lead criterion from R. 61-68 and a load calculated using default values for TSS (1 mg/L), hardness (25 mg/L), and the average daily flow in the stream. In accordance with South Carolina Regulation 61-68, permit limits (expressed as total lead) may be determined using either these default values or site-specific values for hardness and TSS. Percent reduction goals are included to assist in implementation efforts.

Table 9 indicates the percentage reduction or loading required for the watershed analyzed in this TMDL document. Note that any future regulated NPDES-permitted stormwater discharges will also be required to meet the prescribed percentage reductions, or the water quality standard. It should be noted that in order to meet the WQS for lead, prescribed load reductions must be targeted from all sources, including NPDES permitted and nonpoint sources.

5.7 Reasonable Assurance

When a TMDL is developed for a pollutant that has both point and nonpoint sources, or nonpoint sources only, EPA guidance states that the TMDL should provide reasonable assurance that nonpoint source controls will achieve their expected load reductions. NPDES permits issued for regulated dischargers provide this assurance for the waste load allocation.

Unregulated sources of pollutants such as lead may be reduced through best management practices, local ordinances, and outreach and educational efforts and §319 grant funding may be available for these efforts. Due to its high visibility in the City of Columbia and the presence of an active advocacy group (The Gills Creek Watershed Association), it is anticipated that there will be a high level of interest in restoration

activities for Gills Creek. A comprehensive watershed management plan was updated in 2020 (Gills Creek Watershed Management Plan 2020). In addition, and perhaps most importantly, Fort Jackson will be subject to the requirements of ORAP and their RCRA permit to mitigate the impact of lead that is migrating off their munitions sites.

Table 9. Total maximum daily loads for total lead

WQM Site	TMDL	MOS	WLA			LA	
			Continuous Point Source[1]	Intermittent Point Source % reduction goal[2, 3]	SCDOT % reduction goal[2, 3, 4]	Load	% reduction goal[2]
C-078	2.1 ug/L x Q x (5.39377×10^{-3})*	2.1 ug/L x Q x (5.39377×10^{-4})*	See Note 1	62.9%*	62.9%*	2.1 ug/L x Q x (4.85439×10^{-3})*	62.9%*
	0.24 LBS/DAY**	0.024 LBS/DAY**				0.22 LBS/DAY**	

*TMDL, MOS and LA loads are represented here as an equation which includes the total recoverable adjusted chronic lead criterion (CCCtra) of 2.1 ug/L, flow in cfs (Q), and a conversion factor. The CCCtra was derived using default hardness (25 mg/L) and default TSS (1 mg/L) (Section 1.3). Percent reduction goals were determined by comparing instream total lead to sample specific criteria calculated using measured instream TSS and hardness (Section 1.3 and 2.0). Permit writers may use measured instream TSS and hardness when developing permit limits when data are available. The unit conversion factor is expressed as (lb-sec-L)/(ug-day-ft^3).

**Calculated using default hardness (25 mg/L) and TSS (1 mg/L) and average daily flow at C-078 (1/1/2000 through 12/31/2022) = 21.9 cfs

1. There are no permitted continuous point source discharges of lead at this time. Future continuous discharges are required to meet the prescribed loading for the pollutant of concern. Future loadings will be developed based upon permitted flow and an allowable permitted maximum lead concentration.
2. Percent reduction goal is based on the maximum exceedance of the chronic lead water quality standard.
3. Percent reduction applies to all NPDES-permitted stormwater discharges, including current and future MS4, construction and industrial discharges covered under permits numbered SCS & SCR. Stormwater discharges are expressed as a percentage reduction due to the uncertain nature of stormwater discharge volumes and recurrence intervals. Stormwater discharges are required to meet percentage reduction or the existing instream standard for pollutant of concern in accordance with their NPDES Permit.
4. By implementing the best management practices that are prescribed in either the SCDOT annual SWMP or the SCDOT MS4 permit to address the pollutant of concern, SCDOT will comply with this TMDL and its applicable WLAs to the maximum extent practicable (MEP) as required by its MS4 permit.

6.0 Implementation

As implementation strategies progress, SCDHEC will continue to monitor the effectiveness of these measures and evaluate water quality where deemed appropriate. The Department recognizes that adaptive management might be necessary to achieve the water quality standard and we are committed to targeting the load reductions needed to improve water quality in the Gills Creek watershed. As additional data and/or information become available, it may become necessary to revise and/or modify the TMDL target accordingly.

6.1 Implementation Strategies

The strategies presented in this document for implementation of the Gills Creek Lead TMDL are not inclusive and are to be used only as guidance. The strategies in this report are informational suggestions that may lead to the required load reductions being met while demonstrating consistency with the assumptions and requirements of the TMDL. Application of certain strategies provided may be voluntary and are not a substitute for actual NPDES permit conditions.

6.1.1 Continuous Point Sources

Continuous point source WLA reductions are implemented through NPDES permitting. Future continuous discharges are required to meet the prescribed loading for the pollutant of concern and demonstrate consistency with the assumptions and requirements of the TMDL. Loadings will be developed based upon permitted flow and the instream criterion concentration for lead.

6.1.2 Intermittent Point Sources

An iterative BMP approach as defined in the general stormwater NPDES MS4 permit is expected to provide significant implementation of the WLAs in this and other TMDL documents. Permit requirements for implementing WLAs in approved TMDLs will vary across waterbodies, discharges, and pollutant(s) of concern. The allocations within a TMDL can take many different forms – narrative, numeric, specific BMPs – and may be complimented by other special requirements such as monitoring.

The level of monitoring necessary, deployment of structural and non-structural BMPs, evaluation of BMP performance, and optimization or revisions to the existing pollutant reduction goals of the Storm Water Management Plan (SWMP) or any other plan is TMDL and watershed specific. It is expected that NPDES permit holders will evaluate their existing SWMP or other plans in a manner that would effectively address implementation of this TMDL with an acceptable schedule and activities for their permit compliance. The Department (permit writers, TMDL project managers, and compliance staff) is willing to assist in developing or updating the referenced plan as deemed necessary. For SCDOT, existing, and future NPDES MS4 permittees, compliance with terms and conditions of the NPDES permit is effective implementation of the WLA to the Maximum Extent Practicable (MEP) and demonstrates consistency with the assumptions and requirements of the TMDL. For existing and future NPDES construction and industrial stormwater permittees, compliance with terms and conditions of the permit is effective implementation of the WLA. Required load reductions in the LA portion of this TMDL can be implemented through voluntary measures and are eligible for CWA §319 grants. More information may be found at the following websites:

https://scdhec.gov/environment/water-quality/stormwater/bmp-handbook

https://www.epa.gov/npdes/npdes-stormwater-program

6.1.3 Nonpoint Sources

South Carolina has several tools available for implementing the non-point source components of this TMDL. The Nonpoint Source Management Plan (SCDHEC 2020) is one example.

Interested parties (local stakeholder groups, universities, local governments, etc.) may be eligible to apply for CWA §319 grants to install BMPs that will implement the LA portions of this TMDL and reduce nonpoint source pollutant loading to the TMDL watersheds. Congress amended the Clean Water Act (CWA) in 1987 to establish the §319 Nonpoint Source Management Program. Under §319, States receive grant money to support a wide variety of activities including the restoration of impaired waters. TMDL implementation projects are given the highest priority for §319 funding.

