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REMEDIAL INVESTIGATION WORK PLAN ADDENDUM FOR SITE 27 EQUIPMENT PARADE DECK DRAFT ACTING AS FINAL MCRD PARRIS ISLAND SC

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TETRA TECH NUS

Comprehensive Long-term Environmental Action Navy

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RI Work Plan Addendum for Equipment Parade Deck - Site 27

Marine Corps Recruit Depot
Parris Island, South Carolina

Contract Task Order 0039

July 2008

U.S. EPA Identification Number SC6170022762

NAVFAC
Naval Facilities Engineering Command
Southeast
Naval Air Station
Jacksonville, Florida

TETRA TECH NUS, Inc.

REVISION 0
JULY 2008

RI WORK PLAN ADDENDUM
for
EQUIPMENT PARADE DECK - SITE 27

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PARRIS ISLAND, SOUTH CAROLINA
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COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
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Southeast
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Submitted by:
Tetra Tech NUS, Inc.
661 Andersen Drive
Foster Plaza 7
Pittsburgh, Pennsylvania 15220

CONTRACT NUMBER N62467-04-D-0055
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PREPARED UNDER THE SUPERVISION OF:	APPROVED FOR SUBMITTAL BY:
MARK SLADIC TASK ORDER MANAGER TETRA TECH NUS, INC. PITTSBURGH, PENNSYLVANIA	DEBRA M. HUMBERT PROGRAM MANAGER TETRA TECH NUS, INC. PITTSBURGH, PENNSYLVANIA

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1.0 INTRODUCTION

This Remedial Investigation (RI) Work Plan Addendum for field activities at Site 27, Marine Corps Recruit Depot (MCRD) Parris Island, South Carolina has been prepared by Tetra Tech NUS, Inc. (TtNUS) for Naval Facilities Engineering Command Southeast (NAVFAC SE) under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Program, Contract Number N62467-04-D-0055, Contract Task Order (CTO) 0039. This Work Plan Addendum outlines the requirements and describes the procedures for performing Phase II of the RI at Site 27. It is intended for use in conjunction with the Master Work Plan, Volumes I, II, and III for MCRD Parris Island [Brown & Root Environmental (B&R Environmental), 1998] with updated Standard Operating Procedures (SOPs). Phase I of the RI was completed in October 2007.

MCRD Parris Island is located along the southern coast of South Carolina, approximately 1 mile south of the City of Port Royal and 3 miles south of the City of Beaufort within Beaufort County. MCRD Parris Island covers approximately 8,047 acres and consists of dry land, salt marshes, saltwater creeks, and ponds, as shown on Figure 1-1. MCRD Parris Island is the reception and recruit training facility for the Marine Corps for enlisted men from states east of the Mississippi River and for enlisted women nationwide.

1.1 SCOPE AND OBJECTIVES

MCRD Parris Island identified a need for a military construction project at Site 27. Site 27, the Equipment Parade Deck Satellite Accumulation Area (SAA), is a 1-acre asphalt-covered area located in the northwestern portion of MCRD Parris Island. Its former use was as a parade ground, but the area is currently used for storage of miscellaneous equipment. Soil sampling in 1995 indicated volatile organic compound (VOC), semivolatile organic compound (SVOC), pesticide, and inorganic soil contamination. The Fiber Optic Vault (Site 55) is located to the southeast and upgradient of Site 27. At Site 55, groundwater contamination (pesticides and VOCs) was detected at three different depth horizons in 2002, and in 2004, it was found to extend under Site 27. Site 55 was identified only because of groundwater contamination detected during construction to install an underground utility vault and the actual release mechanism remains unknown. The more likely sources for the pesticides in groundwater may have been Site 9 and Site 16 to the east, which have a history of pesticide operations. However, based on the results of Phase I of the RI, these sites do not appear to be the source of groundwater contamination. To characterize the groundwater contamination under Site 27, the geographic area of the investigation includes Sites 9, 16, 27, and 55.

Site 55 - Fiber Optic Vault is a concrete vault installed in September 2001 in the northwestern portion of MCRD Parris Island. Site 27 - Equipment Parade Deck, formerly a parade ground, is an equipment storage area where transformers containing polychlorinated biphenyl (PCB) oils were stored on a concrete pad located approximately 400 feet northwest of Site 55. Site 9 - Paint Waste Storage Area, which was utilized from 1969 to 1984, and Site 16 - Pesticide Rinsate Disposal Area, operated from 1950 to 1977, are located approximately 400 feet northeast of Site 55.

As a result of previous investigations at these sites (described further in Section 2.0), the following objectives were developed to support Phase I of the RI:

- Determine the extent of groundwater contamination associated with Sites 9, 27, and 55.
- Determine whether any releases at Site 16 and/or Site 27 have impacted groundwater, and if so, to what extent.
- Determine the sources of groundwater contamination at these sites.
- Determine the extent of soil contamination in the Site 27 area in support of a remedial action.
- The delineation portion of this investigation for Sites 9 and 16 soils was deferred until the Sites 9, 16, 27, and 55 Remedial Action Work Plan.

Phase I of the RI included collection of groundwater samples in the Sites 9/16/27/55 area and the collection of soil samples in the Site 27 area in October 2007. Phase I of the RI was originally designed to collect screening data via temporary wells and to be quickly followed up by Phase II installation of permanent monitoring wells at locations identified in consultation with the United States Environmental Protection Agency (U.S. EPA) and the South Carolina Department of Health and Environmental Control (SCDHEC). However, the October 2007 data, along with the historical data from this area, indicated VOCs and pesticides in groundwater samples at concentrations that may present an unacceptable risk (i.e., greater than risk-based screening criteria) at locations that were not expected. As a result, the source of the contamination has not been identified, and the extent of contamination has not been completely delineated. Consequently, additional groundwater samples are being proposed as part of Phase II of the RI for Site 27. Additional soil samples will also be collected as part of the Phase II investigation to try to identify possible source areas.

The proposed samples, in conjunction with the existing data, are intended to meet the following objectives:

- Define the extent of the pesticide contamination in groundwater
- Define the extent of the chlorobenzene (and other VOCs) contamination in groundwater
- Determine if there is a soil source of pesticides and VOCs in the Site 27/Site 55 area

The proposed scope of Phase II of the RI includes collection of groundwater samples from three zones of the surficial aquifer in the vicinity of these sites and soil samples at possible source areas at these sites. The data, in conjunction with the historical data, will be used to determine the nature and extent of groundwater contamination and will be used in support of a risk assessment and evaluation of remedies. The investigation is being conducted in support of future construction activities in the Site 27 area, and therefore, this Work Plan Addendum has been developed for Site 27, although adjacent sites (9, 16, and 55) are also being investigated as part of the proposed work.

1.2 PLANNING DOCUMENT ORGANIZATION

This Work Plan Addendum is intended to be used in conjunction with the Master Work Plan for MCRD Parris Island (Volumes I through III) and references the Master Work Plan where appropriate. This Work Plan Addendum includes the site-specific information to be used for sampling at Site 27 (including Sites 9, 16, and 55), and the Master Field Sampling Plan (FSP) and Master Quality Assurance Plan (QAP) provide general information applicable to all sites at MCRD Parris Island. Sections 1.0 through 3.0 of this site-specific Work Plan Addendum identify the project scope and objectives, summarize background information and existing data, and present the proposed sampling. Sections 4.0 and 5.0 are the site-specific field work and sampling plans. Sections 6.0 through 8.0 of this document describe the quality assurance (QA)/quality control (QC) measures for ensuring that usable data are obtained.

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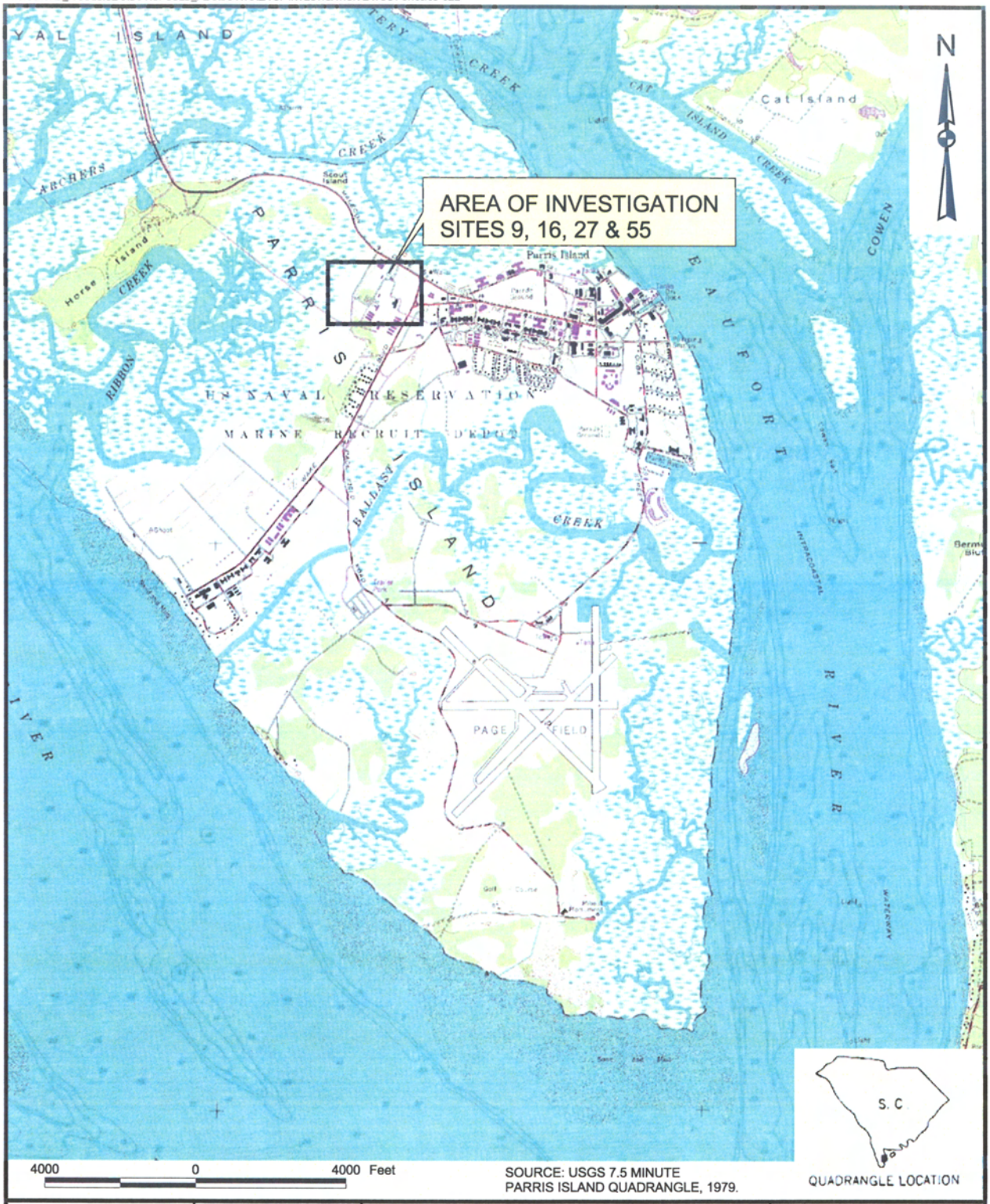


QUADRANGLE LOCATION

SOURCE: USGS 7.5 MINUTE
PARRIS ISLAND QUADRANGLE, 1979.

DRAWN BY K. MOORE	DATE 11/16/06	DEPOT & SITE LOCATION MAP MCRD PARRIS ISLAND PARRIS ISLAND, SC	CONTRACT NUMBER 0039
CHECKED BY G. ZIMMERMAN	DATE 07/09/08		APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED	NAVFAC		DRAWING NO. FIGURE 1-1 REV 0

2.0 SITE BACKGROUND

This section presents a brief history of the sites under investigation, current site conditions, previous investigations, and the basis for the current investigation. The data quality objectives (DQOs) for the current investigation are provided in Section 2.5 to determine what data are necessary to meet the goals of the RI, which are to determine the nature and extent of contamination and to conduct a risk assessment.

2.1 DESCRIPTION AND HISTORY

Site 27, the Equipment Parade Deck SAA, is a 1-acre asphalt-covered area formerly used as a parade ground and is currently used for storage of miscellaneous equipment (Figure 2-1). For an unknown length of time, this site has been an area where out-of-service storage tanks, concrete cylinders, boilers, scrap metal, and piping were stored until suitable facilities for hauling, storage, or destruction of the materials were found. An unknown amount of hazardous materials were handled on the Parade Deck, possibly including waste petroleum products and metals. Additionally, transformers containing PCB oils were reportedly stored in the northern portion of the Equipment Parade Deck; however, the exact location is not known. The asphalt is cracked or deteriorated in several areas, potentially allowing contaminants to enter underlying soil.

Site 9, the former Paint Waste Storage Area, was utilized from 1969 to 1984 to store wastes from the Paint Shop. At that time, the area was a 20-foot by 60-foot unpaved site located in the northwestern corner of Parris Island, between Quonset Hut N277 and Building 895 (Figure 2-1). While Site 9 was active, personnel from the Paint Shop placed liquid paint wastes and paint strippers in 55-gallon and 330-gallon storage drums. The paint wastes generally consisted of mineral spirits, kerosene, and diesel fuels, and the paint strippers were likely methylene chloride. The wastes were accumulated in the drums, and the drums were periodically transported to a waste oil facility. This practice continued until 1978, when a contractor began to dispose of the wastes at an off-base incinerator site. Between 1969 and 1984, an unknown amount of paint wastes may have been spilled at the storage area. In 1984, a site cleanup was performed during which 6 inches of surface soil were removed and the area was covered by a concrete pad. Since 1984, wastes have not been stored at this site [Naval Energy and Environmental Support Activity (NEESA), 1986]. The intent of the 1984 concrete cap was not documented, but it is speculated that the concrete was installed to improve the site's functionality as a storage area (i.e., providing a hard surface for access by material handling, forklifts, pallet jacks, etc.) rather than achieving some remedial objective. However, the Resource Conservation and Recovery Act (RCRA) Facility Assessment Report stated that "Based on a review of past publications, they concluded that prior remediation at Site 9 adequately addressed site concerns" (A.T. Kearny, 1990).

Site 16 is a grassy area located between Quonset Huts N282 and N277 (Figure 2-1) where rinsewaters from pest control spray application containers and equipment were discharged from 1950 to 1977. During this time, the site received an estimated 5 to 10 gallons per week of pesticide rinsate. The disposal area was approximately 6 feet by 25 feet. Pesticides used at the Depot during this period included aldrin, baygon, chlordane, dursban, malathion, naled, and DDT. Assuming an average disposal rate of approximately 300 gallons per year from 1950 to 1977, an estimated 8,000 gallons of rinsate were disposed at Site 16.

Site 55, Fiber Optic Vault, is located approximately 20 feet east of Atsugi Street, 100 feet southwest of Building 401, and 140 feet northwest of Building 405 (Figure 2-1). The vault is comprised of pre-cast concrete with inner dimensions of 12 feet by 6 feet by 7 feet deep. The walls include blanked cutouts for fiber optic cables to enter the vault from the north, east, south, and west. The site is relatively flat with both grassy and paved areas. Overhead power lines are present near the vault, and an underground sewer line is located approximately 70 feet to the northeast. In September 2001 following installation of the vault, petroleum hydrocarbons and water were observed within the vault. In late October 2001, approximately 0.5 inch of free product was observed in the vault floating on approximately 1 foot of water. Efforts were made to remove the free product and stop the infiltration of groundwater into the vault by applying a sealing compound to the internal concrete surfaces. In late fall 2001, the free product and water in the vault were pumped out and the vault was steam cleaned. During early 2002, the water table had fallen and the lower row of cutouts were capped to prevent additional accumulation of fluids. Water/free product was also removed from the vault by TtNUS in March 2003, and the internal concrete surface was resealed at this time.

Sites 9, 16, 27, and 55 are located in an industrial part of MCRD as shown on Figure 2-1. The nearest resident lives approximately 2,000 feet south of these sites. There are no day care facilities or schools within that distance.

Detailed historical building use data are not known to exist. MCRD reports that Building 401 is a Resource Conservation and Recovery Act (RCRA)/Toxic Substances Control Act (TSCA)/Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)-compliant pest control facility that was constructed in the early 1990s and that Building 405 is a small warehouse that has been used by the 3rd Battalion and MCCS over the past 10 years or so. Building 852 (approximately 200 feet to the north) has housed administrative functions for at least the past 30 years, with no known pesticide handling activity at any time.

2.2 PREVIOUS INVESTIGATIONS

Previous investigations at Site 27 included the SI/CS at Sites 9, 16, and 27 in December 1999. Prior to the SI/CS, an Initial Assessment Study (IAS), and/or RCRA Facility Assessments (RFAs), were conducted at these sites. The following investigations have been conducted at the sites in the area of Site 27:

Site 9

- IAS (1986 - no sampling)
- RFA (1990 - no sampling)
- Relative Site Ranking (1995)
- SI/CS (1999)

Site 16

- IAS (1986 - no sampling)
- RI VSI (1988)
- RFA (1990 - no sampling)

Site 27

- RFA (1990 - no sampling)
- Relative Site Ranking (1995)
- SI/CS (1999)

Site 55

- Soil and groundwater field screening (2002)
- Groundwater investigation (2003)

Details of the previous investigations at these sites can be found in the following reports:

- Site Inspection (SI)/Confirmatory Sampling (CS) Report (TtNUS, 2002) .
- Preliminary Assessment/Site Inspection and Confirmatory Sampling Report for Site/SWMU 55 Fiber Optic Vault (TtNUS, 2004).

In October 2007, the field investigation for Phase I of the Site 27 RI was completed. Groundwater samples were collected throughout the Sites 9/16/27/55 area, and soil samples were collected from the Site 27 area.

The following subsections summarize the findings from the previous investigations at these sites.

2.2.1 Site 27

Two soil samples [PI-027-01(46) and PI-027-02(47)] were collected at Site 27 in 1995 to support relative site ranking objectives, and several polynuclear aromatic hydrocarbons (PAHs), pesticides, and inorganics were detected at concentrations that exceeded screening criteria (TtNUS, 2002). The sample locations are shown on Figure 2-1, and the analytical results are provided in Appendix A-1.

The SI/CS field investigation at Site 27 was conducted in December 1999 and included the collection of three surface soil samples (PAI-27-SS-03-01, PAI-27-SS-04-01, and PAI-27-SS-05-01) in the limited area sampled, as shown on Figure 2-1. These samples were analyzed for PCBs, which were not detected.

Evaluation of the soil data collected in 1995 and 1999 indicates that past use of Site 27 as a transformer storage area has not impacted the soil with PCBs. However, inorganics in excess of established MCRD Parris Island soil background levels and organics were detected in the two surface soil samples collected in 1995, indicating that some impact has occurred.

2.2.2 Site 9

This section discusses the results of the relative site ranking investigation conducted in December 1995 and the SI/CS conducted in December 1999. During the relative site ranking, three soil samples were collected. During the SI/CS, TtNUS installed and sampled two groundwater monitoring wells.

Three soil samples [PI-009-01(32), PI-009-02(33), and PI-009-03(34)] were collected at Site 9 in 1995 to support relative site ranking objectives, and several VOCs, PAHs, pesticides, and inorganics were detected at concentrations that exceeded screening criteria (TtNUS, 2002). The sample locations are shown on Figure 2-1, and the analytical results are provided in Appendix A.2.

