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TECHNICAL MEMORANDUM SEDIMENT SAMPLING SUMMARY FOR SITE 13 DEFENSE PROPERTY DISPOSAL OFF YARD OPERABLE UNIT 5 (OU 5) WITH TRANSMITTAL NWS EARLE NJ
3/12/2004
TETRA TECH

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PITT-03-4-018

March 12, 2004

Project Number N6710

Ms. Jessica Mollin
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290 Broadway
New York, NY 10007-1866

Mr. Robert Marcolina
New Jersey Department of Environmental Protection
Division of Responsible Party Site Remediation
P.O. Box 028
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Reference: CLEAN Contract No. N62467D-94-0888
Contract Task Order No. 851

Subject: Technical Memorandum, Sediment Sampling Summary
Site 13 – Defense Property Disposal Office Yard (OU-5)
Naval Weapons Station Earle, Colts Neck, New Jersey

Dear Ms. Mollin and Mr. Marcolina:

On behalf of the Navy, please find enclosed copies of the Technical Memorandum, Sediment Sampling Summary for the above-referenced site for your review. The Technical Memorandum has been updated from the Technical Memorandum sent out on February 23, 2004 to consider New Jersey Department Environmental Protection's Soil Cleanup Criteria. Six copies have been enclosed for Ms. Mollin and three copies for Mr. Marcolina.

Should you have any questions, please call me at (412) 921-8259 or Bob Mertz (412) 921-7167 in our Pittsburgh office.

Sincerely,

Daniel C. Witt, P.E.
Project Manager

DW/kf

Enclosures

c: Mr. Roger Boucher, NORTHDIV (w/o enclosure)
Ms. Michele DiGeambeardino (2 copies)
Mr. Larry Burg, NWS Earle (1 copy)
Mr. Dan Zari, NWS Earle (1 copy)
Mr. Aaron Bernhardt, Tetra Tech NUS, Inc. (1 copy)
Mr. Russ Turner, Tetra Tech NUS, Inc. (1 copy)
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Project File N6710 (1 copy)

Technical Memorandum
Sediment Sampling Summary – 2003 Sampling Events
Site 13 Defense Property Disposal Office (DPDO) Yard, Colts Neck, NJ
Naval Weapons Center Earle

This technical memorandum provides a brief description of the Site 13 sediment sampling investigation which was performed in support of the pre-design activities at Site 13. The sediment sampling occurred in three phases from June 2003 until December 2003. In addition this technical memorandum recommends an area of sediment contamination to be remediated.

1.0 SUMMARY OF PRE-DESIGN SEDIMENT INVESTIGATION

The Proposed Plan (TtNUS, 2002) indicated that there were two areas where sediment might need to be excavated for consolidation within the limits of the proposed landfill low permeability cover system. These areas were designated for possible excavation due to concentrations of silver and total polychlorinated biphenyls (PCBs) that could potentially harm ecological receptors. The first area was related to remedial investigation (RI) sample 13SD01 and was located in a ditch that borders the west side of the DPDO yard. The other area is associated with RI sample 13SD03 and was located along the northwestern toe of slope of the landfill, where an erosion gully had washed dirt and landfill material out of the landfill (see Figure 1). This area will be referred to as the landfill washout area. Surface water originating from the landfill washout area eventually reaches a forested wetland approximately 60 feet down gradient of the toe of the landfill. Based on the wetland delineation report (TtNUS, 2003b), the wetland area appears to be only seasonally saturated and no surface water was visible during the wetland delineation. Therefore, both terrestrial and aquatic invertebrates may be present in the sediment at different times throughout the year.

The objective of the pre-design investigation was to collect data that would be used to define the limit of contamination (i.e., unacceptable silver or PCB concentrations) at both areas. The remediation levels were defined in the Quality Assurance Project Plan for Pre-Design Investigation Sediment Sampling at Site 13 DPDO Yard. The remediation levels were set at 3.7 mg/kg for silver and 1.0 mg/kg for total PCBs (TtNUS, 2003a The New Jersey Department of Environmental Protection (NJDEP) indicated that the New Jersey Soil Cleanup Criteria (NJDEP, 1998) should be considered for evaluating soil (not including the wetland). The residential soil cleanup criteria for silver and PCBs are 110 mg/kg and 0.49 mg/kg, respectively (NJDEP, 1998). All samples collected during 2003 were analyzed for Target Analyte List (TAL) metals and PCBs. In addition a limited number of samples were analyzed for total organic carbon (TOC).

Three sampling events were required to bound the limit of contamination at both areas. Eleven sediment samples were collected from the ditch that borders the west side of the DPDO yard. Thirty-four sediment samples were collected from the landfill washout area. Note that although the samples were called sediment samples, some of the samples are actually soils and others are seasonally saturated as described above. A summary of the sediment sample results is provided in the following sections.

1.1 Ditch Sediment Samples

Eleven surface (0 to 6 inch depth) sediment samples (13SD09 to 13SD19) were collected within the drainage ditch upstream and downstream of RI sediment sample 13SD01. None of the eleven sediment samples collected in June 2003 contained silver or total PCBs in excess of the remediation levels presented in the QAPP or in excess of the NJDEP soil cleanup criteria. No additional sediment samples were collected from the ditch after June 2003 since the limit of contamination was bounded. Sample locations are shown on Figure 1. The validated pre-design sediment data for the ditch is presented in Table 1.

1.2 Landfill Washout Area Sediment Samples

The collection of sediment samples from the landfill washout area proceeded in a stepwise fashion with rings of samples propagating outward from the landfill washout area. The first ring of samples were collected in June 2003, however, these results were in excess of the remediation levels so additional samples were required to define the limit of contamination. Eventually seven rings of sediment samples were collected as shown on Figure 2. Rings four, five, six, and seven were collected in December 2003, however, in order to minimize the analysis cost only samples from ring five were initially analyzed; the rest of the samples were archived. Based on the ring five results, select archived samples were analyzed to bound the limit of contamination. The analyses from ring five were completed on a 7-day turn around time (TAT) so that holding times (14 days) on the archived samples were not exceeded.

The sample locations on Figure 2 are color coded to show that the limit of contamination (based on either the remediation levels from the QAPP or the NJDEP soil cleanup criteria) has been bounded. The color codes are as follows:

- Red -- Samples where either the silver or total PCB remediation level was exceeded,
- Blue -- Samples where the remediation levels were not exceeded,
- Purple -- Samples that were collected, archived, but not analyzed.

As can be seen on Figure 2 the horizontal extent of samples exceeding the remediation levels is bounded by samples with acceptable concentrations.

In addition to surface (0 to 6 inch) sediment samples collected at the landfill washout area, deeper (12 to 18 inch) samples were collected at a rate of approximately 25% of the surface samples to determine if contaminants had migrated vertically from the landfill washout area. At some locations contamination in excess of the remediation levels was found in the deeper samples.

The validated pre-design sediment data for the landfill washout area are presented in Table 2. Exceedances of the lowest of either the remediation levels presented in the QAPP or the NJDEP soil cleanup criteria are highlighted in Table 2.

Figures 3 and 4 present all of the sample results for total PCBs and silver, respectively. In addition, these figures show concentration contours at the remediation level presented in the QAPP (3.7 mg/kg for silver and 1.0 mg/kg for PCBs) and the NJDEP soil cleanup criteria (110 mg/kg for silver and 0.49 mg/kg for PCBs). The concentration contours were developed by linear interpolation of concentrations between sample points. The area within the concentration contour exceeds the remediation level on each figure.

2.0 PROPOSED REMEDIATION AREAS

2.1 Proposed Limit of Excavation in the Ditch Area

The only sample in the ditch area that exceeded the remediation levels was RI sample 13SD01. A limited area of excavation is proposed around this sample since the area in the ditch is bounded by samples with acceptable concentrations. The proposed limit of excavation in the ditch area is shown on Figure 1. It is anticipated that initially the top foot of material would be excavated from this area. The excavated material would be placed under the proposed landfill low permeability cover system to be constructed at Site 13. Verification samples would then be collected from the base of the excavation to confirm that the residual concentrations are acceptable. If the concentrations are not acceptable, additional material would be removed and the area resampled. This process would continue until acceptable concentrations are achieved or if the depth of excavation is such that once restored (backfilled) the ecological receptors would be separated from any residual contamination. A soil thickness of two feet is generally considered to be protective to separate ecological receptors from contaminants.

2.2 Proposed Limit of Excavation in the Landfill Washout Area

The area in excess of the remediation levels at Site 13 extends in to the wetland area. Based on discussions with the NJDEP, the NJDEP soil cleanup criteria should be considered for areas outside the wetland area. The lower of either the NJDEP soil cleanup criteria or the remediation levels presented in the QAPP are considered for cleanup of the contaminated soil (i.e., 3.7 mg/kg for silver and 0.49 mg/kg for PCBs). In the wetland area only the cleanup criteria from the QAPP was considered for setting remediation limits (i.e., 3.7 mg/kg for silver and 1.0 mg/kg for PCBs).

The proposed excavation area was not extended all the way out to the 3.7 mg/kg silver concentration contour line or to the 1.0 mg/kg PCB concentration contour line in the wetland area because it was judged that due to site conditions, leaving some silver concentrations on-site in excess of 3.7 mg/kg and some PCB concentrations in excess on 1.0 mg/kg would still be protective of the environment. Also, the benefit of removing the soil/sediment in the wetland does not outweigh the potential risks from the chemicals remaining in that area. The conditions at Site 13 (primarily high total organic carbon and reducing conditions) will decrease the mobility and toxicity of silver and decrease the bioavailability of PCBs. A discussion of the value of the intact wetland, the reduced toxicity and mobility of silver, and the decreased bioavailability of PCBs at Site 13 is discussed in the following paragraphs.

The forested wetlands north and west of the landfill on Site 13 constitute an ecologically valuable natural resource whose loss could substantially impact the quality of terrestrial and aquatic habitats in the Hockhockson Brook watershed. From the perspective of ecological receptors, the adverse impacts caused by the physical disturbance of the wetlands to excavate contaminated sediment could substantially outweigh the benefits of removing the contamination. Even if the wetlands were replanted with regionally indigenous vegetation following the excavation, several decades would be needed for the planted vegetation to mature into a plant community with the same physical and biological characteristics of the present vegetation. Furthermore the science of wetland restoration (wetland mitigation) is too new for scientists to know for certain whether restored wetlands can ever replicate the properties of intact natural systems such as forested wetlands that require several decades to mature.

