U.S. Army Corps of Engineers
South Atlantic Division

Final
Remedial Investigation Report
Former Incinerator Site
Richmond Naval Air Station
Miami, Miami-Dade County, Florida

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TABLE OF CONTENTS

PROFESSIONAL CERTIFICATION ..... **v**

EXECUTIVE SUMMARY **1**

1.0 INTRODUCTION **4**

1.1 PURPOSE OF REMEDIAL INVESTIGATION 4
1.2 REPORT ORGANIZATION 4

2.0 SITE BACKGROUND **5**

2.1 SITE LOCATION 5
2.2 SITE DESCRIPTION AND HISTORY 5
2.3 PREVIOUS INVESTIGATIONS 6
2.3.1 SITE INSPECTION – MACTEC, JANUARY 2011 ..... *6*

3.0 ENVIRONMENTAL SETTING **7**

3.1 TOPOGRAPHY AND SURFACE FEATURES 7
3.2 CLIMATE 8
3.3 REGIONAL GEOLOGY 8
3.4 SITE HYDROGEOLOGY 10
3.5 WELLS AND WELLHEAD PROTECTION AREAS 10
3.6 SURFACE WATER AND CRITICAL HABITATS 11
3.7 THREATENED, ENDANGERED SPECIES 12
3.8 PLACES OF HISTORIC SIGNIFICANCE 12
3.9 CURRENT AND FUTURE LAND USE 12

4.0 REMEDIAL INVESTIGATION ACTIVITIES **12**

4.1 SOIL SAMPLING 13
4.2 MONITOR WELL INSTALLATION 13
4.3 GROUNDWATER SAMPLING 14
4.4 QUALITY ASSURANCE /QUALITY CONTROL (QA/QC) SAMPLING 14

5.0 REGULATORY CRITERIA **14**

6.0 NATURE AND EXTENT OF CONTAMINATION **15**

6.1 SOIL LABORATORY ANALYSES 15
6.2 GROUNDWATER LABORATORY ANALYSES 16
6.3 DATA VALIDATION 17

7.0 FOCUSED HUMAN HEALTH RISK ASSESSMENT **18**

8.0 REMEDIAL INVESTIGATION SUMMARY AND CONCLUSIONS **18**

9.0 REFERENCES **19**

TABLES

TABLE 1 Soil Analytical Results for Metals, PAHs, and Total TEQs for Dioxins/Furans
TABLE 1A Benzo(a)pyrene Conversion Tables
TABLE 2 Dixon/Furan Conversion Tables
TABLE 3 Groundwater Laboratory Analytical Results

FIGURES

FIGURE 1 Site Location Map
FIGURE 2 Topographic Site Location Map
FIGURE 3 Site Map
FIGURE 4 Soil Sample Locations
FIGURE 5 Monitor Well Locations
FIGURE 6 Benzo(a)Pyrene Equivalent Concentrations in Soil, April & June, 2016
FIGURE 7 Total TEQs for Dioxin and Furan Concentrations in Soil, April, 2016
FIGURE 8 Metals Concentrations in Groundwater, April 2016
FIGURE 9 PAH Concentrations in Groundwater, April 2016

APPENDICES

APPENDIX A Soil Boring Logs
APPENDIX B Monitor Well Construction Diagrams and Well Permits
APPENDIX C Groundwater Sampling Logs, Field Instrument Calibration Logs, and Field Notes
APPENDIX D Photographic Documentation
APPENDIX E Soil Laboratory Analytical Reports
APPENDIX F Groundwater Laboratory Analytical Reports
APPENDIX G Reviewed SEDD File Reports
APPENDIX H Focused Human Health Risk Assessment

LIST OF ACRONYMS AND ABBRERVIATIONS

ADR	Automated Data Review
Aerostar	Aerostar SES LLC
AOC	Area of Concern
APP	Accident Prevention Plan
ARARs	Applicable or Relevant and Appropriate Requirements
BaPe	Benzo(a)pyrene Equivalent
BLS	Below Land Surface
BoP	Bureau of Prisons
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminants of Concern
DD	Decision Document
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
ELL	Empirical Laboratories LLC
EM	Engineering Manual
EO	Executive Order
EPA	Environmental Protection Agency
eQAPP	Electronic Quality Assurance Project Plan
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FEMA	Federal Emergency Management Agency
Fm	Formation
FUDS	Formerly Used Defense Sites
GCRM	Gold Coast Railroad Museum
GCTLs	Groundwater Cleanup Target Levels
HRS	Hazard Ranking System
HSA	Hollow Stem Augers
HSWMR	Hazardous Substance and Waste Management Research, Inc.
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MB	Method Blank
MDWSD	Miami-Dade Water and Sewer Department
mg/kg	Milligram per Kilogram
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NAS	Naval Air Station
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NGVD	National Geodetic Vertical Datum
PAHs	Polynuclear Aromatic Hydrocarbons
PCOC	Potential Constituents of Concern
PVC	Polyvinyl chloride
PWS	Performance Work Statement
QA/QC	Quality Assurance/Quality Control

RA	Risk Assessment
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
SARA	Superfund Amendments and Reauthorization Act
SCTLs	Soil Cleanup Target Levels
SEDD	Staged Electronic Data Deliverable
SI	Site Inspection
SOPs	Standard Operating Procedures
SRCO	Site Rehabilitation Completion Order
SSHP	Site Safety and Health Plan
SVOC	Semi-volatile Organic Compound
TDS	Total Dissolved Solids
TEQs	Total Equivalent Concentrations
UFP-QAPP	Uniform Federal Policy – Quality Assurance Project Plan
µg/kg	Microgram per Kilogram
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
VOCs	Volatile Organic Compounds
WTP	Water Treatment Plant

PROFESSIONAL CERTIFICATION

PROFESSIONAL GEOLOGIST LICENSED IN THE STATE OF FLORIDA

This Final Remedial Investigation Report for the former Incinerator at the Richmond Naval Air Station, Miami, Miami-Dade County, Florida, FUDS Project ID No. I04FL003806, has been prepared under my direct supervision and reviewed by me, Robert H. Young, P.G. (Florida P.G. No. 123). This Final Remedial Investigation Report is dated September 22, 2017.

I hereby certify that, in my professional judgement, the components of this Final Remedial Investigation Report satisfy the requirements set forth in Chapter 62-780, Florida Administrative Code (FAC) and other applicable rules and regulations of the state of Florida. I also certify that Aerostar SES LLC holds a Department of Business and Professional Regulation Board of Professional Geologist's License, License No. GB676, to practice geology in the State of Florida.

ROBERT H YOUNG
LICENSE
No. 123
STATE OF
FLORIDA
PROFESSIONAL GEOLOGIST

Robert H. Young, P.G.
Senior Geologist
Florida P.G License No. 123
Date: September 22, 2017

EXECUTIVE SUMMARY

The United States Army Corps of Engineers (Jacksonville District) prepared this Remedial Investigation Report to summarize the findings of the remedial investigation at the former Richmond Incinerator Site, Richmond Naval Air Station in Miami, Miami-Dade County, Florida. The former Incinerator was part of the World War II era Richmond Naval Air Station which encompassed 2,107 acres. The Richmond Naval Air Station was a Lighter than Air blimp base constructed during World War II. The base also housed and supported a multitude of fixed wing aircraft. The base was the home of Fleet Airship Wing 2 and Airship Patrol Squadron ZP-21. The other support facilities included barracks, officers' quarters, mess halls, and administrative buildings. Other Richmond Naval Air Station activities included training homing pigeons, helium equipment operators, and night torpedo crews. In March 1944, the base consisted of 99 officers, 607 enlisted men, and 202 civilians, including Goodyear technicians. It was reported that the former Incinerator was used to burn the household wastes generated at the former Richmond Naval Air Station.