Pavement, compacted areas, roofs, reduced tree canopy and open space increase runoff volumes that rapidly flow into receiving waters. Runoff can pick up lead contaminated particles and transport them to waterways. The increase in volume and velocity of runoff may cause stream bank erosion, channel incision and pollutant-laden sediment deposition in stream channels. Many strategies exist to reduce stormwater driven pollutant loading from urban runoff and the USEPA nonpoint source pollution website provides extensive resources on this subject:

https://www.epa.gov/nps/nonpoint-source-urban-areas

The most impactful implementation measure will be the remediation of Boyden Arbor Pond, the portions of the Gills Creek watershed adjacent to the munitions ranges on Fort Jackson and the cessation of lead migration off ordnance ranges on Fort Jackson. As discussed in section 3.2.4, the DHEC-led study undertaken in 2021 shows consistently high levels of lead 700 feet downstream from the outlet of Boyden Arbor Pond. This source is covered by Fort Jackson's RCRA permit and studies are being undertaken at this time to characterize the extent of the contamination preliminary to developing a remediation plan.

7.0 Additional Resources for Pollution Management

- Citizen's Guide to Protecting Our Water Resources from Runoff Pollution

  https://scdhec.gov/sites/default/files/media/document/CR-002358.pdf

- Polluted Runoff: Nonpoint Source (NPS) Pollution – EPA's landing page for all things NPS

  https://www.epa.gov/nps

- National Menu of Best Management Practices (BMPs) for Stormwater – Based on the six minimum control measures for Phase I and Phase II MS4s

  https://www.epa.gov/npdes/national-menu-best-management-practices-bmps-stormwater#edu

- South Carolina Forestry Commission Best Management Practices – Includes streamside management, stream crossings, and managing drainage to protect water quality

  https://www.state.sc.us/forest/refbmp.htm#contents

- Clemson Public Service and Agriculture – Center for Watershed Excellence offers professional training for managing stormwater ponds, assessing BMPs, and landscape managing to protect waterways.

  https://www.clemson.edu/public/water/watershed/

- SCDOT Stormwater Management

  https://www.scdot.org/business/storm-water.aspx

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Appendix A: Data Tables

Facilities Reporting Air Lead Emissions to the Toxic Release Inventory (2018-2020)

(Includes all facilities reporting within HUC 03050110 and within 20 miles of the watershed boundary.)

Facility	Reporting Year	Pounds Lead/Year
AKEBONO BRAKE - COLUMBIA PLANT	2018	4.1000
	2019	4.1000
	2020	4.1000
APEX TOOL GROUP LLC - LEXINGTON OPERATIONS	2018	0.0060
	2019	0.0040
	2020	0.0210
ARGOS KEY RD CONCRETE PLANT	2018	0.1100
	2019	0.0500
	2020	0.0800
ARGOS LEXINGTON CONCRETE PLANT	2018	0.0500
	2019	0.0500
CAROLINA CERAMICS INC	2019	8.2400
	2020	6.9400
CMC STEEL SC	2018	497.0000
	2019	407.7700
	2020	434.7200
CONCRETE SUPPLY CO - CAMDEN	2018	0.0037
	2019	0.0038
CONCRETE SUPPLY CO - DOWNTOWN	2018	0.0049
	2019	0.0040
	2020	0.0023
CONCRETE SUPPLY CO LLC BLYTHEWOOD	2018	0.0039
	2019	0.0031
	2020	0.0037
CONCRETE SUPPLY CO LLC-WEST COLUMBIA	2018	0.0037
	2019	0.0039
	2020	0.0049
CONCRETE SUPPLY CO-CALKS FERRY	2018	0.0050
	2019	0.0050
	2020	0.0058
DOMINION ENERGY SOUTH CAROLINA - WATEREE STATION	2018	61.6000
	2019	41.2000
	2020	29.6000

FN AMERICA LLC	2018	1.2135
	2019	9.8300
	2020	9.8300
INTERNATIONAL PAPER CO EASTOVER MILL	2018	54.0000
	2019	55.3100
	2020	53.0900
MICHELIN NA INC	2018	1.4000
	2019	1.2000
	2020	1.0000
NUCOR BUILDING SYSTEMS	2018	0.0200
	2019	0.0200
	2020	0.0200
OAK-MITSUI INC CAMDEN	2018	1.0000
	2019	1.0000
THE SEFA GROUP INC - MCMEEKIN STAR FACILITY	2019	0.6310
	2020	0.6530
TMS INTERNATIONAL LLC	2018	0.0020
	2019	0.0010
US ARMY FORT JACKSON	2018	68.3000
	2019	107.2000
	2020	0.0000

Facilities Reporting Air Lead Emissions Title V (2018-2020)

(Includes all facilities reporting within HUC 03050110 and within 20 miles of the watershed boundary.)

Facility	Reporting Year	Pounds Lead /Year
CMC SOUTHERN POST	2020	0.0020
COIT COMBUSTION TURBINES	2020	0.0107
COLUMBIA ENERGY CENTER	2018	3.8735
	2019	0.4365
	2020	0.4729
DAK AMERICAS LLC COLUMBIA SITE	2018	4.7723
	2019	2.7558
	2020	3.2399
DEVRO INC	2018	0.1525
	2019	0.1434
	2020	0.1240
ENGINEERED COMPOSITES LLC	2020	0.0001

INTERNATIONAL PAPER EASTOVER	2018	49.4666
	2019	50.6563
	2020	48.3553
INVISTA SARL	2018	1.3535
	2019	0.7467
	2020	0.6017
KEMIRA CHEMICALS INC	2020	0.1675
MERIDIAN BRICK LLC - COLUMBIA FACILITY	2020	10.8543
MICHELIN NA US5 & US7 LEXINGTON	2018	1.3561
	2019	1.2164
	2020	0.9626
OWEN ELECTRIC STEEL CO OF SC DBA CMC STEEL	2020	252.3584
OWENS CORNING NON-WOVEN LLC	2020	0.0248
SCE&G MCMEEKIN	2018	3.0679
	2019	3.7625
	2020	5.2331
SCE&G WATEREE	2018	33.6612
	2019	19.2397
	2020	8.0279
SEA HUNT BOAT MANUFACTURING CO INC	2020	0.1192
TIDEWATER BOATS LLC	2019	0.0335
	2020	0.0335
U S SILICA - COLUMBIA PLANT	2020	0.0413
UNIVERSITY OF SOUTH CAROLINA	2020	0.5347
US ARMY TRAINING CENTER AND FORT JACKSON	2020	180.4468
WEYLCHEM US INC	2018	0.9580
	2019	0.3919
	2020	0.3786

USGS Groundwater Sampling

Well ID	Well Depth (ft)	Sample Date	Pb filtered ug/L	Hardness mg/L	Sample Specific Criteria ug/L	Exceedance of Surface WQS?
RIC-572	16.3	8/27/2005	0.707	5.61	0.540968	yes
		8/18/2006	1.89	9.5	0.540968	yes
		8/6/2007	1.63	9.97	0.540968	yes
		9/1/2009	1.66	7.96	0.540968	yes
		8/3/2011	1.65	8.03	0.540968	yes
		8/24/2016	0.85	6.21	0.540968	yes
RIC-563	19.5	8/27/2005	0.484	5.84	0.540968	no
		8/2/2016	0.33	6.04	0.540968	no
RIC-571	53.4	8/15/2006	0.15	9.63	0.540968	no
		8/24/2016	0.14	10.8	0.540968	no
RIC-566	53.3	8/10/2006	76.4	9.55	0.540968	yes
		8/10/2006	73.9	9.68	0.540968	yes
		8/17/2016	0.14	13.8	0.540968	no

