TETRA TECH

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Project Number 112G00873

Mr. Ronald Pinkoski
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Environmental Restoration
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Reference: CLEAN Contract No. N62467-04-D-0055
Contract Task Order 439

Subject: Responses to Comments on Draft Phase III Remedial Investigation Technical Memorandum for Area A Wetland-Site 2B
Naval Submarine Base-New London, Groton, Connecticut

Dear Mr. Pinkoski:

Tetra Tech NUS, Inc. (Tetra Tech) is pleased to submit electronically the responses to comments on the Draft Phase III Remedial Investigation Technical Memorandum for Area A Wetland-Site 2B, Groton, Connecticut for your files. Copies were e-mailed to the distribution list provided below.

If you have any questions regarding the responses, please contact me at (412) 921-8433.

Sincerely,

Aaron Bernhardt
Project Manager

AB/mlg
Enclosure(s)

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**RESPONSES TO EPA'S APRIL 10, 2008 COMMENTS ON THE PHASE III REMEDIAL INVESTIGATION FOR THE AREA A WETLAND – SITE 2B NAVAL SUBMARINE BASE – NEW LONDON, GROTON, CONNECTICUT MAY 2, 2008**

## GENERAL COMMENTS

### Comment 1:

Thank you for the opportunity to review the *Phase III Remedial Investigation Technical Memorandum for the Area A Wetland - Site 2B*, Naval Submarine Base-New London, Groton, Connecticut, dated March 13, 2008. The report presents the results of the October 2007 sediment and surface soil sampling effort and incorporates the data into a revised assessment of ecological risk to benthic invertebrates and terrestrial and wetland wildlife. The sample locations, sampling procedures, and chemical analyses are consistent with the October 2007 QAPP, with appropriate modifications. Detailed comments are provided in Attachment A.

**Response:**

Comment noted. Please see responses to specific comments below.

### Comment 2:

The food chain modeling, COPC selection, ecological receptors, exposure assumptions, bioaccumulation factors, toxicity reference values, *etc.*, are consistent with the QAPP, except as noted herein. The Ecological Effects Quotients (EEQ) were accurately calculated. The EEQ based on average site concentrations and LOAEL-based TRVs were generally below one, with sufficient explanation for the exceptions. Pending resolution of these comments, the conclusion that the EEQ do not merit further evaluation for wildlife receptors is acceptable.

**Response:**

Comment noted. Please see responses to specific comments below.

### Comment 3:

While there are several sample locations with COPC concentrations that exceed PECs, including several locations where multiple COPCs exceeded the PEC, the report inappropriate argues that the concentrations do not merit further evaluation. Much of the argument is based on the questionable habitat quality in the wetland but should be reevaluated considering the following:

a) While it may be true that the *Phragmites* marsh has lost some ecological value, some habitat value remains and if the *Phragmites* is removed in the future, the habitat value could be enhanced.

b) The argument regarding the periodic drying of the wetland should be reconsidered. The argument assumes that the water levels are representative of future conditions, which is probably inappropriate given yearly/seasonal changes in precipitation levels. Further, while organisms may not be present year round, many invertebrates and amphibians could use the areas during period when there is water, such as the spring breeding season.

c) Finally, the assertion that the elevated TOC in the sediments would decrease the likelihood of toxicity to invertebrates is not wholly supportable. This argument could be quantitatively supported using an equilibrium partitioning approach.

**Response:**

a) The Navy agrees that if *Phragmites* were removed in the future, the habitat could be enhanced. However, under the IRP program, risks need to be great enough to justify a removal action, so current risks are related to the current value of the habitat.

b) The Navy concurs that while organisms may not be present year round, many invertebrates and amphibians could use the areas during periods when water is present, such as the spring breeding season. Therefore, the second sentence in first bullet on page 3-16 will be modified as follows: "Although the periodic drying will stress and/or kill sediment invertebrates in the wetland, invertebrates and amphibians may be present when standing water is present."

c) None of the criteria used in the screening level risk assessment were based on equilibrium partitioning so the impact of the TOC cannot be quantitatively evaluated. However, as discussed in USEPA (2004), when TOC values are not reported, a TOC value of 1 percent is typically used as a conservative estimate of TOC so the bioavailability of the associated contaminants is not underestimated. Therefore, the high TOC values in sediment in the Area A Wetland are indicative of sediment that has low bioavailability.

   USEPA (U.S. Environmental Protection Agency), 2004. The Incidence and Severity of Sediment Contamination in Surface Waters of the United States, Volume 1:National Sediment Quality Survey: Second Edition. Office of Science and Technology. Washington, D.C. EPA 823-R-04-007. November.

**Comment 4:**

EPA does not agree that risks at this site are not great enough to warrant further evaluation. The Screening-Level Ecological Risk Assessment (SERA) deviates from EPA protocols. For example, direct exposure to benthic invertebrates is initially identified as a complete exposure pathway, yet later in the SERA, where risks are found, the risks are dismissed on the grounds that the habitat would not support benthic invertebrates. Multiple samples exhibited concentrations above both screening and effects-based benchmarks for numerous chemicals and risks were identified in the food chain models. Moreover, the risks are co-located in three discrete areas, namely, the edge of the Area A Landfill, the Weapons Center, and the western edge of the Area A Wetland. Such risks cannot be dismissed without further evaluation or action.