The former Richmond Incinerator Site consists of approximately one acre of land and is located in Section 26, Township 55 South, Range 39 East. The site is located at the northern end of the Federal Bureau of Prisons' facility and is bordered to the north by a set of railroad tracks and Department of Defense property; to the south by Bureau of Prisons' property; to the west by Bureau of Prisons' property, a railroad line, and residential property; and to the east by Bureau of Prisons' property, followed by the Gold Coast Railroad Museum property, which is owned by the Miami-Dade County Department of Recreation and Open Spaces. **Figure 1** presents a Site Location Map, **Figure 2** is a Topographic Site Location Map, and **Figure 3** is a Site Map. This remedial investigation was performed to further evaluate soil and groundwater quality due to the analytical results reported in a Site Inspection conducted by MACTEC for the Florida Department of Environmental Protection in 2011. The objective of the remedial investigation activities is to collect information including soil and groundwater data necessary to determine if any contaminants from the military's use of the site remains, and if so, in what locations and amounts. An additional objective is to determine if the release presents an unacceptable risk to human health or the environment, for the purpose of developing and evaluating effective remedial measures. The purpose of this Remedial Investigation Report is to summarize and analyze the soil and groundwater data collected to characterize the nature and extent of contamination potentially resulting from past Department of Defense activities at the former Incinerator at the Richmond Naval Air Station.

During the initial phase of the remedial investigation conducted in April 2016, the United States Army Corps of Engineers collected soil samples from 14 surface locations at a depth of 0-0.5 feet below land surface and 14 subsurface locations 0.5-2 feet below land surface. These soil sample locations were identified as first and second-tier step-out locations from soil boring locations investigated during MACTEC's Site Inspection activities. The soil samples were analyzed for polynuclear aromatic hydrocarbons; dioxins/furans; and total arsenic, barium, chromium, lead, and silver. **Figure 4** shows the location of the soil samples.

Groundwater samples were collected and analyzed from four new on-site monitor wells that the United States Corps of Engineers installed surrounding the former Incinerator. The groundwater

samples were analyzed for polynuclear aromatic hydrocarbons; dioxins/furans; and total arsenic, barium, cadmium, lead, and silver. **Figure 5** shows the location of the monitor wells.

Soil and groundwater analytical results obtained from this initial phase of the remedial investigation were compared to the Florida Department of Environmental Protection Soil Cleanup Target Levels and Groundwater Cleanup Target Levels.

Based on the laboratory analytical results, the United States Army Corps of Engineers' contractor mobilized to the site on June 1, 2016, to collect 10 additional soil samples from five third-tier step-out soil boring locations. **Figure 4** shows the location of the soil samples collected. The soil samples were analyzed for polynuclear aromatic hydrocarbons only based on the exceedances observed in the first- and second-tier step-out samples.

Based on the laboratory analysis, the United States Army Corps of Engineers conducted a fourth step-out sampling event and collected six additional soil samples. Soil Laboratory Analytical Results are shown in **Table 1**. The benzo(a)pyrene equivalent Conversion Tables are shown in **Table 1A**. **Figure 6** shows the soil sample locations and the benzo(a)pyrene equivalent concentrations in soil.

The United States Army Corps of Engineers collected a total of 32 soil samples for analysis of arsenic, barium, chromium, lead, silver, and polynuclear aromatic hydrocarbons (including the benzo(a)pyrene equivalent concentrations). Laboratory analysis did not detect any metal concentrations exceeding the Soil Cleanup Target Levels. Laboratory analysis detected seven soil samples with benzo(a)pyrene equivalent concentrations exceeding the Residential Soil Cleanup Target Level (see **Figure 6**). Step-out soil sampling conducted during this remedial investigation defined the horizontal extent of the benzo(a)pyrene equivalent concentrations exceeding the Residential Soil Cleanup Target Level.

The United States Army Corps of Engineers collected a total of 14 soil samples for analysis of dioxins and furans during the initial phase of the remedial investigation. Laboratory analysis detected a Total Toxicity Equivalent Concentration for dioxins plus furans in one soil sample exceeding the Residential Soil Cleanup Target Level. Therefore, two step-out soil samples were analyzed for dioxins/furans. **Figure 7** shows the dioxin/furan sampling locations and the Total Toxicity Equivalent Concentrations for dioxins plus furans for both samples collected during this investigation and previous results from the 2011 Site Inspection Report. The United States Army Corps of Engineers' contractor re-calculated the 2011 Total Toxicity Equivalent Concentrations and discovered that the 2011 total toxicity equivalent concentrations were incorrectly calculated and reported in the 2011 Site Inspection Report. The total toxicity equivalent concentrations displayed in **Figure 7** represent the correctly calculated and revised results for the historical samples. **Table 2** shows the Dioxin/Furan Conversion Tables for the United States Army Corps of Engineers' analytical results and the revised MACTEC concentrations. The soil laboratory analytical results showed the concentrations detected in the step-out soil samples were below the Residential Soil Cleanup Target Levels.

Laboratory analyses of the four groundwater samples collected from the monitor wells did not detect any Contaminants of Concern exceeding the Groundwater Cleanup Target Levels. **Table 3**

shows the groundwater analytical results. **Figure 8** shows the metals concentrations in groundwater, and **Figure 9** shows the polynuclear aromatic hydrocarbon concentrations in groundwater.

The focused Human Health Risk Assessment indicated that the benzo(a)pyrene-impacted soil in the 0-2 feet below land surface interval does not represent a significant concern for current and likely future commercial/industrial use, and also falls within acceptable risk levels for future unrestricted/residential use.

1.0 INTRODUCTION

The United State Army Corps of Engineers (USACE) Jacksonville District has prepared this Remedial Investigation (RI) Report, which includes the planning, collecting, evaluating, and reporting of information gathered during the remedial investigation associated with the former Richmond Incinerator Site (former Incinerator), Richmond Naval Air Station (NAS), Miami, Miami-Dade County, Florida. The project was conducted pursuant to contract W91278-14-D-0017, Task Order CS04; the Performance Work Statement (PWS) dated June 3, 2014; the USACE Safety and Health Requirements Engineering Manual EM-385-1-1; and local ordinances. Field activities were performed between April 6 and June 23, 2016, to determine the nature and extent of contamination at the site.

1.1 Purpose of Remedial Investigation

In accordance with 40 Code of Federal Regulations (CFR) 300.430(d), this RI was conducted to collect soil and groundwater data necessary to adequately characterize whether contaminants exist at the site and, if so, to characterize the source, nature and extent of contaminants, and whether the contaminants present an unacceptable risk to human health and the environment. The purpose of this RI report is to summarize and analyze the soil and groundwater data collected to determine if a Department of Defense (DoD) release at this site poses a risk from Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substances that requires remediation.

This site is being investigated under the authority of the Defense Environmental Restoration Program (DERP) (10 USC §§ 2701 et seq.), and its policies and procedures relating to Formerly Used Defense Sites (FUDS); including Department of Defense (DoD) Manual 4715.20, DERP Management, 9 March 2012; Engineering Regulation 200-3-1, Environmental Quality, FUDS Program Policy; Executive Order (EO) 12580, as amended by EO 13016; and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This RI was conducted in accordance with the Environmental Protection Agency (EPA) *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA, 1988).