RIC-564	24.5	8/15/2006	0.38	5.71	0.540968	no
RIC-582	21.45	8/8/2006	0.35	5.15	0.540968	no
		8/3/2016	0.134	4.35	0.540968	no
RIC-565	13.5	8/22/2006	1.29	6.61	0.540968	yes
		8/4/2016	0.139	3.19	0.540968	no
RIC-573	11.2	8/17/2006	0.52	13.6	0.540968	no
RIC-567	47	8/8/2006	0.39	1.59	0.540968	no
RIC-558	13.85	8/22/2016	0.088	16.7	0.540968	no
RIC-580	8.6	8/23/2016	0.12	19.1	0.540968	no
RIC-584	50.4	8/16/2016	0.45	9.6	0.540968	no
RIC-559	19	8/28/2005	0.165	7.04	0.540968	no
		8/17/2006	0.24	7.68	0.540968	no
		8/7/2007	0.99	8.68	0.540968	yes
RIC-557	23.3	8/23/2016	0.05	8.85	0.540968	no
RIC-581	50	8/17/2006	0.46	7.24	0.540968	no
		9/1/2016	0.17	7.66	0.540968	no
RIC-583	22	8/17/2016	0.16	1.91	0.540968	no
RIC-555	11.7	8/22/2006	0.13	26.7	0.582546	no
		8/9/2011	0.055	17.2	0.540968	no
		8/30/2016	0.19	13.8	0.540968	no
RIC-556	15.4	8/9/2006	0.28	5.47	0.540968	no
		8/17/2016	0.12	10.4	0.540968	no
RIC-561	8.8	8/16/2006	0.17	14.2	0.540968	no
		8/29/2016	0.05	13.6	0.540968	no
RIC-578	33.3	8/11/2006	0.17	2.45	0.540968	no
		8/16/2016	0.02	2.6	0.540968	no
RIC-579	11.1	8/14/2006	1.61	2.9	0.540968	yes
		8/9/2007	1.63	3.33	0.540968	yes
		9/3/2009	0.174	2.83	0.540968	no
		8/8/2011	0.406	4.43	0.540968	no
		8/16/2016	0.11	4.09	0.540968	no
RIC-576	13.1	8/15/2006	0.26	10.3	0.540968	no
		9/2/2009	0.091	5.46	0.540968	no
		8/4/2011	0.1	11.6	0.540968	no
RIC-577	24.2	8/8/2016	0.12	2.09	0.540968	no
RIC-568	54	8/9/2016	0.1	7.31	0.540968	no
RIC-574	24.3	8/23/2006	2.78	2.27	0.540968	yes
		8/15/2016	0.123	3.82	0.540968	no
RIC-575	15.9	8/15/2006	0.9	9.92	0.540968	yes
		8/15/2016	0.05	5.26	0.540968	no
RIC-729	20	8/23/2005	0.486	2.75	0.540968	no
		8/24/2006	0.72	2.63	0.540968	yes
RIC-560	8.75	8/16/2006	0.04	4.55	0.540968	no

SCG830044 Discharge Monitor and Report (DMR) Records for Total Lead

Report Start Date	Monthly Average Limit mg/L	Monthly Average Reported mg/L	Daily Maximum Limit mg/L	Daily Maximum Reported mg/L
1/1/2018	0.00083	0.0085	0.022	0.0085
2/1/2018	0.00083	0.0051	0.022	0.0068
3/1/2018	0.00083	0.0090	0.022	0.016
3/1/2018	0.00083	0.0090	0.022	0.0016
5/1/2018	0.00083	0.069	0.022	0.069
6/1/2018	0.00083	0.0013	0.022	0.0013
7/1/2018	0.00083	0.00052	0.022	0.00052
11/1/2019	0.00083	*R	0.022	*R
12/1/2019	0.00083	*C	0.022	*C
1/1/2020	0.00083	*C	0.022	*C
2/1/2020	0.00083	*C	0.022	*C
3/1/2020	0.00083	*C	0.022	*C
4/1/2020	0.00083	*C	0.022	*C
5/1/2020	0.00083	*C	0.022	*C
6/1/2020	0.00083	*C	0.022	*C
7/1/2020	0.00083	*C	0.022	*C
8/1/2020	0.00083	*C	0.022	*C
9/1/2020	0.00083	*C	0.022	*C
10/1/2020	0.00083	<0.00025	0.022	<0.00025
11/1/2020	0.00083	0.0027	0.022	0.0027
12/1/2020	0.00083	*C	0.022	*C
1/1/2021	0.00083	*C	0.022	*C
2/1/2021	0.00083	*C	0.022	*C
3/1/2021	0.00083		0.022	
4/1/2021	0.00083		0.022	
5/1/2021	0.00083		0.022	
6/1/2021	0.00083		0.022	
7/1/2021	0.00083		0.022	
8/1/2021	0.00083		0.022	
9/1/2021	0.00083		0.022	
10/1/2021	0.00083		0.022	
11/1/2021	0.00083		0.022	
12/1/2021	0.00083		0.022	
1/1/2022	0.00083		0.022	
2/1/2022	0.00083		0.022	
3/1/2022	0.00083	0.000396	0.022	0.00052

4/1/2022	0.00083	0.00057	0.022	0.00057
5/1/2022	0.00083		0.022	
6/1/2022	0.00083		0.022	
7/1/2022	0.00083		0.022	
8/1/2022	0.00083		0.022	
9/1/2022	0.00083		0.022	
10/1/2022	0.00083		0.022	
11/1/2022	0.00083		0.022	
12/1/2022	0.00083		0.022	
1/1/2023	0.00083		0.022	
2/1/2023	0.00083		0.022	
3/1/2023	0.00083		0.022	
4/1/2023	0.00083		0.022	
5/1/2023	0.00083		0.022	
6/1/2023	0.00083		0.022	
7/1/2023	0.00083		0.022	
8/1/2023	0.00083		0.022	
9/1/2023	0.00083	<0.00025	0.022	<0.00025
10/1/2023	0.00083	<0.00025	0.022	<0.00025
11/1/2023	0.00083	<0.0005	0.022	<0.0005
12/1/2023	0.00083	<0.00025	0.022	<0.00025

***C indicates there was no discharge**

***R indicates administratively resolved**

Summary TSS and Hardness Data for TMDL Sites

WQM Site	TSS mg/L			Hardness mg/L		
	Minimum	Average*	Maximum	Minimum	Average	Maximum
C-078	<1	3.2	11	3.9	4.8	5.7

*Averages calculated using detection limit for < DL

Summary Lead and Lead Criteria Data for TMDL Sites

WQM Site	Total Lead ug/L			Criteria and Violations		
	Minimum	Average*	Maximum	Criteria Range ug/L**		Violations/Samples
C-078	<2	4.6	7	2.1	3.0	22/24

*Averages calculated using detection limit for < DL

Appendix B: Criteria Calculations

WQM Site C-078

Sample Date	Total Lead mg/L	Total Lead ug/L	Hardness mg/L	TSS mg/L	CCCd ug/L	CCCtra ug/L	Exceed?
1/27/2021	0.0044	4.4	5.3	4.6	0.54	2.6	yes
2/24/2021	0.0056	5.6	5.2	11.0	0.54	3.0	yes
3/25/2021	0.0041	4.1	4.1	1.4	0.54	2.2	yes
4/20/2021	0.0064	6.4	4.4	4.8	0.54	2.6	yes
5/18/2021	0.0045	4.5	3.9	1.8	0.54	2.2	yes
6/29/2021	0.0056	5.6	4.8	2.9	0.54	2.4	yes
7/28/2021	0.0053	5.3	5.4	3.1	0.54	2.4	yes
8/26/2021	0.0048	4.8	5.2	2.2	0.54	2.3	yes
9/29/2021	0.0035	3.5	4.5	1.8	0.54	2.2	yes
10/27/2021	0.004	4.0	4.2	1.0	0.54	2.1	yes
11/17/2021	0.0025	2.5	4	1.0	0.54	2.1	yes
12/14/2021	0.0031	3.1	4.8	1.2	0.54	2.1	yes
1/26/2022	<0.0020	2.0	5.7	1.0	0.54	2.1	no
2/23/2022	0.0023	2.3	4.6	1.3	0.54	2.1	yes
3/14/2022	0.004	4.0	4.7	2.0	0.54	2.3	yes
4/20/2022	<0.0020	2.0	5.3	2.1	0.54	2.3	no
5/18/2022	0.0058	5.8	5.1	2.3	0.54	2.3	yes
6/13/2022	0.0063	6.3	5.4	4.9	0.54	2.6	yes
7/11/2022	0.0069	6.9	5.1	5.7	0.54	2.7	yes
8/15/2022	0.0063	6.3	4.4	2.6	0.54	2.4	yes
9/27/2022	0.007	7.0	4.7	4.6	0.54	2.6	yes
10/19/2022	0.0049	4.9	4.8	8.1	0.54	2.8	yes
11/16/2022	0.0051	5.1	5	2.6	0.54	2.4	yes
12/13/2022	0.0039	3.9	4.4	1.5	0.54	2.2	yes