The proposed limit of excavation for the landfill washout area is shown on Figure 5. The proposed limit of excavation is based on the 0.49 mg/kg PCB concentration contour line presented on Figure 3, with the exception of the area designated as wetlands. The silver contour line lies outside of the proposed excavation area. Also, the 0.49 and 1.0 mg/kg PCB concentration contour lines in the wetland area lie outside of the proposed excavation area. Excavation in the wetland is not proposed.

Silver Toxicity/Mobility

There are eight sample locations with silver concentrations greater than the proposed remedial level for silver of 3.7 mg/kg outside the proposed excavation area (see Figure 4). By excavating all the areas within the PCB footprint outside of the wetlands areas all of the highest silver concentrations will also be removed. Eight sample locations with silver concentrations in excess of 3.7 mg/kg are not proposed for excavation. These concentrations range from 4.4 mg/kg to 60.7 mg/kg. Seven of the locations are located in the wetland area and the other location (13SD20) is located along the southwestern slope of the landfill. In addition, there is an area to the north showing silver concentrations that exceed the proposed remedial level based on the linear interpolation; no samples outside that area had silver levels that exceeded the proposed remedial level.

Six sediment samples from the landfill washout area were analyzed for TOC; three in the upland area (13SD21, 13SD23, and 13SD31) and three within the delineated wetland boundary (13SD26, 13SD39, and 13SD44) (see Figure 5). The TOC values in the three upland samples were 2.6 percent, 4.2 percent, and 26.5 percent, while the TOC values in the other three samples ranged from 21.2 percent to 35.4 percent. The three samples with the higher TOC values were spread throughout the area indicating the sediments in the entire wetland are likely to have very high TOC levels. Organic matter in soil complexes with silver and reduces its mobility (ASTDR, 1990). The enhanced ability of organic matter to immobilize silver is demonstrated by the increased levels of silver found in peat and bog soils and in marshes (ASTDR, 1990). The very high levels of TOC in the wetland samples are likely the reason for the sharp drop-off in silver concentrations within the wetland because the TOC is binding the silver before it can migrate very far.

The proposed remediation level for silver was 3.7 mg/kg. This value is the Effects-Range Median (ER-M) which is based on risks to benthic invertebrates (Long et al., 1995). The studies used to develop the ER-M for silver were conducted on true sediments (i.e., covered with water). For example, most of the studies were conducted in the Puget Sound, San Francisco Bay, and southern California (Long and Morgan, 1990). As described previously, the sediment at Site 13 is typically not inundated with water. Photographs 1 and 2 show the wetland at Site 13. Although the TOC levels for the samples used to develop the ER-M were not provided in Long and Morgan (1990), when adjustments were made for organic carbon, the authors assumed a value of 1 percent TOC when the actual TOC was not known. The authors likely had reasons to assume

that the TOC levels were likely close to 1 percent, which are much lower than the 20 percent TOC levels found in the Site 13 wetland samples.

Organic matter in sediment/soil can reduce the bioavailability of metals (USEPA, 2003 and Allen, 2002). Reducing the bioavailability of the metals will tend to reduce the toxicity of the metals as well. In natural environments, silver occurs primarily in the form of sulfide or is intimately associated with other metal sulfides, especially those of lead, copper, iron, and gold, which are all essentially insoluble (Eisler, 1996). In fact, under reducing conditions, adsorbed silver in sediments may be released and subsequently reduced to metallic silver, or it may combine with reduced sulfur to form the insoluble silver sulfide (WHO, 2002). As presented in Ratte (1999), insoluble or complexed silver compounds were far less toxic or virtually nontoxic to freshwater invertebrates.

Based on the information provided above, the ER-M of 3.7 mg/kg for silver is likely overprotective for the sediment in the wetland for the following reasons:

- The high TOC levels will significantly reduce the bioavailability of silver
- Wetland sediments are typically reducing environments so the silver is likely to be either metallic silver or silver sulfide; both of which are insoluble
- *Hyalella azteca*, a sediment invertebrate, is rather insensitive to silver sulfide with a Lethal Concentration 50 (LC50) value of greater than 753 mg/kg (Hirsch, 1998).

Also, as discussed above, the samples that were collected are a cross between soil and sediment depending upon how saturated the soil is with water. Therefore, terrestrial plants and invertebrates also live in the area so the silver concentrations in the samples were compared to toxicity data from the literature for these receptors as described below.

- *Lumbriculus terrestris* were exposed to 2,000 mg/kg of silver sulfide in soil for 14 days, and showed no adverse effects (Ratte, 1999)
- *L. terrestris* were exposed to increasing concentrations of silver sulfide for 28 days. A no observed effects concentration (NOEC) was determined to be 62 mg/kg based on reduced growth (Ratte, 1999)
- Research with plants grown in sewage sludge that was spiked with photographic silver waste (5.2 and 120 mg/kg silver) showed no effect on emergence time and rate, or the length of sprouts (Hirsch, 1998b)

The silver concentrations in the wetland samples that are outside the proposed excavation area and that exceed the ER-M range from 4.4 mg/kg to 60.7 mg/kg (see Figure 4). These concentrations are well below the LC50 value referenced in the study above for risks to *H.*

azteca, and are below the NOECs for plants and soil invertebrates referenced in the studies listed above. Therefore, although the silver concentrations in a portion of the wetland (21,000 square feet) exceed the ER-M, there is a low likelihood that the silver is adversely impacting sediment invertebrates in that area for the reasons provided above. For that reason, it appears that the benefit of excavating the sediment outside of the boundary established based on the PCB remediation level does not outweigh the benefit of leaving the wetland intact in that area.

In addition there are two areas outside the wetland which may have silver concentrations in excess of the remediation level outside the proposed limit of excavation based on the linear interpolation. These two areas total approximately 2,600 square feet but may be smaller based on the topography and actual path of the silver migration. These areas are not proposed for excavation because the areas are relatively small in size with silver concentrations generally close to the remediation level. Also, although the TOC values are expected to be lower in these upland areas compared to the wetland samples, the TOC values in the three upland samples (2.6, 4.2 and 26.5 percent) are still relatively high and will limit the bioavailability and toxicity of the silver. Therefore, because there is a low likelihood of impacts to invertebrates, the additional disturbance of this upland area does not outweigh the benefit of lowering the silver concentration in these areas.

PCB and Silver Food Chain Modeling

The proposed sediment remediation level presented in the QAPP for total PCBs is 1.0 mg/kg cited in USEPA Office of Solid Waste and Emergency Response (OSWER) Directive 9355.4-01. A Guide on Remedial Actions at Superfund Sites with PCB Contamination (1990). This level is based on the protection of human health under a residential scenario. Although this cleanup level is based on human health rather than ecological risks, it has been previously used for PCB remedial actions. Since it is now being proposed to leave PCB concentrations in excess of 1.0 mg/kg at Site 13 in the wetland an evaluation was conducted to determine if the levels of PCBs (and silver) remaining in the soil are causing a risk to small mammals and birds that forage in the area. Attachment A contains the food chain model and supporting documentation for the American robin and short-tailed shrew. The following paragraphs describe how the food chain model was calculated.

The first step of the food chain model was to calculate the exposure point concentration of PCBs and silver in the soil. It was assumed that shrews and robins would forage over a one-acre area based on information in USEPA (1993). An assumed 1.0 acre area is shown on Figure 5. Therefore, an average PCB concentration of 2.2 mg/kg over a one-acre area was calculated

using a weighted average of 0 mg/kg in the excavated area (0.50 acres), 6.43 mg/kg in the wetland area where PCBs concentrations exceed 1.0 mg/kg (0.33 acres), and 0.37 mg/kg in the rest of the area (0.17 acres) (see Table A-1 in Attachment A). An average silver concentration of 16.6 mg/kg over a one-acre area was calculated using a weighted average of 0.15 mg/kg (background levels) in the excavated area (0.50 acres), 46.8 mg/kg in the wetland area where PCBs concentrations exceed 1.0 mg/kg (0.33 acres), and 6.5 mg/kg in the rest of the area (0.17 acres) (see Table A-1 in Attachment A). A food chain model was then conducted for the short-tailed shrews and American robin based on the following:

- The average PCB and silver concentration is the exposure point concentration
- The shrew and robin forage exclusively in the one acre area including and surrounding the wetland area where PCBs concentrations exceed 1.0 mg/kg
- Average exposure parameters (i.e., ingestion rates, body weights)
- 100 percent bioavailability of the chemicals
- Literature-based soil to earthworm bioaccumulation factors

Tables A-3 and A-4 in Attachment A present the results of the food chain modeling for the shrew and robin, respectively. As can be seen from the tables, the ecological effects quotients (EEQs) based on the no observed adverse effects level (NOAEL) and lowest observed adverse effects level (LOAEL) were greater than 1.0 for PCBs for both the shrew and robin, but for silver, only the EEQ for the shrew based on the NOAEL was greater than 1.0. EEQs greater than 1.0 based on the NOAEL do not indicate that an impact to wildlife will occur, only that an impact is possible, since the NOAEL is a "no effects" level. The actual effects dose lies somewhere between the NOAEL and LOAEL so chemicals with EEQs greater than 1.0 based on the LOAEL are more likely to potentially impacts wildlife. Because the NOAEL EEQ for silver was just slightly greater than 1.0, potential risks to small mammals from silver in the soil are expected to be low after accounting for some of the conservative factors discussed below.

The LOAEL EEQs for PCBs were slightly greater than 1.0 for both the shrew (EEQ=1.9) and robin (EEQ=1.2). The food chain models are conservative, however, and may estimate a higher dose to the wildlife than is actually occurring at the site. As discussed above, very high TOC levels (>20 percent) were found in the soil in the wetland area. The TOC in the soil is expected to bind the PCBs and substantially decrease the bioavailability of the PCBs so the PCBs may not accumulate in the worms at the concentrations predicted by the bioaccumulation factors. Also, although the home ranges of the shrew and robin are small, the models assume that the receptors' foraging area includes the entire area where chemical concentrations are the greatest. It is more likely that their foraging area will only occupy a certain percentage of the area with the greatest PCB and silver concentrations. Therefore, although it is likely that the LOAEL EEQs

would be less than 1.0 after consideration of these various factors, some risks to wildlife are still be possible because the NOAEL EEQs would be greater than 1.0.