**Response:**

The SERA does not deviate from EPA protocols or Navy procedures. The purpose of Step 3a is to refine the list of chemicals of potential concern (COPCs) and determine whether the site needs to proceed further in the ERA process (i.e., conduct a baseline ERA). The fact that the reviewer does not agree with the rationale used to determine whether risks are significant enough to warrant further action does not indicate the Navy deviated from EPA protocols. However, after further evaluation, the Navy acknowledges that certain areas at the site (as identified in the comment), where chemical concentrations are elevated above criteria, pose a potential risk to sediment invertebrates (when present). The last sentence before the bullets in Section 3.7.1 on page 3-16 will be revised as follows:

"Although potential risks are somewhat mitigated by the following factors, actual risks to sediment invertebrates cannot be determined without site-specific toxicity testing or biological studies."

Also, the last sentence of the last paragraph in Section 3.7.1 (on page 3-17) will be changed as follows:

"In summary, the potential exists for chemicals in sediment to impact sediment invertebrates and amphibians; however, because of the factors discussed above, the significance of the impacts cannot be determined without site-specific toxicity testing or biological studies. These potential impacts are limited

to the areas near the Area A Landfill, Area A Weapons Center, and along the dike at the western portion of the wetland."

**Comment 5:**

The SERA takes shortcuts to minimize risks based on chemical concentrations. It is an inherent limitation of any SERA that usually there is no site-specific tissue residue or toxicity testing information available at this stage for anything more than a conservative screening based on a single line of evidence. The SERA should be refined in order to focus evidence of risk, using no-effect and effect-based benchmarks, or reasonable maximum and central tendency exposure factors. Using these tools in a constructive way would likely reveal that the western wetland edge, the area near the Weapons Center, and the wetland edge near the Area A Landfill all warrant additional action. Instead of synthesizing the data to adequately characterize overall risk, the SERA addresses each COPC detection separately and dismisses them. The magnitude of the exceedances of sediment benchmarks cannot be disregarded without additional information.

**Response:**

The Navy does not agree that shortcuts were taken to minimize potential risks. The risk assessment was refined in Step 3a by comparing the sediment concentrations to probable effects concentrations (PECs) which are effects-based benchmarks, versus the screening levels, which are no-effects benchmarks. Also, in the food chain models, the doses were compared to no observed adverse effects levels (NOAELs) and lowest observed adverse effects levels (LOAELs) to present the range of risks. See response to EPA's General Comment 4.

**Comment 6:**

While the areas of contamination may be discrete, the SERA does not provide enough information to overlook areas where multiple co-located COPCs exceed effects-based benchmarks. Further evaluation is required to determine risk. Alternatively, EPA could consider remedies that use conservative risk assumptions to establish a more efficient path forward.

**Response:**

See response to EPA's General Comment 4. The Navy is willing to discuss remedies based on the assumptions in the existing risk assessment to establish a more efficient path forward versus conducting additional studies (e.g., toxicity tests and/or biological studies). However, depending on the size of the area selected for a removal action, the Navy may elect to conduct additional studies to confirm that a removal action is necessary.

**Comment 7:**

EPA concurs that food chain modeled risks are not noteworthy.

**Response:**

Comment noted.

**Comment 8:**

EPA recommends that a TEC-quotient and PEC-quotient approach be used to better define the areas where multiple contaminants exceed benchmarks. TEC and PEC concentrations for the COPCs (defined by exceeding screening benchmark) present in more than one sample should be calculated, and two separate figures should be produced to show TEC and PEC quotients over 1, 5, and 10. This could help identify the areas requiring further work.

**Response:**

The Navy does not believe that a TEC and/or PEC quotient approach would provide additional information for identifying areas of potential risks. There is no standard "cut-off" for TEC or PEC quotients that signify when an impact will occur and randomly selecting a threshold where effects would occur would not be technically defensible.

However, if TEC and PEC quotients were calculated, they should be calculated using all (or most) of the chemicals that have a TEC and PEC, not only the chemicals that exceed the TEC and PEC. Using only chemicals that have concentrations that exceed TECs and PECs would artificially bias the quotients high.

The Navy believes that Figure 1 (attached), which shows each location where at least one chemical was detected at concentrations greater than its PEC and which chemicals were detected at concentrations greater than their respective PEC is a better way to visually highlight areas where potential risks are greatest. The Navy does not believe a similar figure for the TEC would be beneficial. Table 1 (attached) presents the chemical concentrations for each sample where at least one chemical was detected at a concentration greater than its PEC, and the chemicals' corresponding PEC quotient.

**Comment 9:**

As an additional step, a figure could be produced that shows where effects-based TRV food chain model risks exceed 1 for organic chemicals (PAH, PCB, or DDTR) to determine the extent to which these areas coincide with sediment risk.

**Response:**

Risks via the food chain were calculated using average chemical concentrations in the sediment because mammals and birds do not feed at single locations. Therefore, it is not appropriate to calculate food chain risks at each sediment location.

**Comment 10:**

In areas where the PEC quotient exceeds 1, remedial options could be considered in lieu of additional investigative work. However, better synthesis of the existing data and definition of areas needing further work would have to be performed first.

**Response:**

Please see responses to General Comments 6 and 8.

**Comment 11:**

The text on page 2-6 notes that the Phase II RIA data "show concentrations that are similar to or lower than the historical data." This apparent trend could be more clearly presented with a graph that compares concentrations for the main chemicals of concern.

**Response:**

Samples collected as part of the Phase III investigation were biased towards areas with the greatest chemical concentrations based on historic data. Therefore, graphical representations of the data would be skewed by other locations within the wetlands that have lower chemical concentrations in historic samples. The Navy believes the figures in Appendix D are adequate for a qualitative comparison of current versus historic data, especially as the concentrations relate to the TEC and PEC.

**Comment 12:**

The depth of sediment above the dredge spoils at 2WSD58 was 2.5 inches. According to Table 2-2, the sample interval was 0-4 inches. Please clarify. Did the sample include dredged material?

