N60478.AR.000550
NWS EARLE
5090.3a

FINAL WORK PLAN FOR SLOPE STABILIZATION AT SITE 6, FORMER LANDFILL AREA

NAVAL WEAPONS STATION – EARLE

Issued:

October 13, 1999

Prepared for:

Naval Facilities Engineering Command
10 Industrial Highway
Lester, PA 19113

Prepared by:

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REMEDIAL ACTION CONTRACT N62472-94-D-0398
DELIVERY ORDER NO. 0034

Revision	Date	Prepared By:	Approved By:	Pages Affected
1	October 13, 1999	C. Joblon	M. Heffron, P.G.	5 through 10

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07.04.00.0005

Prepare in quintuplicate (original and 4 copies)

CONTRACTOR DRAWINGS & INFORMATION SUBMITTAL
NORTHNAVFACENGCOM 4335/3 (Rev. 6/80)

CONTROL NO 67B

CONTRACT NO.	DELIVERY ORDER #	ACTIVITY LOCATION
N62472-94-D-0398	0034	Naval Weapons Station (NWS) @ Earle, Colts Neck, NJ

PROJECT TITLE:
SLOPE STABILIZATION AT SITE 6

FROM:	DATE
Foster Wheeler Environmental Corp. Program QC Manager: Mark Miller	October 13, 1999
TO:	DATE
W FAUSTMAN (3 COPIES)	October 13, 1999

1. THE CONTRACTOR SUBMITTALS LISTED BELOW ARE FORWARDED FOR YOUR REVIEW AND RECOMMENDATIONS.
   (a) APPLY APPROPRIATE STAMP IMPRINT TO EACH SUBMITTAL AND INDICATE REVIEW COMMENTS, AS REQUIRED.
   (b) RETAIN ONE (1) COPY OF THIS TRANSMITTAL FORM AND RETURN REMAINING COPIES WITH REVIEWED SUBMITTALS TO ROICC.
2. THESE SUBMITTALS SHOULD BE RETURNED TO THIS OFFICE BY _____

COPY TO:

[X] ROICC T Dunn (2 copies) [ ] OTHER [X] NWS EARLE G Goepfert (2 Copies)

12-13-99
SIGNATURE AND DATE

	DATE
TO:	DATE

1. THE SUBMITTALS LISTED BELOW HAVE BEEN REVIEWED AND ARE RETURNED, WITH ACTION TAKEN AS INDICATED.
2. _____

COPY TO:

[ ] ROICC [ ] DESIGNER

SIGNATURE AND DATE

FROM: ROICC	DATE
TO: CONTRACTOR	DATE

1. THE SUBMITTALS LISTED BELOW HAVE BEEN REVIEWED AND ARE APPROVED/DISAPPROVED AS SHOWN BELOW AND ON EACH STAMP IMPRINT.

COPY TO:

[ ] ROICC [ ] OTHER

FOR COMMANDING OFFICER, NORTHERN DIVISION NAVAL FACILITIES ENGINEERING COMMAND — DATE

ITEM NO.	SUBMITTAL DESCRIPTION	PREPARED/ SUBMITTED BY	APPROVED	DISAPPROVED	REMARKS
92b	SD-08, Statements; Final Work Plan - Slope Stabilization at Site 6	M. Miller			

FOSTER WHEELER ENVIRONMENTAL CORPORATION

File #: 1284-0034-99-0508

TO: Contracting Officer
Northern Division
Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop #82
Lester, PA 19113
Attn: B. Faustman

FROM: Mike Heffron, P.G.

DATE: October 13, 1999

SUBJECT: US NAVY CONTRACT NO. N62472-94-D-0398
DELIVERY ORDER 0034-
NAVAL WEAPONS STATION-EARLE
FINALIZATION OF WORK PLAN FOR
SITE 6 SLOPE STABILIZATION

Following are responses to the Navy's comments received via e-mail and from meetings and verbal conversations with the Navy. No comments were received from New Jersey Department of Environmental Protection (NJDEP).

1. **COMMENT: Figure 7.1 (schedule)** It appears that the erosion control measures and erosion control fence are being removed a day or two after seeding. These erosion control measures should stay in place and be maintained until the seeded vegetation has become established, which usually requires at least a month. If seeding is not done until late in the fall season, it may be necessary to leave the silt fence in place until next spring.

RESPONSE: The silt fence will remain in place until next spring. The schedule in Figure 7-1 was changed to reflect this modification.

2. **COMMENT: Page 7-** Where the topsoil and fill are discussed, it should be made clear that "recycled" or manufactured" topsoil will not be used. Also, for fill dirt, it should be made clear that "acid producing" soils are not to be used. These soils are sometimes known as black marl, iron pyrite soils, gluaconitic, etc. If there is concern that these soils may present, the Rutgers Soil Testing Laboratory soil test #6 should be used to test the presence of iron sulfide.

RESPONSE: The pre-approved source for common backfill,used at Sites 4 and 5, shall be used for the backfill material. We will insure that the topsoil meets the base requirements prior to placement. Section 3.6 of the Work Plan was modified to add the statements in the comments.

2300 LINCOLN HIGHWAY EAST, ONE OXFORD VALLEY, SUITE 200, LANGHORNE, PA 19047-1829
PHONE (215) 702-4000 FAX (215) 702-4045

GENERAL CHANGES

Through conversations with the Navy, the Action Memorandum and Engineering Evaulation/Cost Analysis and the Coastal Zone Management Determination were not submitted since the stabilization work was considered routine landfill maintenance. Reference to these documents was removed from the Final Work Plan.

As per the on-site meeting with Foster Wheeler, Navy and New Jersey Department of Environmental Protection (NJDEP) personnel, no stabilization work shall be conducted at Site 17. The flat portion of this site shall be graded, covered with topsoil and seeded. A wooden barricade shall also be installed on the flat upper portion of the site to prevent any future deposition of soils or debris on the sloped area of Site 17.

DRAFT WORK PLAN
FOR SLOPE STABILIZATION AT SITE 6,
FORMER LANDFILL AREA

NAVAL WEAPONS STATION - EARLE
COLTS NECK, NEW JERSEY

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APPENDICES

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APPENDIX C: SPECIFICATIONS

1.0 INTRODUCTION

Foster Wheeler Environmental Corporation (Foster Wheeler Environmental) has been contracted by the Northern Division, Naval Facilities Engineering Command (Northern Division) to perform the work outlined in this Work Plan at Site 6 - Former Landfill Area, at the Naval Weapons Station (NWS) Earle located in Colts Neck, NJ. This Work Plan is being submitted to satisfy the pre-construction submittal requirements included in paragraph 1.2.1, Pre- and Post-Construction Documentation of the Statement of Services for Delivery Order No. 0034 under Remedial Action Contract No. N62472-94-D-0398.

1.1 PROJECT OBJECTIVES

The project objectives in this Work Plan include clearing and grubbing, backfilling, regrading and seeding the former landfill slope in order stabilize the northern slope of the site.. Existing debris shall also be removed from the Site 6 area. This work is being conducted in response to requests for bank stabilization from the New Jersey Department of Environmental Protection (NJDEP) and the Environmental Protection Agency (EPA).

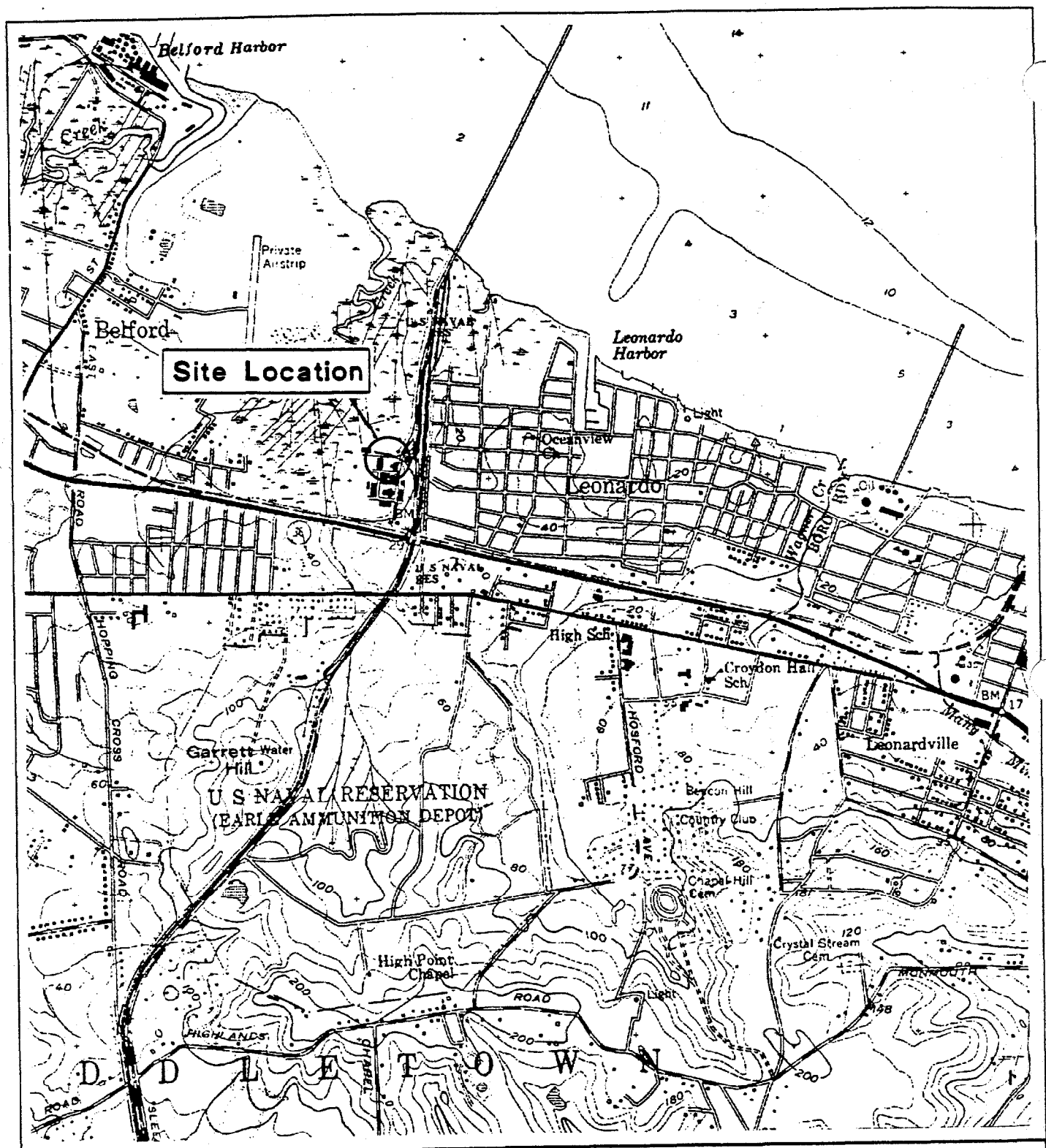
The Health and Safety Plan previously submitted for SPCC Bilge Water Plant shall be used for this effort. An individual Activity Hazard Assessment (AHA) has been prepared and includes action levels and hazards specific to the work outlined in this Work Plan. The AHA is further addressed in this Work Plan, Section 5.0, Health and Safety Requirements.

The Quality Control Plan previously submitted for the Site 4 and 5 Landfill work shall be used for this effort.

2.0 PROJECT LOCATION AND DESCRIPTION

NWS-Earle is located in east-central Monmouth County, New Jersey. NWS-Earle consists of a 10,248-acre Main Base located in Colts Neck Township approximately 10 miles inland from the Atlantic Ocean, and a 706-acre Waterfront Area, in the town of Leonardo, New Jersey, approximately 47 miles south of New York City. Site 6 is located in the Waterfront area of the base. Figure 2-1 provides the site location. Drawing C-2 in Appendix B provides the site details.

Site 6 is a former 4-acre landfill west of Normandy Road in the Waterfront Area. The landfill was used from 1943 to 1965 to dispose of lumber, glass, paper, packing materials, and small amounts of paint and solvents. The wastes were reportedly burned before they were covered. The majority of the landfill has been paved and is covered with buildings. The landfill surface is 3 to 10 feet higher than the adjacent marsh wetlands. The area of the clear cutting includes the northwestern edge of the former landfill, from west of Normandy Road to monitoring well MW6-03.



0 2000 4000 FT

Source: U.S.G.S. Topographic Maps (7.5 Minute)
Marlboro & Farmingdale, NJ Quadrangles

QUADRANGLE LOCATION

NWS – Earle
Colts Neck, N.J.

Figure 2–1
Site 6

FOSTER WHEELER ENVIRONMENTAL CORPORATION

earle\site6\siteloc.dwg

2.1 SITE CONDITIONS

The majority of the former landfill at Site 6 has been covered over, paved, and is overlain by buildings or other structures. The area of concern at Site 6 is the northern perimeter of the former landfill. The northern perimeter of the site consists of a steep wooded slope. The northern perimeter of the site slopes 40% to 60% to a flat wetland buffer area to the north. While the northern perimeter of the site is covered with trees, the underlying sloped surface has minimal vegetative growth, and is subject to erosion. Miscellaneous debris is scattered about the slopes of the former landfill. The miscellaneous debris consists of wood, metal, and concrete.

Site 6 is accessed from a dirt road off of Normandy Road, located to the east of the site. There are wetlands, and wetland buffers to the north and west of the site. The area to the south contains buildings, a former above ground water tank, and tennis and handball courts.

2.1.1 Site Geology

NWS-Earle is situated in the Coastal Plain Physiographic Province of New Jersey. The Coastal Plain consists of a series of seaward-dipping unconsolidated sediments of Cretaceous through Quaternary Age, deposited atop pre-Cretaceous bedrock. The Coastal Plain sediments were deposited in continental, coastal, and marine depositional environments, and consist of numerous sequences of sand and gravel, silt, and clay. These deposits generally strike northeast-southwest, and dip to the southeast at 10 to 60 feet per mile. The Coastal Plain section is nearly 900 feet thick beneath NWS-Earle.

Site 6 is located in an outcrop area of the Englishtown Formation. Soil borings at Site 6 encountered fill material, sand, silty sand, silt and clay.

2.1.2 Groundwater

The depth to groundwater at Site 6 ranges from 6 to 10 feet below grade. The groundwater flow gradient is to the north and northwest.

2.2 PREVIOUS INVESTIGATIONS

A Site Investigation (SI) was conducted at Site 6 in 1993. Four soil boring were drilled and converted to monitoring wells during the SI. Low levels of volatiles, pesticides and metals were detected in the soil samples collected during the installation of two of the four monitoring wells. The laboratory analyses of four sediment samples collected in the marsh area downgradient of the site revealed elevated concentrations of metals, pesticides, semi-volatile organic compound (SVOCs), and PCBs. Groundwater samples collected from the monitoring wells contained elevated concentrations of metals.

Between June and October 1995, Brown and Root Environmental conducted a Remedial Investigation (RI) at Site 6. The RI activities included the collection and laboratory analyses of surface water, sediment, and groundwater from existing wells. Appendix A contains a summary of the RI findings.

Two surface water samples were obtained in the wetlands located to the west of the site. The laboratory analyses of the two surface water samples did not detect any volatile or semi-volatile organics. The following metals/inorganics were detected in the surface water samples at concentrations greater than background concentrations: arsenic, iron, manganese, selenium, and barium. The surface water samples were also analyzed for ammonia, biological oxygen demand (BOD), chemical oxygen demand (COD), chlorides, hardness, total organic carbon (TOC), phosphate, and turbidity, all of which were considered to be at concentrations below the range typically associated with concentrated landfill leachate.

Four sediment samples were collected in wetland areas to the north and northwest of Site 6. The laboratory analyses of the sediment samples revealed concentrations of metals, volatile organic compounds (VOCs), SVOCs, and pesticides that were elevated above background sediment concentrations. Appendix A contains the a summary of the laboratory analyses.

Groundwater samples were obtained from the existing wells during the RI. The groundwater samples were analyzed for VOCs, SVOCs, PCBs/pesticides, metals, explosives, TOC, COD, phosphate, ammonia, turbidity, chloride, sulfates, nitrite/nitrates, and BOD. Most of the metals detected in the groundwater at Site 6 were similar to background concentrations, however, the following metals were detected at concentrations higher than background: cadmium, iron, and manganese. The only organics detected in the groundwater at Site 6 were low concentrations of pesticides. No explosives, or related degradation products, were detected in the groundwater at Site 6.

3.0 SCOPE OF WORK

The following tasks summarize the project approach to be used for the bank stabilization project.

3.1 TASK 1 - PROJECT PLANNING/MANAGEMENT

Project Planning/Management activities include the preparation of pre-construction submittals, coordinating utility requirements, mobilization to the site, and providing home office support functions during the estimated period of performance. The subtasks involved in Project Planning/Management are described below.

3.1.1 Subtask 1A - Pre-Construction Submittals

Foster Wheeler Environmental will prepare and submit the following pre-construction documents to the Navy:

Work Plan
The Work Plan presents Foster Wheeler Environmental's approach to executing the project, including the site description, statement of work, procurement approach, system information, materials, engineering data, transportation and disposal data.

Health and Safety Plan (HASP)
The HASP developed and approved for the SPCC Bilge Water Plant will be used for the Site 6 activities. The HASP includes Foster Wheeler Environmental's approach to providing for the health and safety of its employees during the project. The Activity Hazard Analysis and Action Levels for this effort shall be submitted as an Addendum to the SPCC Bilge Water Plant HASP.

Soil Erosion and Sediment Control Plan

A Soil Erosion and Sediment Control Plan shall be prepared and submitted to the Freehold Soil Conservation District in accordance to the Soil Erosion and Sediment Control Act, Chapter 251, P1.L 1975, as amended (NJSA 4:24-39 et seq). The Plan shall detail final slope of the site, the erosion controls to be implemented, and the appropriate seeding requirements.

3.1.2 Subtask 1B - Mobilization

Mobilization will consist of contacting appropriate Navy personnel at NWS Earle to arrange for contractor passes and to coordinate support requirements for the excavation work. A utility survey shall be conducted to determine all utility lines in the work area. A thorough survey of above ground utilities and structures will be conducted prior to work. Subsurface utilities shall be located by NWS-Earle Public Works personnel. A dig permit shall be obtained prior to any excavation work.