1.2 Report Organization

Detailed descriptions of the site, site history, past and current site uses, site-specific and regional geology and hydrogeology, and the results of the field work activities are presented in this RI report. Specific objectives of this RI report include the following:

- Identify the source of contamination reported in the previous investigation.
- Prepare a focused Human Health Risk Assessment (RA).
- Evaluate potential risks identified.
- Evaluate the nature and extent of impacts to the soil and groundwater to assist the FS process for developing and evaluating effective remedial alternatives.
- Prepare a Feasibility Study based on the results of the RI, if warranted.

Supporting technical information derived from laboratory analytical analyses is summarized in tables, figures and appendices.

2.0 SITE BACKGROUND

2.1 Site Location

The former Incinerator is located in Section 26, Township 55 South, Range 39 East, in Miami, Miami-Dade County, Florida. The site is located at the northern end of the Bureaus of Prisons' (BoP) facility and is bordered to the north by a set of railroad tracks owned by the Gold Coast Railroad Museum (GCRM) and a DoD property; to the south by BoP property; to the west by BoP property, a CSX railroad line, and residential property; and to the east by a BoP property, followed by the GCRM property, which is owned by the Miami-Dade County Department of Parks, Recreation and Open Spaces. The approximate geographic coordinates of the former Incinerator are 25°37'19.47" north latitude and 80°24'29.11" west longitude. **Figure 1** shows a Site Location Map and **Figure 2** presents a Topographic Site Location Map. **Figure 3** presents a Site Map.

2.2 Site Description and History

The former Incinerator was part of the World War II era Richmond NAS which encompassed 2,107 acres. The Richmond NAS was a Lighter than Air blimp base constructed during World War II. The base also housed and supported a multitude of fixed wing aircraft. The base was the home of Fleet Airship Wing 2 and Airship Patrol Squadron ZP-21. The Goodyear Airship Corporation K-Series, and later M-Series Blimps, were used by the Navy to patrol the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico to spot German Nazi U-Boats, which were causing havoc on the Allied merchant marine fleet and restricting the use of shipping lanes. The base consisted of three blimp hangars (Hangars #1, 2 & 3), mooring-out site (landing mats), a helium plant (including a Horton sphere), a maintenance shop, propeller shop, battery shop, welding shop, plating shop, paint shop and other support facilities. A bunker area, high-explosives storage area, ammunition magazine storage area and a firing range reportedly existed on the southern part of the base, south of the largest landing mat. The other support facilities included barracks, officers' quarters, mess halls, and administrative buildings. Other Richmond NAS activities included training homing pigeons, helium equipment operators, and night torpedo crews. In March 1944, the base consisted of 99 officers, 607 enlisted men, and 202 civilians, including Goodyear technicians.

On September 15, 1945, a massive hurricane, with sustained winds of over 120 miles per hour, and an associated fire, starting in Hangar #1, destroyed the hangars, blimps, fixed wing aircraft, and many other structures associated with the base. The hangars were never rebuilt. The base's helium plant continued to supply Navy airships for years after the war. Several of the remaining buildings and facilities were used by Navy and Marine Corps Reserve Units. A Coast Guard Communication installation was also built at the former base. The Richmond NAS remained active until the 1960s when most of its facilities were no longer needed. Between 1959 and 1985, the acreage of the former Richmond NAS was transferred, reassigned, or disposed of to several Federal agencies and Miami-Dade County. In April, 1973, approximately 205 acres of land was transferred to the Department of Justice for construction of a Correctional Institution.

In December 1979, approximately 72 acres were transferred to the Department of Justice for the BoP.

The former incinerator building remains standing on a relatively small parcel of land (less than a quarter acre) at the northern end of the current BoP property. It is assumed that the former Incinerator was used by the Richmond NAS (DoD) to incinerate food and household wastes during the time the Navy base was operational.

2.3 Previous Investigations

In July 2011, MACTEC prepared a Site Inspection (SI) Report for the Florida Department of Environmental Protection (FDEP). The purpose of the SI was to characterize surface and subsurface soil and groundwater conditions across the entire former Richmond NAS including the area of the former Incinerator.

2.3.1 Site Inspection – MACTEC, January 2011

In January 2011, MACTEC conducted a SI in the area known as the former Incinerator. The former Incinerator area is referred to in the MACTEC report as Area of Concern 2 (AOC #2). The former Incinerator property is located near the northwest corner of the former Richmond NAS site, approximately 2,850 feet northwest of Hangar #1. It is not known specifically what was burned in the Incinerator but it is assumed that most of the Base's wastes were incinerated at this location.

Surface and subsurface soil samples were collected from eight locations around the incinerator building. Eight surface soil samples (RNA-SF29 through RNA-SF36) were collected from 0 to 2 feet below land surface (BLS) and five subsurface soil samples (RNA-SB29, RNA-SB30, RNA-SB33 through RNA-SB35) were collected from 2 to 4 feet BLS. The soil samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), Resource Conservation and Recovery Act (RCRA) 8 metals, and dioxins/furans.

One temporary well (TMW17) was installed southeast of the incinerator building to assess groundwater quality at AOC #2. The groundwater sample was analyzed for VOCs, SVOCs, RCRA 8 metals and dioxins/furans.

Site Inspection Results for AOC #2 – None of the surface soil samples collected from the area of the former Incinerator building contained any target VOC analytes at concentrations above the FDEP SCTLS established in Chapter 62-777, FAC guidelines.

Four surface soil samples collected from AOC #2 contained one or more SVOC target analytes at concentrations that exceeded their respective background screening concentration (not including benzo(a)pyrene equivalent (BaPe) concentrations). One surface soil sample collected from AOC #2 contained one or more analytes at concentrations that exceeded their respective SCTLs (not including BaPe). Soil sample RNA-SF33 contained benzo(a)anthracene (2,400 micrograms per kilogram [µg/kg]) and benzo(b)fluoranthene (4,100 µg/kg) exceeding the SCTL Leachability to Groundwater criteria. The detected concentration of benzo(a)pyrene (2,200 µg/kg) exceeded the Industrial Direct Exposure criteria. The following samples exceeded the

BaPe Residential or Industrial SCTLs: RNA-SF30 (0.158 milligrams per kilogram [mg/kg]), RNA-SF31 (0.216 mg/kg), RNA-SF33 (3.50 mg/kg), RNA-SF34 (0.275 mg/kg), and RNA-SF35 (0.230 mg/kg).

Three surface soil samples collected from AOC #2 contained one or more of the 8 RCRA metals at concentrations that exceeded their respective background screening concentration. Seven surface soil samples collected from AOC #2 contained one or more of the 8 RCRA metals at concentrations that exceeded their respective SCTLs. Arsenic was detected in seven surface soil samples collected at AOC #2 at concentrations that exceeded its SCTL; however, only one soil sample RNA-SF34 (19 mg/kg) was above the 2014 Miami-Dade County Anthropogenic Arsenic Background Study that established the average Soil Concentration of 5.2 mg/kg for arsenic. Laboratory analysis of soil sample RNA-SF29 detected an estimated concentration of chromium (41 mg/kg) exceeding the Leachability to Groundwater criteria. Laboratory analysis of soil sample RNA-SF34 showed an estimated concentration of chromium (46 mg/kg) and a silver concentration (93 mg/kg) exceeding the Leachability to Groundwater criteria.