Appendix C: Reduction Goal Calculations

To determine the role streamflow may play in lead exceedances, data were sorted by flow occurring on the day the sample was collected. Flows were divided into percentile ranges (0 – 10, 10 – 40, 40 – 60, 60 – 90 and 90 – 100) and the 90th percentile of exceedances in each flow range was calculated. Exceedances are highlighted in yellow. Total lead < DL are entered as 2 ug/L (the DL). Flow zones are shaded. Loads were calculated using the following equation: lbs/day = flow mgd * concentration mg/L * 8.34 lbs/gal

WQM Site C-078

Sample Date	Total Lead ug/L	Adjusted Flow (CFS)	Total Lead lbs/day	Flow Percentile	Percent Exceedance	Maximum Exceedance in Each Flow Category
2/24/2021	5.6	51.7	1.6	8.0%	46.4%	6.4%
7/11/2022	6.9	33.7	1.3	17.0%	60.9%	
1/27/2021	4.4	30.8	0.7	19.8%	40.9%	
4/20/2022	2.0	29.2	0.3	21.2%	-15.0%	
1/26/2022	2.0	27.9	0.3	22.7%	-5.0%	
8/26/2021	4.8	26.4	0.7	24.4%	52.1%	
3/25/2021	4.1	21.9	0.5	30.8%	46.3%	
12/13/2022	3.9	20.4	0.4	33.4%	43.6%	60.9%
12/14/2021	3.1	15.1	0.3	45.6%	32.3%	
11/16/2022	5.1	14.7	0.4	46.6%	52.9%	
3/14/2022	4.0	14.6	0.3	47.1%	42.5%	
7/28/2021	5.3	14.5	0.4	47.3%	54.7%	
2/23/2022	2.3	12.4	0.2	53.9%	8.7%	
4/20/2021	6.4	12.2	0.4	54.5%	59.4%	
6/29/2021	5.6	11.0	0.3	58.8%	57.1%	59.4%
5/18/2021	4.5	10.5	0.3	61.2%	51.1%	
9/29/2021	3.5	9.6	0.2	65.0%	37.1%	
10/19/2022	4.9	8.9	0.2	67.6%	42.9%	
8/15/2022	6.3	8.7	0.3	68.5%	61.9%	
9/27/2022	7.0	7.8	0.3	72.2%	62.9%	
10/27/2021	4.0	7.6	0.2	73.2%	47.5%	
5/18/2022	5.8	6.8	0.2	76.8%	60.3%	
11/17/2021	2.5	6.7	0.1	77.4%	16.0%	
6/13/2022	6.3	5.0	0.2	85.2%	58.7%	62.9%

Addendum:

Additional information (including a new map: Figure 10) was added to section 3.2.2 to clarify the groundwater sampling information. Also, the following sentence was deleted to correct errors and to clarify.

Of the wells in the watershed that have had elevated lead levels (RIC 559, 574, 575, 579, 729) all but RIC 729 had lower levels (below the surface water quality standard) when retested 10 years after the first sampling. RIC-729 was not resampled.

The paragraph now reads:

Of the wells in the watershed that had elevated lead levels all but RIC-572 (located outside of the watershed) had lower levels (below the surface water quality standard) when retested 10 years after the first sampling (RIC-559 and RIC-729 were not resampled). Because of this, it seems unlikely that these aquifers are contributing directly to lead in surface water. Figure 10 shows the lead status after the most recent sampling at each of the sites. A summary of the data and calculations may be found in Appendix A.

Data for RIC-560 was inadvertently left off of the table in Appendix A. It has been added.

Appendix D: Responsiveness Summary

Five sets of comments were submitted during the public notice period which ran from December 14, 2023 through January 15, 2024. Responses to the comments are provided below. They are separated by contributor but numbered consecutively.

Comments from Gills Creek Watershed Association (comments 1 – 3)

Comment 1.

The Draft TMDL holds that Fort Jackson's "compliance with the terms of their Resource Conservation and Recovery Act (RCRA) permit will effectively implement this TMDL." Draft TMDL, p. ii. While Gills Creek Watershed Association fervently hopes this is true, it requests clarification on the progress of this plan as outlined in the Draft TMDL, which states:

> A RCRA Facility Investigation and Corrective Measures Study Plan was *submitted to SCDHEC in May 2022 and conditionally approved July 2022*. The purpose of the study is to further characterize the lead contamination outside the boundary of the firing ranges and identify possible remedial actions and *is currently underway.*

Draft TMDL, p. 17 (*emphasis added*). The Association requests a copy of this plan, as well as clarification on what portions of the study have been undertaken, which portions are underway, and additional information on which portions, if any, of the plan have been finally approved. On a similar note, the Draft TMDL states that to address the lead impairment of Gills Creek:

> The most impactful implementation measure will be the remediation of Boyden Arbor Pond, the portions of the Gills Creek watershed adjacent to the munitions ranges on Fort Jackson and the cessation of lead migration off ordnance ranges on Fort Jackson. As discussed in section 3.2.4, the DHEC-led study undertaken in 2021 shows consistently high levels of lead 700 feet downstream from the outlet of Boyden Arbor Pond. This source is covered by Fort Jackson's RCRA permit and studies are being undertaken at this time to characterize the extent of the contamination preliminary to developing a remediation plan.

Draft TMDL, p. 27. The TMDL leans on Fort Jackson's RCRA permit to limit discharges to obtain the TMDL target but provides no information on the permit to ascertain whether the permit's language is sufficiently specific to implement the TMDL. Gills Creek Watershed Association requests a copy of this permit language and further requests any necessary remediation be ascertained and included as part of this TMDL process. Though no specifics of Fort Jackson's plan have been made publicly available for review with the Draft TMDL, Fort Jackson itself has a document available online that discusses Boyden Arbor Pond, the Fort Jackson Army Cleanup Program Installation Action Plan Final (September 2021), which states in relevant part:

> Professional judgement, regulatory framework, as well as similar sites/constituents provide a basis that [Corrective Measures Implementation (Construction)] and [Corrective Measures Implementation (Operations)] will be necessary. The exit strategy is continuation of [Corrective Measures Implementation (Operations)] until groundwater [Contaminants of Concern] are below applicable cleanup criteria, which will then transfer the site to [Long-Term Management] and provide [Response Complete]. Fort Jackson may request a discontinuation or ramp-down for constituents at specific groundwater

> monitoring locations once [Long-Term Management] demonstrates constituent levels below applicable criteria for a minimum of three sampling events. [Site Closure] can occur once SCDHEC approves the Fort Jackson recommendation for discontinuation of [Long-Term Management]. Because hazardous substances, pollutants, or contaminants will remain at the site at concentrations exceeding levels that allow for [Unlimited Use/Unrestricted Exposure], five-year remedy reviews will continue until [Unlimited Use/Unrestricted Exposure] is achieved.

