REVISED

NEW RIVER AND TRIBUTARIES STUDY RADFORD ARMY AMMUNITION PLANT RADFORD, VIRGINIA

PREPARED FOR:

U.S. ARMY
ENVIRONMENTAL CENTER
Aberdeen Proving Ground, Maryland

PREPARED BY:

PARSONS ENGINEERING SCIENCE, INC.

10521 Rosehaven Street
Fairfax, Virginia 22030

DECEMBER 1997

AEC Form 45, 1 Feb 93 replaces THAMA Form 45 which is obsolete.

Response to

USEPA Comments on
New River and Tributaries Study
Radford Army Ammunition Plant
***Radford, Virginia*, May 1997**

1. Sample locations are listed in Tables 1 and 2 and shown in Figure 2. Tables 1 and 2 and Figure 2 depict 29 sampling locations, yet it is reported on page 4-4 that 28 locations were sampled. Clarify this discrepancy. Also, there appears to be inconsistency in the reported number of samples collected. For instance, Paragraph 1 on p. 4-4 describes a total of 28 sediment samples. In counting the samples on Page 4-5 in Table 2, the reviewer counts 9 sediment samples collected in the 1995 event and 20 sediment samples collected in the 1996 sampling event. Furthermore, Table 7, lists metals occurring at a frequency of detection of XX/**29**. QA/QC samples should not be presented along with the other data without being identified. Nor should QA/QC samples be used in determining frequency of detection. Please check the data, tables and text and verify the frequency of detection.

   Response:

   Section 4.1 has been expanded to clarify the sample count. 29 total samples were used for the study. However, this total included sampling data from different sampling events performed at different times and with different objectives. Therefore, not all parameters were collected from all samples. For example, SPG3 SE/SW 1, a New River sediment and surface water sample collected to characterize the subsurface migration pathways associated with SWMU 17, was only analyzed for metals and explosives (the contaminants of concern for that SWMU). That sample, plus two others, was not analyzed for VOCs or SVOCs resulting in a total of only 26 samples for those parameters. All data were used since they provide information useful in determining potential risks to human health and the environment.

   No QA/QC samples have been included in the frequency of detection totals. In addition to the expanded Section 4.1, an explanatory footnote has been added to Table 7 to help clarify sample totals.

2. **Table 2, Page 4-6**, add pesticides to this table.

   Response:

   Pesticides are shown on this table, in the same column as PCBs.

3. **Table 3, Page 4-9**. Table 3 includes information for total petroleum hydrocarbon (TPH) analysis. However, TPH analysis was not included in the study. Please remove information for TPH analysis from the Table.

   Response:

   Table 3 has been revised.

4. **Table 3, Page 4-9**. Table 2 includes the following analyses among those for surface water samples: metals - total and dissolved, pesticides and PCBs and chloride. However, Table 3 does not include sample preservation and holding time information for total metals, pesticide and PCBs or chloride analyses. Add this information to Table 3.

Response:

This information has been added to Table 3.

5. **Table 3, Page 4-9**. Table 3 references an analytical method for TOC as MCAWW 415.1. However, Table 2 referenced SW-846 9060 for TOC analysis. Resolve this discrepancy regarding TOC methodology. It should be noted that the analytical method identified in the Work Plan for TOC is MCAWW 415.1.

Response:

Table 3 has been revised to indicate TOC analysis by MCAWW415.1.

6. **Table 3, Page 4-9**. Add the sample preservation and holding time for sediment sample analysis for acid volatile sulfides (AVS) analysis to Table 3.

Response:

This information has been added to Table 3.

7. **Section 4**. Add a paragraph to this section summarizing deviations from the Work Plan.

Section 4.1 states that "it was not possible to ensure that each sediment sample contained at least 50% fines, the section does not state that the Work Plan required the sediment samples to be collected from fine grained depositional areas with at least 50% fine grained (silt and clay) sediment. . .". This section needs to state that only three of the sediment samples met this requirement and clearly specify which tributaries could not be sampled because they were dry during the sampling event.

In addition, the Work Plan stated that description of each sample would be included in the Report, Table 1 may be an appropriate location for the description. Add each sample description to the Report.

Response:

Section 4.1 has been expanded to clarify the Work Plan requirements and to indicate the number of samples meeting the requirement. However, the reviewers should understand that within a reasonable lateral variation from the selected sample location, the depositional environment may be such that a sample containing at least 50% fines can not be obtained.

Table 1 has been expanded to include sediment sample descriptions.

8. **Section 4.3, Page 4-7.** This section states that the "*Quality Assurance Project Plan (QAPjP), Engineering-Science, Inc., May 1994, provides the procedures to be used to ensure that all activities conform to the project requirements.*" EPA's November 1, 1996 Conditional Approval for the Work Plan specifically requires that the April 1995 version of the QAPjP be followed. Therefore, identify the differences between the May 1994 and April 1995 QAPjPs as applied to this investigation and evaluate the impact on this study.

Response:

This reference is in error. The April 1995 QAPjP was followed for this study. The differences between the two versions are minor, involving mainly the addition of pesticide and PCB analyses for the samples. The reference has been corrected.

9. **Section 6.2, Page 6-13**. The Work Plan states that a map showing "key ecological features such as community types" will be developed. This map is not included in the report. Figure 2, a blown-up copy of the USGS 7.5 minute quadrangle map, does not designate the "Horseshoe Area" with its "large contiguous stand of pine trees" or the mixed hardwood forest. The location of the cliff community also is not designated. Therefore, include such a map in the revised report.

Response:

This map has been included as Figure 4. The level of detail is commensurate with the screening level effort; as described in Section 6.2.1, a more detailed map will be completed by the VDGIF.

10. **Section 6.2.1, Page 6-13**. The content of the first two sentences is awkwardly stated. The reader is left wondering how the soil can be seasonally flooded or saturated but there is "*never*" dominant hydrophytic vegetation and *"never"* hydric soils. The sentences need clarification. Are there areas where water periodically lays but is not there a sufficient amount of time to develop hydrophytic vegetation or hydric soils? If this is the case, it should be clearly stated. Also, it should be stated in this subheading whether there are temporary pools that could be habitat for herpitiles. Page 6-14 states that vernal pools are "scattered throughout the mixed hardwood and pine forests". Please correct the Report.

Response:

This section has been clarified.

11. **Section 6.2.2, Page 6-16, Paragraph 1.** In this paragraph, threatened and endangered species are discussed. It is indicated that the VA Department of Conservation and Recreation, Natural Heritage Program was contacted concerning potential sensitive habitats and federal and state statuses for sensitive species that may occur in the project area. No mention is made about coordination with the Fish and Wildlife Service (FWS). This information should be provided in the text. Discuss any recommendations made by FWS. If the FWS does not need to be contacted or had no recommendations, so state in the text.

Response:

The FWS was not contacted since the Virginia DCR and the ongoing VDGIF survey will provide the most complete and accurate information available. The ongoing survey is discussed in Section 6.

12. **Section 6.2.2, Page 6-16, Paragraph 1.** Threatened and endangered species are discussed in this paragraph. The writer states, "the VA Department of Game and Inland Fisheries has been awarded a contract to survey RFAAP for endangered plant and animal species." No further information about this survey is provided for the reader. If possible, identify who awarded the contract and when and how the survey will be conducted. It should be noted that the acceptability of any study's conclusions is directly related to the qualifications of the individual's qualifications performing the work.

Response:

The facility contractor, Alliant Techsystems contracted the VDGIF to conduct an extensive two year ecological survey. Section 6 describes this effort in more detail.

13. **Section 6.2.2, Page 6-16, Paragraph 1 and 2.** These paragraphs detail information provided by the Natural Heritage Program. Provide a map showing the locations of the sensitive habitats (*e.g.*, caves) and species of concern mentioned by the Natural Heritage Program. This information is necessary so that the reader can see how closely these resources are located to the boundary of RFAAP.

Response:

Specific locational information was not provided by the DCR. It is expected that comprehensive, detailed mapping will be part of the VDGIF effort.

14. **Section 6.2.3, Page 6-18, Paragraph 2.** This paragraph states that a statistical summary of all New River and tributary data is included as Appendix D. Appendix D is the National Heritage Program Data. Provide a statistical summary appendix.

Response:

It was not intended to include a statistical summary as an appendix since many of the elements of the summary, e.g., frequency of detection and maximum detection, were incorporated directly into the tables in the report. No stand alone statistical summary is included.

15. **Table 6, Page 6-17.** Table 6 lists rare species identified in the vicinity of RFAAP. Table 6 should show the "Heritage Rank" for the smooth coneflower (*Echinacea laevigata*) as "G2G3/S2/LE/NS" and the "Federal Rank" for the Virginia fringed mountain snail (*Polygyriscus virginicus*) as "LE" or "Listed Endangered." Under the state rank and federal rank columns no ranks are given for the Herot's Cave isopod, a cave dipluran, or James cave amphipod. If no legal statuses are assigned to these species, then modify the table to reflect this information.

Response:

The table has been modified.

16. **Table 6, Page 6-17.** Table 6 lists rare species identified in the vicinity of RFAAP. In the footnotes under Table 6, no explanations are given for the LE, NF or NR abbreviations. Include explanations for these abbreviations in the footnotes for clarity.

Response:

The table has been modified.

17. **Section 6.2.3, Page 6-24**. The Report states, "*Chemical that were not detected at any sampling locations were eliminated from the screening process.*" The exception to this statement is when a sample detection limit is greater than the screening number. Should a detection limit exceed the screening level, that chemical shall be retained as a chemical of potential concern (COPC). Revise the Report to retain as COPCs those non-detected chemicals where the detection limit is greater than the screening level or state that the detection limits for the non-detect chemical do not exceed the screening level.

The Environmental Protection Agency's approval letter for the November 1996 Work Plan inadvertently approved deleting chemicals a COPC if it is detected in less than five percent of samples in a sample set of 20 or more. Therefore, revise Tables 8, 9, and 10, eliminating the frequency of detection criterion from the determination.

Response:

Tables 11 A and 11 B have been added to the report to address those non-detected chemicals where the detection limit is greater than the screening level. Where no screening criteria were available, the chemical was retained for this phase of the screening level ecological risk assessment. These actions have resulted in the addition of 67 chemicals to the sediment COPC list and 85 chemicals to the surface water COPC list.

The frequency of detection criterion has been eliminated, resulting in an addition of 15 samples to the sediment COPC list. Table 9 has been revised to show the 15 chemicals retained as COPCs. No surface water samples had been eliminated by using this criterion, therefore no changes were required for Table 8.

18. **Table 7, Page 6-19 and Appendix C**. The data contained in Table 7 was spot-checked with Appendix C to determine if there were any discrepancies between the two. Unfortunately, data are missing. For instance, samples NRSE1 to 6 listed on Table 5, p. 6-6 are missing from the raw data in Appendix C; page 1 of the sediment data starts with NRSE7. Although these samples were collected in 1995, include these data so that tables within the New River and Tributaries document can be verified.

Discrepancies exist between Table 7 and Appendix C. For instance, one cannot duplicate the frequency of detection column of Table 7, using the information provided in Appendix C. While spot checking, it was determined that the frequency of surface water samples for Di-n-butylphthalate was 2/10, not 2/13 as listed in Table 7 and for Barium (total) was 6/12, not 14/16, respectively. Please correct the table.

Response:

The last sentence of Section 6.1 states that the 1995 data are contained in the Parsons ES RFI report, (Volume II, Appendix G). Just as the Work Plan for this study was supplemental to the overall project Work Plan, this report references material which has previously been presented more comprehensively (e.g., site background) in other submittals.

The Table 7 totals originally presented are correct. Using table 4, and not counting the QA/QC duplicates SCSW3, NRSW8, or NRSW38, Di-n-butylphthalate was detected in 2 of 13 samples, and barium (total) was detected in 14 of 16 samples. Note that SCSW3(B) is not the same sample as SCSW3.

19. **Table 7. Page 6-20**. "Not detected" is a more appropriate footnote then the present definition for the dashes. The present definition in the footnote is, "Not a chemical of potential concern in this media". Table 7 is presented prior to screening for chemicals of potential concern. The title of Table 7 is misleading since the screening against ecological benchmarks does not occur prior to this table. Please use a title such as "Frequency of detection".

Response:

Table 7 has been revised to include this footnote.

20. **Table 7, Page 6-19 and Table 9, Page 6-22**. Discrepancies exist between the Table 7 and the Table 9 "frequency of detection" columns. For example, bis(2-Ethylhexyl)phthalate is listed as having a frequency of detection of 1/26 and 7/26 on Tables 7 and 9, respectively. Please correct the tables.

Response:

Both tables have been revised to eliminate discrepancies.

21. **Table 8, Page 6-21**. Please explain why the lead and zinc surface water criterion's equations specify a different hardness value then that specified in footnote five. Verify hardness dependent surface water screening criteria values.

Response:

This error has been corrected. The hardness value is 134 mg/L.

22. **Table 9, Page 6-23**. The reviewer cannot calculate the same mean organic carbon value located at the bottom of Table 9 p. 6-23. Using information provided from Table 5 on pp. 6-5 to 6-12, the mean total organic carbon value is be 1.32, not 1.25 as listed in Table 9. Verify the mean organic carbon value and adjust sediment quality criteria as necessary.

Response:

The value has been recalculated. The correct mean total organic carbon percentage should be 1.22. All appropriate adjustments have been made. It is possible that the reviewer included QA/QC samples in the count. QA/QC samples SCSE3, NRSE8, and NRSE30, are shown on Table 5 but are not included in the sample totals for Tables 7 through 10.

23. **Table 10, Page 7-2**. The surface water screening criterion for lead is incorrectly typed in Table 10. Correct the table

Response:

This correction has been made.

24. **Tables 7, 8, 9, and 10.** When revising the tables, change the number format from the scientific notation to a general format. Eliminating the scientific notation will reduce the chance for error when comparing the value to the published criteria.

Response:

This change has been made.

25. **Appendix B, Volatile Organics, third page.** This paragraph states that reported detections of methylene chloride in the associated samples less than or equal to 10 times the level in the contaminated blank have been requalified as nondetects. The approved QAPjP does not allow this to be done. Revise all necessary tables using the appropriate qualifier.

Response:

This error has been corrected for Volatile Organics, and other parameters, where necessary. Revised Appendix C data summary tables have been submitted. The positive results tables have been corrected, as appropriate.

26. **Figure 2, oversized map in plastic sleeve.** Add the locations of detected chemical (and their values) to this figure.

Response:

It is not practical to add all of the sample data to the oversized map. For many reasons, the oversized map is not available in an electronic version and is therefore difficult to change or manipulate. Even if it were available in an electronic version, the inclusion of all of the positive detections for 29 sediment and 16 surface water samples would result in a virtually unreadable map with so many features hidden that the map would not be very useful. The original version of the map should be retained.

27. Although Appendix C, Data Summary Tables, shows the analytical results for each sample, please include as an appendix, the laboratory's report which includes the sample identification number, collection and analytical dates, analytical method, detection or quantation limits, sample results, and any qualifiers.

Response:

One copy of the laboratory data sheets has been included for review. It has not been made part of the report.

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TABLE OF CONTENTS

Page

REVISED
NEW RIVER AND TRIBUTARIES STUDY
RADFORD ARMY AMMUNITION PLANT
RADFORD, VIRGINIA

TABLE OF CONTENTS
(Continued)

Page

LIST OF TABLES

LIST OF FIGURES

APPENDICES

SECTION 1

INTRODUCTION

This document is the draft report for the New River and Tributaries Study at the Radford Army Ammunition Plant (RFAAP) located in Radford, Virginia. This report has been prepared for the U.S. Army Environmental Center (USAEC), and is being submitted under the requirements of Contract No. DAAA15-90-D-0008, Task DA04. The document was prepared by Parsons Engineering Science (Parsons ES).

A Permit for Corrective Action and Incinerator Operation (No. VA1-21-002-0730) was issued to Hercules Incorporated and the U.S. Army by the U.S. Environmental Protection Agency (USEPA), under the authority of the Solid Waste Disposal Act, as amended by RCRA (1976), and the Hazardous and Solid Waste Amendments (HSWA) of 1984. RFAAP is owned by the U.S. Army. In 1995, Alliant Techsystems assumed the responsibility of operating RFAAP from Hercules Incorporated. The RCRA permit allows Alliant Techsystems to operate a hazardous waste treatment, storage, and disposal facility in Radford, Virginia. The full RCRA permit comprises USEPA's portion, which addresses provisions of HSWA, and the Virginia Department of Environmental Quality portion, which addresses the provisions of RCRA for which the Commonwealth of Virginia is authorized. Corrective action is addressed by HSWA and enforced by USEPA. Section 3004(u) of RCRA (Section 206 of HSWA requires corrective action as necessary to protect human health and the environment from releases of hazardous waste constituents from any solid waste management unit (SWMU). The corrective action permit includes requirements for RFAAP to conduct verification investigations (VIs) at sites of suspected contamination, RFIs at sites of known contamination, and Corrective Measures Studies (CMSs) at sites requiring remediation.

In 1992, RFAAP completed several VIs and RFIs at selected SWMUs throughout the installation. Results of those studies were presented in the Draft RFI Report (Dames & Moore, 1992a) and the Draft VI Report (Dames & Moore, 1992b). Parsons ES was tasked

to conduct further investigations at SWMUs 17, 40, 31, 48, and 54, based upon recommendations made in those reports. The results of those investigations were presented in the *RCRA Facility Investigation for Solid Waste Management Units 17, 31, 48, and 54 at Radford Army Ammunition Plant, Parsons Engineering Science, January 1996.*

USEPA comments on that report and previous investigation reports indicated that further characterization of the New River and its tributaries was warranted. Therefore, USEPA required that a screening level ecological risk assessment be performed. During USEPA's August 19, 1996 site visit, members of the Biological Technical Assistance Group traveled the New River in a boat to select tributary sampling sites. Upon their return, they provided the Army the desired sampling locations. Pursuant to those USEPA requirements, Parsons ES prepared the *Supplemental Work Plan, New River and Tributaries Sampling, Radford Army Ammunition Plant, November 1996.* This document was conditionally approved by USEPA (letter from Mary F. Beck, USEPA RCRA Operations Branch, to Commander, Radford Army Ammunition Plant, November 1, 1996).

The New River and tributaries sampling was conducted in accordance with the Supplemental Work Plan in late November 1996. Since the primary concern of USEPA was the screening level ecological risk assessment, that is the focus of this report. Data from this sampling event were not used to supplement the human health risk discussions presented in sections 11 and 12 of the Parsons ES RFI. However, the human health risks will be reevaluated upon finalization of the Parsons ES RFI.

SECTION 2

STUDY OBJECTIVES

In accordance with USEPA comments (letter from Robert Thompson, USEPA SuperFund Branch, to Mary Beck, USEPA RCRA Branch, April 26, 1996), the objective of the New River and tributaries study is to provide data for migration pathways along the river and tributaries to assess adverse impacts to human health and the environment.

To fulfill the objectives of the human health assessment, sections 11 and 12 of the Parsons ES RFI will be revised, as necessary, utilizing data from the New River and tributaries study sampling event. In accordance with USEPA comments (letter from Mary F. Beck, USEPA RCRA Operations Branch, to Commander, Radford Army Ammunition Plant, November 1, 1996), a screening level ecological risk assessment consistent with the guidance provided in *Process for Designing and Conducting Ecological Risk* Assessment, was performed. The results of the ecological screening are presented in section 6 of this report.

SECTION 3

BACKGROUND

3.1 CURRENT CONDITIONS

The New River is the most significant surface water feature within the Radford Army Ammunition Plant (RFAAP). The facility is built within and adjacent to a prominent meander loop of this river. Figure 1 shows the main section of RFAAP. Figure 2 presents a larger scale version of the facility (oversized map in plastic sleeve). The river flow varies due to water management at Claytor Dam, approximately 9 miles upstream (south) from RFAAP. Downstream from Claytor Dam, typical flows of the New River range between 3,200 and 8,000 million gallons per day (mgd). During typical flow conditions, the depth is approximately 4 to 6 feet; however, pools may be 10 feet deep.

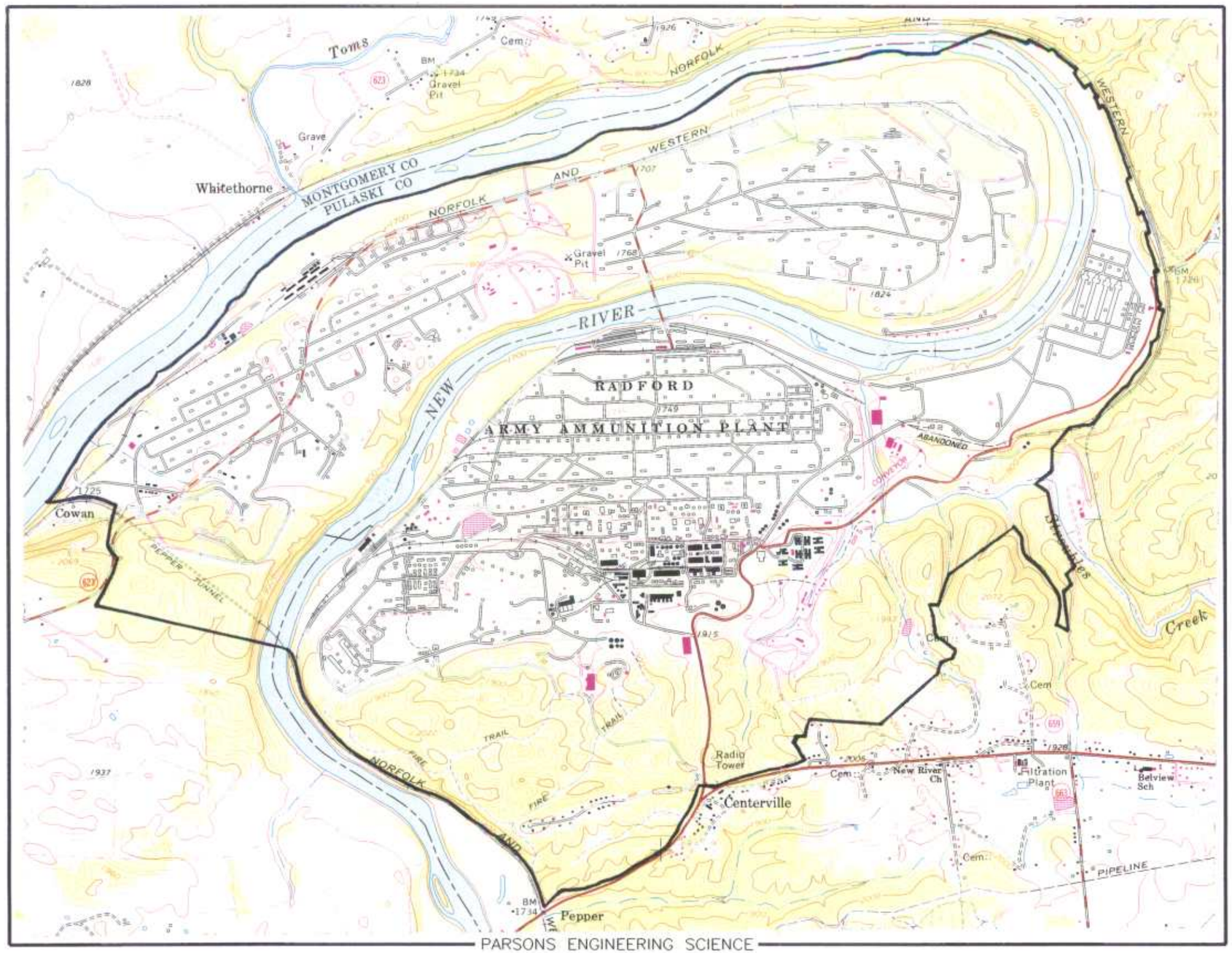
Stroubles Creek is the largest local tributary of the New River and flows through the southeast sector of RFAAP. Prior to entering the facility, branches of Stroubles Creek flow through rural areas and the city of Blacksburg. The Commonwealth of Virginia has classified Stroubles Creek as water generally satisfactory for beneficial uses including public or municipal water supply, secondary contact recreation, and propagation of fish and aquatic life.

RFAAP discharges approximately 25 mgd at fifteen industrial wastewater outfalls along the New River and Stroubles Creek under VPDES permit number VA0000248. The effluent consists of various treated process water, wash water, cooling water, run off, sanitary wastewater, and stormwater. The approximate locations of the discharge outfalls are shown in Figure 3.

Various minor unnamed tributaries to Stroubles Creek and the New River transect the facility. Although they have been designated unnamed tributaries in this document, some of these areas are actually drainage ditches or culverts which infrequently contain surface water.

FIGURE 1

MAIN SECTION OF RAAP
RADFORD ARMY AMMUNITION PLANT
RADFORD, VIRGINIA



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FEET

SCALE = 1:24,000

LEGEND

PROPERTY LINE

SOURCE: U.S. GEOLOGICAL SURVEY, RADFORD NORTH QUADRANGLE

PARSONS ENGINEERING SCIENCE

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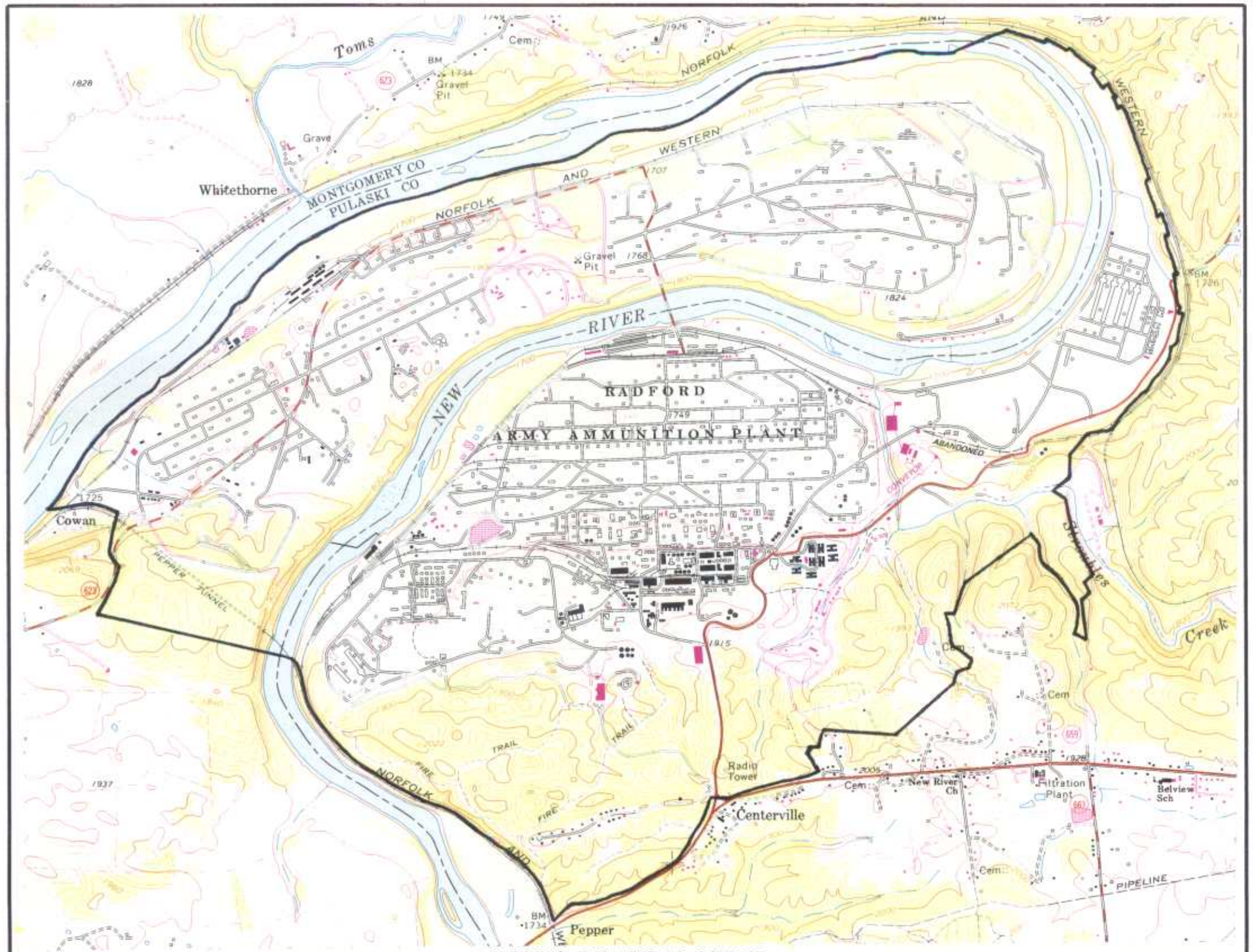
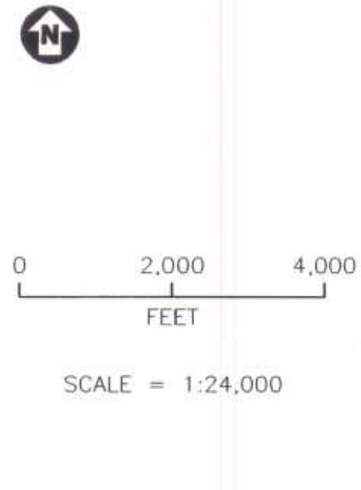
FIGURE 1

MAIN SECTION OF RAAP
RADFORD ARMY AMMUNITION PLANT
RADFORD, VIRGINIA





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SOURCE: U.S. GEOLOGICAL SURVEY, RADFORD NORTH QUADRANGLE

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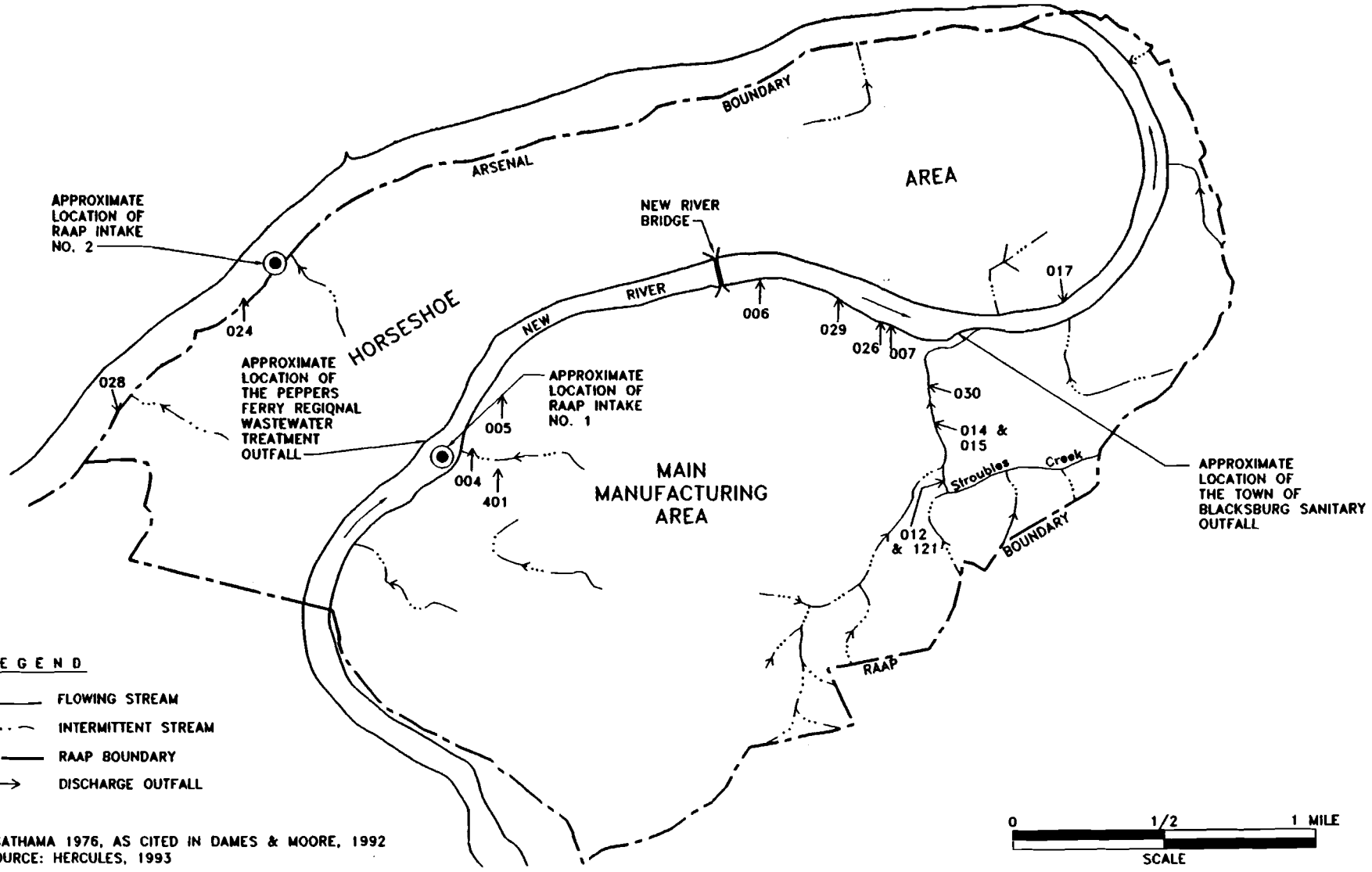
FIGURE 3
SURFACE WATER DRAINAGE/OUTFALL LOCATIONS
RADFORD ARMY AMMUNITION PLANT
RADFORD, VIRGINIA



SOURCE: USATHAMA 1976, AS CITED IN DAMES & MOORE, 1992
OUTFALL SOURCE: HERCULES, 1993

PARSONS ENGINEERING SCIENCE, INC.

3.2 PREVIOUS INVESTIGATIONS

Previous investigations of the New River and tributaries included sampling by the USAEHA in 1994 (for propellant compounds only) and by Dames & Moore (one surface water sample in Stroubles Creek and four sediments and three surface water samples taken in the vicinity of SWMU 13).

As part of the Parsons ES RFI, eight surface water and sediment samples were collected from the New River and Stroubles Creek in January and July 1995. Those sample results, which were included in the Parsons ES RFI, were also used as the basis of conclusions presented in this document.

In accordance with the discharge permit issued to RFAAP by the Virginia Department of Environmental Quality, an annual benthic study must be performed to determine if any environmental impact has occurred within the New River as a result of the Radford facility activities. The November 1995 report, prepared by Central Virginia Laboratories & Consultants, Inc., concluded that "there appears to be no current negative impacts on benthic macroinvertebrates of the New River as a result of the activities of RFAAP."

SECTION 4

FIELD INVESTIGATION PROCEDURES

4.1 SCOPE OF WORK

In general accordance with the Supplemental Work Plan, twenty sediment samples and seven surface water samples were collected to supplement the nine samples (surface water and sediments) obtained during the January and July 1995 RFI investigations. Deviations from the Supplemental Work Plan were the result of dry tributaries, where only sediment samples could be obtained. Additionally, it was not possible to ensure that each sediment sample contained at least 50% fines (silt and clay), which was the Supplemental Work Plan requirement; although every attempt was made, within a reasonable lateral range of the approved sample location, only depositional environments comprising larger grained materials were present. Three of the sediment samples collected during the 1996 sampling contained 50% fines. The 1995 samples were not analyzed for grain size. Geotechnical data are presented in Appendix A.

All sample locations are listed in Table 1 and shown on Figure 2 (oversized map in plastic sleeve). Table 1 indicates the SWMU or group of SWMUs for which useful information can be obtained from a given sample. Table 1 also provides the sediment sample descriptions and indicates which tributaries did not contain surface water during the sampling event.

This plan resulted in a total of 29 sample locations (29 sediments samples, and 16 surface water samples associated with those sediments) used in this study to characterize the New River and its tributaries. This total does not include QA/QC samples. The analytical program for the New River and tributaries sampling effort, including QA/QC requirements, is presented in Table 2.

Of the 29 sediment and 16 surface water samples collected, not all were analyzed at the same time or for the same parameters. Some sampling events had different objectives than

TABLE 1
NEW RIVER AND TRIBUTARIES STUDY
SAMPLE LOCATION SUMMARY
RADFORD ARMY AMMUNITION PLANT

Field Sample Name	Sample Date	Location	Comments or Rationale	Sediment Sample Description
SPG3 SE/SW1	1/13/95	Upstream-dye trace migration pathway point (SWMU 17)	Spring outlet to New River	USCS[a]=SM, sand, some silt, brw-gry, organic matter
NR SE/SW 1	7/21/95	Upstream of facility	Background New River	USCS=SM, sand, some silt, brw, organic matter
NR SE/SW 2	7/21/95	Upstream of facility	Background New River	USCS=SM, sand, some silt, brw, organic matter
NR SE/SW 3	7/21/95	Upstream of facility	Background New River	USCS=SM, sand, some silt, brw, organic matter
NR SE/SW 4	7/28/95	Downstream SWMUs 48, 50, and 59	Potential impacts from SWMUs 48, 50, and 59	USCS=SM, sand, little silt, brw
NR SE/SW 5	7/18/95	Downstream SWMU 54	Potential impacts from SWMU 54	USCS=SC, sand and clay, some silt, drk-brw, organic matter
NR SE/SW 6	7/28/95	Downstream SWMU 31 tertiary lagoon	Potential impacts from SWMU 31	USCS=SM, sand, some silt, drk-brw, organic matter
SC SE/SW 1	1/17/95	Upstream of Facility	Background Stroubles Creek	USCS=SP, sand and gravel, few fines
SC SE/SW 2	1/17/95	Downstream SWMUs 4 and 41	Potential impacts from SWMUs 4, 41, and off-site sources	USCS=SC, silt, some sand, drk-brw
SC SE/SW 3(b)	11/20/96	Upstream SWMU 41	Potential impacts from off-site sources sediment and surface water	USCS=SM, sand and silt, dark brown
SC SE/SW 4	11/21/96	Downstream SWMU 41	Potential impacts from SWMU 4, 41, and off-site sources. Sediment and surface water	USCS=SM, sand and gravel, some silt
NR SE 7	11/26/96	Downstream SWMU 37 and unnamed tributary	Potential impacts from SWMU 7, 37, and unnamed tributary	USCS=SM, sand, little silt, dark brown
NR SE 8(b)	11/26/96	Downstream SWMU 9	Potential impacts from SWMU 9	USCS=CL, clay and sand, organic matter
NR SE 9	11/26/96	Downstream SWMUs 38, 45, and Q	Potential impacts from SWMUs 38, 45, and Q	USCS=SC, sand and silt and clay, drk brw
NR SE 10	11/26/96	Downstream SWMUs P, 10, and 35	Potential impacts from SWMUs 10, 35, F, and P	USCS=SC-SM, sand and silt, some clay
NR SE 11	11/26/96	Downstream SWMUs 8, 36	Potential impacts from SWMUs 8 and 36	USCS=SC, sand and silt, some clay, light yellow-brw

TABLE 1
NEW RIVER AND TRIBUTARIES STUDY
SAMPLE LOCATION SUMMARY
RADFORD ARMY AMMUNITION PLANT

Field Sample Name	Sample Date	Location	Comments or Rationale	Sediment Sample Description
NR SE 12	11/22/96	Upstream SWMU 43	Potential impacts from unnamed tributary, upstream of SWMU 43	USCS=SC-SM, sand and silt, brw, organic matter
NR SE 13	11/22/96	Downstream SWMU 43	Potential impacts from SWMU 43	USCS=SC, sand and silt, some drk brw-blk, organic matter
NR SE 14	11/22/96	Downstream SWMU 13	Potential impacts from SWMUs 13, 27, 29, and 53	USCS=SC, sand and silt, some drk brw, organic matter
NR SE/SW 15	11/22/96	Unnamed tributary from SWMU 32, 39, and 58 vicinity	No surface water present	USCS=SC, sand and silt, some clay, light brw, organic matter
NR SE/SW 16	11/22/96	Unnamed tributary downstream of SWMUs 57, 68, and 69	Potential impacts from SWMUs 57, 68, and 69 No surface water present	USCS=SC, sand and silt, some clay, light brw
NR SE/SW 17	11/22/96	Downstream SWMU 31 primary lagoon	Sediment and surface water to characterize potential metals migration from SWMU 31	USCS=SM, sand and silt, drk brw-blk, organic matter
NR SE/SW 18	11/22/96	Downstream SWMU 31 secondary lagoon	Sediment and surface water to characterize potential metals migration from SWMU 31	USCS=SC, sand and silt, some clay, drk brw, organic matter
TRIB SE/SW 1	11/25/96	Unnamed tributary	Potential impacts from Pepper's Ferry wastewater treatment outfall	USCS=SP, sand and gravel, no fines
TRIB SE/SW 2	11/25/96	Unnamed tributary near SWMU 46	Potential impacts from south-central site drainage	USCS=SM, sand, some silt, little gravel
TRIB SE/SW 3	11/25/96	Unnamed tributary near SWMUs 7 and 37	Potential impacts from SWMUs 7 and 37 No surface water present	USCS=SM, sand, little silt
TRIB SE/SW 4	11/21/96	Unnamed tributary near SWMU 4	Potential impacts from SWMUs 4, 75, and O	USCS=CL, clay and silt, dark gry-brw, organic matter
TRIB SE/SW 5	11/20/96	Unnamed tributary upstream of facility	Potential impacts from off-site sources	USCS=SM, sand and silt, light brown
TRIB SE/SW 6	11/21/96	Unnamed tributary dividing SWMU 43 landfill in half	Potential impacts from SWMU 43 No surface water present	USCS=SC, sand and clay, light brw, organic matter

TABLE 1
NEW RIVER AND TRIBUTARIES STUDY
SAMPLE LOCATION SUMMARY
RADFORD ARMY AMMUNITION PLANT

Field Sample Name	Sample Date	Location	Comments or Rationale	Sediment Sample Description

NOTES:

1) Surface water locations sampled based on USEPA November 1, 1996 letter to RAAP.
2) Some locations listed as unnamed tributaries were drainage ditches or culverts; surface water samples were taken where sufficent water was available.
3) The notation (b) was added to sample name to distinguish from QA/QC (duplicate) sample collected during 1995 RFI.

