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FINAL ENGINEERING EVALUATION/COST ANALYSIS FOR CANAL ROAD DREDGE PILES
AT SITE 8 HERBICIDE ORANGE STORAGE AREA NCBC GULFPORT MS
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TETRA TECH

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Final Engineering Evaluation/ Cost Analysis for Canal Road Dredge Piles – Site 8 Herbicide Orange Storage Area

**Naval Construction Battalion Center
Gulfport, Mississippi**

Contract Task Order 0049

November 2007



Southeast

2155 Eagle Drive

North Charleston, South Carolina 29406

REVISION 2
NOVEMBER 2007

**FINAL ENGINEERING EVALUATION/COST ANALYSIS
FOR
CANAL ROAD DREDGE PILES –
SITE 8 HERBICIDE ORANGE STORAGE AREA**

**NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI**

**COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT**

**Submitted to:
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Southeast
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ACRONYMS

2,4-D	2,4-dichlorophenoxyacetic acid
2,4,5-T	2,4,5-trichlorophenoxyacetic acid
ABB-ES	ABB Environmental Services, Inc.
AFESC	Air Force Engineering and Service Center
AO	Agreed Order
AOC	Area of Contamination
ARAR	Applicable or Relevant and Appropriate Requirement
bgs	below ground surface
CCI	CH2MHill Constructors, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	Chemical of concern
COPC	Chemical of potential concern
DoD	Department of Defense
DPT	Direct push technology
EE/CA	Engineering Evaluation/Cost Analysis
FFS	Focused Feasibility Study
HLA	Harding Lawson Associates, Inc.
HO	herbicide orange
IAS	Initial Assessment Study
LDR	land disposal restriction
MCL	maximum contaminant level
MDEQ	Mississippi Department of Environmental Quality
MTR	Minimum Technological Requirements
NAVFAC SE	Naval Facilities Engineering Command Southeast
NCBC	Naval Construction Battalion Center
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
ng/kg	nanograms per kilogram
NPV	net present value
NTCRA	non-time-critical removal action
OSHA	Occupational Safety and Health Administration

PCB	Polychlorinated biphenyl
pg/L	Picograms per liter
PRSC	Post-removal site control
RBC	Risk-Based Concentration
RCC	roller compacted concrete
RCRA	Resource Conservation and Recovery Act
RG	Remedial goal
RME	Reasonable maximum exposure
SARA	Superfund Amendments and Reauthorization Act
SRT	Sediment recovery trap
SVOC	Semivolatile organic compound
TBC	To Be Considered
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TEQ	Toxicity equivalent
TPH	Total petroleum hydrocarbons
TRG	Target remediation goal
TtNUS	Tetra Tech NUS, Inc.
UCL	Upper confidence limit
µg/kg	Microgram per kilogram
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
UTS	Universal treatment standards
VOC	Volatile organic compound
yd ³	Cubic yards

1.0 INTRODUCTION

1.1 SCOPE

Tetra Tech NUS, Inc. (TtNUS), under contract to the United States Department of the Navy (Navy), Naval Facilities Engineering Command Southeast (NAVFAC SE), has prepared this Engineering Evaluation/ Cost Analysis (EE/CA) for the Canal Road Dredge Piles located west of Canal Road in the Off-Base¹ Area of Contamination (AOC) associated with Site 8 – Herbicide Orange (HO) Storage Area (Site 8.) Surface soil in this area pose a potential threat to human health, welfare, and the environment due to exposure to dioxins. This EE/CA was prepared under the Comprehensive Long-Term Environmental Action Navy (CLEAN) IV, Contract No. N62467-04-D-0055, Contract Task Order 0049.

1.2 PURPOSE

The Navy has determined that a non-time-critical removal action (NTCRA) under the guidance provided by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 is necessary to prevent, minimize, or mitigate damage to public health or welfare based on the potential for environmental contamination from dioxin-contaminated sediment and soil located in the Off-Base AOC. This EE/CA has been prepared in general accordance with the procedures developed under CERCLA as amended by SARA and to provide CERCLA documentation in support of an NTCRA for the Canal Road Dredge Piles.

1.3 REGULATORY FRAMEWORK

This EE/CA has been prepared in accordance with the Defense Environmental Installation Restoration Program, a program formally established by statute that provides for the cleanup of hazardous substances associated with past Department of Defense (DoD) activities consistent with the provisions of CERCLA, as amended by SARA, and as implemented by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This document is also intended to comply with the National Environmental Policy Act (NEPA) of 1969.

Naval Construction Battalion Center (NCBC) Gulfport and Site 8 are not listed in the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) and therefore do not have a United States Environmental Protection Agency (USEPA) identification number.

¹ "Off-Base" refers to the area outside the limits of the Naval Construction Battalion Center (NCBC) Gulfport ("Base"), Gulfport, Mississippi.

Activities to date and this EE/CA have been performed pursuant to an Agreed Order (AO) between the Mississippi Department of Environmental Quality (MDEQ), the United States Environmental Protection Agency (USEPA), and the United States Air Force (USAF) (MDEQ, 1997). Under the CERCLA program, an EE/CA is prepared to document the decision-making process for conducting an NTCRA. This EE/CA has been prepared using USEPA's Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA (USEPA, 1993).

1.4 ORGANIZATION

The EE/CA is organized into six sections. Section 1.0 provides an introduction to the EE/CA, including the scope, purpose, and regulatory framework. Section 2.0 presents the Base description and site characterization. Section 3.0 identifies the removal action objectives. Section 4.0 identifies and analyzes potential removal technologies and alternatives, and Section 5.0 compares the removal action alternatives with respect to their ability to achieve the objectives presented in Section 3.0. Section 6.0 presents the recommended removal action alternative. A list of references and appendices is provided at the end of the EE/CA.

2.0 SITE CHARACTERIZATION

2.1 SITE DESCRIPTION

NCBC Gulfport is located in the southeastern corner of Mississippi, approximately 2 miles north of the Gulf of Mexico, in southeastern Harrison County in the western portion of the City of Gulfport. Figure 2-1 shows the location of the Base in relation to the City of Gulfport and the Gulf of Mexico. The Base occupies 1,100 acres with an average elevation of approximately 30 feet above sea level. A map of NCBC Gulfport is provided in Figure 2-2.

The Canal Road Dredge Piles are the result of dredging activities conducted in 1974 and 1975 in Canal No. 1 between 28th Street and the Turkey Creek Bridge. Canal No. 1 receives surface water discharge from Site 8, among other areas of the Base.

Site 8 consists of three contiguous HO drum storage areas (referred to as Site 8A, Site 8B, and Site 8C) located in the north-central portion of the Base (Figure 2-2). After completion of remedial activities in October 2006, Site 8A (the main former HO storage area) was regraded, dioxin-contaminated material stabilized within the limits of Site 8A, and a roller compacted concrete (RCC) cover constructed over the stabilized contaminated material. The Off-Base AOC is located north of the Base, across 28th Street, and includes the area between Canal No. 1 and 53rd Avenue. A map of the Off-Base AOC is provided in Figure 2-3.

The surface water hydrology information presented below was derived from the Remediation Planning Document [Harding Lawson Associates, Inc. (HLA), 2000a] and the Focused Feasibility Study (FFS) for Site 8 (TtNUS, 2003).

NCBC surface water drainage is collected and transported to several outfalls via a network of drainage channels. These drainage channels collect surface water from six drainage areas throughout the NCBC (see Figure 2-4). Site 8A, Site 8B, and Site 8C contribute to Drainage Areas 1, 2, and 3 (see Figures 2-5, 2-6, and 2-7, respectively). Throughout the year, flow throughout the majority of the on-base drainage channels is perennial. Surface drainage from Site 8A flows to the northwest, exiting the Base at Outfall 3 into a drainage system that feeds Canal No. 1, which flows north to Turkey Creek.

As shown on Figures 2-5 and 2-6, Drainage Areas 1 and 2 drain to the northwestern corner of the Base and exit the Base at Outfall 3 (Figure 2-4). Prior to 1995, surface water leaving the Base via Outfall 3 flowed north under 28th Street into the Off-Base AOC. Surface water in the Off-Base AOC flowed north, and at approximately 1,700 feet north of 28th Street, it flowed either west under Canal Road to Canal No.

1 via a culvert or, during storm events, northeast to the natural drainageway (the southern branch of Turkey Creek) until it reached the confluence with the main branch of Turkey Creek.

In 1974 and 1975, the Navy reduced the flooding potential for the Base by dredging Canal No. 1 between 28th Street and the Turkey Creek Bridge. The dredge spoils were piled on the western side of Canal No. 1 on privately owned residential property.

Beginning in 1995, efforts were initiated to limit the flow of surface water into the Off-Base AOC to minimize the migration of dioxin-contaminated sediments. These efforts resulted in the permanent rerouting of Outfall 3 flow on the northern side of 28th Street to Canal No. 1, effectively bypassing the Off-Base AOC. These measures included the replacement of three 18-inch-diameter reinforced concrete pipe culverts under 28th Street with a single 5-foot-wide reinforced concrete box culvert and construction of a drainage ditch on the northern side of 28th Street to convey storm water to the west under Canal Road and into Canal No. 1.

2.2 SITE HISTORY

As stated in Section 2.1, dredging activities in Canal No. 1 were conducted by the Navy in 1974 and 1975 to reduce the flooding potential for the Base. The dredging was conducted in Canal No. 1 between 28th Street and the Turkey Creek Bridge, and the dredge piles were placed along the western side of Canal No. 1. Local community members identified the presence of the Canal Road Dredge Piles and expressed concerns that the material may have been impacted by HO-related dioxins. From 2004 to 2006, the Canal Road Dredge Piles were sampled, samples were analyzed, and a survey was completed. The Canal Road Dredge Piles extend approximately 4,400 feet from the northern side of the Ladnier Home complex north to Turkey Creek, range in height from 3 to 10 feet above pre-dredge pile grade, vary in width from approximately 5 to 35 feet, and contain approximately 6,500 cubic yards (yd³) of material. The Canal Road Dredge Pile samples contained the primary congener 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), which links the dredge pile dioxin contamination to Site 8.

HO is an herbicide formulation employed during the Vietnam War to defoliate trees and shrubbery. It is an equal mixture of two agricultural herbicides [2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T)] in a diesel or jet fuel mixture. Spills and leaks of HO occurred within Site 8, contaminating surface soil and sediment with the mixture components, 2,4,5-T and 2,4-D, as well as byproduct contaminants (dioxins and furans), primarily TCDD. Concentrations of 2,4,5-T and 2,4-D have degraded over time; however, dioxin and furan concentrations have remained at concentrations greater than regulatory limits. Throughout this EE/CA, TCDD and its chemically related dioxin and furan congeners are collectively referred to as "dioxins."

Historical information related to Site 8, including previous removal actions and previous investigations, is presented in Appendix A.

2.3 PREVIOUS INVESTIGATIONS

Dredge pile delineation studies were conducted to delineate the extent of dioxin contamination in dredge piles located west of Canal No. 1 in the Off-Base AOC (TtNUS, 2006). The evaluation of the Canal Road Dredge Piles is discussed in the Site Investigation Report for Canal Road (TtNUS, 2005). Sampling was conducted in three phases, and the findings were as follows:

- The dredge piles are located on private property that is zoned residential; therefore, the MDEQ Tier 1 soil/sediment target remediation goal (TRG) concentration of 4.26 nanograms per kilogram (ng/kg) for unrestricted residential use is the appropriate benchmark.
- The 95 percent upper confidence limit (UCL) of the mean dioxin concentration for the 39 samples collected was 20.43 ng/kg, indicating the need for further action. Concentrations in 30 of the 39 samples exceeded the MDEQ unrestricted Tier 1 TRG for dioxin.
- The primary congener was TCDD, possibly linking the reported dioxin contamination to Site 8. TCDD is associated with Herbicide Orange (HO) and as explained in previous investigations Site 8 served as HO drum storage.
- Concentrations of dioxin in the dredge piles did not vary with distance from NCBC Gulfport or with depth in the dredge piles. Therefore, the entire length of the dredge pile, approximately 4,400 feet, is considered impacted by HO-related dioxins.
- The volume of the Canal Road Dredge Piles, as derived from detailed topographic profiling, is approximately 6,500 yd³. The topographic survey information is provided in Appendix B.

2.4 SOURCE, NATURE, AND EXTENT OF CONTAMINATION

The source of contamination for the Canal Road Dredge Piles is assumed to be Site 8. Section 2.3 discusses the nature and extent of contamination based on the Final Letter Report, Site 8B and 8C Verification Sampling and Associated Drainage Systems (TtNUS, 2006).

2.4.1 Estimated Extent of Contaminated Media

Based on the Canal Road Dredge Piles delineation sampling conducted in the Off-Base AOC during 2005 and 2006, it was estimated that approximately 6,500 yd³ of off-base surface soil (Canal Road Dredge Piles) has dioxin concentrations greater than the MDEQ Tier 1 soil/sediment TRG concentration of 4.26 ng/kg for unrestricted residential use.

2.5 ANALYTICAL DATA

Surface soil sampling at the Canal Road Dredge Piles occurred in various phases. A sediment sample was also collected from the adjacent water body. The sampling strategy incorporated the use of bio-assay analysis (USEPA Method 4025) in conjunction with high resolution analysis (USEPA Method 8290). A more focused sampling approach in Phase 2 required only the high resolution analysis.