Fort Jackson Army Cleanup Program Installation Action Plan Final (September 2021).[1]

While it may be true that the remediation of Boyden Arbor Pond is the most impactful aspect of the plan to reduce lead in the Gills Creek Watershed, the Association has questions about the specific CMI(C)/CMI(O) DHEC will require Fort Jackson to implement as part of its RCRA permit. The Association is aware that programmatic environmental assessments have been conducted by the Army to assess the potential environmental effects of modernizing and operating Army small arms firing ranges on previously disturbed ground where the total of disturbed ground would be approximately 40 acres or less.[2] One such study, the Programmatic Environmental Assessment for Modernizing and Operating Training Ranges on Previous or Existing Range Sites on Army Training Areas, states that:

> [C]umulative effects of modernizing and operating a range on the land previously used for an Army range, would not be significant. However, research shows the potential of migration of lead and other metals from spent ammunition on small arms ranges could be significant, unless proper design elements and best management practices are incorporated into a range's design and operation. This effect can be effectively mitigated through engineering design of the range itself and implementation and sustained maintenance of best management practices (BMPs) that reduce or eliminate the risk of erosion from a training range.

Programmatic Environmental Assessment for Modernizing and Operating Training Ranges on Previous or Existing Range Sites on Army Training Areas, pp. iv-v. (internal cites omitted). That document further states that the engineering design solutions and best management practices are identified and discussed in detail in the Army Small Arms Training Range Environmental Best Management Practices (BMPs) Manual[3] and Prevention of Lead Migration and Erosion from Small Arms Ranges.[4]

Though this document repeatedly references Fort Jackson, it does not make clear whether the engineering design solutions and best management practices outlined above have been implemented at the range responsible for lead migration into Boyden Arbor Pond and Gills Creek. Most pressing for the Association are questions of whether Fort Jackson intends for the ranges impacting Boyden Arbor Pond and, consequently, Gills Creek, to continue to be operational as and where they have been historically, or whether those ranges will be relocated to areas with less likelihood of contamination of Gills Creek or any other water. If the ranges are not relocated to a safer area, the Association would like information on what Best Management Practices Fort Jackson intends to implement to ensure the ranges do not continue

[1] Bracketed terms are supplemented from the list of acronyms available on p. 6 of the document.
[2] https://aec.army.mil/application/files/9114/9520/4728/RangePEA.pdf
[3] Army Small Arms Training Range Environmental Best Management Practices (BMPs) Manual (Fabian and Watts, 2005 [available at: https://www.enviro.wiki/images/c/c0/Fabian-2005-Army-Small-Arms-Training-Range-BMP.pdf]
[4] Prevention of Lead Migration and Erosion from Small Arms Ranges (U.S. Army Environmental Center, 1998).

contributing lead to Boyden Arbor Pond and, ultimately, the Creek. The Association also questions what the long-term management of this site will consist of to ensure lead-impairment of Gills Creek is no longer an issue.

Response 1.

The Army has implemented the Operational Range Assessment Program at Ft. Jackson to determine if there is a release or substantial threat of release from on-base ranges. If there is a release off-range at Ft. Jackson, it is subject to the requirements of the RCRA Hazardous Waste Management Permit.

The study currently underway (RCRA Facility Investigation or RFI) is a preliminary step in the effort to determine the next steps appropriate for this site. Upon review of the RFI Report and in accordance with the RCRA permit, SCDHEC will determine if additional investigation and/or a Corrective Measures Study will be required. The fieldwork for the RFI has been completed and SCDHEC is awaiting the submittal of the report.

Identifying the specific corrective measures required to restore Gills Creek is not part of TMDL development. The TMDL is preliminary to restoration. It provides loading targets and calculates the reductions necessary to achieve those targets. These calculations will inform the implementation process which is separate from TMDL development. When finalized and approved, the TMDL will provide the Ft Jackson RCRA program with load reduction goals. How Fort Jackson achieves these reductions is not within the scope of the TMDL.

The Bureau of Water will communicate regularly with the Bureau of Land and Waste Management which manages the RCRA program for the state and we will monitor progress toward achievement of the TMDL target, however Ft Jackson is the lead for Operational Range Management. Additional information regarding the management of the ranges and the Ft. Jackson Operational Range Assessment Program may be requested from Fort Jackson's Directorate of Public Works Environmental Division (803)751-6858.

A copy of the RCRA Facilities Investigative Plan may be obtained by submitting a Freedom of Information Act request via the SCDHEC website: https://scdhec.gov/about-dhec/freedom-information-act-requests. Ask for the Area of Concern (AOC DD) RCRA Facilities Investigation Work Plan.

A copy of the RCRA permit may be obtained by submitting a Freedom of Information Act request via the SCDHEC website: https://scdhec.gov/about-dhec/freedom-information-act-requests. Ask for the Fort Jackson RCRA Hazardous Waste Management Permit (number SC3210020449).

Comment 2.

The Draft TMDL document acknowledges that "[m]uch of the lead found in the developed environment originated from air emissions." Draft TMDL, p. 7. As to air emissions, the Draft TMDL identifies several facilities that reported lead releases to air in the vicinity of the impaired portion of Gills Creek, stating:

> Facilities reporting more than 10 pounds of lead emitted to the atmosphere/year (for any or all of 2018-2020) in the vicinity of the impaired sites include Owens Steel, CMC Steel, Dominion (SCE&G) Wateree Station, International Paper, and Fort Jackson. Prevailing

winds in this area tend to be from the southwest and to a lesser extent the northeast[5] so it is less likely that those facilities to the southeast of the watershed (International Paper and Dominion Wateree Station) are contributing lead to the watershed.

Draft TMDL, p. 13. Gills Creek Watershed Association agrees the geographic locations of Dominion Wateree Station and International Paper make it unlikely these facilities are contributing to the lead impairment in Gills Creek, however, the Association is concerned that the remaining facilities continue to emit lead in the vicinity of the creek in the face of its impairment. While the Association understands the TMDL has no binding effect on air programs, the Association requests strong coordination among DHEC's air and water programs to ensure progress toward the TMDL and ensure these lead-emitting facilities work to reduce lead that could find its way into Gills Creek.

Response 2.

We agree that coordination among Bureaus within the agency is desirable and, in this case, it will be necessary to achieve our goal of water quality improvement in the Gills Creek watershed (see also Response 1).

The study conducted preliminary to drafting the TMDL did not demonstrate lead exceedances anywhere in the watershed except at C-078 and C-001 and we are confident that the source of lead at these sites is upstream flow originating within the boundary of the C-078 watershed. Impacts from air deposition of lead were not evident (for more information, see Response 7).

Comment 3.

As stated above, Gills Creek Watershed Association is committed to restoration, education, and advocacy for the Gills Creek Watershed. This includes the advocacy for environmental justice implications of the chemical releases in Gills Creek. On this point, the Draft TMDL raises a significant environmental justice concern: the human consumption of lead-contaminated fish in the minority and low-income communities located near Gills Creek.

This Draft TMDL has renewed our concerns about the public's consumption of Gills Creek fish. The Environmental Protection Agency recognized the prevalence of subsistence fishing in the watershed in 2015 and awarded Gills Creek Watershed Association a grant to investigate the presence of mercury in the fish the community relied on and communicate those findings to the Arthurtown, Washington Park, Little Camden, Starlite, Eastway Park, Sims, and Bluff Estates communities. While the Association worked tirelessly to protect these communities under the grant it received and, to this day, does what it can advise the community not to eat from Gills Creek, we have been advised Gills Creek is still used for recreational fishing and those fish are used for human consumption by minority and low-income communities.

DHEC is well-aware that the continuous human exposure to lead can lead to brain damage, digestive problems, reproductive and kidney damage and learning disabilities in children.[6] The Draft TMDL acknowledges that lead is toxic to all aquatic life and that bioaccumulation of lead may occur when larger animals feed in and around lead-contaminated waters (*i.e.,* fish in lead contaminated waters may have bioaccumulated lead and any animals—including humans—who eat those fish are subject to lead exposure through those fish). Draft TMDL, p. 7. DHEC's 2022 Monitoring Strategy stresses core and supplemental water quality indicators as monitoring activities for section 303(d) of the Clean Water Act.