Two temporary monitoring wells [(PAI-09-MW-01(S) and PAI-09-MW-02(S)] were installed and sampled by TtNUS during the SI/CS field investigation in December 1999 to determine whether paint storage activities had adversely affected groundwater at Site 9. Sample locations are shown on Figure 2-1. Site 9 groundwater analytical results indicated that past paint storage activities had not impacted groundwater at Site 9 (Appendix A.2).

2.2.3 Site 16

In February 1988, McClelland Consultants conducted an RI VSI of various sites at MCRD Parris Island. Site 16 was included in the investigation based on the results of the IAS. During this investigation, three soil borings (PAI16-SB1 to PAI16-SB3) were advanced at Site 16.

The chemical analyses of samples from these borings indicated that lead [8.4 milligram per kilogram (mg/kg)], the pesticide 4,4'-DDT [1,380 microgram per kilogram (µg/kg)], and its degradation products 4,4'-DDE (421 µg/kg) and 4,4'-DDD (486 µg/kg) were detected at concentrations greater than screening criteria in one sample (PAI16-SB1). Sample locations are shown on Figure 2-1.

2.2.4 Site 55

The investigations associated with Site 55 started after the discovery of environmental releases following the installation of the Fiber Optic Vault. In September 2001 following installation of the vault, petroleum hydrocarbons and groundwater infiltration were observed within the vault. A soil sample was collected and sent to General Engineering Laboratory in Charleston, South Carolina, for analysis for lead, PCBs, and benzene, toluene, ethylbenzene, and xylenes (BTEX). Analytical results for lead and PCBs were less than detection limits. Benzene was detected at 19.7 mg/kg, ethylbenzene at 61 mg/kg, toluene at 51 mg/kg, and xylenes at 2,790 mg/kg. In late October 2001, approximately 0.5 inch of free product was observed in the vault floating on approximately 1 foot of water. Efforts were made to remove the free product and stop the infiltration of groundwater into the vault by applying a sealing compound to the internal concrete surfaces. In late fall 2001, the free product and water in the vault were pumped out and the vault was steam cleaned. During early 2002, the water table had fallen and the lower row of cutouts was capped to prevent additional accumulation of fluids. Water/free product was also removed from the vault by TtNUS in March 2003, and the internal concrete surface was resealed at this time. Based on the presence of free product and the sampling analytical results, the SCDHEC requested that an assessment of the vault be performed. Results of subsequent investigations indicated the presence of BTEX, naphthalene, and chlorobenzene in groundwater.

Site 55 Soil and Groundwater Field Screening

In July 2002, soil and groundwater field screening were performed during which field personnel collected a total of 19 subsurface soil and 23 groundwater samples using a direct-push technology (DPT) rig equipped with a membrane interface probe (MIP). Samples were analyzed with an on-site mobile laboratory.

Sample locations are shown on Figure 3-1 in Appendix A.3. The soil screening data and groundwater screening data are also presented in Appendix A.3.

The results of the field screening indicated contamination of the shallow surficial aquifer. Additionally, free product was observed in boring FDP13 directly south of the vault and adjacent to boring FDP20. Only one PAH, naphthalene, was detected in the soil samples.

Site 55 July 2003 Groundwater Investigation

Based on the results of the July 2002 field screening, a supplemental groundwater investigation was conducted at Site 55 to isolate/confirm a source area, to characterize the intermediate and deep portions of the surficial aquifer, and to investigate the downgradient shallow surficial aquifer. Because of the limited surface soil detections observed during the field screening, a soil sampling program was not conducted during the July 2003 investigation.

Twenty-one permanent monitoring wells were installed at Site 55 in December 2002, at which time free product was encountered at shallow monitoring well MW-06 during static water level measurements. Monitoring well locations are shown on Figure 2-1. In July 2003, only 12 of the wells were sampled (shallow monitoring wells MW-01, MW-10, MW-11, MW-17, intermediate wells MW-07I, MW-12I, and MW-18I, and deep wells MW-08D and MW-13D and Site 27 shallow wells MW-19, MW-20, and MW-21) because of cost issues. Free product was not encountered during the July 2003 groundwater sampling event. Sample locations are shown on Figure 2-1, and a summary of the detected concentrations is provided in Appendix A.4.

The following summarizes the findings of the 2002/2003 investigations at Site 55:

- Groundwater contamination is present within the shallow surficial aquifer in the area of Site 27 and Site 55. Chemicals of significance detected in groundwater with the on-site laboratory during the 2002 field screening include chlorobenzene, BTEX, and naphthalene. Fixed-base laboratory results from the July 2003 groundwater investigation confirmed the presence of these chemicals in groundwater; however, they were observed at lower concentrations than during the 2002 field screening. This observation correlates with the finding that free product was encountered during the initial field screening but was not observed during the groundwater sampling event in July 2003. The 2003 investigation also identified the presence of 1,4-dichlorobenzene and seven pesticides in groundwater at concentrations that exceeded both human health [Maximum Contaminant Levels (MCLs) and tap water Preliminary Remediation Goals (PRGs)] and ecological [surface water ecological screening values (ESVs) – freshwater] screening criteria.

- The 2002 field screening investigation indicated minimal contamination in soil. Naphthalene was the only contaminant detected (DPT boring locations FDP02, FPD03, and FDP04).

2.2.5 Phase I RI

The field investigation for the first phase of the RI was completed in September 2007. This field investigation included the installation of 26 temporary monitoring wells, collection of groundwater samples from 9 existing monitoring wells and the 26 temporary wells, collection of surface and subsurface soil samples from 13 locations, and collection of water level measurements. The groundwater samples were collected throughout the Sites 27/55 area, and the soil samples were collected from drainage areas around Site 27. Groundwater sample locations (including some from the previous investigations) are shown on Figures 2-2 and 2-3. Soil sample locations are shown on Figure 2-4, and soil sample results are provided in Appendix A.5.

Low concentrations of VOCs (less than 17 µg/kg) were detected sporadically in surface soil samples. Acetone at 90 µg/kg was the highest detected VOC in the subsurface soil sample. Based on the detected concentrations and frequencies of detections, VOCs in soil are not a significant concern.

Low concentrations of SVOCs (less than 300 µg/kg) were detected sporadically in surface soil samples. High concentrations of PAHs (1,000 to 83,000 µg/kg) were detected in two surface soil samples (SS12 and SS13). No SVOCs were detected in the subsurface soil sample. The elevated concentrations of PAHs detected in the two samples (SS12 and SS13) are most likely the result of asphalt pavement included in the sample matrix.

Pesticides (DDT and its degradation products) were detected in most soil samples. Concentrations appear to be result of widespread application of pesticides across the installation. The concentrations detected do not represent a source of the pesticides detected in the groundwater samples because the soil samples were collected downgradient of the highest groundwater contamination. Pesticides were not detected in the subsurface soil sample.

Aroclor-1260 was detected in one surface soil sample (SS08 and its duplicate) at an average concentration of 485 µg/kg.

Metals were detected at low concentrations (most likely attributable to background conditions) in the surface and subsurface soil samples.

Figure 2-2 presents the pesticide concentrations detected in the Phase I RI and previous groundwater samples. Figure 2-3 presents the VOC concentrations detected in the Phase I RI and previous

groundwater samples. Complete analytical results for the Phase I RI groundwater samples are provided in Appendix A.5. The VOC and pesticide concentrations shown on these two figures were compared to the U.S. EPA Region 9 Tap Water PRGs as a preliminary screening step.

Consistent with previous results, elevated concentrations of VOCs and pesticides were detected in groundwater samples from the area of the Fiber Optic Vault (Site 55). Figures 2-2 and 2-3 show that contaminated groundwater (VOCs and pesticides) extends to the north/northwest from the area of highest concentrations and appears to follow to some extent the direction of groundwater flow (potentiometric contours from 2002 are shown on Figure 2-5).

The source of groundwater contamination in the Site 27/55 area has not been identified, and the extent of contamination has not been completely delineated.

2.3 SURFACE FEATURES AND GEOLOGY

This section describes the general site features and geology of the sites based on previous investigations and updated using information generated during the first phase of the RI. Potentiometric surface maps are provided as Figure 2-5 (2002 water levels), Figure 2-6 (2007 shallow wells water levels), and Figure 2-7 (2007 intermediate wells water levels). The location of cross section A-A' is shown on Figure 2-5, and the location of cross section B-B' is shown on Figure 2-6. Figure 2-8 shows the generalized geological cross section A-A' (using 2003 information), and Figure 2-9 shows the generalized geological cross section B-B' (using 2007 information).

2.3.1 Site 27

Site 27 includes asphalt and grassy areas. Based on DPT drilling and sampling, the asphalt area consists of approximately 3 to 4 inches of asphalt and gravel underlain by sand with varying organic content. The site surface slopes to the northwest, and the site lies within 1,000 feet of the marsh adjacent to the Third Battalion Causeway Pond. The site lies within the 100-year flood zone, as indicated in the Master Work Plan (B&R Environmental, 1998). Recharge to groundwater in this area is through precipitation.

2.3.2 Sites 9 and 16

Sites 9 and 16 are located within the paved and grassy areas of the current maintenance facility compound. The sites are within the 100-year flood zone, as indicated in the Master Work Plan (B&R Environmental, 1998). Groundwater flow in the vicinity of Sites 9 and 16 is expected to be to the north-northeast towards an unnamed tributary of Archers Creek. Subsurface soil samples were collected from Site 9 temporary well borings for lithologic classification in 1999. The soil at PAI-09-MW-01(S) consisted

of sand to a depth of 6 feet below ground surface (bgs). Clay was encountered at a depth of 6 to 8 feet bgs. No soil sample was recovered from 8 to 12 feet bgs. Similar lithology was also observed in the three soil borings installed at Site 16 in 1988. At well PAI-09-MW-02(S) installed in 1999, concrete, base gravels, and sands were encountered to a depth of 2 feet bgs. From 2 to 12 feet bgs, sand was encountered. Groundwater samples from the site (1999) exhibited salinity readings indicative of fresh water. Recharge to groundwater in this area is through precipitation. Land surfaces in the area gently slope to the southwest away from the site to the north, south, and west.

2.3.3 Site 55

Site 55 includes paved and grassy areas. The paved area at the site consists of approximately 4 inches of asphalt and gravel. Groundwater flow was determined to be to the north-northeast during a 2002 investigation. The area around the Fiber Optic Vault is grassy and slopes to the northwest and southeast. The Site 55 area is one of the highest topographic areas at MCRD Parris Island. The nearest surface water body, the marsh adjacent to the Third Battalion Causeway Pond, is approximately 1,000 feet northwest of the Fiber Optic Vault. The site lies within the 100-year flood zone, as indicated in the Master Work Plan (B&R Environmental, 1998). Recharge to groundwater in this area is primarily through precipitation.

Subsurface soil samples were collected in 2002 from DPT/MIP borings for lithologic classification. Based on the soil borings and MIP information, the soil at the Fiber Optic Vault consists of light brown to tan, fine to very fine sand to a depth of approximately 6 feet bgs. A greenish-gray silty clay was encountered at a depth of approximately 6 to 8 feet bgs. The uppermost clay varies in thickness but was present at most locations at Site 55. Below the uppermost clay is a tan to greenish-gray fine sand with thin discontinuous layers of clay that extends to approximately 24 feet bgs where another greenish-gray clay approximately 2 feet thick was encountered. Below this clay layer was a medium gray, medium to fine sand that extends to approximately 29 feet bgs and was underlain by another greenish-gray to blue-gray clay approximately 1.5 feet thick at location PAI-FOV-MW08D and almost 2 feet thick at PAI-FOV-MW13D (see Figure 2-8). This clay was underlain by a medium gray fine sand with clayey intervals to approximately 36 feet bgs where another clay layer was encountered.

2.4 HYDROGEOLOGY

The aquifer of interest at these sites is the surficial aquifer, which is separated from the underlying regional Tertiary Floridan aquifer by the Hawthorn Formation, a confining unit that extends beneath Parris Island. The surfical aquifer discharges to on-site streams and tidal areas within the base. Therefore, contaminants within this unit would discharge to these site streams and tidal areas, which ultimately discharge to the Beaufort and Broad Rivers, which form Port Royal Sound.

The surficial aquifer consists of medium to fine sand with interbeds of silty clay and clay. This aquifer has been investigated to depths of approximately 42 feet bgs in the Site 55 area. The 2002 investigation at Site 55 did not determine the depth to the bottom of the surficial aquifer; however, as discussed below, several clay-rich intervals at about 6 to 8 feet and 30 feet bgs were considered to be aquitards for shallow groundwater at the site. Groundwater was first encountered during the 2002 investigation at approximately 5 to 6 bgs. Based on the 2002 potentiometric surface map (Figure 2-5), the shallow water table at Site 55 appears to slope to the northwest and east and mimics local topography in the vicinity of Site 55. Although fewer data points are available for intermediate wells, groundwater flow at deeper intervals appears to be similar to the shallow groundwater flow pattern, with divergent flow generally towards the west and east. Groundwater flow to the northwest appears to discharge at the Third Battalion Causeway Pond. Water level data for the Site 9/16 area suggests a northeasterly flow direction. The 2007 potentiometric surface map (Figures 2-6 and 2-7) show the same basic groundwater flow pattern.

There do appear to be semi-confined conditions in the shallow portion of the surficial aquifer. There is a thin clay layer (0.5 to 3.5 feet thick) ranging in depth from approximately 2 feet bgs (TW42I) to 9 feet bgs (TW25I). During the installation of temporary wells in 2007, water was not encountered until this clay layer had been penetrated, and water levels in the temporary wells rose above this layer.

Shallow water levels at the two on-site well clusters (PAI-FOV-MW-6, PAI-FOV-7I, PAI-FOV-8D and PAI-FOV-MW-11, PAI-FOV-MW12I, PAI-FOV-MW13D) are 0.68 to 1.51 feet higher than the intermediate wells and 6.63 to 7.16 feet higher than the deep wells at these respective locations, indicating a downward hydraulic gradient. These water-level differences suggest that the clay-rich beds between the screened intervals of these wells act to retard vertical groundwater flow. Also, the downward gradients and the site's location on a topographic high suggest that the Site 55 area is a local recharge area and that the overall groundwater flow pattern at Site 55 may include a downward component of flow. This also appears to be true with the TW30S, TW31I, and TW45D cluster (Figure 2-7).

2.5 DATA QUALITY OBJECTIVES

This Work Plan Addendum was developed using the DQO process, which is a focused, iterative process for developing data collection to support decision making. The goal of the process is to conduct investigations in an efficient and effective manner without unnecessary precision or redundancy of data. The process consists of seven steps ordered in a downward decision flow. A flow diagram with descriptions of each step is provided as Figure 2-10. The DQO process is further explained in Volume I, Section 1.2.2 of the Master Work Plan (B&R Environmental, 1998). The problem statement and decisions to be made to address the stated problems are critical items in the DQO process and are discussed below in relation to Phase I RI activities.

2.5.1 Statement of Problem

This section is a concise summary of the understanding of the environmental issues and general objectives of the investigation. A groundwater plume of chlorobenzene and other VOCs has been detected in the vicinity of the sites as shown on Figure 2-3. BTEX constituents, some SVOCs, and non-aqueous and phase liquid (NAPL) have also been detected in the groundwater at a few locations. Co-mingled with VOCs and SVOCs, high concentrations of certain pesticides have also been detected in groundwater (Figure 2-2). The following are the specific problems of concern at the Site 27 area (includes Sites 9, 16 and 55):

1. The source of groundwater contamination present in the area must be determined.

2. The nature of groundwater contamination has been determined for the area (as discussed in Section 2.2); however, the extent of the contamination has not been determined. The horizontal and vertical extent of groundwater contamination must be delineated.

2.5.2 Decisions

This section states what action-based decisions will be taken to address the stated problems. The following decisions will be made based on the findings of the investigation:

1. The available historical data have been used to select soil sample locations to identify possible sources of groundwater contamination. If contaminants are detected in the soil samples, the source of groundwater contamination may be identified.

2. The available historical data have also been used to select locations for permanent monitoring wells and to identify existing permanent wells to be resampled. If contaminant concentrations are such that lower concentrations exist at upgradient, sidegradient, and downgradient locations, the extent of contamination will have been defined.

2.5.3 Action Levels

This section provides the human health and ecological screening levels that will be used for making the decisions associated with this investigation.

The extent of the groundwater plume will be determined by comparing groundwater concentrations to the following screening levels:

- Federal MCLs
- Regional Screening Levels for Chemicals at Superfund Sites (Oak Ridge National Laboratory, June 20, 2008)
- U.S. EPA Region 4 surface water ESVs

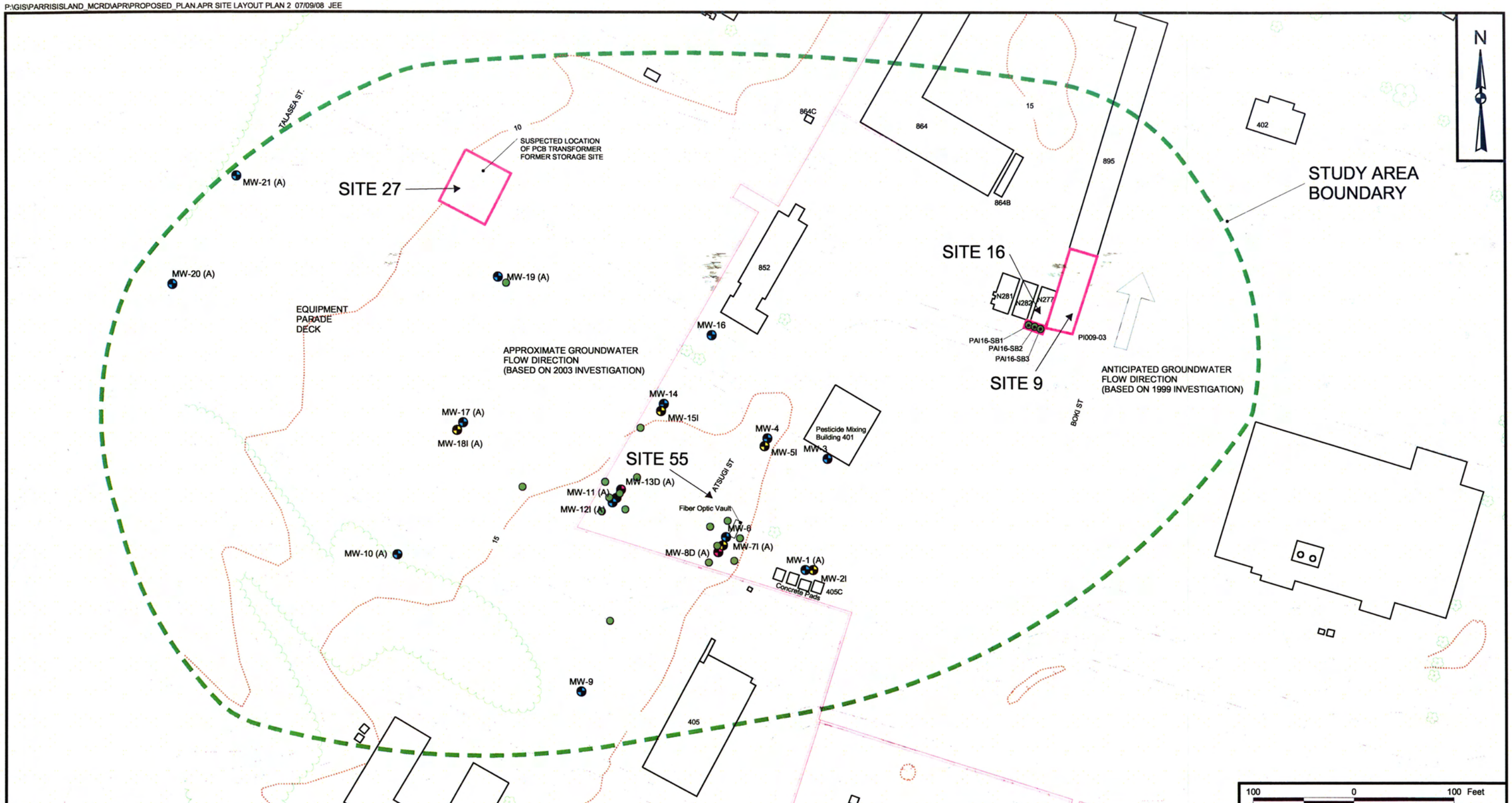
The extent of soil contamination will be determined by comparing soil concentrations to the following screening levels:

- Regional Screening Levels for Chemicals at Superfund Sites (Oak Ridge National Laboratory, 2008).