Sixteen dioxin and furan congeners were detected in one or more of the surface and subsurface soil samples collected from AOC #2 near the former Incinerator building. None of the individual dioxin/furan congeners were detected in the subsurface soil samples collected from AOC #2 at concentrations that exceeded the background screening concentrations. Six subsurface soil samples including the background location had a calculated dioxin Total Toxicity Equivalent (TEQ) concentration exceeding the SCTL as set forth in Chapter 62-777, FAC, including RNA-SB01(0.0008327 mg/kg), RNA-SB29 (0.0003509 mg/kg), RNA-SB30 (0.0004088 mg/kg), RNA-SB33 (0.0004097 mg/kg), RNA-SB34 (0.0004270 mg/kg) and RNA-SB35 (0.0004672 mg/kg). However, the USACE's contractor re-calculated MACTEC's Total Dioxins/Furans Conversion Tables and determined that all six of these samples exhibited Total TEQ concentrations below the Residential SCTL. Only one surface soil sample RNA-SF34 (0.0000142 mg/kg) collected by MACTEC indicated a Total TEQ concentration exceeding the Residential SCTL. All other surface and subsurface soil samples collected exhibited Total TEQ concentrations below the Residential SCTL.

A groundwater sample was collected from one temporary monitor well that was installed southeast of the former Incinerator building. The groundwater sample was analyzed for VOCs, SVOCs, RCRA 8 metals, and dioxins/furans. Laboratory analysis of the groundwater sample did not detect any concentrations above the GCTLs established in Chapter 62-777, FAC.

3.0 ENVIRONMENTAL SETTING

3.1 Topography and Surface Features

The site is situated on the Atlantic Coastal Ridge geomorphologic feature, within the Southern or Distal Geomorphologic Province of Florida. The Atlantic Coastal Ridge is a narrow, gently rolling limestone ridge that spans the eastern portion of Miami-Dade County. It extends from the Broward – Miami-Dade County line to as far south as Homestead. It ranges from 10 to 24 feet in elevation. The Ridge is formed of oolitic limestone (Miami Limestone) deposited as a shoal, under shallow water conditions, during the Pleistocene Epoch. The majority of Miami-Dade County, with the exception of the extreme northeastern Miami-Dade County, is situated

on bare or thinly covered limestone. Sinkholes are not common in the area. When present, solution sinkholes dominate. They are generally shallow and broad. The sinkholes in this area tend to develop gradually. In the northeast part of the county, in the area of Aventura and North Miami Beach, the overburden varies between 20 and 200 feet thick. The cover consists of in-cohesive, permeable sand. Sinkholes are generally few, shallow and of small diameter. **Figure 2** presents a Topographic Map.

3.2 Climate

The climate in Miami-Dade County is a tropical monsoon climate with an average temperature in Miami of 75.9º F. The proximity of Miami-Dade County to the Gulf Stream significantly influences its climate. The daily mean temperature varies from 67.29º F in January to 82.9º F in August. The rainy season occurs from May through mid-October. Approximately half of the rainfall occurs during this time frame. During the summer months, convection thunderstorms can produce heavy but localized rainfall. Tropical storms and hurricanes can also produce copious amounts of rainfall. The annual, net and 2-Year/24-Hour precipitation for the site area are 55.91, 9.0, and 6.0 inches, respectively.

3.3 Regional Geology

Three principal hydrogeologic units are present in the Miami-Dade County. These units consist of the surficial aquifer system, intermediate aquifer system/confining unit and the Floridan aquifer system.

Surficial Aquifer System

The principal source of freshwater in Miami-Dade and Broward County is the surficial aquifer system. The Biscayne aquifer is the most productive unit of this system. Under Section 1424(e) of the Safe Drinking Water Act of 1974, the Biscayne aquifer was designated as a sole-source aquifer. This was based on the fact that it supplies at least 50% of the drinking water in the area and that there is no alternative drinking water source. This surficial aquifer system is composed of upper Cenozoic sediments that are hydraulically connected. The surficial aquifer system includes, in ascending order, the Tamiami Formation (Fm), Caloosahatchee Fm, Fort Thompson Fm, Key Largo Limestone, Miami Limestone and the Pamlico Sand (undifferentiated Pleistocene-Holocene sediments). As a result of facies changes, it should be noted that not all the named units may be present at any one location in Miami-Dade County. The surficial aquifer system exists under water-table conditions and is found generally within five feet of land surface. It is overlain by a thin veneer of peat, muck (a mixture of silt and very fine-grained decomposed organic matter) or sand. The surficial aquifer system is composed of limestone, sandstone, sand, shell, lime mud, silt, clay claystone, siltstone and a mixture of these materials. These sediments range in age from Pliocene to Holcene age. Carbonates of the Miami Limestone were observed outcropping at the surface and along the rock pit walls in the southern portion of the site area. The surficial aquifer system ranges in thickness from 140 feet (southeast Miami-Dade County) to more than 280 feet (northeast Miami-Dade County) in eastern Miami-Dade County. It is important to note that the carbonates of the Biscayne aquifer exhibit numerous secondary porosity features such as solution cavities, channels and vugs. This secondary permeability is the result of solution enlarged carbonate grains, bedding plane cracks, root molds and paleo-karst surfaces. As a result, the Biscayne aquifer is considered a karst aquifer. A wide range of

permeabilities exist in the surficial aquifer system. Locally, the surficial aquifer system in Miami-Dade County can be divided into one or more aquifers separated by less permeable or semi-confining units. One of the informally named permeable units, underlying the Biscayne aquifer, is the "Grey Limestone aquifer". This aquifer consists of gray, shelly, sandy limestone of the middle Tamiami Fm. It has been identified in western Miami-Dade County at depths of between 70 and 160 feet BLS. It grades into a less permeable, sandy, clayey, limestone and sandstone to the east and south. As a whole however, it does not appear that continuous, lower permeability units having more than two orders of magnitude hydraulic conductivity difference exist within the Biscayne aquifer in Miami-Dade County. As a result, the surficial aquifer system, in particular the Biscayne aquifer, can be considered a single hydrologic unit in Miami-Dade County.

The principal source of recharge for the surficial aquifer system is local rainfall. During periods of low rainfall, the extensive canal system in Miami-Dade County provides a significant source of recharge. Discharge from the aquifer occurs by pumping and groundwater flow into Biscayne Bay, the Atlantic Ocean and canals during the wet season. The regional groundwater flow in Miami-Dade County is generally east or southeast toward the Atlantic Ocean. However, the presence of active well fields, surface water control canals and tidal fluctuations commonly cause local deviations in the regional flow pattern. The average transmissivity of the Biscayne aquifer unit ranges from 3 to 5 million gallons/day/foot. Yields from wells (6-inch diameter wells) range from 1,000 to 1,500 gallons/minute. Water from this aquifer is generally colored either with organic material or iron in the upper part of the aquifer. Excessive amounts of iron are encountered in some parts of the aquifer. Salt-water encroachment along the coast, as a result of inland lowering of groundwater levels via well field pumping, is a problem along coastal Miami-Dade County.