**Response:**

The sample interval from 0 to 4 inches was sent to the laboratory for chemical analysis. The dredge spoils were observed at 2.5 inches at that location so the sample included about 1.5 inches of dredge material.

**SPECIFIC COMMENTS**

**Comment 1: p. 2-4, §2.3**

The first bullet incorrectly lists the number of metals/samples with rejected data. There were actually ten locations for antimony and five locations for selenium where the data should have been rejected (*see also* comment for Appendix B). Please correct.
Response:

**Response:**

Please see response to EPA Specific Comment 7.

**Comment 2: p. 2-7, §2.3.3**

The text discusses the concentrations of PAHs in the ditch near the weapons area. The previous sample (2WSD9) had a concentration of 411 mg/kg and the new, adjacent sample was 48 mg/kg. The text states that concentrations of PAHs have decreased over time in this area. This assertion overstates the observation. The difference between the two sample concentrations only reflects a spatial difference and does not indicate a temporal trend. This misleading text should be deleted from the report.

**Response:**

The sample near location 2WSD9 was added based on an EPA comment on the draft QAPP. The objective of that sample was to confirm the elevated PAH result at 2WSD9 and determine whether the concentrations of PAHs were still elevated. The new sediment sample (at 2WSD57) was collected within a few feet of the wooden stake that marked sample location 2WSD9 so the sample represents more of a temporal trend than a spatial trend. However, instead of stating the concentrations "have decreased over time" the sentence will be revised to state: "Therefore, the current concentrations of PAHs and metals at

2WSD57 are lower than they were at 2WSD9, and the elevated cadmium ....." Other references to this statement in the report also will be modified, accordingly.

**Comment 3: Figure 2-2**

It is not clear if the figure represents the depth of the organic material or the thickness of the overlying sediment. Should the figure indicate depth "to" dredge spoils instead of depth "of" dredge spoils?

**Response:**

The title of Figure 2-2 will be changed to say "Depth To Dredge Spoils."

**Comment 4: p. 3-16**

Section 3.7.1 asserts that the sediment risk indicated by chemical concentrations above TEC and PEC benchmarks is exaggerated because of habitat unsuitability. This is not correct because the SERA previously identified the area as benthic invertebrate habitat. Also, this section states that benthic invertebrates would not live here because the area was dry during the fall of 2007. The summer/fall of 2007 was particularly dry and certainly not typical. Low dissolved oxygen and stagnation are cited as reasons why benthic invertebrates would not be present. While EPA agrees that the area may not support a rich and varied benthic community, these conditions could support invertebrates that could serve as a food base for amphibians or birds. Finally, TOC is mentioned as a mitigating factor. There are protocols for evaluating risk from some chemicals based on TOC (notably PAHs); however the data collected for this report do not support use of these protocols. Please delete these statements.

**Response:**

Please see response to General Comments 3 and 4.

**Comment 5: p. 5-1**

The text is not consistent with the available evidence and is not relevant to risk management. The statement that Phase III RI samples indicate that PAH and metals concentrations have decreased over time is not sufficiently documented. The variability in sediments horizontally and vertically requires a more robust study to definitely show that an actual reduction has occurred. Regarding the DDT concentrations, it is not clear why it matters that the higher-effect levels are bounded in the horizontal direction. The only available lines of evidence (sediment benchmarks, food chain models) indicate risk.

**Response:**

The text in this section will be modified based on the Navy's responses to other EPA comments. It is important to know whether DDT concentrations are bounded to less than the higher-effects levels in the horizontal direction to determine whether additional sampling may be necessary.

**Comment 6: R-1**

Please include the reference for the NOAA screening values used (Buchman, 1999). This paper is referenced in Table 2-5.

**Response:**

The reference, Buchman 1999 was actually updated in 2006. The new reference will be cited in Table 2-5 and the reference will be added to the reference section. None of the values for chemicals where Buchman 1999 was used were updated in the 2006 version.

**Comment 7: Appendix B**

The October 2007 QAPP stated that the sediment samples should have 30% solids. At 8 of 16 sediment sample locations (2WSD43, 2WSD44, 2WSD45, 2WSD47, 2WSD50, 2WSD51, 2WSD54, 2WSD55) the percent solids did not meet this preferred level. The validation reports in Appendix B note that for samples that had lower percent solids, non-detect values were rejected. Some of the results for antimony (*e.g.,* at 2WSD45, 2WSD47, 512WSD51, 2WSD54, and 2WSD55) and selenium (2WSD45) should be flagged as UR, not just U. Please correct the data tables (*e.g.,* Appendix B Wetland Table 2) for these samples.

**Response:**

There were several locations where the percent solids were less than 30% but non-detected data were not rejected because of a hierarchy that was followed during the data validation process. For example, if a parameter in a sample is qualified as a "U" because of "laboratory blank contamination", the "U" qualifier trumps the "R" qualifier, so the result is not rejected.

**Comment 8: Appendix F, Table 1**

It appears that the mammal LOAEL TRVs for PAHs were based on a mean for LOAELs for growth, reproduction, and survival for low-molecular or high-molecular weight PAHs in EPA (2007). Please clarify how the values were derived from the cited EcoSSL document.

**Response:**

As stated in the last paragraph of Section 3.4.2 on Page 3-7, "..., the geometric mean of growth and reproduction LOAELs from the chemical-specific Eco SSL documents were used to calculate LOAEL TRVs."

**Comment 9: Appendix F, Table 3**

The bioaccumulation factors listed are not the same values used for some chemicals to calculate dietary exposures in the food chain model calculations in the Appendix G tables. The BSAF for PAHs is listed as 1.0, while the value used in the uptake equations was 0.29. Please revise Table 3 to explain where the bioaccumulation factors originated.