Results are presented in Table 2-1 and are summarized as follows:

- Two of the samples analyzed using USEPA Method 8290 had dioxin concentrations that exceeded the 38 ng/kg MDEQ Tier 1 restricted TRG – sample CR26 (40.1 ng/kg) and sample CR28 (39.5 ng/kg).
- In total, 30 of the 39 samples had dioxin concentrations that exceeded the 4.26 ng/kg MDEQ unrestricted Tier 1 TRG.
- The 95 percent UCL of the mean dioxin concentration for the samples collected at the Canal Road Dredge Piles was 20.43 ng/kg.
- These results indicate that a removal action is necessary for the Canal Road Dredge Piles.
- Dioxin concentrations are distributed throughout the dredge piles with no discernable pattern; therefore, additional characterization will not likely result in a reduced volume estimate of material to be removed.

3.0 IDENTIFICATION OF REMOVAL ACTION OBJECTIVES

3.1 REMOVAL ACTION OBJECTIVES

Removal action objectives are based on the contaminated media found at the site, potential human health and environmental threats, and regulatory standards, requirements, and guidance. Based on previous investigations and human health and ecological risk assessments, the media of concern is the surface soil from the Canal Road Dredge Piles. The chemicals of concern (COCs) are dioxins.

The removal action objectives are as follows:

- Protect human health from the potential carcinogenic and noncarcinogenic risks associated with incidental ingestion of, inhalation of, and dermal contact with contaminated surface soil and sediment.
- Protect human health from the carcinogenic risks associated with ingestion of and dermal contact with on-site and off-site groundwater based on potential residential future use scenarios.
- Comply with federal and state regulations and guidance criteria in accordance with accepted USEPA and MDEQ guidelines.

3.2 REMOVAL ACTION SCOPE

Based on the Canal Road Dredge Piles delineation studies conducted during 2005 and 2006 and documented in the Site 8B and 8C Verification Sampling and Associated Drainage Systems Final Letter Report (TtNUS, 2006), approximately 6,500 yd³ of off-base sediments (Canal Road Dredge Piles) have dioxin concentrations greater than the MDEQ Tier 1 soil/sediment TRG concentration of 4.26 ng/kg for unrestricted residential use. The contaminated off-base soil and sediments should be removed and stabilized at Site 8B.

3.3 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO BE CONSIDERED CRITERIA

Applicable or relevant and appropriate requirements (ARARs) for this EE/CA are the federal and state environmental requirements used to define the appropriate extent of site cleanup, identify sensitive land areas or land uses, develop remedial action alternatives, and direct site remediation. CERCLA and the NCP require remedial actions to comply with state ARARs when they are more stringent than federal ARARs.

The NCP defines two ARAR components: (1) applicable requirements and (2) relevant and appropriate requirements. Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental or facility siting laws specifically addressing a hazardous substance, pollutant, contaminant, remedial action, or other circumstances found at a CERCLA site. Applicable state standards are only those (1) identified by the state in a timely manner, (2) consistently enforced, and (3) more stringent than federal requirements.

Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, under federal and state environmental and facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, or remedial action, address situations sufficiently similar to those encountered at the CERCLA site so their use is well suited to the particular site. Only those state standards (1) identified in a timely manner and (2) more stringent than federal requirements may be relevant and appropriate.

"Applicability" is a legal determination of jurisdiction of existing statutes and regulations, whereas "relevant and appropriate" is a site-specific determination of the appropriateness of existing statutes and regulations. Therefore, relevant and appropriate requirements allow flexibility not provided by applicable requirements in the final determination of cleanup levels. After a requirement is identified as an ARAR, the selected remedy must comply with or be waived from the ARAR, even if the ARAR is not required to assure protectiveness. Applicable requirements apply to both on- and off-site remedial actions.

To Be Considered (TBC) Guidance Criteria are federal and state non-promulgated advisories or guidance criteria that are not legally binding and do not have the status of potential ARARs. However, if there are no specific ARARs for a chemical or site condition, or if ARARs are not deemed sufficiently protective, then guidance or advisory criteria should be identified and used to ensure the protection of human health and the environment.

Under the description of ARARs set forth in the NCP and SARA, state and federal ARARs are categorized as follows:

- **Chemical-Specific:** Controlling the extent of site remediation with regard to specific contaminants and pollutants.
- **Location-Specific:** Governing site features such as wetlands, floodplains, and sensitive ecosystems (including features of historical significance).

- Action-Specific: Pertaining to the proposed site remedies and governing the implementation of the selected site remedy.

During the detailed evaluation of alternatives, each alternative will be analyzed to determine its compliance with ARARs. Chemical-, location-, and action-specific ARARs are presented in Table 3-1.

3.3.1 Land Disposal Restrictions

The Land Disposal Restriction (LDR) program included under the Resource Conservation and Recovery Act (RCRA) requires that hazardous wastes undergo physical or chemical changes to reduce the toxicity or mobility of the hazardous constituents so that the wastes pose less of a threat to groundwater, surface water, and air prior to disposal. Both listed and characteristic wastes must meet the LDR treatment standards before they are eligible for land disposal. The treatment standards for most characteristic hazardous wastes entail rendering the waste nonhazardous. However, some characteristic waste treatment standards have additional requirements for "underlying hazardous constituents" that may pose a threat and must therefore be treated to meet contaminant-specific levels referred to as universal treatment standards (UTSs). The "underlying hazardous constituent" is generally defined as any constituent listed that can reasonably be expected to be present at the point of generation of the hazardous waste at a concentration greater than the constituent-specific UTS. The nonwastewater UTS for tetrachlorodibenzo-p-dioxins (i.e., dioxin) contained in 40 Code of Federal Regulations (CFR) 268.48 is 1.0 microgram per kilogram ($\mu\text{g}/\text{kg}$) (1,000 ng/kg).

4.0 IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION ALTERNATIVES

4.1 IDENTIFICATION OF REMOVAL ACTION ALTERNATIVES

Two removal action alternatives judged to meet the removal action objectives were identified for this removal action. The two alternatives involve traditional approaches to the type of environmental impact associated with the Canal Road Dredge Piles.

Excavation and off-site disposal of dioxin-contaminated material from the Canal Road Dredge Piles were developed as Alternative 1. Excavation of dioxin-contaminated material from the Canal Road Dredge Piles, and consolidation and stabilization of excavated dredge pile material within the limits of Site 8B and Site 8C was developed as Alternative 2. The two removal action alternatives are described below.

4.1.1 Alternative 1 – Excavation and Off-Site Disposal

The Canal Road Dredge Piles consist of approximately 6,500 yd³ of off-base soil with dioxin concentrations greater than the MDEQ Tier 1 soil/sediment TRG of 4.26 ng/kg for unrestricted residential use and must therefore be removed. The maximum dioxin concentration in the Canal Road Dredge Piles is more than an order of magnitude less than the UTS for dioxin of 1,000 ng/kg; treatment of Canal Road Dredge Pile material to meet the UTS is therefore not required. To protect human health and the environment, the Canal Road Dredge Pile material with dioxin concentrations greater than the 4.26 ng/kg criterion would be excavated and disposed at an approved and permitted off-site waste disposal facility.

Alternative 1 removes the source from the Off-Base AOC site, thus eliminating potential risk to human health and ecological receptors.

Under this alternative, contaminated material with dioxin concentrations greater than the 4.26 ng/kg criterion would be excavated from the Canal Road Dredge Piles located immediately west of Canal No. 1. Prior to excavating the dredge pile material, temporary erosion and sediment control features would be installed to prevent transport of sediment, and the excavation and contiguous area would be cleared of trees, brush, other vegetation, and debris. The excavated Canal Road Dredge Pile material would be transported and disposed off-site at an approved and permitted off-site waste disposal facility. Transportation would be by either over the road haulers or by rail. Based on the sampling and topographic survey performed for the Canal Road Dredge Piles, approximately 6,500 yd³ of material would be excavated resulting in approximately 9,600 tons of dredge pile material for off-site disposal.

Following excavation of the dredge pile material, sampling would be performed at the base of the excavation to verify that dioxin concentrations are less than the MDEQ unrestricted Tier 1 TRG of 4.26 ng/kg. Samples would likely be subject to bio-assay analysis (USEPA Method 4025), with high resolution laboratory analysis (USEPA Method 8290) used to confirm the results. The excavated areas would then be backfilled with clean fill and graded to pre-dredge material placement elevations. The Canal Road Dredge Pile area would be covered with 6 inches of topsoil and revegetated with a permanent seed mixture to minimize erosion. The removal action activities would be completed in approximately 4 months.

Alternative 1 would not involve institutional controls or post-removal site controls (PRSCs) for the Canal Road Dredge Piles because the contaminated material would be removed and disposed off site.

Alternative 1 would be considered the application of the removal presumptive remedy. This alternative will be considered for further evaluation.

4.1.2 Alternative 2 – Excavation, Consolidation, and Stabilization

To protect human health and the environment, the Canal Road Dredge Pile material with dioxin concentrations greater than the 4.26 ng/kg criterion would be excavated, placed and stabilized within the limits of Site 8B and Site 8C.

Alternative 2 removes the source from the Off-Base AOC site, thus eliminating potential risk to human health and ecological receptors in an area zoned for residential use. Further, Alternative 2 consolidates and stabilizes this material at the original site on-base, where industrial land use and PRSCs will prevent unacceptable residential exposure scenarios.

Similar to Alternative 1, contaminated material with dioxin concentrations greater than the 4.26 ng/kg criterion would be excavated from the Canal Road Dredge Piles located immediately west of Canal No. 1. Prior to excavating the dredge pile material, temporary erosion and sediment control features would be installed to prevent transport of sediment, and the excavation and contiguous area would be cleared of trees, brush, other vegetation, and debris. For Alternative 2, the excavated Canal Road Dredge Pile material would be placed on Site 8B, consolidated (i.e., blended) with existing Site 8B soil, and chemically stabilized in place using Portland cement or another stabilizing agent. Based on the sampling and topographic survey performed for the Canal Road Dredge Piles, approximately 6,500 yd³ of material would be excavated. A portion of Site 8B will be prepared by milling the surface to a consistent grade; the off-base material will then be combined with the resulting soil from 8B and stabilized into a hardstand using a cement mixture of approximately 14 percent by weight.

Following excavation of the dredge piles, sampling would be performed at the base of the excavation to verify that dioxin concentrations are less than the MDEQ unrestricted Tier 1 TRG of 4.26 ng/kg. Samples will be subject to high resolution laboratory analysis (USEPA Method 8290) to confirm the results. The dredge pile excavation area would then be backfilled with clean fill and graded to pre-dredge material placement elevations. The Canal Road Dredge Pile area would be covered with 6 inches of topsoil and revegetated to minimize erosion, and no post-removal site control (PRSC) will be needed.

Following application of the stabilization agent, the stabilized dioxin-contaminated material now located in Site 8B would be graded to preclude ponding of stormwater. The drainage channels within the Site 8B and Site 8C limits would primarily be restored with a geotextile separation layer and riprap to minimize erosion in the channels. The remainder of the drainage channels would be restored using topsoil to minimize erosion. The removal action activities would be completed in approximately 4 months.

With Alternative 2, the consolidated and stabilized material at Site 8B will be used as a hardstand surface storage area. With contaminant levels at Site 8B (11.07 ng/kg) below the industrial standard of 38 ng/kg, industrial activities such as surface storage are permitted with the following PRSCs:

- No residential (temporary or permanent) occupation of structures would be allowed at Site 8B.
- No development of groundwater for any purpose would be permitted at Site 8B.
- Sediment recovery traps (SRTs) at each of the three locations where channelized surface water exits Site 8B and Site 8C would be installed.
- A sediment monitoring program: consisting of a baseline event, followed by monitoring events every six months for the first 2 years and annually thereafter would be implemented. Sediment samples would be collected from upgradient and downgradient locations at each of the SRTs. For consistency and comparability, the locations would be marked and revisited during each sampling event.
- Every 5 years, the status of Site 8B would be formally reviewed and evaluated to determine the continued effectiveness of this alternative, according to CERCLA.

While Alternative 2 may be upgraded with a surface pavement in the future, the contaminant levels in the soil at Site 8B, as well as the material removed from the material removed from the Canal Road Dredge Piles (20.43 ng/kg), are less than the TRG for industrial use and therefore do not pose unacceptable risk for industrial use activities. Appendix A contains the source data for the statistical evaluation of soil contamination levels presented.

4.2 EVALUATION OF REMOVAL ACTION ALTERNATIVES

In accordance with USEPA's Guidance on Conducting Non-Time Critical Removal Action Under CERCLA (1993), each retained alternative is evaluated with respect to effectiveness, implementability, and cost as follows:

- Effectiveness of the alternatives is evaluated in terms of overall protection of public health and the environment and ability to achieve removal action objectives. Protectiveness of public health and the environment is evaluated in terms of protection of public health and the community, protection of workers during implementation, protection of the environment, and compliance with ARARs. The ability to achieve removal action objectives is evaluated in terms of expected level of containment, residual effects, and ability to maintain long-term control.
- Implementability of the alternatives is evaluated based on technical feasibility, availability, and administrative feasibility. Technical feasibility is evaluated in terms of construction and operational considerations, demonstrated performance and useful life, adaptability to environmental conditions, contribution to remedial performance, and ability to be implemented within 1 year. Availability is evaluated in terms of equipment, personnel and services, outside laboratory testing capacity, off-site treatment and disposal capacity, and PRSCs. Administrative feasibility is evaluated in terms of permits required, easements or right-of-ways required, impact on adjoining property, ability to impose institutional controls, and likelihood of obtaining exemptions from statutory limitations (if needed).
- Cost of the alternatives is evaluated by considering the capital cost, PRSC cost, and net present value (NPV).