In summary, the potential for silver and PCBs to impact ecological receptors in the wetland area is uncertain but there is an overall reduction in risk at the site because the area with overall greater PCB and silver concentrations is being removed. Therefore, the loss of a mature forested wetland appears to outweigh the benefits of removing the contamination in this area that is not likely causing a significant risk to ecological receptors.

It is anticipated that initially the top foot of material would be excavated from the proposed excavation area. The contaminated sediment would then be placed under the proposed landfill low permeability cover system to be constructed at Site 13. Verification samples would then be collected from the base of the excavation to confirm that the residual concentrations are acceptable. If the concentrations were not acceptable, additional material would be removed and the area resampled. This process would continue until acceptable concentrations are achieved or if the depth of excavation is such that once restored (backfilled) the ecological receptors would be separated from any residual contamination. A soil thickness of two feet is generally considered to be protective to separate ecological receptors from contaminants.

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TABLE 1
SUMMARY OF ANALYTICAL RESULTS DITCH AREA
PRE-DESIGN INVESTIGATION
NWS EARLE
COLTS NECK, NEW JERSEY

Constituent	Criteria	13SD09 0 TO 6 " 6/26/2003	13SD10 0 TO 6 " 6/26/2003	13SD11 0 TO 6 " 6/26/2003	13SD12 0 TO 6 " 6/26/2003	13SD13 0 TO 6 " 6/26/2003	13SD14 0 TO 6 " 6/26/2003	13SD14-D 0 TO 6 " 6/26/2003	13SD15 0 TO 6 " 6/26/2003	13SD16 0 TO 6 " 6/26/2003	13SD17 0 TO 6 " 6/26/2003	13SD18 0 TO 6 " 6/26/2003	13SD19 0 TO 6 " 6/26/2003
Polychlorinated Biphenyls (PCBs) (ug/kg)													
AROCLOR-1016		37 U	42 U	44 U	44 U	42 U	42 U	43 U	45 U	43 U	43 U	42 U	42 U
AROCLOR-1221		74 U	84 U	87 U	87 U	84 U	84 U	86 U	90 U	86 U	85 U	83 U	84 U
AROCLOR-1232		37 U	42 U	44 U	44 U	42 U	42 U	43 U	45 U	43 U	43 U	42 U	42 U
AROCLOR-1242		37 U	42 U	44 U	44 U	42 U	42 U	43 U	45 U	43 U	43 U	42 U	42 U
AROCLOR-1248		37 U	42 U	44 U	44 U	42 U	42 U	43 U	45 U	43 U	43 U	42 U	42 U
AROCLOR-1254		37 U	42 U	44 U	44 U	42 U	42 U	43 U	45 U	43 U	43 U	42 U	42 U
AROCLOR-1260		37 U	42 U	44 U	44 U	42 U	42 U	43 U	45 U	43 U	43 U	42 U	42 U
AROCLOR-1268													
TOTAL AROCLORS	1000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Inorganics (mg/kg)													
ALUMINUM		4180 J	3150 J	1710 J	944 J	823 J	818 J	686 J	1120 J	443 J	635 J	753 J	975 J
ANTIMONY		0.85 J	0.55 J	0.55 J	0.40 J	0.25 UJ	0.25 UJ	0.36 J	0.27 UJ	0.27 UJ	0.22 UJ	0.23 UJ	0.26 UJ
ARSENIC		11.1	4.9	2.0	1.3	0.65	0.86	1.2	1.0	0.56	0.60	0.52	0.99
BARIUM		3.9	5.5	1.3	1.3	1.9	2.4	0.85	0.95	0.95	0.96	1.2	3.6
BERYLLIUM		0.60 J	0.30	0.29	0.21	0.15	0.16	0.15	0.14	0.07	0.07	0.10	0.06
CADMIUM		0.04 UJ	0.04 UJ	0.04 UJ	0.05 UJ	0.04 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.05 UJ	0.04 UJ	0.04 UJ	0.05 J
CALCIUM		73.8	92.3	20.1	41.6	81.4	524	20.2	25.9	21.8	23.3	135	275
CHROMIUM		110	46.1	45.0	27.9	34.8	29.7	39.4	26.8	9.6	13.5	12.5	6.1
COBALT		0.23	0.25	0.11 U	0.12 U	0.38	0.11 U	0.13 U	0.12 U	0.12 U	0.10 U	0.17	0.78
COPPER		3.2 J	4.4 J	1.5 J	1.0 J	0.70 J	0.64 J	0.49 J	1.3 J	0.45 J	0.72 J	0.87 J	2.9 J
IRON		16200	8920	4940	3380	2990	2430	2520	4010	1350	2030	2190	3490
LEAD		13.4 J	14.5 J	7.4 J	3.1 J	360 J	3.3 J	3.0 J	3.4 J	1.6 J	2.7 J	2.4 J	4.2 J
MAGNESIUM		956	491	368	176	139	184	153	259	74.7	119	172	163
MANGANESE		8.1	18.7	2.1	2.9	4.4	5.9	3.5	4.5	1.8	4.7	9.7	27.0
MERCURY		0.03	0.08	0.02	0.04	0.02 U	0.03	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02
NICKEL		1.8 J	1.4 J	0.91 J	0.66 J	0.87 J	0.42 J	0.34 J	0.82 J	0.34 J	0.45 J	0.64 J	1.5 J
POTASSIUM		2730	1360	1200	574	366	436	444	756	210	330	450	201
SELENIUM		0.55	0.46 U	0.46 U	0.50 U	0.47 U	0.48 U	0.53 U	0.51 U	0.52 U	0.43 U	0.45 U	0.49 U
SILVER	3.7	0.73	0.34	0.13 U	0.14 U	0.13 U	0.14 U	0.15 U	0.15 U	0.15 U	0.12 U	0.13 U	3.4
SODIUM		18.9	17.1	16.8	30.3	18.9	17.1	15.8	14.2	15.4	10.8	13.4	18.3
THALLIUM		0.48 U	0.50 U	0.50 U	0.53 U	0.50 U	0.51 U	0.57 U	0.55 U	0.56 U	0.46 U	0.48 U	0.53 U
VANADIUM		64.6	39.7	23.7	13.6	8.2	10.4	14.6	14.5	7.0	9.3	9.3	6.0
ZINC		16.5	10.5	5.9	5.2	20.6	3.4	3.8	5.2	3.5	4.0	6.4	16.3
Miscellaneous Parameter (%)													
TOTAL ORGANIC CARBON													

Results presented for June 2003 sampling event.
Total Aroclors represents the calculated sum of the detected values for Aroclors-1016, -1221, -1232, -1242, -1248, -1254, -1260, and -1268.

ND - Not Detected
J - Value is estimated due to technical noncompliance.
U - Value is non-detected as reported by the laboratory.
UJ - Non-detected value is estimated due to technical noncompliance.

TABLE 2
SUMMARY OF ANALYTICAL RESULTS LANDFILL WASHOUT AREA
PRE-DESIGN INVESTIGATION
NWS EARLE
COLTS NECK, NEW JERSEY

Constituent	Criteria	13SD04 0 TO6 " 6/26/2003	13SD05 0 TO6 " 6/26/2003	13SD06 0 TO6 " 6/26/2003	13SD06-D 0 TO6 " 6/26/2003	13SD07 0 TO6 " 6/26/2003	13SD08 0 TO6 " 6/26/2003	13SD200006 0 TO6 " 9/25/2003	13SD210006 0 TO6 " 9/25/2003	13SD211218 12 TO 18" 9/25/2003	13SD220006 0 TO6 " 9/25/2003	13SD230006 0 TO6 " 9/25/2003	13SD240006 0 TO6 " 9/25/2003
Polychlorinated Biphenyls (PCBs) (ug/kg)													
AROCLOR-1016		370 U	370 U	400 U	390 U	360 U	36 U	38 U	360 U	420 U	520 U	380 U	380 U
AROCLOR-1221		750 U	730 U	790 U	780 U	730 U	71 U	38 U	360 U	420 U	520 U	380 U	380 U
AROCLOR-1232		370 U	370 U	400 U	390 U	360 U	36 U	38 U	360 U	420 U	520 U	380 U	380 U
AROCLOR-1242		370 U	370 U	400 U	390 U	360 U	36 U	38 U	360 U	420 U	520 U	380 U	380 U
AROCLOR-1248		370 U	370 U	400 U	390 U	360 U	36 U	38 U	360 U	420 U	520 U	380 U	380 U
AROCLOR-1254		1000	2000	940	860	360 U	36 U	38 U	360 U	420 U	520 U	380 U	380 U
AROCLOR-1260		370 U	370 U	400 U	390 U	1800	36 U	250	970	2500	4400	2400 J	860 J
AROCLOR-1268													
TOTAL AROCLORS	1000	1000	2000	940	860	1800	ND	250	970	2500	4400	2400 J	860 J
Inorganics (mg/kg)													
ALUMINUM		1380 J	2150 J	1340 J	1460 J	2180 J	2650 J	2080	1500	6090	22000	1800	3360
ANTIMONY		1.1 J	2.3 J	1.3 J	0.65 J	1.2 J	0.53 J	0.56 J	0.46 J	1.8 J	7.9 J	2.0 J	1.1 J
ARSENIC		2.5	4.5	3.3	2.8	3.5	4.1	2.9 J	2.5 J	8.1 J	37.0 J	5.3 J	7.5 J
BARIUM		4.6	35.3	3.4	3.3	3.2	3.4	4.0	2.4	12.5	32.8	6.9	5.1
BERYLLIUM		0.15	0.20	0.21	0.21	0.31	0.42 J	0.26	0.18	0.62 J	1.8 J	0.20	0.36
CADMIUM		0.14 J	3.1 J	0.16 J	0.04 UJ	0.04 UJ	0.04 J	0.14	0.07	0.63	2.2	0.46	0.46
CALCIUM		49.4	88.6	33.6	32.5	34.5	88.2	51.4	29.8	157	133	60.0	106
CHROMIUM		19.1	30.1	21.7	22.8	43.8	59.5	36.9	30.9	88.2	284	31.3	84.5
COBALT		0.10 U	2.9	0.25	0.10 U	0.29	0.22	0.36	0.30	0.98	2.6	0.82	0.32
COPPER		10.7 J	61.9 J	11.2 J	10.4 J	8.5 J	1.8 J	3.8	3.6	25.2	109	42.8	12.4
IRON		5900	14300	7370	6590	10700	11400	9080	7300	21700	69200	16600	15700
LEAD		30.8 J	112 J	30.5 J	28.5 J	37.2 J	7.2 J	11.5	14.9	106	302	116	33.7
MAGNESIUM		254	289	258	295	497	740	467	363	1310	3870	379	623
MANGANESE		12.4	28.8	16.5	10.1	22.4	9.3	9.7	6.1	22.3	48.7	49.9	9.0
MERCURY		0.12	0.23	0.11	0.08	0.15	0.01 U	0.36 J	0.06 J	0.38 J	2.0 J	0.51 J	0.19 J
NICKEL		1.2 J	14.3 J	2.1 J	1.3 J	2.2 J	1.5 J	1.4	1.1	4.2	13.4	4.1	2.3
POTASSIUM		741	821	788	1120	1500	2290	1420 J	1100 J	3650 J	11100 J	912 J	2080 J
SELENIUM		0.41 U	0.72	0.50 U	0.41 U	0.49	0.34 U	0.25 U	0.30 U	0.35 U	1.4	0.27 U	0.49
SILVER	3.7	10.9	34.3	20.9	9.7	13.1	1.6	14.3	4.5	18.2	55.8	42.3	7.6
SODIUM		18.6	17.0	14.0	15.1	15.7	13.1	15.0	9.3	24.3	57.0	15.2	14.0
THALLIUM		0.44 U	0.32 U	0.53 U	0.43 U	0.46 U	0.36 U	0.47 U	0.56 U	0.67 U	0.85 U	0.51 U	0.48 U
VANADIUM		18.4	24.9	18.3	20.3	44.2	61.7	39.4 J	32.9 J	87.0 J	253 J	25.4 J	44.1 J
ZINC		14.6	47.9	18.2	11.4	13.4	59.8	16.5	8.5	33.2	108	86.5	22.4
Miscellaneous Parameter (%)													
TOTAL ORGANIC CARBON									2.55 J			4.2 J	