2.5.4 Conceptual Site Model and Risk Assessment

The areas of investigation are mostly paved, with relatively small grass-covered areas, within an industrially active part of MCRD Parris Island. Consequently, there is little or no ecological habitat that would require an ecological risk assessment. The groundwater plume does not appear to be close to posing a threat to the nearest surface water body (the Third Battalion Causeway Pond), which is approximately 1,000 feet from the site. The relatively flat to gently sloping topography also suggests that erosion of contaminated surface soil would not be a significant mechanism of transport of contaminants to the pond. A screening-level ecological risk (SLERA) is required, but it is anticipated that only steps 1 and 2 will be required to support a scientific management decision point. However, if contaminant concentrations in soil or groundwater exceed risk screening levels, a human health risk assessment addressing exposure pathways to soil and groundwater for potential current and future receptors will be conducted as part of the RI. Figure 2-11 illustrates the proximity of surface water bodies to Sites 9, 16, 27, and 55.

P:\GIS\PARRISISLAND_MCRD\APR\PROPOSED_PLAN.APR SITE LAYOUT PLAN 2 07/09/08 JEE



LEGEND

- (A) - Abandoned
- Shallow Monitoring Well (2002)
- Intermediate Monitoring Well (2002)
- Deep Monitoring Well (2002)
- Building
- Aerial Pipe
- Topographic Contour
- Tree Line
- Sidewalk
- Road
- Surface Soil Sample Location (1999)
- Soil Boring (1988)
- Temporary Monitoring Well Location (1999)
- Surface Soil Sample Location (1995)

DRAWN BY	DATE
J. ENGLISH	07/09/08
CHECKED BY	DATE
G. ZIMMERMAN	07/09/08
REVISED BY	DATE
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SCALE	
AS NOTED	

NAVFAC

SITE LAYOUT AND PREVIOUS INVESTIGATION LOCATIONS MAP
SITES 9, 16, 27 AND 55
MCRD PARRIS ISLAND
PARRIS ISLAND, SOUTH CAROLINA

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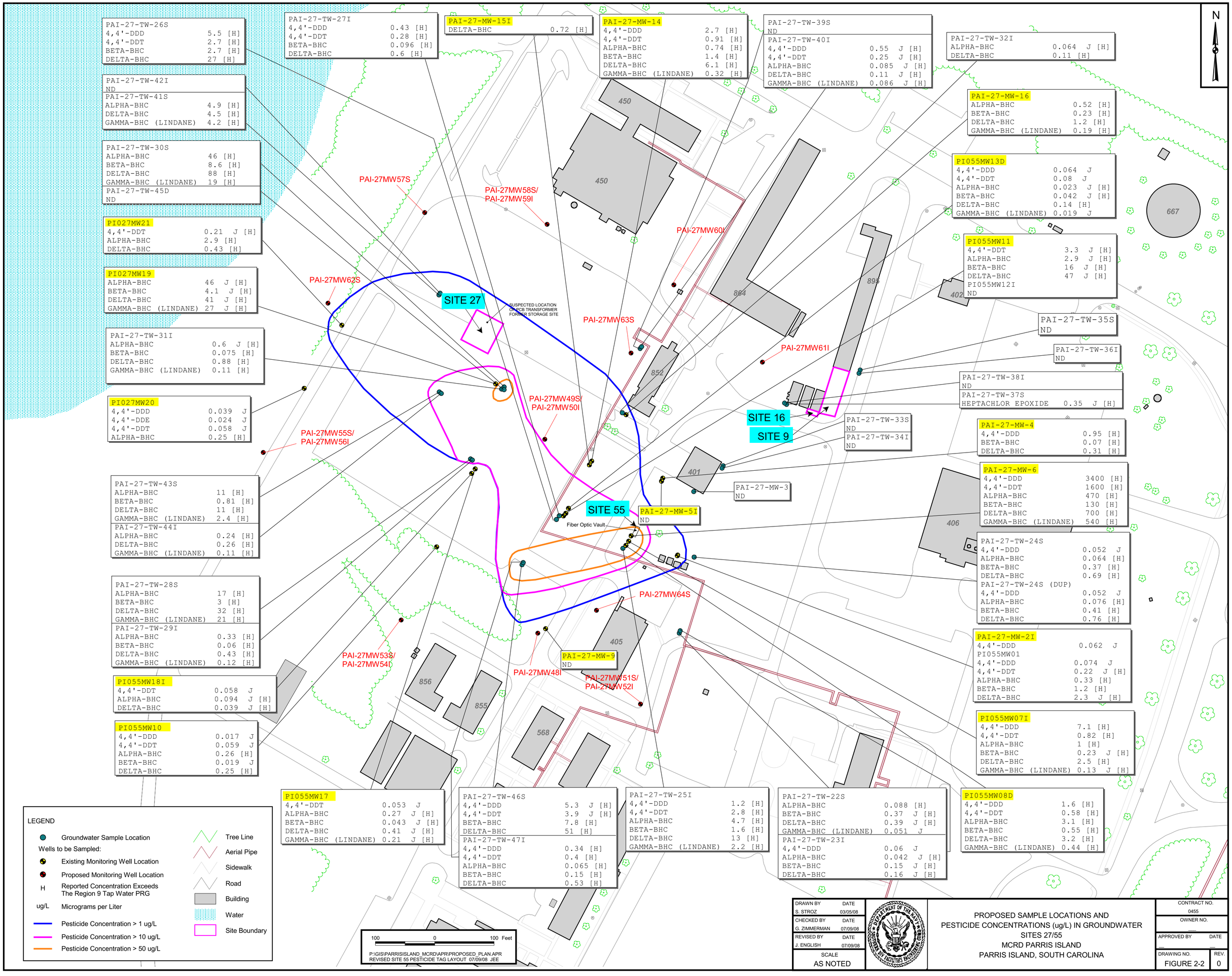
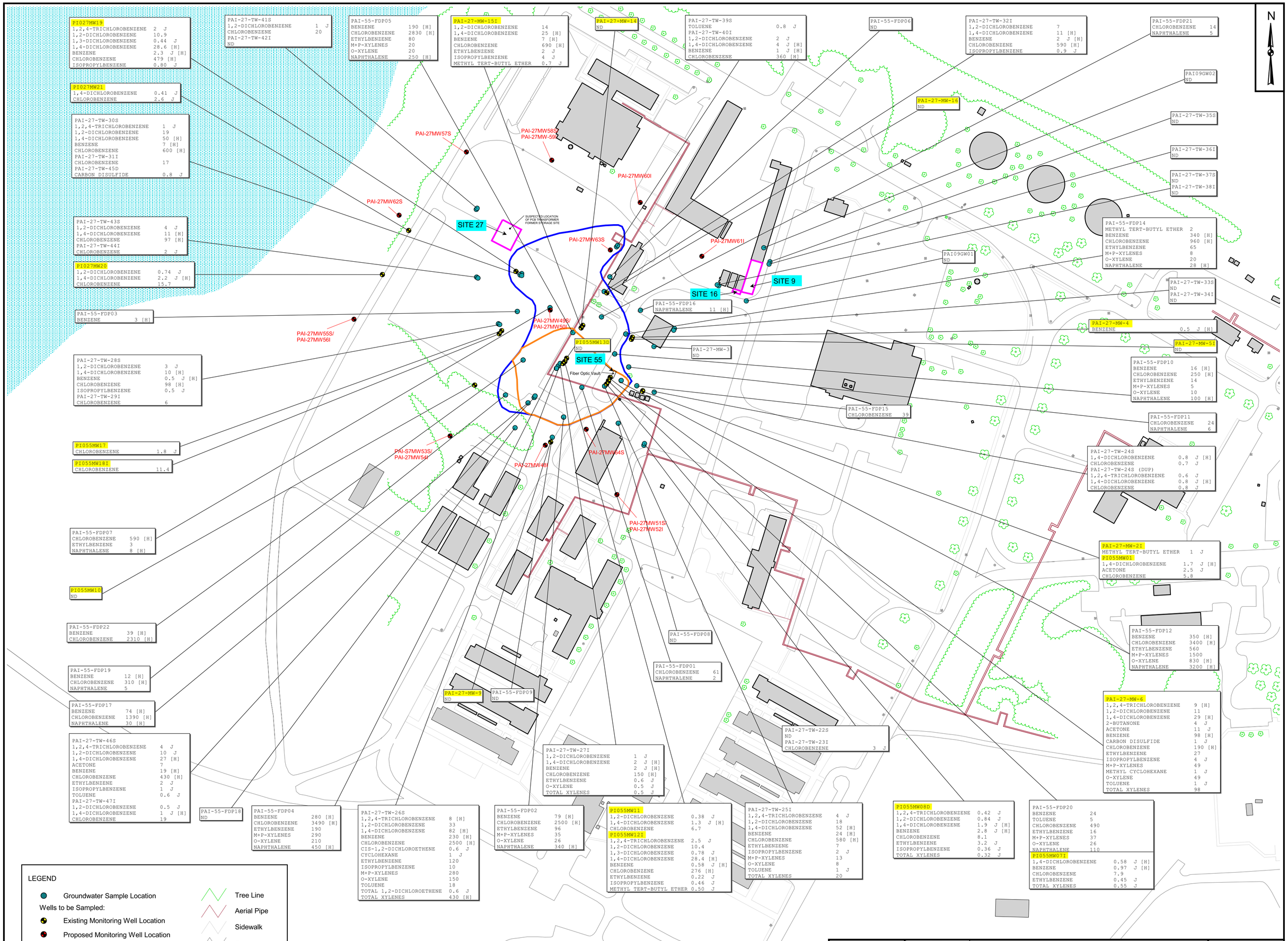
FIGURE 2-1	0


N
PAI-27-TW-26S
4,4'-DDD 5.5 [H]
4,4'-DDT 2.7 [H]
BETA-BHC 2.7 [H]
DELTA-BHC 27 [H]
PAI-27-TW-27I
4,4'-DDD 0.43 [H]
4,4'-DDT 0.28 [H]
BETA-BHC 0.096 [H]
DELTA-BHC 0.6 [H]
PAI-27-MW-15I
DELTA-BHC 0.72 [H]
PAI-27-MW-14
4,4'-DDD 2.7 [H]
4,4'-DDT 0.91 [H]
ALPHA-BHC 0.74 [H]
BETA-BHC 1.4 [H]
DELTA-BHC 6.1 [H]
GAMMA-BHC (LINDANE) 0.32 [H]
PAI-27-TW-39S
ND
PAI-27-TW-40I
4,4'-DDD 0.55 J [H]
4,4'-DDT 0.25 J [H]
ALPHA-BHC 0.085 J [H]
DELTA-BHC 0.11 J [H]
GAMMA-BHC (LINDANE) 0.086 J [H]
PAI-27-TW-32I
ALPHA-BHC 0.064 J [H]
DELTA-BHC 0.11 [H]
PAI-27-TW-42I
ND
PAI-27-TW-41S
ALPHA-BHC 4.9 [H]
DELTA-BHC 4.5 [H]
GAMMA-BHC (LINDANE) 4.2 [H]
PAI-27-MW-16
ALPHA-BHC 0.52 [H]
BETA-BHC 0.23 [H]
DELTA-BHC 1.2 [H]
GAMMA-BHC (LINDANE) 0.19 [H]
PAI-27-TW-30S
ALPHA-BHC 46 [H]
BETA-BHC 8.6 [H]
DELTA-BHC 88 [H]
GAMMA-BHC (LINDANE) 19 [H]
PAI-27-TW-45D
ND
PI055MW13D
4,4'-DDD 0.064 J
4,4'-DDT 0.08 J
ALPHA-BHC 0.023 J [H]
BETA-BHC 0.042 J [H]
DELTA-BHC 0.14 [H]
GAMMA-BHC (LINDANE) 0.019 J
PI027MW21
4,4'-DDT 0.21 J [H]
ALPHA-BHC 2.9 [H]
DELTA-BHC 0.43 [H]
PI055MW11
4,4'-DDT 3.3 J [H]
ALPHA-BHC 2.9 J [H]
BETA-BHC 16 J [H]
DELTA-BHC 47 J [H]
PI055MW12I
ND
PI027MW19
ALPHA-BHC 46 J [H]
BETA-BHC 4.1 J [H]
DELTA-BHC 41 J [H]
GAMMA-BHC (LINDANE) 27 J [H]
PAI-27-TW-35S
ND
PAI-27-TW-36I
ND
PAI-27-TW-31I
ALPHA-BHC 0.6 J [H]
BETA-BHC 0.075 [H]
DELTA-BHC 0.88 [H]
GAMMA-BHC (LINDANE) 0.11 [H]
PAI-27-TW-38I
ND
PAI-27-TW-37S
HEPTACHLOR EPOXIDE 0.35 J [H]
PI027MW20
4,4'-DDD 0.039 J
4,4'-DDE 0.024 J
4,4'-DDT 0.058 J
ALPHA-BHC 0.25 [H]
PAI-27-TW-33S
ND
PAI-27-TW-34I
ND
PAI-27-MW-4
4,4'-DDD 0.95 [H]
BETA-BHC 0.07 [H]
DELTA-BHC 0.31 [H]
PAI-27-MW-3
ND
PAI-27-MW-6
4,4'-DDD 3400 [H]
4,4'-DDT 1600 [H]
ALPHA-BHC 470 [H]
BETA-BHC 130 [H]
DELTA-BHC 700 [H]
GAMMA-BHC (LINDANE) 540 [H]
PAI-27-TW-43S
ALPHA-BHC 11 [H]
BETA-BHC 0.81 [H]
DELTA-BHC 11 [H]
GAMMA-BHC (LINDANE) 2.4 [H]
PAI-27-TW-44I
ALPHA-BHC 0.24 [H]
DELTA-BHC 0.26 [H]
GAMMA-BHC (LINDANE) 0.11 [H]
PAI-27-MW-5I
ND
PAI-27-TW-24S
4,4'-DDD 0.052 J
ALPHA-BHC 0.064 [H]
BETA-BHC 0.37 [H]
DELTA-BHC 0.69 [H]
PAI-27-TW-24S (DUP)
4,4'-DDD 0.052 J
ALPHA-BHC 0.076 [H]
BETA-BHC 0.41 [H]
DELTA-BHC 0.76 [H]
PAI-27-TW-28S
ALPHA-BHC 17 [H]
BETA-BHC 3 [H]
DELTA-BHC 32 [H]
GAMMA-BHC (LINDANE) 21 [H]
PAI-27-TW-29I
ALPHA-BHC 0.33 [H]
BETA-BHC 0.06 [H]
DELTA-BHC 0.43 [H]
GAMMA-BHC (LINDANE) 0.12 [H]
PAI-27-MW-2I
4,4'-DDD 0.062 J
PI055MW01
4,4'-DDD 0.074 J
4,4'-DDT 0.22 J [H]
ALPHA-BHC 0.33 [H]
BETA-BHC 1.2 [H]
DELTA-BHC 2.3 J [H]
PI055MW18I
4,4'-DDT 0.058 J
ALPHA-BHC 0.094 J [H]
DELTA-BHC 0.039 J [H]
PI055MW07I
4,4'-DDD 7.1 [H]
4,4'-DDT 0.82 [H]
ALPHA-BHC 1 [H]
BETA-BHC 0.23 J [H]
DELTA-BHC 2.5 [H]
GAMMA-BHC (LINDANE) 0.13 J [H]
PI055MW10
4,4'-DDD 0.017 J
4,4'-DDT 0.059 J
ALPHA-BHC 0.26 [H]
BETA-BHC 0.019 J
DELTA-BHC 0.25 [H]
PI055MW17
4,4'-DDT 0.053 J
ALPHA-BHC 0.27 J [H]
BETA-BHC 0.043 J [H]
DELTA-BHC 0.41 J [H]
GAMMA-BHC (LINDANE) 0.21 J [H]
PAI-27-TW-46S
4,4'-DDD 5.3 J [H]
4,4'-DDT 3.9 J [H]
BETA-BHC 7.8 [H]
DELTA-BHC 51 [H]
PAI-27-TW-47I
4,4'-DDD 0.34 [H]
4,4'-DDT 0.4 [H]
ALPHA-BHC 0.065 [H]
BETA-BHC 0.15 [H]
DELTA-BHC 0.53 [H]
PAI-27-TW-25I
4,4'-DDD 1.2 [H]
4,4'-DDT 2.8 [H]
ALPHA-BHC 4.7 [H]
BETA-BHC 1.6 [H]
DELTA-BHC 13 [H]
GAMMA-BHC (LINDANE) 2.2 [H]
PAI-27-TW-22S
ALPHA-BHC 0.088 [H]
BETA-BHC 0.37 J [H]
DELTA-BHC 0.39 J [H]
GAMMA-BHC (LINDANE) 0.051 J
PAI-27-TW-23I
4,4'-DDD 0.06 J
ALPHA-BHC 0.042 J [H]
BETA-BHC 0.15 J [H]
DELTA-BHC 0.16 J [H]
PI055MW08D
4,4'-DDD 1.6 [H]
4,4'-DDT 0.58 [H]
ALPHA-BHC 3.1 [H]
BETA-BHC 0.55 [H]
DELTA-BHC 3.2 [H]
GAMMA-BHC (LINDANE) 0.44 [H]
PAI-27MW57S
PAI-27MW58S/
PAI-27MW59I
PAI-27MW60I
PAI-27MW62S
PAI-27MW63S
PAI-27MW61I
PAI-27MW49S/
PAI-27MW50I
PAI-27MW55S/
PAI-27MW56I
PAI-27MW64S
PAI-27MW53S/
PAI-27MW54I
PAI-27MW48I
PAI-27MW51S/
PAI-27MW52I
SITE 27
SUSPECTED LOCATION OF PCB TRANSFORMER FORMER STORAGE SITE
SITE 16
SITE 9
SITE 55
Fiber Optic Vault
450
450
667
864
895
402
852
401
406
405
856
855
568
LEGEND
Groundwater Sample Location
Wells to be Sampled:
Existing Monitoring Well Location
Proposed Monitoring Well Location
H Reported Concentration Exceeds The Region 9 Tap Water PRG
ug/L Micrograms per Liter
Pesticide Concentration > 1 ug/L
Pesticide Concentration > 10 ug/L
Pesticide Concentration > 50 ug/L
Tree Line
Aerial Pipe
Sidewalk
Road
Building
Water
Site Boundary
100 0 100 Feet
P:\GIS\PARRISISLAND_MCRD\APR\PROPOSED_PLAN.APR
REVISED SITE 55 PESTICIDE TAG LAYOUT 07/09/08 JEE
DRAWN BY S. STROZ DATE 03/05/08
CHECKED BY G. ZIMMERMAN DATE 07/09/08
REVISED BY J. ENGLISH DATE 07/09/08
SCALE AS NOTED
PROPOSED SAMPLE LOCATIONS AND
PESTICIDE CONCENTRATIONS (ug/L) IN GROUNDWATER
SITES 27/55
MCRD PARRIS ISLAND
PARRIS ISLAND, SOUTH CAROLINA
CONTRACT NO. 0455
OWNER NO.
APPROVED BY DATE
DRAWING NO. FIGURE 2-2
REV. 0