[a] USCS= Unified Soil Classification System
NR = New River
SC = Stroubles Creek
SPG = Spring
SE = Sediment Sample
SW = Surface Water Sample
TRIB = Unnamed Tributary
SWMU = Solid Waste Management Unit

...LE 2
NEW RIVER AND TRIBUTARIES STUDY
ANALYTICAL PROGRAM:
RADFORD ARMY AMMUNITION PLANT

			Analytical Parameter (1)												
	Field Sample						PEST/			Acid Vol.		Chloride		rain size	
Area	Name (2)	Media (3)	Metals	Explosives	VOCs	SVOCs	PCBs	TOC	TOX	Sulfide	Hardness		pH	Analysis	Comments
	SPG3SW1	SW	X	X				X	X				X		
	SPG3SE1	SE	X	X				X	X						Associated with SPG3SW1
New River and	NRSW1	SW	X	X	X	X		X	X		X	X	X		
Tributaries	NRSE1	SE	X	X	X	X		X	X				X		Associated with NRSW1
(1995 RFI Sampling)	NRSW2	SW	X	X	X	X		X	X		X	X	X		
	NRSE2	SE	X	X	X	X		X	X				X		Associated with NRSW2
	NRSW3	SW	X	X	X	X		X	X		X	X	X		
	NRSE3	SE	X	X	X	X		X	X				X		Associated with NRSW3
	NRSW4	SW	X	X	X	X		X	X		X	X	X		
	NRSE4	SE	X	X	X	X		X	X				X		Associated with NRSW4
	NRSW5	SW	X	X	X	X		X	X		X	X	X		
	NRSE5	SE	X	X	X	X		X	X				X		Associated with NRSW5
	NRSW6	SW	X	X	X	X		X	X		X	X	X		
	NRSE6	SE	X	X	X	X		X	X				X		Associated with NRSW6
	SCSW1	SW	X	X	X	X		X	X		X	X	X		
	SCSE1	SE	X	X	X	X		X	X				X		Associated with SCSW1
	SCSW2	SW	X	X	X	X		X	X		X	X	X		
	SCSE2	SE	X	X	X	X		X	X				X		Associated with SCSW2
	SCSW3(b)	SW	X	X	X	X	X	X	X		X		X		
	SCSE3(b)	SE	X	X	X	X	X	X	X	X			X	X	Associated with SCSW3(b)
New River and	SCSW4	SW	X	X	X	X	X	X	X		X		X		
Tributaries	SCSE4	SE	X	X	X	X	X	X	X	X			X	X	Associated with SCSW4
(1996 Sampling)	NRSE7	SE	X	X	X	X	X	X	X	X			X	X	
	NRSE8(b)	SE	X	X	X	X	X	X	X	X			X	X	
	NRSE9	SE	X	X	X	X	X	X	X	X			X	X	
	NRSE10	SE	X	X	X	X	X	X	X	X			X	X	
	NRSE11	SE	X	X	X	X	X	X	X	X			X	X	
	NRSE12	SE	X	X	X	X	X	X	X	X			X	X	
	NRSE13	SE	X	X	X	X	X	X	X	X			X	X	
	NRSE14	SE	X	X	X	X	X	X	X	X			X	X	
	NRSW15	SW	*No*	*SW*	*present*										Tributary to New River
	NRSE15	SE	X	X	X	X	X	X	X	X			X	X	
	NRSW16	SW	*No*	*SW*	*present*										Tributary to New River
	NRSE16	SE	X	X	X	X	X	X	X	X			X	X	
	NRSW17	SW	X				X				X		X		
	NRSE17	SE	X				X			X				X	Associated with NRSW17
	NRSW18	SW	X				X				X		X		
	NRSE18	SE	X				X			X				X	Associated with NRSW18

T. _E 2

NEW RIVER AND TRIBUTARIES STUDY
ANALYTICAL PROGRAM:
RADFORD ARMY AMMUNITION PLANT

Area	Field Sample Name (2)	Media (3)	Analytical Parameter (1) Metals	Explosives	VOCs	SVOCs	PEST/PCBs	TOC	TOX	Acid Vol. Sulfide	Chloride Hardness	pH	rain size Analysis	Comments
	TRIBSE1	SE	X	X	X	X	X	X	X	X		X	X	New River location
	TRIBSW2	SW	X	X	X	X	X	X	X		X	X		
	TRIBSE2	SE	X	X	X	X	X	X	X	X		X	X	Associated with TRIBSW2
	TRIBSW3	SW	*No*	*SW*	*present*									
	TRIBSE3	SE	X	X	X	X	X	X	X	X		X	X	
	TRIBSW4	SW	X	X	X	X	X	X	X		X	X		
	TRIBSE4	SE	X	X	X	X	X	X	X	X		X	X	Associated with TRIBSW4
	TRIBSW5	SW	X	X	X	X	X	X	X		X	X		
	TRIBSE5	SE	X	X	X	X	X	X	X	X		X	X	Associated with TRIBSW5
	TRIBSW6	SW	*No*	*SW*	*present*									
	TRIBSE6	SE	X	X	X	X	X	X	X	X		X	X	
	NRSW38	SW	X	X	X	X	X	X	X		X	X		Duplicate of TRIBSW2
QA/QC Samples	NRSE30	SE	X	X	X	X	X	X	X	X		X		Duplicate of NRSE15
	NRSWEQ	SW	X	X	X	X	X	X	X		X			Equipment Blank
	NRSWFB2	SW	X	X	X	X	X	X	X		X			Field Blank
	NRSWTB4	SW			X									Trip Blank
	NRSEEQ2	SE	X	X	X	X	X	X	X					Equipment Blank
	NRSEFB2	SE	X	X	X	X	X	X	X					Field Blank
	NRSETB2	SE			X									Trip Blank
	NRSWTB5	SW			X									Trip Blank
	NRSETB3	SE			X									Trip Blank

(1) ANALYTICAL PARAMETERS

TAL Metals (by SW-846 6010/7000 series), total and dissolved for aqueous samples
Semivolatile Organics (SVOC's) by SW846 8270
Total Organic Carbon (TOC) by MCAWW415.1
Total Organic Halogens (TOX) by SW-846 9020
Volatile Organics (VOC's) by SW-846 8240
Pesticides/PCBs by 8080
Acid Volatile Sulfides by EMAX SOP AP-3070
Hardness by SM 2340B
Explosives by SW-846 8330

(2) FIELD SAMPLE NAME

NR-New River
SC-Stroubles Creek
TRIB-Unnamed Tributary
SPG-Spring

(3) MEDIA

SW-Surface Water
SE - Sediment

NOTES:

QA/QC samples associated with those samples collected during the 1995 RFI are shown in tables 4.3 and 4.4 of that report.
Metals analyses for the aqueous samples collected during the 1995 RFI do not include dissolved fractions.

others. For example, one sediment and its associated surface water sample (SPG3 SE/SW 1) was collected to monitor the SWMU 17 subsurface migration pathway to the New River, and was only analyzed for metals and explosives. Two sediment and their associated surface water samples (NR SE/SW 17 and NR SE/SW 18) were collected to address data gaps in the Parsons ES RFI evaluation of the SWMU 31 lagoons; they were sampled for Target Analyte List (TAL) metals only. The Human Health Risk Assessment found a risk associated with metals in the groundwater of SWMU 31. Since this SWMU is located on the river, and since migration of metals from the lagoon sediments to groundwater is occurring, it was necessary to monitor the surface water and sediment directly outside the lagoons. These data will support or refute a direct discharge of metals from SWMU 31 groundwater to the New River.

4.2 SAMPLING PROCEDURES

All sediment and surface water sampling procedures were adopted from USEPA review comments on the Parsons ES RFI (R. Thompson to Mary Beck, April 26, 1996 correspondence) and conformed to the guidance outlined in that document or the November 1, 1996 USEPA letter (Mary Beck to RFAAP Commander). It was determined that sampling the river from a boat would not be efficient because of space limitations and security fencing access problems from the river to the facility grounds. Therefore, each sampling location was accessed from the river bank.

The attempt was made to sample during dry weather, low flow conditions. However, precipitation was encountered prior to and during the sampling event. In the interest of report submittal commitments, the sampling was not delayed to await dry conditions. As requested in USEPA's November 1, 1996 letter, if surface water was present, an attempt was made to collect it. The wet conditions provided a better opportunity to comply with this request and obtain surface water samples from some of the historically dry tributaries/drainage culverts. However, as indicated on Table 2, many of these areas were still dry and no surface water sample could be collected.

Sediment samples were collected from the top 4 to 6 inches of sediment, whenever possible. Sediment samples were collected after the collection of surface water samples and downstream samples were collected before upstream samples. Sediment samples were collected with a stainless steel hand-operated sampler that isolated collected sediment from the overlying water. Sediment samples were taken from depositional areas composed of at least 50% fine grained (silt and clay) sediment, where possible. Prior to sampling, the chosen sampling device was decontaminated with USAEC-approved water, Alconox® and methanol. Only stainless-steel implements were used to place sediment into the sample containers.

For surface water samples, all equipment and containers, except vials containing preservatives, were triple-rinsed with water from the sampling location prior to sample collection. Surface water samples were collected before sediment samples and downstream samples were collected before upstream samples. All samples were collected with the sampling device facing upstream. Grab samples were collected at approximately one-half to two-thirds of the water depth for shallow streams and ditches, where possible. The mouth of the sample collection device was maintained completely underwater, when possible. All sampling locations were marked with a wooden stake placed at the nearest bank.

All surface water samples were preserved according to the requirements specified on Table 3. Preservatives were added to the empty sample bottles at the site. Due to a relatively short duration field schedule, no samples were filtered in the field; the dissolved metals samples were filtered by the laboratory and therefore could not be preserved in the field by lowering pH since this would adversely affect the results. Field logbooks included the time, date, project location, weather conditions, sample location, number and sample ID number, flow conditions, a sketch of the sampling location, approximate water depth, sample collection depth, relative position with respect to SWMUs, the location of the wooden identifier stake, and description of the sediment. All sediment and surface water samples were shipped at a temperature of 4°C to the laboratory in sufficient time so that specified holding times would not be exceeded.

TABLE 3

SAMPLE PRESERVATION AND HOLDING TIMES FOR AQUEOUS SAMPLES
Radford Army Ammunition Plant, Virginia

Parameter	USAEC Method Code[a]	EPA Analytical Method [b]	Preparation (a) Method	Instrument/ Technique [c]	Sample Container	Preservative	Lot Size	Holding Time (days) [d]
Volatile Organics (VOCs)	UM21	SW-846 8240	Purge and trap	GC/MS	Amber G, 3-40ml vials with Teflon-lined septa	Cool, 4°C; HC1 to pH<2	15	14
Semivolatile Organics (SVOCs)	UM25	SW-846 8270	Liquid-liquid extraction	GC/MS	Amber G, 2-1 liter with Teflon-lined caps	Cool, 4°C	15	7/40[e]
Explosives	UM25	SW-846 8330	Column Filtration Process	HPLC	Amber G, 2-1 liter with Teflon-lined caps	Cool, 4°C; store in dark	20	7/40
Total Metals and Dissolved Metals [f]	SS12/CC8/ AX8, SD18, SD25,SD26	SW-846 6010/ 7000s	Digestion in acid solution	ICP/CVAA/ GFAA	1-liter	Cool, 4°C; HN03 to pH<2	*	180[g]
Total Organic Carbon (TOC)	NA	MCAWW 415.1	NA	Auto Analyzer	Amber G, 250 ml with Teflon-lined cap	Cool, 4°C; H_2SO_4 to pH<2	20	28
Total Organic Halogens (TOX)	NA	SW-846 9020	NA	Auto Analyzer	Amber G, 500 ml with Teflon-lined cap	Cool, 4°C; H_2SO_4 to pH<2	20	28
Hardness	NA	SM 2340B	NA	ICP/Calculation	P, 500 ml	Cool, 4°C; HN03 to pH<2	40	28
Pesticides/PCBs	UM32	SW-846 8080	Liquid-liquid extraction	GC/ECD	Amber G, 2-1 liter with Teflon-lined caps	Cool, 4°C;	20	7/40
Chloride	NA	MCAWW 325.2	Colorimetric	Colorimeter	P, 500 ml	Cool, 4°C	20	28

Notes:

(a) USAEC Method code descriptions include all preparation methods used.
(b) SW-486 - Physical/Chemical Methods for Evaluating Solid Waste
(c) GC/MS - Gas chromatography/mass spectroscopy; ICP - inductively coupled plasma; GLFAA - graphite furnace atomic absorption; CVAA - cold vapor atomic absorption; HPLC - high performance liquid chromatography; ECD - Electron Capture Detector
(d) Holding times based on sample collection data.
(e) 7 days until extraction; 40 days after extraction until analysis.
(f) All samples to be filtered by the laboratory.
(g) Holding time for Mercury is 28 days.

* Lot Size for Metals

Analysis	H_2O	Soil
ICP	40	40
GFAA	40	40
CVAA	60	60

TABLE 3 (Continued)

SAMPLE PRESERVATION AND HOLDING TIMES FOR SOIL/SEDIMENT SAMPLES
Radford Army Ammunition Plant, Virginia

Parameter	USAEC Method Code	EPA Analytical Method [a]	Instrument/ Technique [b]	Sample Container	Preservative	Lot Size	Holding Time (days) [c]
Volatile Organics (VOCs)	LM23	SW-846 8240	GC/MS	Wide-mouth G, 2 oz with teflon-lined septa	Cool, 4° C	15	14
Semivolatile Organics (SVOCs)	LM25	SW-846 8270	GC/MS	Wide-mouth G, 8 oz with teflon-lined septa	Cool, 4° C	15	7/40 (d)
Explosives	LW23	SW-846 8330	HPLC	Wide-mouth G, 4 oz with teflon-lined septa	Cool, 4° C; store in dark	20	7/40
Metals	JS12/Y9/JD20, JD21 JD22, B9	SW-846 6010/ 7000s series	ICP/CVAA/GFAA	Wide-mouth G, 8 oz	Cool, 4° C	*	180 (e)
TCLP Metals	NA	SW-846 1311/ 6010/ 7000series	ICP/CVAA/GFAA	Wide-mouth G, 16 oz	Cool, 4° C	25	180/180 (e)
Ignitability	NA	SW-846 7.1.2.2	Pensky Cup	Use TCLP Metals Sample	Cool, 4° C	25	NA
Corrosivity	NA	SW-846 9045	pH Meter	Use TCLP Metals Sample	Cool, 4° C	25	NA
Reactivity	NA	SW-846 Chap 7	Colorimetric/ Titrametric	Use TCLP Metals Sample	Cool, 4° C	25	NA
Paint Filter Test	NA	SW-846 9095	Filter	Use TCLP Metals Sample	Cool, 4° C	25	NA
BTU	NA	ASTM D240-76	Filter	Wide-mouth G, 16 oz	Cool, 4° C	10	NA
Pesticides/PCBs	LM26	SW-846 8080	GC/ECD	Wide-mouth G, 8 oz with teflon-lined caps	Cool, 4° C	26	7/40 (d)
Acid Volatile Sulfides	NA	Emax SOP AP-3070	Colorimeter	Wide-mouth G, 8 oz with teflon-lined caps	Cool, 4 °C	25	14

Notes:

(a) SW-486 - Physical/Chemical Methods for Evaluating Solid Waste
(b) GC/MS - Gas chromatograph/mass spectroscopy; ICP - inductively coupled plasma; GFAA - graphite furnace atomic absorption; CVAA - cold vapor atomic absorption; HPLC - high performance liquid chromatography; ECD - Electron Capture Detector
(c) Holding times based on sample collection data.
(d) 7 days until extraction; 40 days after extraction until analysis.
(e) Holding time for Mercury is 28/28
NA Not applicable.

* Lot Size for Metals

Analysis	H_2O	Soil
ICP	40	40
GFAA	40	40
CVAA	60	60

4.3 CHEMICAL ANALYSIS PROGRAM

The overall chemical analysis program for the project is described in detail in Section 7.0 of the original Parsons ES RFI Work Plan. The *Quality Assurance Project Plan (QAPjP), Engineering-Science, Inc., April 1995,* provides the procedures to be used to ensure that all activities conform to the project requirements. The QAPjP also contains the data reduction, validation, and reporting procedures (section 6). Except for the minor revisions noted below, all sampling and analysis was conducted in accordance with the Work Plan, the Supplemental Work Plan, and QAPjP. The QAPjP was modified to include pesticide and PCB analysis for this study. Although pesticides and PCBs have not historically been contaminants of concern at RFAAP, these compounds were analyzed at the USEPA's request. Analytical methodology, instrumentation, and bottleware, preservation, and holding time requirements, for all sample media, are summarized in Table 3.

All samples, sediment and surface water, were analyzed for target compound list (TCL) and target analyte list (TAL) constituents, explosives, pesticides, polychlorinated biphenyls (PCBs), total organic carbon (TOC), total organic halogens (TOX), pH, hardness (surface water only) and for sediments only, acid volatile sulfides and grain size analysis.

Parsons ES used EMAX Laboratories, Inc. (EMAX), located in Torrance, California, for the analytical services. EMAX is USAEC certified and has extensive experience with the Army's IRDMIS electronic data deliverable requirements.

SECTION 5

SCREENING LEVEL

ECOLOGICAL RISK ASSESSMENT PROCEDURES

5.1 INTRODUCTION

This section summarizes the additional field studies, data compilation, and data evaluation that was conducted as a screening level ecological risk assessment. The investigation fulfilled the objectives of future ecological risk characterization by addressing the following items (as highlighted in the November 1, 1996 letter from Mary F. Beck, USEPA):

- Conduct a habitat receptor characterization, including the presence or absence of federal and/or state listed threatened or endangered species; and
- Perform a screening level ecological risk assessment on historical and new data following previously provided guidance, *Process for Designing and Conducting Ecological Risk Assessment.* Background data shall not be used as a screening tool.

The ecological risk assessment (ERA) efforts at RFAAP conformed to the USEPA's Proposed Guidelines for Ecological Risk Assessment (September 9, 1996 Federal Register). The general procedures in the Environmental Response Team guidance were also followed.

5.2 ECOLOGICAL SITE CHARACTERIZATION

The objective of this task was to collect information on the ecological characteristics of the site so that ecological values of concern, ecological receptors, and preliminary assessment endpoints could be identified. This task involved collecting and evaluating existing background information and conducting a reconnaissance level ecological survey.

Existing ecological information was compiled from installation personnel and federal, state, and local agencies. Specific types of information that was collected, included the following: biological survey reports for the installation (e.g., benthic macroinvertebrate survey reports, wetlands delineation reports, threatened and endangered species survey reports, etc.), fish survey reports for the New River, water quality data for the New River, aerial photographs, national wetlands inventory maps, and soil survey maps. Informal consultation with the Virginia Natural Heritage Program (NHP) was conducted to identify threatened and endangered species known or likely to occupy the site.

A reconnaissance level ecological survey was conducted at the site in conjunction with the New River and tributaries sampling. The survey was qualitative in nature and involved pedestrian surveys of the site and the immediate vicinity. The field biologists recorded information and observations in field logbooks. It should be noted that the timing of the survey limited the ecological information that could be collected.

The primary focus of the survey was describing the aquatic habitat of the New River and its tributaries on the site. In addition, terrestrial and wetland communities, common wildlife species, and wildlife habitat were described.

The findings of the background research and the reconnaissance level ecological survey were used to develop an ecological description of the site. This information was used to identify ecological values of concern, ecological receptors, and preliminary assessment endpoints.

5.3 SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT

The primary objective of the screening level ERA was to identify chemicals of potential concern (COPC). This scope assumed that the ecological values of concern for this screening was limited to aquatic communities. The screening process to identify COPC was outlined in the Supplemental Work Plan, which was approved by the USEPA in November 1996.

SECTION 6

DATA RESULTS

6.1 CHEMICAL CHARACTERIZATION

All samples were analyzed as outlined in Table 2. The data were validated and qualified as usable as discussed in the Data Validation Summary Report contained in Appendix B. Data summary tables presenting the results of all sampling performed for this study are contained in Appendix C. Positive results (concentrations greater than detection limits) are summarized in Tables 4 and 5 of this section. Samples collected during the Parsons ES RFI (June and July 1995) are included with the positive results tables. However, data validation discussions and the complete data summary tables for those samples can be found in the Parsons ES RFI.

6.2 ECOLOGICAL RISK ASSESSMENT

As part of the New River and tributaries study, Parsons ES conducted a habitat characterization and performed a screening level ecological risk assessment on the historical and recently collected surface water and sediment samples surrounding the RFAAP facility.

6.2.1 Habitat Receptor Characterization

The Virginia Department of Game and Inland Fisheries (VDGIF) is in the process of conducting a detailed two-year ecological survey at the RFAAP facility. The survey was initiated in 1997 and will be completed in 1998. Both the Main Section of RFAAP and the New River Ammunition Storage Area Unit near Dublin are covered by the survey. The survey includes ecological community mapping, plants, reptiles, amphibians, birds, mammals, fish, and aquatic and terrestrial invertebrates; with an emphasis on rare, threatened, and endangered species. A draft progress report summarizing the findings of the 1997 field work has been submitted to Alliant Techsystems, Inc.; however, a copy of this draft was not available at the

TABLE 4
POSITIVE RESULTS TABLE OF STROUBLES CREEK - Aqueous Samples
RADFORD ARMY AMMUNITION PLANT

Field Sample Number	SCSW1 1/17/95	SCSW2 1/17/95	SCSW3* 1/17/95
METALS (ug/l)			
Barium	44.7 J4	47.3 J4	48 J4
Beryllium	1.95	2.22	2.23
Chromium		30.9 J4	
EXPLOSIVES (ug/l)			
Cyclotetramethylenetetranitramine (HMX)	5.3 J9	5.3 J9	5.3 J9
OTHER (ug/l)			
*TOTAL HARDNESS	148000	152000	153000
*TOTAL ORGANIC CARBON	2690	2490 J7	2370
*TOTAL ORGANIC HALOGENS	16.9	18 J7	16
CHLORIDE	11000	10000	11000

* SCSW3 is a duplicate sample of SCSW2

J The analyte was analyzed for and was positively identified, but the associated numerical value may be imprecise due to a QC anomaly or due to being between the method detection limit (MDL) and the project reporting limit. The data is considered estimated and usable for many purposes.

TABLE 4 (Continued)
POSITIVE RESULTS TABLE OF NEW RIVER - Aqueous Samples
RADFORD ARMY AMMUNITION PLANT

Field Sample Number Sample Collection Date	NRSW1 7/21/95	NRSW2 7/21/95	NRSW3 7/21/95	NRSW4 7/28/95	NRSW5 7/18/95	NRSW6 7/28/95	NRSW8* 7/18/95	SPG3SW1 1/13/95
METALS (ug/l)								
Lead				9.80				25.20
Barium	24.90	25.10	24.90	26.30	21.10	24.80	21.10	26.60 J4
Beryllium								1.64
VOLATILES (ug/l)								
Methylene chloride								
OTHER (ug/l)								
Total Hardness	42700.00	42800.00	43200.00	44600.00	47800.00	51300.00	47700.00	
Total Organic Carbon	2180.00	2320.00	2080.00	1960.00	1810.00	2310.00	1870.00 J7	1200.00
Total Organic Halogens				10.00				
Chloride	3890.00	3750.00	3810.00	3950.00	4030.00	4120.00	4000.00	

* NRSW8 is a duplicate sample of NRSW5

J The analyte was analyzed for and was positively identified, but the associated numerical value may be imprecise due to a QC anomaly or due to being between the method detection limit (MDL) and the project reporting limit. The data is considered estimated and usable for many purposes.

TABLE 4 (Continued)
POSITIVE RESULTS TABLE - Aqueous Samples
RADFORD ARMY AMMUNITION PLANT
NEW RIVER AND TRIBUTARIES STUDY

FIELD SAMPLE ID:		NRSW17	NRSW18	NRSW38	SCSW3(B)	SCSW4	TRIBSW2	TRIBSW4	TRIBSW5
SAMPLING DATE:		11/22/96	11/22/96	11/25/96 DUP/TRIB2	11/20/96	11/21/96	11/25/96	11/21/96	11/20/96
Semivolatile Organic Compounds									
Di-n-butylphthalate	ug/l				74	44 J1		19 J1	17
Butylbenzylphthalate	ug/l				11				
bis(2-Ethylhexyl)phthalate	ug/l				13				
Dissolved Metals									
Barium	ug/l	121	124	132	133		123		170
Calcium	ug/l	8880	9380	49500	56700	58300	47400	36600	72400
Iron	ug/l	165	154						
Magnesium	ug/l	3920	4040	21900	23000	25500	20900	18700	42400
Manganese	ug/l			10.4					12.6
Potassium	ug/l	1880	2470	2320	3300	3210	2470	3880	3120
Sodium	ug/l	5110	5110	17700	13500	13500	17600	11000	7490
Zinc	ug/l	15.6	16.2	11.3			10.5	15.2 J1	
Total Metals									
Aluminum	ug/l	153	168				110	168	
Barium	ug/l	24.8	26	42.5	60.5		49.5		63
Calcium	ug/l	9190	9980	44300	54000	47300	50800	33600	61500
Iron	ug/l	443	436	76.7	51.4	70	125	432	
Magnesium	ug/l	4220	4540	19600	22400	20500	22500	16900	34400
Manganese	ug/l	88.2	83.2	19.6			30.6	146	18.2
Potassium	ug/l	2300	2390	2350	3530	3310	2620	3650	3140
Sodium	ug/l			15800	10300		17700		4880
Wet Chemistry Parameters									
Hardness	ug/l	42900	45600	192000	226000	202000	219000	153000	295000
Total Organic Carbon	ug/l			11000	12000	5000	10000	11000	14000

J1 Analyte detected in the field or laboratory blank associated with this sample. Result should be considered estimated and biased high.

TABLE 5
POSITIVE RESULTS TABLE OF STROUBLES CREEK - Sediment Samples
RADFORD ARMY AMMUNITION PLANT

Field Sample Number Sample Collection Date	SCSE1 1/17/95	SCSE2 1/17/95	SCSE3 * 1/17/95
METALS (ug/g)			
Arsenic	10.59 J4	9.03 J4	6.70 J4
Lead	13.41 J6	95.87 J6	31.21 J6
Silver	0.03 J4	0.18 J4	0.21 J4
Barium	141.45 J1	240.41 J1	262.41 J1
Beryllium	1.38 J4	1.45 J4	1.39 J4
Chromium	27.80 J6	39.53 J6	36.17 J6
Nickel	32.60 J4	26.99 J4	26.10 J4
SEMIVOLATILES (ug/g)			
Chrysene		0.22	
Di-n-butyl phthalate		7.82 J1	5.53 J1
Fluoranthene		0.27	0.16
Phenanthrene		0.29	0.13
OTHER (ug/g)			
Total Organic Carbon	2841.33	63274.30	43829.80
Extractable Organic Halides (total)	123.00	147.49	141.84

* SCSE3 is a duplicate sample of SCSE2

J The analyte was analyzed for and was positively identified, but the associated numerical value may be imprecise due to a QC anomaly or due to being between the method detection limit (MDL) and the project reporting limit. The data is considered estimated and usable for many purposes.

TABLE 5 (Continued)
POSITIVE RESULTS TABLE OF NEW RIVER - Sediment Samples
RADFORD ARMY AMMUNITION PLANT

Field Sample Number Sample Collection Date	NRSE1 7/21/95	NRSE2 7/21/95	NRSE3 7/21/95	NRSE4 7/28/95	NRSE5 7/18/95	NRSE6 7/28/95	NRSE8* 7/18/95	SPG3SE1 1/13/95
METALS (ug/g)								
Arsenic					6.92		7.83	17.40 J4
Selenium			1.85					
Lead	148.42 J1	136.29 J1	200.00 J1	4415.58	220.08 J1	141.99 J1	245.90 J1	548.59 J6
Silver	0.14	0.09	0.15	0.10	0.10	0.11	0.07	0.22 J4
Barium	226.35 J1	151.82 J1	415.00 J1	97.14	178.82 J1	109.77 J1	187.16 J1	700.63 J1
Beryllium			3.03	0.99	1.31		1.31	4.23 J4
Chromium	46.20 J1	32.01 J1	77.33 J1	37.53	31.50 J1	24.89 J1	33.88 J1	62.70 J6
Nickel	25.05	15.72	41.83	13.25	15.82	12.49	14.89	52.98 J4
Mercury								0.13 J4
SEMIVOLATILES (ug/g)								
Bis (2-ethylhexyl) phthalate				6.62				
Diethyl phthalate				6.23				
Dimethyl phthalate				8.31				
Di-n-butyl phthalate				12.99				
Benzo[a]anthracene	0.58	0.32	0.72			0.40		
Chrysene	1.67	0.35	0.68			0.53		
Fluoranthene		0.30	0.80	0.08		0.50		
Phenanthrene	0.76	0.51	0.82			0.35		
Pyrene	0.80	0.40	1.00			0.76		
N-Nitrosodiphenylamine				2.60				
EXPLOSIVES (ug/g)								
2,4,6-Trinitrotoluene					28.89 J10			
OTHER (ug/g)								
Total Organic Carbon	91651.20	58478.60	36333.30	9831.17	11251.70	22595.40	20218.60	33742.00
Extractable Organic Halides (tot	185.53	158.48	166.67	129.87	82.53	152.67	81.97	244.40

* NRSE8 is a duplicate sample of NRSE5

J The analyte was analyzed for and was positively identified, but the associated numerical value may be imprecise due to a QC anomaly or due to being between the method detection limit (MDL) and the project reporting limit. The data is considered estimated and usable for many purposes.

TABLE 6 (Continued)
POSITIVE RESULTS TABLE - Sediment Samples
RADFORD ARMY AMMUNITION PLANT
NEW RIVER AND TRIBUTARIES STUDY

FIELD SAMPLE ID:		NRSE7	NRSE8(b)	NRSE9	NRSE10	NRSE11	NRSE12	NRSE13	NRSE14	NRSE15
SAMPLING DATE:		11/26/96	11/26/96	11/26/96	11/26/96	11/26/96	11/22/96	11/22/96	11/22/96	11/22/96
Volatile Organic Compounds										
Methylene Chloride	µg/g						0.017	0.022		0.014
Acetone	µg/g									
2-Butanone	µg/g									
Semivolatile Organic Compounds										
Diethylphthalate	µg/g									
Fluorene	µg/g									0.76
Phenanthrene	µg/g									4
Anthracene	µg/g									0.86
Carbazole	µg/g									0.49
Fluoranthene	µg/g									2.8
Pyrene	µg/g									3.3
Benzo(a)anthracene	µg/g									2.2
Chrysene	µg/g									1.8
Benzo(b)fluoranthene	µg/g									2.5
Benzo(k)fluoranthene	µg/g									1.1
Benzo(a)pyrene	µg/g									1.6
Indeno(1,2,3-cd)pyrene	µg/g									0.56
Benzo(g,h,i)perylene	µg/g									0.54
Pesticide/PCB Compounds										
Alpha Chlordane	µg/g	0.01								
gamma-Chlordane	µg/g	0.012								
Total Metals										
Aluminum	µg/g	3730 J	12100 J	4290 J	6740 J	8350 J	9070	11200	9910	8680
Arsenic	µg/g	2.5	2.2	1.7	2.8	2.2	4	4.4	3.9	4.6
Barium	µg/g	39.9 J	151 J	60.5 J	105 J	130 J	129	156	110	63.7
Beryllium	µg/g	0.43	0.83	0.46	0.63	0.88	0.78	0.83	0.71	0.48
Cadmium	µg/g					1				2.4
Calcium	µg/g	2810 J	3270 J	1310 J	2830 J	1670 J	4310	5350	2190	11200
Chromium	µg/g	10.9	22.8	13.1	17.8	16.6	18.8	19	21	29.4
Cobalt	µg/g	7.8 J	11.7 J	6.5 J	8.9 J	8.9 J	10	10.2	10	10.9
Copper	µg/g	11.7	21.5	7.5	16.8	13.8	15.9	17.8	13.4	110
Iron	µg/g	17300 J	25000 J	18700 J	21900 J	29200 J	30700	30000	30800	43500
Lead	µg/g	54.1 J	78.1 J	74.7 J	79.4 J	259 J	112	118	104	34.3
Magnesium	µg/g	2610 J	3650 J	1490 J	2410 J	2110 J	3040 J	3790 J	2600 J	7400
Manganese	µg/g	423 J	1570 J	703 J	917 J	909 J	1100 J	1160 J	1210 J	512

TABLE 5 (Continued)
POSITIVE RESULTS TABLE - Sediment Samples
RADFORD ARMY AMMUNITION PLANT
NEW RIVER AND TRIBUTARIES STUDY

FIELD SAMPLE ID: / SAMPLING DATE:		NRSE7 11/26/96	NRSE8(b) 11/26/96	NRSE9 11/26/96	NRSE10 11/26/96	NRSE11 11/26/96	NRSE12 11/22/96	NRSE13 11/22/96	NRSE14 11/22/96	NRSE15 11/22/96
Nickel	µg/g	6.9	11.7	7.3	8.9	9.1	12.4	15.1	10.6	44.8
Potassium	µg/g	579 J	1840 J	835 J	1160 J	1160 J	1430	1570	1420	1300
Sodium	µg/g									
Thallium	µg/g				1.7	1.8			1.6	1.6
Vanadium	µg/g	11.3	30.5	13.1	18.9	22.4	22.4	25.8	24.7	33.8
Zinc	µg/g	206 J	250 J	254 J	259 J	797 J	466	479	378	1430
Wet Chemistry Parameters										
Acid Volatile Sulfide	µg/g						4.1			
PH		7.8	7.4	7.4	7.9	7.7	7.3	7.1	6.9	7.6
Total Organic Carbon	µg/g	40	57	60	51	41	51	59	40	71
Total Organic Halogens	µg/g	60.2 J1	137	53.4 J1	65.7 J1	29.7 J1		54.8 J1		

J1 Analyte detected in the field or laboratory blank associated with this sample. Result should be considered estimated and biased high.

TABLE 5 (Continued)
POSITIVE RESULTS TABLE - Sediment Samples
RADFORD ARMY AMMUNITION PLANT
NEW RIVER AND TRIBUTARIES STUDY

FIELD SAMPLE ID: / SAMPLING DATE:		NRSE16 11/22/96	NRSE17 11/22/96	NRSE18 11/22/96	NRSE30 11/22/96 Dup NR15	SCSE3(B) 11/20/96	SCSE4 11/21/96	TRIBSE1 11/25/96	TRIBSE2 11/25/96	TRIBSE3 11/25/96
Volatile Organic Compounds										
Methylene Chloride	µg/g	0.014						0.015		
Acetone	µg/g									
2-Butanone	µg/g									
Semivolatile Organic Compounds										
Diethylphthalate	µg/g								0.82	
Fluorene	µg/g									
Phenanthrene	µg/g				1.7					
Anthracene	µg/g				0.51					
Carbazole	µg/g									
Fluoranthene	µg/g				1.9					
Pyrene	µg/g				1.6					
Benzo(a)anthracene	µg/g				1.1					
Chrysene	µg/g				0.95					
Benzo(b)fluoranthene	µg/g				1.2					
Benzo(k)fluoranthene	µg/g				0.44					
Benzo(a)pyrene	µg/g				0.84					
Indeno(1,2,3-cd)pyrene	µg/g									
Benzo(g,h,i)perylene	µg/g									
Pesticide/PCB Compounds										
Alpha Chlordane	µg/g									0.011
gamma-Chlordane	µg/g									0.01
Total Metals										
Aluminum	µg/g	16000	11800	15800	12100	6010	7270	8770 J	4360 J	2210 J
Arsenic	µg/g	5.1	2.7	3.8	4	6.5	8.7	1.8	1.8	
Barium	µg/g	48.2	134	170	75.2	58.9		55.4 J	48.6 J	25.1 J
Beryllium	µg/g	0.62	0.81	1	0.57	0.48	0.66	0.55	0.41	
Cadmium	µg/g	2.8			1.5					
Calcium	µg/g	900	3600	4190	3260	7740	17200	52500 J	2380 J	5050 J
Chromium	µg/g	29.8	22.2	25.9	30	12.6	16.7	15.9	13.4	6.9
Cobalt	µg/g	10.6	10.2	13.1	10.6	9.1	10.3	5.3 J	6.9 J	2.7 J
Copper	µg/g	13.7	16.7	21.8	27.5	12.7	11.3	10.3	8.1	3.7
Iron	µg/g	22100	27000	33200	27500	20500	34400	14700 J	14900 J	5970 J
Lead	µg/g	14	80.8	87.8	23.5	10.3	12.7	37.8 J	54.9 J	7.4 J
Magnesium	µg/g	9000 J	3780 J	4730 J	3530 J	4400	10200	38900 J	1950 J	1560 J
Manganese	µg/g	512 J	1220 J	1830 J	536 J	260	442	382 J	545 J	135 J

TABLE 5 (Continued)
POSITIVE RESULTS TABLE - Sediment Samples
RADFORD ARMY AMMUNITION PLANT
NEW RIVER AND TRIBUTARIES STUDY

FIELD SAMPLE ID:		NRSE16	NRSE17	NRSE18	NRSE30	SCSE3(B)	SCSE4	TRIBSE1	TRIBSE2	TRIBSE3
SAMPLING DATE:		11/22/96	11/22/96	11/22/96	11/22/96 Dup NR15	11/20/96	11/21/96	11/25/96	11/25/96	11/25/96
Nickel	µg/g	19	12.3	16.1	15.9	13.2	17.9	8.6	5.1	
Potassium	µg/g	1670	1800	2210	1600	972	946	3710 J	625 J	454 J
Sodium	µg/g			97.6 J1			89.3 J1			
Thallium	µg/g	1.6		1.9	1.4			1.6		
Vanadium	µg/g	40.9	27.5	35.4	45.8	13.4	20	19.3	13.4	8.1
Zinc	µg/g	33.2	323	358	849	60.4	70.2 J1	122 J	131 J	29.3 J
Wet Chemistry Parameters										
Acid Volatile Sulfide	µg/g					5.5	4.5			
PH		7.2			7.5	7.6	7.4	7.9	8.1	8.2
Total Organic Carbon	µg/g	72			76	45	40	27	36	58
Total Organic Halogens	µg/g	24.3 J1			12.5 J1	76.5		74.4 J1		125 J1

J1 Analyte detected in the field or laboratory blank associated with this sample. Result should be considered estimated and biased high.

TABLE 5 (Continued)
POSITIVE RESULTS TABLE - Sediment Samples
RADFORD ARMY AMMUNITION PLANT
NEW RIVER AND TRIBUTARIES STUDY

FIELD SAMPLE ID:		TRIBSE4	TRIBSE5	TRIBSE6
SAMPLING DATE:		11/21/96	11/20/96	11/21/96
Volatile Organic Compounds				
Methylene Chloride	µg/g			
Acetone	µg/g	0.093		
2-Butanone	µg/g	0.016		
Semivolatile Organic Compounds				
Diethylphthalate	µg/g			
Fluorene	µg/g			
Phenanthrene	µg/g			
Anthracene	µg/g			
Carbazole	µg/g			
Fluoranthene	µg/g			1.1
Pyrene	µg/g			0.69
Benzo(a)anthracene	µg/g			
Chrysene	µg/g			
Benzo(b)fluoranthene	µg/g			
Benzo(k)fluoranthene	µg/g			
Benzo(a)pyrene	µg/g			
Indeno(1,2,3-cd)pyrene	µg/g			
Benzo(g,h,i)perylene	µg/g			
Pesticide/PCB Compounds				
Alpha Chlordane	µg/g			
gamma-Chlordane	µg/g			
Total Metals				
Aluminum	µg/g	11500	13700	10700
Arsenic	µg/g	3.2	13.4	6.9
Barium	µg/g		197	
Beryllium	µg/g	0.6	0.95	0.54
Cadmium	µg/g			
Calcium	µg/g	2660	15600	1230 J1
Chromium	µg/g	19.4	29.6	18.5
Cobalt	µg/g	6	18.5	7.2
Copper	µg/g	12.3	27.6	16.5
Iron	µg/g	15800	36800	20200
Lead	µg/g	19.3	23.7	19.4
Magnesium	µg/g	2870	13300	2450
Manganese	µg/g	423	2430	345

TABLE 5 (Continued)
POSITIVE RESULTS TABLE - Sediment Samples
RADFORD ARMY AMMUNITION PLANT
NEW RIVER AND TRIBUTARIES STUDY

FIELD SAMPLE ID:		TRIBSE4	TRIBSE5	TRIBSE6
SAMPLING DATE:		11/21/96	11/20/96	11/21/96
Nickel	µg/g	10.4	20.9	10
Potassium	µg/g	940	1500	1400
Sodium	µg/g			
Thallium	µg/g			
Vanadium	µg/g	25.2	33.2	27.7
Zinc	µg/g	44.8 J1	76.9 J1	75.9 J1
Wet Chemistry Parameters				
Acid Volatile Sulfide	µg/g			
PH		6.7	7.7	6.5
Total Organic Carbon	µg/g	50	36	56
Total Organic Halogens	µg/g	46.7 J1	54 J1	

J1 Analyte detected in the field or laboratory blank associated with this sample. Result should be considered estimated and biased high.

time this report was prepared. The anticipated completion date for the final report is late 1998. The final report will include geographic information system mapping of ecological communities and rare species habitat (personal communication, Rick Reynolds, VDGIF). The finding of the VDGIF survey should be used in future ecological risk assessment efforts.

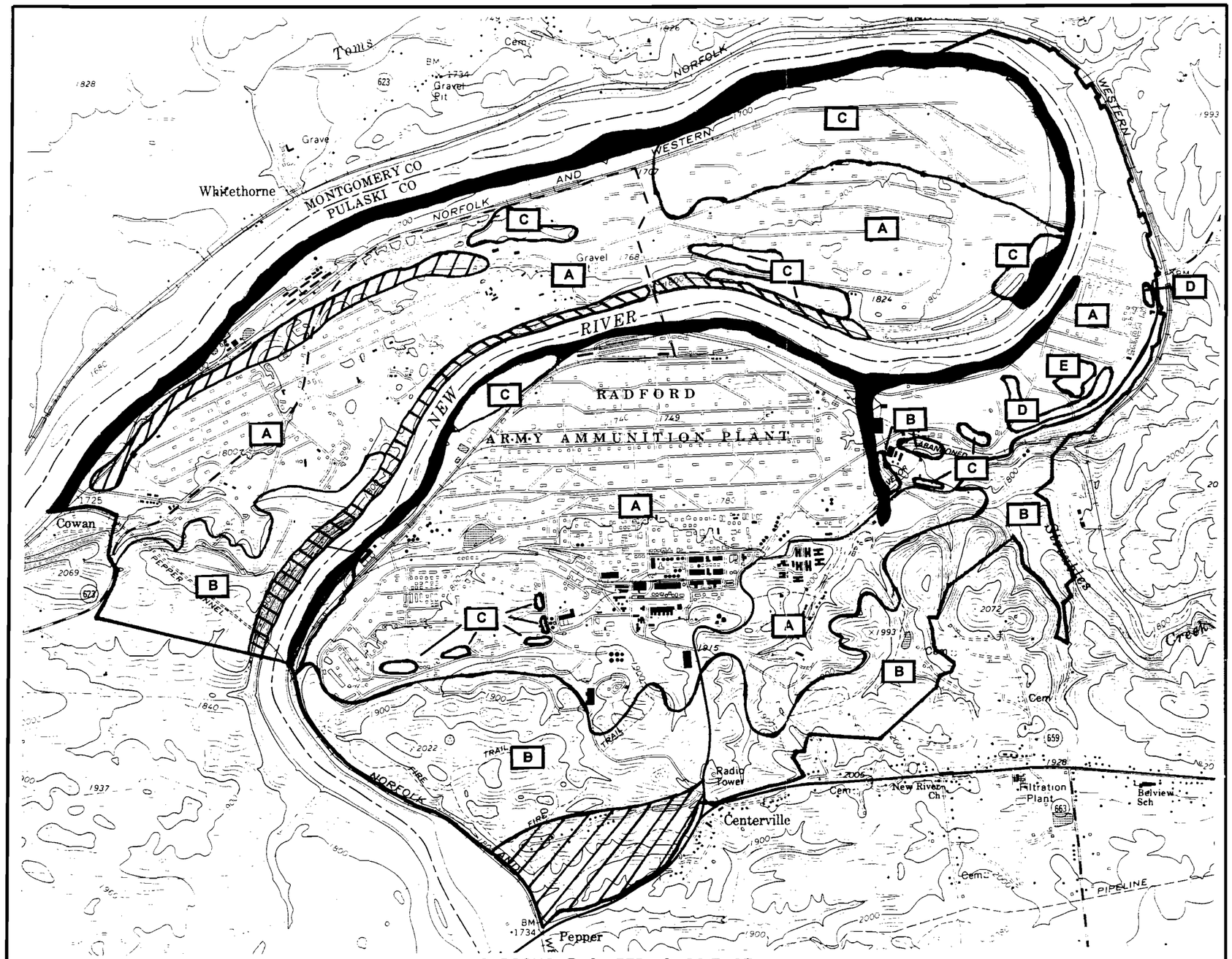
A reconnaissance level ecological community survey was conducted as part of the New River and Tributaries Study to provide general information about ecological communities at RFAAP. The ecological communities within the installation were classified based on their vegetation, topography, soils, hydrology, and other natural features. The following four major ecological systems were identified at the installation: terrestrial, palustrine, riverine, and subterranean. These systems and associated communities are shown in Figure 4 and are discussed in the following section.

Terrestrial Communities

Terrestrial communities consist of upland habitats with well-drained soils. The terrestrial communities at RFAAP include pine forests, mixed hardwood forests, mixed hardwood/pine forests, cliffs, and various cultural communities. Cultural communities are defined as those communities in which the biological composition is quite different than the composition prior to human disturbance. Terrestrial cultural communities, which include mowed grass, mowed roadsides, and unpaved and paved roads/paths, are make up the majority of the installation. While these communities provide habitat elements and opportunities for various kinds of wildlife, they do not independently support populations of wildlife distinct from the surrounding habitats.

The pine forests at RFAAP are dominated by shortleaf pine, loblolly pine, and eastern white pine. The largest congregation of this community is located in the Horseshoe Area, within the meander of the New River. A large contiguous stand of pine trees runs along the northern and southern banks of the Horseshoe Area, parallel to the River's floodplain forest (discussed later). In some areas within the Horseshoe Area, the pine forest is intermingled with the mixed hardwood forests, which include species such as yellow poplar, oaks, hickories, maple, and black walnut. Conversations with RFAAP Conservation Specialist (Thompson, 1995) indicated that 2,537 acres of the woodland at RFAAP are managed. Limited reforestation has occurred in the Main Manufacturing Area. In 1964, 922 acres of the

FIGURE 4
ECOLOGICAL COMMUNITIES MAP
RADFORD ARMY AMMUNITION PLANT
RADFORD, VIRGINIA



0 2,000 4,000
FEET

SCALE = 1:24,000

LEGEND

PROPERTY LINE

A	MOWED GRASS
B	MIXED HARDWOOD FOREST
C	PINE FOREST
D	SHALLOW EMERGENT MARSH/ WET DITCH
E	OLD FIELD
	MIXED HARDWOOD/ PINE FOREST
	CLIFF COMMUNITY
	FLOODPLAIN FOREST

Map Source: U.S. Geological Survey, Radford North Quadrangle

Horseshoe Area were reforested. Common wildlife species found in the pine and mixed hardwood forests are wild turkey, white-tailed deer, and various raptors and song birds.