[5] https://www.wcc.nrcs.usda.gov/ftpref/downloads/climate/windrose/ [available at: https://apps.dtic.mil/sti/pdfs/ADA352254.pdf]

[6] South Carolina Department of Health and Environmental Control. (n.d.). *SCDHEC Lead Overview*. scdhec.gov. https://scdhec.gov/environment/your-home/lead-overview

Section 303(d) governs TMDLs. According to the strategy, a core set of indicators usually includes physical, chemical, and *biological* measurements of a waterbody. DHEC 2022 Monitoring Strategy, p 9. Core indicators that may be routinely collected include Lead for Aquatic Life Use Support and Mercury in Fish Tissue for Fish Consumption. DHEC 2022 Monitoring Strategy, p. 10. According to the 2022 Monitoring Strategy, DHEC has the capability to conduct macroinvertebrate bioassessments for special studies:

> Special studies are conducted as needed and are normally completed in order to evaluate potential perturbation from point source or non-point source events. Examples include chemical releases, oil spills, forestry activities, or development activities. These studies usually involve comparing an upstream control station with a station downstream of the potential impact. These studies can be a one-time event or they may continue over a period of months or years.

DHEC 2022 Monitoring Strategy, p. 29. The Strategy goes on to state that "[t]he collection of fish for the purpose of tissue analysis is necessary to detect the presence and levels of heavy metals, pesticides, and toxic organic compounds in edible tissue that may concentrate through aquatic food chains and threaten the health of human consumers." DHEC 2022 Monitoring Strategy, p. 29.

Based on the parameters laid out in the 2022 Monitoring Strategy, the Gills Creek Watershed Association believes that the fish in Gills Creek pose a threat to the health of human consumers and request DHEC establish a special study[7] to conduct lead sampling in fish tissue in the Gills Creek Watershed. While DHEC has not specifically identified C-078, near Boyden Arbor Lake, as impaired for fish consumption, the agency has previously identified site C-068, in Forest Lake, for fish consumption in the Gills Creek Watershed Management Plan.[8] Due to the proximity of these two waterbodies, the Gills Creek Watershed Association believes DHEC should consider that fish consumption also occurs in the vicinity of the new C-078 site as it does in C-068 and much of the Gills Creek Watershed. While the Association is especially concerned about the fish located near or downstream of the new C-078 site and requests a study focused on that area, it would welcome a broader study of the Watershed since DHEC has already established that there is lead coming from a variety of sources. Draft TMDL, pp. 10-11, 13-15; *see also* Section 2, *supra.*

We therefore ask DHEC to consider collecting samples of the aquatic wildlife to provide surrounding communities and the Association with an updated study of the lead levels contained in fish tissues to protect the human health of the communities surrounded by Gills Creek. We also request DHEC lend any support it can to a renewed public information campaign.[9]

Response 3.

> In January 2020, DHEC published A Review of Lead in Surface Waters which included a statewide survey of lead in fish tissue. Section 4.2 of this document refers to the work the agency did to determine, based on the data collected, whether there was a risk and, therefore, a need for fish

[7] The Gills Creek Watershed Association acknowledges that SCDHEC previously conducted a lead contamination study in fish however, that study (1) did not include the Gills Creek Watershed, and (2) made broad conclusions regarding the safety of fish consumption throughout the entire state based on an inadequate sample size given the geographic size of the study, which included 2,094 samples of varying species from 151 sites statewide, over a 12 year period. An average of 1.16 fish per site per year. There is no recorded site-specific breakdown of the data. https://scdhec.gov/sites/default/files/media/document/final_Pb_report_w_annexes_jan_2020_0.pdf, pg.16.

[8] Gills Creek Watershed Management Plan (referenced on page 24 of the Draft TMDL and available at https://columbiascwater.net/wp-content/uploads/2020/10/Gills-Creek-Watershed-Plan-2020.pdf, p. 44).

[9] We are aware that on November 8, 2023, DHEC awarded $1 million in grant funds from the U.S. Environmental Protection Agency (EPA). DHEC committed those funds to develop disaster resiliency plans and build capacity to better prepare for, respond to, and recover from disasters such as hurricanes, flooding, pandemics and chemical releases. Gills Creek Watershed should be no exception in receiving relief from chemical releases.

consumption advisories due to lead. To date, there are no locations that have been tested that would need a fish consumption advisory for lead as noted in the Summary for Section 4.2, found at the top of page 28 of the PDF (page 23 of the report):

> "The screening analysis of incidental and occasional ingestion of fish from the State's surface waters relative to lead did not indicate realistic concerns. The upper-end exposure scenarios (e.g., more frequent meals; all fish contained the maximum level observed) used were conservative (i.e., erring on the side of being health protective) and not completely plausible to occur in actual life circumstances. When more realistic scenarios comprising less frequency and duration of exposure (i.e., the lower end of the scenario band) were considered, consumption of fish was not indicated to be of concern relative to the lead dataset that is the subject of this report."

Prior to the Gills Creek lead study initiated 1/2021, the Bureau of Water had current stream lead data in Gills Creek watershed at two locations: RS-09323 in the upper northwestern part of the watershed, which met the water quality standard for lead, and C-017 at the bottom of the watershed, which violated the water quality standard for lead. The magnitude and frequency of the stream water lead violations at C-017 were not meaningfully different than the other waters in the state that had also shown violations of the stream water quality standard for lead. This observation — plus the statewide conclusion of the 2020 lead study that none of the waters tested for lead in fish tissue across the state were considered a realistic risk to human health — suggested there was no cause for alarm about fish tissue levels in Gills Creek at that time.

Analysis of the water quality data collected for the Gills Creek lead study shows that the situation in Gills Creek at C-078 is unique to that site and we recognize that additional study is necessary to determine any health risks from consuming fish in this area. The high frequency of water quality standard violations for lead found at C-078, as cited in the draft TMDL, suggests a more persistent problem, including the potential for greater accumulation in fish tissue. The Bureau of Water is currently considering launching a study to collect fish tissue lead level data in Gills Creek watershed to determine the risk to human health. We also understand the importance of communicating the resulting information to the citizens who fish in the watershed. Achieving environmental justice is a focus area of our TMDL program. We meet regularly with our environmental justice coordinators and we will work with our Watershed Managers and Aquatic Sciences program as well to make certain that the results of any fish tissue study undertaken are made available to the public.

Comments from Congaree River Keeper (comments 4 – 7)

Comment 4.

The Department's lead investigation identified Fort Jackson, specifically Boyden Arbor Pond and the nearby munitions ranges, as the likely source of lead impairment for Gills Creek. As such, significant emphasis in the TMDL has been placed on the Fort's RCRA permit and associated Corrective Measures Study Plan. We recommend that the Department and the Fort provide more information to stakeholders and the public on the changes to the RCRA permit and the corrective measures to ensure steps are being taken to address this issue and the TMDL will be effective. Convening a public meeting and creating a specific resource page on the DHEC website would be reasonable efforts towards that end.

Response 4.

We agree that keeping the public informed on this issue is important. This TMDL is a step in this process. Additional studies are needed (see Response 3) and as data become available we are committed to making them available to the public.

See also Response 1 for more information on accessing the RCRA permit and RFI information.

Comment 5.

Many people in the community fish in Gills Creek, including people who regularly consume those fish and/or provide them to their families. We recommend that the Department, along with the Fort, conduct fish tissue sampling for lead (and other contaminants that may be a concern for fish consumption) along Gills Creek. The Department should also work to educate the community about the results of that study, and the risks of consuming contaminated fish.

Response 5:

Please see Response 3 above.

Comment 6.

The TMDL mentions addressing lead reduction through the use of BMPs as required by local MS4 permits. To accomplish this the Department must ensure that MS4 permits are updated and approved in a timely fashion, which has not historically been the case.