DRAWN BY S. STROZ	DATE 02/12/08	
CHECKED BY G. ZIMMERMAN	DATE 07/09/08	
REVISED BY J. ENGLISH	DATE 07/09/08	
SCALE AS NOTED		

PROPOSED SAMPLE LOCATIONS AND VOC CONCENTRATIONS (ug/L) IN GROUNDWATER SITES 27/55 MCRD PARRIS ISLAND PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NO. 0455	
OWNER NO.	
APPROVED BY	DATE
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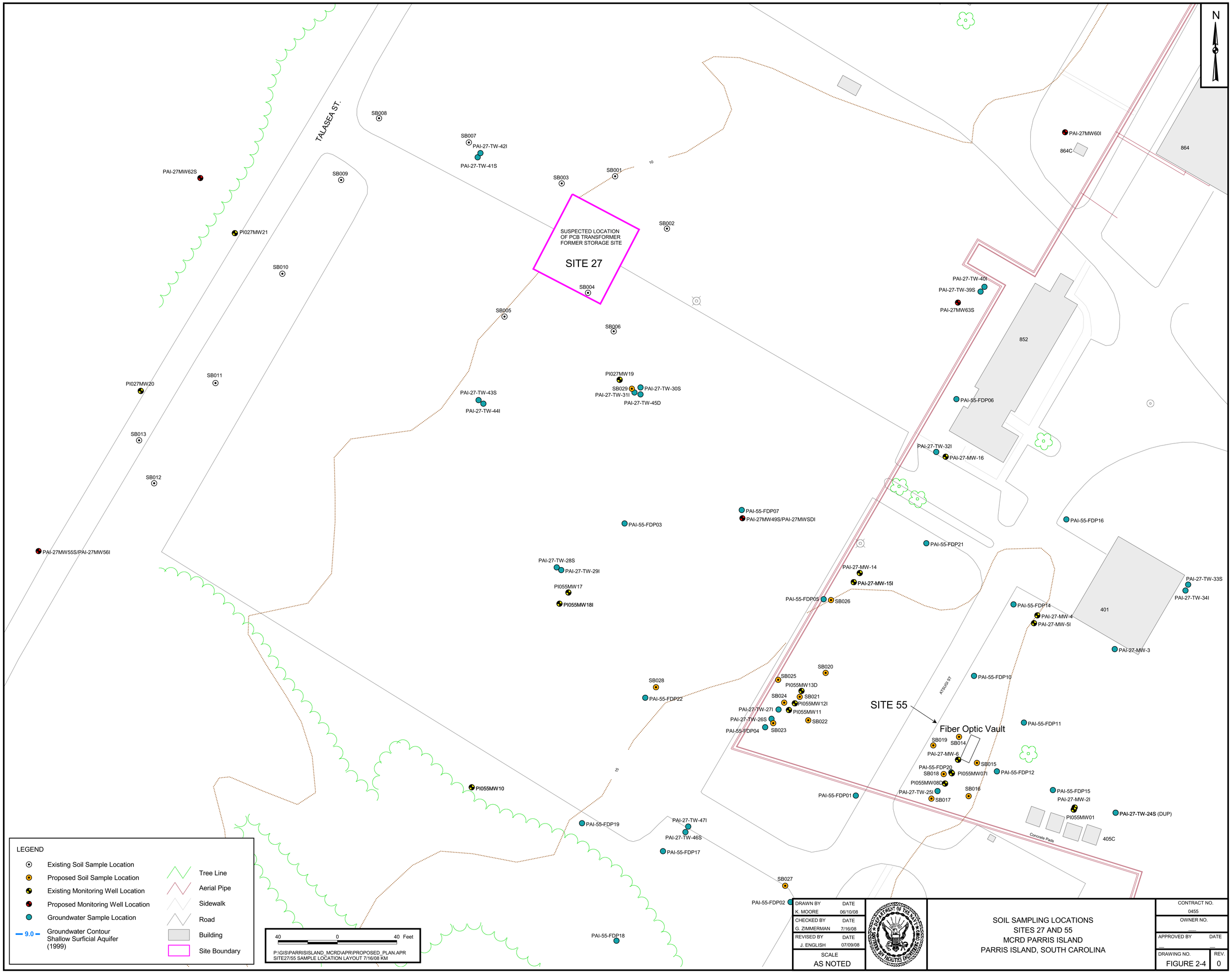
N
TALASEA ST.
SB008
SB007
PAI-27-TW-42I
PAI-27-TW-41S
SB009
SB003
SB001
SB002
SUSPECTED LOCATION
OF PCB TRANSFORMER
FORMER STORAGE SITE
SITE 27
SB004
SB005
SB006
SB010
SB011
SB013
SB012
PI027MW21
PI027MW20
PAI-27MW62S
PAI-27MW55S/PAI-27MW56I
PI027MW19
SB029
PAI-27-TW-30S
PAI-27-TW-31I
PAI-27-TW-45D
PAI-27-TW-43S
PAI-27-TW-44I
PAI-27MW60I
864C
864
PAI-27-TW-40I
PAI-27-TW-39S
PAI-27MW63S
852
PAI-55-FDP06
PAI-27-TW-32I
PAI-27-MW-16
PAI-55-FDP07
PAI-27MW49S/PAI-27MWSDI
PAI-55-FDP03
PAI-55-FDP16
PAI-55-FDP21
PAI-27-TW-28S
PAI-27-TW-29I
PI055MW17
PI055MW18I
PAI-27-MW-14
PAI-27-MW-15I
PAI-55-FDP05
SB026
PAI-27-TW-33S
PAI-27-TW-34I
401
PAI-55-FDP14
PAI-27-MW-4
PAI-27-MW-5I
PAI-27-MW-3
SB020
SB025
PI055MW13D
SB024
SB021
PI055MW12I
PAI-27-TW-27I
PI055MW11
PAI-27-TW-26S
SB022
PAI-55-FDP04
SB023
SB028
PAI-55-FDP22
PAI-55-FDP10
ATSUB ST
SITE 55
Fiber Optic Vault
PAI-55-FDP11
SB019
SB014
PAI-27-MW-6
SB015
PAI-55-FDP20
SB018
PI055MW07I
PAI-55-FDP12
PI055MW08D
PAI-27-TW-25I
SB017
SB016
PAI-55-FDP01
PAI-55-FDP15
PAI-27-MW-2I
PI055MW01
PAI-27-TW-24S (DUP)
Concrete Pads
405C
PI055MW10
PAI-55-FDP19
PAI-27-TW-47I
PAI-27-TW-46S
PAI-55-FDP17
SB027
PAI-55-FDP02
PAI-55-FDP18
LEGEND
Existing Soil Sample Location
Proposed Soil Sample Location
Existing Monitoring Well Location
Proposed Monitoring Well Location
Groundwater Sample Location
9.0
Groundwater Contour
Shallow Surficial Aquifer
(1999)
Tree Line
Aerial Pipe
Sidewalk
Road
Building
Site Boundary
40 0 40 Feet
P:\GIS\PARRISISLAND_MCRD\APR\PROPOSED_PLAN.APR
SITE27/55 SAMPLE LOCATION LAYOUT 7/16/08 KM
DRAWN BY K. MOORE DATE 06/10/08
CHECKED BY G. ZIMMERMAN DATE 7/16/08
REVISED BY J. ENGLISH DATE 07/09/08
SCALE AS NOTED
SOIL SAMPLING LOCATIONS
SITES 27 AND 55
MCRD PARRIS ISLAND
PARRIS ISLAND, SOUTH CAROLINA
CONTRACT NO. 0455
OWNER NO.
APPROVED BY
DATE
DRAWING NO. FIGURE 2-4
REV. 0

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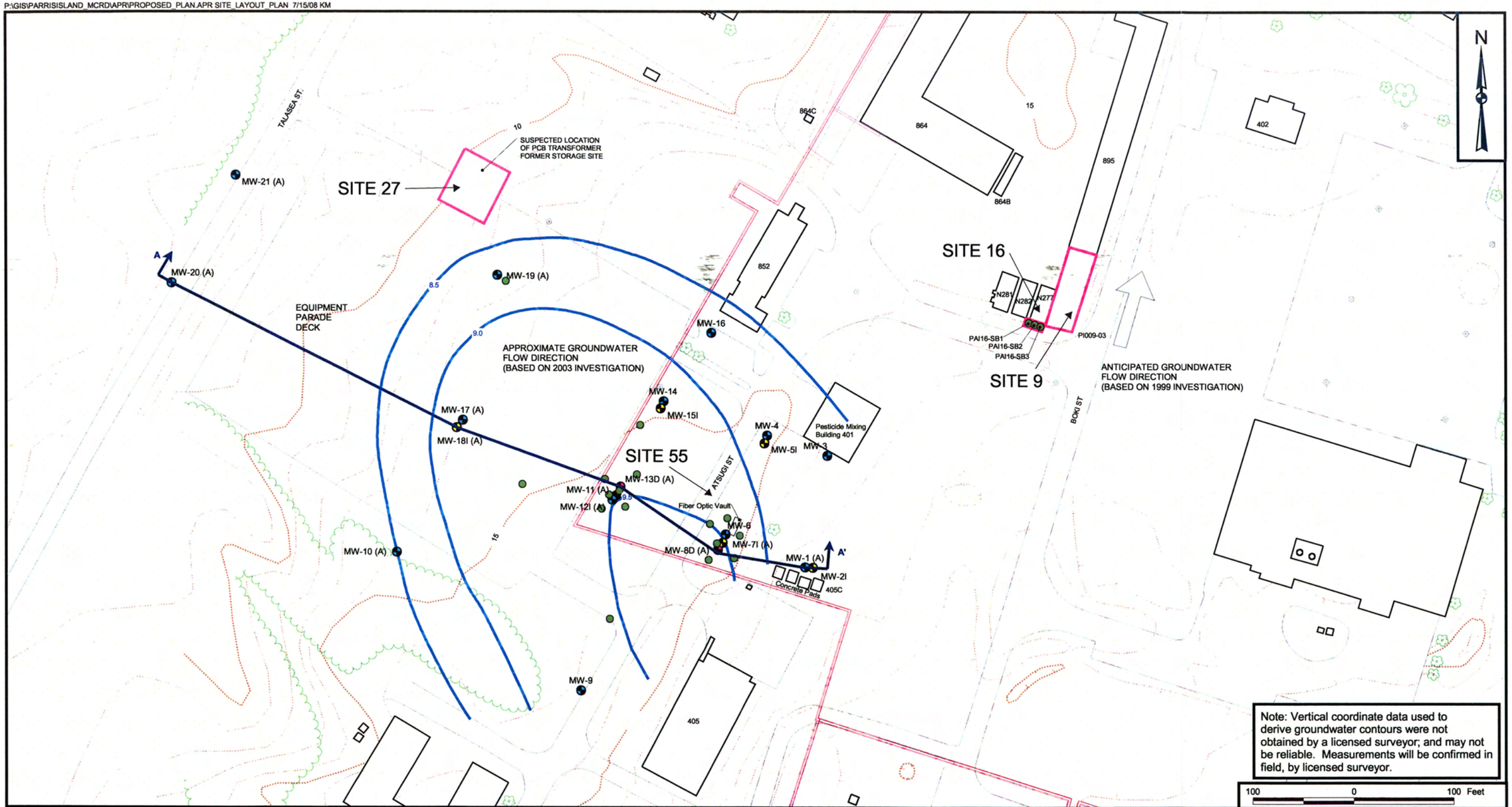

Note: Vertical coordinate data used to derive groundwater contours were not obtained by a licensed surveyor; and may not be reliable. Measurements will be confirmed in field, by licensed surveyor.

100 0 100 Feet

LEGEND

- (A) - Abandoned
- Shallow Monitoring Well (2002)
- Intermediate Monitoring Well (2002)
- Deep Monitoring Well (2002)
- Building
- Aerial Pipe
- Topographic Contour
- Tree Line
- 9.0 Groundwater Contour Shallow Surficial Aquifer
- Sidewalk
- Road
- Surface Soil Sample Location (1999)
- Soil Boring (1988)
- Temporary Monitoring Well Location (1999)
- Surface Soil Sample Location (1995)

DRAWN BY K. PEILA	DATE 10/21/03
CHECKED BY G. ZIMMERMAN	DATE 7/16/08
REVISED BY K. MOORE	DATE 7/15/08
SCALE AS NOTED	

NAVFAC

2002 POTENTIOMETRIC SURFACE MAP
SITES 9, 16, 27 AND 55
MCRD PARRIS ISLAND
PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NO. 0039
OWNER NO. —
APPROVED BY ____ DATE ____
DRAWING NO. FIGURE 2-5
REV. 0

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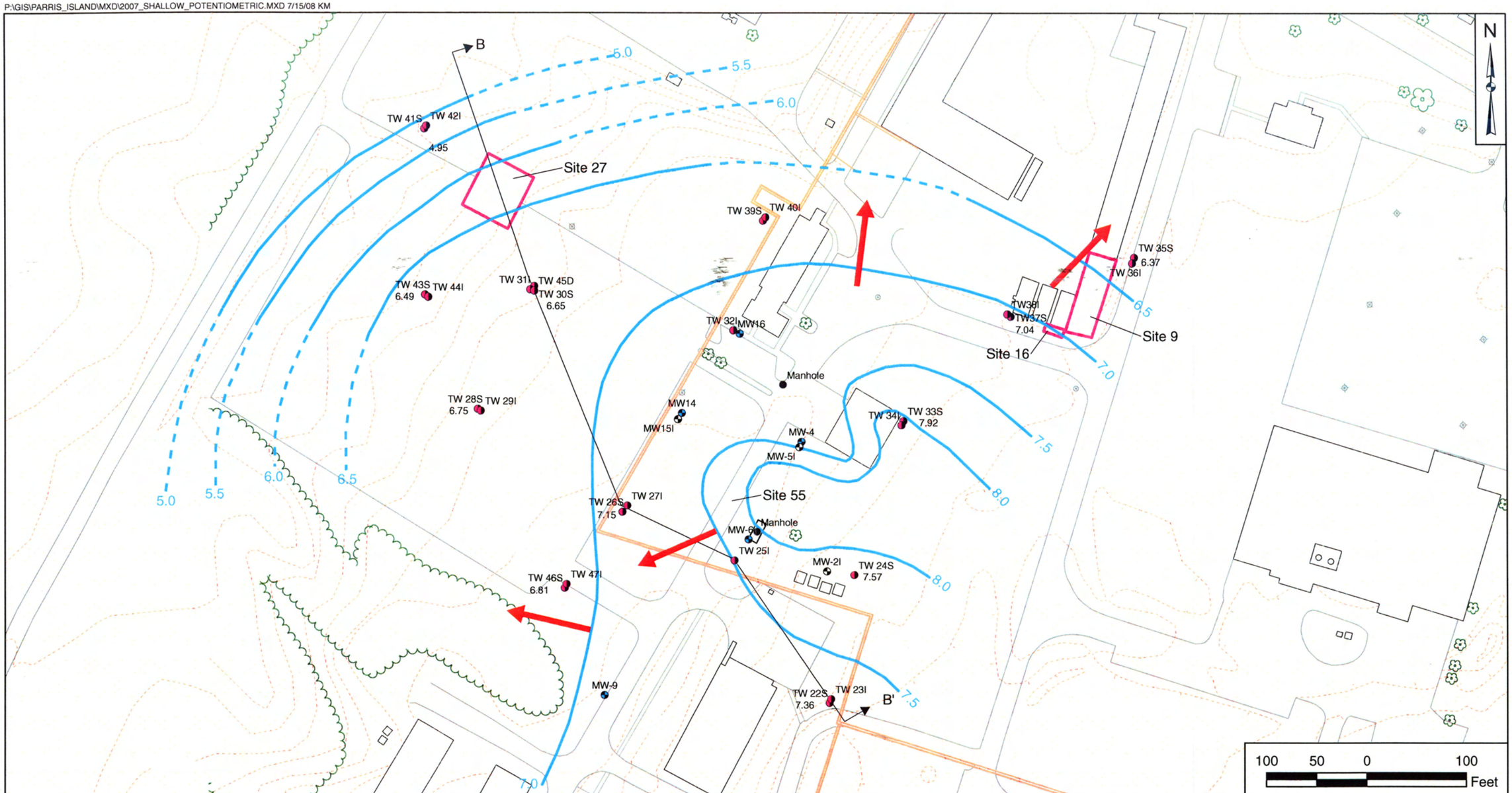

Legend

- 2007 Temporary Well
- Intermediate Monitoring Well (2002)
- Shalllow Monitoring Well (2002)
- Manhole

Groundwater Contour
- Inferred
- Regular

- Tree Line
- Aerial Pipe
- Topographic Contour

- Building
- Sidewalk
- Road

DRAWN BY	DATE
K. MOORE	7/15/08
CHECKED BY	DATE
G. ZIMMERMAN	7/16/08
COST/SCHEDULE-AREA	
SCALE AS NOTED	

NAVFAC

2007 SHALLOW WELLS
POTENTIOMETRIC SURFACE MAP
SITES 9, 16, 27, AND 55
MCRD PARRIS ISLAND
PARRIS ISLAND, SOUTH CAROLINA

CONTRACT NUMBER 0039	
APPROVED BY —	DATE —
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FIGURE NO. FIGURE 2-6	REV 0