Intermediate Aquifer System/Confining Unit

The intermediate aquifer system/confining unit consists of the relatively impermeable marl; limestone; greenish-gray sandy clay and silt units located in the lower part of the Tamiami Fm (Pliocene age) and Hawthorn Group. The Miocene age Hawthorn Group consists of the Arcadia and Peace River FMs in southern Florida. The Peace River Fm is composed of interbedded quartz sands, clays and carbonates. The carbonates consist of variably sandy, clayey phosphatic limestone and micro to very fine crystalline variably sandy phosphatic dolostones. The underlying Arcadia Fm consists of predominantly limestone and dolostone with varying amounts of quartz sand, clay, and phosphate grains. Dolomite is the most abundant carbonate component of the Arcadia Fm. Well sorted medium sands interbedded with claystones or siltstones within the intermediate system yield low to moderate quantities of water. The intermediate system is not a major source of water in the County. The intermediate aquifer system/confining unit generally ranges from 550 feet to 800 feet thick in Miami-Dade County. The intermediate confining unit underlies the surficial aquifer system to a depth of 975 feet in eastern Miami-Dade County and forms the upper confining unit for the Floridan aquifer system. The Hawthorn Group is found approximately 150 feet BLS and is approximately 900 feet thick in the site area.

Floridan Aquifer System

The artesian Florida aquifer system is composed of carbonate and evaporite units ranging from upper Paleocene to Oligocene age. The Floridan aquifer system consists of an upper Floridan

aquifer and lower Floridan aquifer separated by a lower permeability unit called the middle confining unit. The upper Floridan aquifer system consists of, in descending order, the Suwannee Limestone, Ocala Limestone and upper portions of the Avon Park Fm. The lower Floridan aquifer consists of, in descending order, the lower part of the Avon Park Fm, the Oldsmar Fm and the upper part of the Cedar Keys Fm. The middle confining unit, which consists of lower permeability clays, micritic limestone and porous dolomite filled with anhydrite, exists in the middle portion of the Avon Park Fm. This unit restricts the movement of groundwater between the upper and lower Florida aquifers. The top of the Floridan aquifer system is found ranging from approximately 1,000 feet below sea level in the northeast part of Miami-Dade County to approximately 900 feet below sea level in the southern part of the County. Water from the Floridan aquifer system is highly mineralized and without desalination treatment is unsuitable for potable water supplies in Miami-Dade County. In southeast Florida, and extremely permeable cavernous zone, referred to as the "Boulder Zone" exists in the lower Floridan aquifer. This zone is encountered between 2,800 to 3,000 feet below sea level in Miami-Dade County. This zone contains brackish water and is used for the injection of sewage and industrial waste waters.

3.4 Site Hydrogeology

The soil borings advanced during this investigation prior to the installation of monitor wells using a direct-push rig with a macro core sampling device encountered brown fine sand to a depth of approximately 4 to 5 feet BLS. Brown clayey sand or clay was encountered in two borings from 5 to 7 feet BLS. White, weathered limestone was encountered in each of the four borings from 5 to 8 feet BLS and was present to the final depth of 14 or 16 feet BLS in each boring. The depth to groundwater in the four monitor wells installed surrounding the former Incinerator building ranged from 7.22 feet BLS to 12.94 feet BLS. Two of the wells were installed on a hill surrounding the former Incinerator building. Soil Boring Logs are presented in **Appendix A**. The direction of groundwater flow on a nearby groundwater remediation project on the BoP property is southeasterly which is consistent with the regional groundwater flow in the area.

3.5 Wells and Wellhead Protection Areas

The majority of the population within a 4-mile radius of the site relies on water supplies provided by the Miami-Dade Water and Sewer Department (MDWSD). The MDWSD water system is broken into three regional water distribution systems in Miami-Dade County: the Hialeah and John E. Preston Water Treatment Plants (WTPs), the Alexander Orr, Jr. WTP and the South Miami-Dade Water Supply system. It should be noted that the Hialeah/Preston WTPs and the Alexander Orr, Jr. WTP regional system supply treated water to a common distribution system. It is estimated that the MDWSD system supplies 2,100,000 people with water in Miami-Dade County. The Hialeah and John E. Preston WTPs and the South Miami-Dade Water Supply system, and their associated well fields, are significantly more than four miles from the site.

The Alexander Orr Jr. WTP and its associated well fields serve customers of central Miami-Dade County south of SW 8th Street to near SW 264th Street. This includes the former Richmond NAS area. The well fields belonging to this regional system include the Alexander Orr well field, Snapper Creek well field, Southwest well field and West well field. The majority of wells in these well fields tap the Biscayne aquifer. However, a few wells are open to the upper Floridan

aquifer. Small amounts of this brackish water are blended with the Biscayne aquifer well water at the Alexander Orr Jr. WTP. The amounts of water blended into the system from the Floridan aquifer are limited as a result of increased sodium and chloride levels as well as increased total dissolved solids (TDS). Future plans may include using a reverse osmosis treatment on the Floridan aquifer derived water to reduce those levels. However, as measured from the center of the former Richmond NAS, just north of the former Hangars #1 and #2 area, the Alexander Orr Jr. WTP and its associated well fields are more than four miles from the former Richmond NAS site and therefore, beyond the EPA's Hazard Ranking System (HRS) Target Distance Limit for the Groundwater Migration Pathway.

Six non-community well systems have been identified within four miles of the site. These wells are open to the upper portions of the Biscayne aquifer. These well systems collectively serve 264 people. The nearest well located at the Coral Reef Driver License office, reportedly serves 100 people and is located approximately one-mile northeast of the former Richmond NAS.

Six private drinking water wells, also open to the upper portions of the Biscayne aquifer, were identified within four miles of the former Richmond NAS. The nearest private well was identified 1.8 miles southwest of the former Richmond NAS.

3.6 Surface Water and Critical Habitats

The former Richmond NAS site is located approximately 10 feet above the National Geodetic Vertical Datum (NGVD). Based on the topographic map, and site reconnaissance, the site area is relatively flat. However, a number of shallow depressions are evident on the topographic map. Based on the Federal Emergency Management Agency (FEMA) floodplain map, this area is located in an area of minimal flooding and outside the 100-year floodplain zone. No surface water bodies are located in the immediate area of the former Incinerator building. Overland drainage is routed to a drainage ditch which loops through portions of the U.S. Coast Guard Communications Station, University of Miami, GCRM, BoP, and Miami Zoo properties. It is estimated that this ditch has an average flow rate of less than 10 cubic feet per second. The ditch, which is carved through the limestone bedrock, appears to jog west from the western edge of the Zoo and likely connects with Black Creek Canal, located approximately 0.5 miles west of the Zoo. Black Creek Canal, which becomes Black Creek Canal C1 further downstream, flows southeast and south where it outfalls into the tidally influenced waters of Biscayne Bay, approximately nine miles southeast and downstream of the site. A flood gate and a salinity control structure exists on the Canal, approximately 3.75 and 8.2 miles, respectively, downstream of the site. As such, Black Creek/Black Creek Canal is fresh water for the majority of its length. A Topographic Site Location Map is shown in **Figure 2**.

No drinking water intakes are located within 15 downstream miles of the site. Black Creek, Black Creek Canal C1 and Biscayne Bay are used for recreational fishing. Aquatic species, commonly caught in Black Creek and Black Creek Canal C1, includes butterfly peacock and largemouth bass. Snook may be caught near the lower stretches of the Black Creek Canal C1, near Biscayne Bay. Salt water aquatic species, commonly caught in Biscayne Bay, include grouper, cobia, snook and sheepshead. Biscayne Bay and the lower reaches of the Black Creek Canal C1 are critical habitats for the federally designated endangered West Indian manatee.