TABLE 2
SUMMARY OF ANALYTICAL RESULTS LANDFILL WASHOUT AREA
PRE-DESIGN INVESTIGATION
NWS EARLE
COLTS NECK, NEW JERSEY

Constituent	Criteria	13SD240006-D 0 TO6 " 9/25/2003	13SD241218 12 TO 18" 9/25/2003	13SD250006 0 TO6 " 9/25/2003	13SD260006 0 TO6 " 9/25/2003	13SD261218 12 TO 18" 9/25/2003	13SD270006 0 TO6 " 9/25/2003	13SD281218 12 TO 18" 9/25/2003	13SD290006 0 TO6 " 12/11/2003	13SD300006 0 TO6 " 12/11/2003	13SD310006 0 TO6 " 12/11/2003	13SD320006 0 TO6 " 12/11/2003
Polychlorinated Biphenyls (PCBs) (ug/kg												
AROCLOR-1016		380 U	550 U	77 U	3700 U	40 U	2600 U	380 U	1700 U	1900 U	680 U	340 U
AROCLOR-1221		380 U	550 U	77 U	3700 U	40 U	2600 U	380 U	1700 U	1900 U	680 U	340 U
AROCLOR-1232		380 U	550 U	77 U	3700 U	40 U	2600 U	380 U	1700 U	1900 U	680 U	340 U
AROCLOR-1242		380 U	550 U.	77 U	3700 U	40 U	2600 U	380 U	1700 U	1900 U	680 U	340 U
AROCLOR-1248		380 U	550 U	77 U	3700 U	40 U	2600 U	380 U	1700 U	1900 U	680 U	340 U
AROCLOR-1254		380 U	550 U	77 U	3700 U	40 U	2600 U	380 U	1700 U	13000	680 U	340 U
AROCLOR-1260		700 J	4900 J	520	9600 J	46	7200 J	780	8200	1900 U	970	860
AROCLOR-1268											680 U	340 U
TOTAL AROCLORS	1000	700 J	4900 J	520	9600 J	46	7200 J	780	8200	13000	970	860
Inorganics (mg/kg)												
ALUMINUM		1520	12400	5150 J	12000 J	1260	16800	1360	14000	10700	5880 J	10700
ANTIMONY		1.0 J	8.1 J	2.7 J	7.7 J	1.2 J	4.8 J	1.5 J	9.1 J	9 J	4.3 BJ	3.5 BJ
ARSENIC		4.1 J	21.7 J	10 J	28.7 J	1.7 J	23.4 J	1.8 J	24.7	28	9.6 J	27.3
BARIUM		6.2	38.2	41.4 J	47.2 J	7.2	36.0	3.0	49.7	66.2	40.4 J	38.3
BERYLLIUM		0.21	0.80	0.53 J	0.80 J	0.14	0.92 J	0.22	1.1	0.81	0.24 J	0.48
CADMIUM		0.51	3.3	2.2 J	6.8 J	0.84	2.9	0.07	8	5.9	1.9 J	0.39 J
CALCIUM		137	221	235 J	303 J	41.6	123	36.1	250	1030	1600 J	143
CHROMIUM		41.3	122	39.0 J	118 J	292	132	28.9	138	112	43.3 J	73.6
COBALT		0.48	1.9	0.83 J	2.5 J	0.22	1.7	0.55	2.2 J	3.7 J	0.72 J	0.97 J
COPPER		15.7	114	36.9 J	96.8 J	7.6	91.5	18.3	110	197	29.2 J	43.7
IRON		9330	37700	12500 J	33600 J	2540	40300	8500	43100	36400	24500 J	29700 J
LEAD		33.0	435	88.4 J	290 J	23.8	231	118	436 J	604 J	123 J	107
MAGNESIUM		287	1420	315 J	1320 J	126	1530	249	1880	1480	637 J	684
MANGANESE		17.4	49.1	12.6 J	25.9 J	4.9	24.5	30.7	30.1	40.3	54.5 J	14.6
MERCURY		0.16 J	2.6 J	0.46 J	1.8 J	0.37 J	1.8 J	0.11 J	2.6	4.2	1 J	0.52
NICKEL		2.8	10.3	5.8 J	14.6 J	1.5	9.8	2.9	14.7	20.8	6.5 J	4.9
POTASSIUM		872 J	3930 J	874 J	3800 J	378 J	4420 J	788 J	5150	3830	1500 J	2100
SELENIUM		0.33 U	1.6	1.7 J	2.7 J	0.68	2.4	0.33 U	2.9	2.1	2.6 J	3.4
SILVER	3.7	11.6	76.6	12.3 J	60.7 J	4.4	79.5	8.3	52.6 J	147 J	2.1 BJ	4.4
SODIUM		14.4	49.1	34.8 J	87.8 J	13.3	42.3	12.7	57 J	97	76.1 J	46.8 J
THALLIUM		0.62 U	0.89 U	1.3 U	1.2 U	0.60 U	0.82 U	0.63 U	1.4 U	1.4 U	2.1 UJ	1.1 U
VANADIUM		24.8 J	112 J	31.4 J	118 J	9.9 J	120 J	29.2 J	134	105	34.7 J	70.2
ZINC		22.8	110	53.7 J	175 J	17.7	73.0	12.7	109	205	81.5 J	32.5
Miscellaneous Parameter (%)												
TOTAL ORGANIC CARBON					21.2 J						26.5 J	

TABLE 2
SUMMARY OF ANALYTICAL RESULTS LANDFILL WASHOUT AREA
PRE-DESIGN INVESTIGATION
NWS EARLE
COLTS NECK, NEW JERSEY

Constituent	Criteria	13SD330006 0 TO6 " 12/11/2003	13SD360006 0 TO6 " 12/11/2003	13SD370006 0 TO6 " 12/11/2003	13SD371218 12 TO 18" 12/11/2003	13SD380006 0 TO6 " 12/11/2003	13SD390006 0 TO6 " 12/11/2003	13SD391218 12 TO 18" 12/11/2003	13SD400006 0 TO6 " 12/11/2003
Polychlorinated Biphenyls (PCBs) (ug/kg									
AROCLOR-1016		520 U	46 UJ	38 UJ	45 UJ	85 UJ	170 UJ	130 UJ	820 U
AROCLOR-1221		520 U	46 U	38 U	45 U	85 U	170 U	130 U	820 U
AROCLOR-1232		520 U	46 U	38 U	45 U	85 U	170 U	130 U	820 U
AROCLOR-1242		520 U	46 U	38 U	45 U	85 U	170 U	130 U	820 U
AROCLOR-1248		520 U	46 U	38 U	45 U	85 U	170 U	130 U	820 U
AROCLOR-1254		520 U	46 U	38 U	45 U	85 U		130 U	820 U
AROCLOR-1260		630	46 UJ	38 UJ	45 UJ	110 J		420 J	2600 J
AROCLOR-1268		520 U							
TOTAL AROCLORS	1000	630	ND	ND	ND	110	ND	420	2600
Inorganics (mg/kg)									
ALUMINUM		12100	1360	2960	7880	6650	1270 J	10800 J	16600
ANTIMONY		4.9 BJ	1 J	0.29 UJ	0.39 UJ	1.5 J	1.4 UJ	1 UJ	5 J
ARSENIC		20.1	4.2	4		10.6	2.5 J	3.7 J	29.4
BARIUM		45.5	13.6	1.9	7.8	29.4	23.5 J	25.6 J	28
BERYLLIUM		0.54	0.08	0.43	0.64	0.32	0.19 UJ	0.4 J	0.89
CADMIUM		1.3	0.19	0.04 UJ	0.05 UJ	0.38	1.4 J	0.73 J	1.9 J
CALCIUM		1420	62.7	15.5	19.5	348	2130 J	229 J	103
CHROMIUM		81	10.9	68.3	101	44.7	7.3 BJ	215 J	229
COBALT		1.6	0.28	0.15 J	0.28 J	0.98	1.1 J	0.67 J	1.6 J
COPPER		49.9	13.3	1.7 BJ	5.1	25.2	18.2 J	9.9 BJ	67
IRON		29100 J	3660	11000	19500	15700	2620 J	2810 J	46800
LEAD		176	70 J	7.6 J	7 J	86.9 J	53.3 J	43 J	219 J
MAGNESIUM		1030	145	769	1100	536	730 J	106 J	1600
MANGANESE		42.8	5.7	4.1	11	16.2	37.1 J	4.2 J	21.2
MERCURY		0.93	0.09	0.02 U	0.02	0.21	0.51 J	0.15 J	1.6
NICKEL		10.6	2.7	1.2	2.4	7.8	11.4 J	10.7 J	9
POTASSIUM		2980	428	2370	3260	1370	360 J	311 J	4670
SELENIUM		3.2	0.9	0.38	0.8	1.8	1.4 UJ	5.4 J	5
SILVER	3.7	8.4	0.39 J	0.08 U	0.17 J	0.57 J	1.5 J	2.8 J	15.8 J
SODIUM		71.6 J	19.9	14.5 BJ	22.7 J	57.2	131 J	60.7 J	54.8 J
THALLIUM		1.8 U	0.61 U	0.54 U	0.73 U	1.3 U	2.6 UJ	2 UJ	1.3 U
VANADIUM		90.4	15.2	44.7	71	47.1	9.1 J	14.4 J	139
ZINC		68.3	12.7	9.5	13.4	38.7	101 J	23.4 J	57.6
Miscellaneous Parameter (%)									
TOTAL ORGANIC CARBON								35.4 J	