**Response:**

As indicated in the middle paragraph on Page 3-8, "Fish BSAFs were used for organic chemicals (except PCBs) because sediment-to-invertebrate BSAFs were not available for most organic chemicals." The following footnote will be added to Table 3: "Fish BSAFs were used for organic chemicals (except PCBs) in the food chain model in Appendix G because sediment-to-invertebrate BSAFs were not available for most organic chemicals."

**RESPONSES TO USFWS'S APRIL 28, 2008 COMMENTS ON THE PHASE III REMEDIAL INVESTIGATION FOR THE AREA A WETLAND – SITE 2B NAVAL SUBMARINE BASE – NEW LONDON, GROTON, CONNECTICUT MAY 2, 2008**

**Comment 1: Section 2.2**

Table 2-9 does not have a corresponding location 2W-SD-SD46-0002, as stated in the text, with a subsurface PAH concentration. Please clarify.

**Response:**

The text in Section 2.2 will be corrected to reference 2W-SD-SD45-0002 instead of 2W-SD-SD46-0002.

**Comment 2: Section 2.3.1**

EPA Region 1 supports the use of Pro-UCL 4.0 for the determination of representative concentrations for detection limit and UCL issues and its use may aid in this investigation.

**Response:**

Upper Confidence Limits were not calculated for the risk assessment, so Pro-UCL 4.0 will not be used. Please see response to USFWS Comment 12.

**Comment 3: Section 2.3.3**

It would be beneficial to have graphical presentations of the data, to evaluate contaminant concentrations over time and substantiate statements of generally decreasing trends for major contaminants of concern.

**Response:**

Please see the Navy's response to EPA's General Comment 11.

**Comment 4: Section 3.7**

It would be helpful to state the Threshold Effects Concentration (TEC) and Probable Effects Concentration (PEC) on each figure (Appendix D, Figures 1-12) for the individual contaminants of concern.

**Response:**

The TECs and PECs will be added to each figure. Note that the flysheet in front of the figures in Appendix D indicates that green locations have chemical concentrations less than the TEC, yellow locations have chemical concentrations between the TEC and PEC, and red locations have chemical concentrations greater than the PEC.

**Comment 5: Section 3.7.1**

PAHs are elevated along the base of the landfill but there appears to be a small data gap northeast of samples T8B/9B. These samples were taken in 1999, are above TEC criteria, and are not bounded with below TEC detections until 2WMW5S/2WSD5/2WSD3. Therefore, it is unclear if PAH concentrations emanate farther into the wetland than just along the base of the landfill and if temporal trends have led to decreasing concentrations.

**Response:**

The samples in question were collected during the Focused Feasibility Study (FFS) in 1994, not 1999. The sample dates were not in the database so the default 99990101 date was included on Table 2 in Appendix C. The correct dates will be added to the database and tables.

As presented in the Phase III QAPP, the Phase III sampling focused on the western portion of the wetland, with a few exceptions, because that is where the greatest chemical concentrations were observed during previous investigations. No samples were proposed for collection from the area in question. It is not known whether PAH concentrations emanate farther into the wetland than just along the base of the landfill or whether temporal trends have led to decreasing concentrations. However, PAH concentrations greater than the TEC, but lower than the PEC, are not likely to drive a remedial action, so it is not necessary to collect additional data.

**Comment 6:**

Chlordane (gamma/alpha) is detected in approximately 30% of the samples, has minimum detected concentrations exceeding screening levels, and a hazard quotient of 18. The concentrations are of a significant enough frequency and magnitude to warrant additional consideration. Co-location with tDDT distribution throughout the wetland could magnify total risks due to pesticides. Modeled risks to biota should be evaluated and added into total risk scenarios.

**Response:**

As presented in the Phase III QAPP, alpha and gamma chlordane were detected in approximately 30 percent of the sediment samples, but at much lower concentrations compared to their screening levels than were tDDT. The QAPP stated that the further evaluations of pesticides at the site would focus on 4,4 -DDD, 4,4'-DDE, and 4,4'-DDT because these are the primary pesticide risk drivers. It was assumed that potential risks to sediment invertebrates from the other pesticides would be accounted for by evaluating risks from 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT. To address USFWS's concern, a total chlordane figure will be added to Appendix D, similar to the other figures in Appendix D.

**Comment 7:**

Elevated arsenic patterns suggest a potential transport pathway along the upper thumb (southwest corner of the Weapons Center) of the wetland.

**Response:**

The Navy does not believe that elevated arsenic patterns suggest a transport pathway along the southwest corner of the wetland near the Weapons Center. Arsenic concentrations were only particularly elevated at two locations (see attached Table 1). 2WSD55 and 2WSD50 had arsenic concentrations of 52.5 mg/kg and 43.6 mg/kg, respectively. Most of the other arsenic concentrations across the site were less than 15 mg/kg. The reason for these two elevated detections is not known, but the elevated detections do not appear to be linked to a source. None of the other sediment or surface soil samples associated with the Area A Weapons Center had arsenic levels greater than 20 mg/kg.

**Comment 6:**

Cadmium is elevated within the thumb but is also detected far into the wetland. The outer wetland locations, elevated above TEC and PEC, are not bounded and suggest further investigation.