Response 6.

SCDHEC is committed to issuance of MS4 permits that address the discharge of lead, and other pollutants, to achieve TMDL pollution reduction goals. We are placing focus this year on reissuance of expired, yet administratively continued, individual MS4 Permits. This includes those for the City of Columbia and Richland County. SCDOT's statewide MS4 permit was recently reissued and will become effective on March 1, 2024.

MS4 permits will include mandates for regulated dischargers to assess their individual contributions of lead into Gills Creek and subsequently develop and implement best management practices (BMPs) to achieve the wasteload allocation specified in the TMDL.

Comment 7.

The TMDL discusses potential air sources of lead, specifically referencing permitted air discharges. The TMDL does not mention more diffuse air sources such as the use of leaded gas. While leaded gas was phased out in cars, it is still often used in small aircraft, and there is a small airport in the Gills Creek watershed. The TMDL should discuss the potential of this source of lead and how to eliminate it.

Response 7.

The draft TMDL document discusses leaded fuel use in section 3.0 although it did not specifically reference its use in aircraft. EPA has determined that aircraft using leaded fuel are a source of lead emissions to air. EPA and FAA are working together to eliminate the use of leaded fuel in aircraft by 2030 (https://www.epa.gov/newsreleases/lead emissions from aircraft engines).

Air deposition is not believed to be a significant source of lead in the TMDL watershed based on sampling results from 2020 through 2022. The sampling site closest to Owens Airport (C-079 – Plowden Road) had no results above the detection limit for lead. This site was specifically located to capture runoff from the area around the airport as well as a former phosphate fertilizer manufacturing site that was located nearby. The next downstream station (C-017 – Bluff Road) had only 9 out of a total of 32 samples tested that were greater than the detection limit for lead. None of the 9 samples with lead detections violated the lead water quality standard. These results support the hypothesis that the source of lead in this watershed is upstream of C-078 at Percival Road, rather than air sources.

Comments from Friends of Congaree Swamp (comments 8 – 10)

Comment 8.

Friends of Congaree Swamp has reviewed the draft TMDL document for Gills Creek, for lead-impaired Water Quality Monitoring Site C-078. We support SCDHEC's target recommendation for a 62.9% reduction in lead. Issues with lead contamination, outside historical studies, were brought to light by sampling in 2013 as part of the ORAP (Operational Range Assessment Program) at Fort Jackson. Evidence of lead contamination was found both in Boyden Arbor Pond and Gills Creek upstream of the pond. Based on the evidence of lead contamination, Boyden Arbor Pond on Fort Jackson property has been added to the fort's Resource Conservation and Recovery Act permit.

SCDHEC had considered establishing TMDL for lead at other sampling sites in the Gills Creek watershed, but sampling in 2021-2022 proved inconclusive. C-078 was included in the 2021-2022 study because it was downstream from a known source, and was found to violate the lead standard for 22 of 24 monthly sampling events during the study period. We studied SCDHEC's review of possible continuous and intermittent point sources and non-point sources for the pollution, and largely agree with analysis that eliminates several possible candidates (airborne pollution, known point sources, etc) as sources of the contamination. We did have concerns that a groundwater analysis based only on groundwater wells outside Fort Jackson (numerous as they are) could reliably be used to conclude that groundwater contamination will not be an ongoing concern.

Response 8.

We agree that uncertainty remains about the contribution of lead from groundwater to surface water upstream of C-078. Based on the analysis of available data it appears to be an unlikely source elsewhere in the watershed, however.

The RFI work plan and previous studies on the Fort identified erosion of lead contaminated soils during rain events as the primary means of lead transport from the munitions ranges to Gills Creek (UFP-QAPP for RFI Work Plan 45455.1058/FTJA-42 (AOC DD), Fort Jackson, South Carolina, May 2022), rather than migration through groundwater. Thus, the focus of this TMDL is on surface water.

Comment 9.

As noted in the report, Fort Jackson has firing ranges onsite, and review of aerial imagery suggests that the extant Ranges 1-13 have been in place since at least the 1950's (the study indicates small arms ranges have been in place as early as the 1940's). Two tributary streams of Gills Creek flow through the firing ranges—Mack Creek between Range 1 and Range 2 and Rowell Creek between Range 6 and Range 7. We

agree with SCDHEC's conclusion that the firing ranges are a likely source of the lead contamination at C-078.

We have submitted a Freedom of Information Act request to SCDHEC for more information on lead contamination studies Fort Jackson has submitted as part of its RCRA permit but could not receive the documents in a timely fashion. We will submit supplemental comments upon receipt and study of these documents. In addition to a study of lead contamination, we would request that studies be conducted for other metals possibly associated with the firing range (including Copper and Zinc) to see whether TMDL's should be developed for these metals as well.

Response 9.

Available data from SCDHEC show that there have been two violations of the copper standard at C-001, one on 5/15/2001 and one on 8/28/2006. The zinc standard was violated at C-001 on 5/15/2001 as well. Monitoring for copper and zinc at this site was discontinued in 2006. These violations were not sufficient for listing the site on the 303(d) list with impairments for copper or zinc. Farther downstream at C-017, there have been no violations of the copper or zinc standard from 1999 through 2023.

Copper and Zinc were included for sampling under the RFI Workplan. Once SCDHEC reviews the RFI Report, a determination will be made regarding the need for additional investigation and/or a Corrective Measure Study for copper and zinc.

The Bureau of Water is considering additional sampling for copper and zinc in the watershed along with ongoing monitoring for lead. We will consider developing TMDLs for these pollutants if impairments are discovered.

Comments from Fort Jackson Stormwater Manager (comments 11 – 18)

Comment 11.

Section 1.2, paragraph 1, sentence 7 states that "Gills Creek is dammed to form Boyden Arbor Pond at the southeastern boundary of the Fort." This is incorrect. This location is on the western boundary of Fort Jackson.

Response 11.

The document text was corrected to read: Gills Creek is dammed to form Boyden Arbor Pond at the western boundary of the Fort.

Comment 12.

Section 3.1.2, paragraph 3, sentence 1 states that "In addition to the MS4 permit coverage depicted in Figure 5…". The Figure 5 legend and header imply that the yellow shaded area depicts Fort Jackson's MS4 permit coverage. This is incorrect. Fort Jackson is responsible for the yellow shaded area but most of it is not covered by Fort Jackson's MS4 permit. Fort Jackson's MS4 permit is for the urbanized area only. Please revise the verbiage or the shading.

Response 12.

A clarifying sentence was added to the document: Fort Jackson's MS4 permit covers the urbanized area within the Fort. The figure caption and legend were edited to emphasize that the map shows areas of responsibility.

Comment 13.

Section 3.1.2, paragraph 6 (top of page 12), sentence 4 states that "There is one industrial facility in the watershed in a sector that requires benchmark monitoring for lead, Fort Jackson (Figure 5). This is incorrect. Fort Jackson does not have an industrial facility in the watershed that requires benchmark monitoring for lead.

Response 13.

The industrial stormwater permit held by Fort Jackson (SCR001898) covers a facility in sector N (scrap recycling facilities). In general, sector N facilities have benchmark monitoring for lead. The recyclables at this Fort Jackson facility are "source separated" (materials are grouped by type rather than random when received) so they do not have a lead benchmark.

The document text was corrected to read: Fort Jackson holds an industrial stormwater permit for a recycling facility in sector N (SCR001898). In this facility, the recyclables are "source separated" which means that they are separated by type when received. This eliminates the requirement for benchmark monitoring. The map (Figure 5) was edited to remove the facility location.

Comment 14.

Section 3.2.2, paragraph 1, sentence 5 states that "The petroleum contamination at this site was a result of leaking underground storage tanks and overfills at an abandoned fueling station, and it is possible that leaded fuels …". This is incorrect. The petroleum contamination is a result of an underground storage tank that was punctured during removal. There is no evidence that it is a result of overfills. The station is still active, it is not abandoned. Only unleaded gasoline was used at this station.