3.1.3 Subtask 1C - Home Office Support

Foster Wheeler Environmental's Langhorne, Pennsylvania office will provide home office support for the duration of the project. Home office support includes the preparation of the monthly progress reports, financial, and technical reports.

3.2 TASK 2 - PERMIT AND REPORT PREPARATION/SUBMISSION

3.2.1 Subtask 2A-Dig Permit

Foster Wheeler Environmental shall contact the NWS-Earle Public Works Department to obtain a dig permit and have all utilities marked-out prior to excavation activities. Foster Wheeler will also contact the New Jersey Dig Safe to clear additional utilities.

3.2.2 Subtask 2B-Soil Erosion and Sediment Control Plan

Foster Wheeler Environmental shall prepare and submit a Soil Erosion and Sediment Control Plan to the Freehold Soil Conservation District. The slope stabilization will proceed upon

approval of the plan. All work will be performed in accordance with the Soil Erosion and Sediment Control Plan.

3.2.3 Subtask 2D-Preparation of Closure Report

Foster Wheeler Environmental shall prepare a report detailing the actions performed at Site 6, and any subsequent findings or changes based on the field work. This report will be submitted to the Navy. Any photo documentation will be included in this report.

3.3 TASK 3 – DEBRIS REMOVAL

All debris shall be removed from around the perimeter of the Site 6 area. Debris to be removed includes wood, telephone poles, railroad ties, metal, and other general debris. All debris shall be segregated and transported off-site for recycling or disposal at approved facilities.

3.4 TASK 4 - ROAD STABILIZATION

The existing dirt road that behind Building R-23 that accesses Site 6 will be graded (if required) and covered with gravel in order to prevent erosion of the road surface to the site and surrounding areas. The drawings in Appendix B depict the road location and details.

3.5 TASK 5 – CLEAR CUTTING

Trees and brush shall be removed from the 0.5-acre area of work at Site 6. Clearing will consist of removal of existing standing trees, brush, down timbers, logs, and other growth in the designated areas. The trees and brush shall be cut as low as possible to ground level. All cleared material shall removed from the site.

3.6 TASK 6 - SLOPE STABILIZATION

The slope stabilization activities shall be conducted upon the removal of all trees and brush and approval of all applicable permits. Erosion controls shall be installed, in accordance with the approved Soil Erosion and Sediment Control Permit, prior to any grading operations.

Backfill and topsoil shall be placed on the northern perimeter of Site 6 in order to regrade the site and stabilize the landfill bank adjacent to the flat, wetland buffer area. Appendix B contains the Site Stabilization Plan Drawings detailing the existing and proposed slopes for the area of concern at Site 6. Appendix C contains detailed Specifications for the slope stabilization at Site 6.

Certified-clean fill and topsoil will be placed to complete the final grade elevations. Recycled or manufactured topsoil shall not be used at the site. No acid producing soils shall be used as backfill or topsoil. Front-end loaders, tracked bulldozers, and vibratory rollers shall be used to place, grade and compact the fill material in accordance to the specifications contained in

Appendix C. The backfilled soils shall be placed and compacted in six to nine inch lifts. All materials placed on the slope during the stabilization activities will be compacted and tested as required in the specifications in Appendix C to achieve the required density and moisture content. The fill material shall be placed to within 6 inches of the final grade. The final 6 inches of the surface shall be backfilled with topsoil and seeded in accordance to the Soil and Sediment Erosion Control Plan.

The topsoil shall be treated with lime and fertilizer, seeded and mulched upon the completion of the final grade. The topsoil will be tested in an approved laboratory to determine fertilization and liming ratios. The seed shall be placed in accordance to the specifications contained in Appendix C. A vegetative mat (Miramat TM8) or some other typed of stabilizer shall be placed atop the seeded slope to aid in the prevention of soil erosion while the seed is established at the site. If a vegetative mat is elected to be used, it shall be anchored on the top and bottom of the slope as indicated in Drawing C-1 of Appendix B.

4.0 PROCEDURES FOR FIELD CHANGES AND CORRECTIVE ACTION

The Senior Project Engineer/Manager (SPEM) or his designee is responsible for all site activities. In this role, the SPEM is required at times to adjust the field program to accommodate site-specific needs. When it becomes necessary to modify a program, the responsible field personnel will notify the SPEM of the anticipated changes prior to implementation. Changes will only be acted upon with the SPEM's concurrence. The SPEM will consult with the Navy Technical Representative (NTR) in advance for major changes and receive his/her approval. If changes are implemented that are subsequently determined to be unacceptable, the actions taken during the period of deviation will be evaluated to determine the significance of any departure from established program practices.

The changes in the program will be documented on a Change Request Form (CRF), which will be signed by the Project Superintendent and the SPEM. A typical CRF Form used to document field changes is provided as Figure 4-1. The CRFs for each change will be numbered sequentially starting with the number "01." The SPEM is responsible for controlling, tracking, and implementing the identified changes.

5.0 HEALTH AND SAFETY REQUIREMENTS

The site-specific Health and Safety Plan (HASP) has been provided as a separate submittal. As required by paragraph 1.2.1, Pre- and Post-Construction documentation, the HASP includes organizational information, a potential hazards assessment, protective equipment requirements, air monitoring, site controls and protective zones, medical surveillance procedures, emergency response and spill control measures, and training requirements. The previously-submitted HASP, developed for the SPCC Bilge Water Plant, shall be used for the activities outlined in this Work Plan. An Activity Hazard Analysis (AHA), addressing issues specific to the Site 6 activities, will be added to the approved HASP as an addendum.

Figure 4-1

Foster Wheeler Environmental Corporation
Change Request Form

Section 1 thru 4 to be filled out by Foster Wheeler, Section 5 to be filled out by Navy

PROJECT:	OFS.No. **1284 00**	Change Request Form: **CRF- 000** **Rev. 0**

To: _____ Dept. _____ Location: _____ Date:

Re: ☐ Drawing No. _____ Title _____

☐ Spec. No. _____ Title _____

☐ Other _____

1. DESCRIPTION (*Items involved, submit sketch if applicable*)

2. REASONS FOR CHANGE (*If from disposition of nonconformance report, list report number*)_____

3. RECOMMENDED DISPOSITION

☐ Technical Direction (Minor Scope Shift-<10%/50k) [COTR/NR approval required]

☐ Technical Direction (Major Scope shift->10%/50k) [CO approval required]

☐ ROM Estimate $_____

☐ Cost Growth

☐ Out of Scope(Minor-<10%/50k) [CO approval required]

☐ Out of Scope (Major->10%/50k) [CO approval required]

☐ Schedule Impact _____

Initiator Signature:

4. Resident Engineer (Signature)	Date	Project Superintendent Concurrence (Signature)	Date

5. Disposition

☐ Approved per recommended disposition

☐ Not approved (give reason)

☐ Approved with modification(s) [describe below]

Project Manager (*Signature*)	Date	ROICC Approval (*Signature*)	Date
Contracting Officer Technical Representative Approval (*Signature*)(as required)		Contracting Officer Approval (*Signature*)	Date

Engineer signs and transmits to Resident Engineer with copies to:

_____ Project Manager
_____ Project Superintendent
_____ Quality Control

Others as Required _____
File: _____

p:\shared\forms\fcrform.doc

6.0 WASTE REMOVAL/REGULATORY COMPLIANCE

This section addresses how the waste generated during the Site 6 activities will be handled on site and disposed of off site. The wastes are anticipated to be non-hazardous. These wastes include vegetative material, decontamination water, miscellaneous debris, and PPE. No waste classification samples will be analyzed for wastes generated during these activities. If field conditions differ drastically from anticipated conditions (Brown & Root, Draft Remedial Investigation Report, March 1996), the Navy will be notified and Foster Wheeler Environmental will proceed under direction from the Navy. Foster Wheeler Environmental shall provide completed waste manifests and/or bills of lading and transport documentation to the Navy for review and signature.

Foster Wheeler Environmental shall subcontract for waste transport and disposal (T&D) services. The T&D subcontractor shall be competitively procured from firms with which Foster Wheeler Environmental has pre-placed basic ordering agreements. This assures the Navy that hazardous and/or solid wastes will be sent to an EPA/NJDEP-approved facility. All disposal facility transporters used to dispose of the Navy's wastes will be evaluated for regulatory compliance and approved for use in accordance with Foster Wheeler Corporation Regulatory Compliance Procedures. Approved facilities and transporters will be submitted to the Navy for final approval.

7.0 PROJECT MANAGEMENT

The project management team shall be responsible for all technical and administrative aspects of the remediation project.

7.1 PROJECT SCHEDULE

The project schedule is provided as Figure 7-1.

7.2 PROJECT STAFFING PLAN

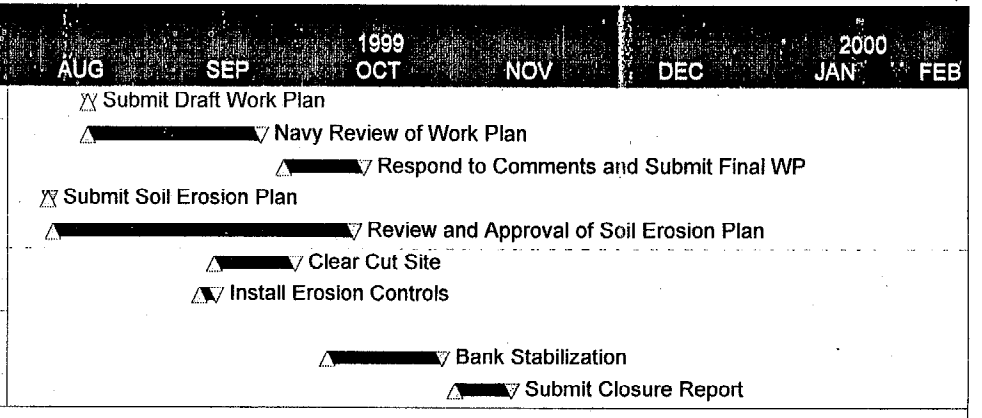
The organization chart for this project is provided in Figure 7-2.

7.3 MEETINGS

7.3.1 Pre-Construction Meeting

Prior to mobilization, the Project Superintendent shall conduct a pre-construction meeting in the ROICC office. The date and time of the pre-construction meeting shall be approved by the ROICC and the NTR.

Act ID	Description	Orig Dur	Rem Dur	Early Start	Early Finish
1000	Submit Draft Work Plan	1d	0	18AUG99 A	18AUG99 A
1040	Navy Review of Work Plan	1d	0	18AUG99 A	22SEP99 A
1050	Respond to Comments and Submit Final	1d	0	27SEP99 A	13OCT99 A
1070	Submit Soil Erosion Plan	1d	0	10AUG99 A	10AUG99 A
1080	Review and Approval of Soil Erosion Plan	1d	0	11AUG99 A	11OCT99 A
1200	Clear Cut Site	1d	0	13SEP99 A	29SEP99 A
1210	Install Erosion Controls	1d	0	10SEP99 A	13SEP99 A
1220	Remove Fence	1d	0	03APR00 A	06APR00 A
1230	Bank Stabilization	1d	0	06OCT99 A	29OCT99 A
1240	Submit Closure Report	1d	0	01NOV99 A	12NOV99 A

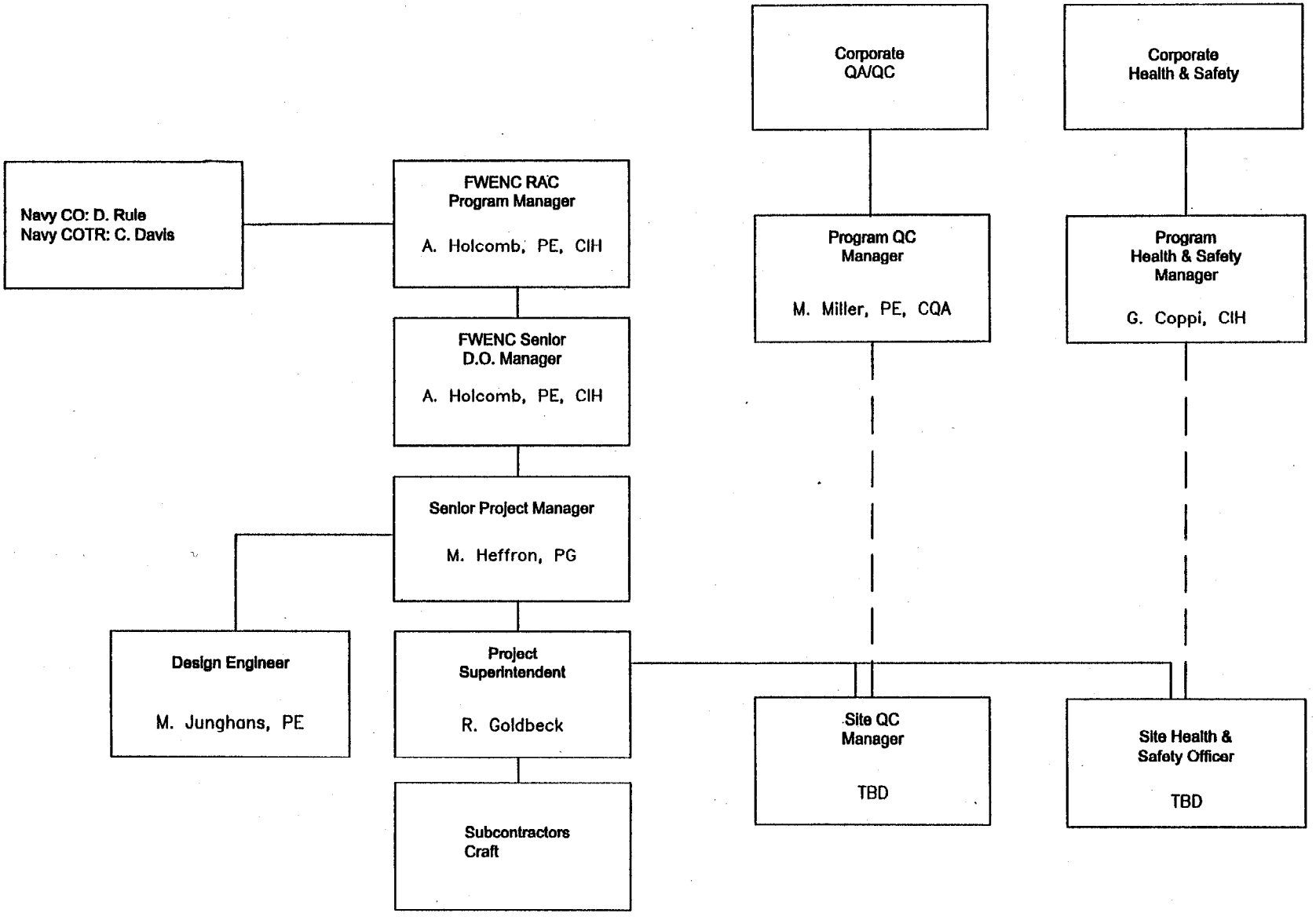


- △ Early start point
- ▽ Early finish point
- Early bar
- ▼ Late finish point
- Total float bar
- Progress bar
- Critical bar
- —— Summary bar
- ▲ Progress point
- ▲ Critical point
- Summary point
- ◆ Start milestone point
- ◆ Finish milestone point

FIGURE 7-1
NWS-EARLE
SITE 6
SCHEDULE OF ACTIVITIES

Date	Revision	Checked	Approved
18AUG99	0	M.H.	
13OCT99	1	M.H.	

Figure 7-2
Navy / FWENC Organization Chart



navyrac\mhorgl

7.3.2 Daily Safety Meetings

Prior to the starting work, a daily safety meeting will be conducted by the Foster Wheeler Environmental Health and Safety Officer. All of the day's planned activities will be reviewed with particular attention focused on PPE and risk. All personnel are required to attend the meeting.

8.0 QUALITY ASSURANCE/QUALITY CONTROL

This Quality Assurance/Quality Control (QA/QC) section describes the organization, inspections, tests, procedures, and documentation necessary to produce a completed project, which complies with the governing regulations and the technical statement of work.

8.1 ORGANIZATION AND RESPONSIBILITIES

The project team will include the following personnel:

The Senior Project Engineer/Manager (SPEM) has final responsibility for the development of the Work Plan and management of the project team.

The Project Superintendent (PS) is responsible for assuring that all the work is conducted in accordance with the Work Plan. In addition, the PS is responsible for coordinating with the subcontractors for execution of all of the on-site work.

The Site Health and Safety Officer (SHSO) is responsible for the safety of all site personnel, as detailed in the site-specific Health and Safety Plan (HASP), presented under separate cover.

Foster Wheeler Environmental will direct and maintain responsibility for the overall QA/QC requirements. Subcontractors shall be used for clearing and grubbing, laboratory analyses, and waste removal.

8.2 PROBLEM OR WORK DEFICIENCY MEETINGS

If a major problem or deficiency occurs or is likely to occur, a special meeting to address related issues will be held. The meeting may be attended by the SPEM, Navy Representative(s) and others, as required. Meetings may be conducted at NWS Earle, Northern Division in Lester, PA, or by teleconference. The purpose of the meeting will be to define and resolve potential problems or work deficiencies in the following manner:

- Define and discuss the problem or deficiency
- Review alternative solutions, including their effects on schedule and budget
- Implement plan to resolve the problem or deficiency

8.3 SUBMITTALS

The Quality Control Manager is responsible for maintaining the submittal register and reviewing and certifying that submittals are in compliance with the contract requirements. All submittals will be accompanied by a transmittal form, which will identify the submittal and provide a unique tracking number.

8.4 TESTS AND INSPECTIONS

Foster Wheeler Environmental will perform preparatory, initial, and follow-up inspections.

8.5 CHANGES

If circumstances develop during the project that make it necessary or advisable to revise the Work Plan in order to accomplish project objectives, a Change Request Form (CRF) will be forwarded to the Navy for approval. Events such as a change in the site conditions or system performance may result in a CRF. Changes may be discussed with the Navy Design Manager telephonically and followed up with a CRF to avoid negative impacts on the project budget. A typical CRF used to document field changes is provided as Figure 4-1.

8.6 DOCUMENTATION

Documentation of operations, record keeping, photographic evidence of work performed, and any engineering or analytical results will be provided to the Navy in the Closure Report for the slope stabilization, soil testing, waste disposal, and site restoration activities.