Response:

The locations where cadmium concentrations exceed the TEC are generally in the middle portions of the wetland, away from potential source areas (i.e., Area A Weapons Center and Area A Landfill). The locations where cadmium concentrations exceeded the PEC were sporadic and not indicative of a particular source of contamination. With one exception, all concentrations that exceeded the PEC were just slightly greater than the PEC (quotients were <1.5). One sediment sample (at 2WCSD5) had a cadmium concentration of 29.5 mg/kg; cadmium was not detected in a Phase III sample (at 2WSD53), which is adjacent to 2WCSD5. Based on an EPA comment on the draft QAPP, one sediment sample (at 2WSD58) was added to the Phase III investigation to evaluate the presence of cadmium near 2WSD8 and 2WTB8. Cadmium was not detected at 2WSW58. In fact, cadmium was either not detected or detected at low concentrations (less than the PEC) in all of the Phase III sediment samples. Therefore, cadmium at the site does not appear to be a significant risk driver that warrants further investigation to bound its extent.

**Comment 8:**

Elevated iron levels are suggested to potentially be attributable to more recent sources such as groundwater/surface water. This should be further investigated or substantiated, especially if other contaminants are co-occurring within new waste sources.

Response:

The Navy acknowledges that iron flocculent has been observed in the Area A Wetland indicating that iron is precipitating from the groundwater after it becomes surface water. The Navy conducted a concentration investigation in 2002. The results of this evaluation were presented in the Year 3 Annual Groundwater Monitoring Report for Area A Landfill (TtNUS, 2003). The investigation concluded that under mildly reducing anaerobic conditions, iron oxyhydroxide coatings on sediment grains undergo reduction to more soluble states and dissolution occurs. The primary result is mobilization of iron in the sediment porewater. This is one likely source of the iron flocculent observed at the site and the cause for the elevated concentrations of iron in the sediment. In addition, for the State of Connecticut, the USGS National Water Summary (USGS, 1986) reports that high concentrations of iron (up to 40,000 ug/L) are a common natural groundwater-quality problem in Connecticut. Therefore, the elevated levels of iron in sediment are not indicative of a new source so further investigation of iron at the site is not necessary.

**Comment 10:**

It is apparent that several contaminants of concern (COC) exceed TECs and/or PECs, generally in the western thumb of the wetland but also along the base of the landfill and east of the Weapons Center. The more concentrated pattern in the western thumb suggests potential impacts to sediment invertebrates from the combined co-occurring COC present at low to moderate levels and lesser but potential impacts in more isolated regions emanating from the landfill and Weapons Center.

Response:

The Navy agrees that the greatest potential for risks to sediment invertebrates is in the western portion of the wetland along the dike, along the base of the landfill, and just east of the Weapons Center. Potential risks to sediment invertebrates in the more isolated regions away from the landfill and Weapons Center are possible, but less likely.

**Comment 11:**

As discussed by EPA, statements concerning the perceived low to no potential risk to sediment invertebrates are conjectural at this juncture. Many wetlands experience hydrologic fluxes throughout the year and provide seasonally variable resources to biota. Invertebrate biomass flux with these hydrologic patterns and is opportunistically utilized by upper food chain biota, especially migratory birds and amphibians which often critically linked to these cyclic food sources. Sediment invertebrate surveys during seasonal flux would help determine if the wetland is functioning in this manner. In lieu of this data, we assume that the wetland should be capable of providing those resources and that contaminant concentrations may be impacting those services. Additionally, as with most wetlands, TOC content is high. There are quantitative mechanisms to evaluate potential TOC influence on contaminant bioavailability and these should be conducted. Furthermore, if indicated, toxicity tests could be conducted to address if COC are bioavailable and impacting sediment-associated biota.

Response:

Please see the Navy's response to EPA's General Comments 3 and 4.

**Comment 12: Section 3.7.2**

Discuss the data from Tables 3-2/3-3 for comparison to Tables 3-5/3-6. State whether arithmetic or geometric means were used for calculation inputs. Typically, both the average and 95% UCL or reasonable maximum are modeled and should be considered for further evaluation.

Response:

On Tables 3-2 and 3-3, the maximum concentrations were used for the food chain model because these results were presented in the screening step. On Tables 3-5 and 3-6, the arithmetic means were used for the food chain model because these results were presented in Step 3a..

**Comment 13: Section 3.7.2.1**

As mentioned previously, non-quantitative evaluation of potential TOC-COC interactions is not sufficient to dismiss COC as potential risk drivers. Atmospheric deposition of mercury in the wetland is a distinct probability; however, without appropriate background data this is not substantiated. Furthermore, the bird tissue data warrants further discussion relative to potential avian exposure dynamics for all COCs. We would be interested to review the bird and frog tissue investigation so that we can better evaluate its ability to contribute to risk evaluation.

Response:

Please see the Navy's response to EPA's General Comment 3.

Based on the spatial distribution of the mercury concentrations and the low concentrations of mercury in most of the sediment samples (less than 0.3 mg/kg), it is difficult to attribute mercury to a site-related release, except perhaps at T6B.

The bird and frog tissue data are presented on the CD in Appendix B. The samples were collected in 1991; however, the data are almost 17 years old and the exact locations of the samples are not known.

**Comment [illegible] Section 3.7.2.2**

Mallard home range [illegible] are significantly reduced during breeding and may be restricted to areas much smaller than stated. It is [illegible] how Area Use Factors (AUFs) have been used in determining COC exposure/effects and it warrants further discussion relative to food uptake modeling for all species. Iron concentrations (Table 2-7) are up to 315,000 mg/kg. Average and maximum concentrations are up to an order of magnitude higher than adjacent [illegible] soil concentrations and allude to groundwater/surface water influx or other contaminant processes [illegible], as discussed previously, and warrant further discussion.

Response:

Area use factors were discussed qualitatively in the Step 3a refinement step but were not quantitatively used to calculate risks. Although the iron concentrations are elevated, iron is typically not bioavailable, especially at pH values greater than 5.5 (the average pH at the site is 5.7), and at high TOC levels. Also, please see the Navy's response to USFWS Comment 9.