TABLE 2
SUMMARY OF ANALYTICAL RESULTS LANDFILL WASHOUT AREA
PRE-DESIGN INVESTIGATION
NWS EARLE
COLTS NECK, NEW JERSEY

Constituent	Criteria	13SD400006-D 0 TO6 " 12/11/2003	13SD410006 0 TO6 " 12/11/2003	13SD410006-D 0 TO6 " 12/11/2003	13SD411218 12 TO 18" 12/11/2003	13SD440006 0 TO6 " 12/11/2003	13SD450006 0 TO6 " 12/11/2003	13SD450006-D 0 TO6 " 12/11/2003	13SD460006 0 TO6 " 12/11/2003
Polychlorinated Biphenyls (PCBs) (ug/kg									
AROCLOR-1016		8300 U	1000 U	1000 U	180 U	60 U	54 U	51 U	28 U
AROCLOR-1221		8300 U	1000 U	1000 U	180 U	60 U	54 U	51 U	28 U
AROCLOR-1232		8300 U	1000 U	1000 U	180 U	60 U	54 U	51 U	28 U
AROCLOR-1242		8300 U	1000 U	1000 U	180 U	60 U	54 U	51 U	28 U
AROCLOR-1248		8300 U	1000 U	1000 U	180 U	60 U	54 U	51 U	28 U
AROCLOR-1254		8300 U	1000 U	1000 U	180 U	60 U	54 U	51 U	28 U
AROCLOR-1260		4400 J	1200	1800	490	350	110 J	200 J	28 U
AROCLOR-1268						60 U	54 U	51 U	28 U
TOTAL AROCLORS	1000	4400	1200	1800	490	350	110	200	ND
Inorganics (mg/kg)									
ALUMINUM		20500	12200	19800	16100 J	4700 J	18900	18100	18300
ANTIMONY		4.3	3.6 J	3.4	3.1 J	4.9 BJ	4.1 BJ	3.4 BJ	3 BJ
ARSENIC		27.3	16.7	23.6	11.2 J	14.1 J	36.1	15.5	21.8
BARIUM		35.6	26.4	30.7	17 J	49.2 J	25.4	24.3	17.7
BERYLLIUM		0.95	0.55	0.73	0.56 J	0.23 J	0.7	0.67	1.5
CADMIUM		1.8	1.7	0.85	2.6 J	1.2 J	0.46 J	0.53	0.04 U
CALCIUM		176	254	167	252 J	465 J	87.8	73.5	67.8
CHROMIUM		234	138 J	232 J	774 J	24.1 J	408	422	225
COBALT		2.1 J	3.2	2.6 J	1.2 J	1.5 J	0.9 J	0.96	2.1 J
COPPER		63.1	53.4	55.5	33.7 J	49.2 J	30.2	26.4	23.2
IRON		46200	29400	41000	9390 J	10100 J	43000 J	23400 J	48300 J
LEAD		190	194 J	214	153 J	175 J	112	96.8	99.4
MAGNESIUM		2150	1300	1690	510 J	516 J	1230	1120	2790
MANGANESE		28.5	19.4	22.6	7.8 J	19.9 J	12.9	12.8	16.7
MERCURY		1.4	0.91	1.3	0.39 J	0.8 J	0.75	0.86	0.27
NICKEL		11.6	12.1	13	10.8 J	12.6 J	6.7	6.4	7.9
POTASSIUM		6070	3220	4760	1490 J	690 J	3660	3330	7500
SELENIUM		4.5 J	3.8	4.3 J	13 J	3.8 J	6.5	5.9	2.4
SILVER	3.7	20.5	31.9 J	19.4	6.2 J	2.7 J	1.3 BJ	1.9 BJ	0.84 BJ
SODIUM		66.3 BJ	56	63.7 BJ	67.5 BJ	69.2 J	44.9 J	40.5 J	33.7 J
THALLIUM		1.3 UJ	1.6 U	1.7 UJ	2.9 UJ	2 UJ	1.8 U	1.6 U	0.84 U
VANADIUM		154	98.1	138	52.4 J	37.3 J	118	85.9	204
ZINC		73.8	74.3	61.4	35.8 J	59 J	25.8	25.7	39
Miscellaneous Parameter (%)									
TOTAL ORGANIC CARBON						21.4 J			

Results presented for June, September, and December 2003 sampling events.
Total Aroclors represents the calculated sum of the detected values for Aroclors-1016, -1221, -1232, -1242, -1248, -1254, -1260, and -1268.

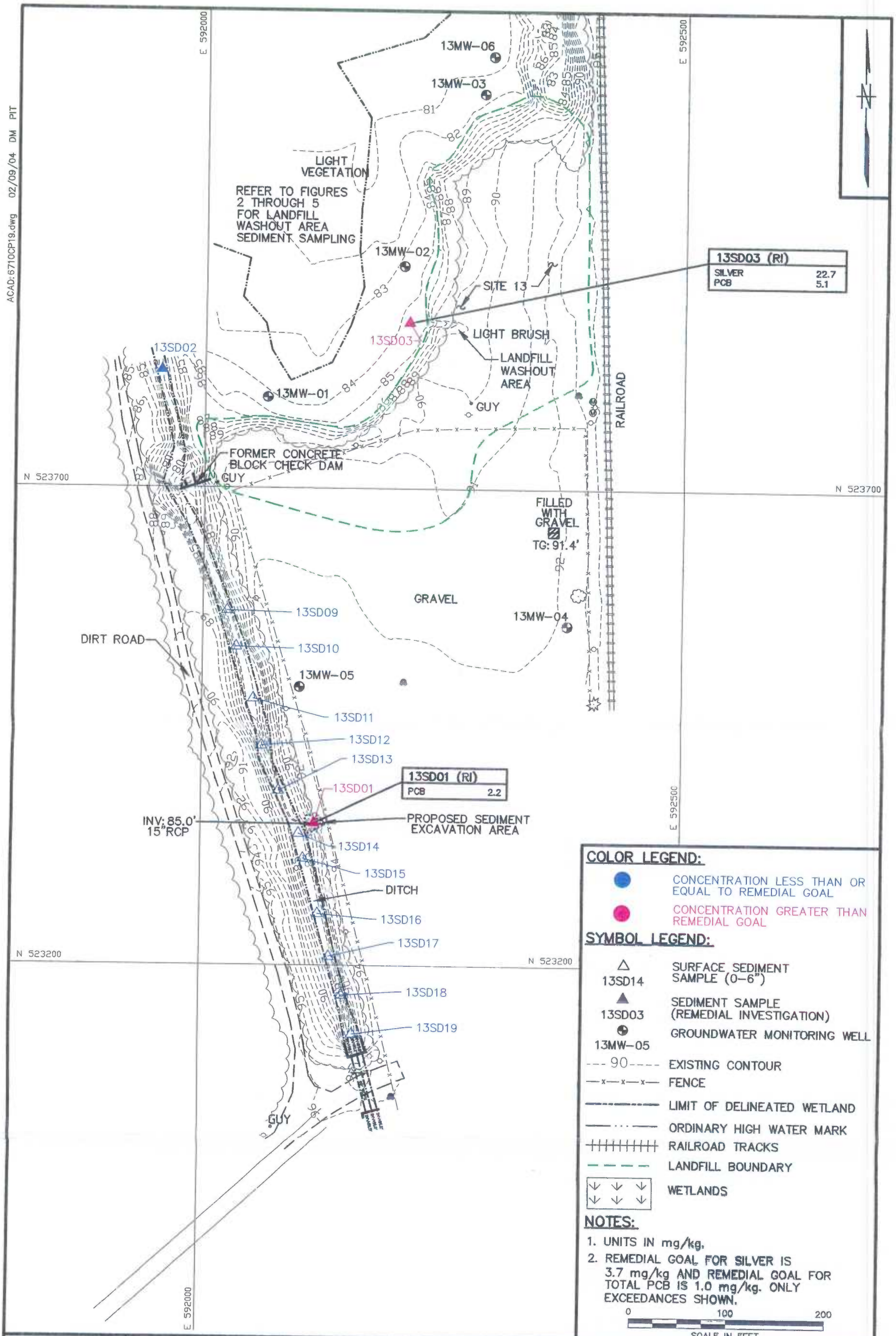
ND - Not Detected
J - Value is estimated due to technical noncompliance.
U - Value is non-detected as reported by the laboratory.
UJ - Non-detected value is estimated due to technical noncompliance.

Photograph 1: Palustrine Forested Wetland, Site, 13 facing away from the landfill

Photograph 2: Shallow Root Systems and Hummocking at Red Maple and Black Gum Trees in Palustrine Forested Wetlands, Site, 13 facing away from the landfill.