The cliff community occurs on vertical exposures of calcareous bedrock with some ledges. Minimal soil development exists within this community and vegetation is sparse. The cliff community at RFAAP is found along the south-central to southwestern bank of the Horseshoe Area.

Palustrine Communities

The palustrine communities consist of non-tidal perennial wetlands characterized by emergent vegetation. Wetlands communities are distinguished by their plant composition, underlying soils that differ from dry habitats, and hydrologic regime. The palustrine communities at RFAAP include floodplain forests, sinkhole wetlands, and various cultural communities (shallow emergent marsh/wet ditch). As with the terrestrial system, cultural communities are defined as wetlands communities in which the biological composition is quite different than the composition prior to human disturbance. These communities, which primarily include wet ditches, are scattered throughout the installation.

RFAAP contains prominent karstic features including sinkholes, caves, and caverns. Karst landforms occur in carbonate rock formations as the result of the dissolution of rock by naturally occurring carbonic acid in rainwater. As the rock is dissolved, cavities or caverns are formed beneath the earth's surface. Occasionally, large caverns collapse producing a depression or sinkhole on the surface. As these depressions continue to collect water, vegetation establishes on available soil creating sinkhole wetlands. A few small sinkhole wetlands are apparent within the boundaries of the facility.

The floodplain forest, which is perhaps the largest palustrine community at RFAAP, is composed of mixed hardwood species (sycamore and maple) that occur on mineral soils on low terraces of river floodplains. These sites are characterized by their flood regime. Low areas are annually flooded in the spring and high areas are flooded irregularly. Some sites are dry by late summer. The RFAAP floodplain forest runs along the northern and southern banks of the New

River. Large numbers of black vultures are present during certain times of the year and congregate on large sycamore trees in this community.

Riverine Communities

The riverine system at RFAAP consists of aquatic communities of flowing non-tidal waters that lack persistent emergent vegetation, but may include areas with submerged or floating-leaved aquatic vegetation. The New River is the primary riverine community at RFAAP. Within RFAAP, the New River width varies from 200 to 1,000 feet, but averages approximately 400 feet. The river's shoreline within the RFAAP boundaries is 13 miles. The headwaters of the New River are in northwestern North Carolina, near the Tennessee state line. In the vicinity of RFAAP, the New River flows northwesterly cutting cliffs through the bedrock. The river is perhaps the oldest river in North America, estimated to be 350 million years old.

Other riverine communities at RFAAP include main channel streams and intermittent streams. Stroubles Creek, the main channel stream that flows through the southeast sector of the installation, is the largest local tributary to the New River. Stroubles Creek consists primarily of stormwater runoff from the rural areas through which it flows, as well as municipal wastewater treatment plant effluent. Groundwater discharging from the karst bedrock may also supply significant stream flow. This creek is fed by several branches that originate on and off the installation. Manmade surface drainage ways at RFAAP also influence local drainage. All surface drainage flow within RFAAP is ultimately toward the New River.

Subterranean Communities

RFAAP contains prominent karstic features including caves and caverns. The caves and caverns comprise the subterranean communities at RFAAP. While detailed surveys were not conducted to identify the types of subterranean communities that occur at the installation, it is believed that the two primary subterranean habitats are small aquatic and terrestrial cave communities. Specific locations of these communities were not documented during the survey.

6.2.2 Threatened and Endangered Species

As discussed above, VDGIF is in the process of conducting detailed rare species surveys at RFAAP. No federal- or state-listed endangered or threatened species were documented at the Main Section of RFAAP during the 1997 field efforts. However, some invertebrate samples collected during 1997 are still being identified (personal communication, Rick Reynolds, VDGIF). Complete results of the survey should be available in late 1998 and should be used in future ecological risk assessment efforts.

Information concerning the potential for rare species to occur at RFAAP was obtained from the Virginia Department of Conservation and Recreation, Division of Natural Heritage (DCR). The DCR searched its Biological and Conservation Data System (BCD) for occurrences of natural heritage resources within the boundaries of RFAAP and the surrounding area. Natural heritage resources are defined by DCR as the habitat of rare, threatened, or endangered plants and animal species, unique or exemplary natural communities, and significant geologic formations. Results of this database search are provided in Appendix D. The database search produced no records of natural heritage resources within the boundaries of RFAAP. Several rare species were identified by DCR as having the potential to occur at the site based on historic occurrences in the general vicinity of the site. These species are listed in Table 6 along with their status. Specific locational information for species documented in the general vicinity of RFAAP was not provided by DCR. More detailed information on these species is provided in the correspondence from DCR which is found in Appendix D.

The US Fish and Wildlife Service was not contacted regarding the potential presence of threatened or endangered species at RFAAP because DCR's records and the ongoing VDGIF survey should provide the most complete and up to date information.

6.2.3 Screening and Selection of Chemicals of Potential Concern

Surface water and sediment data collected for the New River and tributaries were compared to ecological screening criteria to identify chemicals of potential concern (COPC). Although the screening process does not constitute a complete ecological risk assessment (ERA), the findings are intended to support future ERA efforts, if necessary.

TABLE 6
RARE SPECIES IDENTIFIED
RADFORD ARMY AMMUNITION PLANT

SCIENTIFIC NAME	COMMON NAME	STATE STATUS	FEDERAL STATUS	HERITAGE RANK
PLANTS				
Carex cristatella	Crested sedge	No legal status	No legal status	G5/S2
Clematis coactilus	Virginia white-haired leatherflower	No legal status	No legal status	G3/S2S3
Echinacea laevigata	Smooth coneflower	No legal status	Listed Endangered	G2G3/S2
Lithospermum latifolium	American gromwell	No legal status	No legal status	G5/S2
Paxistima canbyi	Canby's mountain-lover	No legal status	Species of Concern	G2/S2
INVERTEBRATES				
Lasmigona subviridis	Green floater	Candidate	Species of Concern	G3/S2
Lasmigona holstonia	Tennessee heelsplitter	Listed Endangered	Species of Concern	G2G3/S1
Polygyriscus virginicus	Virginia fringed mountain snail	Listed Endangered	Listed Endangered	G1/S1
Caecidotea henroti	Henrot's cave isopod	No legal status	No legal status	G2/S1S2
Litocampa sp. 3	a cave dipluran	No legal status	No legal status	G?/S1
Stygobromus adbitus	James Cave amphipod	No legal status	No legal status	G1/S1
AMPHIBIANS				
Cryptobranchus alleganiensis	Hellbender	Candidate	Species of Concern	G4/S2S3

S= State; G= Global
S1 = Extremely rare in the state, usually 5 or fewer populations or occurrences in the state; or may be a few remaining individuals; often especially vulnerable to extirpation.
S2 = Very rare, usually between 5 and 20 populations or occurrence; or with many individuals in fewer occurrences; often susceptible to becoming extirpated.
S3 = Rare to uncommon; usually between 20 and 100 populations or occurrences; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.
G1 = same as S1, but refers to a species rarity throughout its total range.
G2 = same as S2, but refers to a species rarity throughout its total range.
G3 = same as S3, but refers to a species rarity throughout its total range.
G4 = Common in total range; usually >100 populations or occurrences, but may be fewer with many large populations; may be restricted to only a portion of the state; usually not susceptible to immediate threats.
G5 = Very common in total range; demonstrably secure under present conditions.

COPC were identified for the sediment and surface water of the New River and tributaries following qualification and evaluation of analytical data and comparison to ecologically risk-based screening values. The selection and identification of COPC are presented in Tables 7, 8, and 9, along with the analytes' maximum detected concentrations, frequency of detection, laboratory detection limit, and whether the analyte is a COPC.

For surface water, maximum concentrations were based on positive results. In the case where an analyte was not detected in any sample, then it was not included in Table 7. Both total and dissolved metals are included in the analysis. The screening criteria, in the order in which the comparisons were made, are presented below:

- 1st - Virginia Chronic Water Quality Standards for Protection of Aquatic Life;
- 2nd - USEPA Chronic Ambient Water Quality Criteria;
- 3rd - USEPA Ecotox Thresholds;
- 4th - USEPA Region 4 Freshwater Surface Water Screening Values;
- 5th - Region 3 Biological Technical Advisory Group (BTAG) Draft Screening Values.

The screening benchmarks used for sediment samples are presented below in order:

- 1st - USEPA Sediment Quality Criteria for the Protection of Benthic Organisms: acenaphthene, phenanthrene, and ;
- 2nd - USEPA Ecotox Thresholds;
- 3rd - USEPA Region 4 Sediment Screening Values; and
- 4th - USEPA Region 3 BTAG Draft Screening Values.

Data obtained from all sampling locations in the New River and tributaries were combined and used to represent the exposure area. This procedure was used since ecological receptors that would be exposed to site-related contaminants are mobile and thus potentially exposed to all sampling locations.

Table 7
Radford Army Ammunition Plant
Frequency of Positive Detections

Analyte	SEDIMENT			SURFACE WATER		
	Detection Limit (mg/kg)	Frequency of Detection[1]	Maximum Conc. (mg/kg)	Detection Limit (mg/L)	Frequency of Detection[1]	Maximum Conc. (mg/L)
Volatiles						
2-Butanone	0.01	1/26	0.016	0.01	--	--
Acetone	0.01	1/26	0.093	0.01	--	--
Methylene Chloride	0.01	5/26	0.022	0.01	--	--
Semi-Volatiles						
Anthracene	0.33	1/26	0.86	0.01	--	--
Fluoranthene	0.33	7/26	2.8	0.01	--	--
Bis(2-Ethylhexyl)phthalate	0.33	1/26	6.62	0.01	1/13	0.013
Butylbenzylphthalate	0.33	--	--	0.01	1/13	0.011
Dimethylphthalate	0.33	1/26	8.31	0.01	--	--
N-Nitrosodiphenylamine	0.33	1/26	2.6	0.01	--	--
Benzo(a)anthracene	0.33	5/26	2.2	0.01	--	--
Benzo(a)pyrene	0.33	1/26	1.6	0.01	--	--
Benzo(b)fluoranthene	0.33	1/26	2.5	0.01	--	--
Benzo(g,h,i)perylene	0.33	1/26	0.54	0.01	--	--
Benzo(k)fluoranthene	0.33	1/26	1.1	0.01	--	--
Carbazole	0.33	1/26	0.49	0.01	--	--
Chrysene	0.33	6/26	1.8	0.01	--	--
Di-n-butylphthalate	0.33	--	--	0.01	4/13	0.074
Diethylphthalate	0.33	2/26	6.23	0.01	--	--
Fluorene	0.33	1/26	0.76	0.01	--	--
Indeno(1,2,3-cd)pyrene	0.33	1/26	0.56	0.01	--	--
Phenanthrene	0.33	6/26	4	0.01	--	--
Pyrene	0.33	6/26	3.3	0.01	--	--
Pesticides / PCBs						
alpha-Chlordane	0.0034	2/20	0.011	0.00005	--	--
gamma-Chlordane	0.0034	2/20	0.012	0.00005	--	--
Metals						
Aluminum	0.1	20/20	16000	0.1	4/7	0.168
Arsenic	1.0	23/29	17.4	0.01	--	--
Barium	81.8	26/29	700.6	0.01	14/16	0.063
Beryllium	0.3	25/29	4.23	0.0011	3/16	0.00223
Cadmium	0.5	3/29	2.8	0.005	--	--
Chromium	0.01	29/29	77.3	0.01	1/16	0.0309
Cobalt	0.02	20/20	18.5	0.02	--	--
Copper	0.01	20/20	110	0.01	--	--
Iron	0.05	20/20	43500	0.05	6/7	0.443
Lead	10.3	29/29	4415.6	0.0044	2/16	0.0252
Manganese	345.0	20/20	2430	0.01	5/7	0.146
Mercury	0.1	1/29	0.13	0.0002	--	--
Nickel	2.0	28/29	52.9	0.02	--	--
Selenium	1.0	1/29	1.85	0.01	--	--
Thallium	1.0	7/29	1.9	0.01	--	--
Vanadium	8.1	20/20	33.8	0.01	--	--
Zinc	44.8	17/20	1430	0.01	--	--

Table 7 (Continued)
Radford Army Ammunition Plant
Frequency of Positive Detections

Analyte	SEDIMENT			SURFACE WATER		
	Detection Limit (mg/kg)	Frequency of Detection[1]	Maximum Conc. (mg/kg)	Detection Limit (mg/L)	Frequency of Detection[1]	Maximum Conc. (mg/L)
Dissolved Metals						
Barium	NA	--	--	0.028	5/7	0.17
Iron	NA	--	--	0.05	2/7	0.165
Manganese	NA	--	--	0.01	2/7	0.0126
Zinc	NA	--	--	0.01	4/7	0.0162
Explosives						
2,4,6-Trinitrotoluene	0.4	1/27	28.89	0.0008	--	--
HMX	0.4	--	--	0.0008	2/14	0.0053

Note:

"--" = Not detected in this media.

[1] Refer to Table 2 and Section 4.1 for the following discussion.

Sediment sample totals: 29 total samples were collected-
- 3 were not analyzed for VOCs or SVOCs, resulting in 26 for those parameters.
- 9 (all the 1995 samples) were not analyzed for Pest/PCBs.
- 9 (all the 1995 samples) did not include as many total metals as during the 1996 event. Therefore, some metals could only be detected in 20 samples, e.g., aluminum and cobalt could not be detected in any of the 9 samples collected in 1995.
- 2 were not analyzed for Explosives.

Surf. Water sample totals: 16 total samples were collected-
- 3 were not analyzed for VOCs or SVOCs, resulting in 13 for those parameters.
- 9 (all the 1995 samples) were not analyzed for Pest/PCBs or Dissolved metals.
- 9 (all the 1995 samples) did not include as many total metals as during the 1996 event. Therefore, some metals could only be detected in 7 samples, e.g., aluminum and cobalt could not be detected in any of the 9 samples collected in 1995.
- 2 were not analyzed for Explosives.

Table 8
Radford Army Ammunition Plant
Surface Water Screening

Analyte	Frequency of Detection	Detection Limit	Maximum Concentration Detected	Surface Water Screening Criteria[1]		Maximum Exceeds Toxicity-Based Screening Criterion (Y/N)[2]	Retained as COPC (Y/N)[3]
Chemical-units in mg/L							
Semi-Volatiles							
Bis(2-Ethylhexyl)phthalate	1/13	0.01	0.013	0.032	(c)	N	N
Butyl benzyl phthalate	1/13	0.01	0.011	0.019	(c)	N	N
Di-n-butylphthalate	4/13	0.01	0.074	0.033	(c)	Y	Y
Metals[4]							
Aluminum	4/7	0.1	0.168	0.087	(d)	Y	Y
Barium	14/16	0.01	0.063	0.0039	(c)	Y	Y
Beryllium	3/16	0.0011	0.00223	0.0053	(b)	N	N
Chromium	1/16	0.01	0.0309	0.011	(b)	Y	Y
Iron	6/7	0.05	0.443	1.00	(b)	N	N
Lead [5]	2/16	0.0044	0.0252	0.00462	(b)	Y	Y
Manganese	5/7	0.01	0.146	0.08	(c)	Y	Y
Dissolved Metals[4]							
Barium	5/7	0.028	0.17	NR		Y	Y
Iron	2/7	0.05	0.165	NR		Y	Y
Manganese	2/7	0.01	0.0126	NR		Y	Y
Zinc [5]	4/7	0.01	0.0162	0.1358	(a)	N	N
Explosives							
HMX	2/14	0.0008	0.0053	NR		Y	Y

Notes

(1) Value refers to level indicated in a,b,c,d,e below. Radford Army Ammunition Plant Risk-Based Work Plan, November 1996.
(2) If toxicity-based screening criteria were not available the chemical was retained.
(3) Analyte was retained as a Chemical of Potential Concern (COPC) if the max. conc. exceeded the screening criteria.
(4) Naturally occurring analytes calcium, sodium, potassium, and magnesium, were not included in screening.
(5) Hardness dependent.

Hardness = 134 mg/L

Lead: =EXP((1.273*(LN(134))-4.705))
Zinc: =EXP((0.8473*(LN(134))+0.7614))

(a) State of Virginia, Standards for Surface Water, May 20, 1992.
(b) EPA Water Quality Criteria Summary, May 1, 1991.
(c) EPA Ecotox Threshold, 1996
(d) EPA Region IV Freshwater Surface Water Screening Values, 1995
(e) EPA Region III BTAG Draft Screening Levels, 1995
NR = No criteria value was assigned.

Table 9
Radford Army Ammunition Plant
Sediment Screening

Analyte	Frequency of Detection	Detection Limit (mg/kg)	Maximum Concentration Detected (mg/kg)	Sediment Screening Criteria[1] (mg/kg)		Maximum Exceeds Toxicity -Based Screening Criterion (Y/N)[2]	Retained as COPC (Y/N)[3]
Volatiles							
2-Butanone	1/26	0.01	0.016	NR		Y	Y
Acetone	1/26	0.01	0.093	NR		Y	Y
Methylene Chloride	5/26	0.01	0.022	NR		Y	Y
Semi-Volatiles							
Anthracene	1/26	0.33	0.86	0.33	(c)	Y	Y
Bis(2-Ethylhexyl)phthalate	1/26	0.33	6.62	0.182	(c)	Y	Y
N-Nitrosodiphenylamine	1/26	0.33	2.6	0.028	(d)	Y	Y
Benzo(a)anthracene	5/26	0.33	2.2	0.33	(c)	Y	Y
Benzo(a)pyrene	1/26	0.33	1.6	0.43	(b)	Y	Y
Benzo(b)fluoranthene	1/26	0.33	2.5	0.33	(c)	Y	Y
Benzo(g,h,i)perylene	1/26	0.33	0.54	0.33	(c)	Y	Y
Benzo(k)fluoranthene	1/26	0.33	1.1	0.33	(c)	Y	Y
Carbazole	1/26	0.33	0.49	NR		Y	Y
Chrysene	6/26	0.33	1.8	0.33	(c)	Y	Y
Diethylphthalate	2/26	0.33	6.23	0.7875	(b)	Y	Y
Dimethylphthalate	1/26	0.33	8.31	0.071	(d)	Y	Y
Fluoranthene	7/26	0.33	2.8	7.75	(a1)	N	N
Fluorene	1/26	0.33	0.76	0.675	(b)	Y	Y
Indeno(1,2,3-cd)pyrene	1/26	0.33	0.56	0.33	(c)	Y	Y
Phenanthrene	6/26	0.33	4	2.25	(a2)	Y	Y
Pyrene	6/26	0.33	3.3	0.66	(b)	Y	Y
Pesticides / PCBs							
alpha-Chlordane	2/20	0.0034	0.011	0.0017	(c)	Y	Y
gamma-Chlordane	2/20	0.0034	0.012	0.00463	(b)	Y	Y
Metals[4]							
Aluminum	20/20	0.1	16000	NR		Y	Y
Arsenic	23/29	1.0	17.4	8.2	(b)	Y	Y
Barium	26/29	81.8	700.6	NR		Y	Y
Beryllium	25/29	0.3	4.23	NR		Y	Y
Cadmium	3/29	0.5	2.8	1.2	(b)	Y	Y
Chromium	29/29	0.01	77.3	81	(b)	N	N
Cobalt	20/20	0.02	18.5	NR		Y	Y
Copper	20/20	0.01	110	34	(b)	Y	Y
Iron	20/20	0.05	43500	NR		Y	Y
Lead	29/29	10.3	4415.6	47	(b)	Y	Y
Manganese	20/20	345.0	2430	NR		Y	Y
Mercury	1/29	0.1	0.13	0.15	(b)	N	N
Nickel	28/29	2.0	52.9	21	(b)	Y	Y
Selenium	1/29	1.0	1.85	NR		Y	Y
Thallium	7/29	1.0	1.9	NR		Y	Y
Vanadium	20/20	8.1	33.8	NR		Y	Y
Zinc	20/20	44.8	1430	150	(b)	Y	Y

Table 9 (Continued)
Radford Army Ammunition Plant
Sediment Screening

Analyte	Frequency of Detection	Detection Limit (mg/kg)	Maximum Concentration Detected (mg/kg)	Sediment Screening Criteria[1] (mg/kg)	Maximum Exceeds Toxicity -Based Screening Criterion (Y/N)[2]	Retained as COPC (Y/N)[3]
Explosives						
2,4,6-Trinitrotoluene	1/27	0.4	28.89	NR	Y	Y

Notes

NR = no criteria value was assigned

(1) Value refers to level indicated in Risk-Based Work Plan. Radford Army Ammunition Plant draft, Nov. 1996.
(2) If toxicity-based screening criteria were not available the chemical was retained.
(3) Analyte was retained as a Chemical of Potential Concern (COPC) if the maximum concentration exceeded the screening criteria.
(4) Naturally occurring analytes sodium, potassium, magnesium, and calcium were not included in screening.
(a1) EPA "Sediment Quality Criteria for the Protection of Benthic Organisms: Fluoranthene," September 1993.
Value is based on site Total Organic Carbon (TOC) to be site-specific.
(a2) EPA "Sediment Quality Criteria for the Protection of Benthic Organisms: Phenanthrene," September 1993.
Value is based on site Total Organic Carbon (TOC) to be site-specific.

(b) EPA Ecotox Threshold values, 1996. SQB values were multiplied by the site mean percent organic carbon to be site-specific.
(c) EPA Region IV Sediment Screening values, 1995
(d) EPA Region III BTAG Draft Screening Levels, 1995

Mean Organic Carbon % = 1.22
Mean Total Organic Carbon =12,255 mg/kg

Chemicals that were not detected at any sampling locations were eliminated from the initial screening process *(based on the October 20, 1997 USEPA comments, non-detects were further evaluated; they are addressed in Section 7).*

Dissolved metals data for surface water were included for comparison to the screening values against Virginia Water Quality Standards for metals which are expressed as dissolved concentrations. Total metals data for surface water were also included for comparison to the screening values. Total metals have typically been used as part of the screening process for projects that required regulatory oversight by other USEPA regional offices.

Screening Results

The screening data for surface water and sediments in the New River and tributaries are present in Tables 8 and 9. For each analyte, the maximum concentration was compared to the screening criteria; exceedances were noted with a "Y" or yes indicator.

Surface Water

For surface water, 10 COPC were retained by the screening process using the maximum detected concentration. Of these 10 COPC, 4 of the COPC identified were retained because no criteria were available for screening, and therefore require further evaluation. One COPC identified (chromium) was based on only one positive detection value out of 16 surface water samples collected.

Sediment

For sediments, 37 COPC were retained by the screening process using the maximum detected concentration. Fourteen of the COPC identified were retained because no criteria were available for screening, and therefore require further evaluation. Fifteen COPC were identified based on only one positive detection in a sample set greater than 20.

SECTION 7

CONCLUSIONS/RECOMMENDATIONS

7.1 CONCLUSIONS

Impacts to human health have not been evaluated in this document since the focus of the New River and tributaries study was the ecological risk assessment. Reevaluation of human health risks posed by the New River and tributaries surface water and sediments will be part of the finalization of the Parsons ES RFI.

The screening level ecological risk assessment suggests that further investigation is warranted to evaluate those compounds which exceeded screening criteria or for which no screening criteria are available. Table 10 summarizes those compounds in the final list of detected COPC for sediment and surface waters at RFAAP.

Based on the October 20, 1997 comments from the USEPA, all non-detected analytes were re-evaluated to compare screening criteria against detection limits. If the detection limit was greater than the screening criteria, the chemical was retained as a COPC. If no screening criteria were available, the chemical was retained as a COPC for further evaluation. Tables 11 A and 11 B summarize these data for sediment and surface water, respectively.

In addition to the totals presented in Table 10, 5 sediment and 34 surface water COPC were added because the detection limit was greater than the screening criteria for that chemical. 62 sediment and 51 surface water COPC were added because no screening criteria were available for these non-detected chemicals.

TABLE 10
Radford Army Ammunition Plant
Final COPC List

Analyte	SEDIMENT			SURFACE WATER		
	Frequency of Detection	Maximum Concentration Detected (mg/kg)	Sediment Screening Criteria[1] (mg/kg)	Frequency of Detection	Maximum Concentration Detected (mg/L)	Surface Water Screening Criteria[1] (mg/L)
Volatiles						
2-Butanone	1/26	0.016	NR	--	--	--
Acetone	1/26	0.093	NR	--	--	--
Methylene Chloride	5/26	0.022	NR	--	--	--
Semi-Volatiles						
Anthracene	1/26	0.86	0.33	--	--	--
Bis(2-Ethylhexyl)phthalate	1/26	6.62	0.182	--	--	--
N-Nitrosodiphenylamine	1/26	2.6	0.028	--	--	--
Benzo(a)anthracene	5/26	2.2	0.33	--	--	--
Benzo(a)pyrene	1/26	1.6	0.43	--	--	--
Benzo(b)fluoranthene	1/26	2.5	0.33	--	--	--
Benzo(g,h,i)perylene	1/26	0.54	0.33	--	--	--
Benzo(k)fluoranthene	1/26	1.1	0.33	--	--	--
Carbazole	1/26	0.49	NR	--	--	--
Chrysene	6/26	1.8	0.33	--	--	--
Diethylphthalate	2/26	6.23	0.7875	--	--	--
Dimethylphthalate	1/26	8.31	0.071	--	--	--
di-n-butylphthalate	--	--	--	4/13	0.074	0.033
Fluorene	1/26	0.76	0.675	--	--	--
Indeno(1,2,3--cd)pyrene	1/26	0.56	0.33	--	--	--
Phenanthrene	6/26	4	2.25	--	--	--
Pyrene	6/26	3.3	0.66	--	--	--
Pesticides / PCBs						
alpha-Chlordane	2/20	0.011	0.0017	--	--	--
gamma-Chlordane	2/20	0.012	0.00463	--	--	--
Metals						
Aluminum	20/20	16000	NR	4/7	0.168	0.087
Arsenic	23/29	17.4	8.2	--	--	--
Barium	26/29	700.6	NR	14/16	0.063	0.0039
Beryllium	25/29	4.23	NR	--	--	--
Cadmium	3/29	2.8	1.2	--	--	--
Chromium	--	--	--	1/16	0.0309	0.011
Cobalt	20/20	18.5	NR	--	--	--
Copper	20/20	110	34	--	--	--
Iron	20/20	43500	NR	--	--	--
Lead	29/29	4415.6	47	2/16	0.0252	0.00462
Manganese	20/20	2430	NR	5/7	0.146	0.08
Nickel	28/29	52.9	21	--	--	--
Selenium	1/29	1.85	NR	--	--	--
Thallium	7/29	1.9	NR	--	--	--
Vanadium	20/20	33.8	NR	--	--	--
Zinc	20/20	1430	150	--	--	--

TABLE 10
Radford Army Ammunition Plant
Final COPC List

Analyte	SEDIMENT			SURFACE WATER		
	Frequency of Detection	Maximum Concentration Detected (mg/kg)	Sediment Screening Criteria[1] (mg/kg)	Frequency of Detection	Maximum Concentration Detected (mg/L)	Surface Water Screening Criteria[1] (mg/L)
Dissolved Metals						
Barium	NA	NA	NA	5/7	0.17	NR
Iron	NA	NA	NA	2/7	0.165	NR
Manganese	NA	NA	NA	2/7	0.0126	NR
Explosives						
2,4,6-Trinitrotoluene	1/27	28.89	NR	--	--	--
HMX	--	--	--	2/14	0.0053	NR

Notes

(1) Defined explained in Tables 8 and 9.

"--" = Not a Chemical Of Potential Concern retained in this media.

NR = no criteria value was assigned.

NA = Not applicable.

TABLE 11 A

Radford Army Ammunition Plant

Sediment Screening Criteria for Non-Detected Analytes

Analyte	Detect Limit (mg/kg)[1]	Sediment Screening Criteria[2](mg/kg)		Retained as COPC (Y/N)
Volatiles				
1,1,1-Trichloroethane	.0005	0.207	(a)	N
1,1,2,2-Tetrachloroethane	.0008	1.15	(a)	N
1,1,2-Trichloroethane	.0008	0.031	(c)	N
1,1-Dichloroethane	--	NR		Y
1,1-Dichloroethene	--	NR		Y
1,2-Dichloroethane	--	NR		Y
1,2-Dichloroethene (Total)	--	NR		Y
1,2-Dichloropropane	--	NR		Y
2-Hexanone	--	NR		Y
4-Methyl-2-Pentanone	--	NR		Y
Acrylonitrile	--	NR		Y
Benzene	.0004	0.070	(a)	N
Bromodichloromethane	--	NR		Y
Bromoform	--	NR		Y
Bromomethane	--	NR		Y
Carbon Disulfide	--	NR		Y
Carbon Tetrachloride	--	NR		Y
Chlorobenzene	.0004	1.00	(a)	N
Chloroethane	--	NR		Y
Chloroform	--	NR		Y
Chloromethane	--	NR		Y
cis-1,3-Dichloropropene	--	NR		Y
Dibromochloromethane	--	NR		Y
Ethylbenzene	.0005	4.39	(a)	N
Styrene	--	NR		Y
Tetrachloroethene	.0003	0.647	(a)	N
Toluene	.0004	0.817	(a)	N
Total Xylenes	.0006	0.0305	(a)	N
trans-1,3-Dichloropropene	--	NR		Y
Trichloroethene	.0004	1.95	(a)	N
Trichlorofluoromethane	--	NR		Y
Vinyl Chloride	--	NR		Y
Semi-Volatiles				
1,2,4-Trichlorobenzene	--	NR		Y
1,2-Dichlorobenzene	.0004	0.415	(a)	N
1,3-Dichlorobenzene	.0004	2.07	(b)	N
1,4-Dichlorobenzene	.0003	0.427	(a)	N
2,4,5-Trichlorophenol	--	NR		Y
2,4,6-Trichlorophenol	--	NR		Y
2,4,6-Tribromophenol	--	NR		Y
2,4-Dichlorophenol	--	NR		Y
2,4-Dimethylphenol	.0895	0.029	(c)	Y
2,4-Dinitrophenol	--	NR		Y

TABLE 11 A (Continued)
Radford Army Ammunition Plant
Sediment Screening Criteria for Non-Detected Analytes

Analyte	Detect Limit (mg/kg)[1]	Sediment Screening Criteria[2](mg/kg)		Retained as COPC (Y/N)
Semi-Volatiles cont.				
2-Chlorophenol	--	NR		Y
2-Methylnaphthalene	.1021	0.330	(b)	N
2-Methylphenol	.0961	0.063	(c)	Y
2-Nitroaniline	--	NR		Y
2-Nitrophenol	--	NR		Y
3,3'-Dichlorobenzidine	--	NR		Y
3-Nitroaniline	--	NR		Y
4,6-Dinitro-2-Cresol	--	NR		Y
4-Bromophenylphenylether	.1035	1.59	(a)	N
4-Chloro-3-Cresol	--	NR		Y
4-Chloroaniline	--	NR		Y
4-Chlorophenyl-phenylether	--	NR		Y
4-Methylphenol	.0679	0.67		N
4-Nitroaniline	--	NR		Y
4-Nitrophenol	--	NR		Y
Acenaphthene	.0932	0.62	(a)	N
Acenaphthylene	.0883	0.33	(b)	N
bis(2-chloroethoxyl)methane	--	NR		Y
bis(2-chloroethyl)ether	--	NR		Y
bis(2-chloroisopropyl)ether	--	NR		Y
Butylbenzylphthalate	.2027	13.42	(a)	N
Di-n-butylphthalate	.3300	13.42	(a)	N
Di-n-octylphthalate	.0904	6.20	(c)	N
Dibenz(a,h)anthracene	.0958	0.33	(b)	N
Dibenzofuran	.1004	2.44	(a)	N
Hexachlorobenzene	.1123	0.02	(c)	Y
Hexachlorobutadiene	.1039	0.01	(c)	Y
Hexachlorocyclopentadiene	.3300	5.37	(d)	N
Hexachloroethane	.0879	1.22	(a)	N
Isophorone	--	NR		Y
N-Nitroso-di-n-propylamine	--	NR		Y
Naphthalene	.0973	0.59	(a)	N
Pentachlorophenol	.0305	0.36	(c)	N
Phenol	.0784	0.42	(c)	N
Metals				
Antimony	10.00	12.00	(c)	N
Silver	2.00	2.00	(c)	N
Pesticides / PCBs				
4,4'-DDD	.0027	0.0033	(b)	N
4,4'-DDE	.0004	0.0030	(b)	N
4,4'-DDT	.0014	0.0016	(a)	N
Aldrin	.0002	0.0020	(e)	N
Alpha-BHC	.0003	0.0060	(e)	N

TABLE 11 A

Radford Army Ammunition Plant

Sediment Screening Criteria for Non-Detected Analytes

Analyte	Detect Limit (mg/kg)[1]	Sediment Screening Criteria[2](mg/kg)		Retained as COPC (Y/N)
Pesticides/PCBs cont.				
Aroclor-1016	.0067	0.0230	(a)	N
Aroclor-1221	.0449	0.0230	(a)	Y
Aroclor-1232	.0159	0.0230	(a)	N
Aroclor-1242	.0087	0.0230	(a)	N
Aroclor-1248	.0126	0.0230	(a)	N
Aroclor-1254	.0040	0.0230	(a)	N
Aroclor-1260	.0070	0.0230	(a)	N
Beta-BHC	.0034	0.0050	(e)	N
delta-BHC	--	NR		Y
Dieldrin	.0066	0.052	(a)	N
Endosulfan I	.0034	0.0035	(a)	N
Endosulfan II	.0066	0.017	(a)	N
Endosulfan Sulfate	--	NR		Y
Endrin	.0009	0.020	(a)	N
Endrin Aldehyde	--	NR		Y
Endrin Ketone	--	NR		Y
gamma-BHC	.0013	0.0045	(a)	N
Heptachlor	.0004	0.122	(d)	N
Heptachlor Epoxide	.0003	0.122	(d)	N
Methoxychlor	.0035	0.023	(a)	N
Toxaphene	.0043	0.034	(a)	N
Explosives				
1,3,5-Trinitrobenzene	--	NR		Y
1,3-Dinitrobenzene	--	NR		Y
2,4-Dinitrotoluene	--	NR		Y
2,6-Dinitrotoluene	--	NR		Y
2-AM-4,6-Dinitrotoluene	--	NR		Y
2-Nitrotoluene	--	NR		Y
3-Nitrotoluene	--	NR		Y
4-AM-2,6-Dinitrotoluene	--	NR		Y
4-Nitrotoluene	--	NR		Y
HMX	--	NR		Y
Nitrobenzene	--	NR		Y
RDX	--	NR		Y
Tetryl	--	NR		Y

TABLE 11 A

Radford Army Ammunition Plant

Sediment Screening Criteria for Non-Detected Analytes

Analyte	Detect Limit (mg/kg)[1]	Sediment Screening Criteria[2](mg/kg)	Retained as COPC (Y/N)

Notes

(--) = Where no screening criteria were available, the chemical was automatically retained and no screen against detection limits was necessary.

NR = No criteria value was assigned.

(1) Method detection limits used for screen. If screening criteria was less than detection limit, chemical was retained.

(2) Value refers to level indicated in Risk-Based Work Plan, Radford Army Ammunition Plant draft, Nov. 1996.

(a) EPA Ecotox Threshold values, 1996. SQB values were multiplied by the site mean percent organic carbon to be site-specific

(b) EPA Region IV Sediment Screening values, 1995

(c) EPA Region III BTAG Draft Screening Levels, 1995

(d) New York Department of Environmental Conservation, "Technical Guidance for Screening Contaminated Sediments," November 1993.

(e) Ontario Ministry of Environment and Energy, "Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario," August 1993.

Mean Organic Carbon % = 1.22

Mean Total Organic Carbon = 12,255 mg/kg

TABLE 11 B

Radford Army Ammunition Plant

Surface Water Screening Criteria for Non-Detected Analytes

Analyte	Detection Limit[1] (mg/L)	Surface Water Screening Criteria[2] (mg/L)		Retained as COPC (Y/N)
Volatiles				
1,1,1-Trichloroethane	.0003	0.062	(c)	N
1,1,2,2-Tetrachloroethane	.0003	0.420	(c)	N
1,1,2-Trichloroethane	.0002	0.940	(d)	N
1,1-Dichloroethane	.0005	160	(e)	N
1,1-Dichloroethene	--	NR	(c)	Y
1,2-Dichloroethane	.0003	2.00	(d)	N
1,2-Dichloroethene (Total)	.0100	11.60	(e)	N
1,2-Dichloropropane	.0008	0.525	(d)	N
2-Butanone	.0013	3220	(e)	N
2-Hexanone	.0009	428	(e)	N
4-Methyl-2-Pentanone	--	NR		Y
Acetone	.0021	9000	(e)	N
Acrylonitrile	.0100	0.0755	(d)	N
Benzene	.0007	0.046	(c)	N
Bromodichloromethane	.0004	11.0	(e)	N
Bromoform	.0003	0.293	(d)	N
Bromomethane	--	NR		Y
Carbon Disulfide	.0004	0.002	(e)	N
Carbon Tetrachloride	.0004	0.352	(d)	N
Chlorobenzene	.0003	0.130	(c)	N
Chloroethane	--	NR		Y
Chloroform	.0004	0.289	(d)	N
Chloromethane	--	NR		Y
cis-1,3-Dichloropropene	.0003	0.0244	(d)	N
Dibromochloromethane	--	NR		Y
Ethylbenzene	.0004	0.290	(c)	N
Methylene Chloride	.0007	1.93	(d)	N
Styrene	--	NR		Y
Tetrachloroethene	.0003	0.120	(c)	N
Toluene	.0003	0.130	(c)	N
Total Xylenes	.0007	0.0018	(c)	N
trans-1,3-Dichloropropene	.0001	0.0244	(d)	N
Trichloroethene	.0003	0.350	(c)	N
Trichlorofluoromethane	.0006	11.0	(e)	N
Vinyl Chloride	.0004	11.6	(e)	N
Semi-Volatiles				
1,2,4-Trichlorobenzene	.0027	0.110	(c)	N
1,2-Dichlorobenzene	.0004	0.014	(c)	N
1,3-Dichlorobenzene	.0003	0.071	(c)	N
1,4-Dichlorobenzene	.0003	0.015	(c)	N

TABLE 11 B (Continued)
Radford Army Ammunition Plant
Surface Water Screening Criteria for Non-Detected Analytes

Analyte	Detection Limit[1] (mg/L)	Surface Water Screening Criteria[2] (mg/L)		Retained as COPC (Y/N)
Semi-Volatiles cont.				
2,4,5-Trichlorophenol	--	NR		Y
2,4,6-Trichlorophenol	.0035	0.0032	(d)	Y
2,4-Dichlorophenol	.0030	0.0365	(d)	N
2,4-Dimethylphenol	.0022	0.0212	(d)	N
2,4-Dinitrophenol	.0250	0.0062	(d)	Y
2-Chloronaphthalene	--	NR		Y
2-Chlorophenol	.0029	0.0438	(d)	N
2-Methylnaphthalene	--	NR		Y
2-Methylphenol	--	NR		Y
2-Nitroaniline	--	NR		Y
2-Nitrophenol	.0003	3.50	(d)	N
3,3'-Dichlorobenzidine	--	NR		Y
3-Nitroaniline	--	NR		Y
4-Bromophenylphenylether	.0042	0.0015	(c)	Y
4-Chloro-3-Cresol	.0100	0.0003	(d)	Y
4-Chloroaniline	--	NR		Y
4-Chlorophenyl-phenylether	--	NR		Y
4-Methylphenol	--	NR		Y
4-Nitroaniline	--	NR		Y
4-Nitrophenol	.0009	0.0828	(d)	N
4,6-Dinitro-2-Cresol	--	NR		Y
Acenaphthene	.0031	0.023	(c)	N
Acenaphthylene	--	NR		Y
Anthracene	.0028	0.0001	(e)	Y
Benzo(a)anthracene	.0023	0.0063	(e)	N
Benzo(a)pyrene	.0028	0.000014	(c)	Y
Benzo(b)fluoranthene	--	NR		Y
Benzo(g,h,i)perylene	--	NR		Y
Benzo(k)fluoranthene	--	NR		Y
bis(2-chloroethoxy)methane	.0030	11.0	(e)	N
bis(2-chloroethyl)ether	.0028	2.38	(d)	N
bis(2-chloroisopropyl)ether	--	NR		Y
Carbazole	--	NR		Y
Chrysene	--	NR		Y
Di-n-octylphthalate	.0025	0.0003	(e)	Y
Dibenz(a,h)anthracene	--	NR		Y
Dibenzofuran	.0037	0.020	(c)	N
Diethylphthalate	.0028	0.220	(c)	N
Dimethylphthalate	.0035	0.330	(d)	N
Fluoranthene	.0027	0.0081	(c)	N

TABLE 11 B (Continued)
Radford Army Ammunition Plant
Surface Water Screening Criteria for Non-Detected Analytes

Analyte	Detection Limit[1] (mg/L)	Surface Water Screening Criteria[2] (mg/L)		Retained as COPC (Y/N)
Semi-Volatiles cont.				
Fluorene	.0033	0.0039	(c)	N
Hexachlorobenzene	.0036	0.00368	(e)	N
Hexachlorobutadiene	.0022	0.00093	(d)	Y
Hexachlorocyclopentadiene	.0100	0.000070	(d)	Y
Hexachloroethane	.0020	0.012	(c)	N
Indeno(1,2,3-cd)pyrene	--	NR		Y
Isophorone	.0029	1.17	(d)	N
N-Nitroso-di-n-propylamine	--	NR		Y
N-Nitrosodiphenylamine	.0030	0.0585	(d)	N
Naphthalene	.0028	0.024	(c)	N
Pentachlorophenol	.0024	12.8	(a) (4)	N
Phenanthrene	.0030	0.0063	(c)	N
Phenol	.0029	0.256	(d)	N
Pyrene	--	NR		Y
Pesticides/PCBs				
4,4'-DDD	.00002	0.000006	(d)	Y
4,4'-DDE	.00001	0.0105	(d)	N
4,4'-DDT	.00002	0.000001	(a)	Y
Aldrin	.00002	0.0003	(a)	N
Alpha Chlordane	--	NR		Y
Alpha-BHC	.00004	0.50	(d)	N
Aroclor-1016	.00008	0.000014	(a)	Y
Aroclor-1221	.00046	0.000014	(a)	Y
Aroclor-1232	.00017	0.000014	(a)	Y
Aroclor-1242	.00020	0.000014	(a)	Y
Aroclor-1248	.00008	0.000014	(a)	Y
Aroclor-1254	.00012	0.000014	(a)	Y
Aroclor-1260	.00005	0.000014	(a)	Y
Beta-BHC	.00002	5.00	(d)	N
delta-BHC	--	NR		Y
Dieldrin	.00002	0.000002	(a)	Y
Endosulfan I	.00001	0.000056	(b)	N
Endosulfan II	.000008	0.000056	(b)	N
Endosulfan Sulfate	--	NR		Y
Endrin	.00002	0.0000023	(a)	Y
Endrin Aldehyde	--	NR		Y
Endrin Ketone	--	NR		Y
gamma-BHC	.00003	0.00008	(a)	N
gamma-Chlordane	--	NR		Y
Heptachlor	.00003	0.000004	(a)	Y

TABLE 11 B (Continued)
Radford Army Ammunition Plant
Surface Water Screening Criteria for Non-Detected Analytes

Analyte	Detection Limit[1] (mg/L)	Surface Water Screening Criteria[2] (mg/L)		Retained as COPC (Y/N)
Pesticides/PCBs cont.				
Heptachlor Epoxide	.000006	0.000004	(b)	Y
Methoxychlor	.00009	0.000030	(a)	Y
Toxaphene	.00035	0.0000002	(a)	Y
Total Metals[3]				
Antimony	.1000	0.160	(d)	N
Arsenic	.0100	0.190	(b)	N
Cadmium	.0050	0.0014	(d) (5)	Y
Cobalt	--	NR		Y
Copper	.0100	0.0152	(d) (5)	N
Mercury	.0002	0.0013	(c)	N
Nickel	.0200	0.20	(d) (5)	N
Selenium	.0100	0.005000	(d)	Y
Silver	.0200	0.0067	(d) (5)	Y
Thallium	.0100	0.004000	(d)	Y
Vanadium	--	NR		Y
Zinc	.0100	0.136	(d) (5)	N
Dissolved Metals				
Aluminum	--	NR		Y
Antimony	--	NR		Y
Arsenic	.0100	0.19	(a)	N
Beryllium	.0030	0.0051	(c)	N
Cadmium	.0050	0.0014	(a) (5)	Y
Chromium	.0100	0.263	(a) (5)	N
Cobalt	.0200	0.003	(c)	Y
Copper	.0100	0.0152	(a) (5)	N
Lead	.0050	0.0046	(a) (5)	Y
Mercury	.0002	0.000012	(a)	Y
Nickel	.0200	0.20	(a) (5)	N
Selenium	.0100	0.0050	(a)	Y
Silver	.0200	0.0067	(a) (5)	Y
Thallium	--	NR		Y
Vanadium	.0100	0.019	(c)	N
Explosives				
1,3,5-Trinitrobenzene	--	NR		Y
1,3-Dinitrobenzene	.0002	1.20	(e)	N
2-AM-4,6-Dinitrotoluene	--	NR		Y
2-Nitrotoluene	--	NR		Y
2,4,6-Trinitrotoluene	--	NR		Y
2,4-Dinitrotoluene	.0001	0.31	(d)	N
2,6-Dinitrotoluene	--	NR		Y

TABLE 11 B (Continued)
Radford Army Ammunition Plant
Surface Water Screening Criteria for Non-Detected Analytes

Analyte	Detection Limit[1] (mg/L)	Surface Water Screening Criteria[2] (mg/L)		Retained as COPC (Y/N)
Explosives cont.				
3-Nitrotoluene	--	NR		Y
4-AM-2,6-Dinitrotoluene	--	NR		Y
4-Nitrotoluene	--	NR		Y
Nitrobenzene	.0004	0.27	(d)	N
RDX	--	NR		Y
Tetryl	--	NR		Y

Notes

(--) = Where no screening criteria were available, the chemical was automatically retained and no screen against detection limits was necessary

NR = No criteria value was assigned.