**Comment [illegible]: Appendix C, Table 1**

Provide Phase designations for all sample locations. Table 2: Clarify sample year designations for all Phase 1 data provided. Provide event designations for all locations. Please clarify why boron was rejected for 1999 samples and unreported for all 2007 samples. Provide a footnote to describe detection qualifiers at the end of the table.

Response:

The phase designations will be provided in Tables 1 and 2. The dates when the Phase 1 samples were collected will be clarified in Table 2. The rejected boron data were from samples collected in 1990, during the Phase I RI. The data were rejected because sulfur interfered with the instrument's detector used to quantify boron, causing elevated readings. Basically, the wavelength of sulfur was the same as the wavelength for boron. Boron has not been an issue at the site, and was not proposed for analysis in the Phase II QAPP. Footnotes will be added to Tables 1 and 2 that describe the qualifiers.

**Comment [illegible]:**

This refined SERA shows elevated risk to varying biota in a few general areas, as mentioned. The presence of co-occurring [illegible] that exceed risk thresholds, even though at low to moderate levels, infers impacts may be occurring. As presented, the SERA does not sufficiently characterize elevated risk in a manner that would allow for no further evaluation as stated. Presentation of TEC/PEC quotients for co-occurring COC, as suggested by EPA, along with issues discussed above, would aid in evaluation of combined risk issues.

Response:

Please see the Navy's response to EPA's General Comment 8.

## TABLE 1

## SUMMARY OF SEDIMENT/SOIL RESULTS EXCEEDING PECS AND PEC-QUOTIENTS
## SITE 2B - AREA A WETLAND
## NSB-NLON, GROTON, CONNECTICUT

| | Sample Concentrations (organics in ug/kg, metals in mg/kg) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LOCATION | TOTAL PAHS | TOTAL DDT | AROCLOR-1260 | ARSENIC | CADMIUM | COPPER | LEAD | MERCURY | NICKEL | ZINC | TOTAL PAHS | TOTAL DDT | AROCLOR-1260 |
| 2WSD3 | 1,060 | 57 | 350 UJ | 9.5 | 5.3 | 69.5 | 46.1 | 0.31 | 27 | 127 | 0.05 | 0.10 | |
| 2WSD8 | 4,940 | 0 U | 320 UJ | 8.1 | 5 | 71.5 | 69.2 | 0.48 | 24.2 | 124 | 0.22 | | |
| 2WSD9 | 411,400 | 0 U | 640 UJ | 11.8 | 6.1 | 39.6 | 241 | 0.24 | 21.2 | 109 | 18.04 | | |
| 2WSD43 | 3,115 | 1,355 | 300 | 16.6 | 1.8 | 161 | 127 | 0.72 | 30.9 | 654 | 0.14 | 2.37 | 0.44 |
| 2WSD44 | 7,633 | 122 | 150 | 12.8 | 1.1 | 82.3 | 45.2 | 0.26 | 19.6 | 600 | 0.33 | 0.21 | 0.22 |
| 2WSD45 | 4,130 | 1459 | 46 U | 12.4 | 2.5 | 60.6 | 51.3 | 0.28 | 28.7 | 200 | 0.18 | 2.55 | |
| 2WSD47 | 8,171 | 989 | 430 | 7.5 | 2.6 | 120 | 94.8 | 0.34 | 36 | 322 | 0.36 | 1.73 | 0.64 |
| 2WSD48 | 11,479 | 515 | 580 | 11.5 | 1.2 | 59.9 | 49.7 | 0.21 | 30.2 | 624 | 0.50 | 0.90 | 0.86 |
| 2WSD49 | 1,640 | 87 | 56 U | 14.6 | 1.2 | 92.3 | 39.2 | 0.13 | 28.3 | 646 | 0.07 | 0.15 | |
| 2WSD50 | 2,430 | 118 | 370 | 43.6 | 0.14 UR | 64 | 54 | 0.29 | 28.8 | 447 | 0.11 | 0.21 | 0.55 |
| 2WSD52 | 2,230 | 794 | 46 U | 13.5 | 1.1 | 96.7 | 119 | 0.31 | 23.5 | 60.6 | 0.10 | 1.39 | |
| 2WSD55 | 2,246 | 3.9 | 73 UR | 52.5 | 0.10 UR | 41.2 | 33.4 | 0.23 | 15.2 | 80.1 | 0.10 | 0.01 | |
| 2WSD57 | 48,109 | 0 | 0 | 4.3 | 1.1 | 19.2 | 159 | 0.02 | 11.2 | 339 | 2.11 | | |
| 2WCSD14 | 31,265 | 0 | 0 | 10.3 | 0.76 U | 33.2 | 106 | 0.19 U | 22.3 | 154 | 1.37 | | |
| 2WCSD4 | 24,326 | 66.5 | 600 UJ | 6.9 | 1.1 | 39.4 | 49.9 | 0.38 | 18.5 | 61.9 | 1.07 | 0.12 | |
| 2WCSD5 | 2,982 | 10 | 630 UJ | 5.6 | 29.5 | 57.2 | 204 | 0.18 | 31.5 | 292 | 0.13 | 0.02 | |
| 2WSD23 | | 693 | 150 U | | | | | | | | | 1.21 | |
| 2WSD24 | | 3,340 | 470 U | | | | | | | | | 5.84 | |
| 2WSD25 | | 8,420 | 480 U | | | | | | | | | 14.7 | |
| T2A | 6,262 | 524 | 50.5 U | 2.5 | 0.38 | 103 | 133 | 0.21 | 57.3 | 302 | 0.27 | 0.92 | |
| T3A | 26,869 | 1,540 | 390 U | 3 | 0.26 | 34.5 | 32.1 | 0.15 | 8.6 | 87.4 | 1.18 | 2.69 | |
| T3B | 5,588 | 4,630 | 500 U | 2.6 | 0.43 | 52.6 | 61.5 | 0.19 | 18.9 | 284 | 0.25 | 8.09 | |
| T5A | 3,172 | 1,737 | 240 U | 2.1 | 0.15 U | 28.4 | 40.6 | 0.15 UR | 13.8 | 68.2 | 0.14 | 3.04 | |
| T6A | 3,558 | 12.5 | 1,450 | 7.7 | 0.68 | 124 | 125 | 0.43 | 27.6 | 204 | 0.16 | 0.02 | 2.14 |
| T6B | 2,309 | 448 | 530 | 4.8 | 0.68 | 82 | 78.4 | 1.2 | 15.8 | 172 | 0.10 | 0.78 | 0.78 |
| T7B | 4,280 | 140 | 550 | 8.1 | 1.6 | 173 | 110 | 0.76 UR | 47.7 | 702 | 0.19 | 0.24 | 0.81 |
| T9A | 2,239 | 679 | 57 U | 7.2 | 0.57 | 48.1 | 40.6 | 0.27 U | 20.7 | 132 | 0.10 | 1.19 | |
| 2WMW2S | 849 | 0 | 170 U | 2.5 | 6.9 | 26.1 | 16.3 | 0.11 U | 25.3 | 125 | 0.04 | | |
| 2WTB2 | 1,240 | 0 | 370 | 8.1 | 7.2 | 20.2 | 11.2 | 0.18 U | 26.8 | 75.5 | 0.05 | | 0.55 |
| 2WTB7 | 170 | 0 | 300 U | 7.2 | 6.7 | 39.1 | 49.5 | 0.38 | 26.2 | 79.8 | 0.01 | | |
| 2WTB8 | 4,279 | 0 | 330 U | 6.8 | 6.7 | 55 | 83.7 | 0.67 | 26.9 | 62.9 | 0.19 | | |