Migration of the manatees up Black Creek Canal is more prevalent during the colder parts of the year when the tributary waters are warmer. However, sightings of manatees in the Black River are noted during all seasons of the year. The State-designated Biscayne Bay Aquatic Preserve supports diverse biological communities rich in fauna. This includes submerged aquatic, coastal wetland, intertidal and coastal upland habitats. Sea grasses, mangroves and salt marshes support a wide variety of habitats for fish, reptiles, wading birds and the West Indian manatee.

Many of these species have been designated as threatened or endangered by the State and/or Federal governments. The slash pine stands present in the northern portion of the BoP have been designated as a critical habitat and signage is in place designating the areas.

3.7 Threatened, Endangered Species

Based on the United States Fish and Wildlife Services (USFWS) (2015), the Threatened or Endangered Species List for Miami-Dade County includes the following: Birds – Cape Sable seaside sparrow, Bachman's warbler, Kirtland's warbler, wood stork, Audubon's crested caracara, Piping Plover, Red Knot; Plants – Florida bristle fern, Florida brickell-bush, Carter's small-flowered flax, Garber's spurge, Deltoid spurge, Okeechobee gourd, Beach jacquemontia, Tiny polygala, Crenulate lead-plant, Small's milkpea, Cape Sable Thoroughwort, Florida semaphore cactus; Insects – Schaus swallowtail butterfly, Miami Blue butterfly, Bartram's hairstreak Butterfly, Florida leafwing Butterfly; Mammals – West Indian Manatee, Florida panther, Florida bonneted bat; and Reptiles – American alligator, eastern indigo snake, American crocodile; and Snail – Stock Island tree snail.

3.8 Places of Historic Significance

Based on information reviewed in the National Historic Preservation Program and the Historic American Buildings Survey/Historic American Engineering Record, the former Incinerator building was not recorded in the National Register of Historic Places.

3.9 Current and Future Land Use

The current area surrounding the former Incinerator building is owned by the BoP, but is not used by the BoP. According to the BoP, they have no current plans to expand the prison operations into this area; however, long term development in the area may occur.

4.0 REMEDIAL INVESTIGATION ACTIVITIES

Due to the historical presence of Polynuclear Aromatic Hydrocarbons (PAHs), BaPe, arsenic, silver, and chromium in soil above the SCTLs, the USACE's contractor Aerostar SES LLC (Aerostar) conducted additional soil sampling to determine the nature and extent of the impacted soil surrounding the former Incinerator building. The USACE's contractor also installed four shallow monitor wells and collected groundwater samples for laboratory analysis of PAHs, arsenic, barium, chromium, lead, silver, and dioxin/furans.

Sampling activities were conducted during April 6-8 and June 1 and 23, 2016, in accordance with the USACE approved the Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) dated November 2015.

The following sections detail the RI soil and groundwater sampling activities.

4.1 Soil Sampling

On April 6, 2016, the USACE's contractor Aerostar mobilized to the site to initiate field activities. The contractor marked the locations of 14 soil borings where soil samples were collected from depths of 0-0.5 feet BLS and 0.5-2 feet BLS.

On April 6 and 7, 2016, the USACE's contractor collected 14 surface soil samples from a depth of 0 to 0.5 feet below land surface (BLS) and 14 subsurface soil samples from a depth of 0.5 to 2 feet BLS using a stainless steel hand auger. The USACE's contractor collected surface soil samples RNASI-SS2901, SS2902, SS3401, SS3402, SS3001, SS3002, SS3501, SS3502, SS3301, SS3302, SS3201, SS3202, SS3101, and SS3102; and subsurface soil samples RNASI-SB2901, SB2902, SB3401, SB3402, SB3001, SB3002, SB3501, SB3502, SB3301, SB3302, SB3201, SB3202, SB3101, and SB3102 for laboratory analysis of PAHs, arsenic, barium, chromium, lead, silver, and dioxins/furans. Soil samples RNASI-SS2902, RNASI-SS3502, RNASI-SS3202, and RNASI-SS3102 were held at the laboratory and were not analyzed.

On June 1, 2016, the USACE's contractor collected 10 additional soil samples for analysis of PAHs. The USACE's contractor collected soil samples RNASI-SS3003-0-0.5, RNASI-SB3003-0.5-2, RNASI-SS3003A-0-0.5, RNASI-SB3003B-0.5-2, RNASI-SS3004-0-0.5, RNASI-SB3004-0.5-2, RNASI-SS3403-0-0.4, RNASI-SB3403-0.5-2, RNASI-SS3403A-0-0.5, and RNASI-SB3403B-0.5-2. Soil samples RNASI-SS3004-0-0.5 and RNASI-SB3004-0.5-2 were held at the laboratory and were not analyzed.

On June 23, 2016, the USACE's contractor collected six additional soil samples for analysis of PAHs. The contractor collected soil samples RNASI-SS3404-0-0.5, RNASI-SB3404-0.5-2, RNASI-SS3405-0-0.5, RNASI-SB3405-0.5-2, RNASI-SS3406-0-0.5, and RNASI-SB-3406-0.5-2. Soil samples RNASI-SS3406-0-0.5 and RNASI-SB3406-0.5-2 were held at the laboratory and were not analyzed. The results of the soil laboratory analyses are discussed in **Section 6.1**. **Figure 4** shows the soil sampling locations. **Table 1** shows the soil analytical results for the metals, PAHs, and dioxins/furans. **Table 1A** shows the soil Benzo(a)Pyrene Conversion Tables. **Table 2** shows the Dioxin/Furan Conversion Tables.

4.2 Monitor Well Installation

On April 6, 2016, the USACE's contractor marked the location of four shallow monitor wells surrounding the former Incinerator building and installed four shallow monitor wells (RNASI-MW001, RNASI-MW002, RNASI-MW003, and RNASI-MW004) using a track-mounted direct-push drill rig and hollow stem augers (HSA). The wells were installed to depths ranging from 14 to 16 feet BLS. The monitor wells were constructed with 10 feet of 2-inch diameter, Schedule-40 polyvinyl chloride (PVC), 0.010-inch slotted well screen threaded to 4 to 6 feet of 2-inch diameter, Schedule-40 PVC riser. The monitor wells were completed by placing a 20/30-grade sand pack from the bottom of the screen to one foot above the top of the screen. Approximately one foot of 30/65-grade fine sand was placed on top of the sand pack, and the remaining annual space was grouted with Type I Portland cement. Each well was protected using an eight-inch diameter manhole secured in a two foot by two foot by four-inch concrete pad. A map showing

the location of the monitor wells is included as **Figure 5**. Monitor well construction diagrams along with the well permits are included in **Appendix B**.

4.3 Groundwater Sampling

On April 8, 2016, the USACE's contractor collected groundwater samples from monitor wells RNASI-MW001, RNASI-MW002, RNASI-MW003, and RNASI-MW004 for laboratory analyses of the parameters listed in EPA Method 8270 for PAHs; by EPA Method 6010C for arsenic, barium, chromium, lead, and silver; and by EPA Method 8290 for dioxins/furans. Groundwater samples were collected using a peristaltic pump and dedicated high density polyethylene tubing. The samples were placed in laboratory-supplied containers and shipped to Empirical Laboratories, LLC (ELL) for analyses of PAHs and the five metals; and to Cape Fear Analytical LLC for analysis of dioxins/furans. Groundwater sampling was conducted in accordance with the USACE UFP-QAPP and the FDEP Standard Operating Procedures (SOPs). Results of the groundwater laboratory analyses are discussed in **Section 6.2**. Groundwater analytical results are presented in **Table 3**.