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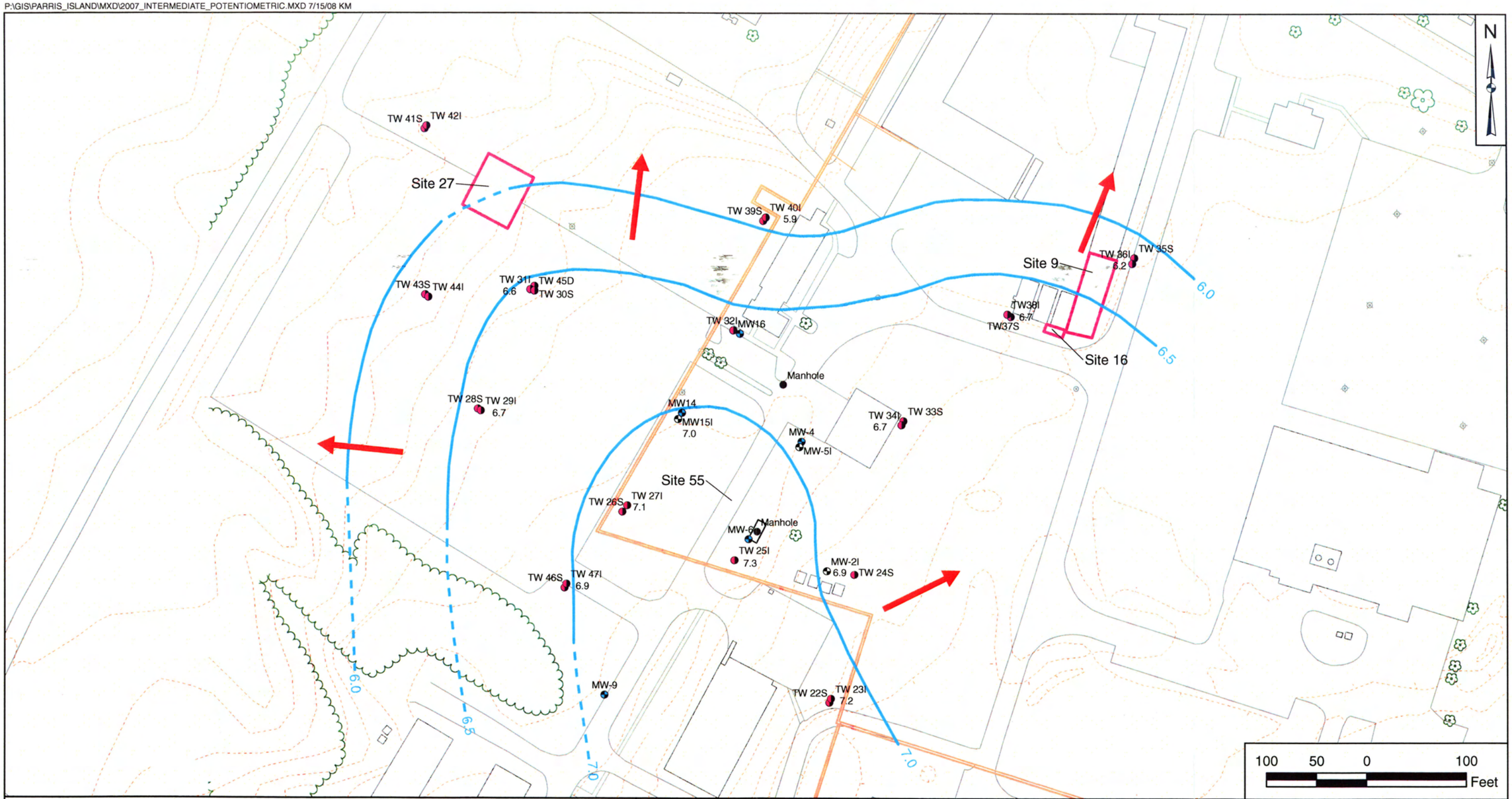


Legend

- 2007 Temporary Well
- Intermediate Monitoring Well (2002)
- Shalllow Monitoring Well (2002)
- Manhole

Groundwater Contour
- Inferred
- Regular

- Tree Line
- Aerial Pipe
- Topographic Contour

- Building
- Sidewalk
- Road

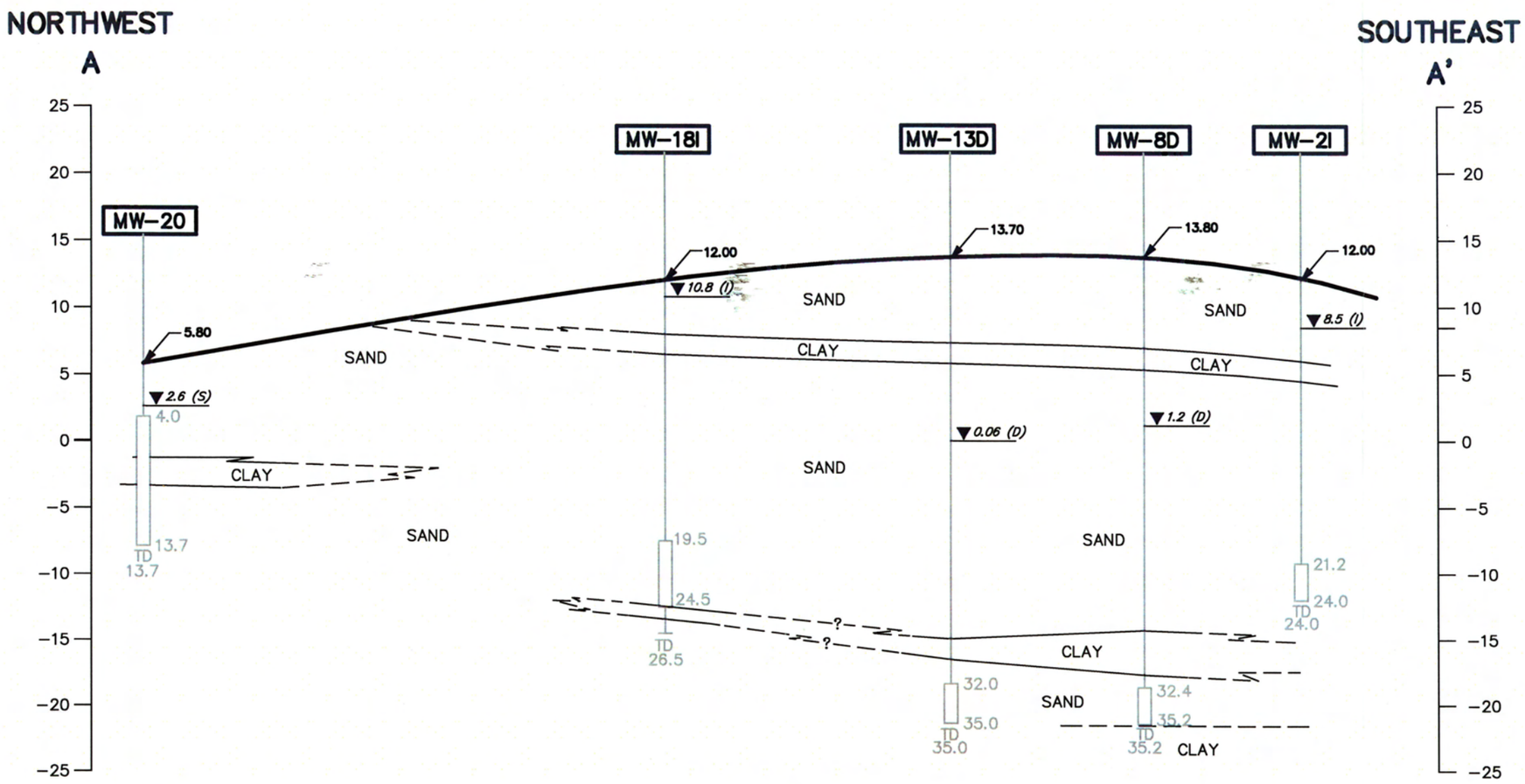
DRAWN BY K. MOORE	DATE 7/15/08
CHECKED BY G. ZIMMERMAN	DATE 7/16/08
COST/SCHEDULE-AREA	
SCALE AS NOTED	

NAVFAC

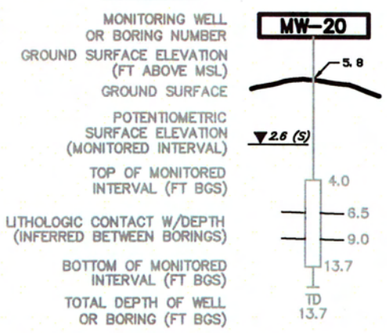
2007 INTERMEDIATE WELLS
POTENTIOMETRIC SURFACE MAP
SITES 9, 16, 27, AND 55
MCRD PARRIS ISLAND
PARRIS ISLAND, SOUTH CAROLINA

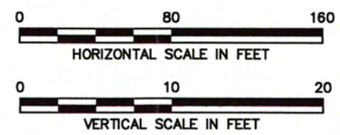
CONTRACT NUMBER 0039	
APPROVED BY —	DATE —
APPROVED BY —	DATE —
FIGURE NO. FIGURE 2-7	REV 0

ACAD: 0455GX03.dwg 7/14/08 CK PIT



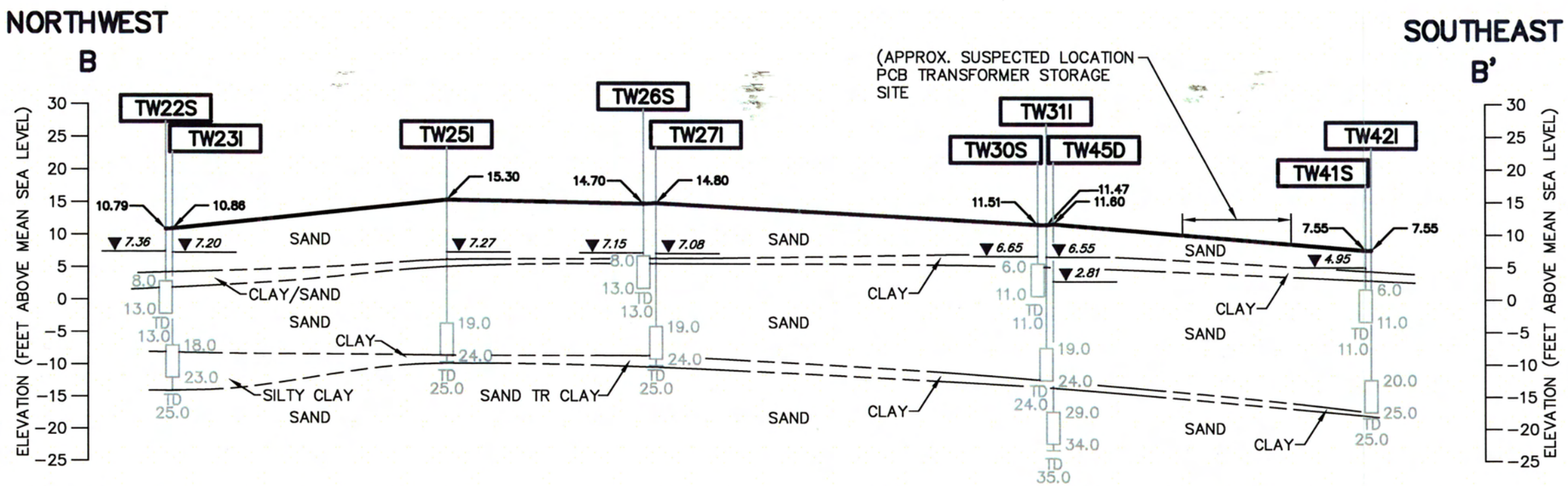
LEGEND:



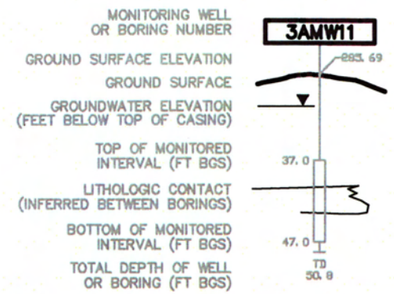


DRAWN BY CK DATE 7/14/08	NAVFAC	CROSS SECTION A – A' SITE 27 MCRD PARRIS ISLAND PARRIS ISLAND, SOUTH CAROLINA	CONTRACT NO. 0039
CHECKED BY DATE			OWNER NO.
REVISED BY DATE			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2-8 / REV. 0

FORM CADD NO. SDIV-BH.DWG - REV 1 - 9/10/98



LEGEND:



NOTES:

1.) WATER LEVELS TAKEN ON 9/26/07.
2.) WATER LEVEL OF 45D MAY NOT HAVE STABILIZED AT THE TIME TAKEN.

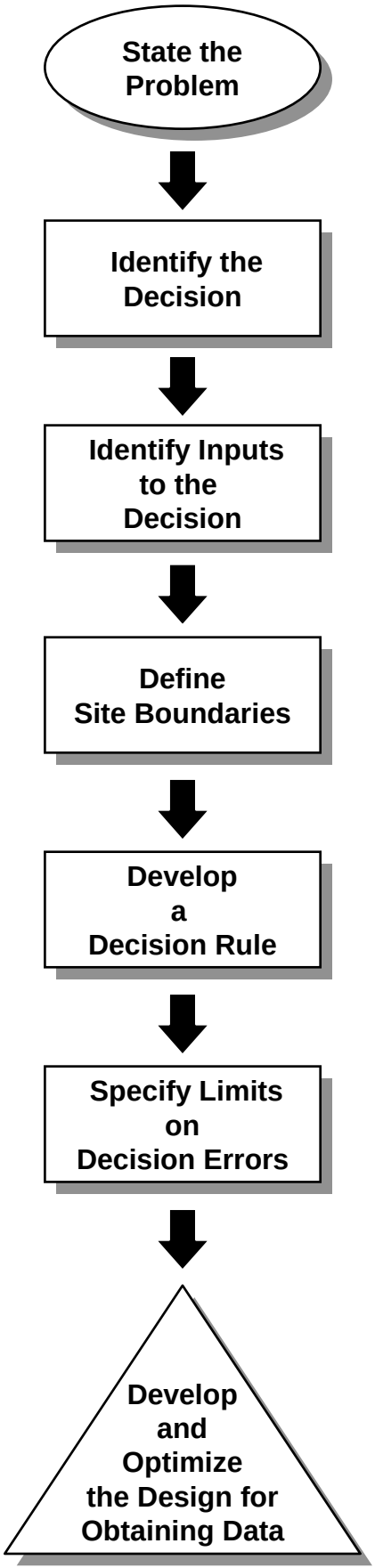
0 80 160
HORIZONTAL SCALE IN FEET
0 20 40
VERTICAL SCALE IN FEET

DRAWN BY CK DATE 7/14/08	NAVFAC	CROSS-SECTION B – B' SITE 27 MCRD PARRIS ISLAND PARRIS ISLAND, SOUTH CAROLINA	CONTRACT NO. 0455
CHECKED BY DATE			OWNER NO.
REVISED BY DATE			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2-9 / REV. 0

FORM CADD NO. SDIV-BH.DWG - REV 2 - 6/19/06

ACAD: 0455GX04.dwg 7/14/08 CK PIT

FIGURE 2-10
DATA QUALITY OBJECTIVES PROCESS
SITE 27 REMEDIAL INVESTIGATION
MCRD PARRIS ISLAND, SOUTH CAROLINA



- Definition of problem for data collection (Section 2.5)
- Review of historical and background information (Section 2.0)
- Preliminary assessment of existing data (Sections 2.1 - 2.4)

- Statement of the action-based decisions to resolve problems (Section 2.5.2)

- Identification of measurable variables and action levels to support decisions (Section 2.5.3)

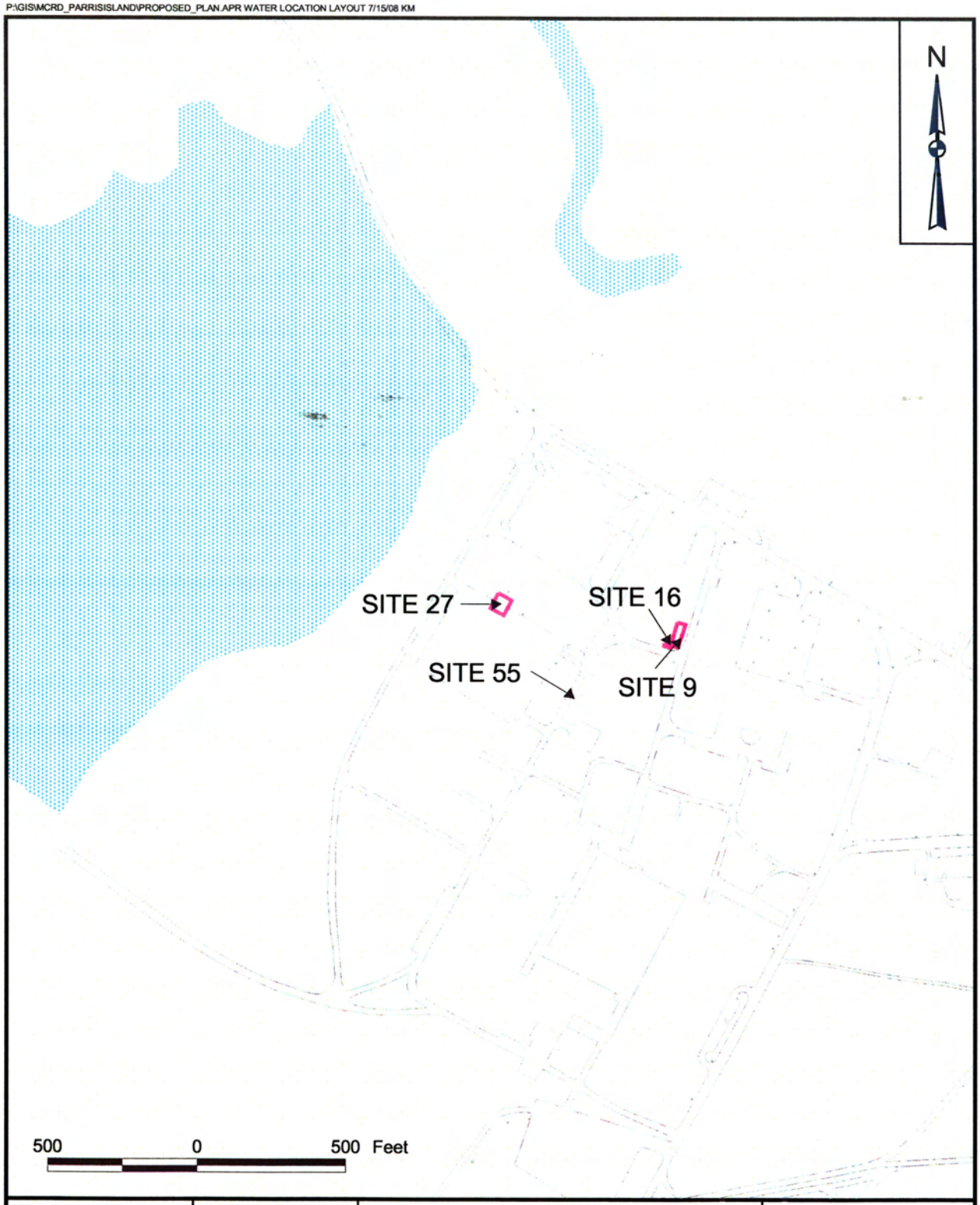
- Definition of sampling population and spatial and temporal boundaries and limitations (Section 3.0)

- Single statement synthesizing previous steps and summarizing how data will be used to make decisions (Section 2.5.2 and Master Work Plan, Volume III)
- An “if...then” statement defining values for deciding between alternative actions (Section 2.5.3 and Master Work Plan, Volume III)

- Definition of acceptable limits of decision error and potential consequences of incorrect decisions (Master Work Plan, Volume III)

- Development of alternative sampling designs and selection of most effective design for sampling and analysis (Section 3.2)

P:\GIS\MCRD_PARRISISLAND\PROPOSED_PLAN.APR WATER LOCATION LAYOUT 7/15/08 KM



DRAWN BY K MOORE — DATE 9/11/07	NAVFAC	SURFACE WATER BODIES SITES 9, 16, 27 AND 55 MCRD PARRIS ISLAND PARRIS ISLAND, SC	CONTRACT NUMBER 0039
CHECKED BY G. ZIMMERMAN — DATE 9/12/07			APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 2-11 — REV 0

3.0 INVESTIGATION SCOPING

The Phase II RI field activities will consist of monitoring well installation, groundwater sampling, and soil sampling. The results of these activities will be used to supplement the data collected in previous investigations to determine the nature and extent of contamination in groundwater and soil at the sites under investigation. However, additional sampling to complete delineation of Site 9 and 16 soil will be deferred, to be addressed in a design document for those sites, provided the current data are sufficient to support development of the Feasibility Study (FS), Proposed Plan (PP), and Record of Decision (ROD).