## TABLE 1

## SUMMARY OF SEDIMENT/SOIL RESULTS EXCEEDING PECS AND PEC-QUOTIENTS
## SITE 2B - AREA A WETLAND
## NSB-NLON, GROTON, CONNECTICUT

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PEC | 22800 | 572 | 676 | 33 | 4.98 | 149 | 128 | 1.06 | 48.6 | 459 | 22800 | 572 | 676 |

Shaded cells are chemical concentrations that exceed their respective PEC or PEC-Quotients that are greater than 1.0.

PEC-Q = Sample Concentration/PEC
PEC - Probable Effects Concentration

## TABLE 1

## SUMMARY OF SEDIMENT/SOIL RESULTS EXCEEDING PECS AND PEC-QUOTIENTS
## SITE 2B - AREA A WETLAND
## NSB-NLON, GROTON, CONNECTICUT

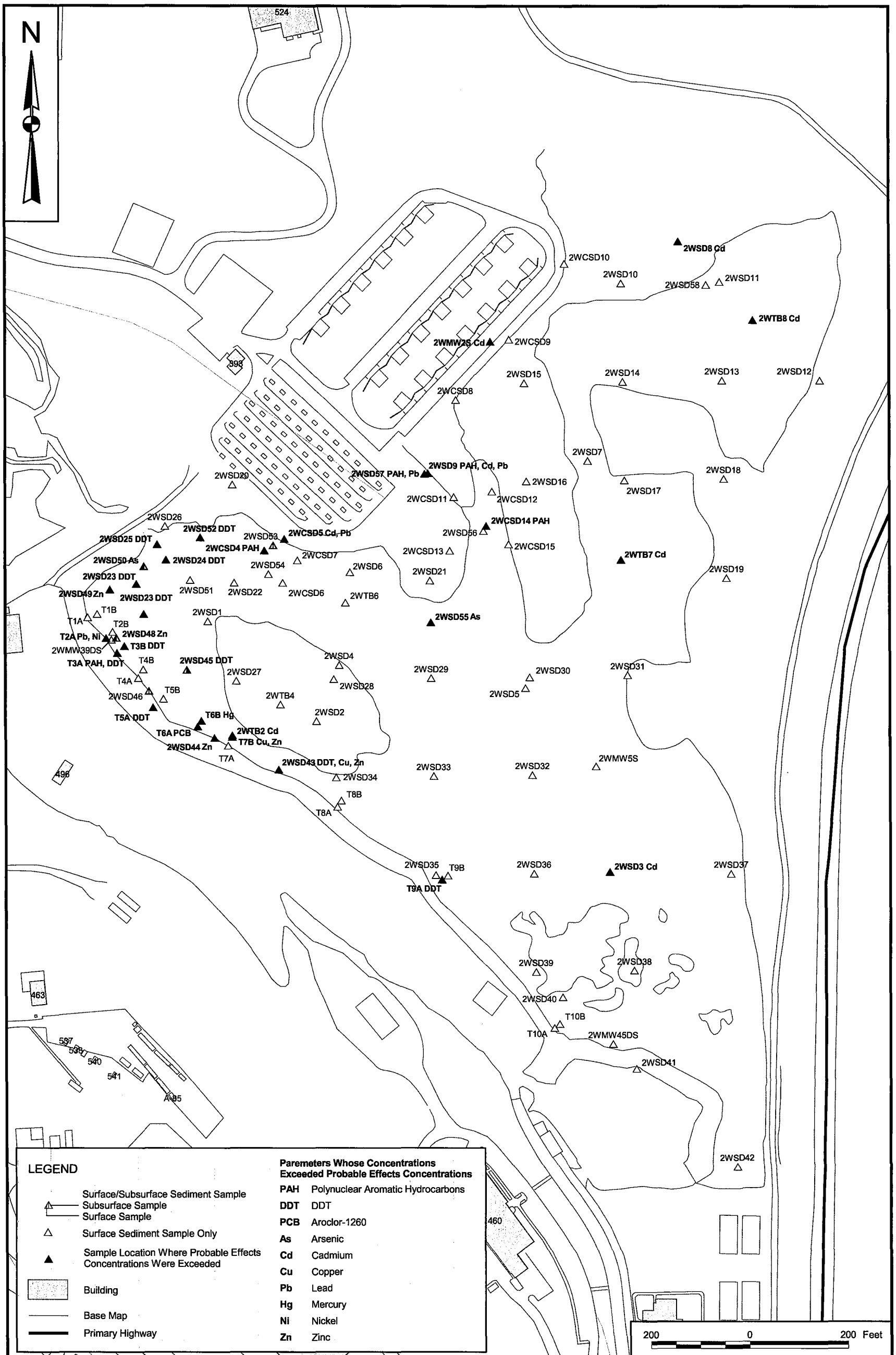
| PEC-Quotients | | | | | | | AVERAGE |
|---|---|---|---|---|---|---|---|
| ARSENIC | CADMIUM | COPPER | LEAD | MERCURY | NICKEL | ZINC | PEC-Q |
| 0.29 | 1.06 | 0.47 | 0.36 | 0.29 | 0.56 | 0.28 | 0.38 |
| 0.25 | 1.00 | 0.48 | 0.54 | 0.45 | 0.50 | 0.27 | 0.46 |
| 0.36 | 1.22 | 0.27 | 1.88 | 0.23 | 0.44 | 0.24 | 2.83 |
| 0.50 | 0.36 | 1.08 | 0.99 | 0.68 | 0.64 | 1.42 | 0.86 |
| 0.39 | 0.22 | 0.55 | 0.35 | 0.25 | 0.40 | 1.31 | 0.42 |
| 0.38 | 0.50 | 0.41 | 0.40 | 0.26 | 0.59 | 0.44 | 0.63 |
| 0.23 | 0.52 | 0.81 | 0.74 | 0.32 | 0.74 | 0.70 | 0.68 |
| 0.35 | 0.24 | 0.40 | 0.39 | 0.20 | 0.62 | 1.36 | 0.58 |
| 0.44 | 0.24 | 0.62 | 0.31 | 0.12 | 0.58 | 1.41 | 0.44 |
| 1.32 | | 0.43 | 0.42 | 0.27 | 0.59 | 0.97 | 0.54 |
| 0.41 | 0.22 | 0.65 | 0.93 | 0.29 | 0.48 | 0.13 | 0.51 |
| 1.59 | | 0.28 | 0.26 | 0.22 | 0.31 | 0.17 | 0.37 |