(1) Method detection limits used for screen. If screening criteria was less than detection limit, chemical was retained.
(2) Value refers to level indicated in Risk-Based Work Plan, Radford Army Ammunition Plant draft, November 1996.
(a) State of Virginia, Standards for Surface Water, May 20, 1992.
(b) EPA Water Quality Criteria Summary, May 1, 1991.
(c) EPA Ecotox Threshold, 1996
(d) EPA Region IV Freshwater Surface Water Screening Values, 1995
(e) EPA Region III BTAG Draft Screening Levels, 1995
(3) Naturally occurring analytes calcium, sodium, potassium, and magnesium were not included in screening.
(4) PH dependent. Site pH not available, default value of 7.8 was used.

Hardness = 134 mg/l

Cadmium: =EXP((0.7852*(LN(134))-3.49))
Chromium: =EXP((0.819*(LN(134))+1.561))
Copper: =EXP((0.8545*(LN(134))-1.465))
Lead: =EXP((1.273*(LN(134))-4.705))
Nickel: =EXP((0.846*(LN(134))+1.1645))
Silver: =EXP((1.72*(LN(134))-6.52))
Zinc: =EXP((0.8473*(LN(134))+0.7614))

7.2 RECOMMENDATIONS

The following recommendations are based on the evaluation of the New River surface water and sediment data and the impacts associated with the screening level ecological risk assessment.

1) Review Screening Level Compounds with No Available Criteria Value

There are 4 surface water and 14 sediment detected analyte COPC with no available screening criteria. There are 51 surface water and 62 sediment non-detected analyte COPC with no available screening criteria. The first recommendation is to complete the ecological risk assessment combining the habitat receptor characterization with site specific receptor information to determine if any of these analytes are toxic to the local fish and macroinvertebrates normally found in the New River near the RFAAP facility. By performing the ecological risk assessment, the final COPC list could more completely be evaluated. This analysis was not performed as part of this study because the first phase of the effort was to first determine if any analytes would exceed the ecological screening criteria.

2) Identify COPC that had a Frequency of Detection Less than 5%

From Table 7, results indicate that 15 COPC in the sediments were detected at a frequency less than 5% in a sample set greater than 20. Frequency of detection is an important issue in considering the significance of identified COPC. A frequency of detection of less than 5% may indicate that the COPC is not significant in assessing risks to the environment. It may be reasonable to remove some or all of those 15 COPC from further consideration.

The Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual, Part A, Section 5.9.2 and 5.9.3, USEPA, December 1989 states: *"Chemicals that are infrequently detected may be artifacts in the data due to sampling, analytical, or other problems, and therefore may not be related to site operations or disposal practices. Consider the chemical as a candidate for elimination from the quantitative risk assessment if: (1) it is detected infrequently in one or perhaps two environmental media, (2) it is not detected in any other sampled media or at high concentrations, and (3) there is no reason to believe that the*

chemical may be present". Based upon successful use of the less than 5% frequency of detection criterion for elimination of chemicals, including projects in USEPA Region I and Region IV, it is recommended that discussions with USEPA Region III personnel be initiated to evaluate this situation at RFAAP.

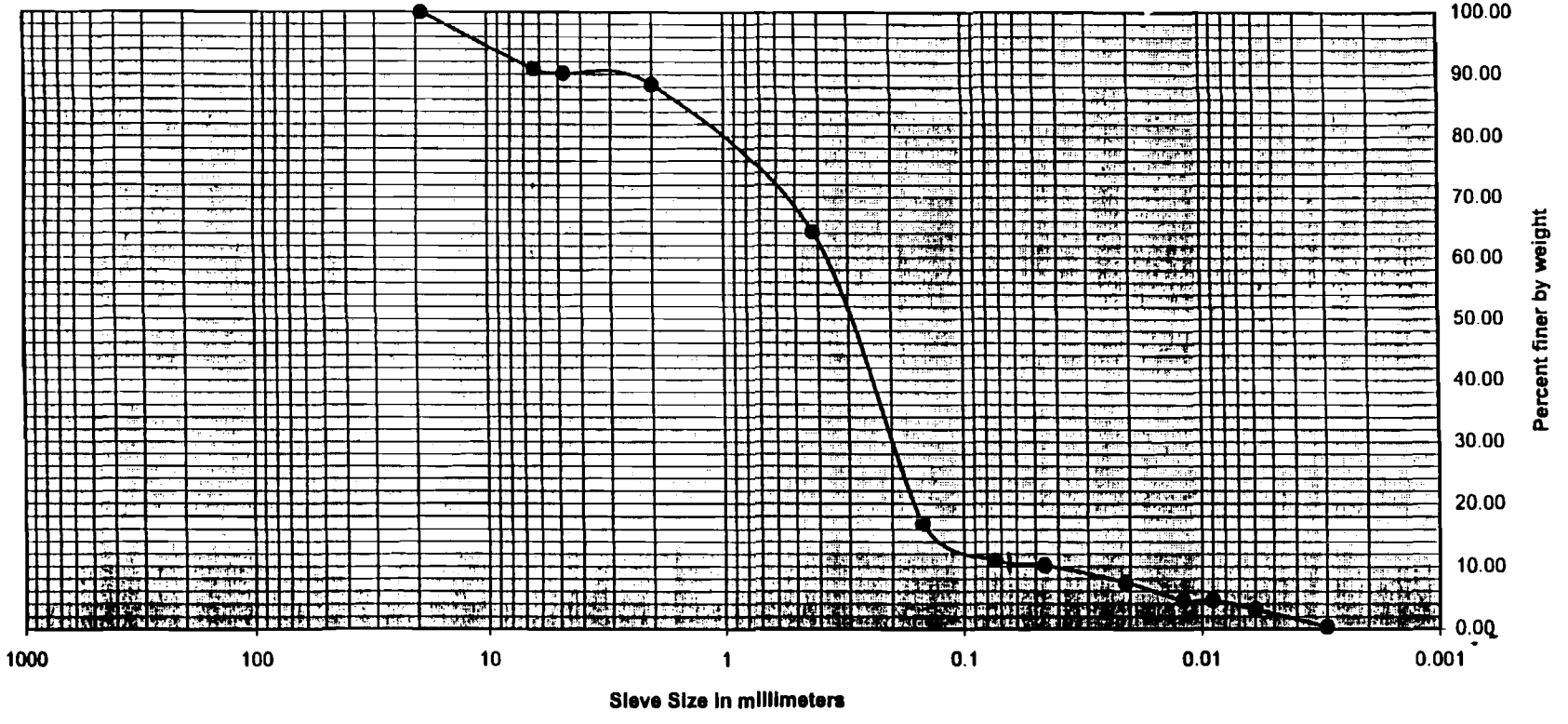
3) Evaluate low detection limit analytical methodologies

34 surface water and 5 sediment COPC could be eliminated from further evaluation if re-analysis at detection limits below the screening criteria results in non-detection for that chemical. However, resampling and reanalysis for lower detection limits is not standard risk assessment practice unless matrix interferences or excessive dilutions have occurred. Standard analytical methods were used for all sampling and the results were not qualified because of excessive dilutions. Analytical methodologies available to produce detection limits below the screening criteria would need to be specialized or modified procedures and would not be practical. Specialized or modified procedures still may not be sufficient to screen below certain screening criteria.

APPENDIX A

GEOTECHNICAL DATA RESULTS

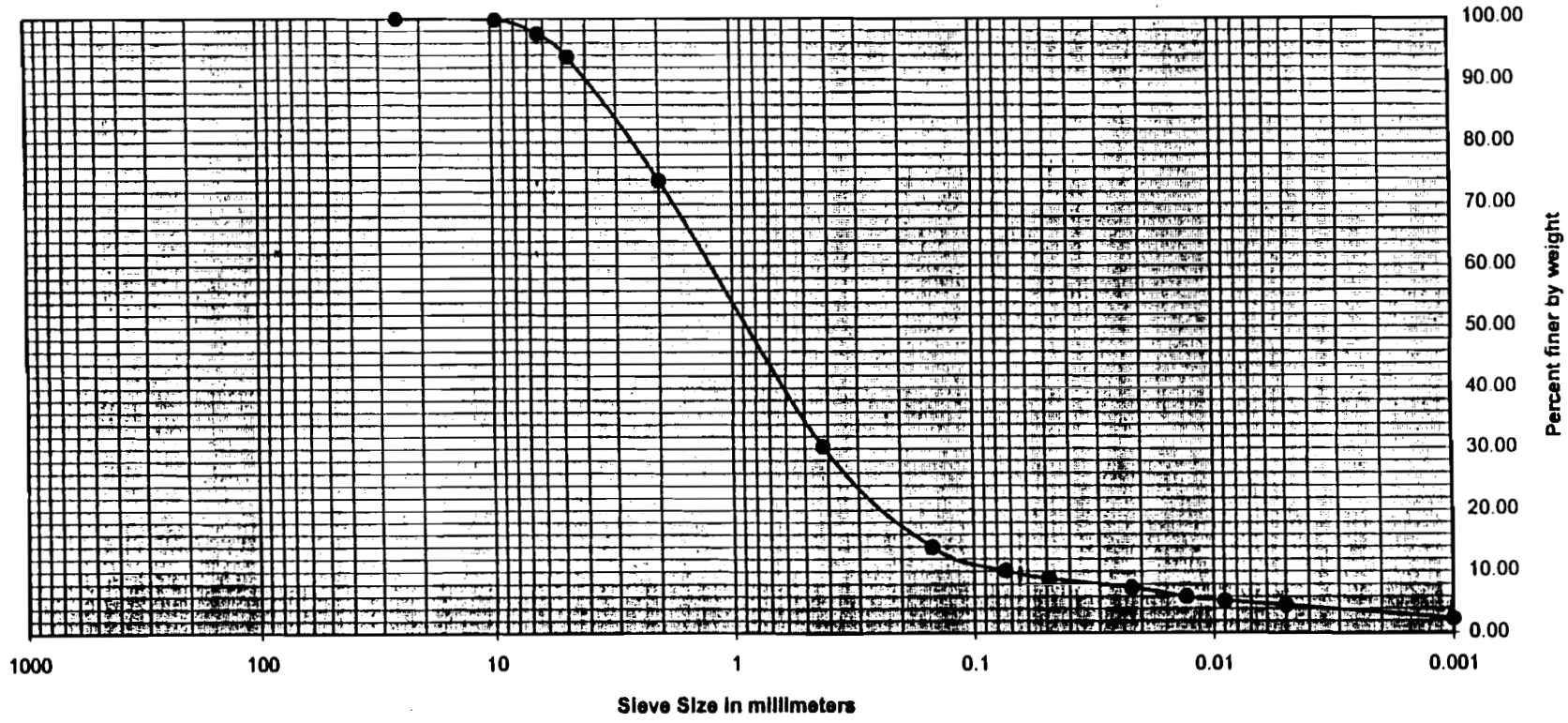
GRADATION CURVE



Boring Number	Classification	NWC	LL	PL	PI	USCS
#1	Brown silty sand	-	NP	NP	NP	SM
296-11-0651-001	Gravel - 10%					
	Sand - 79%					
SCSE 3(b)	Silt & Clay - 11%					

CT&E Environmental Services Inc.			
Client:	**Parsons Engineering Science**		
Project:	**Radford Army Ammo Plant**		
Date:	**12/12/96**	**Tech:**	**AW**

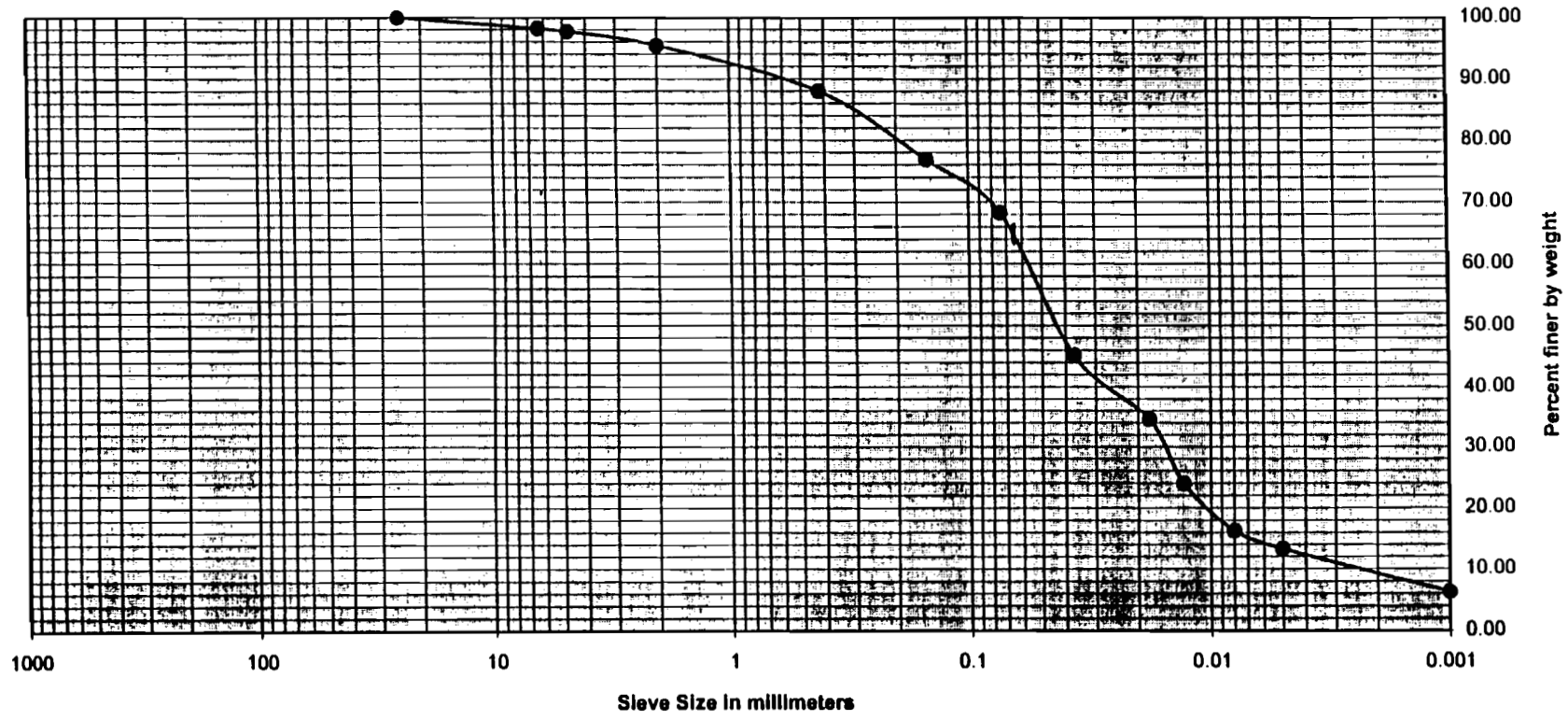
GRADATION CURVE



Boring Number	Classification	NWC	LL	PL	PI	USCS
#2 ;	Brown silty sand	-	NP	NP	NP	SM
296-11-0651-002	Gravel - 6%					
	Sand - 84%					
TRIB SE 5	Silt & clay - 10%					

CT&E Environmental Services Inc.	
Client: Parsons Engineering Science	
Project: Radford Army Ammo Plant	
Date: 12/16/96	**Tech:** AW

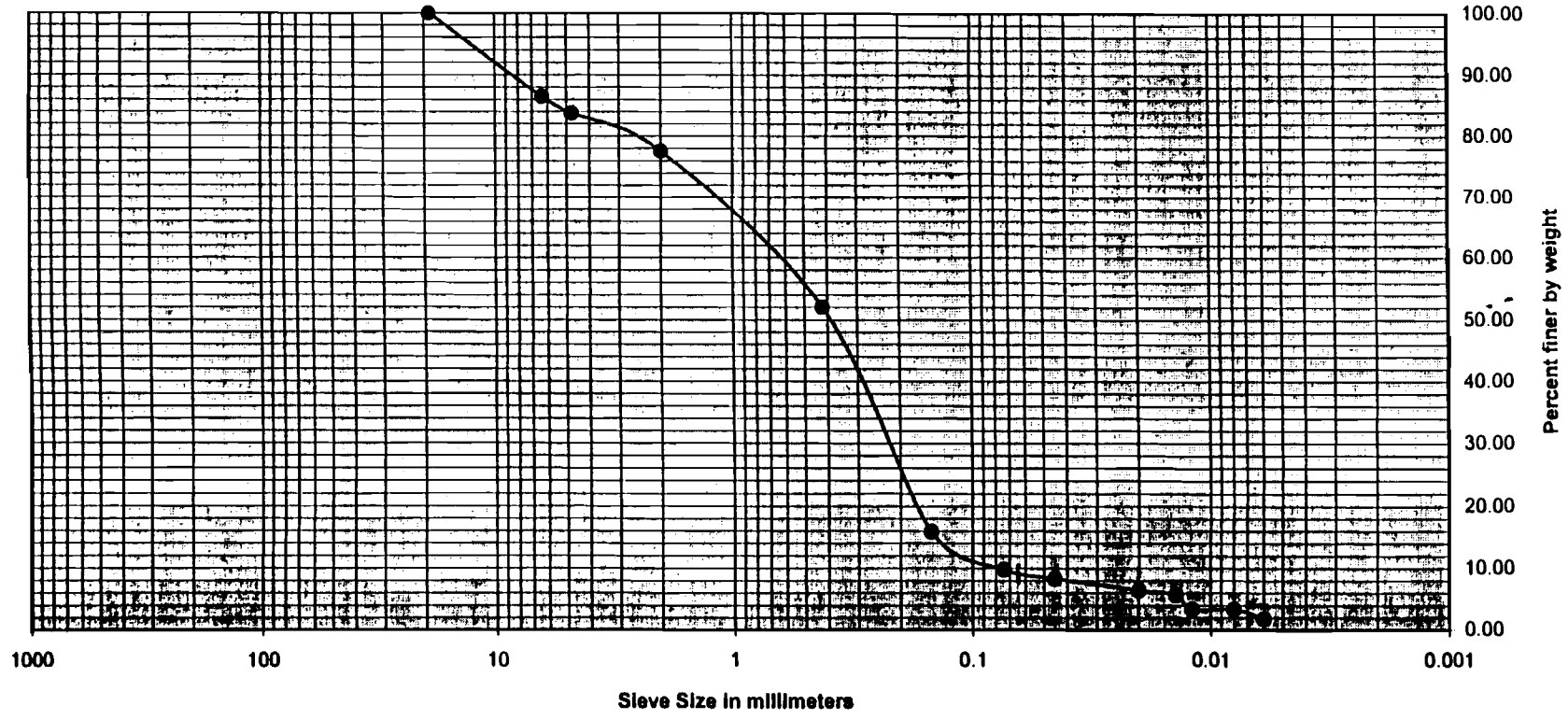
GRADATION CURVE



Boring Number	Classification	NWC	LL	PL	PI	USCS
#3	Brown sandy lean clay	-	-	-	-	CL
296-11-0651-003	Gravel - 2%					
	Sand - 29.7%					
TRIB SE 4	Silt & Clay - 68.3%					

CT&E Environmental Services Inc.			
Client:	**Parsons Engineering Science**		
Project:	**Radford Army Ammo Plant**		
Date:	**12/14/96**	**Tech:**	**AW**

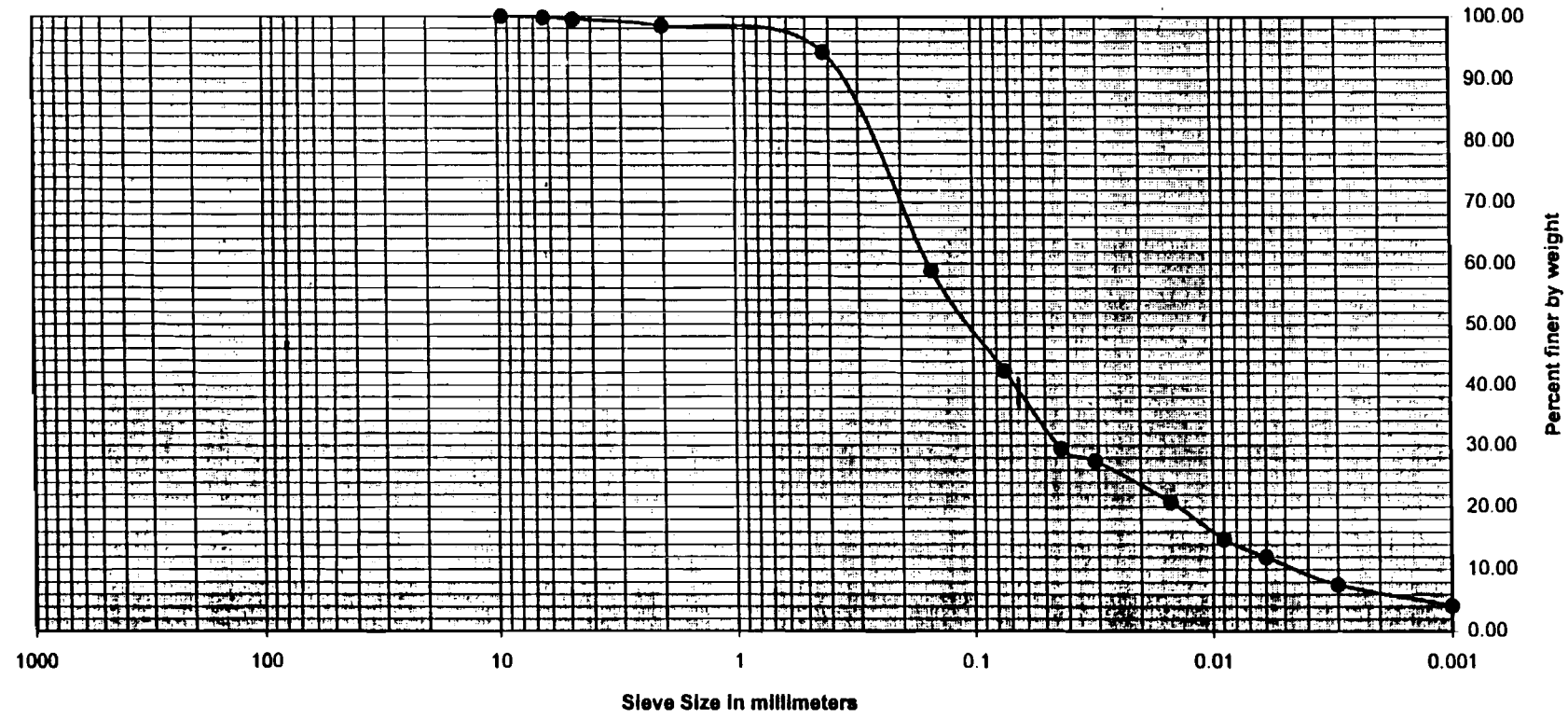
GRADATION CURVE



Boring Number	Classification	NWC	LL	PL	PI	USCS
#4	Brown silty sand	-	NP	NP	NP	SM
296-11-0651-004	Gravel - 16%					
	Sand - 74%					
SCSE 4	Silt & Clay - 10%					

CT&E Environmental Services Inc.			
Client:	**Parsons Engineering Science**		
Project:	**Radford Army Ammo Plant**		
Date:	**12/12/96**	**Tech:**	**AW**

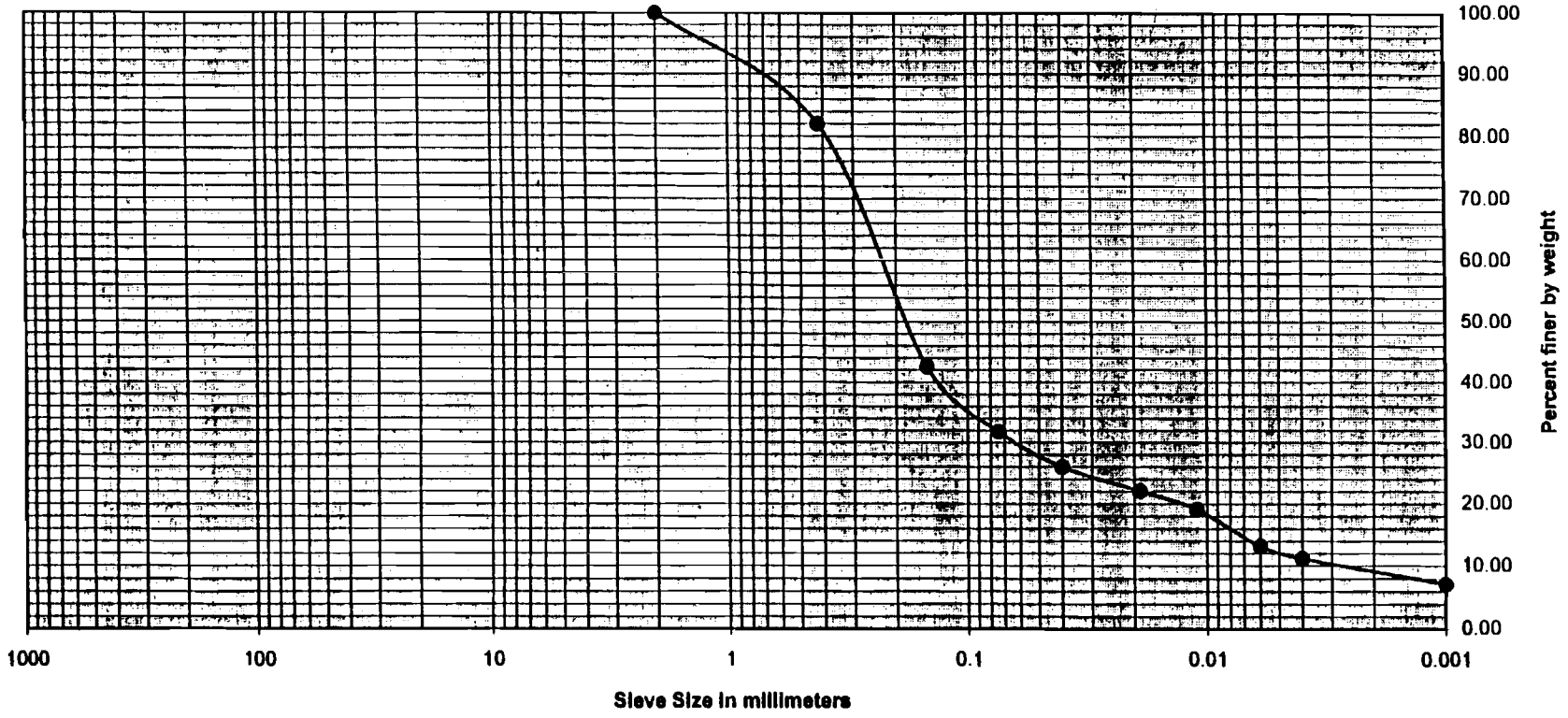
GRADATION CURVE



Boring Number	Classification	NWC	LL	PL	PI	USCS
#5	Brown clayey sand	-	-	-	-	SC
296-11-0651-005	Gravel 1%					
	Sand - 57%					
TRIB SE 6	Silt & Clay - 42%					

CT&E Environmental Services Inc.	
Client: Parsons Engineering Science	
Project: Radford Army Ammo Plant	
Date: 12/16/96	Tech: AW

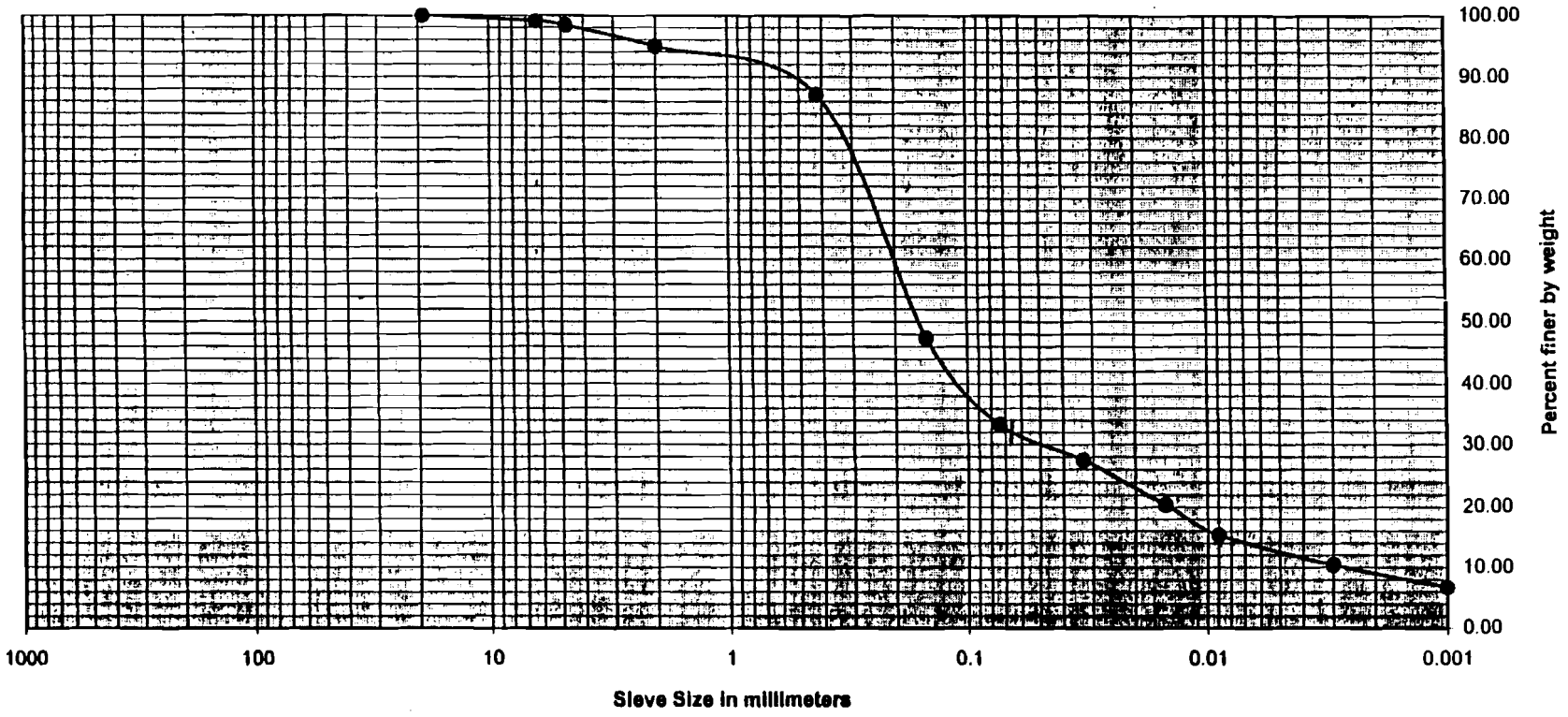
GRADATION CURVE



Boring Number	Classification	NWC	LL	PL	PI	USCS
#6	Brown clayey sand	-	-	-	-	SC
296-11-0651-006						
	Sand - 68%					
NRSE 16	Silt & Clay - 32%					

CT&E Environmental Services Inc.	
Client: Parsons Engineering Science	
Project: Radford Army Ammo Plant	
Date: 12/12/96	**Tech:** MKP

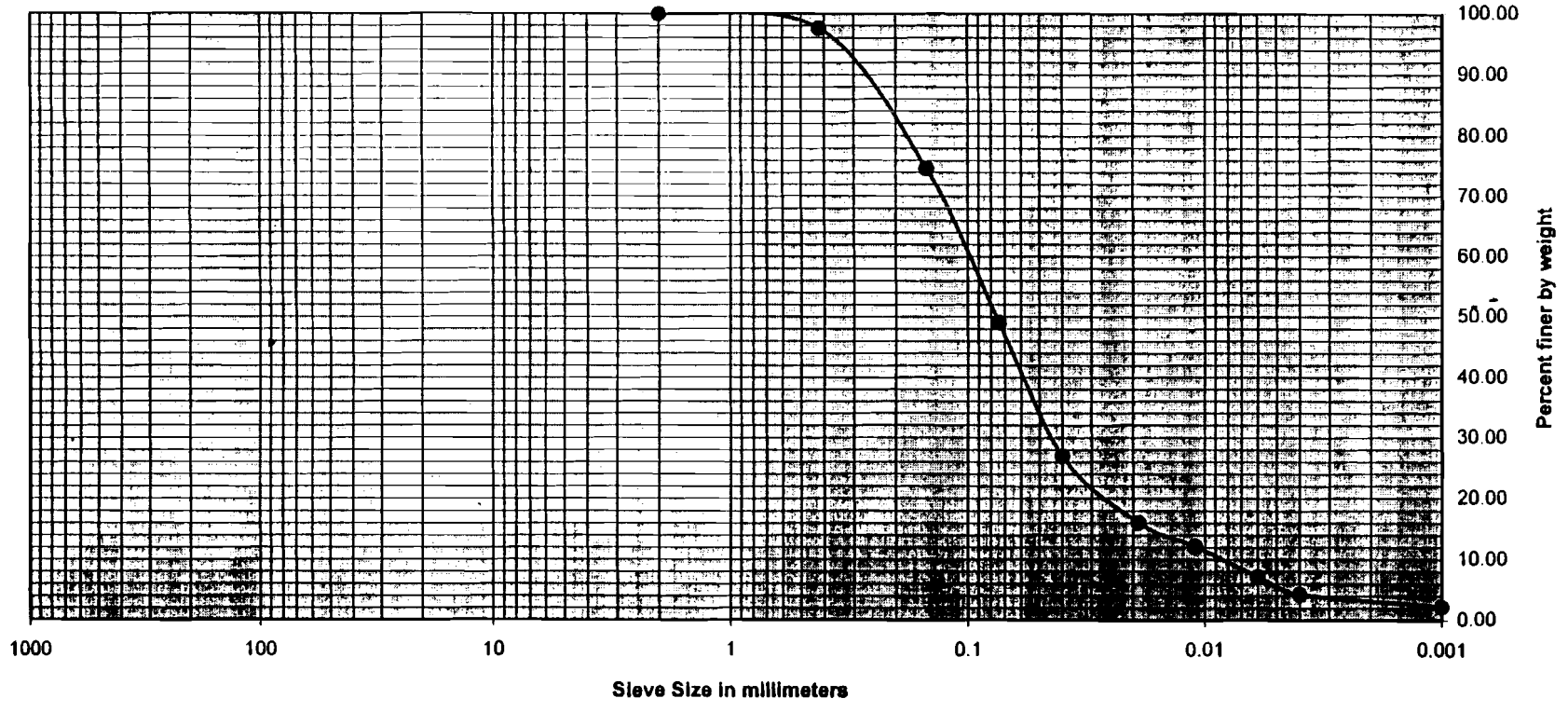
GRADATION CURVE



Boring Number	Classification	NWC	LL	PL	PI	USCS
#7	Brown clayey sand	-	-	-	-	SC
296-11-0651-007	Gravel - 1%					
	Sand - 65.9%					
NR SE 15	Silt & Clay - 33.4%					

CT&E Environmental Services Inc.	
Client: Parsons Engineering Science	
Project: Radford Army Ammo Plant	
Date: 12/14/96	Tech: AW

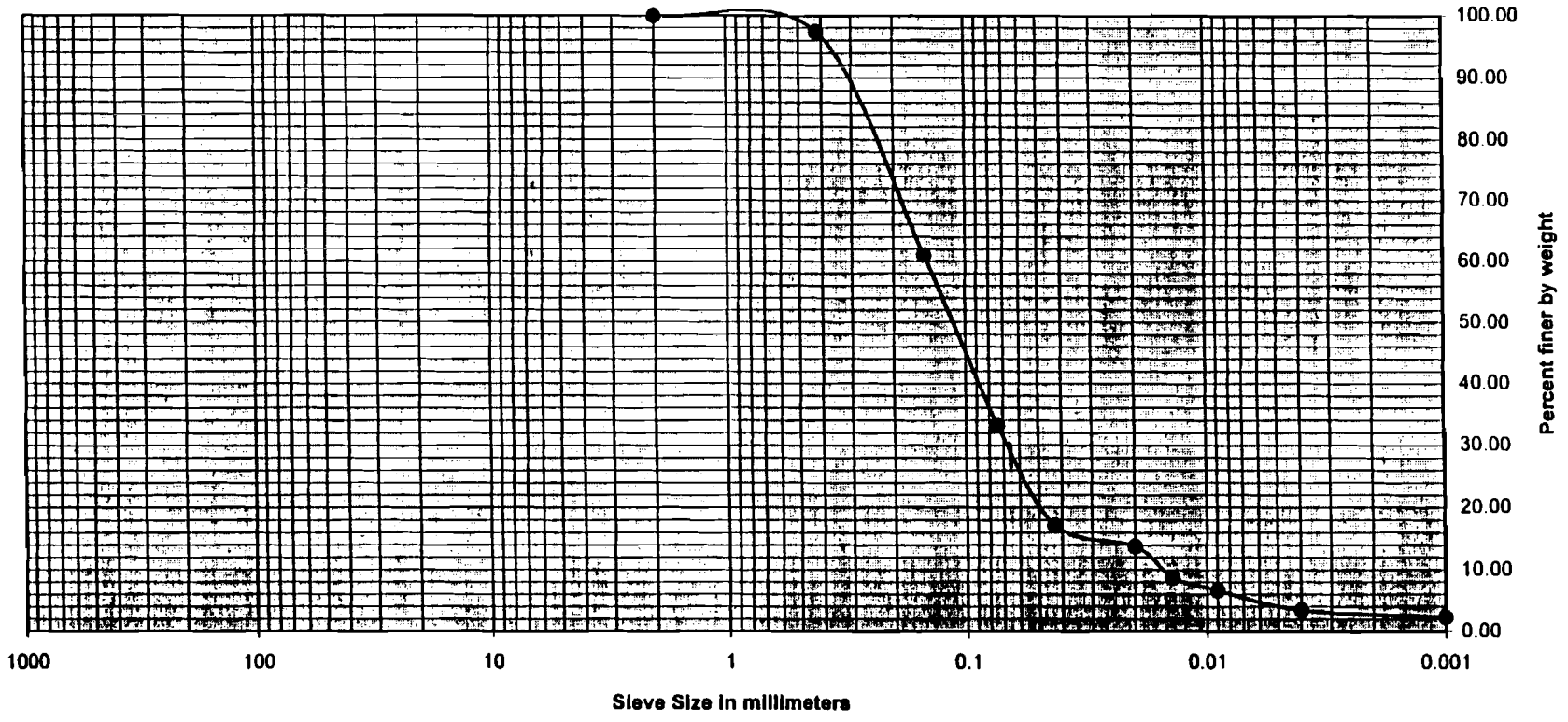
GRADATION CURVE



Boring Number	Classification	NWC	LL	PL	PI	USCS
#8	Brown clayey sand	-	-	-	-	SC
296-11-0651-008						
	Sand - 51%					
NRSE 18	Silt & Clay - 49%					

CT&E Environmental Services Inc.		
Client:	**Parsons Engineering Science**	
Project:	**Radford Army Ammo Plant**	
Date:	**12/12/96**	**Tech:** **MKP**

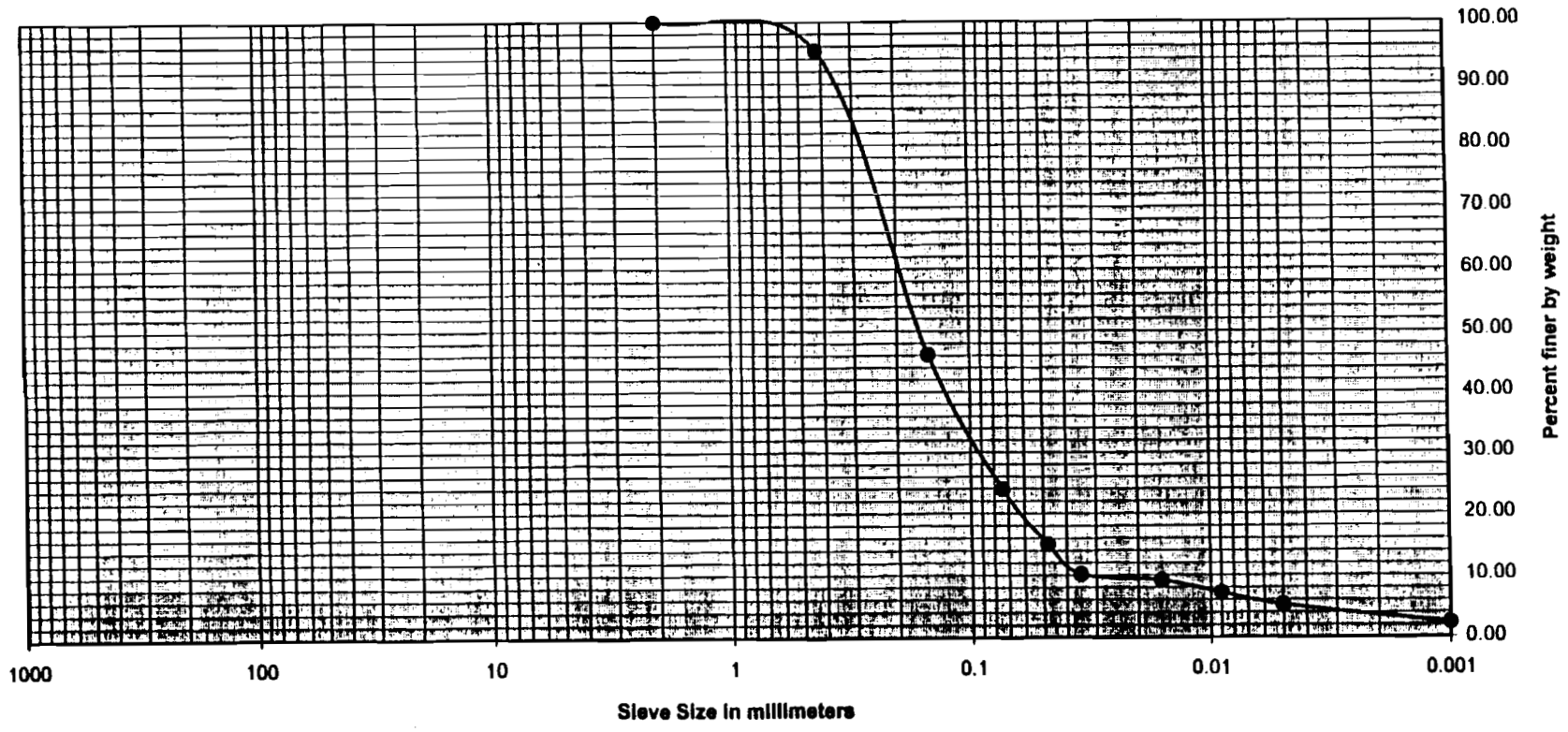
GRADATION CURVE



Boring Number	Classification	NWC	LL	PL	PI	USCS
#9,	Brown silty sand	-	NP	NP	NP	SM
296-11-0651-009						
	Sand - 67%					
NRSE 17	Silt & Clays - 33%					

CT&E Environmental Services Inc.		
Client:	Parsons Engineering Science	
Project:	Radford Army Ammo Plant	
Date: 12/12/96	Tech:	MKP