Retained Alternatives 1 and 2 are evaluated below.

4.2.1 Alternative 1 – Excavation and Off-Site Disposal

4.2.1.1 Effectiveness

Long-term risk to human health and the environment is effectively eliminated at the Canal Road Dredge Pile area by excavation and off-site disposal of dioxin-contaminated material. However, this alternative does not satisfy the regulatory preferences for on-site treatment over off-site disposal.

Short-term risk to human health and the environment would be effectively addressed by use of engineering controls. Engineering controls would consist of controlling fugitive emissions during

excavation, load-out, and transport of contaminated material; controlling off-site transport of contaminated material and clean material through use of equipment tracking pads and decontamination pads; and use of silt fence and SRTs to control migration of water-borne contaminated sediment during removal action implementation.

Monitoring is an effective tool used to evaluate potential migration of contaminants and to determine the direction of future actions if adverse effects to human or ecological receptors occur. Sediment, surface water, and groundwater sampling is ongoing and will continue on a periodic basis on Site 8B. Monitoring would be conducted during the removal action to minimize adverse effects to human health and the environment.

This alternative achieves removal action objectives by protecting human health and the environment from risks associated with ingestion, inhalation, or contact with the contaminated material.

4.2.1.2 Implementability

Excavation of contaminated material is performed extensively for site remediations and is applicable to almost all site conditions. The Canal Road Dredge Pile excavation area would be readily accessible by tracked and off-road heavy-construction equipment following removal of trees, brush, vegetation, and debris. The depth of excavation would range from surficial to up to 10 feet below ground surface (bgs). The depth to groundwater, under normal conditions, would be below the anticipated base of the excavation.

Permits and temporary easements or right-of-ways would be required for access to, and work within, the Canal Road Dredge Pile area. The property is privately owned, and access to and from the work area would likely require construction of a crossing over Canal No. 1 and a temporary road entrance onto Canal Road near Turkey Creek. Transport equipment would also travel on public roadways (i.e. Canal Road and 28th Street).

4.2.1.3 Cost

Excavation and off-site disposal capital costs are estimated to be approximately \$8.0 million. A detailed cost estimate is provided in Appendix C.

4.2.2 Alternative 2 – Excavation, Consolidation, and Stabilization

4.2.2.1 Effectiveness

Long-term risk to human health and the environment is effectively eliminated at the Canal Road Dredge Pile area by excavation and consolidation of the contaminated material within the limits of Site 8B. Long-term risk to human health and the environment is effectively eliminated at Site 8B by chemically stabilizing (i.e., treating) the contaminated material. Chemical stabilization would reduce the mobility and prevent migration of dioxin-contaminated material. Chemical stabilization would also be effective in reducing contaminant migration by erosion. Based on the contaminant concentrations, soil type, and contaminated material volume, on-site treatment would be effective as evidenced by implementation of the same technology at Site 8A (TiNUS, 2005). The alternative satisfies regulatory preferences of on-site (i.e., within the limits of Site 8B) treatment over off-site disposal. The long-term effectiveness would be assured provided PRSCs are maintained.

Short-term risk to human health and the environment would be effectively addressed by use of engineering controls. Engineering controls would consist of controlling fugitive emissions during excavation, transport, grading, blending, and stabilization of contaminated material; controlling off-site transport of contaminated material and clean material through use of equipment tracking pads and decontamination pads; and the use of silt fence and SRTs to control migration of water-borne contaminated sediment during removal action implementation.

Institutional controls (i.e., PRSCs) would be effective in preventing unacceptable risk by preventing exposure of human receptors to contaminated soil, sediment, surface water, and groundwater in an industrial scenario. After completion of the chemical stabilization at Site 8B, the Base Master Plan should be revised to allow the use of the site for industrial activities and indicate the PRSCs. The PRSCs will remain in place for Site 8B. Legal requirements for property transfer would need to be met in the event of base closure.

Monitoring is an effective tool used to evaluate potential migration of contaminants and to determine the direction of future actions if adverse effects to human or ecological receptors occur. Sediment sampling will be conducted on a periodic basis until the site is resurfaced or a petition to end the monitoring program is accepted by MDEQ. Monitoring will be conducted during the removal action to minimize adverse effects to human health and the environment.

The alternative achieves removal action objectives by protecting human health and the environment from risks associated with ingestion, inhalation, or contact with the contaminated material for the industrial

scenario. The contaminated material would be consolidated in an area of the Base where residential future use would not occur and restrictions have been placed on land and associated groundwater use.

4.2.2.2 Implementability

Excavation of contaminated material is performed extensively for site remediations and is applicable to almost all site conditions. The Canal Road Dredge Pile excavation area would be readily accessible by tracked and off-road heavy-construction equipment following removal of trees, brush, vegetation, and debris. The depth of excavation would range from surficial to up to 10 feet bgs. The depth to groundwater, under normal conditions, would be below the anticipated base of the excavation.

For Site 8B, grading, blending, consolidation, stabilization, and compaction of contaminated materials would be performed using both common and specialty heavy-construction equipment. The specialty equipment would consist of self-propelled mixing equipment for soil stabilization. The surface of Site 8B is flat and easily accessible and poses no restrictions on implementability.

Permits and temporary easements or right-of-ways would be required for access to, and work within, the Canal Road Dredge Pile area. The property is privately owned, and access to and from the work area would likely require construction of a crossing over Canal No. 1 and a temporary road entrance onto Canal Road near Turkey Creek. Transport equipment would also travel on public roadways (i.e. Canal Road and 28th Street).

4.2.2.3 Cost

Excavation, consolidation, and stabilization capital costs and PRSC associated with sediment monitoring up- and downstream of SRTs is estimated to be approximately \$3.5 million. A detailed cost estimate is provided in Appendix C.

5.0 COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

This section compares the evaluations presented for Alternatives 1 and 2 in Section 4.0.

5.1 EFFECTIVENESS

Alternative 1 would be protective because the dioxin-contaminated Canal Road Dredge Pile material would be removed from the Off-Base AOC and sent to an approved and permitted off-site waste disposal facility. Alternative 2 would also be protective because the dioxin-contaminated Canal Road Dredge Pile material would be removed from the Off-Base AOC. Stabilization of the Canal Road Dredge Pile material within the limits of Site 8B would also increase the level of protection for human health and the environment. Stabilization would reduce the mobility and prevent migration of dioxin-contaminated soil and sediment to unrestricted residential use areas (i.e., the Off-Base AOC). The filling and stabilization activities at Site 8B would provide the additional benefits of providing the final repository for the treated Canal Road Dredge Pile material, restoring the surface of Site 8B to pre-remediation grades, improving surface water drainage, reducing stormwater infiltration, and creating a durable surface.

Alternative 1 would comply with chemical-, location-, and action-specific ARARs and TBCs because the contaminated material would be removed from the Off-Base AOC. Alternative 2 would not comply with chemical-specific ARARs and TBCs due to the presence of dioxin at Site 8B. It would comply with location- and action-specific ARARs and TBCs.

Alternative 2 would remove the contaminated Canal Road Dredge Piles from their present location and effectively chemically stabilize them on Site 8B, thereby reducing the risk of exposure to dioxin. Alternative 1 would be more long-term effective and permanent than Alternative 2 because it would remove the contaminated Canal Road Dredge Pile material from the site. Alternative 2 would be effective as long as the PRSCs are implemented and maintained.

Alternative 1 would not achieve a reduction in toxicity of dioxin-contaminated media through treatment because no treatment is proposed. Alternative 2 would achieve a reduction in toxicity of dioxin-contaminated media through treatment and would achieve a reduction in mobility through treatment.

Implementation of Alternatives 1 and 2 would potentially expose construction workers and residents to dioxin contamination during removal action activities. However, the risk of exposure would be effectively controlled by implementing engineering controls (e.g., fugitive dust suppression) and compliance with applicable Occupational Safety and Health Administration (OSHA) regulations and proper site-specific health and safety procedures. Implementation of Alternatives 1 and 2 would potentially impact the

surrounding community because the dioxin-contaminated material from the Canal Road Dredge Piles would be transported over public roads. The impacts would be effectively controlled by measures such as decontaminating transportation vehicles, covering transportation vehicle loads, providing traffic control, selecting a travel route that minimizes potential exposure, and implementing a spill prevention and emergency response plan. Alternative 1 would attain the removal action objectives immediately upon removal of the contaminated material. Alternative 2 would attain the removal action objectives in the Canal Road Dredge Pile area immediately upon removal of the contaminated material and at Site 8B immediately after stabilization of the contaminated material.

5.2 IMPLEMENTABILITY

The technical implementability of Alternative 1 would be slightly difficult because it would require the excavation, load-out, and transport of contaminated dredge pile material to an approved and permitted off-site waste disposal facility. The technical implementability of Alternative 2 would be moderately difficult because it would require the excavation of contaminated dredge pile material and the consolidation and chemical stabilization of this material within Site 8B limits. However, the activities associated with Alternative 2 would be technically implementable, and their effectiveness was proven through pilot- and full-scale activities performed at Site 8A. Material, equipment, and labor are readily available to perform the tasks associated with Alternatives 1 and 2.

Administratively, Alternative 1 would not require any PRSCs because the dioxin-contaminated Canal Road Dredge Pile material would be removed from the Off-Base AOC and sent to an approved and permitted off-site waste disposal facility. Alternative 1 would require access agreements for the excavation, load-out, and transport of the Off-Base AOC dredge pile material.

Administratively, Alternative 2 would not require any additional PRSCs because PRSCs have been in place since the end of the soil incineration project in 1986. The completion of the chemical stabilization would allow the resumption of surface storage at Site 8B which is a significant component of the war material storage and transfer mission at NCBC Gulfport. Alternative 2 would also require access agreements for the excavation, load-out, and transport of the Off-Base AOC dredge pile material. Long-term monitoring and 5-year site reviews would continue to be performed.

5.3 COST

Capital cost for the alternatives is summarized below:

Alternative	Capital Cost (\$)	PRSC (\$) ⁽¹⁾	Total Cost (\$)
1	8,000,000	0	8,000,000
2	3,300,000	200,000	3,500,000

⁽¹⁾ Additional PRSC not currently included in long-term monitoring program.

The detailed cost estimates for Alternatives 1 and 2 are provided in Appendix C.

6.0 RECOMMENDED REMOVAL ACTION ALTERNATIVE

Alternative 2 – Excavation, Consolidation, and Stabilization is recommended for the Canal Road Dredge Piles. Upon completion of this alternative, potential risks to human health and the environment would be significantly reduced. In addition, the completion of the chemical stabilization would allow the resumption of surface storage at Site 8B which is a significant component of the war material storage and transfer mission at NCBC Gulfport.

In accordance with 40 CFR 300.415(n) and 300.820, the local community will be kept informed about the EE/CA process using procedures described in the Community Relations Plan. A copy of the final EE/CA will be placed both in the Information Repository and the Administrative Record at the Environmental Office at NCBC. The original Administrative Record was destroyed along with the main branch of the Harrison County Library during Hurricane Katrina in 2005. A newspaper notice was published announcing both the availability of the EE/CA for review and a 30-day public comment period. The written responses to comments are provided in Appendix B of this Action Memorandum.

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TABLE 2-1

**SUMMARY OF CANAL ROAD DREDGE PILES DELINEATION SAMPLING
SITE 8B, SITE 8C, AND CANAL ROAD DREDGE PILES EE/CA
NCBC GULFPORT, MISSISSIPPI**

Sample Identification	Dioxin Concentration	Sample Identification	Dioxin Concentration
CR01	17 / 11.00	CR21	NT / 14.214
CR02	11 / 37.26	CR22	NT / 4.98
CR03	25 / NT	CR23	NT / 4.313
CR04	16 / 10.57	CR24	NT / 7.213
CR05	19 / NT	CR25	NT / 7.519
CR06	9 / 7.508	CR26	NT / 40.157
CR07	19 / NT	CR27	NT / 9.149
CR08	23 / 13.33	CR28	NT / 39.506
CR09	15 / NT	CR29	NT / 2.063
CR10	17 / NT	CR30	NT / 3.126
CR11	16 / NT	CR31	NT / 3.526
CR12	28 / 19.50	CR32	NT / 5.497
CR13	10 / NT	CR33	NT / 2.245
CR14	20 / 6.925	CR34	NT / 13.895
CR15	32 / 25.45	CR35	NT / 1.767
CR16	21 / 7.640	CR36	NT / 3.833
CR17	15 / NT	CR37	NT / 4.569
CR18	19 / 3.112	CR38	NT / 0.082
CR19	10 / NT	CRPOND	NT / 2.448
CR20	NT / 0.867		

- 1 Samples tested using bio-assay analysis (USEPA Method 4025) / high resolution analysis (USEPA Method 8290).
- 2 All results are reported in nanograms per kilogram (ng/kg).
- 3 Highlighted values exceed the 38 ng/kg Tier 1 restricted target remediation goal designated by MDEQ.
- 4 Sample locations are shown on Figure 2-8.