01008CB1Y

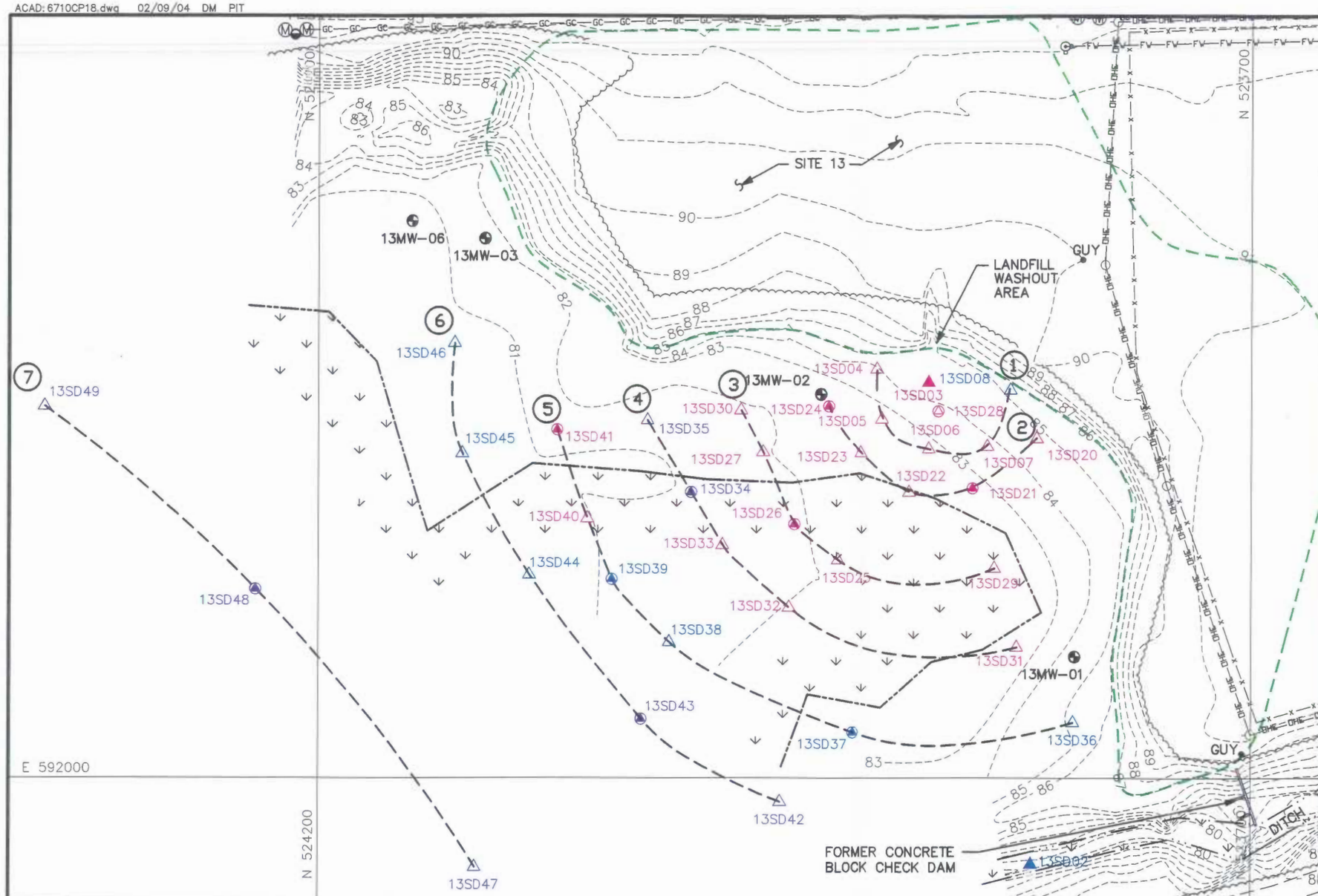
ACAD: 6710CP19.dwg 02/09/04 DM PIT



DRAWN BY DM DATE 2/4/04	Tetra Tech NUS, Inc.	CONTRACT NO. 0851	OWNER NO. 6710
CHECKED BY RCM DATE 2/4/04	DITCH SEDIMENT SAMPLE LOCATION EXCEEDANCES SITE 13 – DPDO YARD NAVAL WEAPONS STATION EARLE COLTS NECK, NEW JERSEY	APPROVED BY Daniel C Witt DATE 2/23/04	
COST/SCHED-AREA		APPROVED BY DATE	
SCALE AS NOTED		DRAWING NO. FIGURE 1	REV. 0

TM CADD NO. TEMLS_BV.DWG REV 0 1/20/98

ACAD: 6710CP18.dwg 02/09/04 DM PIT



NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY DM DATE 2/3/04
CHECKED BY RCM DATE 2/3/04
COST/SCHED-AREA
SCALE AS NOTED

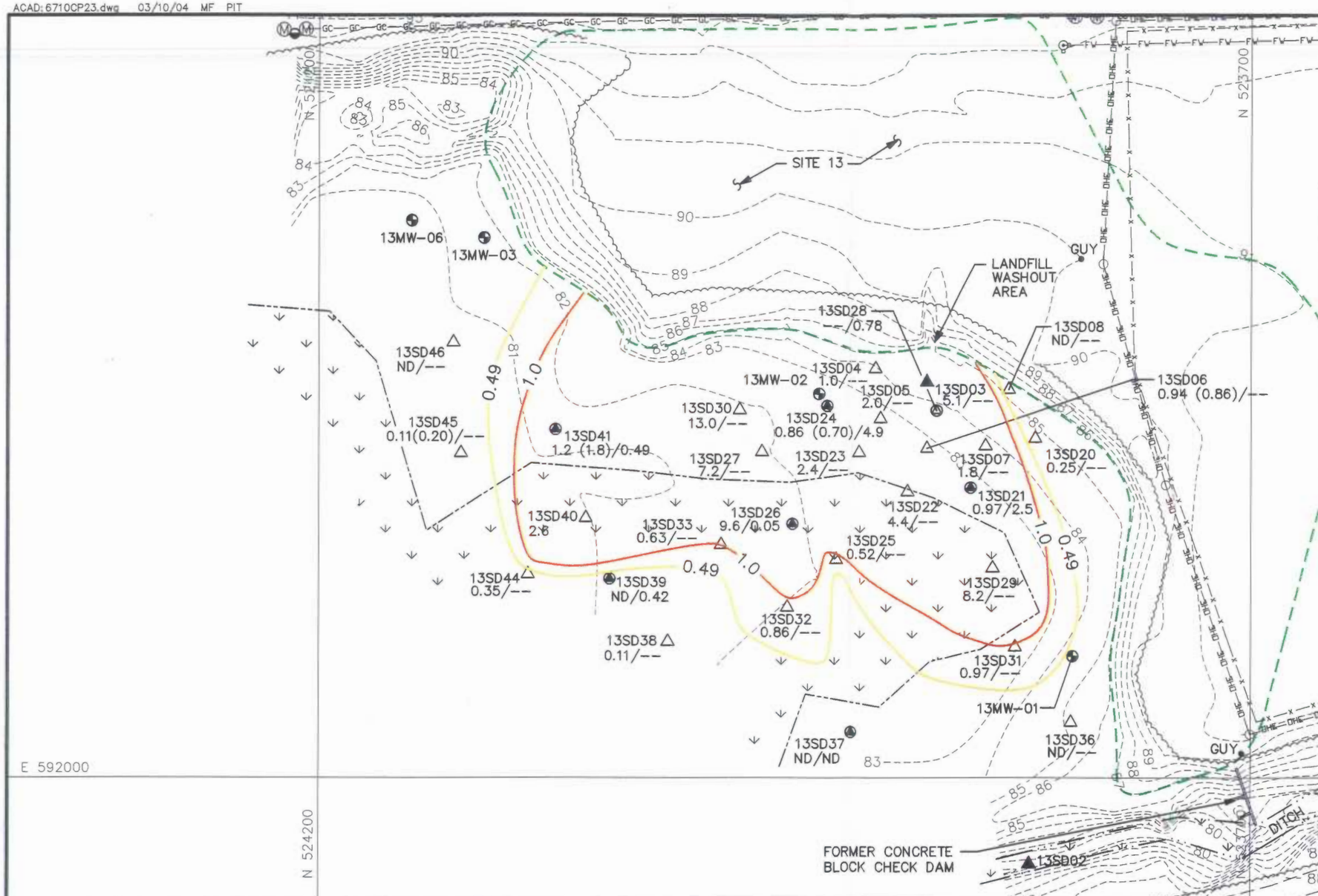
Tetra Tech NUS, Inc.

SEDIMENT SAMPLE LOCATION EXCEEDANCES
SITE 13 – DPDO YARD
NAVAL WEAPONS STATION EARLE
COLTS NECK, NEW JERSEY

CONTRACT NO. 0851
OWNER NO. 6710
APPROVED BY [signature] DATE 3/12/04
APPROVED BY DATE
DRAWING NO. FIGURE 2
REV. 0

FORM CADD NO. TtNUS_BH.DGN - REV 0 - 11/20/98

ACAD: 6710CP23.dwg 03/10/04 MF PIT



LEGEND:

- 13SD35 — SURFACE SEDIMENT SAMPLE (0–6")
- 13SD28 — DEEP SEDIMENT SAMPLE (12–18")
- 13SD43 — SURFACE AND DEEP SEDIMENT SAMPLES (0–6" & 12–18")
- 13SD03 — SEDIMENT SAMPLE (REMEDIAL INVESTIGATION)
- 1.0 mg/kg TOTAL PCB CONCENTRATION CONTOUR
- 0.49 mg/kg TOTAL PCB CONCENTRATION CONTOUR
- 13MW-01 — GROUNDWATER MONITORING WELL
- 90 — EXISTING CONTOUR
- FENCE
- LIMIT OF DELINEATED WETLAND
- ORDINARY HIGH WATER MARK
- RAILROAD TRACKS
- LANDFILL BOUNDARY
- WETLANDS

NOTES:

1. UNITS IN mg/kg.
2. REMEDIAL GOAL FOR TOTAL PCB IS 1.0 mg/kg.
3. TOTAL PCB CONCENTRATION AT 0 TO 6 INCHES FOLLOWED BY CONCENTRATION AT 12 TO 18 INCHES IF APPLICABLE. DUPLICATE RESULTS INDICATED IN (PARENTHESIS).