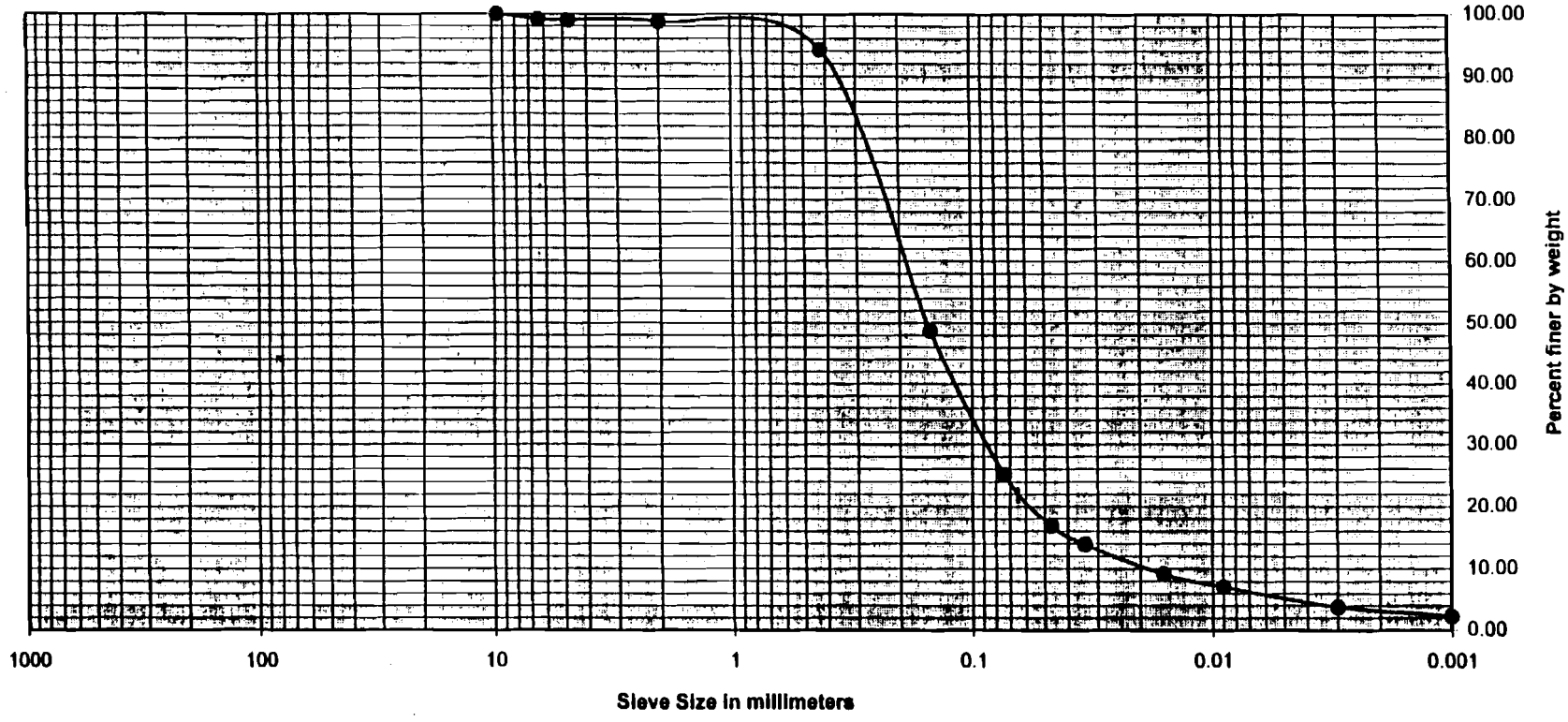
GRADATION CURVE



Boring Number	Classification	NWC	LL	PL	PI	USCS
#10 ,	Brown clayey sand	-	-	-	-	SC
296-11-0651-010						
	Sand - 76%					
NR SE 14	Silt & Clay - 24%					

CT&E Environmental Services Inc.		
Client:	**Parsons Engineering Science**	
Project:	**Radford Army Ammo Plant**	
Date:	**12/12/96**	**Tech:** **MKP**

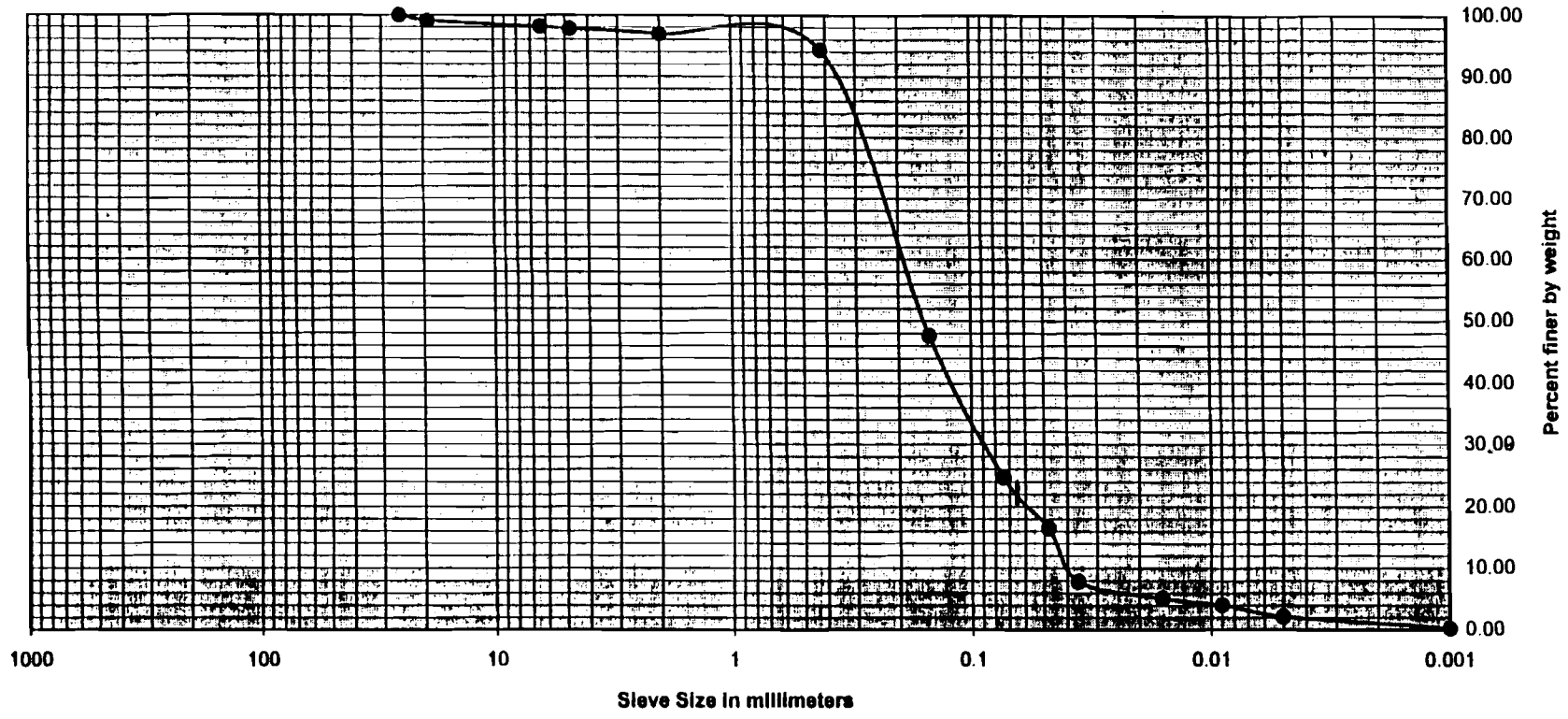
GRADATION CURVE



Boring Number	Classification	NWC	LL	PL	PI	USCS
#11	Brown clayey sand	-	-	-	-	SC
296-11-0651-011	Gravel - 0.5%					
	Sand - 77%					
NR SE 13	Silt & Clay - 22.5%					

CT&E Environmental Services Inc.			
Client:	**Parsons Engineering Science**		
Project:	**Radford Army Ammo Plant**		
Date:	**12/16/96**	**Tech:**	**MKP**

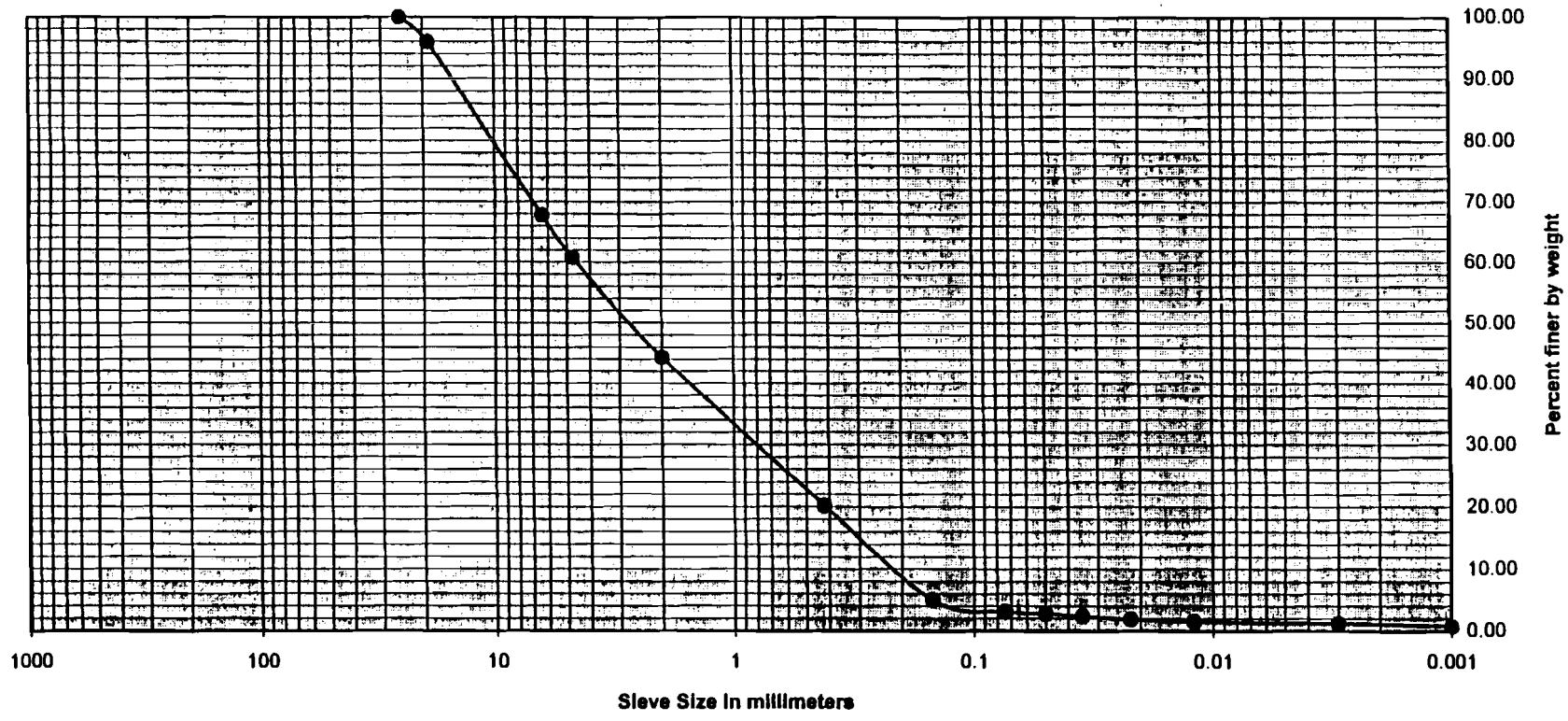
GRADATION CURVE



Boring Number	Classification	NWC	LL	PL	PI	USCS
#12	Brown silty to clayey sand	-	NP	NP	NP	SC-SM
296-11-0651-012	Gravel - 2%					
	Sand 72.7%					
NR SE 12	Silt & Clay - 25.3%					

CT&E Environmental Services Inc.			
Client:	**Parsons Engineering Science**		
Project:	**Radford Army Ammo Plant**		
Date:	**12/14/96**	**Tech:**	**AW**

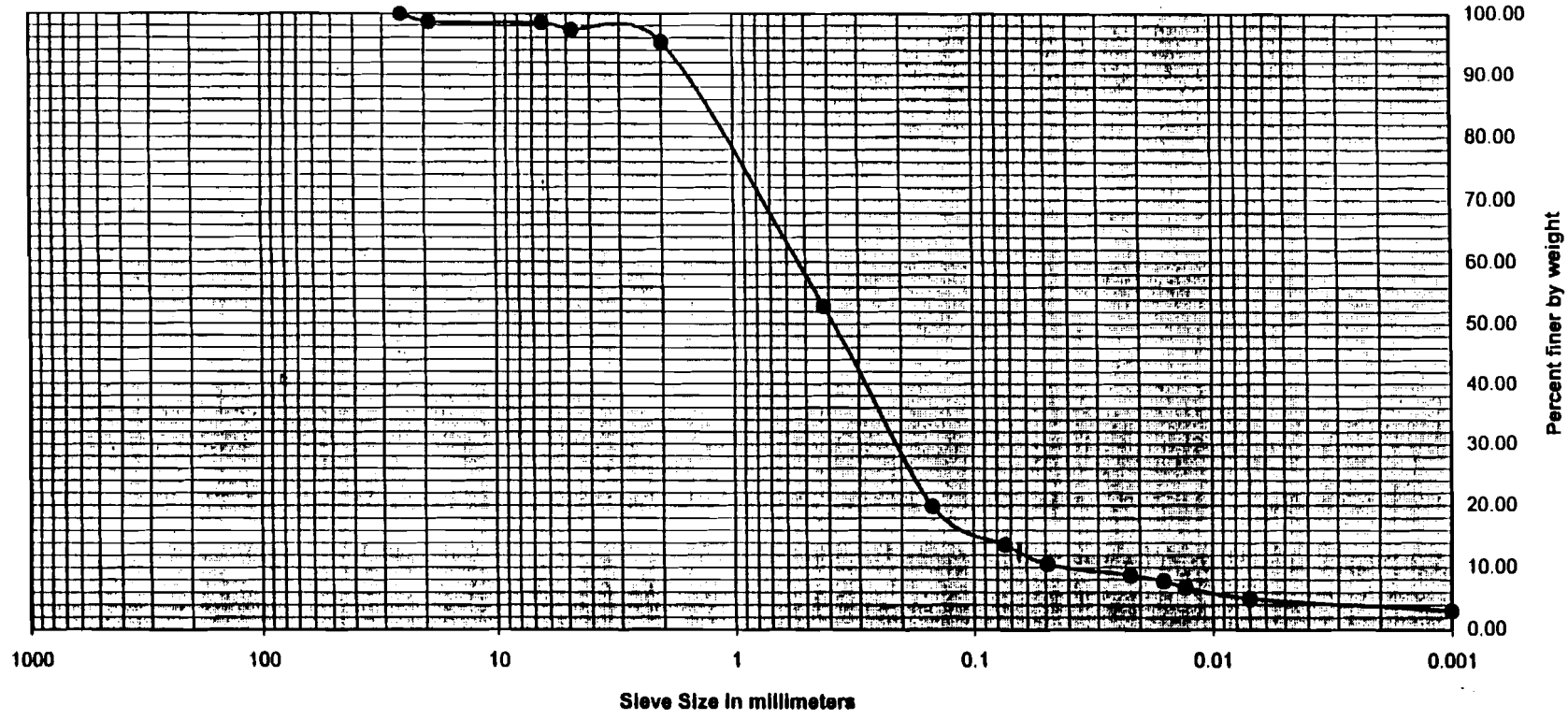
GRADATION CURVE



Boring Number	Classification	NWC	LL	PL	PI	USCS
#13 ,	Poorly graded sand with gravel	-	NP	NP	NP	SP
296-11-0651-013	Gravel - 39%					
	Sand - 58%					
TRIB SE 1	Silt & Clay 3%					
	"					

CT&E Environmental Services Inc.	
Client: Parsons Engineering Science	
Project: Radford Army Ammo Plant	
Date: 12/12/96	Tech: MKP

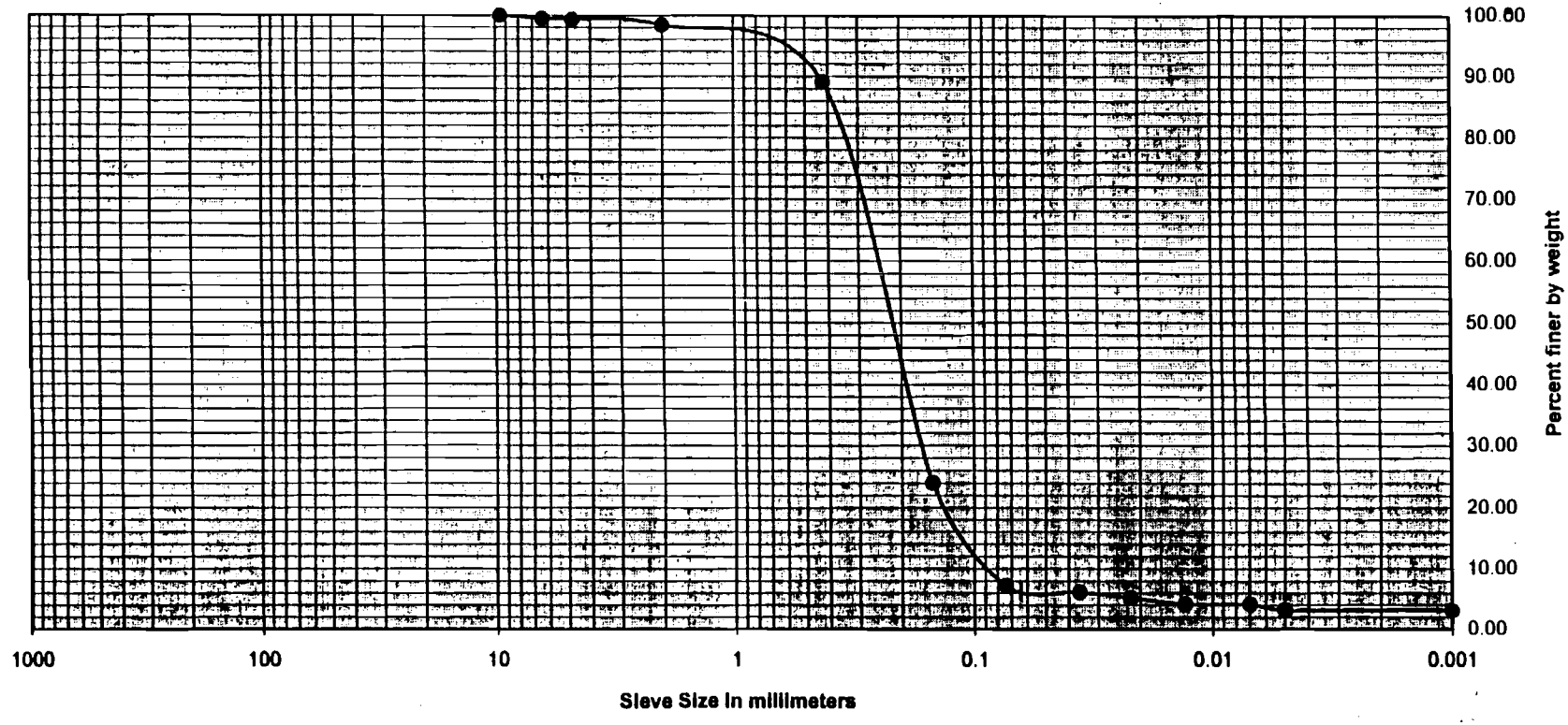
GRADATION CURVE



Boring Number	Classification	NWC	LL	PL	PI	USCS
#14	Brown silty sand	-	NP	NP	NP	SM
296-11-0651-014	Gravel - 3%					
	Sand - 83.3%					
TRIB SE 2	Silt & Clay - 13.7%					

CT&E Environmental Services Inc.		
Client:	Parsons Engineering Science	
Project:	Radford Army Ammo Plant	
Date: 12/12/96	Tech:	AW

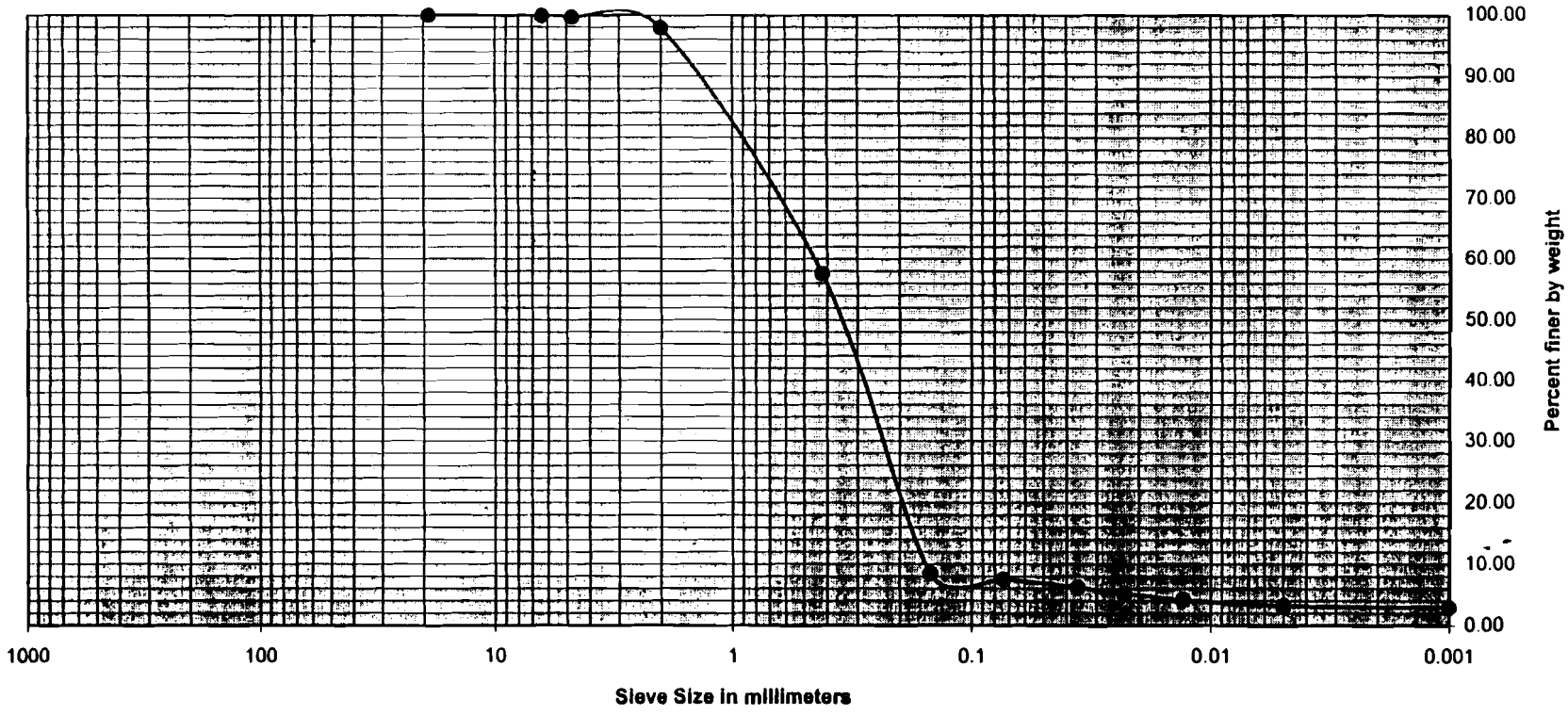
GRADATION CURVE



Boring Number	Classification	NWC	LL	PL	PI	USCS
#15 ,	Brown silty sand	-	NP	NP	NP	SM
296-11-0651-015	Gravel - 1%					
	Sand - 92%					
TRIB SE 3	Silt & Clay - 7%					

CT&E Environmental Services Inc.	
Client: Parsons Engineering Science	
Project: Radford Army Ammo Plant	
Date: 12/16/96	Tech: AW

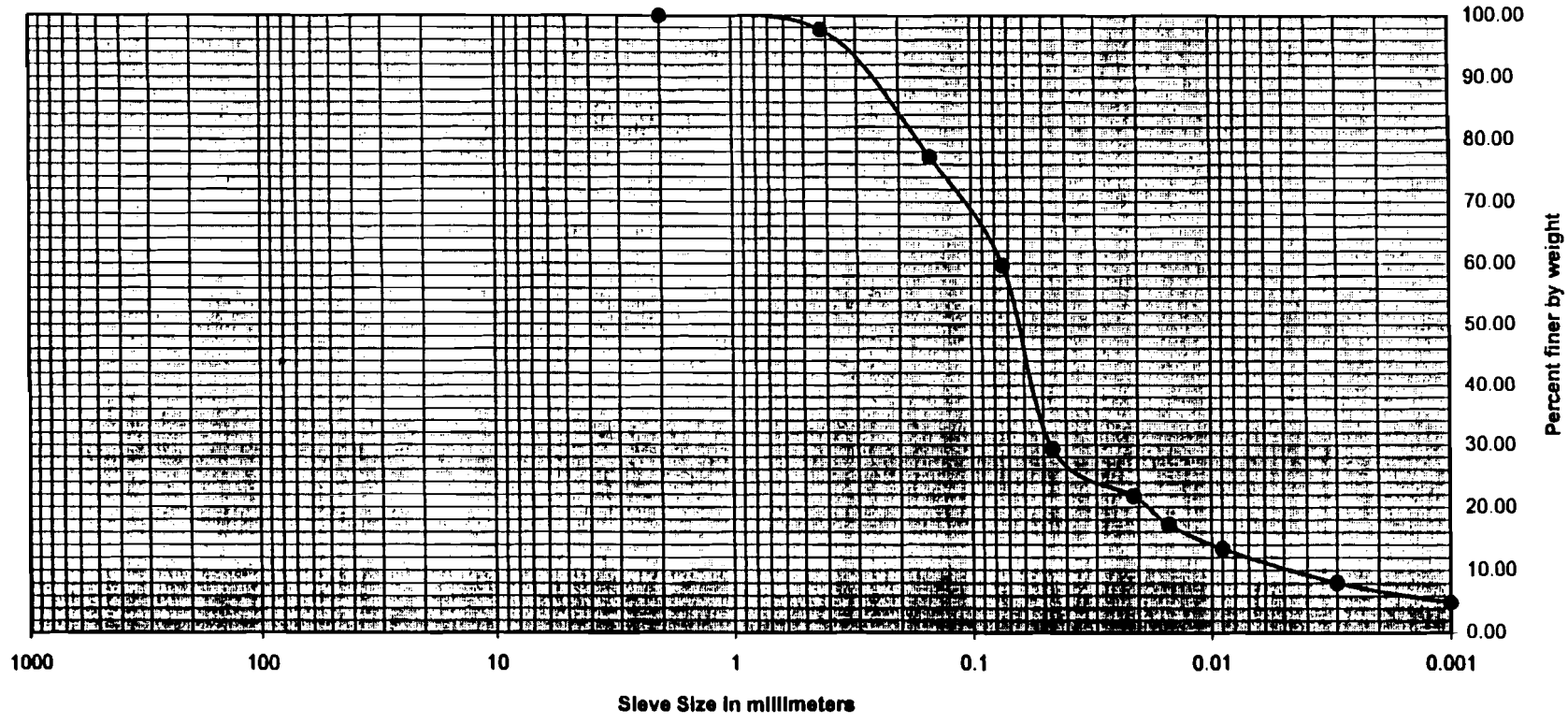
GRADATION CURVE



Boring Number	Classification	NWC	LL	PL	PI	USCS
#16	Brown silty sand	-	NP	NP	NP	SM
296-11-0651-016	Gravel - 0.5%					
	Sand - 91.5%					
NRSE 7	Silt & Clay - 8%					

CT&E Environmental Services Inc.			
Client:	**Parsons Engineering Science**		
Project:	**Radford Army Ammo Plant**		
Date:	**12/14/96**	**Tech:**	**AW**

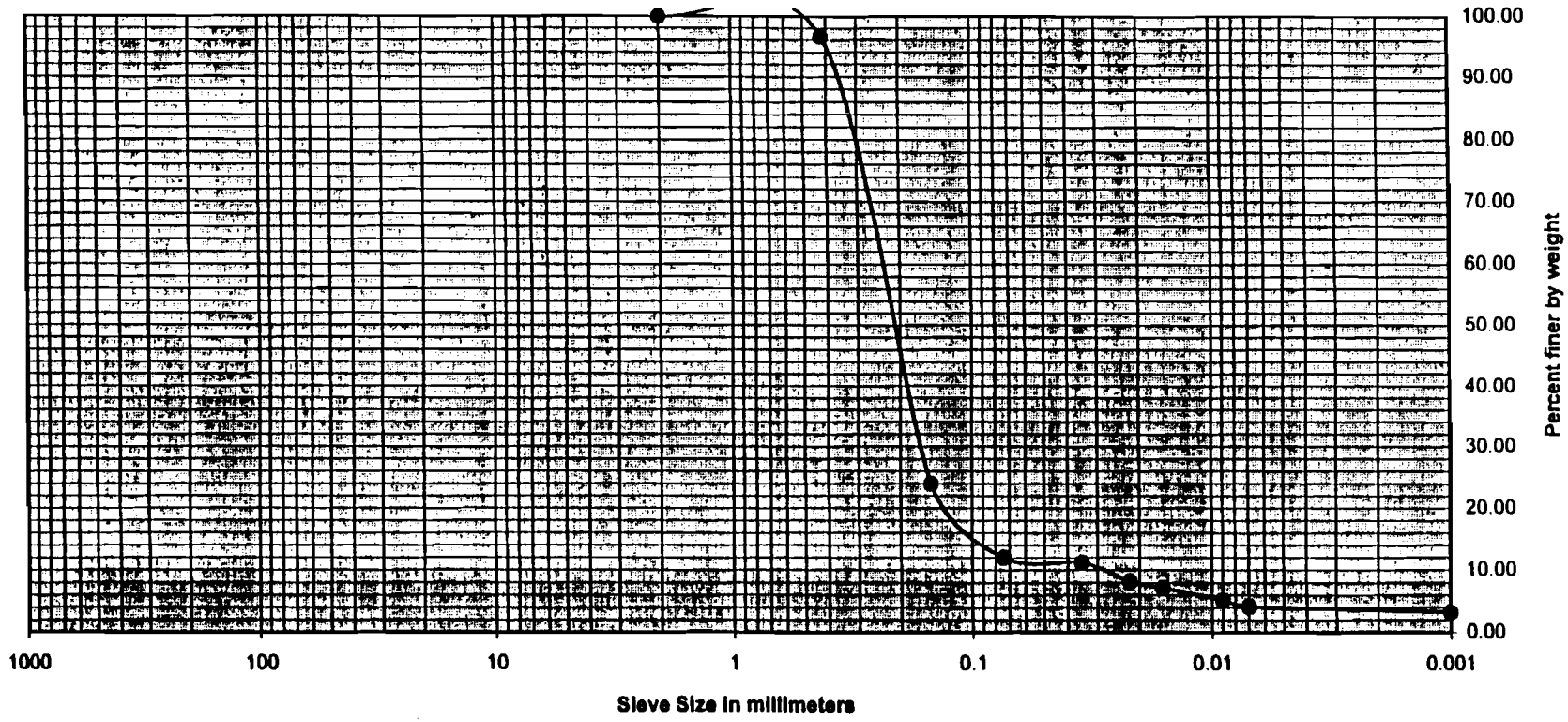
GRADATION CURVE



Boring Number	Classification	NWC	LL	PL	PI	USCS
#17	Brown sandy lean clay	-	-	-	-	CL
296-11-0651-017						
	Sand - 40%					
NRSE 8 (b)	Silt & Clay - 60%					

CT&E Environmental Services Inc.			
Client:	**Parsons Engineering Science**		
Project:	**Radford Army Ammo Plant**		
Date:	**12/12/96**	**Tech:**	**MKP**

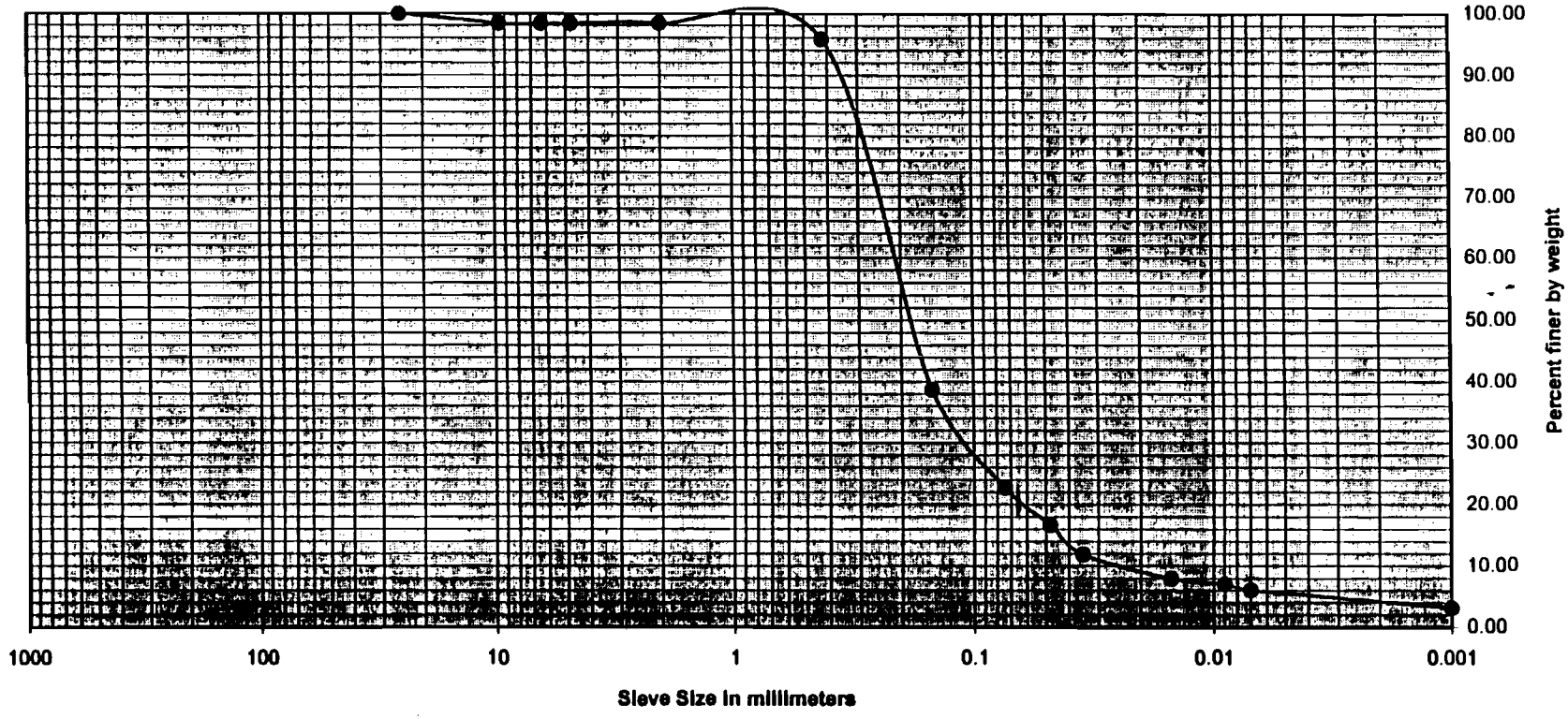
GRADATION CURVE



Boring Number	Classification	NWC	LL	PL	PI	USCS
#18	Brown clayey sand	-	NP	NP	NP	SC
296-11-0651-018						
	Sand - 88%					
NR SE 9	Silt & Clay - 12%					

CT&E Environmental Services Inc.			
Client:	Parsons Engineering Science		
Project:	Radford Army Ammo Plant		
Date:	12/12/96	Tech:	MKP

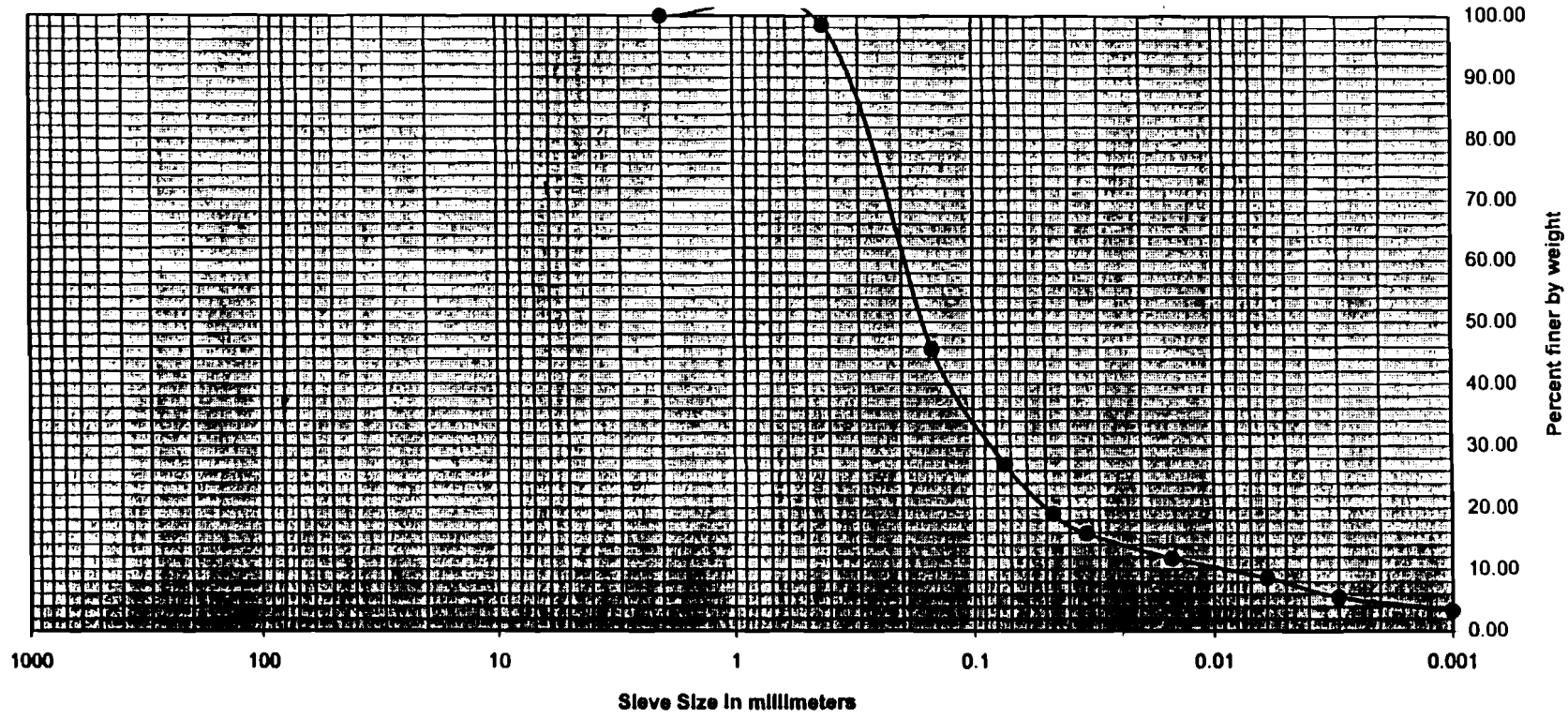
GRADATION CURVE



Boring Number	Classification	NWC	LL	PL	PI	USCS
#19	Brown silty to clayey sand	-	NP	NP	NP	SC-SM
296-11-0651-019						
NR SE 10						

CT&E Environmental Services Inc.		
Client:	Parsons Engineering Science	
Project:	Radford Army Ammo Plant	
Date: 12/16/96		Tech: AW

GRADATION CURVE



Boring Number	Classification	NWC	LL	PL	PI	USCS
#20	Brown clayey sand	-	-	-	-	SC
296-11-0651-020						
	Sand - 63%					
NR SE 11	Silt & clay - 27%					

CT&E Environmental Services Inc.			
Client:	Parsons Engineering Science		
Project:	Radford Army Ammo Plant		
Date:	12/12/96	Tech:	MKP

ENGINEERING–SCIENCE

ANALYTICAL REQUEST FORM
CHAIN OF CUSTODY RECORD

PG 1 of 2

№ 2387

PROJECT NO.	PROJECT NAME/LOCATION
722843 31000	RADFORD ARMY AMMO PLANT

SAMPLERS: (Name/Signature)
Tom J. Bachovchin

METHOD OF ANALYSES
11-657-1115

FIELD NUMBER	COLLECTION DATE	COLLECTION TIME	SAMPLE NAME	MATRIX	NO. OF BOTTLES	GRAIN SIZE ANALYSIS USCS CLASSIFICATION	SPECIAL INSTRUCTIONS (•) (TYPE OF CONTAINER, PRESERVATION, HANDLING, ETC.)
	11-20-96	1440	SC SE 3	SO	1	✓ ✓	PLEASE REPORT GRAIN SIZE ANALYSIS AS PERCENT SAND, SILT, AND CLAY, AND PERCENT WITH PARTICLE SIZE LESS THAN 63 MICROMETERS
	11-20-96	1550	TRIB SW 5		1	✓ ✓	
	11-21-96	1100	TRIB SE 4		1	✓ ✓	
	↓	1150	SC SE 4		1	✓ ✓	
	↓	1440	TRIB SE 6		1	✓ ✓	
	11-22-96	0850	NR SE 16		1	✓ ✓	
	↓	0930	NR SE 15		1	✓ ✓	
	↓	1030	NR SE 18		1	✓ ✓	
	↓	1110	NR SE 17		1	✓ ✓	
	↓	1130	NR SE 14		1	✓ ✓	
	↓	1350	NR SE 13		1	✓ ✓	
	↓	1440	NR SE 12	↓	1	✓ ✓	
	11-25-96	1430	TRIB SE 1	SO	1	✓ ✓	
	↓	1530	TRIB SE 2		1	✓ ✓	
	↓	1630	TRIB SE 3	↓	1	✓ ✓	

Relinquished by: (Name/Signature)	Date/Time	Received by: (Name/Signature)	Date/Time
Tom J. Bachovchin	11/26/96 - 1800		
Relinquished by: (Name/Signature)	Date/Time	Received by: (Name/Signature)	Date/Time
	11/27/96/1100	John Medina	11/27/96 1100

Courier: FEDX
Airbill No.: 5695919460
Custody Seal No.:
Cooler No.: 1 of 1

General Comments: SEND DATA TO TOM BACHOVCHIN (703) 934-2385
1052 ROSEHAVEN ST
FAIRFAX, VA 22030

CRECORD

Distribution: Original: Accompanies Samples (Return to Originator), Yellow Copy: Laboratory Files, Pink Copy: Crew

C-3

ENGINEERING-SCIENCE

ANALYTICAL REQUEST FORM
CHAIN OF CUSTODY RECORD

PG. 2 of 2

No 2009

PROJECT NO.	PROJECT NAME/LOCATION
722843 31 000	RADFORD ARMY AMMO PLANT

SAMPLERS: (Name/Signature) Tom J. Borbonk

METHOD OF ANALYSES

: 651-16/20

FIELD NUMBER	COLLECTION DATE	COLLECTION TIME	SAMPLE NAME	MATRIX	NO. OF BOTTLES	GRAIN SIZE ANALYSIS	USCS CLASSIFICATION	SPECIAL INSTRUCTIONS (•) (TYPE OF CONTAINER, PRESERVATION, HANDLING, ETC.)
	11/26/96	0920	NRSE 7	SO	1	✓	✓	PLEASE REPORT GRAIN SIZE ANALYSIS AS PERCENT SAND, SILT, AND CLAY, AND PERCENT WITH PARTICLE SIZE LESS THAN 63 MICROMETERS.
		0940	NR SE 8		1	✓	✓	
		1040	NR SE 9		1	✓	✓	
		1100	NR SE 10		1	✓	✓	
		1125	NR SE 11		1	✓	✓	

Relinquished by: (Name/Signature)	Date/Time	Received by: (Name/Signature)	Date/Time	Courier:
Tom J. Borbonk	11/26/96-1800			FED X
Relinquished by: (Name/Signature)	Date/Time	Received by: (Name/Signature)	Date/Time	Airbill No.: 569591946O
	11/27/96/11:00	John Meclure	11/27/96/11:00	Custody Seal No.:
General Comments:				Cooler No.: 1 OF 1

CRECORD

Distribution: Original: Accompanies Samples (Return to Originator), Yellow Copy: Laboratory Files, Pink Copy: Crew