Response 14.

According to SCDHEC records, three 10,000-gallon underground storage tanks (UST) that held gasoline were removed from the ground at this site in May 2001. The type of gasoline they held is not available in the records. The tanks were first reported to be in operation in October 1991. A tank closure report received July 16, 2001, found groundwater and soil contamination indicating a release from the referenced UST system. The tank closure report does not include details of a tank puncture during removal. Assessment and groundwater monitoring records dating back to April 2002 do not indicate that groundwater was impacted by lead, however this release is still under active monitoring and remediation for other petroleum Chemicals of Concern.

Currently there are three 12,000-gallon tanks holding regular unleaded gasoline and one 12,000-gallon tank with super/premium gasoline at this site. These tanks were first reported to be in operation in September 2001. An assessment report received by the Bureau of Land and Waste Management (BLWM) June 03, 2021, in response to a regulatory compliance issue, indicated a release from this UST system. A No Further Action for the release was issued by BLWM on January 22, 2024.

Separately, in March of 2021, SCDHEC Bureau of Water received a request for a speculative waste load calculation for a site-specific NPDES permit for groundwater treatment at this facility. The wasteload was requested to determine discharge limits preliminary to designing an upgrade to the existing dual-phase extraction system (DPE). Analytical data collected from the existing DPE treatment system at this site was submitted along with this request. This analysis showed an influent dissolved lead concentration of 35 ug/L, much higher than the surface water quality standard for chronic dissolved lead ($CCC_{dissolved}$) of 0.54 ug/L (which assumes a hardness of 25 mg/L). According to discharge monitoring reports, the discharge violated the monthly average permit limit for lead of 0.83 ug/L six times and the daily maximum of 22 ug/L one time. These violations occurred in 2018 and 2020. There have been no violations of the lead permit limit reported since this time.

Because the filling station is still in operation and it is not clear what caused the release, the statement that the contamination was caused by "leaking underground storage tanks and overfills at an abandoned fueling station" was removed from the document. Even though this facility is downstream of the TMDL site C-078, we believe that evidence of lead in the groundwater in this area is relevant to the TMDL source assessment. SCG830044 DMR data for lead were added to Appendix A and the following sentence was added to the document:

The permit includes total lead limits that are protective of the stream. These limits were violated 6 times during 2018 and once in 2020, but no violations have been reported since then. See Appendix A for discharge monitoring reporting (DMR) data for this site.

Comment 15.

Section 3.2.2, paragraph 2, sentence 5 states that "Figure 8 illustrates the location of the USGS…". The correct reference is Figure 9.

Response 15:

The reference to the figure was corrected in the document.

Comment 16.

Section 3.2.4, paragraph 1, sentence 4 states that "The Department of Defense manages munitions ranges…". The Operation Range Assessment Program does not "manage" munitions ranges, it "assesses" them.

Response 16.

The wording was changed to read: The Operational Range Assessment Program (ORAP, https://denix.osd.mil/orap/) assesses munitions ranges, determining if there is release of munitions constituents off the range site that may prove a risk to human health or the environment.

Comment 17.

Section 3.2.4, paragraph 2, sentence 1 states that the "The study conducted by DHEC in 2021 through 2022 also points to the likelihood of lead contamination at C-078 originating from Boyden Arbor Pond on Fort Jackson." As stated throughout the document, the likely source is the munitions ranges. We suggest replacing the word "originating" with "flowing".

Response 16:

The word 'originating' was replaced with 'flowing'.

Comment 18.
Section 3.2.4, paragraph 3, sentence 3 states that "A RCRA Facility Investigation and Corrective Measures Study Plan was submitted…". This is incorrect. A RCRA Facility Investigation Work Plan was submitted to SCDHEC in May 2022 and conditionally approved July 2022. In accordance with the RCRA permit, SCDHEC will determine if a Corrective Measures Study is required after reviewing the RCRA Facility Investigation Report.

Response 18.

The sentences were changed to read as follows: A RCRA Facility Investigation Work Plan was submitted to SCDHEC in May 2022 and conditionally approved July 2022. This study will further characterize the lead contamination outside the boundary of the firing ranges. Upon review of the results of this study, DHEC will determine if a Corrective Measures Study is required.

Comments from Chauncey Orr, EPA Region 4 303(d)/TMDL Coordinator (comments 19 – 23)

Comment 19.
From the abstract: In addition, for Fort Jackson, compliance with the terms of their Resource Conservation and Recovery Act (RCRA) permit will effectively implement this TMDL.
Are the terms of the current permit protective of WQS? Does the permit need to be modified to include reductions implemented in the WLA of this TMDL?

Response 19.

In conducting RCRA Corrective Action at Ft. Jackson, DHEC follows USEPA guidance for RCRA Corrective Action and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) risk-based decision-making. Part of that process includes consideration of South Carolina Regulations 61-68 and 61-69. The Bureau of Land and Waste Management will continue to coordinate reviews with the Bureau of Water TMDL program.

Once DHEC receives the RCRA Facilities Investigation, we will make a determination of the need for further investigation and/or a Corrective Measures Study to evaluate potential Corrective Actions. Pursuant to the RCRA Permit, once a Corrective Measures is recommended, it will be incorporated into a Draft Permit. The Draft Permit will be put out for public notice pursuant to R.61-79 prior to finalizing a Permit decision.

Comment 20.
From section 1.3: The following describes the calculation of sample specific chronic criteria using hardness and TSS for lead:

$CCC_{dissolved} = \exp\{m_c * [\ln(\text{hardness})] + b_c\} (CF)$
where:
$CF = 1.46203 - [(\ln(\text{hardness}) (0.145712)]$
$m_c = 1.273$
$b_c = -4.705$
$CCC_{tra} = CCC_{dissolved} * [1 + (K_p * TSS * 10E\text{-}6)]$

where:
$K_p = K_{po}*(TSS)^a$
K_{po} = 2.08E+6
a = -0.8
Only CCC was defined above. Please define the remaining variables.

Response 20.

The following definitions were added to the text:
CF: freshwater conversion factor (chronic)
m_c and b_c: empirical hardness coefficients for lead
ln: natural log
K_{po}: calculated default metal specific partitioning coefficient
a: constant for lead

Comment 21.

Please include the percent reduction in section 5.2.2.

Response 21.

The following was added to 5.2.2: The percent reduction goal for intermittent point sources is 62.9% (Table 7).

Comment 22.

Please include the complete LA equation/expression and include the reductions in section 5.3.

Response 22.

The following was added to 5.3: 0.24 lbs/day (TMDL) – 0.024 lbs/day (MOS) – 0 lbs/day (WLA) = 0.22 lbs/day (LA)

Comment 23.

From section 5.3.1: The outflow from Boyden Arbor Pond does not fit neatly into the standard categories typically seen in TMDL tables. The lead in the pond is likely the result of ordnance-related contaminants migrating from the munitions ranges upstream via nonpoint source means, subject to the LA. Fort Jackson is covered by an MS4 permit, and some lead in the pond may have arrived there through stormwater conveyances which then makes it subject to the WLA. Ultimately, it would appear to be subject to both, and the LA load and the percent reduction goal at C-078 should be used to guide TMDL implementation efforts at this site.
This statement implies there may be some unpredictability in where the lead on Fort Jackson derives from. Please consider revising.

Response 23.

This paragraph describes the uncertainty in the *route* through which the ordnance contaminants migrated to the pond and how this uncertainty relates to TMDL allocations (intermittent point source (WLA) vs nonpoint source (LA)). The second sentence states the likely *source*: “the lead in the pond is likely the result of ordnance-related contaminants migrating from the munitions ranges upstream”.