NT – Not tested.

TABLE 3-1

**ARARs AND TBC CRITERIA
SITE 8B, SITE 8C, AND CANAL ROAD DREDGE PILES EE/CA
NCBC GULFPORT, MISSISSIPPI
PAGE 1 OF 3**

Name and Regulatory Citation	Description	Consideration in the Remedial Action Process	Type
Federal			
USEPA Region III RBC Table	Provides risk-based concentrations for screening of soil and groundwater.	Relevant and appropriate. These guidelines aid in the screening of chemicals in soil and groundwater.	Chemical-specific
Safe Drinking Water Act MCLs (40 CFR 140-143)	Protective levels for groundwater that is current or potential drinking water sources.	Applicable if on-Base and off-Base groundwater were to be used for potable purposes in the future.	Chemical-specific
CERCLA and the NCP Regulations (CFR, Section 300.430)	Discusses the types of PRSCs to be established at CERCLA sites.	Applicable. These requirements may be used as guidance in establishing appropriate PRSCs at Site 8.	Action-specific
OSHA (29 CFR Part 1910)	Requires establishment of programs to ensure worker health and safety at hazardous waste sites.	Applicable. These requirements apply to response activities conducted in accordance with the NCP. During the implementation of any remedial alternative for Site 8, these regulations must be followed.	Action-specific
Hazardous Materials Transportation Act Regulations (49 CFR 171-179)	Provides requirements for packaging, labeling, manifesting, and transporting hazardous materials.	Applicable. If soil or sediment is excavated and transported and is found to be hazardous, the material would need to be handled, manifested, and transported as a hazardous waste.	Action-specific
National Emissions Standards for Hazardous Air Pollutants (40 CFR Part 61)	Standards promulgated under the Clean Air Act for significant sources of hazardous air pollutants.	Relevant and appropriate. Remedial action (e.g., soil excavation) may result in release of hazardous air pollutants.	Action-specific
RCRA Treatment, Storage, and Disposal of Hazardous Waste (40 CFR 262-266)	Regulates the treatment, storage, and disposal of hazardous waste.	Relevant and appropriate. Hazardous waste generated by site remediation must meet RCRA generator and treatment, storage, or disposal requirements.	Action-specific
Land Disposal Restrictions (40 CFR Part 268)	Restricts certain listed or characteristic hazardous waste from placement or disposal on land without treatment.	Relevant and appropriate. Excavated soil and sediment or treatment residuals (e.g., spent granular activated carbon) may require disposal in a landfill.	Action-specific

TABLE 3-1

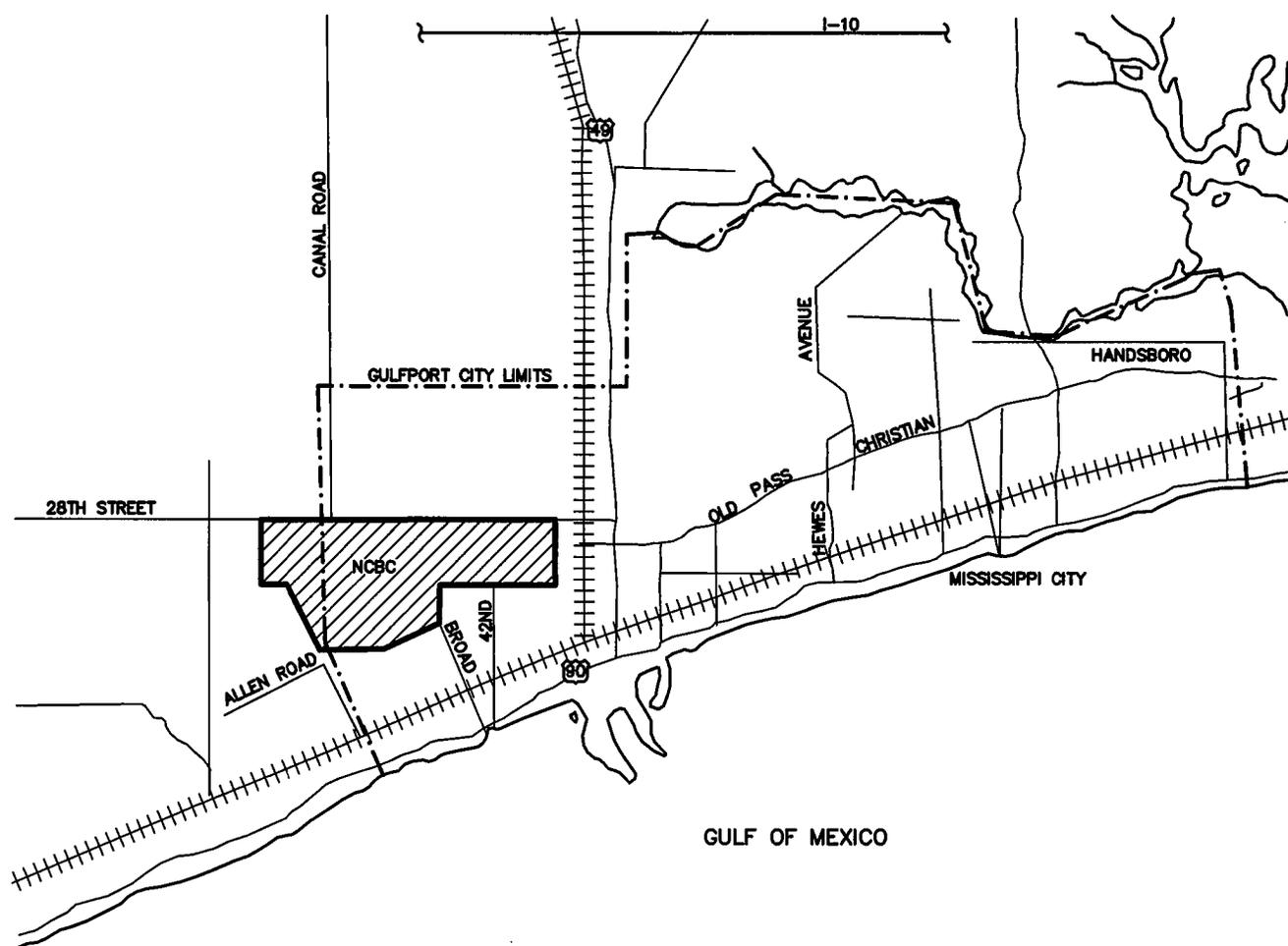
**ARARs AND TBC CRITERIA
SITE 8B, SITE 8C, AND CANAL ROAD DREDGE PILES EE/CA
NCBC GULFPORT, MISSISSIPPI
PAGE 2 OF 3**

Name and Regulatory Citation	Description	Consideration in the Remedial Action Process	Type
Guidance on Demonstrating Compliance with Land Disposal Restrictions – Alternative Soil Treatment Standards (EPA 530-D-00-002)	Encourages the selection of cost-effective cleanup of hazardous/contaminated soils subject to LDRs.	Relevant and appropriate.	Guidance
Hazardous Waste Identification Rule for Contaminated Media (HWIR-Media) (40 CFR Part 260, et al.)	Relieves contaminated media of MTRs, and would give USEPA and authorized states the authority to exempt certain contaminated media from regulation as hazardous waste under Subtitle C of RCRA.	Applicable. The dioxin concentrations in this removal are less than the “bright line” and have been exempted from the requirement for treatment prior to land disposal.	Chemical-specific
Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA (EPA 540-R-93-057)	Provides guidance on aspects of the removal action process focusing on non-time critical removal actions with context on how these actions fit within the CERCLA program.	Applicable. These requirements were used as guidance in the preparation of this EE/CA.	Action-specific
State			
MDEQ TRGs (Mississippi Code Section 49-35-21)	Default screening levels. Human health risk-based cleanup goals for soil and groundwater.	Applicable. These regulations apply to all remedial actions in the State of Mississippi.	Chemical - specific
MDEQ Risk Evaluation Procedures for Voluntary Cleanup and Redevelopment	Risk-based procedures and rationale for site evaluation and remediation.	TBC. These regulations apply to all Voluntary Cleanup and Brownfield actions in the State of Mississippi.	Guidance
MDEQ Sample Strategy and Statistical Training Materials for Part 201 Cleanup Criteria	Provides for the appropriate use of statistically based site characterization and confirmation sampling.	Applicable.	Guidance
MDEQ Office of Pollution Control Hazardous Waste Management Regulations	Adopts by reference, specific sections of the federal hazardous waste regulations.	Relevant and appropriate. These regulations may apply if material is removed from the Base.	Action-specific

TABLE 3-1

**ARARs AND TBC CRITERIA
SITE 8B, SITE 8C, AND CANAL ROAD DREDGE PILES EE/CA
NCBC GULFPORT, MISSISSIPPI
PAGE 3 OF 3**

ARAR	Applicable or Relevant and Appropriate Requirement.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act.
CFR	Code of Federal Regulations.
EE/CA	Engineering Evaluation/Cost Analysis.
LDRs	Land Disposal Restrictions.
MCLs	Maximum Contaminant Levels.
MDEQ	Mississippi Department of Environmental Quality.
MTRs	Minimum Technological Requirements.
NCP	National Oil and Hazardous Substances Pollution Contingency Plan.
OSHA	Occupational Safety and Health Administration.
PRSCs	Post-removal site controls.
RBC	Risk-Based Concentration.
RCRA	Resource Conservation and Recovery Act.
TBC	To Be Considered.
TRG	Target remediation goal.
USEPA	United States Environmental Protection Agency.

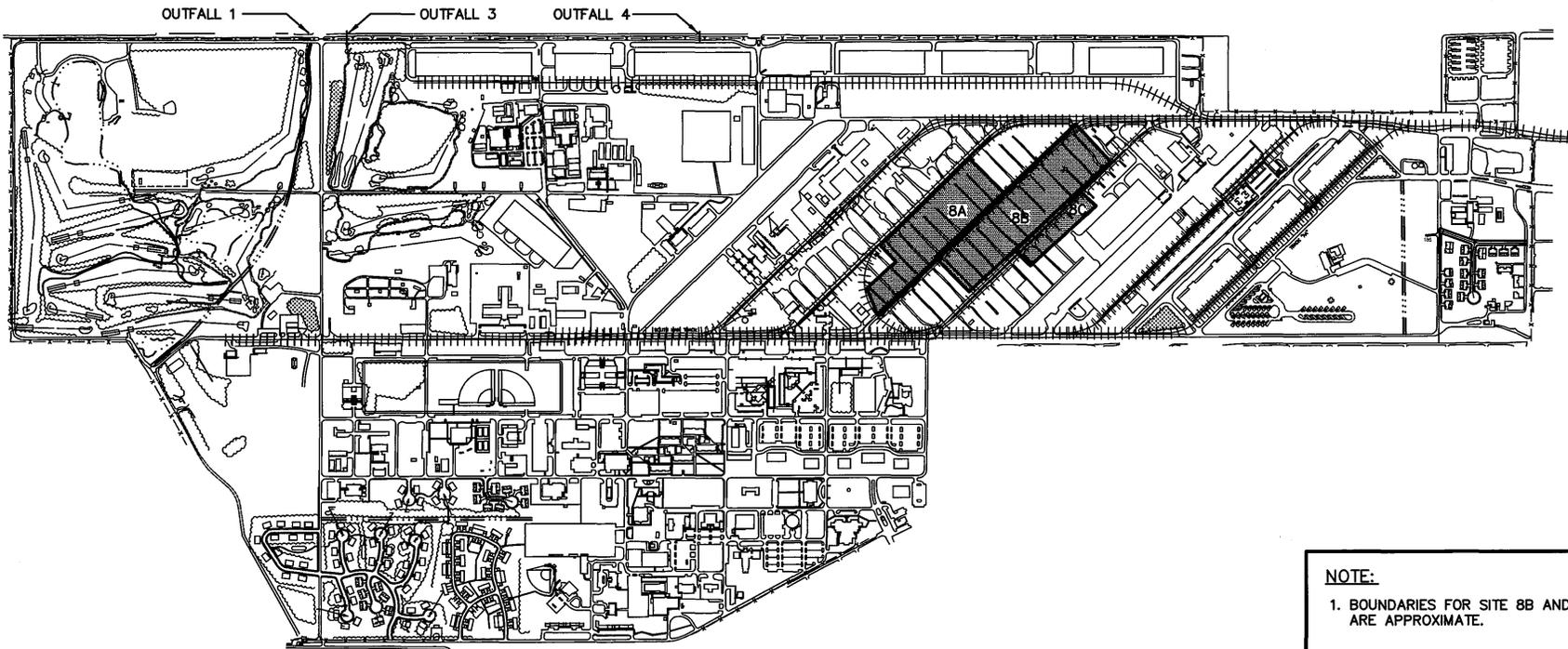


DRAWN BY HJB	DATE 1/9/07
CHECKED BY	DATE
REVISED BY	DATE
SCALE NOT TO SCALE	



VICINITY MAP
CANAL ROAD DREDGE PILES EE/CA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 0521	
OWNER NO. 0000	
APPROVED BY	DATE
DRAWING NO. FIGURE 2-1	REV. 0



NOTE:
 1. BOUNDARIES FOR SITE 8B AND SITE 8C ARE APPROXIMATE.