4-9

APPENDIX C

DATA SUMMARY TABLES

FIELD SAMPLE ID:		NRSW17		NRSW18		NRSW38		SCSW3(B)		SCSW4		TRIBSW2	
SAMPLING DATE:		11/22/96		11/22/96		11/25/96		11/20/96		11/21/96		11/25/96	
Volatile Organic Compounds													
Chloromethane	UGL					10	U	10	U	10	U	10	U
Bromomethane	UGL					10	U	10	U	10	U	10	U
Vinyl Chloride	UGL					10	U	10	U	10	U	10	U
Chloroethane	UGL					10	U	10	U	10	U	10	U
Methylene Chloride	UGL					10	U	10	U	10	U	10	U
Acetone	UGL					10	U	10	U	10	U	10	U
Carbon Disulfide	UGL					10	U	10	U	10	U	10	U
1,1-Dichloroethene	UGL					10	U	10	U	10	U	10	U
1,1-Dichloroethane	UGL					10	U	10	U	10	U	10	U
1,2-Dichloroethene (Total)	UGL					10	U	10	U	10	U	10	U
Chloroform	UGL					10	U	10	U	10	U	10	U
1,2-Dichloroethane	UGL					10	U	10	U	10	U	10	U
2-Butanone	UGL					10	U	10	U	10	U	10	U
1,1,1-Trichloroethane	UGL					10	U	10	U	10	U	10	U
Carbon Tetrachloride	UGL					10	U	10	U	10	U	10	U
Bromodichloromethane	UGL					10	U	10	U	10	U	10	U
1,2-Dichloropropane	UGL					10	U	10	U	10	U	10	U
cis-1,3-Dichloropropene	UGL					10	U	10	U	10	U	10	U
Trichloroethene	UGL					10	U	10	U	10	U	10	U
Dibromochloromethane	UGL					10	U	10	U	10	U	10	U
1,1,2-Trichloroethane	UGL					10	U	10	U	10	U	10	U
Benzene	UGL					10	U	10	U	10	U	10	U
trans-1,3-Dichloropropene	UGL					10	U	10	U	10	U	10	U
Bromoform	UGL					10	U	10	U	10	U	10	U
4-Methyl-2-Pentanone	UGL					10	U	10	U	10	U	10	U
2-Hexanone	UGL					10	U	10	U	10	U	10	U
Tetrachloroethene	UGL					10	U	10	U	10	U	10	U
1,1,2,2-Tetrachloroethane	UGL					10	U	10	U	10	U	10	U
Toluene	UGL					10	U	10	U	10	U	10	U
Chlorobenzene	UGL					10	U	10	U	10	U	10	U
Ethylbenzene	UGL					10	U	10	U	10	U	10	U
Styrene	UGL					10	U	10	U	10	U	10	U
Total Xylenes	UGL					10	U	10	U	10	U	10	U
Semivolatile Organic Compounds													
Phenol	UGL					10	U	10	U	10	U	10	U
bis(2-chloroethyl)ether	UGL					10	U	10	U	10	U	10	U
2-Chlorophenol	UGL					10	U	10	U	10	U	10	U
1,3-Dichlorobenzene	UGL					10	U	10	U	10	U	10	U
1,4-Dichlorobenzene	UGL					10	U	10	U	10	U	10	U
1,2-Dichlorobenzene	UGL					10	U	10	U	10	U	10	U
2-Methylphenol	UGL					10	U	10	U	10	U	10	U
bis(2-chloroisopropyl)ether	UGL					10	U	10	U	10	U	10	U
4-Methylphenol	UGL					10	U	10	U	10	U	10	U
N-Nitroso-di-n-propylamine	UGL					10	U	10	U	10	U	10	U
Hexachloroethane	UGL					10	U	10	U	10	U	10	U
Nitrobenzene	UGL					10	U	10	U	10	U	10	U
Isophorone	UGL					10	U	10	U	10	U	10	U
2-Nitrophenol	UGL					10	U	10	U	10	U	10	U
4-Nitrophenol	UGL					25	U	25	U	25	U	25	U
2,4-Dimethylphenol	UGL					10	U	10	U	10	U	10	U
bis(2-chloroethoxyl)methane	UGL					10	U	10	U	10	U	10	U
2,4-Dichlorophenol	UGL					10	U	10	U	10	U	10	U
1,2,4-Trichlorobenzene	UGL					10	U	10	U	10	U	10	U
Naphthalene	UGL					10	U	10	U	10	U	10	U
4-Chloroaniline	UGL					10	U	10	U	10	U	10	U
Hexachlorobutadiene	UGL					10	U	10	U	10	U	10	U
4-Chloro-3-Cresol	UGL					10	U	10	U	10	U	10	U
2-Methylnaphthalene	UGL					10	U	10	U	10	U	10	U
Hexachlorocyclopentadiene	UGL					10	U	10	U	10	U	10	U
2,4,6-Trichlorophenol	UGL					10	U	10	U	10	U	10	U

FIELD SAMPLE ID:		NRSW17		NRSW18		NRSW38		SCSW3(B)		SCSW4		TRIBSW2	
SAMPLING DATE:		11/22/96		11/22/96		11/25/96		11/20/96		11/21/96		11/25/96	
2,4,5-Trichlorophenol	UGL					25	U	25	U	25	U	25	U
2-Chloronaphthalene	UGL					10	U	10	U	10	U	10	U
2-Nitroaniline	UGL					25	U	25	U	25	U	25	U
Dimethylphthalate	UGL					10	U	10	U	10	U	10	U
Acenaphthylene	UGL					10	U	10	U	10	U	10	U
2,6-Dinitrotoluene	UGL					10	U	10	U	10	U	10	U
3-Nitroaniline	UGL					25	U	25	U	25	U	25	U
Acenaphthene	UGL					10	U	10	U	10	U	10	U
2,4-Dinitrophenol	UGL					25	U	25	U	25	U	25	U
Dibenzofuran	UGL					10	U	10	U	10	U	10	U
2,4-Dinitrotoluene	UGL					10	U	10	U	10	U	10	U
Diethylphthalate	UGL					10	U	10	U	10	U	10	U
4-Chlorophenyl-phenylether	UGL					10	U	10	U	10	U	10	U
Fluorene	UGL					10	U	10	U	10	U	10	U
4-Nitroaniline	UGL					25	U	25	U	25	U	25	U
4,6-Dinitro-2-Cresol	UGL					25	U	25	U	25	U	25	U
N-Nitrosodiphenylamine	UGL					10	U	10	U	10	U	10	U
4-Bromophenylphenylether	UGL					10	U	10	U	10	U	10	U
Hexachlorobenzene	UGL					10	U	10	U	10	U	10	U
Pentachlorophenol	UGL					25	U	25	U	25	U	25	U
Phenanthrene	UGL					10	U	10	U	10	U	10	U
Anthracene	UGL					10	U	10	U	10	U	10	U
Carbazole	UGL					10	U	10	U	10	U	10	U
Di-n-butylphthalate	UGL					10	U	74		44	J1	10	U
Fluoranthene	UGL					10	U	10	U	10	U	10	U
Pyrene	UGL					10	U	10	U	10	U	10	U
Butylbenzylphthalate	UGL					10	U	11		10	U	10	U
3,3-Dichlorobenzidine'	UGL					10	U	10	U	10	U	10	U
Benzo(a)anthracene	UGL					10	U	10	U	10	U	10	U
Chrysene	UGL					10	U	10	U	10	U	10	U
bis(2-Ethylhexyl)phthalate	UGL					10	U	13		10	U	10	U
Di-n-octylphthalate	UGL					10	U	10	U	10	U	10	U
Benzo(b)fluoranthene	UGL					10	U	10	U	10	U	10	U
Benzo(k)fluoranthene	UGL					10	U	10	U	10	U	10	U
Benzo(a)pyrene	UGL					10	U	10	U	10	U	10	U
Indeno(1,2,3-cd)pyrene	UGL					10	U	10	U	10	U	10	U
Dibenz(a,h)anthracene	UGL					10	U	10	U	10	U	10	U
Benzo(g,h,i)perylene	UGL					10	U	10	U	10	U	10	U
Pesticide/PCB Compounds													
Alpha-BHC	UGL	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Beta-BHC	UGL	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
delta-BHC	UGL	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
gamma-BHC	UGL	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Heptachlor	UGL	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Aldrin	UGL	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Heptachlor Epoxide	UGL	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Endosulfan I	UGL	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Dieldrin	UGL	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
4,4-DDE'	UGL	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Endrin	UGL	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Endosulfan II	UGL	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
4,4-DDD'	UGL	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Endosulfan Sulfate	UGL	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
4,4-DDT'	UGL	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Methoxychlor	UGL	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Endrin Ketone	UGL	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Endrin Aldehyde	UGL	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Alpha Chlordane	UGL	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
gamma-Chlordane	UGL	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Toxaphene	UGL	5	U	5	U	5	U	5	U	5	U	5	U
Aroclor-1016	UGL	1	U	1	U	1	U	1	U	1	U	1	U

FIELD SAMPLE ID:		NRSW17		NRSW18		NRSW38		SCSW3(B)		SCSW4		TRIBSW2	
SAMPLING DATE:		11/22/96		11/22/96		11/25/96		11/20/96		11/21/96		11/25/96	
Aroclor-1221	UGL	2	U	2	U	2	U	2	U	2	U	2	U
Aroclor-1232	UGL	1	U	1	U	1	U	1	U	1	U	1	U
Aroclor-1242	UGL	1	U	1	U	1	U	1	U	1	U	1	U
Aroclor-1248	UGL	1	U	1	U	1	U	1	U	1	U	1	U
Aroclor-1254	UGL	1	U	1	U	1	U	1	U	1	U	1	U
Aroclor-1260	UGL	1	U	1	U	1	U	1	U	1	U	1	U
Explosives													
HMX	UGL					0.8	U	0.8	U	0.8	U	0.8	U
RDX	UGL					0.8	U	0.8	U	0.8	U	0.8	U
1,3,5-Trinitrobenzene	UGL					0.8	U	0.8	U	0.8	U	0.8	U
1,3-Dinitrobenzene	UGL					0.8	U	0.8	U	0.8	U	0.8	U
Tetryl	UGL					0.8	U	0.8	U	0.8	U	0.8	U
Nitrobenzene	UGL					0.8	U	0.8	U	0.8	U	0.8	U
2,4,6-Trinitrotoluene	UGL					0.8	U	0.8	U	0.8	U	0.8	U
4-AM-2,6-Dinitrotoluene	UGL					0.8	U	0.8	U	0.8	U	0.8	U
2-AM-4,6-Dinitrotoluene	UGL					0.8	U	0.8	U	0.8	U	0.8	U
2,6-Dinitrotoluene	UGL					0.8	U	0.8	U	0.8	U	0.8	U
2,4-Dinitrotoluene	UGL					0.8	U	0.8	U	0.8	U	0.8	U
2-Nitrotoluene	UGL					0.8	U	0.8	U	0.8	U	0.8	U
4-Nitrotoluene	UGL					0.8	U	0.8	U	0.8	U	0.8	U
3-Nitrotoluene	UGL					0.8	U	0.8	U	0.8	U	0.8	U
Dissolved Metals													
Aluminum	UGL	100	U	100	U	100	U	100	U	100	U	100	U
Antimony	UGL	100	U	100	U	100	U	100	U	100	U	100	U
Arsenic	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Barium	UGL	121		124		132		133		146	U	123	
Beryllium	UGL	3	U	3	U	3	U	3	U	3	U	3	U
Cadmium	UGL	5	U	5	U	5	U	5	U	5	U	5	U
Calcium	UGL	8880		9380		49500		56700		58300		47400	
Chromium	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Cobalt	UGL	20	U	20	U	20	U	20	U	20	U	20	U
Copper	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Iron	UGL	165		154		50	U	50	U	50	U	50	U
Lead	UGL	5	U	5	U	5	U	5	U	5	U	5	U
Magnesium	UGL	3920		4040		21900		23000		25500		20900	
Manganese	UGL	10	U	10	U	10.4		10	U	10	U	10	
Mercury	UGL	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	UGL	20	U	20	U	20	U	20	U	20	U	20	U
Potassium	UGL	1880		2470		2320		3300		3210		2470	
Selenium	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Silver	UGL	20	U	20	U	20	U	20	U	20	U	20	U
Sodium	UGL	5110		5110		17700		13500		13500		17600	
Thallium	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Vanadium	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Zinc	UGL	15.6		16.2		11.3		10	U	10	U	10.5	
Total Metals													
Aluminum	UGL	153		168		100	U	100	U	100	U	110	
Antimony	UGL	100	U	100	U	100	U	100	U	100	U	100	U
Arsenic	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Barium	UGL	24.8		26		42.5		60.5		56	U	49.5	
Beryllium	UGL	3	U	3	U	3	U	3	U	3	U	3	U
Cadmium	UGL	5	U	5	U	5	U	5	U	5	U	5	U
Calcium	UGL	9190		9980		44300		54000		47300		50800	
Chromium	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Cobalt	UGL	20	U	20	U	20	U	20	U	20	U	20	U
Copper	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Iron	UGL	443		436		76.7		51.4		70		125	
Lead	UGL	5	U	5	U	5	U	5	U	5	U	5	U
Magnesium	UGL	4220		4540		19600		22400		20500		22500	

FIELD SAMPLE ID:		NRSW17		NRSW18		NRSW38		SCSW3(B)		SCSW4		TRIBSW2	
SAMPLING DATE:		11/22/96		11/22/96		11/25/96		11/20/96		11/21/96		11/25/96	
Manganese	UGL	88.2		83.2		19.6		10	U	10	U	30.6	
Mercury	UGL	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	UGL	20	U	20	U	20	U	20	U	20	U	20	U
Potassium	UGL	2300		2390		2350		3530		3310		2620	
Selenium	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Silver	UGL	20	U	20	U	20	U	20	U	20	U	20	U
Sodium	UGL	4310	U	4660	U	15800		10300		9040	U	17700	
Thallium	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Vanadium	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Zinc	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Wet Chemistry Parameters													
Hardness	UGL	42900		45600		192000		226000		202000		219000	
Total Organic Carbon	UGL					11000		12000		5000		10000	
Total Organic Halogens	UGL					95	U	50	U	50	U	53	U

FIELD SAMPLE ID:		TRIBSW4		TRIBSW5		NRSEEQ2		NRSEFB2		NRSWEQ		NRSWFB2	
SAMPLING DATE:		11/21/96		11/20/96		11/25/96		11/22/96		11/21/96		11/21/96	
Volatile Organic Compounds													
Chloromethane	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Bromomethane	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Vinyl Chloride	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Chloroethane	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Methylene Chloride	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Acetone	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Carbon Disulfide	UGL	10	U	10	U	10	U	10	U	10	U	10	U
1,1-Dichloroethene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
1,1-Dichloroethane	UGL	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dichloroethene (Total)	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Chloroform	UGL	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dichloroethane	UGL	10	U	10	U	10	U	10	U	10	U	10	U
2-Butanone	UGL	10	U	10	U	10	U	10	U	10	U	10	U
1,1,1-Trichloroethane	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Carbon Tetrachloride	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Bromodichloromethane	UGL	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dichloropropane	UGL	10	U	10	U	10	U	10	U	10	U	10	U
cis-1,3-Dichloropropene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Trichloroethene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Dibromochloromethane	UGL	10	U	10	U	10	U	10	U	10	U	10	U
1,1,2-Trichloroethane	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Benzene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
trans-1,3-Dichloropropene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Bromoform	UGL	10	U	10	U	10	U	10	U	10	U	10	U
4-Methyl-2-Pentanone	UGL	10	U	10	U	10	U	10	U	10	U	10	U
2-Hexanone	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Tetrachloroethene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
1,1,2,2-Tetrachloroethane	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Toluene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Chlorobenzene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Ethylbenzene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Styrene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Total Xylenes	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Semivolatile Organic Compounds													
Phenol	UGL	10	U	10	U	10	U	10	U	10	U	10	U
bis(2-chloroethyl)ether	UGL	10	U	10	U	10	U	10	U	10	U	10	U
2-Chlorophenol	UGL	10	U	10	U	10	U	10	U	10	U	10	U
1,3-Dichlorobenzene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
1,4-Dichlorobenzene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dichlorobenzene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
2-Methylphenol	UGL	10	U	10	U	10	U	10	U	10	U	10	U
bis(2-chloroisopropyl)ether	UGL	10	U	10	U	10	U	10	U	10	U	10	U
4-Methylphenol	UGL	10	U	10	U	10	U	10	U	10	U	10	U
N-Nitroso-di-n-propylamine	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Hexachloroethane	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Nitrobenzene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Isophorone	UGL	10	U	10	U	10	U	10	U	10	U	10	U
2-Nitrophenol	UGL	10	U	10	U	10	U	10	U	10	U	10	U
4-Nitrophenol	UGL	25	U	25	U	25	U	25	U	25	U	25	U
2,4-Dimethylphenol	UGL	10	U	10	U	10	U	10	U	10	U	10	U
bis(2-chloroethoxyl)methane	UGL	10	U	10	U	10	U	10	U	10	U	10	U
2,4-Dichlorophenol	UGL	10	U	10	U	10	U	10	U	10	U	10	U
1,2,4-Trichlorobenzene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Naphthalene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
4-Chloroaniline	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Hexachlorobutadiene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
4-Chloro-3-Cresol	UGL	10	U	10	U	10	U	10	U	10	U	10	U
2-Methylnaphthalene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Hexachlorocyclopentadiene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
2,4,6-Trichlorophenol	UGL	10	U	10	U	10	U	10	U	10	U	10	U

FIELD SAMPLE ID:		TRIBSW4		TRIBSW5		NRSEEQ2		NRSEFB2		NRSWEQ		NRSWFB2	
SAMPLING DATE:		11/21/96		11/20/96		11/25/96		11/22/96		11/21/96		11/21/96	
2,4,5-Trichlorophenol	UGL	25	U	25	U	25	U	25	U	25	U	25	U
2-Chloronaphthalene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
2-Nitroaniline	UGL	25	U	25	U	25	U	25	U	25	U	25	U
Dimethylphthalate	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Acenaphthylene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
2,6-Dinitrotoluene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
3-Nitroaniline	UGL	25	U	25	U	25	U	25	U	25	U	25	U
Acenaphthene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
2,4-Dinitrophenol	UGL	25	U	25	U	25	U	25	U	25	U	25	U
Dibenzofuran	UGL	10	U	10	U	10	U	10	U	10	U	10	U
2,4-Dinitrotoluene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Diethylphthalate	UGL	10	U	10	U	10	U	10	U	10	U	10	U
4-Chlorophenyl-phenylether	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Fluorene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
4-Nitroaniline	UGL	25	U	25	U	25	U	25	U	25	U	25	U
4,6-Dinitro-2-Cresol	UGL	25	U	25	U	25	U	25	U	25	U	25	U
N-Nitrosodiphenylamine	UGL	10	U	10	U	10	U	10	U	10	U	10	U
4-Bromophenylphenylether	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Hexachlorobenzene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Pentachlorophenol	UGL	25	U	25	U	25	U	25	U	25	U	25	U
Phenanthrene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Anthracene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Carbazole	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Di-n-butylphthalate	UGL	19	J1	17		10	U	60	J1	43	J1	68	J1
Fluoranthene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Pyrene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Butylbenzylphthalate	UGL	10	U	10	U	10	U	10	U	10	U	10	U
3,3-Dichlorobenzidine'	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Benzo(a)anthracene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Chrysene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
bis(2-Ethylhexyl)phthalate	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Di-n-octylphthalate	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Benzo(b)fluoranthene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Benzo(k)fluoranthene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Benzo(a)pyrene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Indeno(1,2,3-cd)pyrene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Dibenz(a,h)anthracene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Benzo(g,h,i)perylene	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Pesticide/PCB Compounds													
Alpha-BHC	UGL	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Beta-BHC	UGL	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
delta-BHC	UGL	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
gamma-BHC	UGL	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Heptachlor	UGL	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Aldrin	UGL	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Heptachlor Epoxide	UGL	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Endosulfan I	UGL	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Dieldrin	UGL	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
4,4-DDE'	UGL	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Endrin	UGL	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Endosulfan II	UGL	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
4,4-DDD'	UGL	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Endosulfan Sulfate	UGL	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
4,4-DDT'	UGL	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Methoxychlor	UGL	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Endrin Ketone	UGL	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Endrin Aldehyde	UGL	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Alpha Chlordane	UGL	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
gamma-Chlordane	UGL	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Toxaphene	UGL	5	U	5	U	5	U	5	U	5	U	5	U
Aroclor-1016	UGL	1	U	1	U	1	U	1	U	1	U	1	U

FIELD SAMPLE ID:		TRIBSW4		TRIBSW5		NRSEEQ2		NRSEFB2		NRSWEQ		NRSWFB2	
SAMPLING DATE:		11/21/96		11/20/96		11/25/96		11/22/96		11/21/96		11/21/96	
Aroclor-1221	UGL	2	U	2	U	2	U	2	U	2	U	2	U
Aroclor-1232	UGL	1	U	1	U	1	U	1	U	1	U	1	U
Aroclor-1242	UGL	1	U	1	U	1	U	1	U	1	U	1	U
Aroclor-1248	UGL	1	U	1	U	1	U	1	U	1	U	1	U
Aroclor-1254	UGL	1	U	1	U	1	U	1	U	1	U	1	U
Aroclor-1260	UGL	1	U	1	U	1	U	1	U	1	U	1	U
Explosives													
HMX	UGL	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
RDX	UGL	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
1,3,5-Trinitrobenzene	UGL	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
1,3-Dinitrobenzene	UGL	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
Tetryl	UGL	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
Nitrobenzene	UGL	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
2,4,6-Trinitrotoluene	UGL	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
4-AM-2,6-Dinitrotoluene	UGL	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
2-AM-4,6-Dinitrotoluene	UGL	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
2,6-Dinitrotoluene	UGL	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
2,4-Dinitrotoluene	UGL	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
2-Nitrotoluene	UGL	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
4-Nitrotoluene	UGL	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
3-Nitrotoluene	UGL	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
Dissolved Metals													
Aluminum	UGL	100	U	100	U					100	U	100	U
Antimony	UGL	100	U	100	U					100	U	100	U
Arsenic	UGL	10	U	10	U					10	U	10	U
Barium	UGL	170	U	170						174	U	28.1	U
Beryllium	UGL	3	U	3	U					3	U	3	U
Cadmium	UGL	5	U	5	U					5	U	5	U
Calcium	UGL	36600		72400						386	J1	200	U
Chromium	UGL	10	U	10	U					10	U	10	U
Cobalt	UGL	20	U	20	U					20	U	20	U
Copper	UGL	10	U	10	U					10	U	10	U
Iron	UGL	50	U	50	U					50	U	50	U
Lead	UGL	5	U	5	U					5	U	5	U
Magnesium	UGL	18700		42400						200	U	200	U
Manganese	UGL	10	U	12.6						10	U	10	U
Mercury	UGL	0.2	U	0.2	U					0.2	U	0.2	U
Nickel	UGL	20	U	20	U					20	U	20	U
Potassium	UGL	3880		3120						1000	U	1000	U
Selenium	UGL	10	U	10	U					10	U	10	U
Silver	UGL	20	U	20	U					20	U	20	U
Sodium	UGL	11000		7490						1980	J1	1080	J1
Thallium	UGL	10	U	10	U					10	U	10	U
Vanadium	UGL	10	U	10	U					10	U	10	U
Zinc	UGL	15.2	J1	10	U					107	J1	10	U
Total Metals													
Aluminum	UGL	168		100	U	100	U	100	U	100	U	100	U
Antimony	UGL	100	U	100	U	100	U	100	U	100	U	100	U
Arsenic	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Barium	UGL	58.2	U	63		10	U	10	U	10	U	10	U
Beryllium	UGL	3	U	3	U	3	U	3	U	3	U	3	U
Cadmium	UGL	5	U	5	U	5	U	5	U	5	U	5	U
Calcium	UGL	33600		61500		200	U	200	U	200	U	200	U
Chromium	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Cobalt	UGL	20	U	20	U	20	U	20	U	20	U	20	U
Copper	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Iron	UGL	432		50	U	50	U	50	U	50	U	50	U
Lead	UGL	5	U	5	U	5	U	5	U	5	U	5	U
Magnesium	UGL	16900		34400		200	U	200	U	200	U	200	U

FIELD SAMPLE ID:		TRIBSW4		TRIBSW5		NRSEEQ2		NRSEFB2		NRSWEQ		NRSWFB2	
SAMPLING DATE:		11/21/96		11/20/96		11/25/96		11/22/96		11/21/96		11/21/96	
Manganese	UGL	146		18.2		10	U	10	U	10	U	10	U
Mercury	UGL	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	UGL	20	U	20	U	20	U	20	U	20	U	20	U
Potassium	UGL	3650		3140		1000	U	1000	U	1000	U	1000	U
Selenium	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Silver	UGL	20	U	20	U	20	U	20	U	20	U	20	U
Sodium	UGL	7970	U	4880		500	U	974	U	500	U	500	U
Thallium	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Vanadium	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Zinc	UGL	10	U	10	U	10	U	10	U	10	U	10	U
Wet Chemistry Parameters													
Hardness	UGL	153000		295000						10000	U	10000	U
Total Organic Carbon	UGL	11000		14000		5000	U	5000	U	5000	U	5000	U
Total Organic Halogens	UGL	50	U	50	U	63	J1	50	U	50	U	50	U

FIELD SAMPLE ID:		NRSETB2		NRSETB3		NRSWTB4		NRSWTB5	
SAMPLING DATE:		11/22/96		11/25/96		11/20/96		11/21/96	
Volatile Organic Compounds									
Chloromethane	UGL	10	U	10	U	10	U	10	U
Bromomethane	UGL	10	U	10	U	10	U	10	U
Vinyl Chloride	UGL	10	U	10	U	10	U	10	U
Chloroethane	UGL	10	U	10	U	10	U	10	U
Methylene Chloride	UGL	10	U	10	U	10	U	10	U
Acetone	UGL	10	U	10	U	10	U	10	U
Carbon Disulfide	UGL	10	U	10	U	10	U	10	U
1,1-Dichloroethene	UGL	10	U	10	U	10	U	10	U
1,1-Dichloroethane	UGL	10	U	10	U	10	U	10	U
1,2-Dichloroethene (Total)	UGL	10	U	10	U	10	U	10	U
Chloroform	UGL	10	U	10	U	10	U	10	U
1,2-Dichloroethane	UGL	10	U	10	U	10	U	10	U
2-Butanone	UGL	10	U	10	U	10	U	10	U
1,1,1-Trichloroethane	UGL	10	U	10	U	10	U	10	U
Carbon Tetrachloride	UGL	10	U	10	U	10	U	10	U
Bromodichloromethane	UGL	10	U	10	U	10	U	10	U
1,2-Dichloropropane	UGL	10	U	10	U	10	U	10	U
cis-1,3-Dichloropropene	UGL	10	U	10	U	10	U	10	U
Trichloroethene	UGL	10	U	10	U	10	U	10	U
Dibromochloromethane	UGL	10	U	10	U	10	U	10	U
1,1,2-Trichloroethane	UGL	10	U	10	U	10	U	10	U
Benzene	UGL	10	U	10	U	10	U	10	U
trans-1,3-Dichloropropene	UGL	10	U	10	U	10	U	10	U
Bromoform	UGL	10	U	10	U	10	U	10	U
4-Methyl-2-Pentanone	UGL	10	U	10	U	10	U	10	U
2-Hexanone	UGL	10	U	10	U	10	U	10	U
Tetrachloroethene	UGL	10	U	10	U	10	U	10	U
1,1,2,2-Tetrachloroethane	UGL	10	U	10	U	10	U	10	U
Toluene	UGL	10	U	10	U	10	U	10	U
Chlorobenzene	UGL	10	U	10	U	10	U	10	U
Ethylbenzene	UGL	10	U	10	U	10	U	10	U
Styrene	UGL	10	U	10	U	10	U	10	U
Total Xylenes	UGL	10	U	10	U	10	U	10	U
Semivolatile Organic Compounds									
Phenol	UGL								
bis(2-chloroethyl)ether	UGL								
2-Chlorophenol	UGL								
1,3-Dichlorobenzene	UGL								
1,4-Dichlorobenzene	UGL								
1,2-Dichlorobenzene	UGL								
2-Methylphenol	UGL								
bis(2-chloroisopropyl)ether	UGL								
4-Methylphenol	UGL								
N-Nitroso-di-n-propylamine	UGL								
Hexachloroethane	UGL								
Nitrobenzene	UGL								
Isophorone	UGL								
2-Nitrophenol	UGL								
4-Nitrophenol	UGL								
2,4-Dimethylphenol	UGL								
bis(2-chloroethoxyl)methane	UGL								
2,4-Dichlorophenol	UGL								
1,2,4-Trichlorobenzene	UGL								
Naphthalene	UGL								
4-Chloroaniline	UGL								
Hexachlorobutadiene	UGL								
4-Chloro-3-Cresol	UGL								
2-Methylnaphthalene	UGL								
Hexachlorocyclopentadiene	UGL								
2,4,6-Trichlorophenol	UGL								

FIELD SAMPLE ID:		NRSE7		NRSE8(b)		NRSE9		NRSE10		NRSE11		NRSE12	
SAMPLING DATE:		11/26/96		11/26/96		11/26/96		11/26/96		11/26/96		11/22/96	
Volatile Organic Compounds													
Chloromethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Bromomethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Vinyl Chloride	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Chloroethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Methylene Chloride	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.017	
Acetone	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Carbon Disulfide	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
1,1-Dichloroethene	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
1,1-Dichloroethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
1,2-Dichloroethene (Total)	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Chloroform	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
1,2-Dichloroethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
2-Butanone	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
1,1,1-Trichloroethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Carbon Tetrachloride	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Bromodichloromethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
1,2-Dichloropropane	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
cis-1,3-Dichloropropene	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Trichloroethene	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Dibromochloromethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
1,1,2-Trichloroethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Benzene	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
trans-1,3-Dichloropropene	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Bromoform	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
4-Methyl-2-Pentanone	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
2-Hexanone	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Tetrachloroethene	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
1,1,2,2-Tetrachloroethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Toluene	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Chlorobenzene	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Ethylbenzene	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Styrene	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Total Xylenes	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Semivolatile Organic Compounds													
Phenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
bis(2-chloroethyl)ether	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
2-Chlorophenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
1,3-Dichlorobenzene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
1,4-Dichlorobenzene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
1,2-Dichlorobenzene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
2-Methylphenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
bis(2-chloroisopropyl)ether	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
4-Methylphenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
N-Nitroso-di-n-propylamine	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Hexachloroethane	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Nitrobenzene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Isophorone	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
2-Nitrophenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
4-Nitrophenol	UGG	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
2,4-Dimethylphenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
bis(2-chloroethoxyl)methane	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
2,4-Dichlorophenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
1,2,4-Trichlorobenzene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Naphthalene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
4-Chloroaniline	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Hexachlorobutadiene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
4-Chloro-3-Cresol	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
2-Methylnaphthalene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Hexachlorocyclopentadiene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
2,4,6-Trichlorophenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U

FIELD SAMPLE ID:		NRSE7		NRSE8(b)		NRSE9		NRSE10		NRSE11		NRSE12	
SAMPLING DATE:		11/26/96		11/26/96		11/26/96		11/26/96		11/26/96		11/22/96	
2,4,5-Trichlorophenol	UGG	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
2-Chloronaphthalene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
2-Nitroaniline	UGG	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
Dimethylphthalate	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Acenaphthylene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
2,6-Dinitrotoluene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
3-Nitroaniline	UGG	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
Acenaphthene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
2,4-Dinitrophenol	UGG	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
Dibenzofuran	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
2,4-Dinitrotoluene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Diethylphthalate	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
4-Chlorophenyl-phenylether	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Fluorene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
4-Nitroaniline	UGG	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
4,6-Dinitro-2-Cresol	UGG	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
N-Nitrosodiphenylamine	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
4-Bromophenylphenylether	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Hexachlorobenzene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Pentachlorophenol	UGG	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
Phenanthrene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Anthracene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Carbazole	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Di-n-butylphthalate	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Fluoranthene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Pyrene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Butylbenzylphthalate	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
3,3-Dichlorobenzidine'	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Benzo(a)anthracene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Chrysene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
bis(2-Ethylhexyl)phthalate	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Di-n-octylphthalate	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Benzo(b)fluoranthene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Benzo(k)fluoranthene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Benzo(a)pyrene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Indeno(1,2,3-cd)pyrene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Dibenz(a,h)anthracene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Benzo(g,h,i)perylene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Pesticide/PCB Compounds													
Alpha-BHC	UGG	0.0034	U	0.0034	U	0.0034	U	0.0034	U	0.0034	U	0.0034	U
Beta-BHC	UGG	0.0034	U	0.0034	U	0.0034	U	0.0034	U	0.0034	U	0.0034	U
delta-BHC	UGG	0.0034	U	0.0034	U	0.0034	U	0.0034	U	0.0034	U	0.0034	U
gamma-BHC	UGG	0.0034	U	0.0034	U	0.0034	U	0.0034	U	0.0034	U	0.0034	U
Heptachlor	UGG	0.0034	U	0.0034	U	0.0034	U	0.0034	U	0.0034	U	0.0034	U
Aldrin	UGG	0.0034	U	0.0034	U	0.0034	U	0.0034	U	0.0034	U	0.0034	U
Heptachlor Epoxide	UGG	0.0034	U	0.0034	U	0.0034	U	0.0034	U	0.0034	U	0.0034	U
Endosulfan I	UGG	0.0034	U	0.0034	U	0.0034	U	0.0034	U	0.0034	U	0.0034	U
Dieldrin	UGG	0.0066	U	0.0066	U	0.0066	U	0.0066	U	0.0066	U	0.0066	U
4,4-DDE'	UGG	0.0066	U	0.0066	U	0.0066	U	0.0066	U	0.0066	U	0.0066	U
Endrin	UGG	0.0066	U	0.0066	U	0.0066	U	0.0066	U	0.0066	U	0.0066	U
Endosulfan II	UGG	0.0066	U	0.0066	U	0.0066	U	0.0066	U	0.0066	U	0.0066	U
4,4-DDD'	UGG	0.0066	U	0.0066	U	0.0066	U	0.0066	U	0.0066	U	0.0066	U
Endosulfan Sulfate	UGG	0.0066	U	0.0066	U	0.0066	U	0.0066	U	0.0066	U	0.0066	U
4,4-DDT'	UGG	0.0066	U	0.0066	U	0.0066	U	0.0066	U	0.0066	U	0.0066	U
Methoxychlor	UGG	0.034	U	0.034	U	0.034	U	0.034	U	0.034	U	0.034	U
Endrin Ketone	UGG	0.0066	U	0.0066	U	0.0066	U	0.0066	U	0.0066	U	0.0066	U
Endrin Aldehyde	UGG	0.0066	U	0.0066	U	0.0066	U	0.0066	U	0.0066	U	0.0066	U
Alpha Chlordane	UGG	0.01		0.0034	U	0.0034	U	0.0034	U	0.0034	U	0.0034	U
gamma-Chlordane	UGG	0.012		0.0034	U	0.0034	U	0.0034	U	0.0034	U	0.0034	U
Toxaphene	UGG	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U	0.34	U
Aroclor-1016	UGG	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U

FIELD SAMPLE ID:		NRSE7		NRSE8(b)		NRSE9		NRSE10		NRSE11		NRSE12	
SAMPLING DATE:		11/26/96		11/26/96		11/26/96		11/26/96		11/26/96		11/22/96	
Aroclor-1221	UGG	0.134	U	0.134	U	0.134	U	0.134	U	0.134	U	0.134	U
Aroclor-1232	UGG	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U
Aroclor-1242	UGG	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U
Aroclor-1248	UGG	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U
Aroclor-1254	UGG	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U
Aroclor-1260	UGG	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U	0.066	U
Explosives													
HMX	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
RDX	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
1,3,5-Trinitrobenzene	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
1,3-Dinitrobenzene	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
Tetryl	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
Nitrobenzene	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
2,4,6-Trinitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
4-AM-2,6-Dinitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
2-AM-4,6-Dinitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
2,6-Dinitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
2,4-Dinitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
2-Nitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
4-Nitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
3-Nitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
Total Metals													
Aluminum	UGG	3730	J	12100	J	4290	J	6740	J	8350	J	9070	
Antimony	UGG	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ
Arsenic	UGG	2.5		2.2		1.7		2.8		2.2		4	
Barium	UGG	39.9	J	151	J	60.5	J	105	J	130	J	129	
Beryllium	UGG	0.43		0.83		0.46		0.63		0.88		0.78	
Cadmium	UGG	0.5	U	0.5	U	0.5	U	0.5	U	1		0.5	U
Calcium	UGG	2810	J	3270	J	1310	J	2830	J	1670	J	4310	
Chromium	UGG	10.9		22.8		13.1		17.8		16.6		18.8	
Cobalt	UGG	7.8	J	11.7	J	6.5	J	8.9	J	8.9	J	10	
Copper	UGG	11.7		21.5		7.5		16.8		13.8		15.9	
Iron	UGG	17300	J	25000	J	18700	J	21900	J	29200	J	30700	
Lead	UGG	54.1	J	78.1	J	74.7	J	79.4	J	259	J	112	
Magnesium	UGG	2610	J	3650	J	1490	J	2410	J	2110	J	3040	J
Manganese	UGG	423	J	1570	J	703	J	917	J	909	J	1100	J
Mercury	UGG	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Nickel	UGG	6.9		11.7		7.3		8.9		9.1		12.4	
Potassium	UGG	579	J	1840	J	835	J	1160	J	1160	J	1430	
Selenium	UGG	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ	1	U
Silver	UGG	2	U	2	U	2	U	2	U	2	U	2	U
Sodium	UGG	50	UJ	50	UJ	50	UJ	50	UJ	50	UJ	50	U
Thallium	UGG	1	U	1	U	1	U	1.7		1.8		1	U
Vanadium	UGG	11.3		30.5		13.1		18.9		22.4		22.4	
Zinc	UGG	206	J	250	J	254	J	259	J	797	J	466	
Wet Chemistry Parameters													
Acid Volatile Sulfide	UGG	2	U	2	U	2	U	2	U	2	U	4.1	
PH		7.8		7.4		7.4		7.9		7.7		7.3	
Total Organic Carbon	UGG	40		57		60		51		41		51	
Total Organic Halogens	UGG	60.2	J1	137		53.4	J1	65.7	J1	29.7	J1	10	U

FIELD SAMPLE ID:		NRSE13		NRSE14		NRSE15		NRSE16		NRSE17		NRSE18	
SAMPLING DATE:		11/22/96		11/22/96		11/22/96		11/22/96		11/22/96		11/22/96	
Volatile Organic Compounds													
Chloromethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
Bromomethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
Vinyl Chloride	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
Chloroethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
Methylene Chloride	UGG	0.022		0.01	U	0.014		0.014					
Acetone	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
Carbon Disulfide	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
1,1-Dichloroethene	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
1,1-Dichloroethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
1,2-Dichloroethene (Total)	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
Chloroform	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
1,2-Dichloroethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
2-Butanone	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
1,1,1-Trichloroethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
Carbon Tetrachloride	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
Bromodichloromethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
1,2-Dichloropropane	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
cis-1,3-Dichloropropene	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
Trichloroethene	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
Dibromochloromethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
1,1,2-Trichloroethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
Benzene	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
trans-1,3-Dichloropropene	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
Bromoform	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
4-Methyl-2-Pentanone	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
2-Hexanone	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
Tetrachloroethene	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
1,1,2,2-Tetrachloroethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
Toluene	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
Chlorobenzene	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
Ethylbenzene	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
Styrene	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
Total Xylenes	UGG	0.01	U	0.01	U	0.01	U	0.01	U				
Semivolatile Organic Compounds													
Phenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
bis(2-chloroethyl)ether	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
2-Chlorophenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
1,3-Dichlorobenzene	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
1,4-Dichlorobenzene	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
1,2-Dichlorobenzene	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
2-Methylphenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
bis(2-chloroisopropyl)ether	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
4-Methylphenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
N-Nitroso-di-n-propylamine	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
Hexachloroethane	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
Nitrobenzene	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
Isophorone	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
2-Nitrophenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
4-Nitrophenol	UGG	0.8	U	0.8	U	0.8	U	0.8	U				
2,4-Dimethylphenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
bis(2-chloroethoxyl)methane	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
2,4-Dichlorophenol	UGG	0.33	U	0.33	U.	0.33	U	0.33	U				
1,2,4-Trichlorobenzene	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
Naphthalene	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
4-Chloroaniline	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
Hexachlorobutadiene	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
4-Chloro-3-Cresol	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
2-Methylnaphthalene	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
Hexachlorocyclopentadiene	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
2,4,6-Trichlorophenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U				

FIELD SAMPLE ID:		NRSE13		NRSE14		NRSE15		NRSE16		NRSE17		NRSE18	
SAMPLING DATE:		11/22/96		11/22/96		11/22/96		11/22/96		11/22/96		11/22/96	
2,4,5-Trichlorophenol	UGG	0.8	U	0.8	U	0.8	U	0.8	U				
2-Chloronaphthalene	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
2-Nitroaniline	UGG	0.8	U	0.8	U	0.8	U	0.8	U				
Dimethylphthalate	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
Acenaphthylene	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
2,6-Dinitrotoluene	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
3-Nitroaniline	UGG	0.8	U	0.8	U	0.8	U	0.8	U				
Acenaphthene	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
2,4-Dinitrophenol	UGG	0.8	U	0.8	U	0.8	U	0.8	U				
Dibenzofuran	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
2,4-Dinitrotoluene	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
Diethylphthalate	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
4-Chlorophenyl-phenylether	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
Fluorene	UGG	0.33	U	0.33	U	0.76		0.33	U				
4-Nitroaniline	UGG	0.8	U	0.8	U	0.8	U	0.8	U				
4,6-Dinitro-2-Cresol	UGG	0.8	U	0.8	U	0.8	U	0.8	U				
N-Nitrosodiphenylamine	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
4-Bromophenylphenylether	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
Hexachlorobenzene	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
Pentachlorophenol	UGG	0.8	U	0.8	U	0.8	U	0.8	U				
Phenanthrene	UGG	0.33	U	0.33	U	4		0.33	U				
Anthracene	UGG	0.33	U	0.33	U	0.86		0.33	U				
Carbazole	UGG	0.33	U	0.33	U	0.49		0.33	U				
Di-n-butylphthalate	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
Fluoranthene	UGG	0.33	U	0.33	U	2.8		0.33	U				
Pyrene	UGG	0.33	U	0.33	U	3.3		0.33	U				
Butylbenzylphthalate	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
3,3-Dichlorobenzidine'	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
Benzo(a)anthracene	UGG	0.33	U	0.33	U	2.2		0.33	U				
Chrysene	UGG	0.33	U	0.33	U	1.8		0.33	U				
bis(2-Ethylhexyl)phthalate	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
Di-n-octylphthalate	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
Benzo(b)fluoranthene	UGG	0.33	U	0.33	U	2.5		0.33	U				
Benzo(k)fluoranthene	UGG	0.33	U	0.33	U	1.1		0.33	U				
Benzo(a)pyrene	UGG	0.33	U	0.33	U	1.6		0.33	U				
Indeno(1,2,3-cd)pyrene	UGG	0.33	U	0.33	U	0.56		0.33	U				
Dibenz(a,h)anthracene	UGG	0.33	U	0.33	U	0.33	U	0.33	U				
Benzo(g,h,i)perylene	UGG	0.33	U	0.33	U	0.54		0.33	U				
Pesticide/PCB Compounds													
Alpha-BHC	UGG	0.0034	U	0.0068	U	0.0068	U	0.0034	U	0.0068	U	0.0034	U
Beta-BHC	UGG	0.0034	U	0.0068	U	0.0068	U	0.0034	U	0.0068	U	0.0034	U
delta-BHC	UGG	0.0034	U	0.0068	U	0.0068	U	0.0034	U	0.0068	U	0.0034	U
gamma-BHC	UGG	0.0034	U	0.0068	U	0.0068	U	0.0034	U	0.0068	U	0.0034	U
Heptachlor	UGG	0.0034	U	0.0068	U	0.0068	U	0.0034	U	0.0068	U	0.0034	U
Aldrin	UGG	0.0034	U	0.0068	U	0.0068	U	0.0034	U	0.0068	U	0.0034	U
Heptachlor Epoxide	UGG	0.0034	U	0.0068	U	0.0068	U	0.0034	U	0.0068	U	0.0034	U
Endosulfan I	UGG	0.0034	U	0.0068	U	0.0068	U	0.0034	U	0.0068	U	0.0034	U
Dieldrin	UGG	0.0066	U	0.0132	U	0.0132	U	0.0066	U	0.0132	U	0.0066	U
4,4-DDE'	UGG	0.0066	U	0.0132	U	0.0132	U	0.0066	U	0.0132	U	0.0066	U
Endrin	UGG	0.0066	U	0.0132	U	0.0132	U	0.0066	U	0.0132	U	0.0066	U
Endosulfan II	UGG	0.0066	U	0.0132	U	0.0132	U	0.0066	U	0.0132	U	0.0066	U
4,4-DDD'	UGG	0.0066	U	0.0132	U	0.0132	U	0.0066	U	0.0132	U	0.0066	U
Endosulfan Sulfate	UGG	0.0066	U	0.0132	U	0.0132	U	0.0066	U	0.0132	U	0.0066	U
4,4-DDT'	UGG	0.0066	U	0.0132	U	0.0132	U	0.0066	U	0.0132	U	0.0066	U
Methoxychlor	UGG	0.034	U	0.068	U	0.068	U	0.034	U	0.068	U	0.034	U
Endrin Ketone	UGG	0.0066	U	0.0132	U	0.0132	U	0.0066	U	0.0132	U	0.0066	U
Endrin Aldehyde	UGG	0.0066	U	0.0132	U	0.0132	U	0.0066	U	0.0132	U	0.0066	U
Alpha Chlordane	UGG	0.0034	U	0.0068	U	0.0068	U	0.0034	U	0.0068	U	0.0034	U
gamma-Chlordane	UGG	0.0034	U	0.0068	U	0.0068	U	0.0034	U	0.0068	U	0.0034	U
Toxaphene	UGG	0.34	U	0.68	U	0.68	U	0.34	U	0.68	U	0.34	U
Aroclor-1016	UGG	0.066	U	0.132	U	0.132	U	0.066	U	0.132	U	0.066	U