Groundwater Sampling Logs, Field Instrument Calibration Logs, and field notes are included in **Appendix C**. Photographic documentation is included in **Appendix D**.

4.4 Quality Assurance /Quality Control (QA/QC) Sampling

During the sampling event, Quality Assurance/Quality Control (QA/QC) field duplicates and equipment blanks were collected for laboratory analyses. The QA/QC field duplicates for soil and groundwater samples were collected using the same methods described in Sections 4.1 and 4.3. Two field duplicate samples were collected for analysis of PAHs, metals, and dioxins/furans in soil. One field duplicate was collected for analysis of PAHs, metals, and dioxins/furans in water. One equipment blank was collected for analysis from each media.

The field duplicates were submitted to the same laboratory to be analyzed for the same parameters as the primary sample. The duplicate samples were not labeled with any information that would reveal the identity or the location of the sample.

All QA/QC samples were analyzed for the same parameters as the associated samples. After collection, QA/QC samples remained with the sample set and were subsequently transported to the appropriate laboratory with the sample set for analysis.

5.0 REGULATORY CRITERIA

The comparison of validated analytical results against the federal guidelines (e.g., CERCLA) and designated background concentrations provides the recommendations of further investigation or no further action. Comparing analytical results against these standards and guidelines also aids in the evaluation of risks posed by contaminants present at the site and site cleanup goals and provides a systematic method to identify target analytes present at the site that may require more detailed evaluation. The regulatory standards for the soil and groundwater remedial investigation at this site are as follows:

- CERCLA Risk Guidelines for polynuclear aromatic hydrocarbons (specifically BaPe concentrations) in Soil
- FDEP Chapter 62-777, FAC – SCTLs (including BaPe)
- Miami-Dade County Anthropogenic Background Study, 2014
- Site Background Levels for Total TEQs for dioxins and furans and arsenic
- FDEP Chapter 62-777, FAC - GCTLs

Florida's risk-based closure is an approach to addressing releases of hazardous substances or petroleum to the environment. Risk-based closure recognizes that some substances pose a greater risk than other substances, and that acceptable remaining concentrations of those substances can therefore vary accordingly. Risk-based closure also recognizes that measures such as land use restrictions and engineering controls can often serve to reduce risk to acceptable levels. The purpose of the detailed analysis of remedial alternatives is to provide decision makers with adequate information to permit the selection of an appropriate remedy for the site. The development, screening, and detailed analysis of alternatives may overlap, with one phase beginning before another is completed.

On behalf of FDEP, MACTEC collected two surface (0-2 feet BLS) and one subsurface (2-4 feet BLS) background soil samples during the SI conducted in January 2011. The five soil samples analyzed from the 0-2 feet BLS interval in the location of the former Incinerator during the SI showed Total TEQs for dioxins plus furans above the background sample concentrations of 4.0E-04 (RNA-SF01) and 5.8E-4 mg/kg (RNA-SF02). The Total TEQs for dioxins plus furans encountered in background sample RNA-SB01 (2-4 feet BLS) was 8.30E-04 mg/kg. Laboratory analysis of the soil samples collected during the SI in the location of the former Incinerator from a depth of 2 to 4 feet BLS did not show Total TEQs for dioxin plus furan concentrations exceeding the background concentrations. The USACE's contractor re-calculated the Total TEQ concentrations in the background samples collected during the SI, and determined that the background samples analyzed were not above the Residential SCTL. **Table 1** provides the FDEP SCTLs for the contaminants of concern (COCs) identified for soil. **Table 3** provides the GCTLs for the COCs identified for groundwater.

6.0 NATURE AND EXTENT OF CONTAMINATION

6.1 Soil Laboratory Analyses

On April 6 and 7, 2016, the USACE's contractor collected soil samples from the selected seven soil boring locations (14 samples) surrounding the soil samples collected by MACTEC during the SI. See **Figure 4** for soil sample locations. If concentrations of PAHs, metals or dioxins/furans exceeded the SCTLs, the second set of step-out samples were analyzed. Laboratory analysis of soil samples RNASI-SS3301-0-0.5 (0.237 mg/kg), RNASI-SB3301-0.5-2 (0.167 mg/kg), RNASI-SB3001-0.5-2 (0.204 mg/kg), and RNASI-SS3401-0-0.5 (0.328 mg/kg) detected benzo(a)pyrene equivalent concentrations exceeding the Residential SCTL of 0.1 mg/kg. The USACE directed the laboratory to analyze the step-out samples at each of these locations. Therefore, the laboratory analyzed soil samples RNASI-SS3302-0.0.5, RNASI-SB3302-0.5-2, RNASI-SS3002-0-0.5, RNASI-SB3002-0.5-2, RNASI-SS3402-0-0.5 and RNASI-SB3402-0.5-2 for PAHs. The laboratory analysis of the step-out samples showed soil sample RNASI-SS3402-0-0.5 (0.173 mg/kg) and soil sample RNASI-SS3002-0-0.5 (0.303

mg/kg) exceeded the BaPe Residential SCTL. The BaPe Conversion Tables are shown in **Table 1A**. Based on the laboratory analytical results, the USACE's contractor mobilized to the site on June 1, 2016, to collect 10 additional soil samples from 5 soil boring locations. The contractor stepped-out 40 feet east of RNASI-SS3402-0-0.5 and collected soil samples RNASI-SS3403-0-0.5 and RNASI-SB3403-0.5-2; stepped-out 40 feet south of RNASI-SS3403-0-0.5 and collected soil samples RNASI-SS3403A-0-0.5 and RNASI-SB3403B-0.5-2. In addition, the contractor stepped-out 40 feet northeast of RNASI-SS3002-0-0.5 and collected soil samples RNASI-SS3003-0-0.5 and RNASI-SB3003-0.5-2. The contractor stepped-out 40 feet northwest of RNASI-SS3003-0-0.5 and collected soil samples RNASI-SS3003A-0-0.5 and RNASI-SB3003B-0.5-2. The contractor also stepped-out 40 feet northeast of RNASI-SS3003-0-0.5 and collected two soil samples RNASI-SS3004-0-0.5 and RNASI-SB3004-0.5-2. These two samples were held at the laboratory until the other soil samples were analyzed. The soil samples were transported to ELL for analysis of PAHs by EPA Method 8270. Laboratory analytical results showed BaPe in RNASI-SS3403A-0-0.5 (0.237 mg/kg) above the Residential BaPe SCTL of 0.1 mg/kg.

On June 23, 2016, the USACE's contractor conducted a fourth step-out sampling event and collected six additional soil samples from three soil boring locations. The contractor stepped-out 40 feet south-southwest of RNASI-SS3403A-0-0.5 and collected soil samples RNASI-SS3404-0-0.5 and RNASI-SB3404-0.5-2. The contractor also stepped-out 40 feet to the southeast of RNASI-SS3403A-0-0.5 and collected soil samples RNASI-SS3405-0-0.5 and RNASI-SB3405-0.5-2. In addition, the contractor stepped-out another 40 feet in the southeastern direction and collected soil samples RNASI-SS3406-0-0.5 and RNASI-SB3406-0.5-2. These two soil samples were held at the laboratory pending the analysis of the first four soil samples. The USACE's contractor could not step-out in a due easterly direction from RNASI-SS3403A-0-0.5 because the wooded area to the east is an endangered species habitat. The soil samples were transported to ELL for the analysis of low level PAHs by EPA Method 8270. Laboratory analytical results of the fourth step-out soil sampling event showed BaPe concentrations in RNASI-SS3404-0-0.5, RNASI-SB3404-0.5-2, RNASI-SS3405-0-0.5, and RNASI-SB3405-0.5-2 below the Residential SCTL of 0.1 mg/kg. Based on the analytical results of the first four soil samples analyzed, soil samples RNASI-SS3406-0-0.5 and RNASI-SB3406-0.5-2 were not analyzed. **Table 1** shows the Soil Analytical Results for the PAHs. **Figure 6** shows the BaPe concentrations in soil during the RI and the Site Inspection Report prepared by MACTEC.