8.6.1 Operations Record keeping

All field inspection and testing activities will be documented in a project logbook. The project logbook will be maintained in accordance with the relevant Foster Wheeler Environmental Field Technical Guidelines. The Project Manager will maintain records of quality control operations and activities for subcontractors and suppliers.

8.6.2 Photographic Documentation

Both still 35mm color and digital photographs will be taken as needed to record work progress. At a minimum, photographs will be taken of the existing conditions before work begins, and during the stabilization and site restoration activities. Photograph location, date and description of the activity recorded will be entered in a photo documentation log. The photographs and log will be submitted with the Closure Report.

9.0 SITE 6: LANDFILL WEST OF NORMANDY ROAD

9.1 SITE BACKGROUND AND PHYSICAL SETTING

The landfill west of Normandy Road is a 4-acre site located in the Waterfront area. From 1943 to 1965, the site was used to dispose of refuse from the Waterfront area. The wastes consisted of dunnage lumber, glass, paper, packing material, and small amounts of paint and solvent. It was reported that the wastes were burned before they were covered, and an estimated 2,500 tons of waste were deposited annually at the landfill. The landfill area may have been part of a salt marsh before disposal began. Currently, the majority of the landfill surface is paved or covered with buildings. The landfill surface is 3 to 10 feet higher than the adjacent marsh wetlands areas, and the toe of the landfill is covered with vegetation. Infiltration is limited and overland flow drains toward the salt marsh and eventually into Sandy Hook Bay. Groundwater flow is to the north and northwest based on measured groundwater levels. Figure 9-1 is a map of the site.

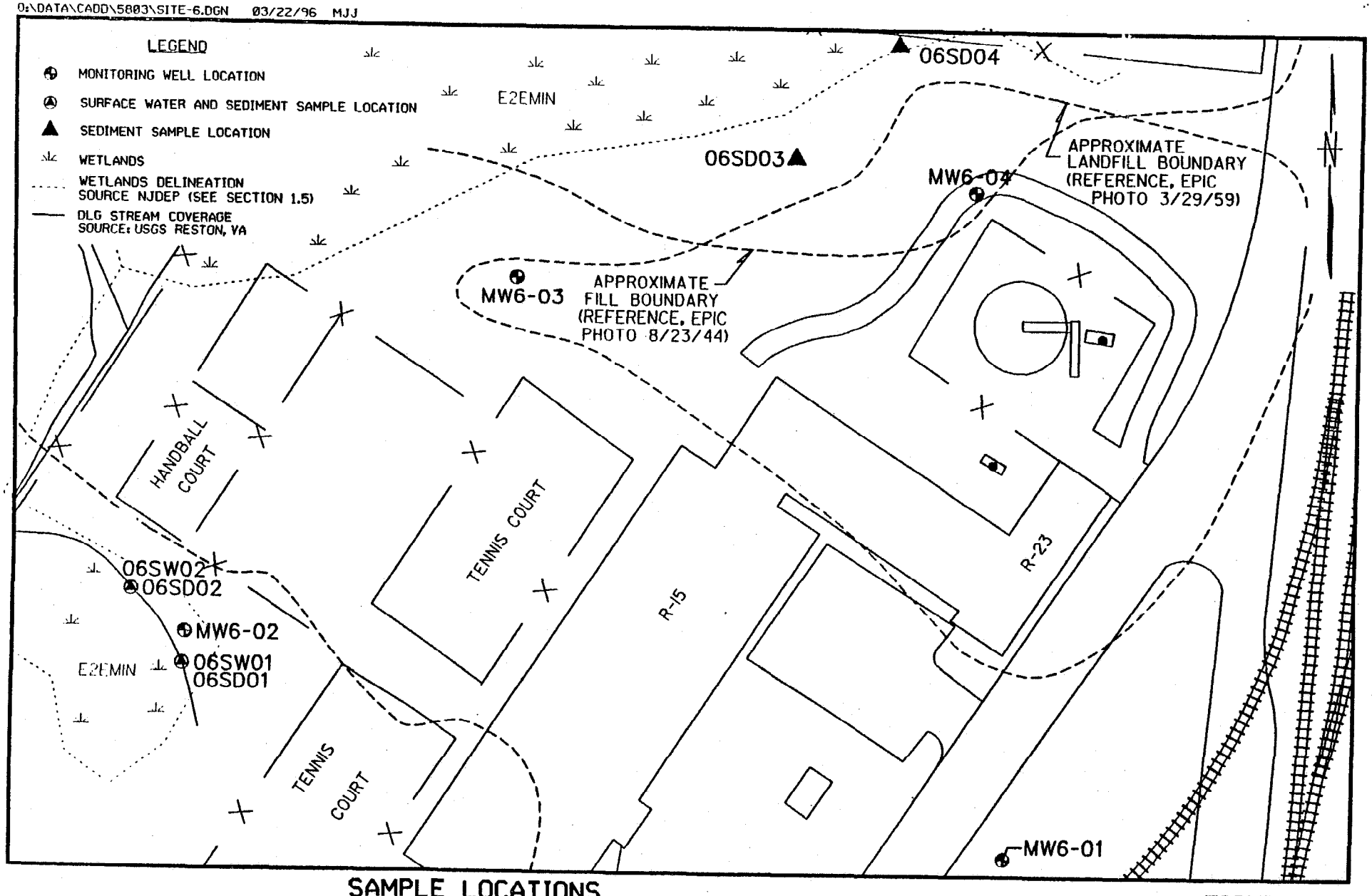
9.2 PREVIOUS INVESTIGATIONS

During the 1993 SI, four soil borings were drilled and converted to monitoring wells. Two soil samples were analyzed for VOCs, SVOCs, pesticides, PCBs, and metals. Low levels of VOCs and two pesticides were detected in soil samples from the locations of MW6-02 and MW6-03. Low levels of metals were also detected. Four sediment samples were collected from the marsh area downgradient of the site. Elevated levels of metals, pesticides, semivolatiles, and PCBs were detected. Groundwater samples were collected from the four monitoring wells and analyzed for metals, organics, and landfill parameters. Elevated levels of metals, one SVOC, and two miscellaneous parameters were detected. Landfill parameters were relatively low compared to active solid waste landfills.

9.3 RI FIELD INVESTIGATIONS

Between June and October 1995, B&R Environmental conducted the following field investigation activities at Site 6:

- Sampling and analysis of surface water (Section 9.3.1).
- Sampling and analysis of sediment (Section 9.3.2).
- Sampling and analysis of groundwater from the four existing monitoring wells (Section 9.3.3).
- Measurement of static-water levels in the four monitoring wells (Section 9.3.3).



SAMPLE LOCATIONS

SITE 6 - LANDFILL WEST OF NORMANDY ROAD

FIGURE 9-1

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A survey was conducted to establish the horizontal locations and vertical elevations of the sediment sample locations, the surface water sample locations, and selected existing monitoring wells. Surveying notes are provided in Appendix F.

9.3.1 Surface Water Sampling

B&R Environmental collected two surface water samples (06 SW 01 and 06 SW 02) in the wetlands in June 1995. Figure 9-1 shows sampling locations. The RI work plan stated that, if any flowing seeps or wet areas were found along the landfill edge, a surface water sample would be collected to determine if the landfill has had an impact on the adjacent wetlands. However, because of very dry conditions during the summer, no surface water seeps were found along the landfill edge. Sample 06 SW 01 was collected from the wetlands area located immediately west of the southernmost tennis court and Sample 06 SW 02 was collected in a wetlands area immediately west of the western fence line (Figure 9-1). Sample log sheets are presented in Appendix D.

The field team collected the surface water samples by dipping the sample bottle directly into the water. Field measurements collected during sampling included pH, specific conductance, temperature, turbidity, dissolved oxygen, and salinity.

The two surface water samples were submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TAL metals, ammonia, phosphate, COD, TOC, nitrite/nitrate, turbidity, chloride, BOD, and hardness analyses.

9.3.2 Sediment Sampling

Two sediment samples (06 SED 01 and 06 SED 02) were collected in June 1995 in the wetlands area surrounding Site 6 to determine if the landfill has had an impact on the adjacent wetlands. 06 SED 01 was collected from the wetlands area located immediately west of the southernmost tennis court. 06 SED 02 was collected in a wetlands area immediately west of the western fence line. Two other sediment samples (06 SED 03 and 06 SED 04) were collected in June 1995 from two dry rills along the northeastern landfill edge (Figure 9-1). Sample log sheets are presented in Appendix D.

The four sediment samples were submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TOC, pH, and moisture analyses.

9.3.3 Static-Water-Level Measurements and Groundwater Sampling

Static-Water-Level Measurements

To define groundwater flow directions and horizontal and vertical groundwater gradients, two rounds of static-water-level measurements were collected. The first round of water-level measurements was collected on August 7, 1995, the second on October 17, 1995. Static-water levels were measured from the top of the PVC riser using an electronic water-level indicator (M-scope) or an interface probe and recorded to the nearest 0.01 foot. The water-table elevation ranged from approximately 4.29 to 5.46 feet above MSL during the first round of measurements and from approximately 3.76 to 5.07 feet above MSL during the second round of measurements. Water-level measurements are summarized in Table 9-1.

Groundwater Sampling

B&R Environmental collected groundwater samples from the four existing monitoring wells (MW6-01 through MW6-04) to determine groundwater quality and to provide data for use in the risk assessment and the evaluation of remedial action alternatives. The four monitoring wells were sampled in late July and early August 1995. Field measurements collected during purging were pump rate (L/min), water-level measurements, pH, conductivity, temperature, turbidity, dissolved oxygen, and salinity. Prior to sampling, B&R Environmental purged the wells, using the micro-purge protocol, to reduce turbidity until groundwater parameters stabilized within acceptable limits. Care was taken to ensure that little or no drawdown in water levels occurred throughout the purge and sample process.

The four groundwater samples (06 GW 01 through 06 GW 04) were submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, explosives, TOC, COD, phosphate, ammonia, turbidity, chloride, sulfates, nitrite/nitrate, and BOD analyses.

Sample log sheets are presented in Appendix D.

9.4 SITE CHARACTERISTICS

9.4.1 Geology

Regional mapping places Site 6 within the outcrop area of the Englishtown Formation. The Englishtown Formation ranges between 35 and 150 feet in thickness and the soil borings are no more than 23 feet deep. The lithology of the sediments encountered in the on-site borings generally agrees with the published description of the Englishtown Formation. In general, the borings encountered fill material, yellowish-brown clay, yellowish-brown, olive and gray sand and silty sand, and gray silt.

Based upon the boring log descriptions, the wells penetrated fill material and the Englishtown Formation.

Table 9-1
Site 6 Static-Water-Level Measurement Summary
NWS Earle, Colts Neck, New Jersey

Monitoring Well Number	August 7, 1995			October 17, 1995		
	Depth to Water Table[1] (feet)	Top of PVC Riser[2]	Elevation of Water Table[2]	Depth to Water Table(1) (feet)	Top of PVC Riser[2]	Elevation of Water Table[2]
MW6-01	12.29	17.75	5.46	12.68	17.75	5.07
MW6-02	8.36	12.68	4.32	8.58	12.68	4.10
MW6-03	9.35	13.64	4.29	9.88	13.64	3.76
MW6-04	10.29	14.58	4.29	10.68	14.58	3.90

(1) In feet below top of riser
(2) In feet above mean sea level

9.4.2 Hydrogeology

Groundwater in the fill material and Englishtown aquifer beneath the site occurs under unconfined conditions and the fill material and formation are interpreted to be hydraulically interconnected. Static-water-level measurements and water-table elevations are summarized in Table 9-1. Groundwater elevations for August 1995 and October 1995 are contoured on Figures 9-2 and 9-3, respectively. The direction of shallow groundwater flow in the aquifer, as indicated by both the August and October groundwater contour maps, is toward the north and northwest. There does not appear to be a significant seasonal variation in groundwater flow direction.

Based upon the boring log descriptions, the wells are screened across the contact between the fill material and the Englishtown Formation.

9.5 NATURE AND EXTENT OF CONTAMINATION

9.5.1 Sediment

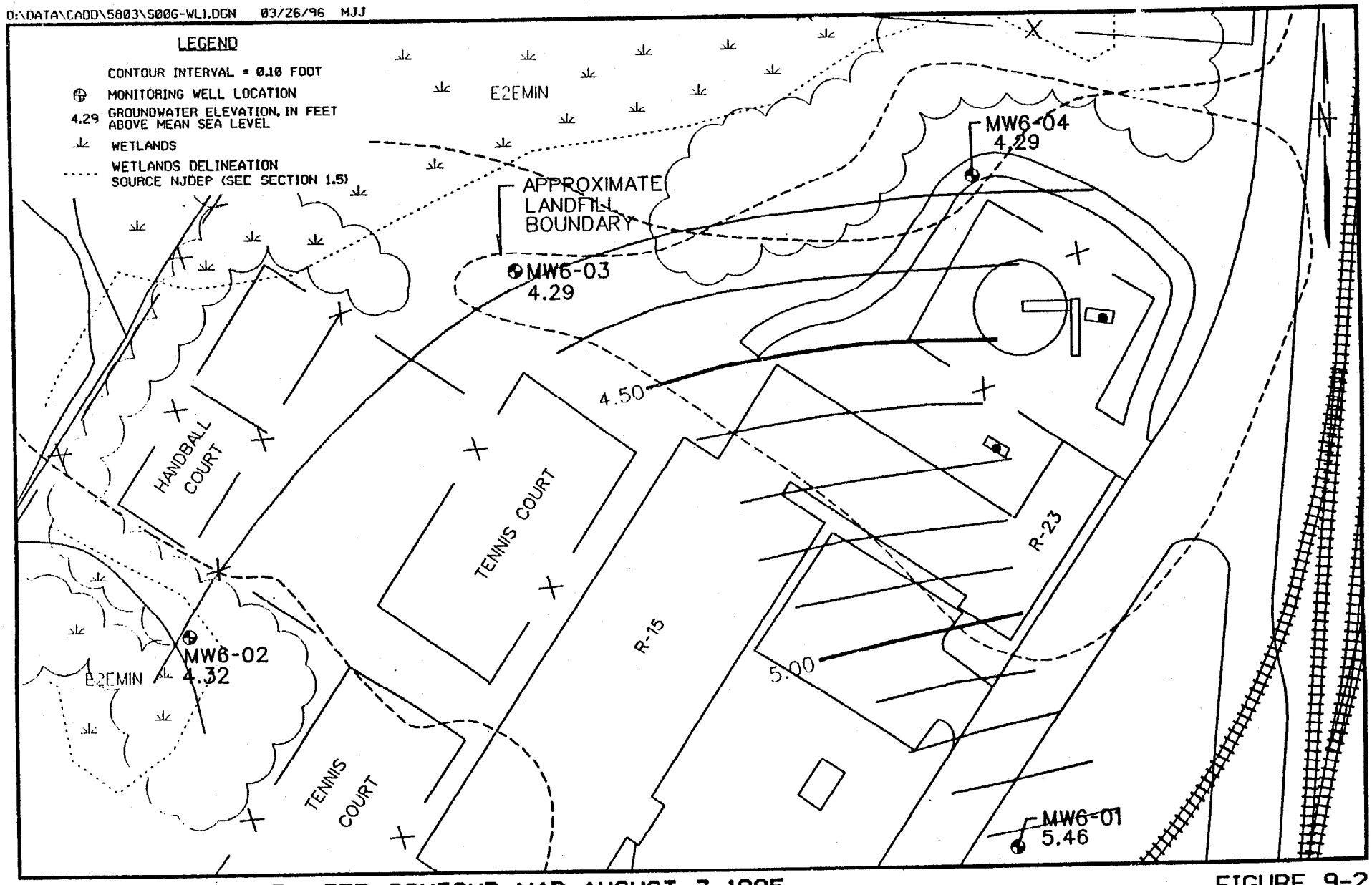
Four site-related sediment samples (06 SD 01 through 06 SD 06) were collected at Site 6 (Figure 9-1). Tables 9-2 and 9-3 present the occurrence and distribution of inorganic and organic chemicals detected in site-related sediment samples and compare them to background as presented in Section 31. Table 9-2a presents a comparison of detected compounds to ARARs. Figure 9-4 shows sample locations and concentrations of compounds which exceed ARARs.

9.5.1.1 Inorganics

Higher concentrations of metals were seen in site-related samples. Samples collected at 06 SD 01 and 06 SD 04 showed arsenic (up to 36.3 mg/kg), barium (up to 138 mg/kg), copper (up to 228 mg/kg), iron (up to 52,200 mg/kg), lead (up to 445 mg/kg), manganese (up to 451 mg/kg), nickel (up to 43.8 mg/kg), selenium (up to 3.4 mg/kg), and zinc (up to 1,720 mg/kg). Antimony and thallium were detected once at levels of 12.4 mg/kg and 2.1 mg/kg, respectively.