FIELD SAMPLE ID:		NRSE13		NRSE14		NRSE15		NRSE16		NRSE17		NRSE18	
SAMPLING DATE:		11/22/96		11/22/96		11/22/96		11/22/96		11/22/96		11/22/96	
Aroclor-1221	UGG	0.134	U	0.268	U	0.268	U	0.134	U	0.268	U	0.134	U
Aroclor-1232	UGG	0.066	U	0.132	U	0.132	U	0.066	U	0.132	U	0.066	U
Aroclor-1242	UGG	0.066	U	0.132	U	0.132	U	0.066	U	0.132	U	0.066	U
Aroclor-1248	UGG	0.066	U	0.132	U	0.132	U	0.066	U	0.132	U	0.066	U
Aroclor-1254	UGG	0.066	U	0.132	U	0.132	U	0.066	U	0.132	U	0.066	U
Aroclor-1260	UGG	0.066	U	0.132	U	0.132	U	0.066	U	0.132	U	0.066	U
Explosives													
HMX	UGG	0.4	U	0.4	U	0.4	U	0.4	U				
RDX	UGG	0.4	U	0.4	U	0.4	U	0.4	U				
1,3,5-Trinitrobenzene	UGG	0.4	U	0.4	U	0.4	U	0.4	U				
1,3-Dinitrobenzene	UGG	0.4	U	0.4	U	0.4	U	0.4	U				
Tetryl	UGG	0.4	U	0.4	U	0.4	U	0.4	U				
Nitrobenzene	UGG	0.4	U	0.4	U	0.4	U	0.4	U				
2,4,6-Trinitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U				
4-AM-2,6-Dinitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U				
2-AM-4,6-Dinitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U				
2,6-Dinitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U				
2,4-Dinitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U				
2-Nitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U				
4-Nitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U				
3-Nitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U				
Total Metals													
Aluminum	UGG	11200		9910		8680		16000		11800		15800	
Antimony	UGG	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ
Arsenic	UGG	4.4		3.9		4.6		5.1		2.7		3.8	
Barium	UGG	156		110		63.7		48.2		134		170	
Beryllium	UGG	0.83		0.71		0.48		0.62		0.81		1	
Cadmium	UGG	0.5	U	0.5	U	2.4		2.8		0.5	U	0.5	U
Calcium	UGG	5350		2190		11200		900		3600		4190	
Chromium	UGG	19		21		29.4		29.8		22.2		25.9	
Cobalt	UGG	10.2		10		10.9		10.6		10.2		13.1	
Copper	UGG	17.8		13.4		110		13.7		16.7		21.8	
Iron	UGG	30000		30800		43500		22100		27000		33200	
Lead	UGG	118		104		34.3		14		80.8		87.8	
Magnesium	UGG	3790	J	2600	J	7400	J	9000	J	3780	J	4730	J
Manganese	UGG	1160	J	1210	J	512	J	512	J	1220	J	1830	J
Mercury	UGG	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Nickel	UGG	15.1		10.6		44.8		19		12.3		16.1	
Potassium	UGG	1570		1420		1300		1670		1800		2210	
Selenium	UGG	1	U	1	U	1	U	1	U	1	U	1	U
Silver	UGG	2	U	2	U	2	U	2	U	2	U	2	U
Sodium	UGG	50	U	50	U	50	U	50	U	50	U	97.6	J1
Thallium	UGG	1	U	1.6		1.6		1.6		1	U	1.9	
Vanadium	UGG	25.8		24.7		33.8		40.9		27.5		35.4	
Zinc	UGG	479		378		1430		33.2		323		358	
Wet Chemistry Parameters													
Acid Volatile Sulfide	UGG	2	U	2	U	2	U	2	U	2	U	2	U
PH		7.1		6.9		7.6		7.2					
Total Organic Carbon	UGG	59		40		71		72					
Total Organic Halogens	UGG	54.8	J1	10	U	10	U	24.3	J1				

FIELD SAMPLE ID:		NRSE30		SCSE3(B)		SCSE4		TRIBSE1		TRIBSE2		TRIBSE3	
SAMPLING DATE:		11/22/96		11/20/96		11/21/96		11/25/96		11/25/96		11/25/96	
Volatile Organic Compounds													
Chloromethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Bromomethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Vinyl Chloride	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Chloroethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Methylene Chloride	UGG	0.01	U	0.01	U	0.01	U	0.015		0.01	U	0.01	U
Acetone	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Carbon Disulfide	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
1,1-Dichloroethene	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
1,1-Dichloroethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
1,2-Dichloroethene (Total)	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Chloroform	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
1,2-Dichloroethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
2-Butanone	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
1,1,1-Trichloroethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Carbon Tetrachloride	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Bromodichloromethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
1,2-Dichloropropane	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
cis-1,3-Dichloropropene	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Trichloroethene	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Dibromochloromethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
1,1,2-Trichloroethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Benzene	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
trans-1,3-Dichloropropene	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Bromoform	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
4-Methyl-2-Pentanone	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
2-Hexanone	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Tetrachloroethene	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
1,1,2,2-Tetrachloroethane	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Toluene	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Chlorobenzene	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Ethylbenzene	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Styrene	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Total Xylenes	UGG	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U	0.01	U
Semivolatile Organic Compounds													
Phenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
bis(2-chloroethyl)ether	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
2-Chlorophenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
1,3-Dichlorobenzene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
1,4-Dichlorobenzene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
1,2-Dichlorobenzene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
2-Methylphenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
bis(2-chloroisopropyl)ether	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
4-Methylphenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
N-Nitroso-di-n-propylamine	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Hexachloroethane	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Nitrobenzene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Isophorone	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
2-Nitrophenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
4-Nitrophenol	UGG	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
2,4-Dimethylphenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
bis(2-chloroethoxyl)methane	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
2,4-Dichlorophenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
1,2,4-Trichlorobenzene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Naphthalene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
4-Chloroaniline	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Hexachlorobutadiene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
4-Chloro-3-Cresol	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
2-Methylnaphthalene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Hexachlorocyclopentadiene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
2,4,6-Trichlorophenol	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U

FIELD SAMPLE ID:		NRSE30		SCSE3(B)		SCSE4		TRIBSE1		TRIBSE2		TRIBSE3	
SAMPLING DATE:		11/22/96		11/20/96		11/21/96		11/25/96		11/25/96		11/25/96	
2,4,5-Trichlorophenol	UGG	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
2-Chloronaphthalene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
2-Nitroaniline	UGG	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
Dimethylphthalate	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Acenaphthylene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
2,6-Dinitrotoluene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
3-Nitroaniline	UGG	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
Acenaphthene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
2,4-Dinitrophenol	UGG	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
Dibenzofuran	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
2,4-Dinitrotoluene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Diethylphthalate	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.82		0.33	U
4-Chlorophenyl-phenylether	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Fluorene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
4-Nitroaniline	UGG	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
4,6-Dinitro-2-Cresol	UGG	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
N-Nitrosodiphenylamine	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
4-Bromophenylphenylether	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Hexachlorobenzene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Pentachlorophenol	UGG	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U	0.8	U
Phenanthrene	UGG	1.7		0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Anthracene	UGG	0.51		0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Carbazole	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Di-n-butylphthalate	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Fluoranthene	UGG	1.9		0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Pyrene	UGG	1.6		0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Butylbenzylphthalate	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
3,3-Dichlorobenzidine'	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Benzo(a)anthracene	UGG	1.1		0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Chrysene	UGG	0.95		0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
bis(2-Ethylhexyl)phthalate	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Di-n-octylphthalate	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Benzo(b)fluoranthene	UGG	1.2		0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Benzo(k)fluoranthene	UGG	0.44		0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Benzo(a)pyrene	UGG	0.84		0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Indeno(1,2,3-cd)pyrene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Dibenz(a,h)anthracene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Benzo(g,h,i)perylene	UGG	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U	0.33	U
Pesticide/PCB Compounds													
Alpha-BHC	UGG	0.0068	U	0.0068	U	0.034	U	0.0034	U	0.0034	U	0.0034	U
Beta-BHC	UGG	0.0068	U	0.0068	U	0.034	U	0.0034	U	0.0034	U	0.0034	U
delta-BHC	UGG	0.0068	U	0.0068	U	0.034	U	0.0034	U	0.0034	U	0.0034	U
gamma-BHC	UGG	0.0068	U	0.0068	U	0.034	U	0.0034	U	0.0034	U	0.0034	U
Heptachlor	UGG	0.0068	U	0.0068	U	0.034	U	0.0034	U	0.0034	U	0.0034	U
Aldrin	UGG	0.0068	U	0.0068	U	0.034	U	0.0034	U	0.0034	U	0.0034	U
Heptachlor Epoxide	UGG	0.0068	U	0.0068	U	0.034	U	0.0034	U	0.0034	U	0.0034	U
Endosulfan I	UGG	0.0068	U	0.0068	U	0.034	U	0.0034	U	0.0034	U	0.0034	U
Dieldrin	UGG	0.0132	U	0.0132	U	0.066	U	0.0066	U	0.0066	U	0.0066	U
4,4-DDE'	UGG	0.0132	U	0.0132	U	0.066	U	0.0066	U	0.0066	U	0.0066	U
Endrin	UGG	0.0132	U	0.0132	U	0.066	U	0.0066	U	0.0066	U	0.0066	U
Endosulfan II	UGG	0.0132	U	0.0132	U	0.066	U	0.0066	U	0.0066	U	0.0066	U
4,4-DDD'	UGG	0.0132	U	0.0132	U	0.066	U	0.0066	U	0.0066	U	0.0066	U
Endosulfan Sulfate	UGG	0.0132	U	0.0132	U	0.066	U	0.0066	U	0.0066	U	0.0066	U
4,4-DDT'	UGG	0.0132	U	0.0132	U	0.066	U	0.0066	U	0.0066	U	0.0066	U
Methoxychlor	UGG	0.068	U	0.068	U	0.34	U	0.034	U	0.034	U	0.034	U
Endrin Ketone	UGG	0.0132	U	0.0132	U	0.066	U	0.0066	U	0.0066	U	0.0066	U
Endrin Aldehyde	UGG	0.0132	U	0.0132	U	0.066	U	0.0066	U	0.0066	U	0.0066	U
Alpha Chlordane	UGG	0.0068	U	0.0068	U	0.034	U	0.0034	U	0.0034	U	0.011	
gamma-Chlordane	UGG	0.0068	U	0.0068	U	0.034	U	0.0034	U	0.0034	U	0.01	
Toxaphene	UGG	0.68	U	0.68	U	3.4	U	0.34	U	0.34	U	0.34	U
Aroclor-1016	UGG	0.132	U	0.132	U	0.66	U	0.066	U	0.066	U	0.066	U

FIELD SAMPLE ID:		NRSE30		SCSE3(B)		SCSE4		TRIBSE1		TRIBSE2		TRIBSE3	
SAMPLING DATE:		11/22/96		11/20/96		11/21/96		11/25/96		11/25/96		11/25/96	
Aroclor-1221	UGG	0.268	U	0.268	U	1.34	U	0.134	U	0.134	U	0.134	U
Aroclor-1232	UGG	0.132	U	0.132	U	0.66	U	0.066	U	0.066	U	0.066	U
Aroclor-1242	UGG	0.132	U	0.132	U	0.66	U	0.066	U	0.066	U	0.066	U
Aroclor-1248	UGG	0.132	U	0.132	U	0.66	U	0.066	U	0.066	U	0.066	U
Aroclor-1254	UGG	0.132	U	0.132	U	0.66	U	0.066	U	0.066	U	0.066	U
Aroclor-1260	UGG	0.132	U	0.132	U	0.66	U	0.066	U	0.066	U	0.066	U
Explosives													
HMX	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
RDX	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
1,3,5-Trinitrobenzene	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
1,3-Dinitrobenzene	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
Tetryl	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
Nitrobenzene	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
2,4,6-Trinitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
4-AM-2,6-Dinitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
2-AM-4,6-Dinitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
2,6-Dinitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
2,4-Dinitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
2-Nitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
4-Nitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
3-Nitrotoluene	UGG	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
Total Metals													
Aluminum	UGG	12100		6010		7270		8770	J	4360	J	2210	J
Antimony	UGG	10	UJ	10	U	10	U	10	UJ	10	UJ	10	UJ
Arsenic	UGG	4		6.5		8.7		1.8		1.8		1	U
Barium	UGG	75.2		58.9		81.8	U	55.4	J	48.6	J	25.1	J
Beryllium	UGG	0.57		0.48		0.66		0.55		0.41		0.3	U
Cadmium	UGG	1.5		0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Calcium	UGG	3260		7740		17200		52500	J	2380	J	5050	J
Chromium	UGG	30		12.6		16.7		15.9		13.4		6.9	
Cobalt	UGG	10.6		9.1		10.3		5.3	J	6.9	J	2.7	J
Copper	UGG	27.5		12.7		11.3		10.3		8.1		3.7	
Iron	UGG	27500		20500		34400		14700	J	14900	J	5970	J
Lead	UGG	23.5		10.3		12.7		37.8	J	54.9	J	7.4	J
Magnesium	UGG	3530	J	4400		10200		38900	J	1950	J	1560	J
Manganese	UGG	536	J	260		442		382	J	545	J	135	J
Mercury	UGG	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Nickel	UGG	15.9		13.2		17.9		8.6		5.1		2	U
Potassium	UGG	1600		972		946		3710	J	625	J	454	J
Selenium	UGG	1	U	1	U	1	U	1	UJ	1	UJ	1	UJ
Silver	UGG	2	U	2	U	2	U	2	U	2	U	2	U
Sodium	UGG	50	U	50	U	89.3	J1	128	J	50	UJ	112	J
Thallium	UGG	1.4		1	U	1	U	1.6		1	U	1	U
Vanadium	UGG	45.8		13.4		20		19.3		13.4		8.1	
Zinc	UGG	849		60.4		70.2	J1	122	J	131	J	29.3	J
Wet Chemistry Parameters													
Acid Volatile Sulfide	UGG	2	U	5.5		4.5		2	U	2	U	2	U
PH		7.5		7.6		7.4		7.9		8.1		8.2	
Total Organic Carbon	UGG	76		45		40		27		36		58	
Total Organic Halogens	UGG	12.5	J1	76.5		10	U	74.4	J1	10	U	125	J1

FIELD SAMPLE ID:		TRIBSE4		TRIBSE5		TRIBSE6	
SAMPLING DATE:		11/21/96		11/20/96		11/21/96	
Volatile Organic Compounds							
Chloromethane	UGG	0.01	U	0.01	U		
Bromomethane	UGG	0.01	U	0.01	U		
Vinyl Chloride	UGG	0.01	U	0.01	U		
Chloroethane	UGG	0.01	U	0.01	U		
Methylene Chloride	UGG	0.01	U	0.01	U		
Acetone	UGG	0.093		0.01	U		
Carbon Disulfide	UGG	0.01	U	0.01	U		
1,1-Dichloroethene	UGG	0.01	U	0.01	U		
1,1-Dichloroethane	UGG	0.01	U	0.01	U		
1,2-Dichloroethene (Total)	UGG	0.01	U	0.01	U		
Chloroform	UGG	0.01	U	0.01	U		
1,2-Dichloroethane	UGG	0.01	U	0.01	U		
2-Butanone	UGG	0.016		0.01	U		
1,1,1-Trichloroethane	UGG	0.01	U	0.01	U		
Carbon Tetrachloride	UGG	0.01	U	0.01	U		
Bromodichloromethane	UGG	0.01	U	0.01	U		
1,2-Dichloropropane	UGG	0.01	U	0.01	U		
cis-1,3-Dichloropropene	UGG	0.01	U	0.01	U		
Trichloroethene	UGG	0.01	U	0.01	U		
Dibromochloromethane	UGG	0.01	U	0.01	U		
1,1,2-Trichloroethane	UGG	0.01	U	0.01	U		
Benzene	UGG	0.01	U	0.01	U		
trans-1,3-Dichloropropene	UGG	0.01	U	0.01	U		
Bromoform	UGG	0.01	U	0.01	U		
4-Methyl-2-Pentanone	UGG	0.01	U	0.01	U		
2-Hexanone	UGG	0.01	U	0.01	U		
Tetrachloroethene	UGG	0.01	U	0.01	U		
1,1,2,2-Tetrachloroethane	UGG	0.01	U	0.01	U		
Toluene	UGG	0.01	U	0.01	U		
Chlorobenzene	UGG	0.01	U	0.01	U		
Ethylbenzene	UGG	0.01	U	0.01	U		
Styrene	UGG	0.01	U	0.01	U		
Total Xylenes	UGG	0.01	U	0.01	U		
Semivolatile Organic Compounds							
Phenol	UGG	0.33	U	0.33	U	0.33	U
bis(2-chloroethyl)ether	UGG	0.33	U	0.33	U	0.33	U
2-Chlorophenol	UGG	0.33	U	0.33	U	0.33	U
1,3-Dichlorobenzene	UGG	0.33	U	0.33	U	0.33	U
1,4-Dichlorobenzene	UGG	0.33	U	0.33	U	0.33	U
1,2-Dichlorobenzene	UGG	0.33	U	0.33	U	0.33	U
2-Methylphenol	UGG	0.33	U	0.33	U	0.33	U
bis(2-chloroisopropyl)ether	UGG	0.33	U	0.33	U	0.33	U
4-Methylphenol	UGG	0.33	U	0.33	U	0.33	U
N-Nitroso-di-n-propylamine	UGG	0.33	U	0.33	U	0.33	U
Hexachloroethane	UGG	0.33	U	0.33	U	0.33	U
Nitrobenzene	UGG	0.33	U	0.33	U	0.33	U
Isophorone	UGG	0.33	U	0.33	U	0.33	U
2-Nitrophenol	UGG	0.33	U	0.33	U	0.33	U
4-Nitrophenol	UGG	0.8	U	0.8	U	0.8	U
2,4-Dimethylphenol	UGG	0.33	U	0.33	U	0.33	U
bis(2-chloroethoxyl)methane	UGG	0.33	U	0.33	U	0.33	U
2,4-Dichlorophenol	UGG	0.33	U	0.33	U	0.33	U
1,2,4-Trichlorobenzene	UGG	0.33	U	0.33	U	0.33	U
Naphthalene	UGG	0.33	U	0.33	U	0.33	U
4-Chloroaniline	UGG	0.33	U	0.33	U	0.33	U
Hexachlorobutadiene	UGG	0.33	U	0.33	U	0.33	U
4-Chloro-3-Cresol	UGG	0.33	U	0.33	U	0.33	U
2-Methylnaphthalene	UGG	0.33	U	0.33	U	0.33	U
Hexachlorocyclopentadiene	UGG	0.33	U	0.33	U	0.33	U
2,4,6-Trichlorophenol	UGG	0.33	U	0.33	U	0.33	U

FIELD SAMPLE ID:		TRIBSE4		TRIBSE5		TRIBSE6	
SAMPLING DATE:		11/21/96		11/20/96		11/21/96	
2,4,5-Trichlorophenol	UGG	0.8	U	0.8	U	0.8	U
2-Chloronaphthalene	UGG	0.33	U	0.33	U	0.33	U
2-Nitroaniline	UGG	0.8	U	0.8	U	0.8	U
Dimethylphthalate	UGG	0.33	U	0.33	U	0.33	U
Acenaphthylene	UGG	0.33	U	0.33	U	0.33	U
2,6-Dinitrotoluene	UGG	0.33	U	0.33	U	0.33	U
3-Nitroaniline	UGG	0.8	U	0.8	U	0.8	U
Acenaphthene	UGG	0.33	U	0.33	U	0.33	U
2,4-Dinitrophenol	UGG	0.8	U	0.8	U	0.8	U
Dibenzofuran	UGG	0.33	U	0.33	U	0.33	U
2,4-Dinitrotoluene	UGG	0.33	U	0.33	U	0.33	U
Diethylphthalate	UGG	0.33	U	0.33	U	0.33	U
4-Chlorophenyl-phenylether	UGG	0.33	U	0.33	U	0.33	U
Fluorene	UGG	0.33	U	0.33	U	0.33	U
4-Nitroaniline	UGG	0.8	U	0.8	U	0.8	U
4,6-Dinitro-2-Cresol	UGG	0.8	U	0.8	U	0.8	U
N-Nitrosodiphenylamine	UGG	0.33	U	0.33	U	0.33	U
4-Bromophenylphenylether	UGG	0.33	U	0.33	U	0.33	U
Hexachlorobenzene	UGG	0.33	U	0.33	U	0.33	U
Pentachlorophenol	UGG	0.8	U	0.8	U	0.8	U
Phenanthrene	UGG	0.33	U	0.33	U	0.33	U
Anthracene	UGG	0.33	U	0.33	U	0.33	U
Carbazole	UGG	0.33	U	0.33	U	0.33	U
Di-n-butylphthalate	UGG	0.33	U	0.33	U	0.33	U
Fluoranthene	UGG	0.33	U	0.33	U	1.1	
Pyrene	UGG	0.33	U	0.33	U	0.69	
Butylbenzylphthalate	UGG	0.33	U	0.33	U	0.33	U
3,3-Dichlorobenzidine'	UGG	0.33	U	0.33	U	0.33	U
Benzo(a)anthracene	UGG	0.33	U	0.33	U	0.33	U
Chrysene	UGG	0.33	U	0.33	U	0.33	U
bis(2-Ethylhexyl)phthalate	UGG	0.33	U	0.33	U	0.33	U
Di-n-octylphthalate	UGG	0.33	U	0.33	U	0.33	U
Benzo(b)fluoranthene	UGG	0.33	U	0.33	U	0.33	U
Benzo(k)fluoranthene	UGG	0.33	U	0.33	U	0.33	U
Benzo(a)pyrene	UGG	0.33	U	0.33	U	0.33	U
Indeno(1,2,3-cd)pyrene	UGG	0.33	U	0.33	U	0.33	U
Dibenz(a,h)anthracene	UGG	0.33	U	0.33	U	0.33	U
Benzo(g,h,i)perylene	UGG	0.33	U	0.33	U	0.33	U
Pesticide/PCB Compounds							
Alpha-BHC	UGG	0.017	U	0.034	U	0.0034	U
Beta-BHC	UGG	0.017	U	0.034	U	0.0034	U
delta-BHC	UGG	0.017	U	0.034	U	0.0034	U
gamma-BHC	UGG	0.017	U	0.034	U	0.0034	U
Heptachlor	UGG	0.017	U	0.034	U	0.0034	U
Aldrin	UGG	0.017	U	0.034	U	0.0034	U
Heptachlor Epoxide	UGG	0.017	U	0.034	U	0.0034	U
Endosulfan I	UGG	0.017	U	0.034	U	0.0034	U
Dieldrin	UGG	0.033	U	0.066	U	0.0066	U
4,4-DDE'	UGG	0.033	U	0.066	U	0.0066	U
Endrin	UGG	0.033	U	0.066	U	0.0066	U
Endosulfan II	UGG	0.033	U	0.066	U	0.0066	U
4,4-DDD'	UGG	0.033	U	0.066	U	0.0066	U
Endosulfan Sulfate	UGG	0.033	U	0.066	U	0.0066	U
4,4-DDT'	UGG	0.033	U	0.066	U	0.0066	U
Methoxychlor	UGG	0.17	U	0.34	U	0.034	U
Endrin Ketone	UGG	0.033	U	0.066	U	0.0066	U
Endrin Aldehyde	UGG	0.033	U	0.066	U	0.0066	U
Alpha Chlordane	UGG	0.017	U	0.034	U	0.0034	U
gamma-Chlordane	UGG	0.017	U	0.034	U	0.0034	U
Toxaphene	UGG	1.7	U	3.4	U	0.34	U
Aroclor-1016	UGG	0.33	U	0.66	U	0.066	U

FIELD SAMPLE ID:		TRIBSE4		TRIBSE5		TRIBSE6	
SAMPLING DATE:		11/21/96		11/20/96		11/21/96	
Aroclor-1221	UGG	0.67	U	1.34	U	0.134	U
Aroclor-1232	UGG	0.33	U	0.66	U	0.066	U
Aroclor-1242	UGG	0.33	U	0.66	U	0.066	U
Aroclor-1248	UGG	0.33	U	0.66	U	0.066	U
Aroclor-1254	UGG	0.33	U	0.66	U	0.066	U
Aroclor-1260	UGG	0.33	U	0.66	U	0.066	U
Explosives							
HMX	UGG	0.4	U	0.4	U	0.4	U
RDX	UGG	0.4	U	0.4	U	0.4	U
1,3,5-Trinitrobenzene	UGG	0.4	U	0.4	U	0.4	U
1,3-Dinitrobenzene	UGG	0.4	U	0.4	U	0.4	U
Tetryl	UGG	0.4	U	0.4	U	0.4	U
Nitrobenzene	UGG	0.4	U	0.4	U	0.4	U
2,4,6-Trinitrotoluene	UGG	0.4	U	0.4	U	0.4	U
4-AM-2,6-Dinitrotoluene	UGG	0.4	U	0.4	U	0.4	U
2-AM-4,6-Dinitrotoluene	UGG	0.4	U	0.4	U	0.4	U
2,6-Dinitrotoluene	UGG	0.4	U	0.4	U	0.4	U
2,4-Dinitrotoluene	UGG	0.4	U	0.4	U	0.4	U
2-Nitrotoluene	UGG	0.4	U	0.4	U	0.4	U
4-Nitrotoluene	UGG	0.4	U	0.4	U	0.4	U
3-Nitrotoluene	UGG	0.4	U	0.4	U	0.4	U
Total Metals							
Aluminum	UGG	11500		13700		10700	
Antimony	UGG	10	U	10	U	10	U
Arsenic	UGG	3.2		13.4		6.9	
Barium	UGG	94.2	U	197		110	U
Beryllium	UGG	0.6		0.95		0.54	
Cadmium	UGG	0.5	U	0.5	U	0.5	U
Calcium	UGG	2660		15600		1230	J1
Chromium	UGG	19.4		29.6		18.5	
Cobalt	UGG	6		18.5		7.2	
Copper	UGG	12.3		27.6		16.5	
Iron	UGG	15800		36800		20200	
Lead	UGG	19.3		23.7		19.4	
Magnesium	UGG	2870		13300		2450	
Manganese	UGG	423		2430		345	
Mercury	UGG	0.1	U	0.1	U	0.1	U
Nickel	UGG	10.4		20.9		10	
Potassium	UGG	940		1500		1400	
Selenium	UGG	1	U	1	U	1	U
Silver	UGG	2	U	2	U	2	U
Sodium	UGG	50	U	50	U	50	U
Thallium	UGG	1	U	1	U	1	U
Vanadium	UGG	25.2		33.2		27.7	
Zinc	UGG	44.8	J1	76.9	J1	75.9	J1
Wet Chemistry Parameters							
Acid Volatile Sulfide	UGG	2	U	2	U	2	U
PH		6.7		7.7		6.5	
Total Organic Carbon	UGG	50		36		56	
Total Organic Halogens	UGG	46.7	J1	54	J1	10	U

APPENDIX D

NATIONAL HERITAGE PROGRAM DATA

PARSONS ENGINEERING SCIENCE, INC.
A UNIT OF PARSONS INFRASTRUCTURE & TECHNOLOGY GROUP INC.

10521 Roschaven Street • Fairfax, Virginia 22030 • (703) 591-7575 • Fax (703) 591-1305

May 1, 1997

Ms. Lesa Berlinghoff
Virginia Department Conservation and Recreation
Division of Natural Heritage
1500 E. Main Street, Suite 312
Richmond, Virginia 23219

Re: Request for Natural Heritage Database Search

Dear Ms. Berlinghoff:

Parsons Engineering Science, Inc. (Parsons ES) has been retained by the United States Army Environmental Center to conduct an ecological risk assessment for the Radford Army Ammunition Plant in Radford, Virginia. As part of the ecological risk assessment, Parsons ES will be collecting background information on the potential for protected plant and animal species to occur in the vicinity of installation and would like to request technical assistance from the Virginia Natural Heritage Program.

The proposed project is located in Pulaski and Montgomery Counties, Virginia. The project location is presented on the attached map, which is a copy of the USGS Radford North, Virginia Quadrangle. Parsons ES requests that an impact review be conducted for the project area highlighted on the attached map, and an additional 5 mile radius outside that highlighted area. A completed order form is enclosed. Please note that this request be given priority service, and send your response and invoice to the following address:

Parsons Engineering Science, Inc.
10521 Roschaven Street
Fairfax, Virginia 22030
Attention: Julie Neviaser

Thank you in advance for your cooperation and assistance on this project. If you have any questions or would like to discuss the project in more detail, please feel free to contact me at (703) 218-6269.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

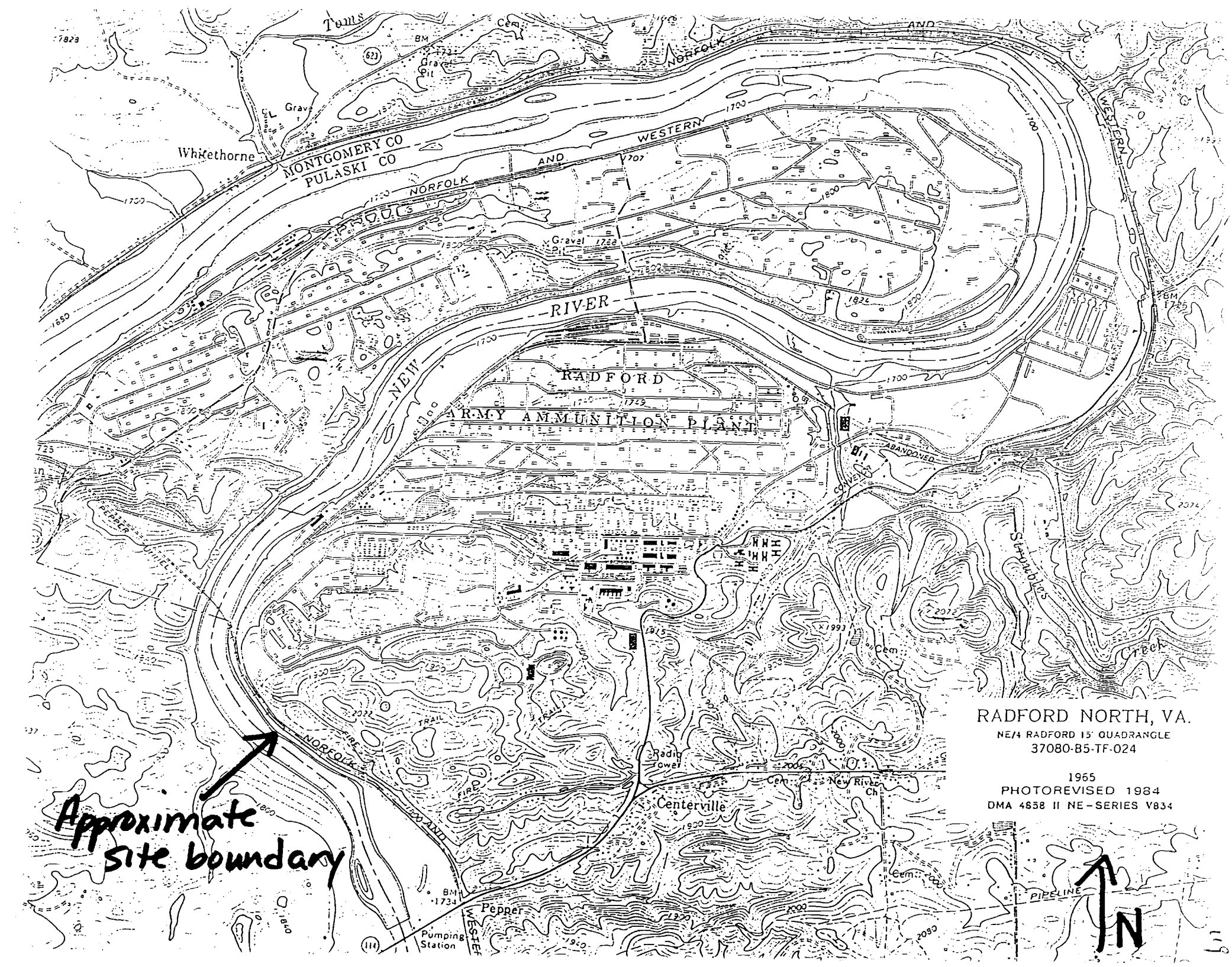
Julie L. Neviaser
Environmental Scientist

JLN:jb
G:\JOBS\722\722843\JN7121CA.LTR

Attachments (2)

cc: File 722843

PARSONS


RADFORD NORTH, VA.
NE/4 RADFORD 15' QUADRANGLE
37080-B5-TF-024
1965
PHOTOREVISED 1984
DMA 4658 II NE-SERIES V834
Approximate site boundary
N
RADFORD
ARMY AMMUNITION PLANT
NEW RIVER
MONTGOMERY CO
PULASKI CO
NORFOLK AND WESTERN
Whitethorne
Centerville
Pepper
Pumping Station
Radio Tower
New River Ch
Cem
PIPELINE
ABANDONED
Stroubles Creek

George Allen
Governor

Becky Norton Dunlop
Secretary of Natural Resources

Kathleen W. Lawrence
Director

COMMONWEALTH of VIRGINIA
DEPARTMENT OF CONSERVATION AND RECREATION
Main Street Station, 1500 East Main Street Suite 312
TDD (804) 786-2121 Richmond, Virginia 23219 (804) 786-7951 FAX (804) 371-2674
http://www.state.va.us/~dcr/vahcr.html

May 5, 1997

Julie Neviaser
Parsons Engineering Science, Inc.
10521 Rosehaven Street
Fairfax, VA 22030

Re: Radford Army Ammunition Plant, Radford, VA

Dear Ms. Neviaser:

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biological and Conservation Data System (BCD) for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

According to the information currently in our files, natural heritage resources have been documented in the vicinity of the Radford Army Ammunition Plant (RAAP). Much of this area of Virginia contains limestone substrate which provides rich habitat for rare plant species. The RAAP may support occurrences of the following species if suitable habitat is present:

Carex cristatella	crested sedge	G5/S2/NF/NS
Clematis coactilus	Virginia white-haired leatherflower	G3/S2S3/NF/NS
Echinacea laevigata	smooth coneflower	G2G3/S2/LE/NS
Lithospermum latifolium	American gromwell	G5/S2/NF/NS
Paxistima canbyi	Canby's mountain-lover	G2/S2/SOC/NS

In addition to the rare plants, the green floater (*Lasmigona subviridis*, G3/S2/SOC/SC), Tennessee heelsplitter (*Lasmigona holstonia*, G2G3/S1/SOC/LE), and the hellbender (*Cryptobranchus alleganiensis*, G4/S2S3/SOC/SC) have historically been documented in the New River downstream and/or upstream from the RAAP.

Considered good indicators of the health of aquatic ecosystems, **freshwater mussels** are dependent on good water quality, good physical habitat conditions, and an environment that will support populations of host fish species (Williams et al., 1993). Because mussels are sedentary organisms, they are sensitive to water quality degradation related to increased sedimentation and pollution. They are also sensitive to habitat destruction through dam construction, channelization, and dredging, and the invasion of exotic mollusk species. Please note that the Tennessee heelsplitter is currently classified as a state endangered species.

The **hellbender**, a large, aquatic salamander, prefers larger, clear, and fast-flowing streams of the Mississippi drainage (Martof, et. al, 1980). The hellbender requires cover in the form of flat rocks (Pague, 1991). Threats to this species include habitat alteration from impoundments and water pollution (Pague, 1991). Please note that this species is classified as a species of concern by the United States Fish and Wildlife Service (USFWS) and is listed as a species of special concern by the Virginia Department of Game and Inland Fisheries (VDGIF).

The **Virginia fringed mountain snail** (*Polygyriscus virginicus*, G1/S1/LE/LE) has been documented in the Radford area along the New River and may occur at the RAAP if suitable habitat is present. This species is a Virginia endemic and very rare, known only from a single location (Batie, 1991). It has been found associated with Elbrook dolomitic limestone and occurs in the rootlet zones of damp, rocky soils between large rock fragments. Please note that the Virginia fringed mountain snail is currently classified as endangered by both the USFWS and the VDGIF.

Based on a review of the maps, a significant cave has also been documented within the five mile radius around the RAAP. This cave supports occurrences of the following invertebrates:

Caecidotea henroti	Henrot's cave isopod	G2/S1S2/NF/NS
Litocampa sp. 3	a cave dipluran	G?/S1/NF/NS
Stygobromus abditus	James Cave amphipod	G1/S1/NF/NS

Isopods are crustaceans that occur in freshwater ecosystems in Virginia. They are common in aquatic habitats and damp, terrestrial situations. The troglobitic species are typically rare, highly specialized forms with restricted ranges and low population sizes. **Henrot's cave isopod** is a troglobitic species and has been collected in substrate gravels in several cave streams (Holsinger, 1991).

Amphipods are a group of tiny crustaceans more commonly known as freshwater shrimp, scuds, or sideswimmers. Their common names arise from their resemblance to shrimp and their habit of swimming or "scudding" along the substrate on their sides in an undulating motion (Penmak 1978). Amphipods are common in freshwater ecosystems of Virginia; they also occur in brackish and marine waters along the coast. Most are eyeless, unpigmented troglobites restricted to caves and other subterranean groundwater habitats (Holsinger 1991). Unable to swim in open water, amphipods are confined to the substrate--the stones, wet leaves and aquatic vegetation of their freshwater habitats--where they feed on detritus (dead animal and plant matter). **James Cave amphipod** is extremely rare, known only from two caves in Pulaski County. This species is

found in small isolated drip or seep pools and under gravels in cave streams (Holsinger, 1991).

The Virginia Department of Game and Inland Fisheries (VDGIF) has been awarded a contract to survey the RAAP for endangered plant and animal species. Therefore, you may wish to contact them for specific information as it is available.

Any absence of data may indicate that the study area has not been surveyed, rather than confirm that the area lacks other natural heritage resources. DCR's Biological and Conservation Data System is constantly growing and revised. Please contact DCR for an update on this natural heritage information if a significant amount of time passes before it is utilized.

A fee of $165.00 has been assessed for the service of providing this information. Please find enclosed an invoice for that amount. Please return one copy of the invoice along with your remittance made payable to the Treasurer of Virginia, Department of Conservation and Recreation, Post Office Box 721, Richmond, VA 23206-0721, ATTN: Financial Services. Payment is due within thirty days of the invoice date.

Thank you for the opportunity to comment on this project.

Sincerely,

Lesa S. Berlinghoff

Lesa S. Berlinghoff
Project Review Coordinator

cc: Cindy Schulz, USFWS
Ray Fernald, VDGIF
Rebecca Wadja, VDGIF

References

Batie, R. 1991. Virginia Fringed Mountain Snail. In Virginia's Endangered Species: Proceedings of a Symposium. K. Terwilliger ed. The McDonald and Woodward Publishing Company. Blacksburg, Virginia.

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124

Definition of Abbreviations Used on Natural Heritage Resource Lists
of the
Virginia Department of Conservation and Recreation

Heritage Ranks

The following ranks are used by the Virginia Department of Conservation and Recreation to set protection priorities for natural heritage resources. Natural Heritage Resources, or "NHR's," are rare plant and animal species, rare and exemplary natural communities, and significant geologic features. The primary criterion for ranking NHR's is the number of populations or occurrences, i.e. the number of known distinct localities. Also of great importance is the number of individuals in existence at each locality or, if a highly mobile organism (e.g., sea turtles, many birds, and butterflies), the total number of individuals. Other considerations may include the quality of the occurrences, the number of protected occurrences, and threats. However, the emphasis remains on the number of populations or occurrences such that ranks will be an index of known biological rarity.

S1 Extremely rare; usually 5 or fewer populations or occurrences in the state; or may be a few remaining individuals; often especially vulnerable to extirpation.

S2 Very rare; usually between 5 and 20 populations or occurrences; or with many individuals in fewer occurrences; often susceptible to becoming extirpated.

S3 Rare to uncommon; usually between 20 and 100 populations or occurrences; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.

S4 Common; usually >100 populations or occurrences, but may be fewer with many large populations; may be restricted to only a portion of the state; usually not susceptible to immediate threats.

S5 Very common; demonstrably secure under present conditions.

SA Accidental in the state.

S#B Breeding status of an organism within the state.

SH Historically known from the state, but not verified for an extended period, usually > 15 years; this rank is used primarily when inventory has been attempted recently.

S#N Non-breeding status within the state. Usually applied to winter resident species.

S? Status uncertain, often because of low search effort or cryptic nature of the element.

SX Apparently extirpated from the state.

SZ Long distance migrant whose occurrences during migration are too irregular, transitory and/or dispersed to be reliably identified, mapped and protected.

Global ranks are similar, but refer to a species' rarity throughout its total range. Global ranks are denoted with a "G" followed by a character. Note that GA and GN are not used and GX means apparently extinct. A "Q" in a rank indicates that a taxonomic question concerning that species exists. Ranks for subspecies are denoted with a "T". The global and state ranks combined (e.g. G2/S1) give an instant grasp of a species' known rarity.

These ranks should not be interpreted as legal designations.

Federal Legal Status

The Division of Natural Heritage uses the standard abbreviations for Federal endangerment developed by the U.S. Fish and Wildlife Service, Division of Endangered Species and Habitat Conservation.

LE - Listed Endangered
LT - Listed Threatened
PE - Proposed Endangered
PT - Proposed Threatened
C - Candidate (formerly C1-Candidate, category 1)
SOC - Species of concern (formerly C2-Candidate, category 2)
NF - no federal legal status

State Legal Status

The Division of Natural Heritage uses similar abbreviations for State endangerment.