GRAPHIC SCALE IN FEET

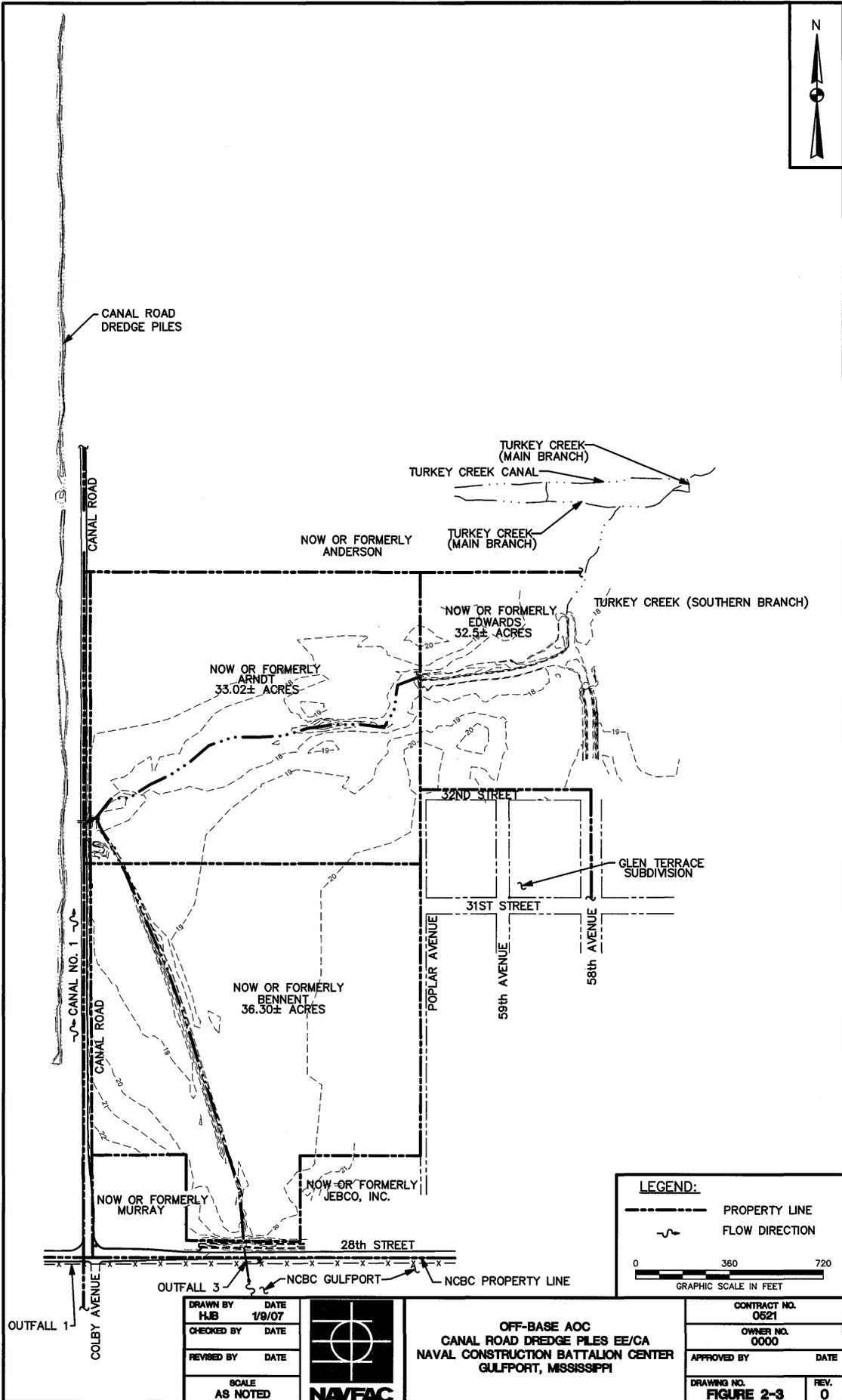
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REVISED BY	DATE
SCALE AS NOTED	



INSTALLATION MAP
CANAL ROAD DREDGE PILES EE/CA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 0521	
OWNER NO. 0000	
APPROVED BY	DATE
DRAWING NO. FIGURE 2-2	REV. 0

SOURCE: BASEMAP.DWG, PUBLIC WORKS DEPARTMENT, NAVAL CONSTRUCTION BATTALION CENTER, GULFPORT, MS, JUNE 2001
 FORM CADD NO. SDIV-BHDWG - REV 1 - 9/10/98

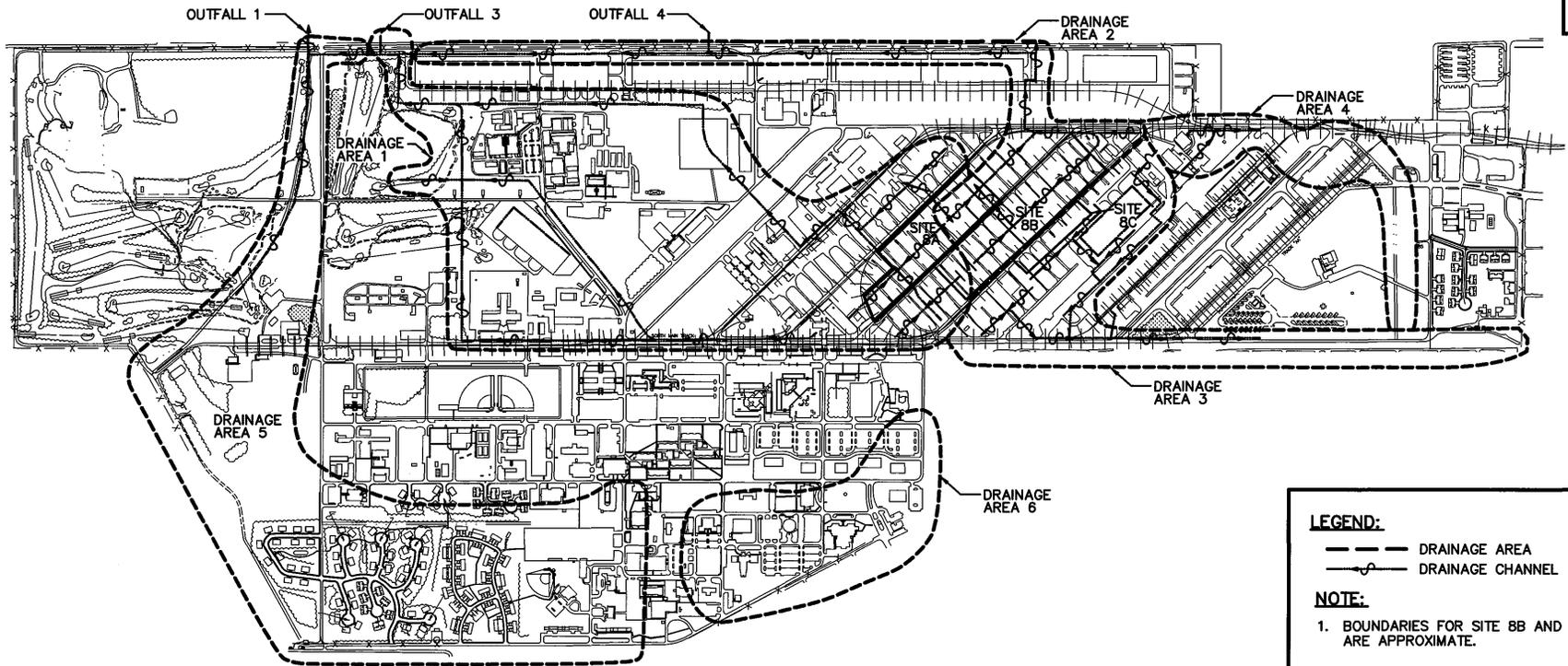


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REVISED BY	DATE
SCALE AS NOTED	



OFF-BASE AOC
CANAL ROAD DREDGE PILES EE/CA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 0521	
OWNER NO. 0000	
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DRAWING NO. FIGURE 2-3	REV. 0

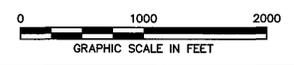


LEGEND:

- DRAINAGE AREA
- DRAINAGE CHANNEL

NOTE:

1. BOUNDARIES FOR SITE BB AND SITE BC ARE APPROXIMATE.



SOURCE: REMEDIATION PLANNING DOCUMENT, HARDING LAWSON ASSOCIATES, AUGUST 2000

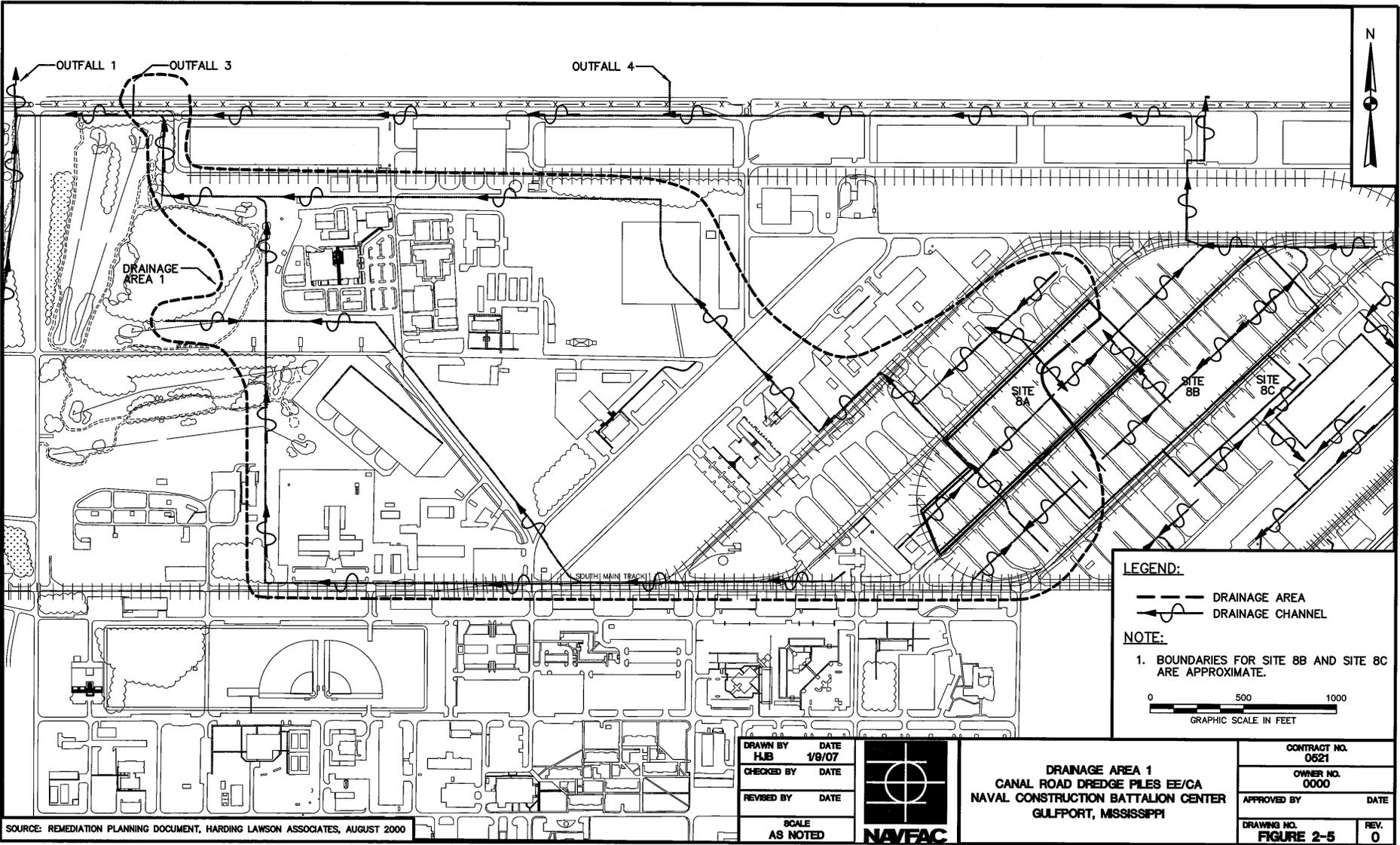
DRAWN BY HLB	DATE 1/9/07
CHECKED BY	DATE
REVISED BY	DATE
SCALE AS NOTED	



**ON-BASE SURFACE WATER DRAINAGE
AREAS 1 THROUGH 6
CANAL ROAD DREDGE PILES EE/CA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI**

CONTRACT NO. 0521	
OWNER NO. 0000	
APPROVED BY	DATE
DRAWING NO. FIGURE 2-4	REV. 0

03/01/07 MF PIT
ACAD:0521CP03.dwg



LEGEND:

- DRAINAGE AREA
- DRAINAGE CHANNEL

NOTE:

1. BOUNDARIES FOR SITE 8B AND SITE 8C ARE APPROXIMATE.

0 500 1000
GRAPHIC SCALE IN FEET

SOURCE: REMEDIATION PLANNING DOCUMENT, HARDING LAWSON ASSOCIATES, AUGUST 2000

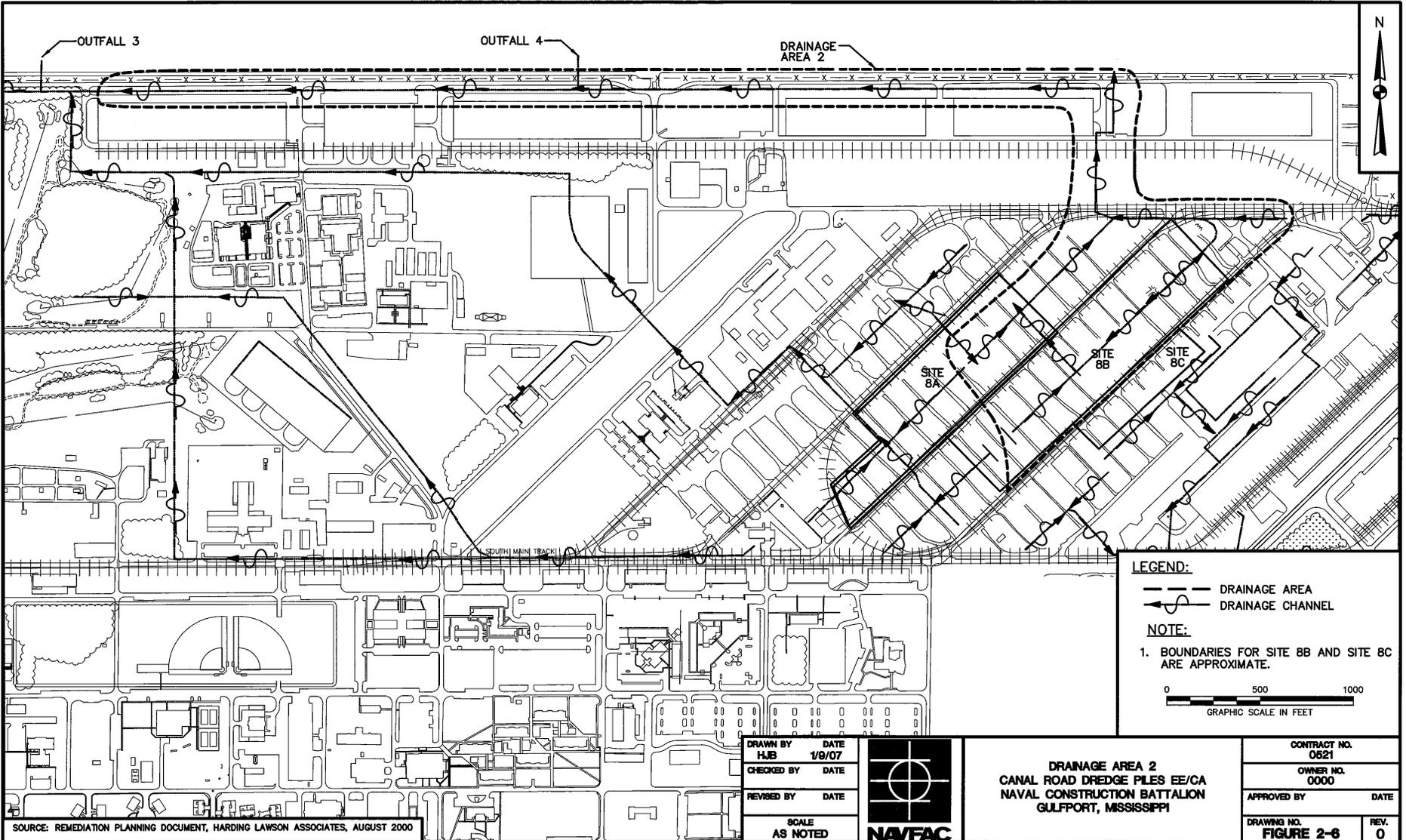
DRAWN BY HJB	DATE 1/9/07
CHECKED BY	DATE
REVISED BY	DATE
SCALE AS NOTED	



DRAINAGE AREA 1
CANAL ROAD DREDGE PILES EE/CA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 0521	
OWNER NO. 0000	
APPROVED BY	DATE
DRAWING NO. FIGURE 2-5	REV. 0