9.5.1.2 Organics

PAHs including benz(a)anthracene, benzo(a)pyrene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, fluoranthene, fluorene, and pyrene were detected in background sediment samples at levels ranging from 110 ug/kg to 1,900 ug/kg. The maximum concentrations of individual PAHs detected in the site-related sediments occurred in sample 06 SD 04 and ranged from one to 10 times higher than the concentrations in background sediment. Background samples



GROUNDWATER CONTOUR MAP AUGUST 7, 1995
SITE 6 - LANDFILL WEST OF NORMANDY ROAD

FIGURE 9-2

0 60 120
SCALE IN FEET

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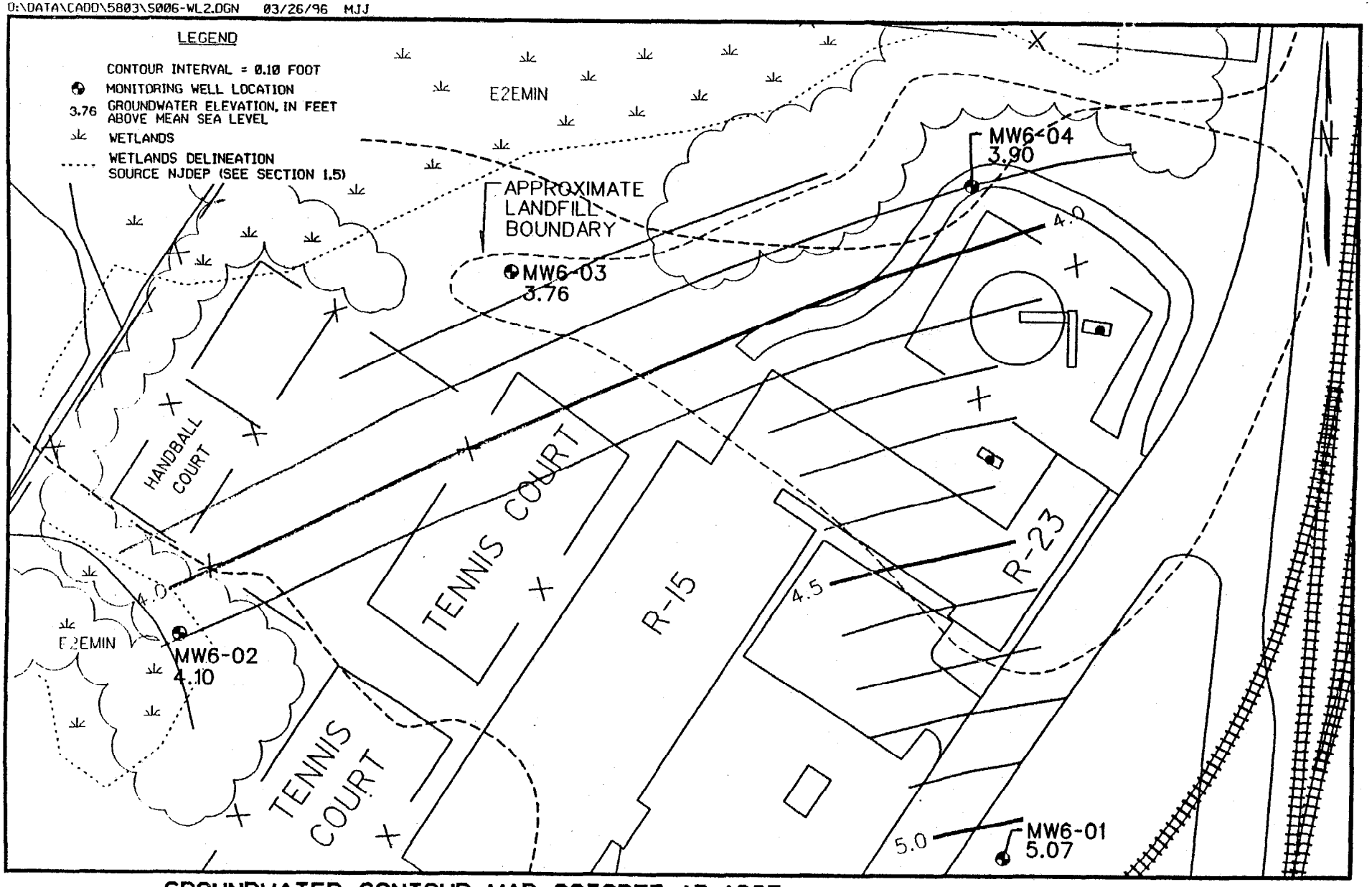

GROUNDWATER CONTOUR MAP OCTOBER 17, 1995
SITE 6 - LANDFILL WEST OF NORMANDY ROAD

FIGURE 9-3

0 60 120
SCALE IN FEET

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TABLE 9-2
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SEDIMENT AT SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
ALUMINUM	3 / 3	839 - 3940	3940	4 / 4	3660 - 7610	7610
ANTIMONY	NOT DETECTED	-	-	1 / 4	12.4	12.4
ARSENIC	2 / 3	2.4 - 6.2	6.2	4 / 4	3 - 36.3	36.3
BARIUM	3 / 3	3.9 - 10.6	10.6	4 / 4	13.7 - 138	138
BERYLLIUM	1 / 3	0.57	0.57	3 / 4	0.21 - 0.99	0.99
CADMIUM	NOT DETECTED	-	-	2 / 4	1.5 - 1.8	1.8
CALCIUM	3 / 3	179 - 518	518	4 / 4	1080 - 8820	8820
CHROMIUM	3 / 3	4.3 - 56	56	4 / 4	18 - 77.2	77.2
COBALT	1 / 3	2.1	2.1	3 / 4	4.3 - 8.2	8.2
COPPER	3 / 3	1.5 - 13	13	4 / 4	13.1 - 228	228
IRON	3 / 3	228 - 7650	7650	4 / 4	13800 - 52200	52200
LEAD	3 / 3	4.6 - 34.3	34.3	4 / 4	28.7 - 445	445
MAGNESIUM	3 / 3	60.7 - 256	256	4 / 4	401 - 2460	2460
MANGANESE	3 / 3	4.6 - 9.2	9.2	4 / 4	27.1 - 451	451
MERCURY	1 / 3	0.068	0.068	4 / 4	0.027 - 0.63	0.63
NICKEL	2 / 3	2.1 - 6	6	4 / 4	2.3 - 43.8	43.8
POTASSIUM	2 / 3	86.1 - 681	681	4 / 4	542 - 1770	1770
SELENIUM	NOT DETECTED	-	-	4 / 4	1.2 - 3.4	3.4
SODIUM	3 / 3	26.6 - 116	116	4 / 4	28.6 - 420	420
THALLIUM	NOT DETECTED	-	-	1 / 4	2.1	1.85
VANADIUM	3 / 3	5.9 - 42.7	42.7	4 / 4	18.2 - 87.8	87.8
ZINC	3 / 3	14.2 - 26.9	26.9	4 / 4	61.1 - 1720	1720

Note: Selected COPCs are indicated in boldface type.

TABLE 9-2a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS - SITE 6

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	06SD01	06SD02	06SD03	06SD04	---	---	---	SELECTED ARARS
LOCATION:	06SD01	06SD02	06SD03	06SD04	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI				
INORGANICS	mg/kg	mg/kg	mg/kg	mg/kg				mg/kg
aluminum	7610 J	6370	3980	3660 J				-
antimony				12.4 E J				2.00 M
arsenic	21.4 E J	3.0	33.1 E	36.3 E J				8.20 L
barium	94.5 E J	138 E J	13.7	114 E J				40.0 B
beryllium	1.0 J	0.57	0.21					-
cadmium	1.5 E J			1.8 E J				1.20 L
calcium	4880 J	1170	1080	8820 J				-
chromium, total	44.5 J	18.0	22.5	77.2 J				81.0 L
cobalt	8.2 J	4.3		7.7 J				50.0 T
copper	111 E J	20.9	13.1	228 E J				34.0 L
iron	52200 J	13800	15300	46000 J				-
lead	221 E J	41.0 J	28.7 J	445 E J				47.0 L
magnesium	2460 J	1180	401	2330 J				-
manganese	134 J	27.1 J	32.3 J	451 J				460 O
mercury	0.38 E J	0.027	0.060	0.63 E J				0.150 L
nickel	21.7 E J	8.1	2.3	43.8 E J				21.0 L
potassium	956 J	1770	542	1530 J				-
selenium	3.2 J	1.3 J	1.2 J	3.4 J				-
sodium	335 J	191	28.6	420 J				-
thallium	2.1 J							-
vanadium	48.7 J	18.2	43.3	87.8 J				-
zinc	486 E J	87.4 J	61.1 J	1720 E J				150 L
SEMIVOLATILES	ug/kg	ug/kg	ug/kg	ug/kg				ug/kg
acenaphthylene				160 J				-
anthracene		88.0 J		260 J				330 F
benzo(a)anthracene	170 J	580 E	75.0 J	1700 E J				330 F
benzo(a)pyrene	160 J	460 E	110 J	2400 E J				430 L
b[illegible]fluor[illegible]ne	340 E	[illegible]700	[illegible] J	[illegible] E				[illegible]30

TABLE 9-2a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS - SITE 6

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	06SD01	06SD02	06SD03	06SD04	---	---	---	SELECTED ARARS
LOCATION:	06SD01	06SD02	06SD03	06SD04	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI				
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**				**ug/kg**
benzo(g,h,i)perylene	170 J	440 E		2600 E J				330 F
benzo(k)fluoranthene	89.0 J	170 J	66.0 J	1100 E J				330 F
bis(2-ethylhexyl)phthalate		880						890000000 S
carbazole				140 J				330 F
chrysene	240 J	570 E	130 J	2400 E J				330 F
dibenz(a,h)anthracene		150 J		720 E J				330 F
dibenzofuran				78.0 J				2000 P
fluoranthene	380 J	1200	110 J	1600 J				2900 Q
fluorene		83.0 J						540 P
indeno(1,2,3-cd)pyrene	130 J	290	69.0 J	2300 E J				330 F
naphthalene				90.0 J				480 P
phenanthrene	210 J	490		740 J				850 Q
pyrene	380 J	1000 E	130 J	2000 E J				660 L
VOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**				**ug/kg**
4-methyl-2-pentanone	2.0 J							-
toluene	31.0 J							-
xylene (total)	3.0 J							-
PESTICIDES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**				**ug/kg**
4,4'-DDD	230 E J	43.0 E	2.4 E JN	5.4 E R				1.60 L
4,4'-DDE	66.0 E J	10.0 E	5.2 E	30.0 E J				2.20 L
4,4'-DDT	89.0 E JN	9.3 E J	14.0 E	110 E J				1.60 L
aldrin		0.077 R		0.35 R				-
alpha-chlordane	48.0 J	22.0	0.39 R					-
dieldrin			0.31 J	1.6 J				-
endosulfan II	24.0 J	2.6 J		5.6 JN				-
endrin			1.6 JN					-
endrin ketone				7.3 J				-
gamma-chlordane	56.0 E J	23.0 E	0.34 JN					1.70 F

TABLE 9-2a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS - SITE 6

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	06SD01	06SD02	06SD03	06SD04	---	---	---	SELECTED ARARS
LOCATION:	06SD01	06SD02	06SD03	06SD04	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI				
PESTICIDES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**				**ug/kg**
heptachlor	0.35 J	0.16 J						-
heptachlor epoxide	2.3 J	0.24 J	0.20 J	1.0 J				-

TABLE 9-3
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SEDIMENT AT SITE 06
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

SUBSTANCE	BACKGROUND			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
4,4'-DDD	2 / 3	4.9 - 21	21	3 / 4	2.4 - 230	230
4,4'-DDE	1 / 3	1.7	1.7	4 / 4	5.2 - 66	66
4,4'-DDT	1 / 3	19	19	4 / 4	9.3 - 110	110
4-METHYL-2-PENTANONE	-	-	-	1 / 4	2	2
ACENAPHTHYLENE	-	-	-	1 / 4	160	160
ALPHA-CHLORDANE	-	-	-	2 / 4	22 - 48	48
ANTHRACENE	-	-	-	2 / 4	88 - 260	260
BENZO(A)ANTHRACENE	2 / 3	140 - 560	560	4 / 4	75 - 1700	1700
BENZO(A)PYRENE	2 / 3	160 - 590	590	4 / 4	110 - 2400	2064.33
BENZO(B)FLUORANTHENE	2 / 3	150 - 490	490	4 / 4	190 - 4800	4102.58
BENZO(G,H,I)PERYLENE	2 / 3	130 - 380	380	3 / 4	170 - 2600	2231.19
BENZO(K)FLUORANTHENE	2 / 3	150 - 470	470	4 / 4	66 - 1100	942.05
BIS(2-ETHYLHEXYL)PHTHALATE	-	-	-	1 / 4	880	880
CARBAZOLE	-	-	-	1 / 4	140	140
CHRYSENE	2 / 3	250 - 940	940	4 / 4	130 - 2400	2400
DIBENZ(A,H)ANTHRACENE	-	-	-	2 / 4	150 - 720	720
DIBENZOFURAN	-	-	-	1 / 4	78	78
DIELDRIN	-	-	-	2 / 4	0.31 - 1.6	1.6
ENDOSULFAN II	-	-	-	3 / 4	2.6 - 24	20.81
ENDRIN	-	-	-	1 / 4	1.6	1.6
ENDRIN KETONE	1 / 3	1.6	1.6	1 / 4	7.3	7.3
FLUORANTHENE	2 / 3	300 - 1800	1800	4 / 4	110 - 1600	1600
FLUORENE	1 / 3	190	190	1 / 4	83	83
GAMMA-CHLORDANE	1 / 3	0.095	0.095	3 / 4	0.34 - 56	56
HEPTACHLOR	-	-	-	2 / 4	0.16 - 0.35	0.35
HEPTACHLOR EPOXIDE	-	-	-	4 / 4	0.2 - 2.3	2.3
INDENO(1,2,3-CD)PYRENE	2 / 3	110 - 310	310	4 / 4	69 - 2300	1959.32
NAPHTHALENE	-	-	-	1 / 4	90	90
PHENANTHRENE	2 / 3	200 - 1900	1900	3 / 4	210 - 740	740
PYRENE	2 / 3	350 - 1900	1900	4 / 4	130 - 2000	2000
TOLUENE	1 / 3	480	480	1 / 4	31	31
XYLENE (TOTAL)	-	-	-	1 / 4	3	3

Footnotes to sample results:

No value - No positive result occurred for this parameter. (Refer to the complete analytical database appendix for detection limits.)

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

. - No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

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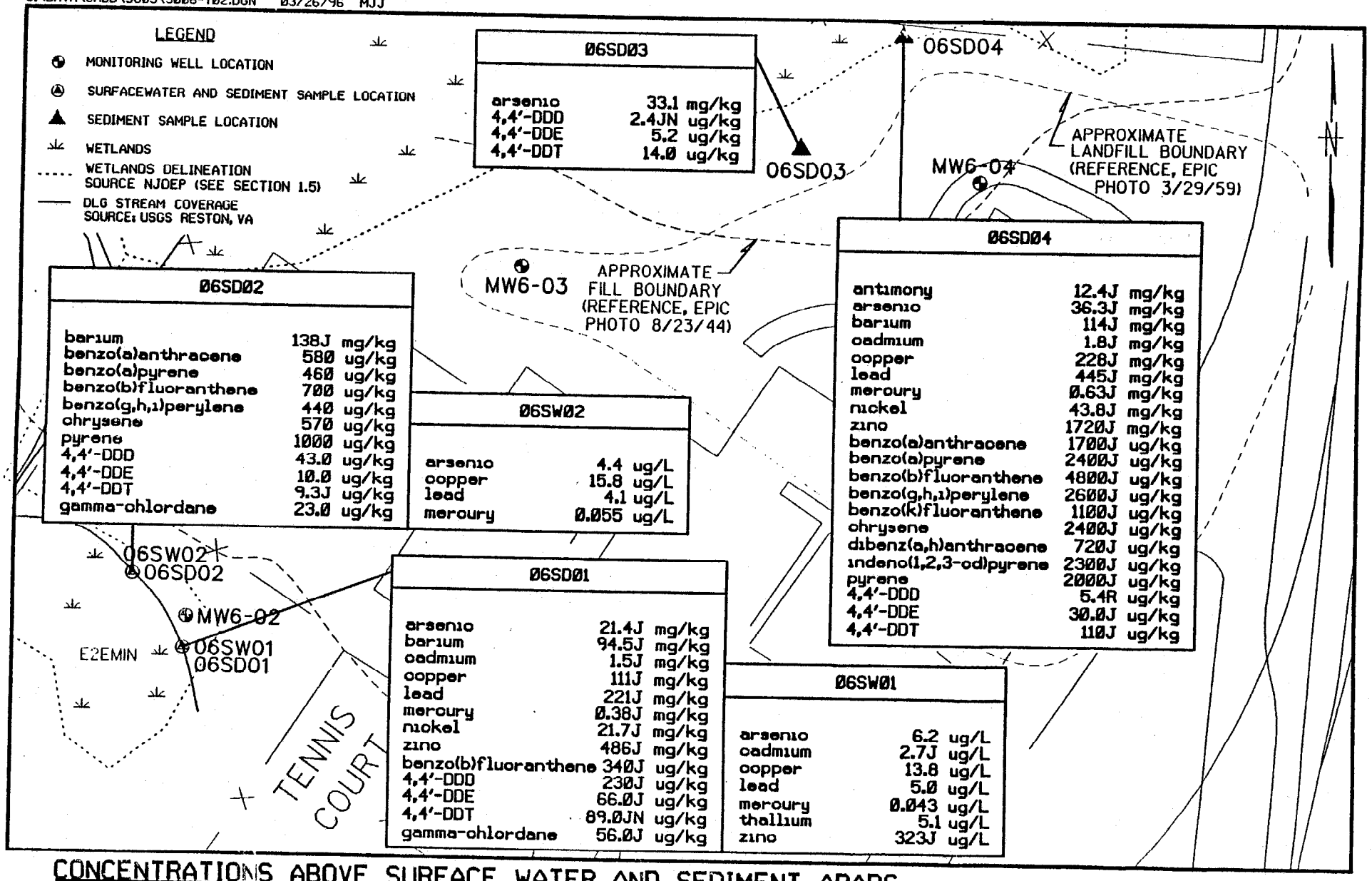

CONCENTRATIONS ABOVE SURFACE WATER AND SEDIMENT ARARS

SITE 6 - LANDFILL WEST OF NORMANDY ROAD

FIGURE 9-4

0 60 120

SCALE IN FEET

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revealed the pesticide DDT and its analogs at the following concentrations: 4,4'-DDT (19 ug/kg), 4,4'-DDE (1.7 ug/kg), and 4,4'-DDD (21 ug/kg). These pesticides were detected in the site-related sediment samples at Site 6, with 4,4'-DDT ranging from 9.3 ug/kg to 110 ug/kg, 4,4'-DDE ranging from 5.2 ug/kg to 66 ug/kg, and 4,4'-DDD ranging from 2.4 ug/kg to 230 ug/kg. Several additional pesticides were detected in site-related sediment samples that were not present in background sediments or present at much lower levels. Trace levels of xylene (3 ug/kg) and 4-methyl-2-pentanone (2 ug/kg) were each detected in one site-related sediment sample, 06 SD 01, but were not found in background sediments. Bis(2-ethylhexyl) phthlalate was present in one site-related sediment sample at a concentration of 880 ug/kg. Toluene was detected in one site-related sediment sample at a level (31 ug/kg) considerably lower than the concentration detected in a background sediment sample (480 ug/kg).