Laboratory analysis detected a Total TEQ for dioxin plus furan concentrations in soil sample RNASI-SS3001-0-0.5 (0.0000158 mg/kg) exceeding the Residential SCTL of 0.000007 mg/kg. Therefore, two step-out soil samples RNASI-SS3002-0-0.5 and RNASI-SB3002-0.5-2 were analyzed for dioxins/furans. The laboratory analytical results showed the step-out soil samples were below the Residential SCTLs. **Table 2** shows the Dioxin/Furan Conversion Tables. **Figure 7** shows the Total TEQs for dioxin plus furan concentrations in soil. **Table 1** shows the soil analytical results for metals, PAHs, and Total TEQs for dioxin and furan concentrations. Soil laboratory analytical reports for the samples collected during the RI are in **Appendix E**.

6.2 Groundwater Laboratory Analyses

On April 8, 2016, the USACE's contractor collected groundwater samples from four on-site monitor wells. Prior to sampling, the monitor wells were purged following the FDEP SOPs. The contractor monitored the field parameters during purging activities to ensure that a representative

groundwater sample was collected for laboratory analysis. After the groundwater samples were collected in laboratory-supplied containers, they were shipped via an overnight carrier to ELL for analysis of PAHs by EPA Method 8270; and total arsenic, barium, chromium, lead, and silver by EPA Method 6010. The dioxin/furan containers were shipped directly to Cape Fear Analytical LLC for analysis. Laboratory analytical results did not detect PAHs, metals, or dioxins/furans above the Chapter 62-777 FAC, GCTLs. **Table 3** shows the groundwater laboratory analytical results. **Figure 8** shows the metals concentrations in groundwater, and **Figure 9** shows the PAH concentrations in groundwater. Groundwater laboratory analytical reports are in **Appendix F**.

6.3 Data Validation

The contractor's project chemist reviewed the Staged Electronic Data Deliverable (SEDD) files provided by the laboratories for each sampling event. The contractor reviewed the SEDD files using the EPA and USACE's version 1.9.0.325 of the Automated Data Review (ADR) software program and checked the analytical results against the existing project electronic-Quality Assurance Project Plan (e-QAPP).

The project chemist documented any manual changes to the ADR validation qualifiers and the corresponding justifications in the Reviewed SEDD File Reports included in **Appendix G**. Copies of the Final SEDD files and e-QAPP are included on a CD in **Appendix G**.

The review of the analytical results was based upon the laboratory-provided quality control (QC) data. The QC samples used to assess data quality consisted of method blanks (MB), laboratory control samples (LCS), laboratory control sample duplicates (LCSD), and matrix spike/matrix spike duplicate (MS/MSD) samples. The data were also evaluated based upon field-submitted duplicate samples, equipment blanks, trip blanks, method-specific holding times and laboratory surrogate spike recoveries. Measurement performance criteria were met for each analysis for each sample delivery group with the following exceptions:

The PAH results reported for sample RNASI-MW001 are considered estimated low at the reported method detection limits due to the associated low surrogate recoveries. The reported chromium result for sample RNASI-MW004 is considered non-detect at the reported concentration due to potential contamination as revealed in the associated laboratory method blank.

The percent moisture analysis for soil samples RNASI-SS3002-0-0.5, RNASI-SB3002-0.5-2, RNASI-SS3402-0-0.5, RNASI-SB3402-0.5-2, RNASI-SS3302-0-0.5, and RNASI-SB3302-0.5-2 was performed outside of the seven day EPA recommended hold time. These samples were part of the second set of step out samples that were held at the laboratory pending the results of the first set of samples analyzed. The samples were analyzed seven days after the recommended hold time; however, this hold time excursion for percent moisture analysis does not have a significant impact on the reported sample data. All data are deemed usable.

The overall assessment of Precision, Accuracy, Representativeness, Comparability, and Completeness showed the data met project requirements with the exceptions noted above. All data are deemed usable for the intended purpose.

7.0 FOCUSED HUMAN HEALTH RISK ASSESSMENT

Hazardous Substance and Waste Management Research, Inc. (HSWMR) prepared a focused Human Health Risk Assessment for the former Incinerator site based on the BaPe concentrations. The RA included evaluating the Potential Constituents of Concern (PCOC) in the soil. The RA evaluated the PAH concentrations in soil and specifically the BaPe concentrations with regards to the CERCLA guidelines. Based on the available data for PAHs (expressed as BaPe) in soil from 0 to 2 feet BLS, the site does not represent a significant concern for current and likely future commercial/industrial use, and also falls within acceptable risk levels for future unrestricted/residential use. It should further be noted that the BaPe 95% UCL of the mean concentration for site soils, 0.15 mg/kg, is not significantly different than that reported in the Miami-Dade County (2014) anthropogenic background study results for BaPe, set at 0.13 mg/kg. A copy of the RA is included in **Appendix H**.

8.0 REMEDIAL INVESTIGATION SUMMARY AND CONCLUSIONS

The laboratory analytical results for the soil samples analyzed during the RI indicated that surface soil (0-0.5 feet below land surface [BLS]) and subsurface soil (0.5-2 feet BLS) surrounding the former Incinerator was impacted with BaPe exceeding the Residential SCTL. BaPe concentrations exceeding the Residential SCTL were detected in surface soil samples RNASI-SS3301-0-0.5, RNASI-SS3401-0-0.5, RNASI-SS3402-0-0.5, RNASI-SS3403A-0-0.5, and RNASI-SS3002-0-0.5. BaPe concentrations exceeding the Residential SCTL were detected in subsurface soil samples RNASI-SB3301-0.5-2 and RNASI-SB3001-0.5-2.

The RA evaluated the PAH concentrations in soil and specifically the BaPe concentrations with regards to the CERCLA guidelines. Based on the available data for PAHs (expressed as BaPe) in soil from 0 to 2 feet BLS, the site does not represent a significant concern for current and likely future commercial/industrial use, and also falls within acceptable risk levels for future unrestricted/residential use. Based on the 0.15 mg/kg BaPe mean concentration determined by the 95% UCL and the similarity in the BaPe concentration determined in the Miami-Dade County anthropogenic background study results for BaPe (0.13 mg/kg), the USACE does not recommend any additional assessment, Feasibility Study, or remediation work at this site.

Laboratory analysis of surface soil sample RNASI-SS3001-0-0.5 indicated the Total TEQs for dioxins and furans were above the Residential SCTL. Two step-out soil samples (RNASI-SS3002-0-0.5 and RNASI-SB3002-0.5-2) that were collected and placed on hold at the laboratory were analyzed. Laboratory analysis of the step-out samples did not show Total TEQ for dioxins plus furans concentrations above the Residential SCTL.

No metals were detected in the soil samples analyzed above the Chapter 62-777, FAC, SCTLs.

Laboratory analysis of groundwater samples collected from four on-site monitor wells showed no PAHS, metals, or dioxins/furans above the GCTLs.

9.0 REFERENCES

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