LE - Listed Endangered
LT - Listed Threatened
C - Candidate
PE - Proposed Endangered
PT - Proposed Threatened
NS - no state legal status

For information on the laws pertaining to threatened or endangered species, contact:

Fish and Wildlife Service for all FEDERALLY listed species
Department of Agriculture and Consumer Services Plant Protection Bureau for STATE listed plants and insects
Department of Game and Inland Fisheries for all other STATE listed animals

5/96

(125)

Definition of Abbreviations Used on Natural Heritage Resource Lists
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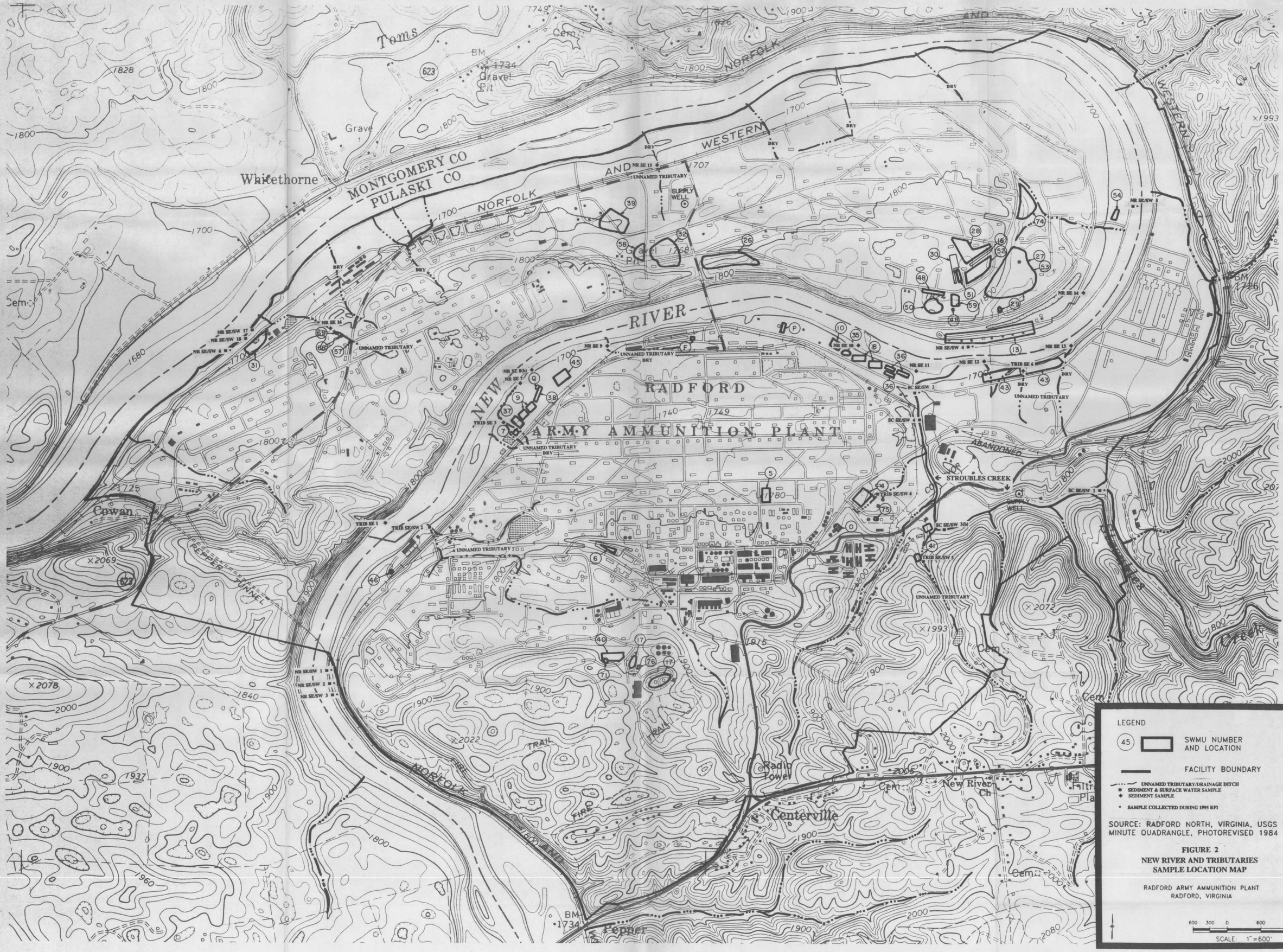
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PULASKI CO
NORFOLK AND WESTERN
NEW RIVER
RADFORD ARMY AMMUNITION PLANT
Whitethorne
Cowan
Centerville
Radio Tower
Pepper
Toms
Grave
Gravel Pit
SUPPLY WELL
UNNAMED TRIBUTARY
TRIB SE 1
TRIB SE/SW 3
TRIB SE/SW 4
TRIB SE/SW 5
STROUBLES CREEK
ABANDONED
PEPPER TUNNEL
MORLOUK TRAIL
FIRE TRAIL
New River Ch
Cem
BM 1734
BM 1726
DRY
LEGEND
SWMU NUMBER AND LOCATION
FACILITY BOUNDARY
UNNAMED TRIBUTARY/DRAINAGE DITCH
SEDIMENT & SURFACE WATER SAMPLE
SEDIMENT SAMPLE
SAMPLE COLLECTED DURING 1995 RFI
SOURCE: RADFORD NORTH, VIRGINIA, USGS 7.5 MINUTE QUADRANGLE, PHOTOREVISED 1984
FIGURE 2
NEW RIVER AND TRIBUTARIES
SAMPLE LOCATION MAP
RADFORD ARMY AMMUNITION PLANT
RADFORD, VIRGINIA
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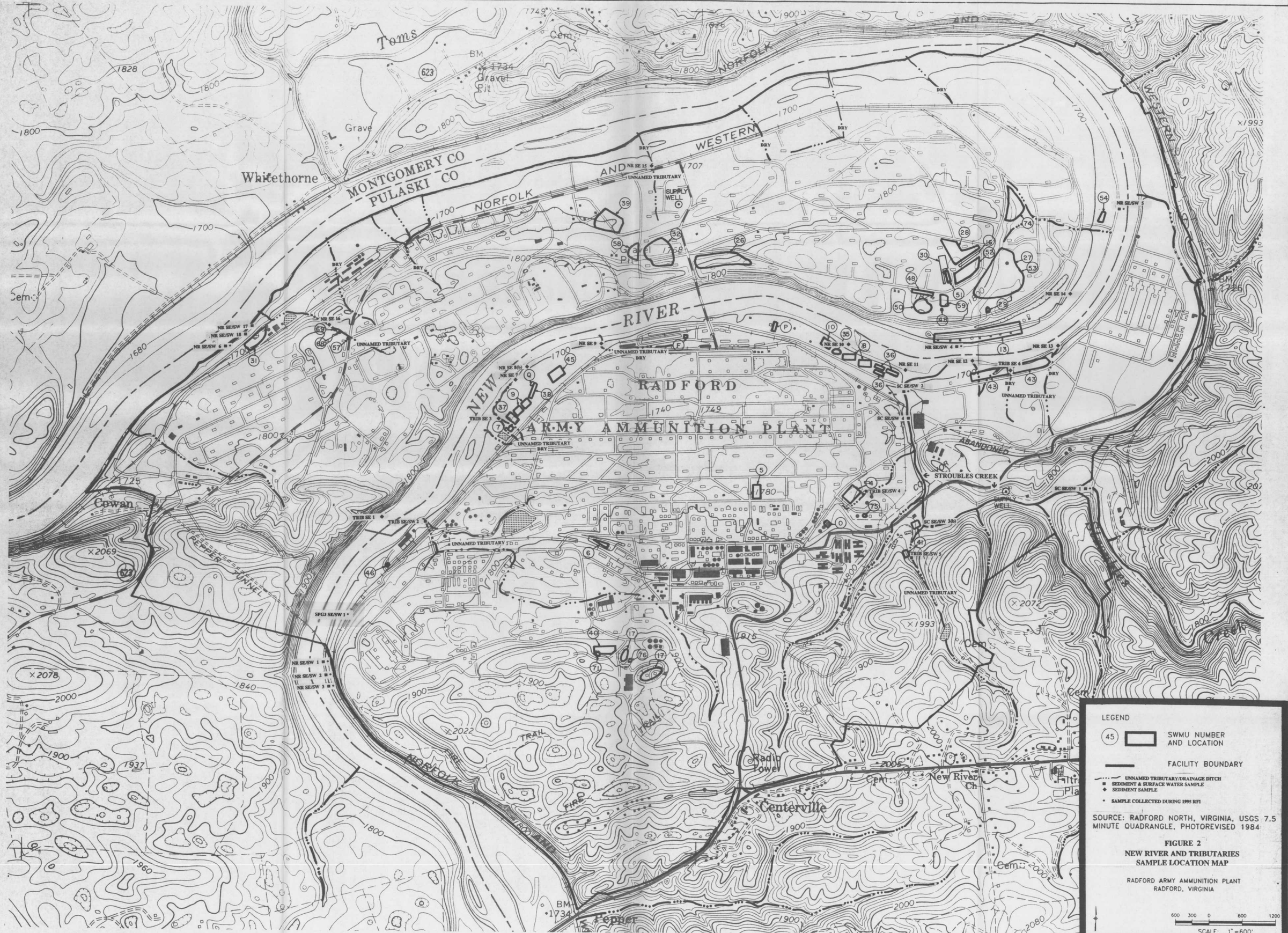
SCALE: 1" = 600'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TRIB SE/SW 3
TRIB SE/SW 4
TRIB SE/SW 5
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SC SE/SW 3(b)
NR SE 9
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NR SE 11
NR SE 12
NR SE 13
NR SE 14
NR SE 15
NR SE 16
NR SE/SW 1
NR SE/SW 2
NR SE/SW 3
NR SE/SW 4
NR SE/SW 5
NR SE/SW 6
NR SE/SW 17
NR SE/SW 18
SPG3 SE/SW 1
STROUBLES CREEK
ABANDONED
PEPPER TUNNEL
ABANDONED RAILROAD
TRAIL
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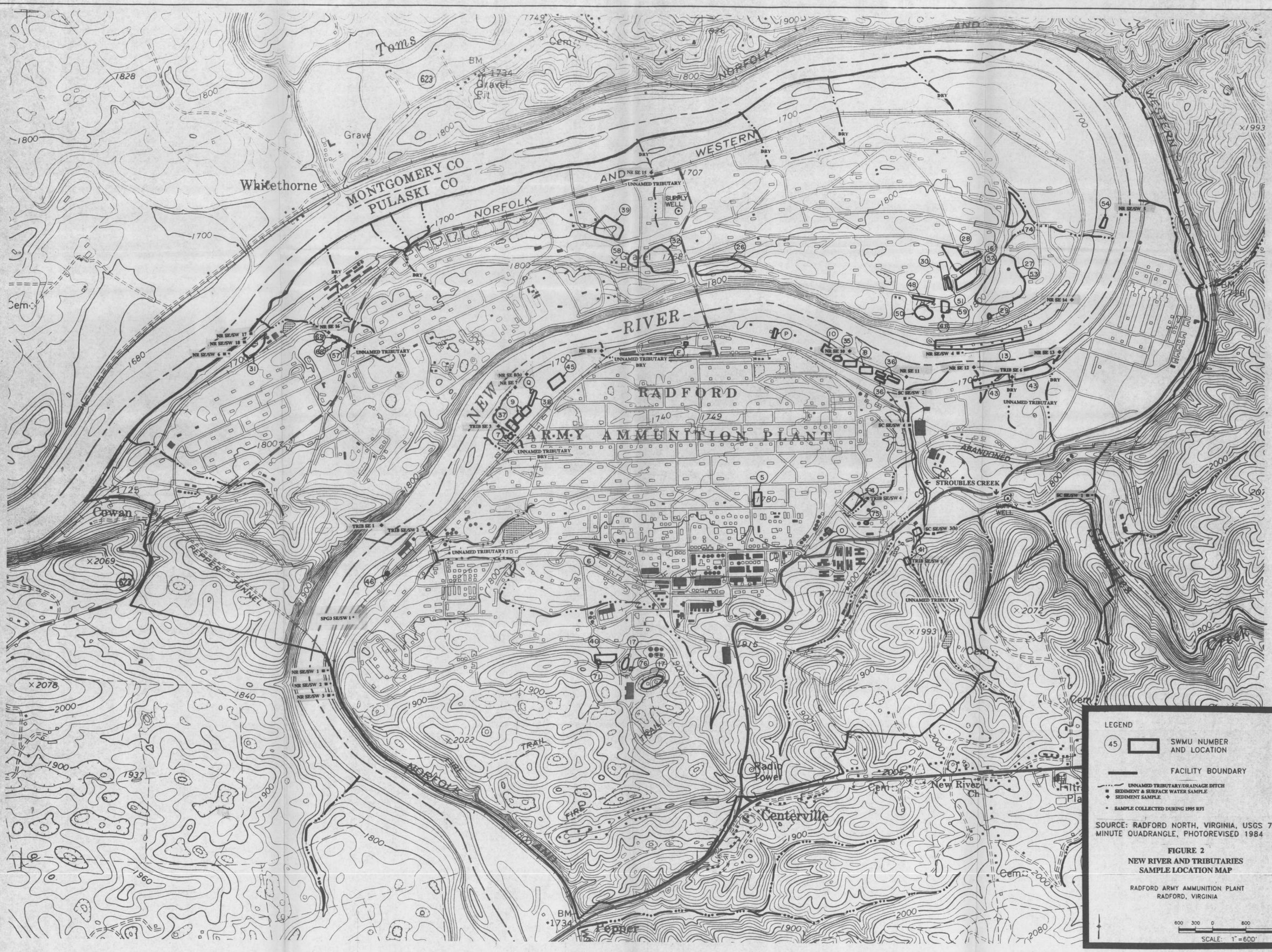
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SPG3 SE/SW 1
NR SE/SW 1
NR SE/SW 2
NR SE/SW 3
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PEPPER TUNNEL
BM 1734
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COMMONWEALTH of VIRGINIA

George Allen
Governor

Department of Game and Inland Fisheries

Becky Norton Dunlop
Secretary of Natural Resources

William L. Woodfin, Jr.
Director

November 21, 1997

Mr. Charles Chase
Alliant Techsystems, INC.
Radford Army Ammunition Plant
P.O. Box 1, State Route 114
Radford, Virginia 24141-0100

Dear Mr. Chase, Charlie.

Enclosed is a draft progress report for the biological inventory of the Radford Army Ammunition Plant. I would like for you to review this draft and let me know if this will meet the requirements for fulfillment of the first phase of our contract. Specifically, please let me know if you would like anything else added or covered in the progress report.

Your comments will allow us the opportunity to address any issues before we submit the progress report and bill for the first phase of the contract. Thank you in advance for your assistance. If you would like to discuss the report or any aspect of the project, please call or write.

Sincerely,

Rick Reynolds

Rick Reynolds
Wildlife Biologist

c.c. Ray Fernald

DRAFT

BIOLOGICAL INVENTORY AND INVENTORY OF RARE, THREATENED, AND ENDANGERED PLANTS, COMMUNITIES, AND ANIMALS OF THE RADFORD ARMY AMMUNITION PLANT

Progress Report to:

Alliant Techsystems, INC
Radford Army Ammunition Plant
P.O. Box 1, State Route 114
Radford, Virginia

November 1997

Virginia Department of Game and Inland Fisheries

Wildlife Information and Enhancement Division

Verona, Virginia 24482

DRAFT

Summary

General biological surveys and surveys for rare, threatened, endangered plants, animals and communities were initiated in March, 1997 at the Dublin and Radford Plants of the Radford Army Ammunition Plant. Five rare plants were identified on the Dublin Plant with four of the five plants found in association with a unique community type, Calcareous Fen. The Calcareous Fen is a prairie remnant that becomes frequent in the Midwestern and northeastern states. The site is relatively small and significantly degraded by encroachment of exotic vegetation and past disturbances. Two state listed birds, Henslow's sparrow (state threatened) and loggerhead shrike (state threatened), were observed on the Dublin Plant. The Henslow's sparrow appears to be breading at the Dublin Plant and the loggerhead shrike utilizes the site during the winter months. Four other bird species recognized in the Virginia's Endangered Species book as either special concern or status undetermined were observed on the Dublin Plant: Northern harrier (special concern), spotted sandpiper (status undetermined), brown creeper (status undetermined), and winter wren (status undetermined). One state threatened terrestrial invertebrate, regal fritillary, was observed on the Dublin Plant. Four individuals were observed in two areas on the Dublin Plant and reproduction appears likely on the plant. No rare, threatened, endangered or unique mammals, reptiles, amphibians, fish, or fresh water mussels have been observed at either plant so far. Surveys will continue through the winter months for selected taxa and species. Intensive surveys for all taxa will resume in spring 1998 and continue through fall 1998. Plant community typing and mapping will be conducted over the winter of 1997-98.

Objectives

1. Inventory the Radford and Dublin Plants for the presence of rare, threatened, endangered, and unique plants, animals, and communities.

2. Inventory the flora and fauna of the Radford and Dublin Plants.

3. Provide management recommendations for rare, threatened, endangered, and unique plants, animals, and communities.

4. Provide a map of the vegetation communities on the Radford and Dublin Plants.

Methods

We initiated flora and fauna surveys in all major habitat types on both the Radford and Dublin Plants. Sampling efforts varied according to taxa and are summarized below. All taxa were sampled by both systematic surveys and incidental observations.

Plants: Vegetation sampling included vegetation delineation using aerial photographs and species collections. Voucher specimens of unique plants and county records were collected for herbaceous specimens and are being housed at the Massey Herbarium, Virginia Polytechnic Institute and State University.

Birds: Avian surveys were conducted by road and ground routes. Birds were identified by sight and sound and classified by habitat use and breeding status.

Mammals: Small mammals were sampled using Sherman live traps, pitfalls, mist nets, and bat detectors. An array of 45 to 50 Sherman live traps were run for four consecutive nights in each major habitat. A pitfall array consisting of four 5-gallon buckets and 30 m of drift fence were placed in each of the major habitat types. These arrays were run in conjunction with Sherman live traps. Mist nets and bat detectors were used to sample bats flying over water.

Reptiles and Amphibians: Reptiles and amphibians were sampled using ground searches, cover boards, funnel traps, pitfall traps, and road counts. Most surveys consisted of searching potential habitat for the presence of reptiles or amphibians. Sheets of corrugated metal were placed in the major habitats as potential cover and checked periodically for presence of reptiles or amphibians. Funnel traps were placed along the side of drift fences and run in conjunction with pitfall traps. Road surveys were conducted on wet, rainy nights to sample for amphibians.

Fish: Electroshocking of the major streams was used to sample fish diversity.

Mussels: Snorkeling the major streams of the Radford Plant and the New River was used to sample mussel diversity.

Terrestrial Invertebrates: Sweep nets were used to sample vegetation dwelling invertebrates,

butterflies, dragon and damselflies. Pitfalls were used to collect ground dwelling invertebrates. A light trap was used to sample moths in each major habitat type.

Results and Progress

Objective 1 and Objective 2: Efforts to locate and identify rare, threatened, endangered, and unique plants, animals, and communities were conducted at both the Radford and Dublin Plants starting in March 1997. Efforts to inventory the flora and fauna of the Radford and Dublin Plants were conducted in conjunction with Objective 1. The findings of these efforts to date are described below.

Plants (Table 1): Three hundred and sixty-seven plants have been identified on the Dublin Plant and 475 on the Radford Plant. No threatened or endangered plants have been identified on either the Dublin or Radford Plants. However, five rare plants and nine plants listed on the Virginia Natural Heritage Vascular Plant Watchlist were discovered. In addition, many new county records were identified.

Rare Vascular Plants:

Carex interior

Carex schweinitzii

Eleocharis intermedia

Liparis loeselii

Clematis coactilis

Vascular Plant Watchlist:

Carex hirtifolia

Carex hitchcockiana

Carex meadii

Carex suberecta

Carex tentanica

Linum sulcatum

Onosmodium molle ssp. hispidissimum

Rhamnus lanceolata

Scutellaria nervosa

In addition, one unique community type, Calcareous Fen, has been located on the Dublin site. This community contains four of the rare plant species found to date (*Carex interior, Carex schweinitzii, Carex suberecta, and Carex tetanica,*). This community type is a prairie remnant that becomes frequent in the midwestern and northeastern states. This site is relatively small and significantly degraded by encroachment of exotic vegetation and past disturbances. To date, other community types have not been named or delineated pending further study.

Habitat typing will be a major emphasis of our winter work. Plant and community surveys will continue starting in spring of 1998 and continue through the fall.

Birds (Table 2): Ninety-six species of birds were identified each at the Dublin and Radford Plants. Two state listed birds have been identified on the Dublin Plant. The state threatened Henslow's sparrow appears to be breeding at two localities on the Dublin Plant. Singing males were observed on several occasions in grassland habitat. The state threatened loggerhead shrike has been observed in the winter on the Dublin Plant but is not believed to be nesting. Other unique birds recognized in Virginia's Endangered Species book (Terwilliger, 1989) that were observed on Arsenal property include:

Special Concern:

Northern Harrier

Status Undetermined:

Spotted Sandpiper

Brown Creeper

Winter Wren

Winter surveys will be conducted to identify over-wintering species. Spring counts will resume in May and June of 1998. Additional emphasis will be placed on identifying areas utilized by Henslow's sparrows and attempts will be made to confirm breeding.

Mammals (Table 3): No rare, threatened or endangered mammals have been observed at

either the Dublin or Radford Plants. Sixteen species of small and medium sized mammals have been identified at the Radford Plant and seventeen at the Dublin Plant. Mist netting for bats produced no captures. The use of Anabat detectors offers the potential for identification of bats by echolocation calls. Analysis of bat calls recorded at ponds on the Dublin Plant will be interpreted this winter.

Sampling will resume in the spring with the use of Sherman live traps, pitfalls, and drift fences. Mist netting and Anabat detectors will be used to identify bat species at selected sites.

Reptiles and Amphibians (Table 4). No rare, threatened or endangered reptiles or amphibians were observed. Seventeen species of amphibians were observed at the Radford Plant and 14 at the Dublin Plant. Twelve species of reptiles were observed at the Radford Plant and nine at the Dublin Plant.

Winter surveys will be conducted for Ambystoma salamanders that may be using ponds for breeding. Additional surveys will resume in the spring when activity of reptiles and amphibians increases.

Fish (Table 5): No rare, threatened or endangered fish were observed. Twenty-eight species of fish were observed at the Radford Plant and 11 were observed at the Dublin Plant.

Sampling efforts for fish were relatively intensive and complete. Further sampling efforts will include spot checks at selected sites.

Fresh Water Mussels (Table 6): No rare, threatened or endangered mussels were observed. Seven species of fresh water mussels were observed at the Radford Plant. Due to lack of habitat, no fresh water mussels were observed at the Dublin Plant.

Due to the lack of potential habitat and potential for finding rare mussels, no further effort will be conducted to sample fresh water mussels.

Terrestrial Invertebrates): One state threatened terrestrial invertebrate, Regal Fritillary (*Speyeria idalia*), was observed at two locations on the Dublin Plant. Most terrestrial invertebrates collected are currently being identified by appropriate experts. Therefore there is no table summarizing the observations of this taxa.

Surveys for selected invertebrates will be conducted over the winter. Most surveys will commence in spring 1998 and continue through the summer and fall. Due to the specialization of this taxa, species identification is being farmed out to appropriate experts.

Objective 3: Management recommendations for rare, threatened, endangered and unique plants, animals, and communities is pending further surveys. Further investigations into species

locations, relative status, and condition are needed in order to formulate appropriate management recommendations.

However, preliminary results indicate that several of the unique fauna (Henslow's sparrow, Loggerhead Shrike, Northern Harrier, and Regal Fritillary) and the unique community type (Calcareous Fen) observed are found in prairie grassland habitats. Identification and maintenance of prairie grassland habitat with emphasis placed on appropriate management for species and communities will ensure their continued existence.

Objective 4: Provide a map of the vegetation communities on the Radford and Dublin Plants. Initial efforts to delineate vegetation communities will be conducted this winter. High elevation aerial photographs will be used to delineate vegetation communities. Ground truthing of community types will be tested over the winter as well.

Conclusions and Recommendations

Further surveys are necessary in order to formulate a more complete picture of the biodiversity and presence of rare, threatened, endangered, and unique plants, animals, and communities. Investigations will continue over the winter months for selected taxa and species. Major sampling efforts will resume in the spring with emphasis being placed on invertebrate species.

Table 1. Plant species identified at the Radford and Dublin Plants of the Radford Army Ammunition Plant.

RAAP: Species List - Radford Site

Pteridophytes

Adiantum pedatum
Asplenium platyneuron
Asplenium resiliens
Asplenium rhizophyllum
Asplenium ruta-muraria
Asplenium trichomanes
Botrychium dissectum
Botrychium virginianum
Cystopteris bulbifera
Deparia acrostichoides
Diphasiastrum digitatum
Diplazium pycnocarpon
Dryopteris intermedia
Dryopteris marginalis
Equisetum arvense
Equisetum hyemale
Huperzia lucidula
Osmunda claytoniana
Pellaea atropurpurea
Phegopteris hexagonoptera
Polypodium appalachianum
Polypodium virginianum
Polystichum acrostichoides
Pteridium aquilinum
Thelypteris noveboracensis
Woodsia obtusa

RAAP: Species List - Radford Site

Herbaceous

Typhaceae
Typha latifolia

Potamogetonaceae
Potamogeton nodosus

Alismataceae

Sagittaria latifolia

Hydrocharitaceae
Elodea canadensis

Poaceae
Agrostis perennans
Aristida purpurascens
Arthraxon hispidus
Bouteloua curtipendula
Brachyelytrum erectum
Bromus latiglumis
Bromus pubescens
Bromus sterilis
Bromus tectorum
Chasmanthium latifolium
Cinna arundinacea
Danthonia spicata
Dichanthelium acuminatum
Dichanthelium boscii
Dichanthelium clandestinum
Dichanthelium commutatum
Dichanthelium dichotomum var. dichotomum
Dichanthelium linearifolium
Dichanthelium oligosanthes var. scribn.
Digitaria ischaemum
Digitaria sanguinalis
Echinochloa crusgali
Elymus riparius
Elymus virginicus
Eragrostis capillaris
Eragrostis cilianensis
Eragrostis frankii
Eragrostis hypnoides
Eragrostis pectinacea
Eragrostis spectabilis
Festuca elatior
Festuca obtusa
Hystrix patula
Leersia oryzoides
Leersia virginica
Melica mutica
Microstegium vimineum

Muhlenbergia frondosa

RAAP: Species List - Radford Site
Herbaceous

Urticaceae
Boehmeria cylindrica
Laportea canadensis
Parietaria pensylvanica
Urtica gracilis

Aristolochiaceae
Aristolochia macrophylla
Aristolochia serpentaria
Asarum canadense

Polygonaceae
Polygonum cespitosum
Polygonum hydropiper
Polygonum persicaria
Polygonum scandens cf.
Polygonum virginianum

Chenopodiaceae
Chenopodium ambrosoides

Aizoaceae
Mollugo verticillata

Caryophyllaceae
Arenaria serpyllifolia
Cerastium fontanum
Cerastium nutans
Dianthus armeria
Myosoton aquaticum
Paronychia canadensis
Silene antirrhina
Silene stellata
Silene virginica
Stellaria media
Stellaria pubera

Ranunculaceae

Anemone virginiana
Aquilegia canadensis
Caulophyllum thalictroides
Cimicifuga racemosa
Clematis coactilis
Clematis viorna
Clematis virginiana
Delphinium tricorne
Hepatica americana
Hydrastis canadensis
Ranunculus abortivus
Ranunculus alleghaniensis
Ranunculus recurvatus

RAAP: Species List - Radford Site
Trees & Shrubs

Acer negundo
Acer rubrum
Acer saccharinum
Acer saccharum
Aesculus flava
Ailanthus altissima
Amelanchier arborea
Asimina triloba
Berberis canadensis
Berberis thunbergii
Carpinus caroliniana
Carya cordiformis
Carya glabra
Carya ovata
Carya tomentosa
Celtis occidentalis
Cercis canadensis
Chionanthus virginicus
Cornus alternifolia
Cornus amomum
Cornus florida
Crataegus uniflora
Elaeagnus umbellata
Fagus grandifolia
Fraxinus americana
Fraxinus pennsylvanica

Gaylussacia baccata
Halesia carolina
Hamamelis virginiana
Hydrangea arborescens
Juglans nigra
Juniperus virginiana
Kalmia latifolia
Lindera benzoin
Liriodendron tulipifera
Lonicera maackii
Lonicera morrowii
Magnolia acuminata
Morus alba
Nyssa sylvatica
Ostrya virginiana
Oxydendron arboreum
Paulownia tomentosa
Physocarpus opulifolius
Pinus pungens
Pinus strobus
Pinus taeda
Pinus virginiana

RAAP: Species List - Dublin Site
Pteridophytes

Adiantum pedatum
Asplenium platyneuron
Asplenium rhizophyllum
Athyrium felix-femina
Botrychium virginianum
Deparia acrostichoides
Diphasiastrum digitatum
Dryopteris carthusiana
Dryopteris marginalis
Equisetum arvense
Phegopteris hexagonoptera
Polystichum acrostichoides
Woodsia obtusa

RAAP: Species List - Dublin Site
Herbaceous

Typhaceae
Typha latifolia

Sparganiaceae
Sparganium americanum

Potamogetonaceae
Potamogeton crispus
Potamogeton foliosus

Poaceae
Agropyron repens
Agrostis alba
Agrostis perennans
Andropogon ternarius
Andropogon virginicus
Anthoxanthum odoratum
Aristida oligantha
Arrhenatherum elatius
Bouteloua curtipendula
Bromus commutatus
Bromus inermis
Bromus japonicus
Bromus nottowayanus
Bromus pubescens
Bromus tectorum
Dactylis glomeratus
Danthonia spicata
Dichanthelium acuminatum var. acuminatum
Dichanthelium acuminatum var. ramulosum
Dichanthelium boscii
Dichanthelium clandestinum
Dichanthelium latifolium
Dichanthelium laxiflorum
Dichanthelium linearifolium
Dichanthelium oligosanthes var. scribn.
Elymus villosus
Elymus virginicus
Eragrostis spectabilis
Festuca elatior
Festuca obtusa
Glyceria striata
Hystrix patula

Leersia oryzoides
Leersia virginica
Muhlenbergia sobolifera
Muhlenbergia sylvatica
Panicum anceps
Panicum flexile
Phleum pratense
Poa compressa

RAAP: Species List - Dublin Site
Herbaceous

Poaceae
Poa cuspidata
Poa pratensis
Poa trivialis
Schizachyrium scoparium
Setaria geniculata
Sorghastrum nutans
Sorghum halepense
Sphenopholis intermedia
Sphenopholis nitida
Sphenopholis pensylvanica
Tridens flavus
Trisetum pensylvanicum

Cyperaceae
Carex aggregata
Carex blanda
Carex cephalophora
Carex digitalis
Carex frankii
Carex granularis
Carex grisea
Carex hirsutella
Carex hystericina
Carex interior
Carex laxiflora
Carex lurida
Carex meadii
Carex mesochorea
Carex oligocarpa
Carex pelita

Carex rosea
Carex schweinitzii
Carex sparganioides
Carex stricta
Carex suberecta
Carex tetanica
Carex umbellata
Carex vulpinoides
Carex willdenowii
Eleocharis intermedia
Schoenoplectus pungens
Schoenoplectus validus
Scirpus atrovirens
Scirpus pendulus

Araceae
Acorus calamus
Arisaema triphyllum

RAAP: Species List - Dublin Site
Herbaceous

Juncaceae
Juncus brachycephalus
Juncus dudleyi
Juncus effusus
Luzula bulbosa

Liliaceae
Allium cernuum
Allium vineale
Asparagus officinalis
Polygonatum biflorum
Smilacina racemosa
Smilax herbacea
Smilax pulverulenta
Smilax rotundifolia
Smilax tamnoides
Trillium grandiflorum
Uvularia perfoliata

Amaryllidaceae
Hypoxis hirsuta

Iridaceae
Sisyrinchium angustifolium

Orchidaceae
Goodyera pubescens
Liparis lilifolia
Liparis loeselii
Orchis spectabilis
Spiranthes gracilis

RAAP: Species List - Radford Site
Trees & Shrubs

Platanus occidentalis
Prunus allegh/americ.
Prunus avium
Prunus serotina
Ptelea trifoliata
Quercus alba
Quercus coccinea
Quercus muhlenbergii
Quercus prinus
Quercus rubra
Quercus velutina
Rhamnus lanceolata
Rhododendron periclymenoides
Rhus aromatica
Rhus copalina
Robinia pseudoacacia
Rosa carolina
Rosa multiflora
Sassafras albidum
Staphylea trifolia
Symphoricarpos orbiculatus
Tilia americana
Tsuga canadensis
Ulmus rubra
Vaccinium pallidum
Vaccinium stamineum
Viburnum acerifolium
Viburnum prunifolium
Viburnum rafinesquianum

Table 2. Bird species observerd on the Dublin and Radford Plants of the Radford Army Ammunition Plant.

		IND= industrial
	W= winter	NR= New river
	B= breeding	WT= wetland
	R= year round resident	PN= Pine plantation
	M= migrant	GR= grass/shrub
	U= unknown	DC= deciduous

Birds	Breeding status	Habitat	Radford 96	Dublin 96
Double-crested cormorant	U	NR	*	
Canada Goose		NR	*	
Black duck	R, M	NR	*	
Mallard	R	NR,WT	*	*
Wood duck	R	NR,WT, riparian	*	*
Pintail	W	NR	*	
Ring-necked duck	W	WT		*
Blue-winged teal	W	WT		*
Hooded merganser	W	WT		*
Great egret	M	NR	*	
Great blue heron	R	NR,WT	*	*
Green heron	R	NR,WT	*	*
Black-crowned night heron	M	NR	*	
American woodcock	U	GR		*
Killdeer	R	NR, WT, GR, IND	*	
Greater yellowlegs	M	WT		*
Solitary sandpiper	M	WT		*
Spotted sandpiper	M, poss. B	NR, WT	*	*
Wild turkey	R	PN, GR, DC	*	*
Bobwhite quail	R	GR		*
Ruffed grouse	R	DC	*	
American coot	W	WT		*

	Breeding status	Habitat	Radford	Dublin
Cooper's hawk	M	PN, GR		*
Sharp-shinned hawk	M	GR, DC	*	*
Northern Harrier (Marsh Hawk)	U	GR		*
Red-tailed Hawk	R,M	GR, DC	*	*
Osprey	M	n/a		*
Turkey Vulture	R, M	PN, GR, DC, IND	*	*
Black Vulture	R, M	PN, GR, DC, IND	*	
American Kestral	R	GR	*	*
Eastern screech owl	R	PN, DC	*	*
Barred owl	R	DC		*
Great horned owl	R	DC		*
Rock dove	R	NR, IND	*	
Mourning Dove	R	PN, GR, DC, IND	*	*
Yellow-billed cuckoo	B	DC	*	*
Black-billed cuckoo	B	DC	*	*
Ruby-throated hummingbird	B	DC	*	
Belted kingfisher	R	NR, WT, riparian	*	*
Pileated woodpecker	R	PN, DC	*	*
Red-bellied woodpecker	R	PN, DC	*	*
Common flicker	R	PN, GR, DC	*	*
Yellow-bellied sapsucker	U	DC		*
Downy woodpecker	R	PN, DC	*	*
Hairy woodpecker	R	PN, DC	*	*
Eastern kingbird	B	WT, GR, DC	*	*
Great crested flycatcher	B	DC		*
Eastern phoebe	R	WT, GR, DC	*	*
Eastern pewee	B	DC	*	*
Acadian flycatcher	B	DC	*	*
Purple martin	B	NR	*	
Tree swallow	B	NR, GR, WT	*	*
Rough-winged swallow	B	NR, GR, WT	*	*
Barn swallow	B	NR, GR, WT	*	*
Chimney swift	B	GR	*	*
Northern Raven	U	PN, GR, DC		*

	Breeding status	Habitat	Radford	Dublin
American crow	R	All	*	*
Bluejay	R	PN, GR, DC, IND	*	*
Carolina chickadee	R	PN, DC	*	*
Black-capped chickadee	W	PN, DC	*	
Tufted titmouse	R	PN, DC	*	*
Brown-headed nuthatch	R	PN	*	*
White-breasted nuthatch	R	PN, DC	*	*
Brown creeper	U	PN	*	
Carolina wren	R	PN, GR, DC	*	*
House wren	B	PN, IND	*	*
Winter wren	U	PN	*	
Blue-gray gnatcatcher	B	DC	*	*
Gray catbird	B	PN, DC	*	*
Northern mockingbird	R	PN, GR, DC, IND	*	*
Brown thrasher	B	DC		*
Eastern bluebird	R	PN, GR	*	*
American robin	R, M	PN, GR, DC, IND	*	*
Woodthrush	B	DC	*	*
Cedar waxwing	R	GR, DC	*	*
Red-eyed vireo	B	PN, DC	*	*
Warbling vireo	B	DC	*	
White-eyed vireo	B	DC	*	
Yellow-throated vireo	B	DC	*	*
Northern parula warbler	B	DC	*	
Yellow-throated warbler	B	DC	*	
Black-throated green warbler	B	PN, DC	*	*
Blackpoll warbler	M	DC	*	
Black and white warbler	B	DC	*	*
Magnolia warbler	M	DC	*	*
Yellow-rumped warbler	W	PN, GR, DC	*	*
Chestnut-sided warbler	M	DC	*	*
Blackburnian warbler	M	DC		*
American redstart	B	DC	*	*
Pine warbler	B	PN	*	*
Prairie warbler	B	GR		*
Palm warbler	M	GR, DC	*	*
Yellow warbler	B	DC	*	
Kentucky warbler	B	DC	*	*
Common yellowthroat	B	GR	*	*
Yellow-breasted chat	B	GR		*
Northern waterthrush	M	n/a	*	

	Breeding status	Habitat	Radford	Dublin
Louisiana waterthrush	B	DC, riparian	*	
Ovenbird	B	DC	*	*
Red-winged blackbird	B	WT, GR	*	*
Brown-headed cowbird	B	WT, PN, GR, DC	*	*
Common grackle	B	All	*	*
Eastern meadowlark	R	GR	*	*
European starling	R	All	*	*
Northern oriole	B	DC	*	*
Orchard oriole	B	DC	*	*
Scarlet tanager	B	DC	*	*
Northern cardinal	R	PN, GR, DC, IND	*	*
House finch	R	PN, GR, DC, IND	*	*
Indigo bunting	B	PN, GR, DC	*	*
American Goldfinch	R	PN, GR, DC, IND	*	*
Rufous-sided towhee	R	PN, GR, DC	*	*
House sparrow	R	IND		
White-throated sparrow	W	PN, GR, DC, IND	*	*
Chipping sparrow	R	PN, GR	*	*
Field sparrow	R	PN, GR, DC	*	*
Swamp sparrow	U	WT, riparian		*
Song sparrow	R	PN, GR, DC, IND	*	*
Grasshopper sparrow	B	GR		*
Henslow's sparrow	B	GR		*

Table 3. Mammal species identified on the Radford and Dublin Plants of the Radford Army Ammunition Plant.

IND= industrial
NR= New river
WT= wetland
PN= Pine plantation
GR= grass/shrub
DC= deciduous

		Habitat	Radford	Dublin
Mammals	22 species		16	17
Opossum	*Didelphis marsupialis*	All	*	*
Least shrew	*Cryptotis parva*	PN, DC		*
Shorttail shrew	*Blarina brevicauda*	WT, PN, GR, DC	*	
Eastern mole	*Scalopus aquaticus*	GR	*	
Red fox	*Vulpes fulva*	GR	*	*
Muskrat	*Ondatra zibethicus*	NR, WT, riparian	*	*
Woodchuck	*Marmota monax*	GR, DC, urban	*	*
Raccoon	*Procyon lotor*	all	*	
Beaver	*Castor canadensis*	NR	*	
Red squirrel	*Tamiasciurus hudsonicus*	PN		*
Eastern chipmunk	*Tamias striatus*	PN, DC	*	*
Eastern gray squirrel	*Sciurus carolinensis*	PN, DC	*	*
Eastern fox squirrel	*Sciurus niger*	DC	*	*
Norway rat	*Rattus norvegicus*	GR		*
House mouse	*Mus musculus*	GR, IND	*	*
Harvest mouse	*Reithrodontomys humulis*	PN		*
White-footed mouse	*Peromyscus leucopus*	PN, GR, DC, WT	*	
Woodland vole	*Pitymys pinetorum*	PN, DC	*	*
Meadow vole	*Microtus pennsylvanicus*	PN, GR, DC, WT		*
Eastern cottontail	*Sylvilagus floridanus*	GR	*	*
Meadow jumping mouse	*Zapus hudsonius*	GR, DC		*
White-tailed deer	*Odocoileus virginianus*	PN, GR, DC	*	*

Table 4. Reptiles and amphibians observed on the Radford and Dublin Plants of the Radford Army Ammunition Plant.

IND= industrial
NR= New river
WT= wetland
PN= Pine plantation
GR= grass/shrub
DC= deciduous

		Habitat	Radford	Dublin
Amphibians	19 species		17	14
American toad	*Bufo americanus*	WT, PN, DC, GR	*	*
Fowler's toad	*Bufo woodhousii fowleri*	WT, DC, GR		*
Spring peeper	*Pseudacris crucifer*	WT, PN, DC, GR	*	*
Gray tree frog	*Hyla versicolor*	WT, PN, DC	*	*
Pickeral frog	*Rana palustris*	NR	*	
Wood frog	*Rana sylvatica*	WT, DC	*	*
Green frog	*Rana clamitans melanota*	WT, riparian, IND	*	*
Bullfrog	*Rana catesbeiana*	WT, riparian, IND	*	*
Spotted salamander	*Ambystoma maculatum*	WT, DC	*	
Jefferson salamander	*Ambystoma jeffersonianum*	WT, PN, DC	*	*
Red-spotted newt	*Notophthalmus v. viridescens*	WT	*	
Red-backed salamander	*Plethodon cinereus*	PN, DC	*	*
Wehrle's salamander	*Plethodon wehrlei*	DC	*	
Slimy salamander	*Plethodon cylindraceus*	DC	*	*
Northern dusky salamander	*Desmognathus f. fuscus*	riparian	*	*
Blackbelly salamander	*Desmognathus quadromaculatus*	riparian	*	
Northern red salamander	*Pseudotriton r. ruber*	riparian		*
Southern two-lined salamander	*Eurycea cirrigera*	WT, riparian	*	*
Longtail salamander	*Eurycea longicauda*	WT, riparian	*	*
			Radford	Dublin
Reptiles	14 species		12	9
Eastern box turtle	*Terrapene c. carolina*	NR, WT, GR, DC,	*	*
Snapping turtle	*Chelydra serpentina*	NR, WT, Riparian	*	*
Eastern painted turtle	*Chrysemys p. picta*	NR, WT	*	*
Eastern river cooter	*Pseudemys c. concinna*	NR	*	

Northern water snake	*Nerodia s. sipedon*	NR,riparian	*	*
Queen snake	*Regina septemvittata*	NR, riparian	*	
Eastern garter snake	*Thamnophis s. sirtalis*	GR, DC	*	*
Northern ringneck snake	*Diadophis punctatus edwardsii*	DC		*
Eastern worm snake	*Carphophis a. amoenus*	PN	*	
Northern black racer	*Coluber c. constrictor*	GR, DC		*
Black rat snake	*Elaphe o. obsoleta*	GR, DC	*	*
Eastern milk snake	*Lampropeltis t. triangulatum*	GR	*	*
Northern copperhead	*Agkistrodon contortrix*	riparian	*	
Eastern fence lizard	*Sceloporus undulatus*	DC	*	

Table 5. Fish species observed at the Radford and Dublin Plants of the Radford Army Ammunition Plant.

IND= industrial
NR= New river
WT= wetland
PN= Pine plantation
GR= grass/shrub
DC= deciduous

Fish	32 species	Habitat	Radford	Dublin
Logperch	*Percina caprodes*	NR	*	
Appalachia darter	*Percina gymnocephala*	NR	*	
Roanoke darter	*Percina roanoka*	NR, riparian	*	
Fantail darter	*Etheostoma flabellare*	NR, riparian	*	
Greenside darter	*Etheostoma blennioides*	NR	*	
Bluntnose minnow	*Pimephales notatus*	NR	*	
River chub	*Nocomis micropogon*	NR	*	
Bluehead chub	*Nocomis leptocephalus*	riparian	*	*
Blacknose dace	*Rhinichthys atratulus*	riparian	*	*
Central stoneroller	*Campostoma anomalum*	NR, riparian	*	*
Whitetail shiner	*Cyprinella galactura*	NR, riparian	*	
Mountain redbelly dace	*Phoxinus oreas*	riparian	*	*
Common carp	*Cyprinus carpio*	WT	*	*
Rosyside dace	*Climostomus funduloides*	riparian	*	
White shiner	*Luxilus albeolus*	riparian	*	
Telescope shiner	*Notropis telescopus*	riparian	*	
Northern hogsucker	*Hypentelium nigricans*	NR, riparian	*	
White sucker	*Catostomus commersoni*	riparian	*	
Largemouth bass	*Micropterus salmoides*	NR, WT	*	
Smallmouth bass	*Micropterus dolomieui*	NR, riparian	*	
Rock bass	*Ambloplites rupestris*	NR, riparian	*	
Spotted bass	*Micropterus punctulatus*	riparian	*	
Bluegill	*Lepomis macrochirus*	NR, WT, riparian	*	*
Green sunfish	*Lepomis cyanellus*	WT, riparian		*
Redbreast sunfish	*Lepomis auritus*	NR, WT, riparian	*	
Bluegill x Green sunfish	*L. macrochirus x L. cyanellus*	WT, riparian		*

Brown trout	*Salmo trutta*	WT		*
Rainbow trout	*Oncorhynchus mykiss*	WT		*
Mottled sculpin	*Cottus bairdi*	NR, riparian	*	
Margined madtom	*Noturus insignis*	NR, riparian	*	*
Flathead catfish	*Pylodictis olivaris*	NR	*	
Muskellunge	*Esox masquinongy*	NR	*	