9.5.1.3 Miscellaneous Parameters

The Site 6 sediment analyses consisted of pH and TOC. Results are presented in Appendix A. TOC levels in sediment did not exceed background.

9.5.2 Groundwater

Four site-related groundwater samples (06 GW 01 through 06 GW 04) were collected at Site 6 (Figure 9-1). Tables 9-4 and 9-5 present the occurrence and distribution of inorganic and inorganic chemicals detected in Site 6 background and site-related groundwater samples and compare them to background. Table 9-4a presents a comparison of detected compounds to ARARs. Figure 9-5 shows sample locations and concentrations of compounds which exceed ARARs.

9.5.2.1 Inorganics

Concentrations of most metals in Site 6 groundwater were similar to the ranges detected in background samples. The following metals exhibited concentrations greater than background: cadmium (1.2 ug/L to 7.0 ug/L) and iron (13,400 ug/L to 95,200 ug/L) in samples 06 GW 01, 06 GW 02, 06 GW 03, and 06 GW 04 and manganese in sample 06 GW 01.

9.5.2.2 Organics

Endosulfan I and gamma-BHC were each detected in one groundwater sample collected at Site 6 at concentrations of 0.0021 ug/L and 0.0008 ug/L, respectively. Neither of these compounds were detected in background groundwater samples. Explosives and related degradation products were analyzed for but not detected in groundwater samples.

TABLE 9-4
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN GROUNDWATER AT SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
ALUMINUM	4 / 4	242 - 2030	2030	4 / 4	145 - 1320	1320
ARSENIC	NOT DETECTED	-	-	3 / 4	5.1 - 26.8	26.8
BARIUM	4 / 4	16.2 - 78.1	78.1	4 / 4	30.4 - 64.9	64.9
BERYLLIUM	1 / 4	0.23	0.23	1 / 4	0.21	0.21
CADMIUM	1 / 4	0.51	0.51	4 / 4	1.2 - 7	7
CALCIUM	4 / 4	1070 - 24100	24100	4 / 4	5670 - 89800	89800
CHROMIUM	2 / 4	14.8 - 42.9	42.9	1 / 4	1.2	1.2
COBALT	3 / 4	2.5 - 8.4	8.4	3 / 4	0.81 - 7.6	7.6
IRON	4 / 4	706 - 4600	4600	4 / 4	13400 - 95200	95200
MAGNESIUM	4 / 4	1000 - 8610	8610	4 / 4	3120 - 53000	53000
MANGANESE	4 / 4	14 - 720	720	4 / 4	61.3 - 1820	1820
NICKEL	4 / 4	3.7 - 11.3	11.3	4 / 4	0.76 - 5	5
POTASSIUM	4 / 4	639 - 3550	3550	4 / 4	2250 - 9270	9270
SODIUM	4 / 4	1980 - 92500	78916.59	4 / 4	20800 - 83100	83100
ZINC	4 / 4	3.7 - 30.9	30.9	3 / 4	3.3 - 18.9	18.9

Note: Selected COPCs are indicated in boldface type.

TABLE 9-5
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN GROUNDWATER AT SITE 06
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

SUBSTANCE	BACKGROUND			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
ENDOSULFAN I	NOT DETECTED	-	-	1 / 4	0.0021	0.0021
GAMMA-BHC (LINDANE)	NOT DETECTED	-	-	1 / 4	0.0008	0.0008

TABLE 9-4a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS - SITE 6

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	06GW01	06GW02	06GW03	06GW04	---	---	SELECTED ARARS		
LOCATION:	06GW01	06GW02	06GW03	06GW04	---	---	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI					
INORGANICS	ug/L	ug/L	ug/L	ug/L			ug/L	ug/L	ug/L
aluminum	1320 E	420 E	190	145			-	-	200
arsenic	5.1		8.8 E	26.8 E			50.0	-	8.00
barium	30.4	64.9	48.2	45.0			2000	2000 a	2000
beryllium		0.21					4.00	4000 e	20.0
cadmium	7.0 E	1.2	2.2	5.2 E			5.00	5.00 e	4.00
calcium	22000	5670	8290	89800			-	-	-
chromium, total				1.2			100 *	100 a	100
cobalt	7.6	4.0	0.81				-	-	-
iron	95200 E	13400 E	24800 E	66700 E			-	-	300
magnesium	17300	5220	3120	53000			-	-	-
manganese	1820 E	280 E	61.3 E	855 E			-	-	50.0
nickel	3.7	5.0	0.76	1.0			100	100 a	100
potassium	3620	2250	2440	9270			-	-	-
sodium	83100 E	34800	25000	20800			-	-	50000
zinc	18.9	25.8 R	7.1	3.3			-	2000 a	5000
PESTICIDES	ug/L	ug/L	ug/L	ug/L			ug/L	ug/L	ug/L
endosulfan I				0.0021 J			-	-	0.400
gamma-BHC (Lindane)	0.0008 J						0.200	0.200 a	0.200

TABLE 9-4a
COMPARISON OF GROUNDWATER DATA TO ARARS - SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

No value - No positive result occurred for this parameter. (Refer to the complete analytical database appendix for detection limits.)

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

E - Result exceeds one or more of the selected ARARs.

Footnotes to MCLs, MCLGs, or SMCLs:

. - No standard is available for this chemical in this classification.

a - Where applicable, value(s) represent the more stringent of criteria for total, cis-, and trans- isomers.

* - Criteria are for total chromium.

** - Action level 1300 ug/L for water treatment technology for public water supply systems.

*** - Action level 15 ug/L for water treatment technology for public water supply systems.

Footnotes to Health Advisories:

. - No standard is available for this chemical in this classification.

a - The listed health advisory criterion, lifetime adult, is equal to the most stringent of the EPA health advisories for this chemical.

b - The listed health advisory criterion, long-term adult, is equal to the most stringent of the EPA health advisories for this chemical.

c - The listed health advisory criterion, one-day child, is equal to the most stringent of the EPA health advisories for this chemical.

d - The listed health advisory criterion, ten-day child, is equal to the most stringent of the EPA health advisories for this chemical.

e - The listed health advisory criterion, long-term child, is equal to the most stringent of the EPA health advisories for this chemical.

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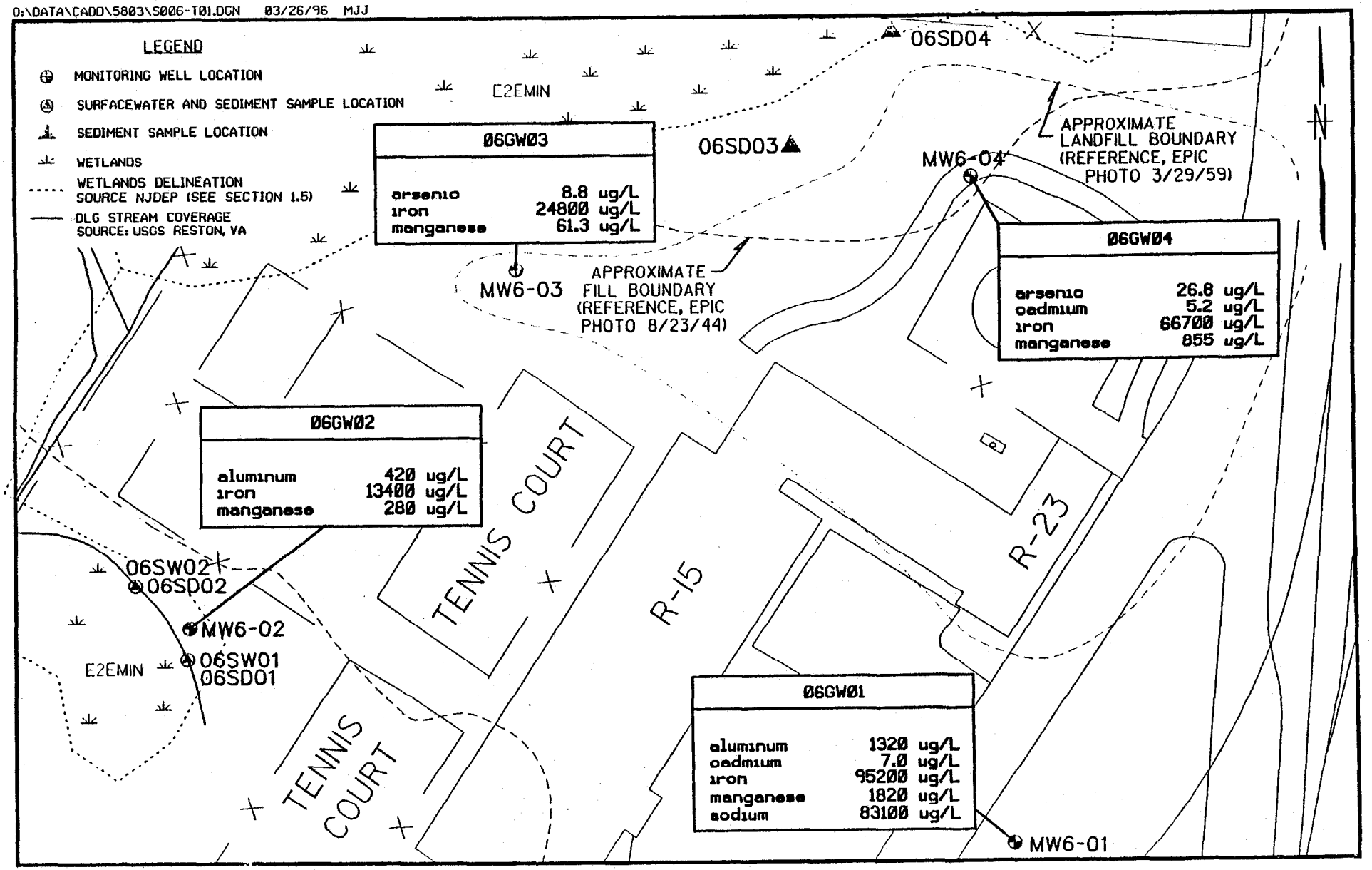

CONCENTRATIONS ABOVE GROUNDWATER ARARS
SITE 6 - LANDFILL WEST OF NORMANDY ROAD

FIGURE 9-5

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9.5.2.3 Miscellaneous Parameters

Miscellaneous parameter analyses of four groundwater samples at Site 6 consisted of ammonia, BOD, COD, chlorides, nitrates, sulfates, TOC, phosphates, and turbidity. Results are presented in Appendix A. Most indicator parameters revealed lower concentrations in all downgradient wells than in upgradient well MW6-01. Downgradient concentrations were slightly greater than upgradient levels and greater than background ranges for ammonia and TOC in MW6-04 and for sulfate in MW6-03. Upgradient well MW6-01 revealed ammonia, chloride, BOD, COD, and TOC at concentrations greater than background. The wells containing maximum detected concentrations were generally consistent with the results of the previous 1993 investigation. None of the indicator parameters in upgradient or downgradient wells were high enough to be within a range typically associated with concentrated landfill leachate (Chian and DeWalle, 1976; ASCE, 1976; Brunner and Keller, 1972).

9.5.3 Surface Water

Two surface water samples were collected in Site 6: 06 SW 01 and 06 SW 02 (Figure 9-1). Table 9-6 presents the occurrence and distribution of inorganic and organic chemicals in site-related surface water samples and compares them to background. No organic chemicals were detected in Site 6 surface water samples. Table 9-6a presents a comparison of detected compounds to ARARs. Figure 9-4 shows sample locations and concentrations of compounds which exceed ARARs.

9.5.3.1 Inorganics

The site-related samples showed the presence of all the metals listed above in addition to arsenic. Concentrations of the following metals were greater than background in both samples: arsenic, iron, manganese, and selenium. Sample 06 SW 01 also revealed barium at a level greater than background.

9.5.3.2 Miscellaneous Parameters

Miscellaneous parameter analyses of the two surface water samples taken at Site 6 consisted of ammonia, BOD, COD, chlorides, total water hardness (hardness), TOC, phosphate, and turbidity. Results are presented in Appendix A. Although several suface water indicator parameters were detected at levels greater than background (chloride, phosphate, nitrate, and ammonia), none were considered to be within a range typically associated with concentrated landfill leachate (op. cit.).

TABLE 9-6
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SURFACE WATER AT SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
ALUMINUM	3 / 3	265 - 409	409	2 / 2	305 - 500	500
ARSENIC	NOT DETECTED	-	-	2 / 2	4.4 - 6.2	6.2
BARIUM	3 / 3	16.3 - 34	34	2 / 2	45.1 - 468	468
BERYLLIUM	2 / 3	0.22 - 0.33	0.33	1 / 2	0.14	0.14
CADMIUM	1 / 3	0.18	0.18	1 / 2	2.7	2.7
CALCIUM	3 / 3	462 - 10100	10100	2 / 2	20000 - 20300	20300
CHROMIUM	3 / 3	0.72 - 2.6	2.6	1 / 2	1.1	1.1
COBALT	3 / 3	0.81 - 1.9	1.9	1 / 2	1.8	1.8
COPPER	2 / 3	1.1 - 9.8	9.8	2 / 2	13.8 - 15.8	15.8
IRON	3 / 3	160 - 702	702	2 / 2	11400 - 13600	13600
LEAD	1 / 3	4.4	4.4	2 / 2	4.1 - 5	5
MAGNESIUM	3 / 3	369 - 2770	2770	2 / 2	5360 - 5390	5390
MANGANESE	3 / 3	14 - 55.5	55.5	2 / 2	337 - 338	338
MERCURY	2 / 3	0.023 - 0.028	0.028	2 / 2	0.043 - 0.055	0.055
NICKEL	3 / 3	2.1 - 7.1	7.1	1 / 2	4.3	4.3
POTASSIUM	2 / 3	251 - 1850	1850	2 / 2	3250 - 3610	3610
SELENIUM	1 / 3	3.5	3.5	2 / 2	3.9 - 4.4	4.4
SODIUM	NOT DETECTED	-	-	2 / 2	53900 - 54700	54700
THALLIUM	2 / 3	3.5 - 5.5	5.5	1 / 2	5.1	5.1
VANADIUM	2 / 3	0.89 - 0.9	0.9	1 / 2	1.2	1.2
ZINC	3 / 3	7.6 - 29.4	29.4	2 / 2	55.4 - 323	323

Note: Selected COPCs are indicated in boldface type.

TABLE 9-6a
COMPARISON OF SURFACE WATER DATA TO ARARS - SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

No value - No positive result occurred for this parameter. (Refer to the complete analytical database appendix for detection limits.)

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

E - Result exceeds one or more of the selected ARARs.

Footnotes to Ambient Water Quality Criteria:

- - No standard is available for this chemical in this classification.

+ - Criterion is hardness dependent and is generated based upon an assumed hardness of 100 mg/L.

TABLE 9-6a

COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS - SITE 6

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	06SW01	06SW02	---	---	---	---	SELECTED ARARS		
LOCATION:	06SW01	06SW02	---	---	---	---	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only
DATA SOURCE:	1995 RI	1995 RI							
INORGANICS	ug/L	ug/L					ug/L	ug/L	ug/L
aluminum	500	305 J					-	-	-
arsenic	6.2 E	4.4 E					189	0.0180	0.140
barium	468 J	45.1					-	-	-
beryllium		0.14					-	-	-
cadmium	2.7 E J						1.10 +	-	-
calcium	20000	20300					-	-	-
chromium, total		1.1					209 +	-	-
cobalt		1.8					-	-	-
copper	13.8 E	15.8 E					11.0 +	-	-
iron	13600	11400					-	-	-
lead	5.0 E	4.1 E					3.20 +	-	-
magnesium	5390	5360					-	-	-
manganese	338	337					-	-	-
mercury	0.043 E	0.055 E					0.0120	0.140	0.150
nickel		4.3					160 +	610	4600
potassium	3610	3250					-	-	-
selenium	3.9 J	4.4 J					5.00	-	-
sodium	53900	54700					-	-	-
thallium	5.1 E						-	1.70	6.30
vanadium		1.2					-	-	-
zinc	323 E J	55.4 J					101 +	-	-

9.6 CONTAMINANT FATE AND TRANSPORT

The behavior of contaminants in the environment at Site 6 is described in this subsection. Various chemicals detected and their transport potential in the environment are discussed in Section 9.6.1. Persistence of detected chemicals in the environment is discussed in Section 9.6.2. Section 9.6.3 presents a brief discussion of contaminant trends.

9.6.1 Detected Chemicals and Transport Potential

Analytical results for the media sampled at Site 6 indicate a wide variety of semivolatile and pesticide compounds, in addition to several inorganics, present in the groundwater and sediment. Only inorganics were present in surface water samples. The physical transport data for the detected contaminants are presented in Table 2-10. Additional discussion with respect to chemical and physical properties, contaminant persistence, and contaminant migration pathways is presented in Section 2.3.

Low levels of two pesticides were detected in groundwater samples. Endosulfan I (downgradient) and gamma-BHC (upgradient) are considered somewhat mobile in groundwater, since their solubilities and K_{oc} values are more favorable for transport than those of organic compounds that are considered highly immobile (for example, PCBs and PAHs). These pesticides may have originated at source locations not identified in this investigation or from source locations that have since been depleted of these compounds. Downgradient samples 06 GW 02, 06 GW 03, and 06 GW 04 revealed elevated concentrations of cadmium, iron, and manganese. However, these data do not suggest migration of inorganic contaminants from the site because upgradient sample 06 GW 01 exhibited the same metals at higher concentrations.

No organics were detected in surface water. Higher concentration of organics detected in the sediments may be attributable to the organic carbon present in the sediments that tends to bind the heavier organics such as PCBs and PAHs.

9.6.2 Contaminant Persistence

For the classes of detected chemicals, environmental persistence varies widely. Transformation of a chemical to its degradation by-product(s) can be the result of numerous processes including biotransformation and uptake, photolysis, acid- or base-catalyzed reaction, or hydrolysis. The by-product chemical(s) may or may not be significantly different toxicologically or be different from a physical transport perspective. If the transformational process is known or suspected, product chemicals can be predicted and extent of transformation can be determined from chemical reaction rate data. Other transformational processes may be identified empirically from analytical data.