ACAD:0521CP04.dwg 03/01/07 MF PIT



SOURCE: REMEDIATION PLANNING DOCUMENT, HARDING LAWSON ASSOCIATES, AUGUST 2000

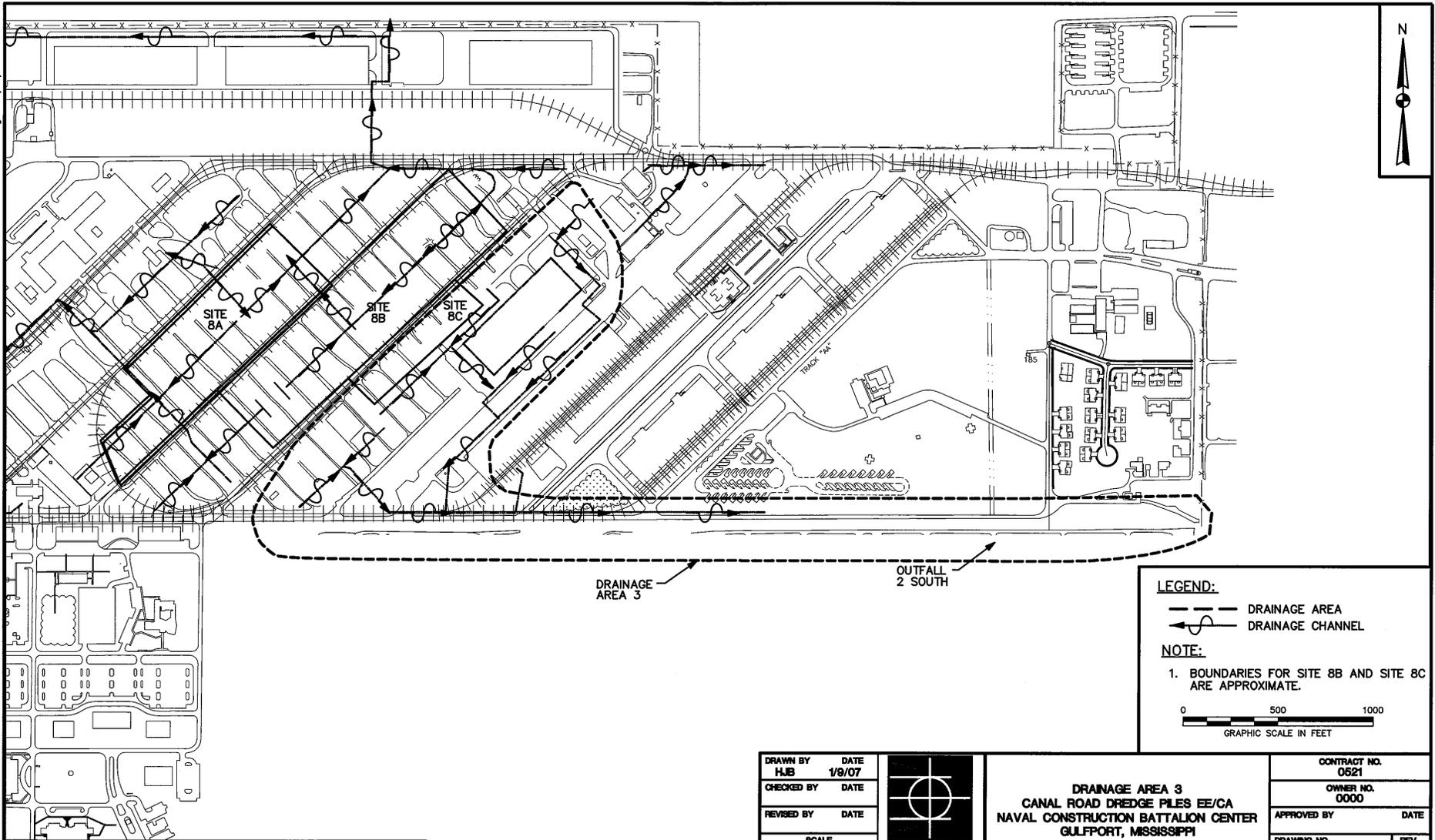
DRAWN BY	DATE
HJB	1/9/07
CHECKED BY	DATE
REVISED BY	DATE
SCALE	
AS NOTED	



DRAINAGE AREA 2
CANAL ROAD DREDGE PILES EE/CA
NAVAL CONSTRUCTION BATTALION
GULFPORT, MISSISSIPPI

CONTRACT NO.	
0521	
OWNER NO.	
0000	
APPROVED BY	DATE
DRAWING NO.	REV.
FIGURE 2-6	0

ACAD:0521CP05.dwg 03/01/07 MF PIT



SOURCE: REMEDIATION PLANNING DOCUMENT, HARDING LAWSON ASSOCIATES, AUGUST 2000

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

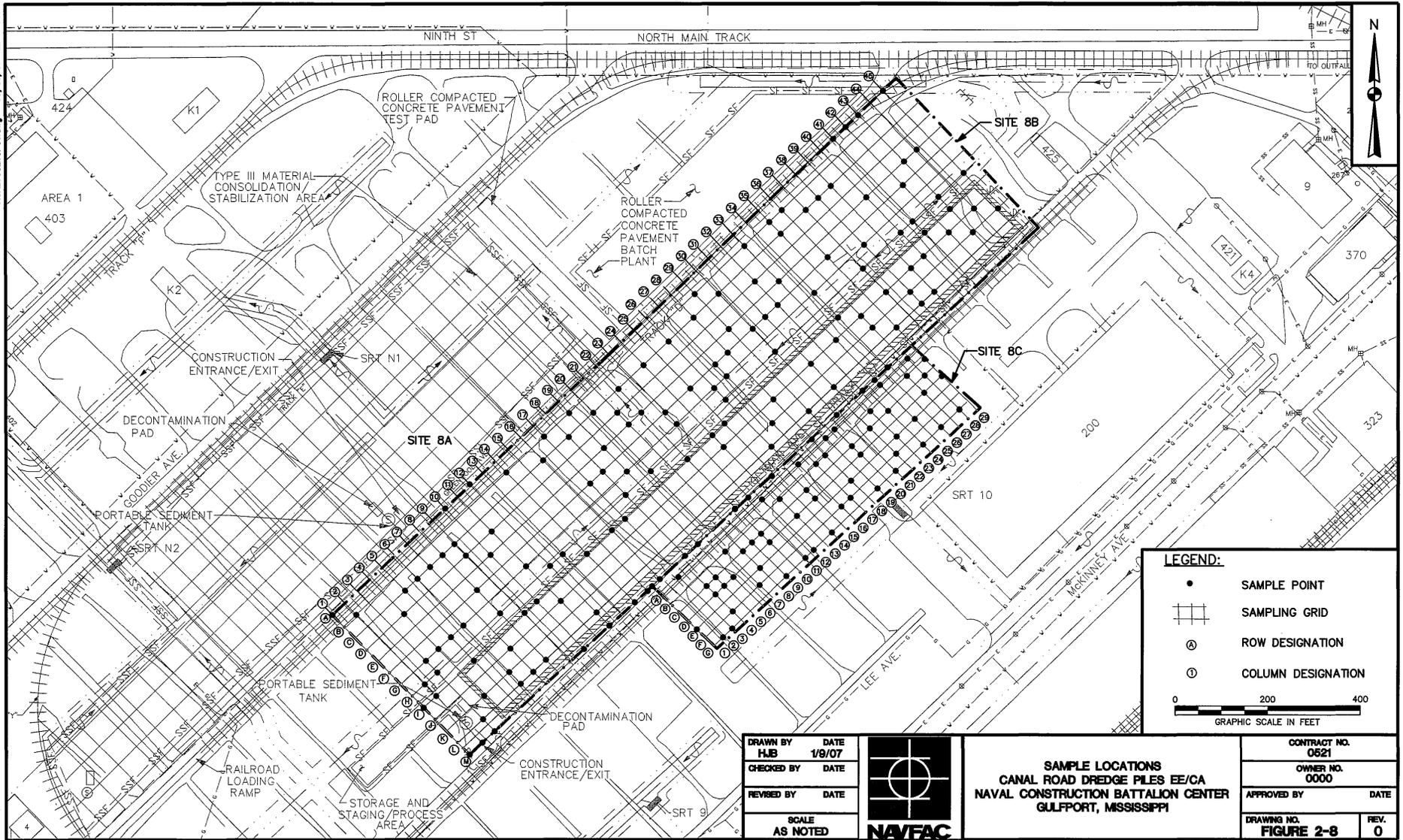
DRAWN BY HJB	DATE 1/9/07
CHECKED BY	DATE
REVISED BY	DATE
SCALE AS NOTED	



DRAINAGE AREA 3
CANAL ROAD DREDGE PILES EE/CA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

CONTRACT NO. 0521	
OWNER NO. 0000	
APPROVED BY	DATE
DRAWING NO. FIGURE 2-7	REV. 0

ACAD:0521CP01.dwg 03/01/07 MF PT



DRAWN BY	DATE
HJB	1/9/07
CHECKED BY	DATE
REVISED BY	DATE
SCALE	AS NOTED



SAMPLE LOCATIONS
CANAL ROAD DREDGE PILES EE/CA
NAVAL CONSTRUCTION BATTALION CENTER
GULFPORT, MISSISSIPPI

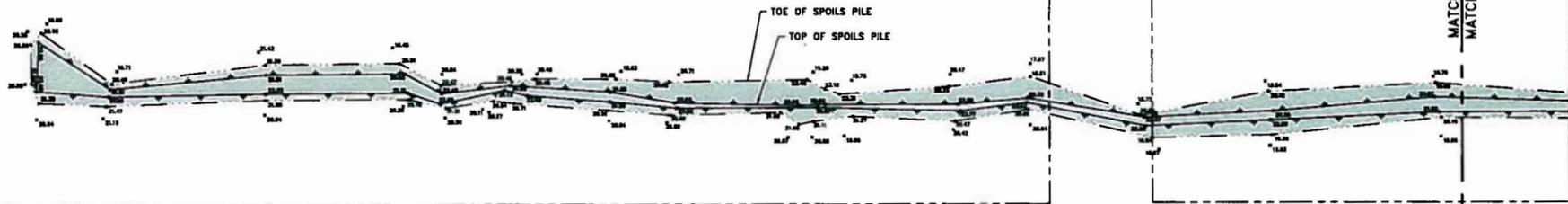
CONTRACT NO.	0521
OWNER NO.	0000
APPROVED BY	DATE
DRAWING NO.	FIGURE 2-8
REV.	0

APPENDIX A

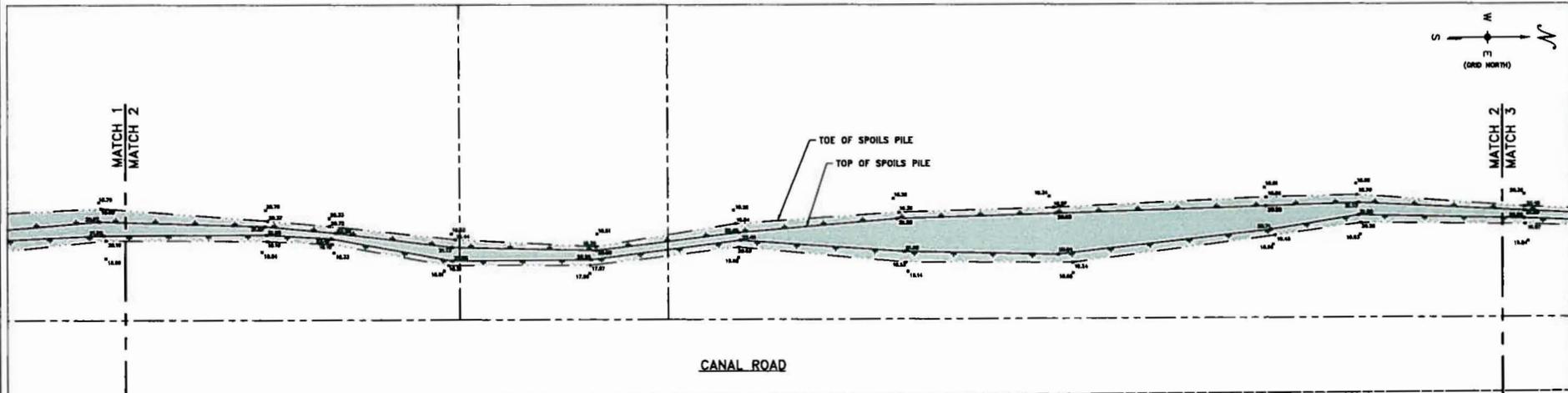
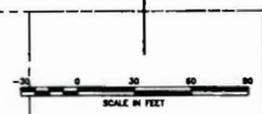
TOPOGRAPHIC SURVEY, CANAL ROAD DREDGE PILES

Prismoidal Volume Results

Original Surface Model:	EXISTING SPOILS
Final Surface Model:	EXISTING FLAT
Cut Compaction Factor:	0.00 %
Fill Compaction Factor:	0.00 %
Raw Cut Volume:	6000± cu yd
Compacted Cut Volume:	0.00 cu yd
Total Cut Volume:	6000± cu yd



CANAL ROAD



CANAL ROAD

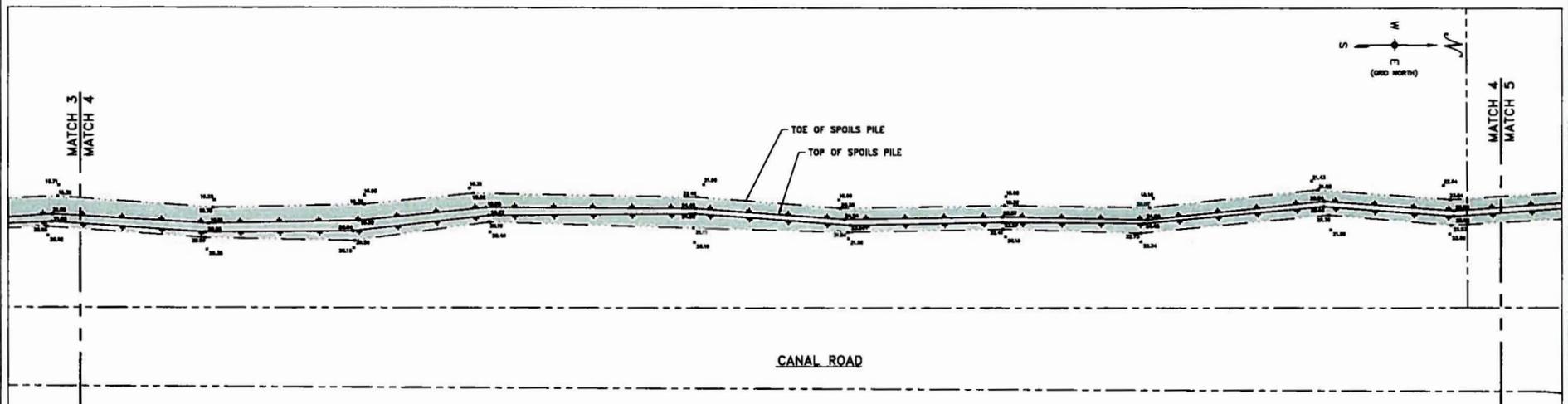
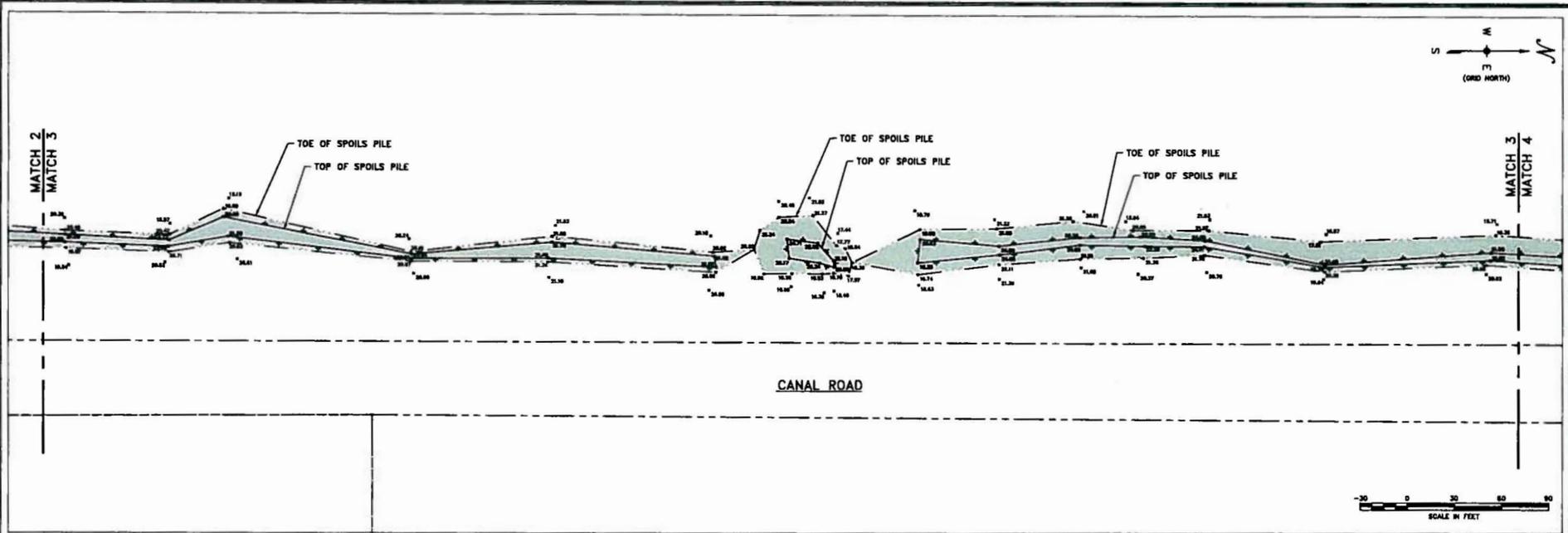


NOTES:

1. Property lines shown are drawn based on the Harrison County Tax Maps: #0610I, #0610P, #0710L, & #0710M.
2. All elevations are based on "Gulfport Reseal", Elevation=15.96' (NAVD 88).
3. Horizontal locations are "State Plane, Mississippi East, Zone-2301 (NAD 83)", based on "Gulfport Reseal".
4. I hereby certify that I have located the spoils piles shown hereon as requested by Robert Fisher with Tetra Tech NUS, INC., and that all measurements and other data indicated are true and correct to the best of my knowledge, information, and belief.

J. COLTER RATLIFF P.S. 33008
Field Surveyed July 18, 2008.

DRAWING NO. 2387 TOPO-1 REV. 1 of 3 SHEET NO. 2387	CHECKED BY DATE CHECKED BY DATE REVISIONS	DRAWING ISSUE PREPARED BY FOR APPROVAL APPROVED FOR ME APPROVED FOR OWNER	TOPOGRAPHIC SURVEY SPOIL PILE CALCULATIONS FOR "TETRA TECH NUS, INC." HARRISON COUNTY, MISSISSIPPI
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- NOTES:**
1. Property lines shown are drawn based on the Harrison County Tax Maps: #06101, #0610P, #0710L, & #0710M.
 2. All elevations are based on "Gulfport Reser", Elevation=15.98' (NAVD 88).
 3. Horizontal locations are "State Plane, Mississippi East, Zone-2301 (NAD 83)", based on "Gulfport Reser".
 4. I hereby certify that I have located the spoils piles shown hereon as requested by Robert Fisher with Tetra Tech NUS, INC., and that all measurements and other data indicated are true and correct to the best of my knowledge, information, and belief.

J. COLTER RATLIFF P.E. 20098
Field Surveyed July 18, 2008.



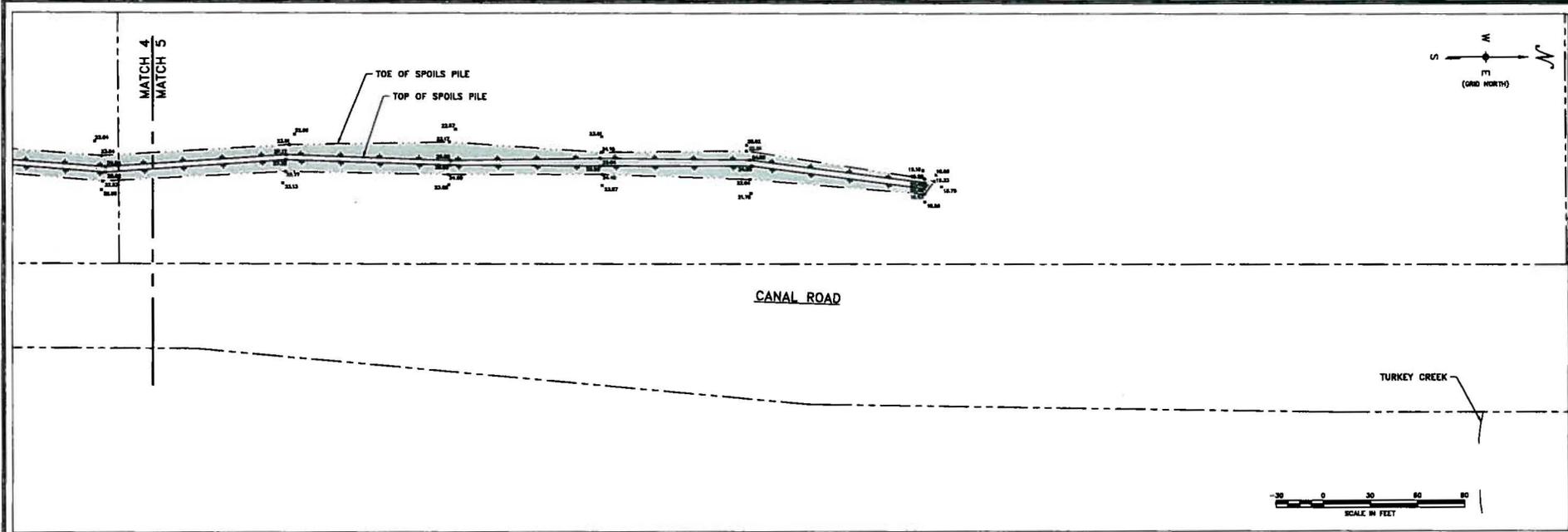
DESIGNED BY	PLM
DRAWN BY	PLM
CHECKED BY	PLM
DATE	07/18/08
PROJECT NO.	MS-21-08
REVISIONS	
DRAWING ISSUE	
DATE	
BY	
APPROVED FOR	
APPROVED FOR	

SPOIL PILE CALCULATIONS FOR
 "TETRA TECH NUS, INC."
 HARRISON COUNTY, MISSISSIPPI
 TOPOGRAPHIC SURVEY

J. COLTER RATLIFF P.E. 20098
 PROJECT NO. MS-21-08
 DATE: 07/18/08
 www.knifesal.com
 www.knifesal.com



DESIGNED BY	SMW
PROJECT NO.	MS-21-08
REV.	2 of 2
DATE	
PROJECT NO.	MS-21-08



REVISION BY:	
DATE:	
BY:	
DATE:	
BY:	
DATE:	
BY:	
DATE:	
BY:	
DATE:	
BY:	
DATE:	

PROJECT NAME: SPOIL PILE CALCULATIONS FOR "TETRA TECH NUS, INC." HARRISON COUNTY, MISSISSIPPI

PROJECT NO: 3387-TOPO-3

DATE: 7/18/2006

REV. 1

NOTES:

1. Property lines shown are drawn based on the Harrison County Tax Maps: #08101, #0810P, #0710L, & #0710M.
2. All elevations are based on "Gulfport Reseal", Elevation=15.98' (NAVD 88).
3. Horizontal locations are "State Plane, Mississippi East, Zone-2301 (NAD 83)", based on "Gulfport Reseal".
4. I hereby certify that I have located the spoils piles shown hereon as requested by Robert Fisher with Tetra Tech NUS, INC., and that all measurements and other data indicated are true and correct to the best of my knowledge, information, and belief.