3.1 INVESTIGATION RATIONALE

Previous investigations have shown the presence of a co-mingled plume consisting of chlorobenzenes, BTEX, and pesticides. The shallow aquifer is separated into three zones (shallow, intermediate, and deep) by two relatively continuous clay layers. The rationale for investigation is as follows:

- **Groundwater source identification:** Although the release mechanism remains unclear and may never be identified, refinement of the characterization of the source area, including upgradient extent, is required.

- **Plume extent:** Contamination has been determined to exist in the shallow and intermediate zones of the shallow aquifer. The deeper zone had minimal contaminant concentrations. Shallow and intermediate depth zones will be investigated where previous data indicate contamination or to verify that the edge of the plume has been reached. Upgradient and far downgradient locations will also be investigated to provide data for the overall spatial extent of contamination in groundwater.

- **Soil:** Soil contamination in subsurface in the area of highest groundwater contamination will be investigated for surface areas and potential migration of contaminants from soil to groundwater.

3.2 INVESTIGATION SUMMARY

The following sections present the proposed investigation. All data will be collected in accordance with the Master FSP, Master QAP (B&R Environmental, 1998) with updated SOPs, and U.S. EPA Region 4 Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM) (1996). Table 3-1 summarizes the rationale for selection of locations (existing permanent monitoring wells, proposed monitoring wells, and soil samples) to be sampled during this field investigation. Descriptions of sample locations and the sampling techniques to be used are discussed in

Section 5.0, and sample locations are shown on Figures 2-2, 2-3, and 2-4. All samples will be analyzed for VOCs and pesticides.

3.2.1 Groundwater Sampling

Existing monitoring wells that were screened in the 3- to 14-foot bgs interval will be used to represent the shallow zone of the surficial aquifer, and wells screened in the 20- to 25-foot bgs interval will be used to represent the intermediate zone. Based on field screening results, the chlorobenzene and pesticide plumes are located within the 8- to 12-foot bgs interval. Therefore, to evaluate the extent of the plume, new shallow monitoring wells will be screened across the water table, which is expected to include the 8- to 12-foot bgs interval. Screen lengths and/or depth intervals may be field adjusted to ensure the screened intervals straddle the water table. The intermediate monitoring wells will be screened immediately above the clay unit previously encountered at approximately 24-25 feet bgs. The top of the clay unit will be determined by visually describing changes in lithology observed in split-spoon samples collected during drilling operations. Once the clay unit is encountered, a few continuous split-spoon samples will be taken to confirm the thickness of the clay unit.

During this field event, 20 existing monitoring wells will be resampled and 17 proposed monitoring wells will be installed and sampled at locations that will aid in delineating the plumes. A majority of these monitoring wells are proposed for determining the edges of the plumes. A few are at locations to verify current contaminant levels where some of the higher concentrations had been previously detected. All groundwater samples will be sent to a fixed-base laboratory for Target Compound List (TCL) VOC, pesticides, total dissolved solids (TDS), total organic carbon (TOC), and total alkalinity analysis. In addition, the groundwater samples will be analyzed in the field for dissolved oxygen (DO), temperature, salinity, specific conductance, turbidity, pH, and oxidation-reduction potential (ORP).

3.2.2 Soil Sampling

Soil samples will be collected at the surface (0 to 1 foot bgs) and subsurface (1 to 2 feet bgs or deeper) to the water table. The vertical extent of investigation will be determined at each location (see Table 3-1 and Figure 2-4) by visual observations of soil staining, odor, and/or photoionization detector (PID) readings indicating the presence of VOCs within the molecular weight range of those previously detected on site. The sample from the depth interval at each location that exhibits the most likelihood of contamination as defined by the criteria in this section (visual observation, PID readings, etc.) will be analyzed for VOCs and pesticides, pH, and TOC at a fixed-base laboratory.

3.3 PROJECT SCHEDULE

Figure 7-1 is a schedule showing the duration of each task under this investigation following the finalization of the Work Plan Addendum. Generally, the activities include the following:

- Installation of monitoring wells and soil borings, sampling of existing and proposed new permanent monitoring wells: 14 days.
- Laboratory analysis and reporting: 30 days following receipt of last sample.
- Evaluation of data: 20 days following data validation.
- RI report preparation: to be determined, as necessary following completion of field effort.

TABLE 3-1

PROPOSED SAMPLING - SITE 27 REMEDIAL INVESTIGATION WORK PLAN ADDENDUM
MCRD PARRIS ISLAND
PARRIS ISLAND, SOUTH CAROLINA

LOCATIONS TO BE SAMPLED	DEPTHS TO BE SAMPLED	RATIONALE
GROUNDWATER		
PAI-27-MW-6 PI055MW07I PI055MW08D	shallow intermediate deep	Confirm high concentrations of pesticides. These three wells are located in a cluster near the Fiber Optic Vault where groundwater contamination was first noted. The highest pesticide concentrations were detected in a sample collected from PAI-27-MW-6. The next highest pesticide concentrations were detected in the sample from PI055MW07I. Samples from the intermediate and deep wells at this location will help to define the vertical extent of contamination. In addition, high concentrations of chlorobenzene were detected in groundwater samples collected from abandoned wells (PAI-55-FDP20, PAI-27-TW-25I, and PAI-55-FDP12) located in this area.
PI055MW11 PI055MW12I PI055MW13D	shallow intermediate deep	Confirm elevated concentrations of pesticides. These three wells are located in a cluster about 100 feet northeast of the Fiber Optic Vault. Elevated concentrations of pesticides (d-BHC at 47 ug/L) were detected in PI055MW11. In addition, elevated concentrations of chlorobenzene were detected in PI055MW12I, PAI-27-TW-26S (abandoned), and PAI-55-FDP04 (abandoned) in this area. Samples from the intermediate and deep wells at this location will help to define the vertical extent of contamination.
PI027MW19	shallow	Confirm elevated concentrations of pesticides (a-BHC at 46 µg/L) and chlorobenzene (479 µg/L). In addition, this well is located near a cluster of three abandoned wells (PAI-27-TW-30S, PAI-27-TW-31I, and PAI-27-TW-45D) that also had elevated detections of pesticides and chlorobenzene.
PI055MW17 PI055MW18I	shallow intermediate	These wells are close to where PAI-27-TW-28S and PAI-27-TW-29I were located. Elevated concentration of d-BHC (32 µg/L) was detected in PAI-27-TW-28S. These wells had low concentrations of VOCs and could also be used to define the horizontal and verticial extent of the VOC contamination.
PAI-27-MW-14 PAI-27-MW-15I	shallow intermediate	A somewhat elevated concentration of d-BHC (6.1 µg/L) was detected in PAI-27-MW14 and an elevated concentration of chlorobenzene (690 µg/L) was detected in PAI-27-MW-15I. Samples would be used to define the horizontal and vertical extent of groundwater contamination. These wells are also within 30 feet of abandoned well PAI-55-FDP05 (2,830 µg/L of chlorobenzene).
PAI-27-MW-16	shallow	Low concentrations of pesticides (d-BHC - 1.2 µg/L) were detected in PAI-27-MW16. Sample would be used to define the horizontal and vertical extent of groundwater contamination.
PI055MW01 PAI-27-MW-2I	shallow intermediate	A somewhat elevetated concentration of d-BHC (2.3 µg/L) was detected in PI055MW01 and low concentrations of VOCs were detected in these wells. The samples would be used to define the extent of contamination.
PI027MW21	shallow	A somewhat elevated concentration of a-BHC (2.9 µg/L) was detected in PI027MW21 and low concentrations of VOCs were detected in this well. The sample would be used to define the horizontal and verticial extent of contamination.

TABLE 3-1

PROPOSED SAMPLING - SITE 27 REMEDIAL INVESTIGATION WORK PLAN ADDENDUM
MCRD PARRIS ISLAND
PARRIS ISLAND, SOUTH CAROLINA

LOCATIONS TO BE SAMPLED	DEPTHS TO BE SAMPLED	RATIONALE
GROUNDWATER		
PAI-27-MW-9 PAI-27-MW48I	shallow intermediate (new)	Pesticides and VOCs were not detected in PAI-27-MW-9. This well would be sampled to confirm the nature and extent of contamination. The new intermediate well would be sampled to confirm the vertical extent of contamination upgradient of the wells with the highest concentrations.
PAI-27-MW-4 PAI-27-MW-5I	shallow intermediate	Low concentrations of VOCs and no pesticides were detected in these wells. These wells are located near PAI-55-FDP14 (960 µg/L - chlorobenzene) and can be used to confirm the horizontal and vertical extent of contamination.
PI055MW10 PI027MW20	shallow shallow	Low concentrations of VOCs and pesticides were detected in these wells. The samples would be used to confirm the horizontal and vertical extent of contamination.
PAI-27MW49S PAI-27MW50I	shallow (new) intermediate (new)	This well would replace PAI-55-FDP07 (chlorobenzene - 590 ug/L). In addition to confirming presence of VOCs, the samples could also be used to define the horizontal and vertical extent of pesticide contamination (no wells in this area sampled for pesticides).
PAI-27MW51S PAI-27MW52I	shallow (new) intermediate (new)	These are new wells that will be used to define the vertical and horizontal extent of contamination upgradient of the wells with the highest concentrations.
PAI-27MW53S PAI-27MW54I	shallow (new) intermediate (new)	These are new wells that will be used to define the horizontal and vertical extent of contamination south west of the wells with the highest concentrations.
PAI-27MW55S PAI-27MW56I	shallow (new) intermediate (new)	These are new wells that will be used to define the horizontal and vertical extent of contamination west of the contaminated area.
PAI-27MW57S	shallow (new)	This well will be used to define the horizontal and vertical extent of contamination north of the contaminated area.
PAI-27MW58S PAI-27MW59I	shallow (new) intermediate (new)	These are new wells that will be used to define the horizontal and vertical extent of contamination north of the contaminated area.
PAI-27MW60I	intermediate (new)	This well will be used to define the horizontal and vertical extent of contamination north of the contaminated area.
PAI-27MW61I	intermediate (new)	This well will be used to define the horizontal and vertical extent of contamination north of the contaminated area.
PAI-27MW62S	shallow (new)	This well will be used to confirm concentrations downgradient of PI027MW21.
PAI-27MW63S	shallow (new)	This well will be used to confirm concentrations in the vicinity of PAI-27-TW-39S (downgradient of PAI-27-MW16).
PAI-27MW64S	shallow (new)	This well will be used to determine the upgradient extent of VOC contamination (downgradient of Building 405).

4.0 FIELD OPERATIONS

This section, the site-specific FSP for Phase II RI activities at the Site 27 Area, outlines the project-specific field investigation activities and describes the procedures to be performed at this area. It is to be used in conjunction with the Master FSP, Volume II of the Master Work Plan for MCRD Parris Island (B&R Environmental, 1998) and references the Master FSP where appropriate.

Field operation activities to be performed at MCRD Parris Island for this investigation include mobilization/demobilization, soil sampling, monitoring well installation, groundwater sampling, water-level and free-product measurements, site surveying, equipment decontamination, waste handling, and site restoration.

All field operation activities will be performed as described in the Master FSP and updated TtNUS SOPs provided in Appendix B.

4.1 MOBILIZATION/DEMOBILIZATION

Mobilization activities will be performed in accordance with the procedures outlined in the Master FSP (B&R Environmental, 1998).

Prior to construction of any monitoring wells, a formal request will be submitted to SCDHEC for approval. The request will contain the following information:

- Proposed locations on a scaled map
- Proposed well construction details
- Well owner's name and mailing address
- Proposed parameters to be analyzed
- Proposed drilling date

4.2 SITE RESTORATION

If investigation activities such as soil sampling or monitoring well installation disturb or alter the landscape, vegetation, or other features of the sites, site surfaces may require restoration to re-establish conditions existing prior to the investigation. If vegetation is stressed or damaged as a result of investigation activities, the affected area will be reseeded. Asphalt and concrete patching will occur in the Site 27 equipment storage pad or if locations are drilled in sidewalks or roadways. Additionally, all equipment used during the investigation and all investigation-derived waste (IDW) will be removed from the site.

4.3 PERMANENT MONITORING WELL INSTALLATION

Permanent monitoring wells will be installed at selected locations and screened within the shallow surficial aquifer to further delineate the VOC and pesticide plumes. As noted earlier in this Work Plan Addendum, well locations, depths, and screening intervals were determined based on the findings of previous investigations, including the first phase of the RI when temporary and existing permanent monitoring wells were sampled.

The permanent monitoring wells will be installed and constructed in accordance with all applicable State of South Carolina regulations (i.e., Code of Laws of South Carolina 2002, Regulation 61-71 Well Standards) and Volume II of the Master Work Plan (B&R Environmental, 1998), with updated SOPs provided in Appendix B. A formal request letter will submitted to SCDHEC prior to advancement of the permanent wells, and a monitoring well record (1903 Form) will be submitted within 30 days after completion.

Monitoring wells will be installed using 4.25-inch hollow-stem augers to the desired depth, which may be within the shallow, intermediate, or deep zones of the shallow surficial aquifer. The monitoring well will be installed through the augers upon completion of each boring. During monitoring well installation, soil will be sampled continuously as necessary at the discretion of the field geologist to the termination depth of the boring to provide lithologic data.

All wells will be constructed with certified-clean well construction material. Monitoring wells will be constructed of 2-inch inside diameter (ID), flush-threaded polyvinyl chloride (PVC) well screen and flush-threaded PVC well casing riser. The PVC will meet National Sanitation Foundation (NSF) Standard 14 as specified in U.S. EPA's EISOPQAM (1996). The well screens will be 5-feet or 10-feet long with 0.020-inch slot-size openings, depending on the lithology. Well screen lengths will be selected so that the screened intervals of the shallow, intermediate, and deep wells within a cluster do not overlap.

A primary filter pack of clean silica sand will be installed from 6 inches below the bottom of the screen to a minimum of 2 feet above the top of the well screen. A sand passing U.S. Standard Sieve No. 20-40 will be used. A minimum 2-foot-thick seal of 100 percent sodium bentonite pellets will be installed above the primary filter pack and allowed to hydrate in accordance with the manufacturer's recommendations. The annular space above the bentonite seal will be grouted with neat cement or a bentonite/cement mixture from the top of the bentonite seal to at least 2 feet bgs. The concrete used to form the pad will fill the remaining annular space.

Permanent monitoring wells may be installed as at-grade (flush-mount) wells or with risers and protective casing, depending on the location. Typical monitoring well construction details are provided in the field

forms included in Appendix B. The specific construction details of permanent wells showing the selected combinations of surface completion (flush-mount or with riser), total depths, penetration of clay layer (if applicable), screen length (5-foot or 10-foot length), etc. will be shown on figures in the RI Report.

A 4-inch by 4-inch aluminum identification plate will be affixed to each well and will contain the following information:

- Well identification number
- Date of construction
- Name of consultant
- Depth of well
- Screened interval
- Top of casing elevation
- Northing of well
- Easting of well
- Reference datum
- Well information contact

A boring log will be maintained as described in the Master FSP for each well boring by the TtNUS field geologist. In the case of well cluster installations, a soil boring log will be maintained only for the deepest boring at each well cluster. Field screening and head-space analysis results and a lithologic description of each soil sample will be recorded on the boring log. At a minimum, the information outlined in the Master FSP will be recorded on the boring log for each boring.

Prior to sampling, all new monitoring wells will be developed to remove formation cuttings (as well as any residual drilling fluids), as described in the Master FSP, Volume II (B&R Environmental, 1998). Bailing and surging or pumping will be used, and water-quality parameters (pH, temperature, and turbidity) of development water will be monitored for stabilization defined as two consecutive readings within a range of ± 0.1 units, ±1 degree Celsius (°C), and 10 nephelometric turbidity units (NTUs), respectively.

To assist in characterizing site hydrogeological conditions, slug tests will be performed on selected monitoring wells (both new and existing, as necessary to provide spatial coverage). Wells to be used for slug testing will be selected based on the lithology noted in the boring logs for the wells. The results of the slug tests will be used to estimate the hydraulic conductivity of the surficial aquifer.

Prior to slug testing, newly installed wells will be thoroughly developed and allowed to stabilize in order to obtain accurate results. After the water level within the well has stabilized, it will be quickly raised or

lowered using a PVC slug or equivalent. The rate of recovery will be measured using pressure-sensitive transducers and electronic data loggers. After the water levels have recovered to within +/- 10 percent of the static water levels, the tests may be terminated. The PVC slug will be decontaminated between wells. Field data (e.g., water-level measurements) will be documented on Hydraulic Conductivity Testing Data Sheets prior to moving to the next well. Data analysis methods will be based on the testing conditions encountered, and may include Hvorslev or Bower and Rice, in addition to recommendations from United States Department of Interior's Ground Water Manual.

If conditions permit, exploratory borings may be installed at three locations (PAI-27MW57S, PAI-27MW49S, and PAI-27MW51S) to provide additional lithology information for the study area. These borings would be installed to a depth of approximately 35 feet bgs where a third clay layer was encountered during previous investigations. To determine the approximate thickness of the clay layer, the borings would extend into the clay layer approximately 2 to 3 feet (the boring would be stopped if the thickness of the clay layer was less than 2 feet). A boring log would be maintained as described in the Master FSP for each soil boring. The soil borings would be abandoned by pressure grouting neat cement, bentonite cement, or 20 percent high solids sodium bentonite grout from the bottom of the boring to the ground surface using a tremie pipe.

4.4 WATER-LEVEL MEASUREMENTS

During this event, two rounds of synoptic water-level measurements (high tide and low tide) will be collected from the existing permanent monitoring wells and proposed monitoring wells listed in Table 3-1.

All water-level measurements will be taken within a short time period (maximum 4 hours) of consistent weather conditions to minimize atmospheric/precipitation effects on groundwater levels. Measurements will be taken with an electric water-level indicator and/or a hydrocarbon interface probe using the top of the well riser as the reference point for determining depths to water. Water-level measurements will be recorded to the nearest 0.01 foot in the appropriate field logbook or on a groundwater level measurement form provided in Appendix B. If a NAPL layer is found, its thickness will also be measured and recorded.

4.5 GROUNDWATER INVESTIGATION

At each permanent monitoring well listed in Table 3-1, a groundwater sample will be obtained using a peristaltic pump and polyethylene tubing. Each well will be purged prior to sampling until a minimum of three well volumes have been removed and stabilization of successive pH, conductivity, and turbidity measurements (per the well purging SOP) is achieved, or a maximum of 10 well volumes have been removed. The groundwater samples will be collected after water-quality parameters stabilize. Groundwater sample aliquots for all analyses except VOC analysis will be collected by reducing the flow to

fill the appropriate containers directly from the tubing. To reduce volatilization, the TCL VOCs sample will be collected by removing the tubing from the pump and allowing the water in the tubing to drain into the sample containers.