Although most chemicals are resistant to chemical change because of their stability and/or lack of reaction sites, many of the more mobile species are subjected to at least limited transformation. Because of more frequent contact with reactive dissolved species and catalysts when compared to unsaturated conditions, the contaminants found in saturated media (groundwater, saturated zone soils, surface water, and sediment) are most likely to be transformed in the environment. Higher molecular weight contaminants tend to be less mobile and less prone to chemical transformation.

9.6.3 Observed Chemical Contaminant Trends

Surface water samples at Site 6 do not demonstrate continuous chemical migration impact from the landfill. The detected sediment contamination could be the result of runoff and erosional dispersion. Organic compounds in sediment fall into three classes: PAHs (which are considered relatively immobile), pesticides (which have varying degrees of mobility), and volatiles (which are considered mobile). Of these classes, the detected levels of PAHs are the highest, although the overall potential for PAH migration impacts is low due to the organic carbon, to which they bind, present in most sediments.

9.6.4 Conclusions

Runoff and erosional dispersion may allow limited migration of contaminated sediments although the compounds found in the sediments may not originate at Site 6. An attempt to obtain surface water samples/sediments from landfill seeps was not possible due to an extended period of dry weather. Detected chemicals in the groundwater indicate the possibility of limited groundwater impacts for certain metals and Endosulfan I at a very low level.

9.7 BASELINE RISK ASSESSMENT

This section presents the results of the baseline risk assessment for Site 6. The risk assessment was performed using the approach outlined in Section 2.4. Tables 9-7 through 9-9 provide the selected COPCs and representative concentrations of inorganics and organics in site-related sediment, groundwater, and surface water (inorganics only), respectively. COPCs and representative concentrations were selected as described in Sections 2.4.1.1, 2.4.1.2, and 2.4.1.3. Exposure pathways, potential receptors, uncertainties, and conclusions are included.

The risk assessment only identifies exposure and risks, not acceptable levels of these parameters. The results of this risk assessment are used for input into the risk management process, where clean-up goals and remediation procedures are identified for a site.

TABLE 9-7
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SEDIMENT - SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)	STATISTICAL DISTRIBUTION
ALUMINUM	7610	NONPARAMETRIC
ANTIMONY	12.4	NONPARAMETRIC
ARSENIC	36.3	NONPARAMETRIC
BARIUM	138	NONPARAMETRIC
BERYLLIUM	0.99	NONPARAMETRIC
CADMIUM	1.8	NONPARAMETRIC
CHROMIUM	77.2	NONPARAMETRIC
COBALT	8.2	NONPARAMETRIC
COPPER	228	NONPARAMETRIC
IRON	52200	NONPARAMETRIC
LEAD	445	NONPARAMETRIC
MANGANESE	451	NONPARAMETRIC
MERCURY	0.63	NONPARAMETRIC
NICKEL	43.8	NONPARAMETRIC
SELENIUM	3.4	NONPARAMETRIC
THALLIUM	1.85	NORMAL
VANADIUM	87.8	NONPARAMETRIC
ZINC	1720	NONPARAMETRIC
4,4'-DDD*	230	NONPARAMETRIC
4,4'-DDE*	66	NONPARAMETRIC
4,4'-DDT*	110	NONPARAMETRIC
4-METHYL-2-PENTANONE*	2	NONPARAMETRIC
ACENAPHTHYLENE*	160	NONPARAMETRIC
ALPHA-CHLORDANE*	48	NONPARAMETRIC
ANTHRACENE*	260	NONPARAMETRIC
BENZO(A)ANTHRACENE*	1700	NONPARAMETRIC
BENZO(A)PYRENE*	2064.33	NORMAL
BENZO(B)FLUORANTHENE*	4102.58	NORMAL
BENZO(G,H,I)PERYLENE*	2231.19	NORMAL
BENZO(K)FLUORANTHENE*	942.05	NORMAL
BIS(2-ETHYLHEXYL)PHTHALATE*	880	NONPARAMETRIC
CARBAZOLE*	140	NONPARAMETRIC
CHRYSENE*	2400	NONPARAMETRIC
DIBENZ(A,H)ANTHRACENE*	720	NONPARAMETRIC
DIBENZOFURAN*	78	NONPARAMETRIC
DIELDRIN*	1.6	NONPARAMETRIC
ENDOSULFAN II*	20.81	NORMAL
ENDRIN*	1.6	NONPARAMETRIC
ENDRIN KETONE*	7.3	NORMAL
FLUORANTHENE*	1600	NONPARAMETRIC
FLUORENE*	83	NONPARAMETRIC
GAMMA-CHLORDANE*	56	NONPARAMETRIC
HEPTACHLOR*	0.35	NONPARAMETRIC
HEPTACHLOR EPOXIDE*	2.3	NONPARAMETRIC
INDENO(1,2,3-CD)PYRENE*	1959.32	NORMAL
NAPHTHALENE*	90	NONPARAMETRIC
PHENANTHRENE*	740	NONPARAMETRIC
PYRENE*	2000	NONPARAMETRIC
TOLUENE*	31	NONPARAMETRIC
XYLENE (TOTAL)*	3	NONPARAMETRIC

* = UNITS FOR ORGANIC CHEMICALS ARE IN ug/kg

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TABLE 9-8
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
GROUNDWATER - SITE 6 (ug/L)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION	STATISTICAL DISTRIBUTION
ARSENIC	26.8	NONPARAMETRIC
BERYLLIUM	0.21	LOGNORMAL
CADMIUM	7	NONPARAMETRIC
IRON	95200	NONPARAMETRIC
MANGANESE	1820	NONPARAMETRIC
ENDOSULFAN I	0.0021	LOGNORMAL
GAMMA-BHC (LINDANE)	0.0008	LOGNORMAL

TABLE 9-9
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SURFACE WATER - SITE 6 (ug/L)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION	STATISTICAL DISTRIBUTION
ALUMINUM	500	NONPARAMETRIC
ARSENIC	6.2	NONPARAMETRIC
BARIUM	468	NONPARAMETRIC
BERYLLIUM	0.14	NONPARAMETRIC
CADMIUM	2.7	NONPARAMETRIC
COBALT	1.8	NONPARAMETRIC
COPPER	15.8	NONPARAMETRIC
IRON	13600	NONPARAMETRIC
LEAD	5	NONPARAMETRIC
MANGANESE	338	NONPARAMETRIC
MERCURY	0.055	NONPARAMETRIC
SELENIUM	4.4	NONPARAMETRIC
VANADIUM	1.2	NONPARAMETRIC
ZINC	323	NONPARAMETRIC

9.7.1 Risk Characterization

The results of the risk assessment are presented in the risk characterization and are discussed on a receptor-specific basis. The identified potential receptors have been evaluated on the basis of hypothetical future land use (residential, recreational, and industrial receptors).

9.7.1.1 Future Industrial Employee

The estimated total cancer risks for the future industrial employee for exposure to COPCs in groundwater at Site 6 are 1.4E-04 (ingestion) and 1.9E-07 (dermal contact). The total groundwater cancer risk exceeds the 1E-04 to 1E-06 target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate ARARs. The principal COPC contributing to the groundwater cancer risk is arsenic (ingestion, 97 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HQs for the future industrial employee assuming exposure to iron and manganese via ingestion of groundwater at Site 6 are 3.1 and 3.6, respectively. The estimated individual noncarcinogenic HQs for the future industrial employee assuming exposure to COPCs via dermal contact with groundwater are less than 1.0. Adverse noncarcinogenic health effects cannot be ruled out when the HI is above 1.0. The target organ for manganese is the central nervous system and the target organs for iron are the pancreas and liver.

Estimated carcinogenic risks and noncarcinogenic HQs are presented for future industrial receptors exposed to groundwater at Site 6 in Tables 9-10 and 9-11, respectively.

9.7.1.2 Future Residential Receptor

The estimated total cancer risks for the future lifetime resident assuming exposure to COPCs in groundwater at Site 6 are 6.1E-04 (ingestion), 4.5E-06 (dermal contact), and 3.9E-08 (inhalation of volatiles). The groundwater cancer risk exceeds the 1E-04 to 1E-06 target acceptable risk range. The principal COPCs contributing to the groundwater cancer risk are arsenic (ingestion, 98 percent of the cancer risk for this pathway; and dermal contact, 32 percent of the cancer risk for this pathway) and beryllium (dermal contact, 68 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HQs for the future child resident assuming exposure to arsenic, iron, and manganese via ingestion of groundwater at Site 6 are 5.7, 20, and 23, respectively. The estimated noncarcinogenic HQs for the future child resident assuming exposure to manganese via dermal contact with groundwater is 1.5. Adverse noncarcinogenic health effects cannot be ruled out when the HI exceeds 1.0. The target organs are as follows: arsenic: skin, iron: pancreas and liver, and manganese: central nervous system.

TABLE 9-10
CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 6
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
ENDOSULFAN I	N/A	N/A
GAMMA-BHC (LINDANE)	3.6E-09	2.3E-10
ARSENIC	1.4E-04	6.1E-08
BERYLLIUM	3.2E-06	1.3E-07
CADMIUM	N/A	N/A
IRON	N/A	N/A
MANGANESE	N/A	N/A
TOTAL RISK	1.4E-04	1.9E-07

NA = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 9-11
NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 6
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
ENDOSULFAN I	3.4E-06	2.9E-07
GAMMA-BHC (LINDANE)	2.6E-05	1.7E-06
ARSENIC	8.7E-01	3.8E-04
BERYLLIUM	4.1E-04	1.7E-05
CADMIUM	1.4E-01	1.1E-03
IRON	3.1E+00	2.5E-02
MANGANESE	3.6E+00	4.9E-02

NA = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

Estimated carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to groundwater at Site 6 in Tables 9-12 and 9-13, respectively.

9.7.1.3 Future Recreational Receptor

The estimated total cancer risks for the future recreational child assuming exposure to COPCs in sediment during wading at Site 6 are 9.3E-07 (ingestion) and 2.1E-07 (dermal contact). The cancer risks for exposure to COPCs in surface water during wading at Site 6 are 1.9E-07 (ingestion) and 3.6E-08 (dermal contact). This sediment cancer risk is below the 1E-04 to 1E-06 target acceptable risk range.

The estimated individual noncarcinogenic HQs for the future recreational child assuming exposure to COPCs in sediment during wading at Site 6 are less than 1.0 for ingestion and dermal contact exposure pathways. The estimated individual noncarcinogenic HQs for exposure to COPCs in surface water during wading at Site 6 are less than 1.0 for ingestion and dermal contact exposure pathways. Adverse noncarcinogenic health effects are not anticipated when the HI is below 1.0.

Estimated carcinogenic risks and noncarcinogenic HQs are presented for future recreational receptors exposed to sediment at Site 6 in Tables 9-14 and 9-15, respectively. Estimated carcinogenic risks and noncarcinogenic HQs are presented for future recreational receptors exposed to surface water at Site 6 in Tables 9-16 and 9-17, respectively.

9.7.1.4 IEUBK Lead Modeling Results

The IEUBK Lead Model was not applied at this site since lead was not detected in groundwater samples and because of the absence of surface soil and subsurface soil sampling at this site.

9.7.2 Conclusions

Sediment, groundwater, and surface water were sampled at Site 6. The potential receptors considered for this site were future industrial, residential, and recreational receptors. The cancer risk associated with future industrial (groundwater) and future residential (groundwater) exposure scenarios was approximately 1E-04, the upper end of the target acceptable risk range. Arsenic (via ingestion of groundwater) was the major COPC that contributed to the cancer risk for these exposure scenarios. Noncarcinogenic HQs associated with future industrial (groundwater) and residential (groundwater) exposure scenarios exceeded 1.0, the cutoff point below which adverse noncarcinogenic effects are not expected to occur. Arsenic (via ingestion), iron (via ingestion), and manganese (via ingestion) are the COPCs that exceeded 1.0 for these exposure scenarios. Risk characterization results (total cancer risks and total noncarcinogenic HIs) are presented for all potential receptors at Site 6 in Table 9-18 for sediment, groundwater, and surface water.

TABLE 9-12
CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 6
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIME	INHALATION OF VOAS IN GW - ADULT
ENDOSULFAN I	N/A	N/A	N/A
GAMMA-BHC (LINDANE)	1.5E-08	7.4E-09	3.9E-08
ARSENIC	6.0E-04	1.4E-06	N/A
BERYLLIUM	1.3E-05	3.0E-06	N/A
CADMIUM	N/A	N/A	N/A
IRON	N/A	N/A	N/A
MANGANESE	N/A	N/A	N/A
TOTAL RISK	6.1E-04	4.4E-06	3.9E-08

NA = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 9-13
NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 6
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - CHILD	GROUNDWATER DERMAL CONTACT - CHILD	INHALATION OF VOAS IN GW - ADULT
ENDOSULFAN I	2.2E-05	1.1E-05	N/A
GAMMA-BHC (LINDANE)	1.7E-04	6.4E-05	N/A
ARSENIC	5.7E+00	1.2E-02	N/A
BERYLLIUM	2.7E-03	5.2E-04	N/A
CADMIUM	8.9E-01	3.5E-02	N/A
IRON	2.0E+01	7.9E-01	N/A
MANGANESE	2.3E+01	1.5E+00	N/A

NA - NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 9-14
CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 6
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
4,4'-DDD	6.0E-10	1.5E-10
4,4'-DDE	2.5E-10	6.1E-11
4,4'-DDT	4.1E-10	1.0E-10
4-METHYL-2-PENTANONE	N/A	N/A
ACENAPHTHYLENE	N/A	N/A
ALPHA-CHLORDANE	6.8E-10	1.7E-10
ANTHRACENE	N/A	N/A
BENZO(A)ANTHRACENE	1.4E-08	*
BENZO(A)PYRENE	1.7E-07	*
BENZO(B)FLUORANTHENE	3.3E-08	*
BENZO(G,H,I)PERYLENE	N/A	N/A
BENZO(K)FLUORANTHENE	7.5E-10	*
BIS(2-ETHYLHEXYL)PHTHALATE	1.4E-10	5.3E-11
CARBAZOLE	3.1E-11	*
CHRYSENE	1.9E-10	*
DIBENZ(A,H)ANTHRACENE	5.8E-08	*
DIBENZOFURAN	N/A	N/A
DIELDRIN	2.8E-10	1.1E-10
ENDOSULFAN II	N/A	N/A
ENDRIN	N/A	N/A
ENDRIN KETONE	N/A	N/A
FLUORANTHENE	N/A	N/A
FLUORENE	N/A	N/A
GAMMA-CHLORDANE	8.0E-10	2.0E-10
HEPTACHLOR	1.7E-11	8.5E-12
HEPTACHLOR EPOXIDE	2.3E-10	1.1E-10
INDENO(1,2,3-CD)PYRENE	1.6E-08	*
NAPHTHALENE	N/A	N/A
PHENANTHRENE	N/A	N/A
PYRENE	N/A	N/A
TOLUENE	N/A	N/A
XYLENE (TOTAL)	N/A	N/A
ALUMINUM	N/A	N/A
ANTIMONY	N/A	N/A
ARSENIC	6.0E-07	2.5E-08
BARIUM	N/A	N/A
BERYLLIUM	4.7E-08	1.8E-07
CADMIUM	N/A	N/A
CHROMIUM	N/A	N/A
COBALT	N/A	N/A
COPPER	N/A	N/A
IRON	N/A	N/A
LEAD	N/A	N/A
MANGANESE	N/A	N/A
MERCURY	N/A	N/A
NICKEL	N/A	N/A
SELENIUM	N/A	N/A
THALLIUM	N/A	N/A
VANADIUM	N/A	N/A
ZINC	N/A	N/A
TOTAL RISK	9.3E-07	2.1E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL
CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 9-15
NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 6
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
4,4'-DDD	NA	NA
4,4'-DDE	NA	NA
4,4'-DDT	2.8E-05	7.0E-06
4-METHYL-2-PENTANONE	3.2E-09	6.3E-10
ACENAPHTHYLENE	NA	NA
ALPHA-CHLORDANE	1.0E-04	2.5E-05
ANTHRACENE	1.1E-07	3.4E-08
BENZO(A)ANTHRACENE	NA	NA
BENZO(A)PYRENE	NA	NA
BENZO(B)FLUORANTHENE	NA	NA
BENZO(G,H,I)PERYLENE	NA	NA
BENZO(K)FLUORANTHENE	NA	NA
BIS(2-ETHYLHEXYL)PHTHALATE	5.6E-06	2.2E-06
CARBAZOLE	NA	NA
CHRYSENE	NA	NA
DIBENZ(A,H)ANTHRACENE	NA	NA
DIBENZOFURAN	2.5E-06	4.9E-07
DIELDRIN	4.1E-06	1.6E-06
ENDOSULFAN II	4.4E-07	1.5E-07
ENDRIN	6.8E-07	2.1E-07
ENDRIN KETONE	NA	NA
FLUORANTHENE	5.1E-06	2.0E-06
FLUORENE	2.7E-07	1.1E-07
GAMMA-CHLORDANE	1.2E-04	3.0E-05
HEPTACHLOR	8.9E-08	4.4E-08
HEPTACHLOR EPOXIDE	2.3E-05	1.1E-05
INDENO(1,2,3-CD)PYRENE	NA	NA
NAPHTHALENE	2.9E-07	1.1E-07
PHENANTHRENE	NA	NA
PYRENE	8.5E-06	2.6E-06
TOLUENE	2.0E-08	7.8E-09
XYLENE (TOTAL)	1.9E-10	8.4E-11
ALUMINUM	9.7E-04	7.7E-04
ANTIMONY	4.0E-03	3.1E-03
ARSENIC	1.5E-02	6.4E-04
BARIUM	2.5E-04	2.5E-04
BERYLLIUM	2.5E-05	1.0E-04
CADMIUM	4.6E-04	3.6E-04
CHROMIUM	2.0E-03	3.9E-03
COBALT	1.7E-05	1.4E-05
COPPER	7.3E-04	NA
IRON	2.2E-02	NA
LEAD	NA	NA
MANGANESE	1.2E-02	NA
MERCURY	2.7E-04	NA
NICKEL	2.8E-04	NA
SELENIUM	8.7E-05	NA
THALLIUM	3.0E-03	NA
VANADIUM	1.6E-03	NA
ZINC	7.3E-04	NA