0 60 120
SCALE IN FEET

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY DM DATE 2/3/04
CHECKED BY RCM DATE 2/3/04
COST/SCHED-AREA
SCALE AS NOTED

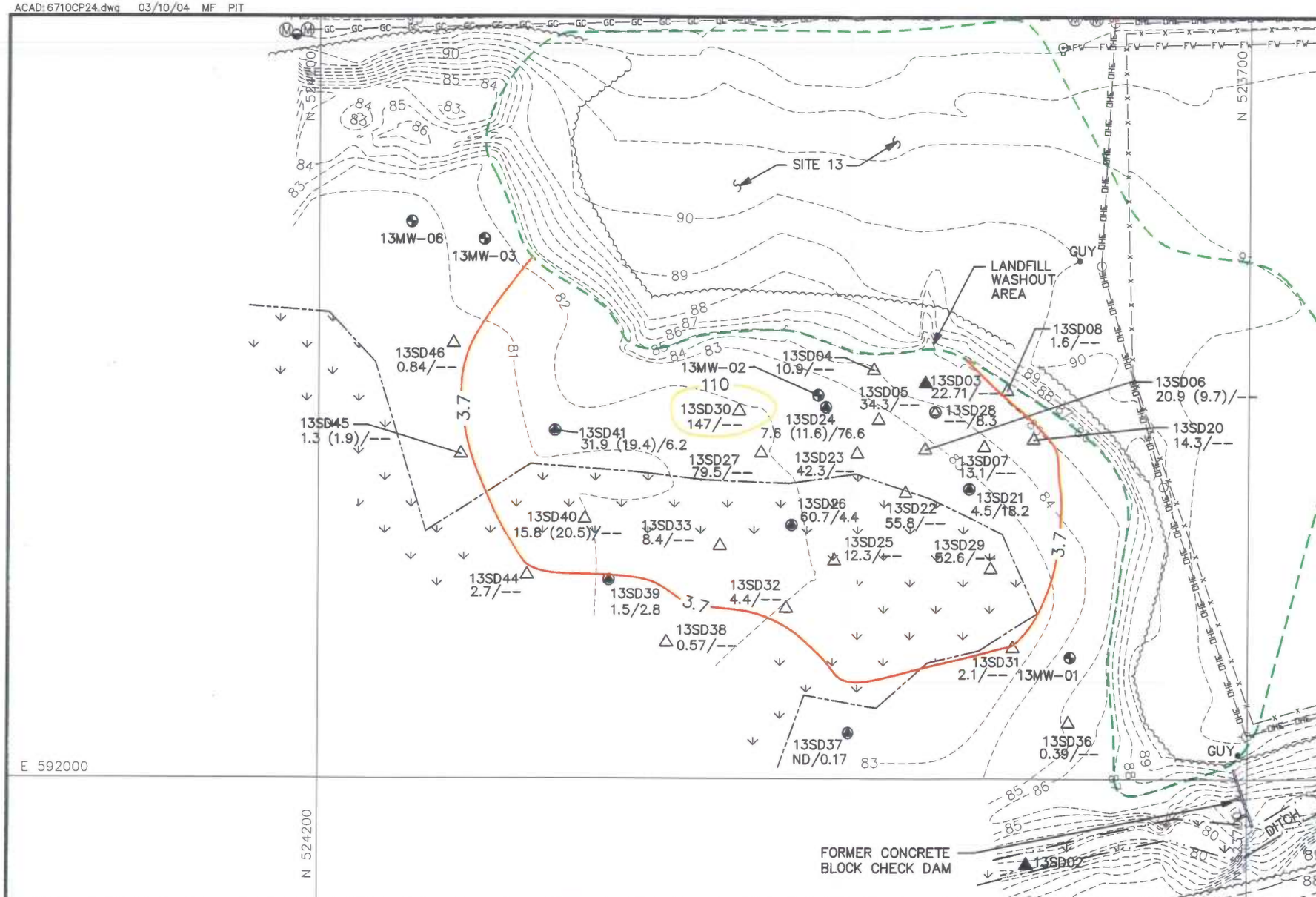
Tetra Tech NUS, Inc.

SEDIMENT SAMPLE PCB EXCEEDANCES
SITE 13 – DPDO YARD
NAVAL WEAPONS STATION EARLE
COLTS NECK, NEW JERSEY

CONTRACT NO. 0851
OWNER NO. 6710
APPROVED BY David Cwitt DATE 3/12/04
APPROVED BY DATE
DRAWING NO. FIGURE 3
REV. 0

FORM CADD NO. TTNUS.BMDD - REV. 0 - 10/96

ACAD: 6710CP24.dwg 03/10/04 MF PIT



LEGEND:

- 13SD35 — SURFACE SEDIMENT SAMPLE (0–6")
- 13SD28 — DEEP SEDIMENT SAMPLE (12–18")
- 13SD43 — SURFACE AND DEEP SEDIMENT SAMPLES (0–6" & 12–18")
- 13SD03 — SEDIMENT SAMPLE (REMEDIAL INVESTIGATION)
- 3.7 mg/kg SILVER CONCENTRATION CONTOUR
- 110 mg/kg SILVER CONCENTRATION CONTOUR
- 13MW-01 — GROUNDWATER MONITORING WELL
- 90 — EXISTING CONTOUR
- FENCE
- LIMIT OF DELINEATED WETLAND
- ORDINARY HIGH WATER MARK
- RAILROAD TRACKS
- LANDFILL BOUNDARY
- WETLANDS

NOTES:

1. UNITS IN mg/kg.
2. REMEDIAL GOAL FOR SILVER IS 3.7 mg/kg.
3. SILVER CONCENTRATIONS AT 0 TO 6 INCHES FOLLOWED BY CONCENTRATION AT 12 TO 18 INCHES IF APPLICABLE. DUPLICATE RESULTS INDICATED IN (PARENTHESIS).

0 60 120
SCALE IN FEET

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY DM DATE 2/5/04
CHECKED BY RCM DATE 2/5/04
COST/SCHED-AREA
SCALE AS NOTED

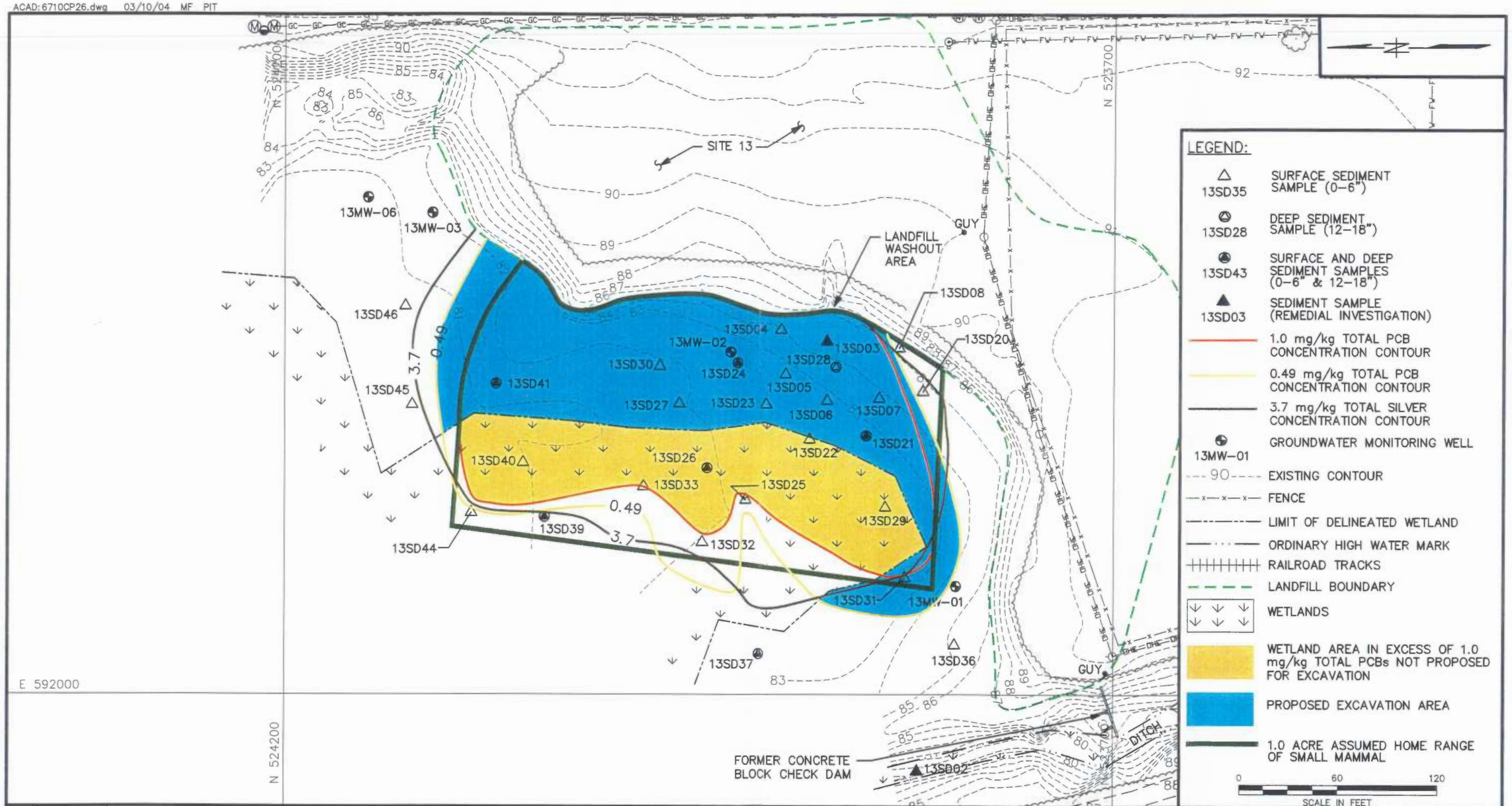
Tetra Tech NUS, Inc.