4.6 SOIL INVESTIGATION

Soil samples will be collected at 16 locations in the areas of highest groundwater contamination to determine if source areas are present. A hollow-stem auger rig will be available during monitoring well installation and will be used to advance the boreholes to collect the soil samples.

Surface soil samples will be collected from the 0- to 1-foot bgs interval beneath the surface cover (root zone or asphalt subbase). Subsurface soil samples will be collected from the depth interval that exhibits the most likelihood of contamination (visual observations, PID readings, etc.) but no deeper than the depth of the water table.

Pre-cleaned disposable sampling trowels will be used for sampling (after removal of asphalt and gravel, as necessary, by other means). After sampling, the holes in any paved surface will be backfilled and patched with ready-mix concrete.

4.7 SURVEYING

The locations and elevations of all newly installed permanent wells and soil borings will be surveyed. The North American Datum (NAD) 1983 will be used as the horizontal datum. Sample locations will be surveyed to the nearest 0.10 foot. Vertical elevations will be referenced to 1988 National Geodetic Vertical Datum (NGVD). Elevations for monitoring wells will be determined at the measuring point where the uncapped PVC well riser pipe is notched and at the top of the protective casing to the nearest 0.01 foot. For all sample locations, including monitoring wells, ground surface elevations will be surveyed to the nearest 0.01 foot.

4.8 DECONTAMINATION

Decontamination of major equipment and sampling equipment will be in accordance with the Master FSP and SOP SA-7.1, Decontamination of Field Equipment and Waste Handling. An area for the decontamination pad for major equipment and a source of potable water for steam washing will be arranged by the Field Operations Leader (FOL) through MCRD personnel.

4.9 WASTE HANDLING

All solid and liquid wastes generated as a result of this investigation will be handled in accordance with the procedures described in Section 2.11 of the Master FSP (B&R Environmental, 1998) and SOP SA-7.1, Decontamination of Field Equipment and Waste Handling.

Soil cuttings will be placed in drums, and these cuttings will be tested and then disposed off site. Well development water will be collected in drums, and based on test results, the water will be either discharged to the sanitary sewer or taken off site for disposal. Decontamination water will also be collected in drums, tested, and then processed in the same manner as well development water.

5.0 ENVIRONMENTAL SAMPLING

This section outlines the environmental sampling program and describes sampling procedures for the field investigation at Sites 9, 16, 27, and 55.

5.1 SUMMARY OF ENVIRONMENTAL SAMPLING

Table 3-1 summarizes the groundwater and soil sampling and analytical program for this field event. Figures 2-2, 2-3, and 2-4 show the proposed groundwater and soil sampling locations during this event. Proposed sampling locations are contingent on utility location and clearance by MCRD personnel.

5.2 SAMPLING PROCEDURES

The following sections describe procedures that will be followed during soil and groundwater sample collection at the proposed sampling locations.

5.2.1 Soil Sampling

Surface soil and subsurface soil samples will be collected from 16 soil boring locations. Soil samples will be collected using a hollow-stem auger drill rig and disposable Teflon trowels. All soil samples will be collected in accordance with the methodologies described in the Master FSP and TtNUS SOPs GH-1.5, Borehole and Sample Logging, and GH-1.3, Soil and Rock Drilling Methods. Soil sample collection logs are included with the field forms in Appendix B.

5.2.2 Groundwater Sampling

Groundwater samples will be collected for this investigation from the 20 existing monitoring wells and 17 proposed monitoring wells listed in Table 3-1 and shown on Figures 2-2 and 2-3. All groundwater samples will be collected using low-flow purge and sampling technique in accordance with the U.S. EPA Region 4 EISOPQAM and TtNUS SOP SA-1.1. Groundwater low-flow purge sheets and sample logs are included with the field forms in Appendix B.

5.3 SAMPLE HANDLING

5.3.1 Sample Containers, Preservation, Holding Times, and Analyses

Sample handling includes selection of proper sample containers, preservation, allowable holding times, and analyses. Sample handling requirements for this investigation are presented in Section 8.0.

5.3.2 Sample Nomenclature

Each sample will be assigned a unique codified sample identification number. The sample nomenclature format described in the Master FSP and SOP CT-04, Sample Nomenclature, will be used for this investigation. The unique labeling system established for this sampling event is based on the following:

1		2		3		4
AAA-NN	-	AA	-	NNN	-	NN
Facility Name-Site Number		Medium		Sample Location		Sample Depth or Sampling Round

1	PAI - Parris Island 27-Site 27	3	An ascending sequential number of samples collected or well number
2	SS - Surface Soil GW - Groundwater SB - Soil Boring/Subsurface Soil TW - Temporary Monitoring Well FB - Field Blank TB - Trip Blank IDW - IDW DU - Duplicate	4	Bottom of sample interval in feet bgs

The following is the medium-specific nomenclature to be used in this program.

Soil Borings and Samples from Soil Borings

1		2		3		4
PAI-YY	-	SB	-	XXX	-	NN
Site Location and Site Number		Medium		Sample Location		Sample Depth

1 27 - Site 27
2 SB for soil boring
3 An ascending sequential number, beginning with 014
4 Bottom of interval in feet bgs

For example, a soil sample collected from boring SB014 from the 0- to 1-foot bgs interval would be numbered PAI-27-SB-014-01. There may be gaps in the sequence of SB soil sample numbers. The sampling interval will be noted on the sample log sheet.

Groundwater Samples

1		2		3		4
PAI-YY	-	GW	-	XXX	-	NN
Site Location and Site Name or Number		Medium		Sample Location		---

1 27 - Site 27
2 GW - permanent well sample
3 Sample location number
4 Round number

For example, the sample from a shallow well (screened from 8 to 12 feet bgs) installed at location MW-49S would be numbered PAI-27-GW-49S. A co-mingled plume is being investigated; therefore, a common site name of "27" will be used for all groundwater samples. For samples collected from permanent monitoring wells, the medium will be designated "GW" and the fourth field will be – "01" for wells being sampled for the first time since installation (new wells), or -02 for wells being sampled for second time (existing wells).

Blanks, IDW Samples, and Duplicates

1		2		3		4
PAI-YY	-	AA	-	AANNNN	-	NN
Site Location and Site Number		Sample Type		Date		Identifier

1 27-Site 27
2 Sample type, as noted at the beginning of this subsection
3 Date of sample, in the format MMDDYY
4 An ascending sequential number to differentiate samples collected on the same date, starting at 01

For example, the first solid IDW sample collected on September 15, 2008, would be numbered PAI-27-IDW-091508-01. As another example, the second groundwater duplicate sample collected on September 15, 2008, from a monitoring well with the site designation of "PAI-27-" would be numbered as PAI-27-DU-091508-02. Only the field logbook will indicate which original sample corresponds with the field duplicate; the chain-of-custody form submitted to the laboratory will show the field duplicate as a "blind" sample.

5.3.3 Sample Documentation, Packaging, and Shipping

Matrix-specific sample log sheets will be maintained for each sample collected. In addition, sample collection information will be recorded in field notebooks and the site logbook. Further description of sample documentation is provided in the Master FSP and TtNUS SOP SA-6.3, Field Documentation.

Samples will be packaged and shipped according the Master FSP and TtNUS SOP SA-6.1, Non-Radiological Sample Handling.

5.3.4 Sample Custody

Sample custody will be maintained and documented at all times. Custody begins at the time of collection and ends at the time of disposal by the laboratory. The procedures for custody described in the Master FSP and TtNUS SOPs SA-6.1 and SA-6.3 will be implemented for this investigation. Chain-of-custody forms are provided with the field forms in Appendix B.

6.0 QUALITY ASSURANCE PLAN

A general discussion of the data quality process is provided in the Master Work Plan (B&R Environmental, 1998). Site-specific DQOs are provided throughout this Work Plan Addendum, and Figure 2-10 illustrates how various sections of the Work Plan Addendum relate to the steps in the DQO process. The laboratory DQOs are discussed in Section 8.0 of this document.

Table 6-1 provides a cross index of U.S. EPA Quality Assurance Project Plan (QAPP) elements and their locations in this Work Plan Addendum, Master QAP, and other project documents.

TABLE 6-1

QAPP CHECKLIST
SITE 27 REMEDIAL INVESTIGATION WORK PLAN
MCRD PARRIS ISLAND, SOUTH CAROLINA

ELEMENT		DQO STEP (QA/R-5 A.3)	COMMENT	REFERENCE(S)/COMMENT
A1.	**Title and Approval Sheet**		-	
	Title		P	Work Plan Addendum Title Page
	Organization's name		P	Work Plan Addendum Title Page
	Dated signature of Project Manager		P	Work Plan Addendum Title Page
	Dated signature of QA officer		NA	Project Manager documents QA process
	Other signatures, as needed		P	Work Plan Addendum Title Page
A2.	**Table of Contents**		P	Included
A3.	**Distribution List**		P	Work Plan Addendum Transmittal letter
A4.	**Project/Task Organization**	1		
	Identifies key individuals with their responsibilities (data users, decision makers, project QA manager, subcontractors, etc.)		P	Work Plan Addendum Section 7
	Organization chart shows lines of authority and reporting responsibilities		P	Work Plan Addendum Figure 7-1
A5.	**Problem Definition/Background**	1 and 2		
	Clearly states problem or decision to be reached		P	Work Plan Addendum Section 2.5.2
	Provides historical and background information		P	Work Plan Addendum Sections 2.1 to 2.4
A6.	**Project/Task Description**	1, 2, 3, and 6		
	Lists measurements to be made		P	Work Plan Addendum Table 3-1
	Cites applicable technical, regulatory, or program-specific quality standards, criteria, or objectives		P	Work Plan Addendum Section 2.5.3
	Notes special personnel or equipment requirements		P	Master Work Plan Addendum Vol. I, Section 3
	Provides work schedule		NA	SMP with regular Partnering Team updates
	Notes required project and QA records/reports		P	Master QAP Section 7.0, Master Work Plan Addendum Vol. II
A7.	**Quality Objectives and Criteria for Measurement Data**	4, 5, and 6		
	States project objectives and limits, both quantitatively and qualitatively		P	Work Plan Addendum Section 3
	States and characterizes measurement quality objectives as to applicable action levels or criteria		P	Master QAP Section 3.2
	States appropriate temporal and spatial boundaries		P	Work Plan Addendum Section 3
	States "scale of decision making"		P	Work Plan Addendum Section 3

TABLE 6-1

QAPP CHECKLIST
SITE 27 REMEDIAL INVESTIGATION WORK PLAN
MCRD PARRIS ISLAND, SOUTH CAROLINA

ELEMENT		DQO STEP (QA/R-5 A.3)	COMMENT	REFERENCE(S)/COMMENT
A8.	**Special Training Requirements/Certification Listed**			
	States how provided, documented, and assured		P	Master Work Plan Addendum Vol. II, HASP Section 8.1
A9.	**Documentation and Records**	3 and 7		
	Lists information and records to be included in the data report (e.g., raw data, field logs, results of QC checks, problems encountered)		P	Master QAP Chapter 8.0
	States requested lab TAT		NA	Standard TAT will be used
	Gives retention time and location for records and reports		P	Master QAP Chapter 7.0 (Stored at Pittsburgh office 7 years after end of contract)
B1.	**Sampling Process Design (Experimental Design) States the following:**	5 and 7		
	Type and number of samples required		P	Work Plan Addendum Table 5-1
	Sampling design and rationale		P	Work Plan Addendum Section 3
	Sampling locations and frequency		P	Work Plan Addendum Section 5
	Sample matrices		P	Work Plan Addendum Table 5-1
	Classification of each measurement parameter as either critical or needed for information only		NA	All data will be used directly or indirectly in project decisions.
	Appropriate validation study information for nonstandard situations		NA	No nonstandard situations expected
B2.	**Sampling Method Requirements**	3 and 7		
	Identifies sample collection procedures and methods		P	TtNUS SOPs SA-1.1 and SA-1.3
	Lists equipment needs		P	Work Plan Addendum Sections 4 and 5
	Identifies support facilities		NA	Subcontractors to be determined
	Identifies individuals responsible for corrective action		P	Master QAP Section 2.0
	Describes process for preparation and decontamination of sampling equipment		P	TtNUS SOP SA-7.1
	Describes selection and preparation of sample containers and sample volumes		P	Work Plan Addendum Table 8-2
	Describes preservation methods and maximum holding times		P	Work Plan Addendum Table 8-2
B3.	**Sample Handling and Custody Requirements**			
	Notes sample handling requirements		P	Work Plan Addendum Section 4
	Notes chain-of-custody procedures		P	Work Plan Addendum Section 8

TABLE 6-1

QAPP CHECKLIST
SITE 27 REMEDIAL INVESTIGATION WORK PLAN
MCRD PARRIS ISLAND, SOUTH CAROLINA

ELEMENT		DQO STEP (QA/R-5 A.3)	COMMENT	REFERENCE(S)/COMMENT
B4.	**Analytical Methods Requirements**	3 and 7		
	Identifies analytical methods to be followed (with all options) and required equipment		P	Work Plan Addendum Table 8-2
	Provides validation information for nonstandard methods		NA	No nonstandard method necessary
	Identifies individuals responsible for corrective action		P	Master QAP Section 2.3
	Specifies needed laboratory TAT		NA	Standard TAT will be used
B5.	**Quality Control Requirements**	3		
	Identifies QC procedures and frequency for each sampling, analysis, or measurement technique, as well as associated acceptance criteria and corrective action		P	Work Plan Addendum Table 8-1, Master QAP Sections 3.2 and 3.3
	References procedures used to calculate QC statistics including precision and bias/accuracy		P	Master QAP Section 3.2
B6.	**Instrument/Equipment Testing, Inspection, and Maintenance Requirements**	3		
	Identifies acceptance testing of sampling and measurement systems		P	Master QAP Section 6.6
	Describes equipment preventive and corrective maintenance		P	Master QAP Section 6.6
	Notes availability and location of spare parts		NA	Not applicable. Critical spare parts not an issue
B7.	**Instrument Calibration and Frequency**	3		
	Identifies equipment needing calibration and frequency for such calibration		P	Master QAP Section 6.6, Master FSP Section 2.5
	Notes required calibration standards and/or equipment		P	Master QAP Section 6.6, Master FSP Section 2.5
	Cites calibration records and manner traceable to equipment		P	Master QAP Section 6.6, Master FSP Section 2.5
B8.	**Inspection/Acceptance Requirements for Supplies and Consumables**			
	States acceptance criteria for supplies and consumables		NA	To be determined during field sampling
	Notes responsible individuals		P	Work Plan Addendum Section 7

TABLE 6-1

QAPP CHECKLIST
SITE 27 REMEDIAL INVESTIGATION WORK PLAN
MCRD PARRIS ISLAND, SOUTH CAROLINA

ELEMENT		DQO STEP (QA/R-5 A.3)	COMMENT	REFERENCE(S)/COMMENT
B9.	**Data Acquisition Requirements for Nondirect Measurements**	1 and 7		
	Identifies type of data needed from nonmeasurement sources (e.g., computer data bases and literature files), along with acceptance criteria for their use		NA	Previous sampling results used only as background information
	Describes any limitations of such data		NA	Historical sampling data previously approved
	Documents rationale for original collection of data and its relevance to this project		P	Work Plan Addendum Section 2.4
B10.	**Data Management**	3 and 7		
	Describes standard record-keeping and data storage and retrieval systems		P	Master QAP Section 8.4, TtNUS SOP CT-05 Section 5.0
	Checklists or standard forms attached to QAPP		P	TtNUS SOP CT-05
	Describes data handling equipment and procedures used to process, compile, and analyze data (e.g., required computer hardware and software)		P	Master QAP Section 8.4, TtNUS SOP CT-05 Section 3.0
	Describes process for assuring that applicable Office of Information Resource Management requirements are satisfied		P	Master QAP Section 8.4, TtNUS SOP CT-05 Section 3.0
C1.	**Assessments and Response Actions**	7		
	Lists required number, frequency, and type of assessments with approximate dates and names of responsible personnel (assessments include, but are not limited to, peer reviews, management system reviews, technical system audits, performance evaluations, and audits of data quality)		P	Master QAP Section 9.0
	Identifies individuals responsible for corrective action		P	Master QAP Section 10.0
C2.	**Reports to Management** Identifies frequency and distribution reports for:			
	Project status		NA	Partnering Team meeting minutes
	Results of performance evaluations and audits		P	Master QAP Section 9.0
	Results of periodic data quality assessments		P	Master QAP Section 9.0
	Any significant QA problems		P	Master QAP Section 8.2
	Preparers and recipients of reports		P	Master QAP Section 9.0

TABLE 6-1

QAPP CHECKLIST
SITE 27 REMEDIAL INVESTIGATION WORK PLAN
MCRD PARRIS ISLAND, SOUTH CAROLINA

ELEMENT		DQO STEP (QA/R-5 A.3)	COMMENT	REFERENCE(S)/COMMENT
D1.	**Data Review, Validation, and Verification**	7		
	States criteria for accepting, rejecting, or qualifying data		P	Master QAP Sections 3.0 and 8.0, TtNUS SOP DV-02, -04
	Includes project-specific calculations or algorithms		P	Master QAP Section 3.0, TtNUS SOP DV-02,-04
D2.	**Validation and Verification Methods**	3		
	Describes process for data validation and verification		P	Master QAP Section 8.2, TtNUS SOP DV-02,-04
	Identifies issue resolution procedure and responsible individuals		P	Master QAP Section 9.0
	Identifies methods for conveying these results to data users		P	Master QAP Section 9.0, TtNUS SOP DV-02,-04
D3.	**Reconciliation with User Requirements**	7		
	Describes process for reconciling project results with DQOs and reporting limitations on use of data		P	Will be evaluated after data are collected.

DQO Steps:
1 - State the Problem
2 - Identify the Decision
3 - Identify Inputs to the Decision
4 - Define the Study Boundaries
5 - Develop a Decision Rule
6 - Specify Limits on Decision Error
7 - Optimize the Design

QAP - Quality Assurance Plan
HASP - Health and Safety Plan
SOP - Standard Operating Procedure
SMP - Site Management plan
QA - Quality assurance
QC - Quality control
QAPP - Quality Assurance Project Plan
FSP - Field Sampling Plan
TAT - Turnaround time
DQO - Data quality objecitve

Comments:
P - Present and acceptable
I - Incomplete
NP - Not present
NA - Not applicable

7.0 PROJECT MANAGEMENT ORGANIZATION

TtNUS will be responsible for management and implementation of the field investigation and coordination of activities with program personnel and MCRD and Navy personnel when appropriate.

7.1 PROJECT ORGANIZATION

An organizational chart of the site-specific project personnel for this investigation is provided as Figure 7-1.

7.2 PROJECT PERSONNEL RESPONSIBILITIES

A description of responsibilities of individual project team members is provided below.