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 9-16
CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 6
SURFACE WATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE WATER INGESTION	SURFACE WATER DERMAL CONTACT
ALUMINUM	N/A	N/A
ARSENIC	1.0E-07	5.0E-09
BARIUM	N/A	N/A
BERYLLIUM	6.6E-09	3.1E-08
CADMIUM	N/A	N/A
COBALT	N/A	N/A
COPPER	N/A	N/A
IRON	N/A	N/A
LEAD	N/A	N/A
MANGANESE	N/A	N/A
MERCURY	N/A	N/A
SELENIUM	N/A	N/A
VANADIUM	N/A	N/A
ZINC	N/A	N/A
TOTAL RISK	1.1E-07	3.6E-08

N/A - NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 9-17
NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 6
SURFACE WATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE WATER INGESTION	SURFACE WATER DERMAL CONTACT
ALUMINUM	6.4E-05	6.0E-05
ARSENIC	2.6E-03	1.3E-04
BARIUM	8.5E-04	9.9E-04
BERYLLIUM	3.6E-06	1.7E-05
CADMIUM	6.9E-04	6.4E-04
COBALT	3.8E-06	3.6E-06
COPPER	5.1E-05	3.9E-06
IRON	5.8E-03	5.4E-03
LEAD	N/A	N/A
MANGANESE	8.6E-03	1.3E-02
MERCURY	2.3E-05	3.6E-05
SELENIUM	1.1E-04	6.5E-06
VANADIUM	2.2E-05	1.0E-04
ZINC	1.4E-04	2.6E-05

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 9-18
SUMMARY OF ESTIMATED CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 6
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index***				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	9.3E-07	N/A	N/A	N/A	N/A	6.4E-02
	Dermal Contact	N/A	N/A	N/A	2.1E-07	N/A	N/A	N/A	N/A	9.3E-03
Groundwater	Ingestion	N/A	1.4E-04	6.1E-04	N/A	N/A	7.7E+00	5.0E+01	N/A	N/A
	Dermal Contact	N/A	1.9E-07	4.4E-06	N/A	N/A	7.6E-02	2.4E+00	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	3.9E-08	N/A	N/A	N/A	N/A	N/A**	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	1.1E-07	N/A	N/A	N/A	N/A	1.9E-02
	Dermal Contact	N/A	N/A	N/A	3.6E-08	N/A	N/A	N/A	N/A	2.1E-02
TOTAL		-	1.4E-04	6.2E-04	1.3E-06	-	7.8E+00	5.2E+01	-	1.1E-01

N/A - Not applicable because this media is not associated with this potential receptor
N/S - Not sampled
* - During Showering, Adult Residents Only
** - No volatile noncarcinogens were detected in groundwater
*** - Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects

9.8 ECOLOGICAL RISK

9.8.1 Habitat Types and Ecological Receptors

Building R-15, two tennis courts, and a handball court have been built on the landfill. The areas around the buildings and courts are mowed grass. Some black locust and box elder trees are located adjacent to the landfill. A *Phragmites* tidal marsh is located around the base of the landfill; this area eventually drains to Sandy Hook Bay. Soils in this wetland area are Sulfaquents black muck soils that are saturated to the surface. The landfill contains no ecological habitat, but the adjacent marsh provides excellent, extensive habitat for terrestrial and saltmarsh-related ecological receptors. No threatened or endangered species are known to exist on or near the Site 6.

9.9 EVALUATION AND RECOMMENDATIONS

9.9.1 Evaluation Summary

The results of the human health risk assessment indicate future scenario cancer risks above the target acceptable range as a result of projected consumption of shallow groundwater from the area. However, due to the low quality of the shallow groundwater in the area (salt concentrations are found in the range of sea water due to intrusion from the adjacent salt marsh) this scenario is not realistic. Without the assumption that future employees or residents would consume site groundwater, the cancer risk would be in the range of background.

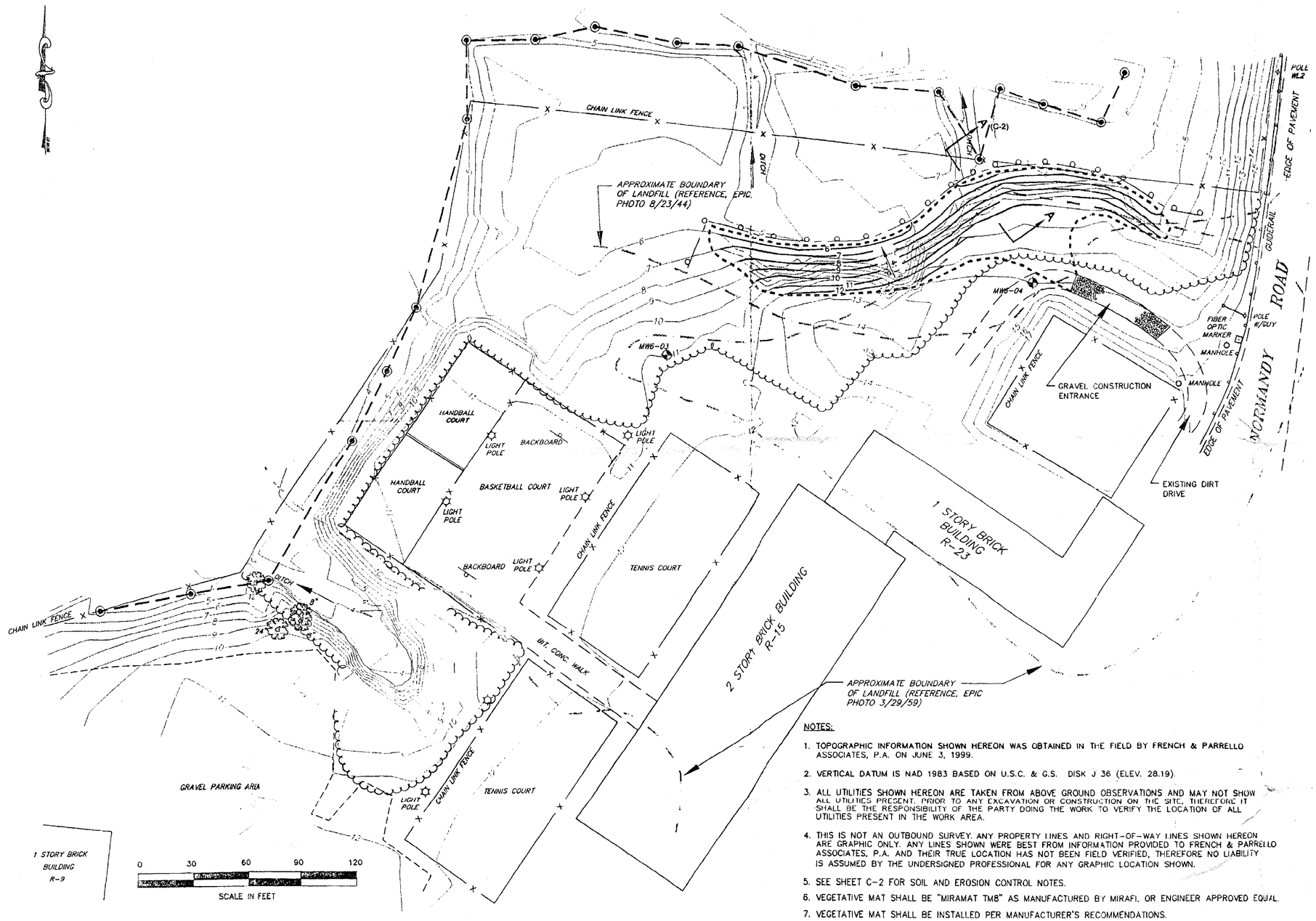
The comparison of site HQs exceeding 1 to background HQs indicates that this site may be within the range of background risk.

The presence of metals and organics in sediments and surface water confirms the need to do a more rigorous ERA for the salt marsh and possibly a FS to determine if future actions are needed.

9.9.2 Recommendations

Performance of a more rigorous ERA is needed to gauge impacts on salt marsh.

Future use of groundwater for human consumption is not feasible because of the proximity of the salt marsh.



LEGEND:

- EXISTING ELEVATION CONTOUR
- PROPOSED ELEVATION CONTOUR
- LIMIT OF WETLANDS
- LIMIT OF DISTURBANCE
- FENCE
- SILT FENCE
- LIMIT OF HISTORICAL LANDFILL ACTIVITIES

NOTES:

1. TOPOGRAPHIC INFORMATION SHOWN HEREON WAS OBTAINED IN THE FIELD BY FRENCH & PARRELLO ASSOCIATES, P.A. ON JUNE 3, 1999.
2. VERTICAL DATUM IS NAD 1983 BASED ON U.S.C. & G.S. DISK J 36 (ELEV. 28.19).
3. ALL UTILITIES SHOWN HEREON ARE TAKEN FROM ABOVE GROUND OBSERVATIONS AND MAY NOT SHOW ALL UTILITIES PRESENT. PRIOR TO ANY EXCAVATION OR CONSTRUCTION ON THE SITE, THEREFORE IT SHALL BE THE RESPONSIBILITY OF THE PARTY DOING THE WORK TO VERIFY THE LOCATION OF ALL UTILITIES PRESENT IN THE WORK AREA.
4. THIS IS NOT AN OUTBOUND SURVEY. ANY PROPERTY LINES AND RIGHT-OF-WAY LINES SHOWN HEREON ARE GRAPHIC ONLY. ANY LINES SHOWN WERE BEST FROM INFORMATION PROVIDED TO FRENCH & PARRELLO ASSOCIATES, P.A. AND THEIR TRUE LOCATION HAS NOT BEEN FIELD VERIFIED, THEREFORE NO LIABILITY IS ASSUMED BY THE UNDERSIGNED PROFESSIONAL FOR ANY GRAPHIC LOCATION SHOWN.
5. SEE SHEET C-2 FOR SOIL AND EROSION CONTROL NOTES.
6. VEGETATIVE MAT SHALL BE "MIRAMAT TM8" AS MANUFACTURED BY MIRAFI, OR ENGINEER APPROVED EQUAL.
7. VEGETATIVE MAT SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS.
8. FOR KEY PLAN AND SOILS MAP, SEE KEY PLAN AND SOILS MAP IN THE ATTACHED SOIL EROSION AND SEDIMENT CONTROL DOCUMENTS.

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TIME: 3:22 PM

FOSTER WHEELER ENVIRONMENTAL

REV.	DESCRIPTION	PREP BY	DATE	APPRVD
0	SUBMITTED TO S.C.S.	J.L.	7/30/99	M.W.J.

DSGN: B.K.J. DR: JF CK: MWJ CH. ENG: B.K.
SUBMITTED BY: (TITLE) (DATE)
RECOMMENDED: DIV. NO.
FPO. NO.
FPO. NO.
OFFICER IN CHARGE
APPROVED DATE

NAVAL FACILITIES ENGINEERING COMMAND
NORTHERN DIVISION
DEPARTMENT OF THE NAVY
LISTED
PENNSYLVANIA
NORTHERN DIV.
DATE

NWS-EARLE – SITE 6 LANDFILL
SLOPE STABILIZATION
SITE PLAN AND SOIL AND EROSION CONTROL PLAN

MICHAEL JUNGHANS
N.J. P.E. NO. 39877

CODE I.D. NO.	80091
SCALE :	AS NOTED
SPEC. NO.	04–
CONSTRN. CONTR NO.	N62472–
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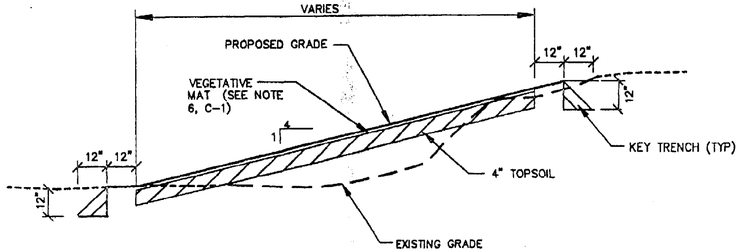

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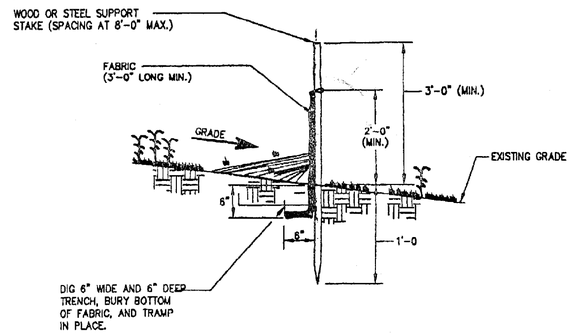
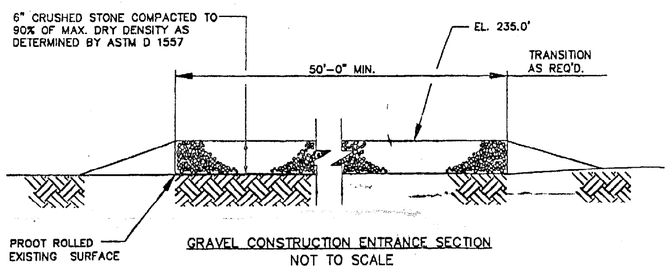


SILT FENCE DETAIL
NOT TO SCALE



GRAVEL CONSTRUCTION ENTRANCE SECTION
NOT TO SCALE

SOIL EROSION AND SEDIMENT CONTROL NOTES

1. ALL SOIL EROSION AND SEDIMENT CONTROL PRATICES ARE TO BE INSTALLED PRIOR TO ANY MAJOR SOIL DISTURBANCE, OR IN THEIR PROPER SEQUENCE, AND MAINTAINED UNTIL PERMANENT PROTECTION IS ESTABLISHED.
2. ANY DISTURBED AREAS THAT WILL BE LEFT EXPOSED MORE THAN THIRTY (30) DAYS, AND NOT SUBJECT TO CONSTRUCTION TRAFFIC, WILL IMMEDIATELY RECEIVE A TEMPORARY SEEDING. IF THE SEASON PREVENTS THE ESTABLISHMENT OF A TEMPORARY COVER, THE DISTURBED AREAS WILL BE MULCHED WITH STRAW , OR EQUIVALENT MATERIAL, AT A RATE OF TWO TONS PER ACRE, ACCORDING TO STATE STANDARDS.
3. PERMANENT VEGETATION TO BE SEEDED OR SODDED ON ALL EXPOSED AREAS WITHIN TEN (10) DAYS AFTER FINAL GRADING. MULCH OR SUITABLE EQUIVALENT TO BE USED AS NECESSARY FOR PROTECTION UNTIL SEEDING IS ESTABLISHED.
4. ALL WORK TO BE DONE IN ACCORDANCE WITH THE STANDARDS FOR SOIL EROSION AND SEDIMENT CONTROL OF NEW JERSEY.
5. IMMEDIATELY FOLLOWING INITIAL DISTURBANCE OR ROUGH GRADING, **ALL CRITICAL AREAS SUBJECT TO EROSION** (I.E. STEEP SLOPES AND ROADWAY EMBANKMENTS) WILL RECEIVE A TEMPORARY SEEDING IN COMBINATION WITH STRAW MULCH OR A SUITABLE EQUIVALENT, AT A RATE OF TWO (2) TONS PER ACRE, ACCORDING TO STATE STANDARDS.
6. THE STANDARD FOR STABILIZED CONSTRUCTION ENTRANCE REQUIRES THE INSTALLATION OF A PAD OF 1 1/2" TO 2" STONE, AT ALL CONSTRUCTION DRIVEWAYS, IMMEDATELY AFTER INITIAL SITE DISTURBANCE. SEE DRAWING C-1 FOR LAYOUT AND DRAWING C-2 FOR DETAILS.
7. IN ACCORDANCE WITH THE STANDARD FOR PERMANENT VEGETATIVE COVER FOR SOIL STABLIZATION, ANY SOIL HAVING A pH OF 4 OR LESS OR CONTAINING IRON SULFIDES SHALL BE COVERED WITH A MINIMUM OF TWELVE (12) INCHES OF SOIL HAVING A pH OF 5 OR MORE PRIOR TO SEEDBED PREPERATION.
8. THE FREEHOLD SOIL CONSERVATION DISTRICT SHALL BE NOTIFIED SEVENTY-TWO (72) HOURS IN ADVANCE OF ANY LAND DISTURBING ACTIVITY.
9. AT THE TIME THE SITE PREPARATION FOR PERMANENT VEGETATIVE STABILIZATION IS GOING TO BE ACCOMPLISHED, ANY SOIL THAT WILL NOT PROVIDE A SUITABLE ENVIRONMENT TO SUPPORT ADEQUATE VEGETATIVE GROUND COVER, SHALL BE REMOVED OR TREATED IN SUCH A WAY THAT WILL PERMANENTLY ADJUST THE SOIL CONDITIONS AND RENDER IT SUITABLE FOR VEGETATIVE GROUND COVER.
   IF THE REMOVAL OR TREATMENT OF THE SOIL WILL NOT PROVIDE SUITABLE CONDITIONS, NONVEGETATIVE MEANS OF PERMANENT GROUND STABILIZATION WILL HAVE TO BE EMPLOYED.
10. IN THAT N.J.S.A. 4:24-39 et.seq. REQUIRES THAT NO CERTIFICATES OF OCCUPANCY BE ISSUED BEFORE THE PROVISIONS OF THE CERTIFIED PLAN FOR EROSION CONTROL HAVE BEEN COMPLIED WITH FOR PERMANENT MEASURES, ALL SITE WORK FOR SITE PLANS AND ALL WORK AROUND INDIVIDUAL LOTS IN SUBDIVISIONS, WILL HAVE TO BE COMPLETED PRIOR TO THE DISTRICT ISSUING A REPORT OF COMPLIANCE FOR THE ISSUANCE OF A CERTIFICAATE OF OCCUPANCY BY THE MUNICIPALITY.
11. ANY CHANGES TO THE CERTIFIED SOIL EROSION AND SEDIMENT CONTROL PLANS WILL REQUIRE THE SUBMISSION OF REVISED SOIL EROSION AND SEDIMENT CONTROL PLANS TO THE DISTRICT FOR RECERTIFICATION. THE REVISED PLANS MUST MEET ALL CURRENT STATE SOIL EROSION AND SEDIMENT CONTROL STANDARDS.
12. UNFILTERED DEWATERING IS NOT PERMITTED. TAKE ALL NEJESSARY PRECAUTIONS DURING ALL DEWATERING OPERATIONS TO MINIMIZE SEDIMENT TRANSFER.
13. SHOULD THE CONTROL OF DUST AT THE SITE BE NECESSARY, THE SITE WILL BE SPRINKLED UNTIL THE SURFACE IS WET, TEMPORARY VEGETATIVE COVER SHALL BE ESTABLISHED OR MULCH SHALL BE APPLIED IN ACCORDANCE WITH STATE STANDARDS FOR EROSION CONTROL.
14. ALL SOIL WASHED, DROPPED, SPILLED, OR TRACKED OUTSIDE THE LIMIT OF DISTURBANCE OR ONTO PUBLIC RIGHT-OF-WAYS WILL BE REMOVED IMMEDIATELY.
15. THE PROPERTY OWNER SHALL BE RESPONSIBLE FOR ANY EROSION OR SEDIMENTATION THAT MAY OCCUR BELOW STORMWATER OUTFALLS OR OFFSITE AS A RESULT OF CONSTRUCTION OF THE PROJECT
16. STOCKPILE AND STAGING LOCATIONS DETERMINED IN THE FIELD, SHALL BE PLACED WITHIN THE LIMIT OF DISTURBANCE ACCORDING TO THE CERTIFIED PLAN. STAGING AND STOCKPILES NOT LOCATED WITHIN THE LIMIT OF DISTURBANCE WILL REQUIRE CERTIFICATION OF A REVISED SOIL EROSION AND SEDIMENT CONTROL PLAN. THE DISTRICT RESERVES THE RIGHT TO DETERMINE WHEN CERTIFICATION OF A NEW AND SEPARATE SOIL EROSION AND SEDIMENT CONTROL PLAN WILL BE REQUIRED FOR THESE ACTIVITIES.
17. ALL SOIL STOCKPILES ARE TO BE TEMPORARILY STABILIZED IN ACCORDANCE WITH SOIL EROSION AND SEDIMENT CONTROL NOTE 2.
18. A COPY OF THE CERTIFIED SOIL EROSION AND SEDIMENT CONTROL PLAN WILL BE AVAILABLE AT THE SITE.
19. ALL TEMPORARY SOIL EROSION MEASURES MUST BE INSPECTED (AND REPAIRED IF NEEDED) AFTER ANY SIGNIFICANT RAIN EVENT