J. COLTER RATLIFF P.S. #3008
Field Surveyed July 18, 2006.



APPENDIX B

COST ESTIMATES

NAVAL CONSTRUCTION BATTALION CENTER
 Gulfport, Mississippi
 Canal Road Dredge Piles EE/CA
 Alternative 1: Excavation & Off-Site Disposal
 Capital Cost

11/26/2007 2:21 PM

Item	Quantity	Unit	Subcontract	Unit Cost			Extended Cost			Subtotal	
				Material	Labor	Equipment	Subcontract	Material	Labor		Equipment
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare Documents & Plans including Permits	300	hr			\$35.00		\$0	\$0	\$10,500	\$0	\$10,500
2 MOBILIZATION/DEMobilIZATION & SITE SUPPORT											
2.1 Office Trailer	5	mo				\$410.00	\$0	\$0	\$0	\$2,050	\$2,050
2.2 Field Office Support	5	mo		\$165.00			\$0	\$825	\$0	\$0	\$825
2.3 Storage Trailer (1)	5	mo				\$111.00	\$0	\$0	\$0	\$555	\$555
2.4 Utility Connection/Disconnection (phone/electric)	1	ls	\$1,500.00				\$1,500	\$0	\$0	\$0	\$1,500
2.5 Construction Survey	7.7	ac	\$1,300.00				\$10,010	\$0	\$0	\$0	\$10,010
2.6 Equipment Mobilization/Demobilization	8	ea			\$158.00	\$384.00	\$0	\$0	\$1,264	\$3,072	\$4,336
2.7 Site Utilities	5	mo	\$160.00				\$800	\$0	\$0	\$0	\$800
2.8 Field Construction Mgt. (4p * 5 days/week)	19	mwk			\$5,000.00		\$0	\$0	\$95,000	\$0	\$95,000
3 DECONTAMINATION											
3.1 Decontamination Services	4	mo		\$1,232.00	\$1,900.00	\$1,381.00	\$0	\$4,928	\$7,600	\$5,524	\$18,052
3.2 Temporary Equipment Decon Pad	2	ls		\$1,540.00	\$2,050.00	\$310.00	\$0	\$1,500	\$2,000	\$200	\$3,700
3.3 Decon Water	5,000	gal		\$0.20			\$0	\$1,000	\$0	\$0	\$1,000
3.4 Decon Water Storage Tank, 6,000 gallon	4	mo				\$702.50	\$0	\$0	\$0	\$2,810	\$2,810
3.5 Clean Water Storage Tank, 4,000 gallon	4	mo				\$630.60	\$0	\$0	\$0	\$2,522	\$2,522
3.6 Disposal of Decon Waste (liquid & solid)	4	mo	\$950.00				\$3,800	\$0	\$0	\$0	\$3,800
4 OFF-BASE SOIL REMOVAL											
4.1 Cut & Chip Trees	7.7	ac			\$2,100.00	\$1,550.00	\$0	\$0	\$16,170	\$11,935	\$28,105
4.2 Remove Chipped Trees	22	day			\$236.40	\$1,014.00	\$0	\$0	\$5,201	\$22,308	\$27,509
4.3 Chip Stumps	22	day			\$307.20	\$106.30	\$0	\$0	\$6,758	\$2,339	\$9,097
4.4 Fence Removal & Reset	4,072	lf	\$20.50				\$83,476	\$0	\$0	\$0	\$83,476
4.5 Excavator, 2 cy bucket	48	day			\$318.40	\$994.60	\$0	\$0	\$15,283	\$47,741	\$63,024
4.6 Backhoe-loader	48	day			\$307.20	\$243.40	\$0	\$0	\$14,746	\$11,683	\$26,429
4.7 Waste characterization	15	ea	\$850.00				\$12,750	\$0	\$0	\$0	\$12,750
4.8 Off-site transport, haz waste	13,233	tons	\$50.00				\$661,650	\$0	\$0	\$0	\$661,650
4.9 Off-site disposal, haz waste	13,233	tons	\$200.00				\$2,646,600	\$0	\$0	\$0	\$2,646,600
4.10 TSDF fees	1	LS	\$200.00				\$200	\$0	\$0	\$0	\$200
4.11 Concrete Pipe, 96" dia., Class 3	100	lf		\$385.00			\$0	\$38,500	\$0	\$0	\$38,500
4.12 Gravel for Pipe	100	cy		\$36.00			\$0	\$3,600	\$0	\$0	\$3,600
4.13 Geotextile for Pipe	250	sy		\$1.45	\$0.29		\$0	\$363	\$73	\$0	\$435
4.14 Labor, crew of 3	48	day			\$690.00		\$0	\$0	\$33,120	\$0	\$33,120
4.15 Temporary SRT, includes disposal cost	9	ea	\$65.00	\$670.00	\$420.00		\$585	\$6,030	\$3,780	\$0	\$10,395
4.16 Silt Fence	4,232	lf		\$0.34	\$0.48		\$0	\$1,439	\$2,031	\$0	\$3,470
4.17 Backfill, soil	500	cy		\$9.75			\$0	\$4,875	\$0	\$0	\$4,875
4.18 Topsoil, loam, 6" thick	2,446	cy		\$22.00			\$0	\$53,812	\$0	\$0	\$53,812
4.19 Excavator, 2 cy bucket	10	day			\$318.40	\$994.60	\$0	\$0	\$3,184	\$9,946	\$13,130
4.20 Labor, crew of 3	10	day			\$690.00		\$0	\$0	\$6,900	\$0	\$6,900
4.21 Hydro Seed, with mulch & fertilizer	369	msf	\$78.10				\$28,819	\$0	\$0	\$0	\$28,819
4.22 Verification Sampling	80	ea	\$850.00	\$20.00	\$55.00	\$20.00	\$68,000	\$1,600	\$4,400	\$1,600	\$75,600
5 OTHER											
5.1 Fence, chain-link, barbed wire topped, 8'	3,700	ft	\$44.00				\$162,800	\$0	\$0	\$0	\$162,800
5.2 Gate, double-swing	2	ea	\$2,350.00				\$4,700	\$0	\$0	\$0	\$4,700
Subtotal							\$3,685,690	\$118,471	\$228,010	\$124,285	\$4,156,456

NAVAL CONSTRUCTION BATTALION CENTER
Gulfport, Mississippi
Canal Road Dredge Piles EE/CA
Alternative 1: Excavation & Off-Site Disposal
Capital Cost

11/26/2007 2:21 PM

Item	Quantity	Unit	Subcontract	Unit Cost			Extended Cost				Subtotal
				Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
Local Area and Year To Date Adjustments							100.0%	100.9%	86.3%	86.3%	
							\$3,685,690	\$119,538	\$196,773	\$107,258	\$4,109,258
									\$59,032		\$59,032
									\$19,677		\$19,677
								\$11,954			\$11,954
										\$10,726	\$10,726
							\$368,569				\$368,569
Total Direct Cost							\$4,054,259	\$131,491	\$275,482	\$117,984	\$4,579,216
											\$1,144,804
											\$457,922
Subtotal											\$6,181,941
											\$123,639
Total Field Cost											\$6,305,580
											\$1,576,395
											\$157,639
TOTAL COST											\$8,039,614

NAVAL CONSTRUCTION BATTALION CENTER
Gulfport, Mississippi
Canal Road Dredge Piles EE/CA
Alternative 1: Excavation & Off-Site Disposal
Annual Cost

11/26/2007 2:21 PM

Item	Item Cost per round	Item Cost every x years	Notes
Sampling ⁽¹⁾	\$0	\$0	Labor, Field Supplies
Report ⁽¹⁾	\$0	\$0	Document sampling events and results
Site Review ⁽¹⁾	\$0	\$0	Five Year Site Reviews
TOTALS	\$0	\$0	

(1) Long-term monitoring reporting and site reviews are currently being performed. A cost of \$0.00 is therefore reflected.

NAVAL CONSTRUCTION BATTALION CENTER
Gulfport, Mississippi
Canal Road Dredge Piles EE/CA
Alternative 1: Excavation & Off-Site Disposal
Present Worth Analysis

11/26/2007 2:21 PM

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
0	\$8,039,614		\$8,039,614	1.000	\$8,039,614
1			\$0	0.935	\$0
2			\$0	0.873	\$0
3			\$0	0.816	\$0
4			\$0	0.763	\$0
5			\$0	0.713	\$0
6			\$0	0.666	\$0
7			\$0	0.623	\$0
8			\$0	0.582	\$0
9			\$0	0.544	\$0
10			\$0	0.508	\$0
11			\$0	0.475	\$0
12			\$0	0.444	\$0
13			\$0	0.415	\$0
14			\$0	0.388	\$0
15			\$0	0.362	\$0
16			\$0	0.339	\$0
17			\$0	0.317	\$0
18			\$0	0.296	\$0
19			\$0	0.277	\$0
20			\$0	0.258	\$0
21			\$0	0.242	\$0
22			\$0	0.226	\$0
23			\$0	0.211	\$0
24			\$0	0.197	\$0
25			\$0	0.184	\$0
26			\$0	0.172	\$0
27			\$0	0.161	\$0
28			\$0	0.150	\$0
29			\$0	0.141	\$0
30			\$0	0.131	\$0
TOTAL PRESENT WORTH					\$8,039,614

NAVAL CONSTRUCTION BATTALION CENTER
Gulfport, Mississippi
Canal Road Dredge Piles EE/CA
Alternative 2: Excavation, Consolidation, and Stabilization
Annual Cost

11/26/2007 2:22 PM

Item	Item Cost per round	Item Cost every x years	Notes
Sampling ⁽¹⁾	\$10,000	\$0	Labor, Field Supplies. Baseline, semiannual for yrs 1 and 2, annually thereafter.
Report ⁽¹⁾	\$0	\$0	Document sampling events and results
Site Review ⁽¹⁾	\$0	\$0	Five Year Site Reviews
TOTALS	\$10,000	\$0	

(1) Long-term monitoring reporting and site reviews are currently being performed. Costs reflected above are only for sediment sampling associated with Site 8B and Site 8C permanent SRTs.

NAVAL CONSTRUCTION BATTALION CENTER
Gulfport, Mississippi
Canal Road Dredge Piles EE/CA
Alternative 2: Excavation, Consolidation, and Stabilization
Present Worth Analysis

11/26/2007 2:22 PM

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
0	\$3,338,740	\$10,000	\$3,338,740	1.000	\$3,338,740
1		\$20,000	\$20,000	0.935	\$18,700
2		\$20,000	\$20,000	0.873	\$17,460
3		\$10,000	\$10,000	0.816	\$8,160
4		\$10,000	\$10,000	0.763	\$7,630
5		\$10,000	\$10,000	0.713	\$7,130
6		\$10,000	\$10,000	0.666	\$6,660
7		\$10,000	\$10,000	0.623	\$6,230
8		\$10,000	\$10,000	0.582	\$5,820
9		\$10,000	\$10,000	0.544	\$5,440
10		\$10,000	\$10,000	0.508	\$5,080
11		\$10,000	\$10,000	0.475	\$4,750
12		\$10,000	\$10,000	0.444	\$4,440
13		\$10,000	\$10,000	0.415	\$4,150
14		\$10,000	\$10,000	0.388	\$3,880
15		\$10,000	\$10,000	0.362	\$3,620
16		\$10,000	\$10,000	0.339	\$3,390
17		\$10,000	\$10,000	0.317	\$3,170
18		\$10,000	\$10,000	0.296	\$2,960
19		\$10,000	\$10,000	0.277	\$2,770
20		\$10,000	\$10,000	0.258	\$2,580
21		\$10,000	\$10,000	0.242	\$2,420
22		\$10,000	\$10,000	0.226	\$2,260
23		\$10,000	\$10,000	0.211	\$2,110
24		\$10,000	\$10,000	0.197	\$1,970
25		\$10,000	\$10,000	0.184	\$1,840
26		\$10,000	\$10,000	0.172	\$1,720
27		\$10,000	\$10,000	0.161	\$1,610
28		\$10,000	\$10,000	0.150	\$1,500
29		\$10,000	\$10,000	0.141	\$1,410
30		\$10,000	\$10,000	0.131	\$1,310
TOTAL PRESENT WORTH					\$3,480,910