The responsibilities of the Task Order Manager (TOM) are provided in the Master Work Plan. The FOL will be responsible for coordinating all site personnel and field activities as follows:

- Act as liaison between the TOM, field team members, Site Safety Officer (SSO), and site QA/QC Officer.
- Supervise all subcontractors.
- Oversee the mobilization and demobilization of all equipment, personnel, and subcontractors and ensure the availability and maintenance of all field sampling and monitoring equipment and materials.
- Oversee the completion of all site documentation.
- Assume custody of all samples and ensure the proper handling and shipment of all samples.
- Resolve all logistical, weather, personnel, and equipment problems that may arise and initiate field change requests after consultation with the TOM, when necessary.

The site QA/QC Officer will be responsible for ensuring that all site activities are performed according to the QA/QC guidelines outlined in the Master QAP as follows:

- Act as liaison between the TtNUS QA Manager (QAM) and laboratory and site personnel.
- Ensure that field duplicates and QC blanks are collected at the proper frequency and volume.
- Ensure that all measuring and testing equipment is calibrated, used, and maintained in accordance with applicable procedures.
- Manage bottleware procurement and oversee field preservation and filtration activities.

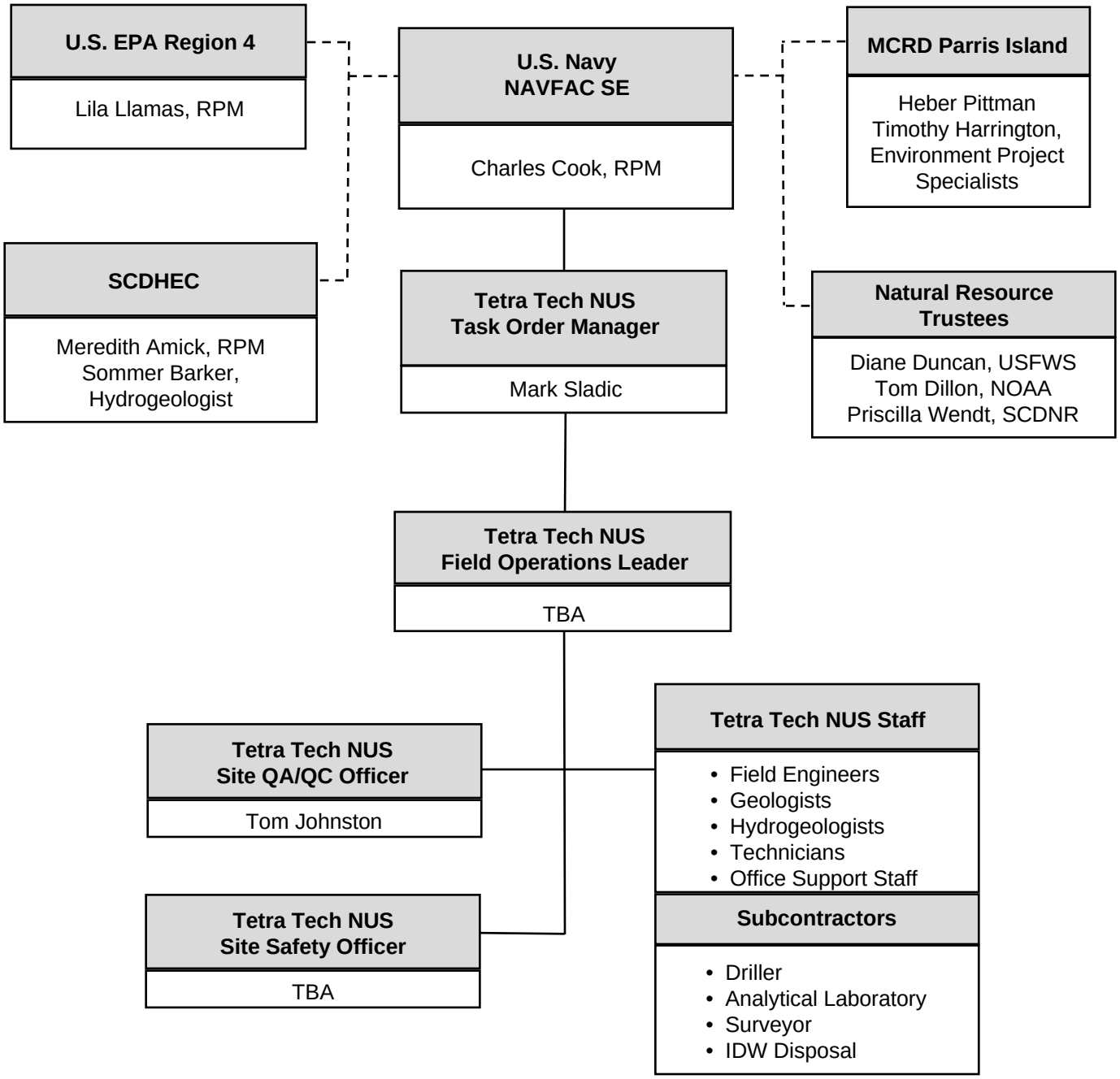
The SSO will advise the FOL on issues of site health and safety. The duties of the SSO are described in the Master Health and Safety Plan (HASP) of the Master Work Plan, Volume II (B&R Environmental, 1998).

7.3 PROJECT SCHEDULE

Figure 7-2 presents the for baseline project schedule for the RI for Site 27.

FIGURE 7-1

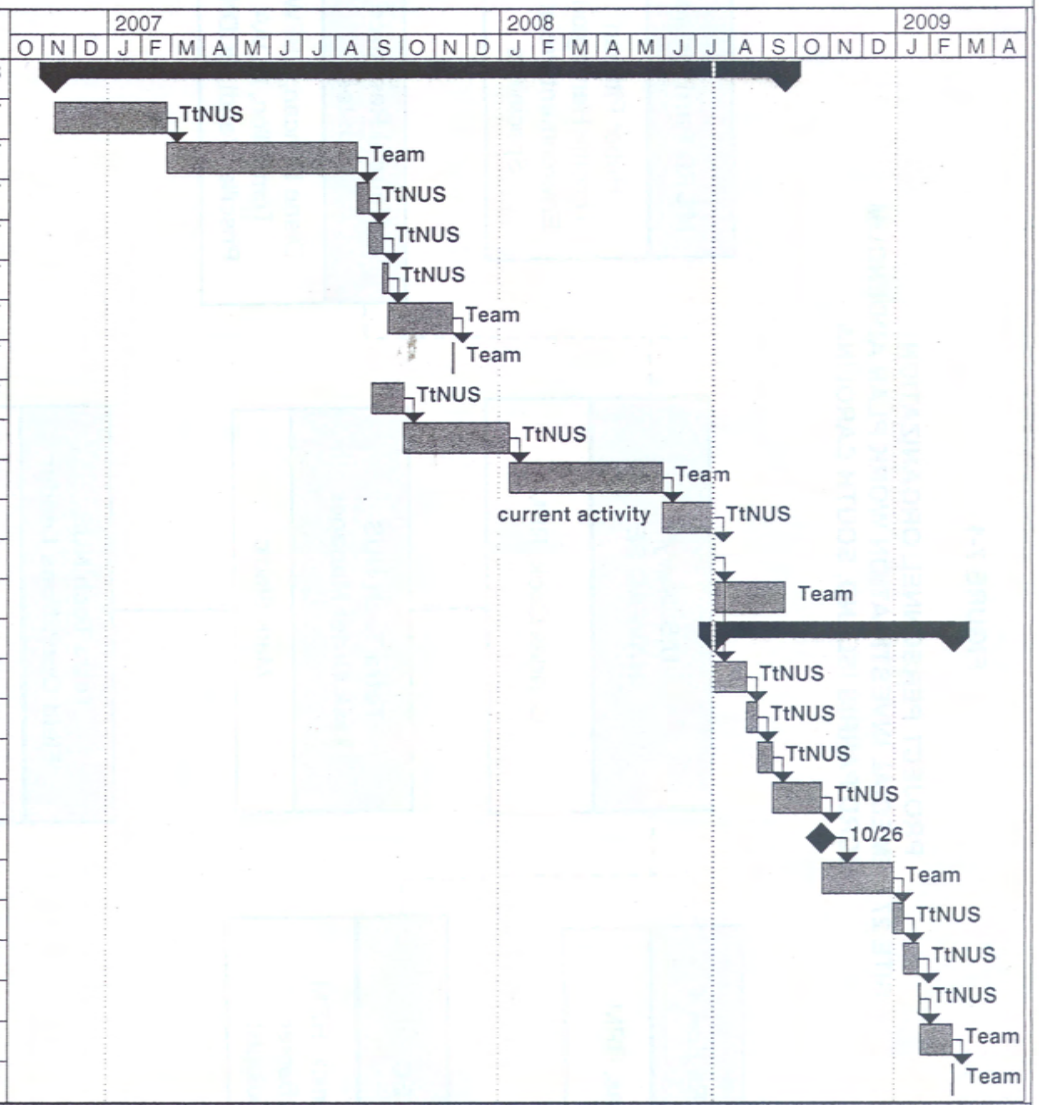
PROJECT PERSONNEL ORGANIZATION
SITE 27 REMEDIAL INVESTIGATION WORK PLAN ADDENDUM
MCRD PARRIS ISLAND, SOUTH CAROLINA



NOAA: National Oceanic and Atmospheric Administration
RPM: Remedial Project Manager
SCNDR: South Carolina Department of Natural Resources
TBA: To be assigned
USFWS: United States Fish and Wildlife Service
IDW: Investigation-derived waste

FIGURE 7-2
PROJECT SCHEDULE
SITE 27 REMEDIAL INVESTIGATION
MCRD PARRIS ISLAND, SOUTH CAROLINA

ID	Task Name	Duration	Start	Finish
1	**Site 27 (and9/16/55) RI WP**	**679 days**	**Mon 11/13/06**	**Sun 9/21/08**
2	Draft WP	105 days	Mon 11/13/06	Sun 2/25/07
3	Team review	177 days	Mon 2/26/07	Tue 8/21/07
4	Prepare RTC	11 days	Wed 8/22/07	Sat 9/1/07
5	Revise WP	13 days	Sun 9/2/07	Fri 9/14/07
6	Submit draft final WP	5 days	Sat 9/15/07	Wed 9/19/07
7	Team concurrence	60 days	Thu 9/20/07	Sun 11/18/07
8	WP approved	1 day	Mon 11/19/07	Mon 11/19/07
9	Fieldwork	30 days	Wed 9/5/07	Thu 10/4/07
10	Lab analysis / validation	98 days	Fri 10/5/07	Thu 1/10/08
11	DDT path forward	142 days	Fri 1/11/08	Sat 5/31/08
12	Revise WP Addendum	47 days	Sun 6/1/08	Thu 7/17/08
13	Submit WP Addendum	1 day	Fri 7/18/08	Fri 7/18/08
14	Team review/approve	65 days	Sat 7/19/08	Sun 9/21/08
15	**Site 27 (and 9/16/55) RI**	**221 days**	**Sat 7/19/08**	**Tue 2/24/09**
16	Mobilize subcontractors	30 days	Sat 7/19/08	Sun 8/17/08
17	Laboratory analysis	10 days	Mon 8/18/08	Wed 8/27/08
18	Data Validation	14 days	Thu 8/28/08	Wed 9/10/08
19	Draft report	45 days	Thu 9/11/08	Sat 10/25/08
20	D1 RI	1 day	Sun 10/26/08	Sun 10/26/08
21	Team review	65 days	Mon 10/27/08	Tue 12/30/08
22	Prepare RTC	10 days	Wed 12/31/08	Fri 1/9/09
23	Revise document	14 days	Sat 1/10/09	Fri 1/23/09
24	D2 RI	1 day	Sat 1/24/09	Sat 1/24/09
25	Team concurrence	30 days	Sun 1/25/09	Mon 2/23/09
26	RI approved	1 day	Tue 2/24/09	Tue 2/24/09



Project: MCRD 27 Accelerated Sched
Date: Thu 7/17/08

Task		Milestone		External Tasks	
Split		Summary		External Milestone	
Progress		Project Summary		Deadline	

FIGURE 7-2

8.0 DATA QUALITY REQUIREMENTS

The purpose of this section is to relate the site-specific laboratory analyses and field QA/QC samples to the DQO statements established for this investigation. See Figure 2-10 for a schematic of the DQO process. The Master QAP of the Master Work Plan (Volume II) is referenced where appropriate.

8.1 LABORATORY ANALYSES

Section 5.0 of the Master QAP describes the laboratory and methodology requirements for the sample analyses for this investigation. Section 5.5 of the Master QAP describes the data reporting requirements for this investigation. Section 5.6 of the Master QAP describes the criteria for laboratory selection. The laboratory selected to perform work at this site must be South Carolina certified.

8.2 EXTERNAL (FIELD) QC SAMPLES

Section 3.3 of the Master QAP contains a general description of external QC measures.

8.2.1 Field QC Sample Types and Frequencies

Table 8-1 summarizes the frequency and type of QA/QC samples to be collected for data to be validated.

Detailed descriptions of QC sample types are provided in Sections 3.3.1 through 3.3.6 of the Master QAP of the Master Work Plan (Volume II).

8.2.2 Matrix Spike/Duplicate Sample Aliquots

Laboratory duplicate and matrix spike samples will be analyzed as described in Section 3.4 of the Master QAP of the Master Work Plan (Volume II). The field sampling team will provide the appropriate additional sample volume as prescribed by laboratory requirements. The additional sample aliquots required for analysis of matrix spike/matrix spike duplicate samples will be collected at a frequency of 1 per 20 samples per matrix.

8.3 BOTTLEWARE REQUIREMENTS

The bottleware and preservation requirements for the analyses proposed for this investigation are provided in Table 8-2. Pre-preserved, certified-clean bottleware will be supplied by the laboratory subcontractor.

8.4 SAMPLE CUSTODY AND SHIPMENT

Sample custody procedures are designed to provide proper documentation of sample acquisition and integrity. Sample custody and shipment procedures for this investigation are described in Section 4.0 of the Master QAP of the Master Work Plan (Volume II). Chain-of-custody forms are provided in Appendix B.

8.5 INTERNAL (LABORATORY) QC CHECKS

Descriptions of the internal (laboratory) QC check types are provided in Section 6.0 of the Master QAP of the Master Work Plan (Volume II).

8.5.1 Laboratory Duplicate, Spike, and Method Blank Analyses

Table 8-3 summarizes the frequency and type of laboratory QC checks to be performed for this investigation.

8.5.2 Other Laboratory QC Checks

Calibration and preventive maintenance of laboratory instruments are described in Section 6.6 of the Master QAP of the Master Work Plan (Volume II). Handling and storage of samples, use of qualified technicians, and independent confirmation of data computations and deliverables are described in the Laboratory QAP.

8.6 PROJECT RECORDS

Record keeping and evidentiary file concerns are described in Section 7.0 of the Master QAP of the Master Work Plan (Volume II). All protocols described therein will be strictly observed.

8.7 DATA REDUCTION, VALIDATION, AND REPORTING

The data generated from this investigation will be validated in accordance with the most recent U.S. EPA National Functional Guidelines for Organic and Inorganic Data Review (U.S. EPA, 1994). The corresponding requirements, as discussed in Section 8.0 of the Master QAP, Volume II, for data validation, data assessment, electronic deliverables, and data interpretation and reporting will be followed.

8.8 PERFORMANCE AND SYSTEM AUDITS

The protocol for conducting audits, as outlined in Section 9.0 of the Master QAP, Volume II, will be followed.

8.9 CORRECTIVE ACTIONS

In the event that there are discrepancies in field activities from the established procedures and/or requirements or modifications to this Work Plan Addendum, the procedures established in Section 10 of the Master QAP, Volume II, for documenting nonconformances shall be implemented and, if appropriate, a Field Task Modification Request Form will be completed.

8.10 TRAINING AND QUALITY PLANNING

Training requirements and proactive management practices are provided in Section 11 and Section 12, respectively, of the Master QAP, Volume II (B&R Environmental, 1998).

TABLE 8-1

FREQUENCY OF FIELD QC SAMPLE COLLECTION
SITE 27 REMEDIAL INVESTIGATION WORK PLAN ADDENDUM
MCRD PARRIS ISLAND, SOUTH CAROLINA

Type of Sample	Frequency
Field Duplicate	1 per 10 samples per medium
Source Water Blank	1 per source per sampling event
Trip Blank (VOCs only)	1 per cooler containing VOC samples
Equipment Rinsate Blank	1 every 2 days(1) per medium (frequency may be reduced depending on level of dedicated equipment used)

1 Blanks are to be collected and analyzed to document the effectiveness of the decontamination procedure when reusable sample equipment comes in direct contact with samples to be analyzed.

VOC - volatile organic comound

TABLE 8-2

SUMMARY OF BOTTLEWARE, PRESERVATION, AND HOLDING TIME REQUIREMENTS
SITE 27 REMEDIAL INVESTIGATION WORK PLAN
MCRD PARRIS ISLAND, SOUTH CAROLINA

Analysis	Analytical Method	Analysis Location	Sample Volume[1]	Bottleware	Preservation	Holding Time[2]
AQUEOUS (GROUNDWATER)						
TCL Volatile Organic Compounds	SW-846 8260B	Fixed-base laboratory	2 x 40 mL	Glass; Teflon-lined septum cap	HCl to pH<2; Cool to 4°C; zero headspace	14 days to analysis
TCL Organochlorine Pesticides	SW-846 8081A	Fixed-base laboratory	2.5 L	Amber glass with Teflon-lined cap	Cool to 4 °C	7 days to extraction; 40 days to analysis
Total Dissolved Solids	EPA 160.1	Fixed-base laboratory	1 L	HDPE	Cool to 4°C	7 days to analysis
Total Organic Carbon	EPA 415.1	Fixed-base laboratory	100 mL	HDPE	HCl or $H2_SO_4$ to pH <2; Cool to 4°C	28 days to analysis
Total Alkalinity	EPA 310.1	Fixed-base laboratory	100 mL	HDPE	Cool to 4°C	14 days to analysis
SOLID (SURFACE AND SUBSURFACE SOIL)						
TCL Volatile Organic Compounds	SW-846 8260B	Fixed-base laboratory	3	Encore sampler	Cool to 4°C (laboratory will preserve)	48 hours to preservation; 14 days to analysis
TCL Organochlorine Pesticides	SW-846 8081	Fixed-base laboratory	240 mL (8 oz)	Wide-mouth glass jar with Teflon-lined lid	Cool to 4 °C	14 days to extraction; 40 days to analysis
Total Organic Carbon	SW-846 9060	Fixed-base laboratory	4 oz	Wide-mouth glass jar with Teflon-lined lid	--	28 days to analysis
pH	SW-846 9045D	Fixed-base laboratory	4 oz	Wide-mouth glass jar with Teflon-lined lid	--	24 hours to analysis

1 Sample volume may vary based on the laboratory.
2 Holding times are measured from the date of collection.

HCl - Hydrochloric acid.
TCL - Target Compound List

TABLE 8-3

FREQUENCY OF LABORATORY QC CHECKS
SITE 27 REMEDIAL INVESTIGATION WORK PLAN ADDENDUM
MCRD PARRIS ISLAND, SOUTH CAROLINA

Type of Sample	Frequency
Laboratory Duplicate	Not applicable
Matrix Spike	1 per 20 samples per medium
Matrix Spike Duplicate	1per 20 samples per medium
Surrogate Spike	Each sample for gas chromatographic analyses
Method Blank	Based on method requirements, with a minimum of 1 per batch of 20 samples

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