APPROXIMATE CONSTRUCTION SCHEDULE

TASK	TIME TO COMPLETE
1. INSTALLATION OF SOIL EROSION CONTROL MEASURES	2 DAYS
2. CLEARING AND GRUBBING	3 DAYS
3. ROUGH GRADING OF SITE	2 DAYS
4. INSTALLATION OF SOIL AND VEGETATIVE MAT	10 DAYS
5. ESTABLISHMENT OF VEGETATION	2 DAYS
6. REMOVAL OF TEMPORARY CONTROL MEASURES	1 DAY

FOSTER WHEELER ENVIRONMENTAL

REV.	DESCRIPTION	PREP BY	DATE	APPRV'D
0	SUBMITTED TO S.C.S.	J.L.	7/30/99	M.N.J.

NAVAL FACILITIES ENGINEERING COMMAND — PENNSYLVANIA

DEPARTMENT OF THE NAVY — NORTHERN DIVISION — LESTER

NWS-EARLE - SITE 6 LANDFILL
SLOPE STABILIZATION
SECTIONS AND DETAILS

NORTHERN FOR COMMANDER, NAVFAC

SEAL AREA

MICHAEL JUNGHANS
N.J. P.E. NO. 39877

CODE I.D. NO. 80091
SCALE : AS NOTED
SPEC. NO. 04-
CONSTRUC. CONTR. NO. N62472-
NAVFAC DRAWING NO.
SHEET 2 OF 2
SIZE: D
DIS. SH. NO. C-2

CAD FILE NAME: SITE6LF.DWG
PLOT SCALE: 1=1
DATE: 08/02/99
TIME: 3:35 PM

DATE CREATED
LATEST CHANGE
CHANGED BY:

SPECIFICATION COVER SHEET

NAVAL WEAPONS STATION EARLE
Leonardo, New Jersey

SPECIFICATIONS

DIVISION 2 - SITE WORK
Section 02110 - Clearing and Grubbing
Section 02200 - Earthwork
Section 02485 - Seeding and Erosion Protection

FOR

SITE 6
SLOPE STABILIZATION

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Revision	Prepared by	Reviewed by	Approved by	Date	Pages Affected
0	J. Lyon		M. Junghans	Jul-99	ALL

SECTION 02110
SITE CLEARING AND GRUBBING

PART 1 - GENERAL

The work required under this Section includes furnishing all plant, labor, equipment, and materials for performing all operation required for clearing and grubbing the site.

1.1 Definitions

1.1.1 Clearing: Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including down timber, snags, brush, and rubbish occurring within the areas to be cleared.

1.1.2 Grubbing: Grubbing shall consist of the removal and disposal of stumps, roots larger than 1-½ inches in diameter, and matted roots and decayed matter to a depth not less than 12 inches below original ground in the designated grubbing areas.

1.2 Dust Control

The Contractor shall comply with dust control requirements specified on drawing C-2, note 13.

PART 2 - REQUIRED WORK

2.1 Clearing:

2.1.1 Clearing shall consist of the removal of all trees (cut just above ground surface), brush, logs, limb wood, rubbish, and all other obstructions on the surface of the original ground within the limits of clearing shown on the Contract Drawings, except such trees and vegetation as may be directed by the Engineer or his designee to be left standing.

2.1.2 Trees directed to be left standing within the cleared areas shall be trimmed of dead branches 1-½ inches or more in diameter and shall be trimmed of all branches to the heights directed. Limbs and branches to be trimmed shall be neatly cut close to the bole of the tree or main branches. Cuts more than 1-½ inches in diameter shall be painted with a tree-wound paint approved by the Engineer.

2.1.3 Trees and vegetation to be left standing shall be protected from damage incident to clearing, and construction operations by the erection of barriers or by such other means as the circumstances require.

2.2 Grubbing:

The Contractor shall grub areas within the limit of disturbance shown on Contract Drawings.

2.3 Disposal

The Contractor shall dispose of all materials from clearing and grubbing off-site.

END OF SECTION

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SECTION 02200
EARTHWORK

PART 1 - GENERAL

The work required under this section includes furnishing all labor, equipment and materials for performing all operations for soil excavation and placement of soil materials required to perform the remediation.

1.1 Definitions

1.1.1 Soil Excavation: Soil excavation shall consist of grading required to prepare the slope to a 4:1 slope.

1.1.2 On Site Fill Material: Soil material resulting from re-grading of the slope.

1.1.3 Off-Site Clean Material: Off-site clean material consists of clean soil material imported from an off-site source.

1.2 Applicable Publications

The latest edition of the following publications will be followed for the work to be performed.

ASTM D2216	Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregates Mixture
ASTM D698	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5-1/2 lb. (2.49 kg) Rammer and 12-inches (304.8 mm) Drop
ASTM-D1556	Density of Soil in Place by the Sand-Cone Method
ASTM-D2922	Density of Soil and Soil-Aggregate in Place by Nuclear Methods
ASTM-D3017	Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Method

PART 2 - REQUIRED WORK

2.1 The Contractor shall grade the site in accordance with the elevation contours presented on the Contract Drawings. Clearing and grubbing will be performed in accordance with Specification Section 02110. Topsoil shall be stripped and stockpiled separately. Soil cut from the site may be reused where fill is required as approved by the Engineer. The Contractor shall compact all materials placed to achieve the required density and moisture content.

2.2 During the grading operations, some excavation of the site and redistribution of the existing stockpiled material will be required to obtain the necessary grades shown on the Contract Drawings.

2.3 The Contractor shall perform the necessary surveys during the performance of the required work and submit the results to the Engineer for acceptance.

2.4 All equipment and material supplied by the Contractor shall be in good working condition and shall not be contaminated.

2.5 Soil material cut from the site shall be temporarily stockpiled on-site as directed by the Engineer.

2.6 The Contractor shall decontaminate all equipment prior to removal from the site in accordance with the Project Health and Safety Plan of this Contract.

2.7 The Contractor shall maintain all work areas free from excess dust to such reasonable degree as to avoid causing a hazard or nuisance to others. Dust control shall be performed as the work proceeds and wherever a dust nuisance or hazard occurs.

2.8 The Contractor shall furnish, install and maintain all erosion control measures as shown on the Contract Drawings during the course of placement operations.

2.9 Placement activities specified in this Section shall conform to safety requirements as specified in OSHA part 1926.

PART 3 - QUALITY ASSURANCE

3.1 Field Inspection and Testing of the Placement and Compaction of the Material.

3.1.1 The tests listed below shall be performed as specified. Field test reports shall be submitted daily for record as required.

(1) Laboratory Maximum Density: Laboratory maximum density tests shall be performed on all materials in accordance with ASTM D698. Prior to placing, at least two tests for each different material shall be performed on representative samples of the material to be placed. Additional tests shall be performed if the composition of the material being used is different than that previously tested.

(2) Moisture Content: At least two tests for each different material for moisture content shall be performed in accordance with ASTM D2216.

(3) In-Place Testing: In-place density and moisture content testing on the materials being placed shall be performed by nuclear materials in accordance with ASTM Standards D2922 and D3817 or the Sand Cone Method for density in accordance with ASTM Standard D1556. In-place density shall be determined at a depth of 12 inches below grade and the tests shall be performed for each 500 cubic yards placed but not less frequently than one test each day for each area being compacted. The nuclear density equipment shall be recalibrated whenever a different material is being placed and compacted.

3.1.2 The Contractor shall perform the necessary surveys required during the placement operations.

3.1.3 The Contractor shall give advance notice to the Engineer or his designee to witness and/or inspect all activities, particularly testing.

PART 4 - MATERIALS

4.1 Fill Materials

4.1.1 On-Site Fill Materials

On-site fill materials consist of soil material excavated during re-grading the site. The acceptability of on-site fill material for reuse as backfill shall be determined by the Engineer.

4.1.2 Off Site Fill Material

The Contractor shall furnish sufficient amounts of off-site fill material from an off-site location as needed. Off-site fill material fill shall contain no sod, brush, roots, or other perishable materials. Off-site fill shall be obtained from off-site area(s) accepted by the Engineer or his designee.

4.1.3 Off-Site Topsoil

The Contractor shall furnish sufficient amounts of off-site topsoil material required to provide a minimum of four inches of topsoil over disturbed areas to be vegetated. The Contractor may reuse stockpiled topsoil as approved by the Engineer.

PART 5 - EXECUTION

5.1 The Contractor shall rough grade the site as required to obtain the grades shown on the Contract Drawings.

5.2 A tolerance of minus 2 inches will be permitted for rough grading the site.

5.3 On-site fill, off-site fill material shall be placed in approximately horizontal layers not to exceed 12 inches and compacted to the rough graded lines.

5.4 Density of the common fill shall be a minimum of 90% of the maximum dry density achieved in Standard Proctor tests (ASTM D698-78) unless otherwise specified. The water content shall not vary more than plus or minus 3% of the optimum moisture content as determined in the lab and accepted by the Engineer. In-place density and moisture content testing on material shall be performed by nuclear methods in accordance with ASTM Standards ASTM D2922-80 and ASTM D3017-78 or the Sand Cone Method for density in accordance with ASTM Standard D1556-82. In-place density shall be determined at a depth of 12 inches below grade and tests shall be performed for each 500 cubic yards placed but not less frequently than one test each day for

area being compacted. The nuclear density equipment shall be recalibrated whenever a different soil is to be placed.

5.5 Off-site clean material, if required, shall be placed in approximately horizontal layers. The thickness of each layer before compaction shall not exceed 12 inches. Materials placed by dumping in piles or windrows shall be spread uniformly to not more than 12 inches thickness before being compacted.

END OF SECTION

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SECTION 02485
SEEDING AND EROSION PROTECTION

PART 1 - GENERAL

The work required under this Section includes furnishing all plant, labor, equipment, and materials to provide fertilizer, mulching, and seeding for the site area, as well as any other disturbed areas requiring vegetation.

1.1 Applicable Publications

Standards for Soil Erosion and Sediment Control in New Jersey, Latest edition.

PART 2 - MATERIALS

2.1 Fertilizers

2.1.1 Quality and Formulation

Fertilizer may be either fluid or dry formulations of commercial carriers of available plant nutrients. Fertilizer shall contain total nitrogen, available phosphoric acid, and soluble potash in the ratio of 10-20-10.

2.1.2 Basis of Acceptance

Manufacturer's label or certificate indicating compliance with specifications. The Engineer or his designee reserves the right to reject any material that has become caked or otherwise damaged.

2.2 Seeds

2.2.1 Quality

Each species, variety, and strain of grasses, legumes, and cereals shall be as specified unless otherwise approved.

2.2.1.1 Materials other than pure live seed shall comprise only nonviable seed, chaff, hulls, live seed of crop plants other than those specified, harmless inert matter and weed seeds except that weed seeds other than seed of noxious weeds will be permitted up to 1 percent of gross weight of each kind of seed. Legume seeds shall be accompanied by adequate amounts of proper inoculants unless accompanied by certification of preinoculation.

2.2.1.2 The percentage of purity as shown on the label shall be acceptable. The percentage of germination as shown on the label shall be not less than the minimum percentage specified.

2.2.2 Packaging

Each kind of seed shall be furnished and delivered, unless otherwise approved, in separate, sealed containers, or bags acceptably sewn tight or sealed.

2.2.3 Seed Mixture

Seed mixture shall be:

Name	Variety	Wt. of Seed Per Acre (lbs)
Tall Fescue	Commercial	218
Ryegrass	Commercial	88
Total		300 lbs/acre

2.3 Mulch

Either hay or straw may be used for mulch. Hay for mulching shall be mowings of acceptable herbaceous growth free from noxious weeds. Straw for mulching shall be stalks of oats, wheat, rye or other approved crops free from noxious weeds. Materials which are low grade and unfit for farm use such as "U.S. Sample Grade" will be acceptable. Weight shall be calculated on the basis of material having not more than 15% of moisture content. In addition, wood chips, if available, may be used as mulch.

PART 3 - APPLICATION AND CONSTRUCTION

3.1 Fertilizer Application

Fertilizer shall be evenly spread over surface of soil in areas as directed. Rates of application shall be as required to promote plant growth. Tests required to determine rate of fertilizer application shall be made by the Contractor and the rate accepted by the Engineer. Any method of application which will ensure an even distribution will be acceptable.

3.2 Seeding Application

3.2.1 Rates

Rates for seeding shall be as specified.

3.2.2 Season

Unless otherwise directed by the Engineer, work shall be performed during normal planting seasons of the year. The Contractor shall notify the Engineer at least 48 hours in advance of the time he intends to begin sowing seed and shall not proceed with such work until permission has been obtained. When delays in operations carry the work beyond dates which are specified, or when conditions of high winds, excessive moisture or ice are such that satisfactory results are not likely to be obtained for any stage of the work, the Engineer will stop work. Work shall be resumed with the Engineer's approval when desired results are likely to be obtained or when accepted corrective measures and procedures are adopted.

3.2.3 Ground Preparation and Seeding

3.2.3.1 Areas to be seeded shall be maintained at approved grades. Irregularities and low places which will hold water shall be eliminated. Fertilizers and seeds shall be evenly distributed on the surfaces to be seeded. All mechanical equipment for soil preparation or seeding shall be as approved and shall pass parallel to the contours unless otherwise approved.

3.2.3.2 When directed by the Engineer, measured plots shall be established to determine if specified quantities of seed, fertilizer, and mulch are being applied. The finished surface of any area that is seeded shall not be rougher, more uneven or have more or larger stones, clods, roots, or other foreign materials than the area it adjoins.

3.2.3.3 Areas to be seeded shall be scarified sufficiently to break up surface crust immediately before seeding except where ground is loose and friable as immediately following grading or as otherwise approved. All stones over six inches in greatest dimension which are loose and subject to rolling or sliding or other sizes as specified and all other objects detrimental to mowing shall be removed and disposed of as approved. Fertilizers and seed may be mixed together immediately before placing. Methods of distribution such as by air or water pressure will be acceptable except that the seed shall not be injured in the process of spreading.

3.3 Mulching

3.3.1 Surface of areas where mulch is to be applied shall be cleared of stones, stumps, wire, and other obstacles which might hinder subsequent seeding operations. Ground shall be harrowed or disked to produce a state of suitable tillage.

3.3.2 Mulch shall be spread uniformly in a continuous blanket of sufficient thickness to completely hide soil from view. Mulch may be spread before

or not later than three days after seeding unless otherwise approved. Anchorage to hold mulch in place may be applied by an approved method during mulching operation or subsequently.

3.3.3 Contractor shall install a vegetative mat, Miramat TM8, on all sloped areas, as manufactured by Mirafi or Engineer-approved equal. The mat shall be installed in accordance with manufacturer's recommendations.

3.4 Erosion and Sediment Control

3.4.1 Contractor shall conduct his operations in accordance with the approved erosion and sediment control plan included in the Contract Documents. Temporary erosion and sediment control measures shall be provided and maintained until the permanent work is completed. The area of bare soil exposed at any given time by construction shall be restricted to a minimum.

PART 4 - CARE DURING CONSTRUCTION

The Contractor shall care for seeded and mulched areas until final acceptance. Such care shall consist of repairing areas damaged following seeding or mulching operations due to wind, water, fire or other causes. Damaged areas shall be repaired to re-establish condition and grade of area prior to seeding and shall be re-fertilized, re-seeded, and re-mulched as specified herein. The Contractor shall keep seeded areas mowed until acceptance by cutting to a height of three inches when growth reaches six inches, or as directed.

PART 5 - QUALITY CONTROL

5.1 When, in the judgment of the Engineer, at any time prior to acceptance, any area which has been seeded fails to produce a satisfactory growth of grass after a suitable period of time has elapsed, the Contractor shall re-seed and re-fertilize such areas as specified. If deemed necessary by the Engineer, the Contractor shall also re-mulch such areas at the rate specified.

END OF SECTION

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