SEDIMENT SAMPLE SILVER EXCEEDANCES
SITE 13 – DPDO YARD
NAVAL WEAPONS STATION EARLE
COLTS NECK, NEW JERSEY

CONTRACT NO. 0851
OWNER NO. 6710
APPROVED BY [signature] DATE 3/12/04
APPROVED BY DATE
DRAWING NO. FIGURE 4
REV. 0

FORM CADD NO. TtNUS 3H.DGN – REV. 0 – 1/20/98

ACAD: 6710CP26.dwg 03/10/04 MF PIT



NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY MF DATE 2/19/04
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

Tetra Tech NUS, Inc.

PROPOSED EXCAVATION – LANDFILL WASHOUT AREA
SITE 13 – DPDO YARD
NAVAL WEAPONS STATION EARLE
COLTS NECK, NEW JERSEY

CONTRACT NO. 6710
OWNER NO.
APPROVED BY Dal C W/ DATE 3/12/04
APPROVED BY DATE
DRAWING NO. FIGURE 5
REV. 0

FORM FHLD NO. TtNUS_DRAFT - REV. 0 - 1/20/98

ATTACHMENT A

FOOD CHAIN MODEL SPREADSHEETS

TABLE A-1
AVERAGE PCB AND SILVER CONCENTRATION OVER A 1 ACRE AREA
SITE 13 DPDO YARD, COLTS NECK, NJ
NAVAL WEAPONS CENTER EARLE

Average PCB Concentration over a 1 acre area of Site 13

	Excavated Area	Wetland PCB contamination		Rest of the area		Total
	(outside Wetland Area	in excess of 1.0 PCBs				
Area (ac.)	0.50	0.33		0.17		1.00
		Sample	Conc. (mg/kg)	Sample	Conc. (mg/kg)	
		13SD40	3.5	13SD44	0.35	
		13SD26	9.6	13SD39	0	
		13SD22	4.4	13SD33	0.63	
		13SD29	8.2	13SD32	0.86	
				13SD25	0.52	
				13SD08	0	
				13SD20	0.25	
Average Conc. (mg/kg)	0		6.425		0.37	
Overall Average (mg/kg)						2.183636

Average PCB Concentration of the Area to be Excavated

	0" to 6"	12" to 18"
13SD03	5.1	
13SD04	1	
13SD05	2	
13SD06	0.9	
13SD07	1.8	
13SD21	0.97	2.5
13SD23	2.4	
13SD24	0.78	4.9
13SD27	7.2	
13SD28		0.78
13SD30	13	
13SD31	9.7	
13SD41	1.5	0.49
Average	3.86	2.17

Average Silver Concentration over a 1 acre area of Site 13

	Excavated Area	Wetland PCB contamination area		Rest of the area		Total
	(outside Wetland Area	in excess of 1.0 mg/kg				
Area (ac.)	0.50	0.33		0.17		1.00
		Sample	Conc. (mg/kg)	Sample	Conc. (mg/kg)	
		13SD40	18.15	13SD44	2.7	
		13SD26	60.7	13SD39	1.5	
		13SD22	55.8	13SD33	8.4	
		13SD29	52.6	13SD32	4.4	
				13SD25	12.3	
				13SD08	1.6	
				13SD20	14.3	
Average Conc. (mg/kg)	0.15		46.8125		6.46	
Overall Average (mg/kg)						16.62084

Average Silver Concentration of the Area to be Excavated

	0" to 6"	12" to 18"
13SD03	22.7	
13SD04	10.9	
13SD05	34.3	
13SD06	15.3	
13SD07	13.1	
13SD21	4.5	18.2
13SD23	42.3	
13SD24	9.6	76.6
13SD27	79.5	
13SD28		8.3
13SD30	147	
13SD31	2.1	
13SD41	25.65	6.2
Average	33.91	27.33

Note: 0.15 mg/kg of silver is assumed for backfill in the excavation area based on the maximum background sediment concentration for NWS Earle
0 mg/kg of PCBs is assumed for backfill in the excavation area

TABLE A-2

TERRESTRIAL FOOD CHAIN MODELING EXPOSURE FACTORS
SITE 13 DPDO YARD, COLTS NECK, NJ
NAVAL WEAPONS CENTER EARLE

	Data from EPA (1993)			Derivation of Factors for Modeling		
Species/Factor	Age/Sex/ Cond./Seas.	Value	Study Average	Calculation of Values		Notes
American Robin						
Body Weight (g)	A B	77.3	77.3	Minimum Value	0.0773 kg	
				Maximum Value	0.0862 kg	
	A M nonbreeding	86.2		Overall Study Average	0.0804 kg	
	A F nonbreeding	83.6	84.9			
	A M breeding	77.4				
	A F breeding	80.6	79			
Food Ingestion Rate (g/g-day)				Average Value	0.01188 kg/day	Used average body weight in below equation Food ingestion rates were calculated from Nagy et al., (1999) for insectivores as follows: $FI = (9.7*BW(g)^{0.705})/18kJ/g/1000$
Short-Tailed Shrew						
Body Weight (g)	A B	15	15	Minimum Value	0.0150 kg	
				Maximum Value	0.01921 kg	
	M summer	19.21	17.27	Overall Study Average	0.01613 kg	
	F summer	17.4				
	M fall	16.87				
	M fall	15.58				
Food Ingestion Rate (g/g-day)	A B	0.49		Average value	0.00143 kg/day	Average ingestion rate * Average Body weight * 0.16[1] [1] - 0.16 = percent solids in earthworms to convert to a dry weight ingestion rate
	A B	0.62				
	Overall Study Average		0.555			

Notes:
A = Adult
F = Female, M = Male, B = Both
BW = Body Weight

TABLE A-3
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
SHORT-TAILED SHREW - AVERAGE INPUT PARAMETERS
SITE 13 DPDO YARD, COLTS NECK, NJ
NAVAL WEAPONS CENTER EARLE

Chemical	Avg Soil Concentration (mg/kg)[1]	Avg Biotransfer Factor (soil to inv.)[2]	Earthworm Concentration (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)[3]	LOAEL (mg/kg/day)[3]	NOAEL EEQn	LOAEL EEQl
PCBs								
Total PCBs	2.18E+00	6.67E+00	1.46E+01	1.29E+00	6.80E-02	6.80E-01	1.90E+01	1.90E+00
Metals								
Silver	1.66E+01	2.05E+00	3.40E+01	3.04E+00	2.38E+00	2.38E+01	1.28E+00	1.28E-01

Exposure Factors[4]

Body Weight = (BW)	1.613E-02	kg
Food Ingestion Rate = (If)	1.430E-03	kg/day
Soil Ingestion Rate = (Is)	2.145E-05	kg/day

Dose=(If*Ce+Is*Cs)/BW
EEQn (Ecological Effects Quotient, NOAEL) = Dose/NOAEL
EEQl (Ecological Effects Quotient, LOAEL) = Dose/LOAEL
NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
Cs = Contaminant concentration in soil
Ce (Contaminant concentration in earthworm) = soil conc.* BF
BF = Soil to invertebrate biotransfer factor

Footnotes:
(1) See Table 1 for source of soil concentrations.
(2) Source of Biotransfer Factors is ORNL (September, 1998) for all chemicals; value used is median value.
(3) Sources of NOAEL and LOAEL TRVs are Sample et al., 1996 for PCBs and Rungby and Danscher, 1984 for silver.
(4) See Table 2 for calculation of exposure factors.

References:
ORNL (Oak Ridge National Laboratory). 1998. Biota Sediment Accumulation Factors for Invertebrates: Review and recommendations for the Oak Ridge Reservation. BJC/OR-112. August.

Rungby, J., and G. Danscher. 1984. "Hypoactivity in Silver Exposed Mice." Acta. Pharmacol. et Toxicol. 55:398-401. Cited in ASTDR, 1989 (Silver).

Sample, B.E., D.M. Opresko, and G.W. Suter II. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Oak Ridge National Laboratory. June. ES/ER/TM-86/R3.

TABLE A-4
TERRESTRIAL WILDLIFE MODEL ECOLOGICAL EFFECTS QUOTIENT CALCULATION
AMERICAN ROBIN - AVERAGE INPUT PARAMETERS
SITE 13 DPDO YARD, COLTS NECK, NJ
NAVAL WEAPONS CENTER EARLE

Chemical	Avg Soil Concentration (mg/kg)[1]	Avg Biotransfer Factor (soil to inv.)[2]	Earthworm Concentration (mg/kg)	Dose (mg/kg/day)	NOAEL (mg/kg/day)[3]	LOAEL (mg/kg/day)[3]	NOAEL EEQn	LOAEL EEQl
PCBs								
Total PCBs	2.18E+00	6.67E+00	1.46E+01	2.16E+00	1.80E-01	1.80E+00	1.20E+01	1.20E+00
Metals								
Silver	1.66E+01	2.05E+00	3.40E+01	5.06E+00	5.44E+00	5.44E+01	9.30E-01	9.30E-02

Exposure Factors[4]

Body Weight = (BW)	8.040E-02	kg
Food Ingestion Rate = (If)	1.188E-02	kg/day
Soil Ingestion Rate = (Is)	1.782E-04	kg/day

Dose=(If*Ce+Is*Cs)/BW
EEQn (Ecological Effects Quotient, NOAEL) = Dose/NOAEL
EEQl (Ecological Effects Quotient, LOAEL) = Dose/LOAEL
NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
Cs = Contaminant concentration in soil
Ce (Contaminant concentration in earthworm) = soil conc.* BF
BF = Soil to invertebrate biotransfer factor

Footnotes:
(1) See Table 1 for source of soil concentrations.
(2) Source of Biotransfer Factors is ORNL (September, 1998) for all chemicals; value used is median value
(3) Sources of NOAEL and LOAEL TRVs are Sample et al., 1996 for PCBs and Petersen and Jensen, 1975 for silver.
(4) See Table 2 for calculation of exposure factors.

References:
ORNL (Oak Ridge National Laboratory). 1998. Biota Sediment Accumulation Factors for Invertebrates: Review and recommendations for the Oak Ridge Reservation. BJC/OR-112. August.

Petersen, R.P. and L.S. Jensen. 1975. Interrelationship of dietary silver with copper in chick. Poultry Science, 54(3): 771-775.

Sample, B.E., D.M. Opresko, and G.W. Suter II. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Oak Ridge National Laboratory. June. ES/ER/TM-86/R3.