| 0.13 | 0.22 | 0.13 | 1.24 | 0.02 | 0.23 | 0.74 | 0.60 |
| 0.31 | | 0.22 | 0.83 | | 0.46 | 0.33 | 0.59 |
| 0.21 | 0.22 | 0.26 | 0.39 | 0.36 | 0.38 | 0.13 | 0.35 |
| 0.17 | 5.92 | 0.38 | 1.59 | 0.17 | 0.65 | 0.64 | 1.07 |
| | | | | | | | 1.21 |
| | | | | | | | 5.84 |
| | | | | | | | 14.72 |
| 0.08 | 0.08 | 0.69 | 1.04 | 0.19 | 1.18 | 0.66 | 0.57 |
| 0.09 | 0.05 | 0.23 | 0.25 | 0.14 | 0.18 | 0.19 | 0.56 |
| 0.08 | 0.09 | 0.35 | 0.48 | 0.18 | 0.39 | 0.62 | 1.17 |
| 0.06 | | 0.19 | 0.32 | | 0.28 | 0.15 | 0.60 |
| 0.23 | 0.14 | 0.83 | 0.98 | 0.41 | 0.57 | 0.44 | 0.59 |
| 0.15 | 0.14 | 0.55 | 0.61 | 1.13 | 0.33 | 0.37 | 0.49 |
| 0.25 | 0.32 | 1.16 | 0.86 | | 0.98 | 1.53 | 0.70 |
| 0.22 | 0.11 | 0.32 | 0.32 | | 0.43 | 0.29 | 0.37 |
| 0.08 | 1.39 | 0.18 | 0.13 | | 0.52 | 0.27 | 0.37 |
| 0.25 | 1.45 | 0.14 | 0.09 | | 0.55 | 0.16 | 0.40 |
| 0.22 | 1.35 | 0.26 | 0.39 | 0.36 | 0.54 | 0.17 | 0.41 |
| 0.21 | 1.35 | 0.37 | 0.65 | 0.63 | 0.55 | 0.14 | 0.51 |

**TABLE 1**

**SUMMARY OF SEDIMENT/SOIL RESULTS EXCEEDING PECS AND PEC-QUOTIENTS**
**SITE 2B - AREA A WETLAND**
**NSB-NLON, GROTON, CONNECTICUT**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 33 | 4.98 | 149 | 128 | 1.06 | 48.6 | 459 | |

P:\GIS\NLON\MAPDOCS\APR\AREA A SITE LOCATION.APR AREA A PHASE III PROBABLE EFFECTS CONCENTRATIONS LAYOUT 04/24/08 JEE




| | | | |
|---|---|---|---|
| DRAWN BY J. ENGLISH DATE 04/23/08 | Tetra Tech NUS, Inc. | CONTRACT NUMBER CTO 0439 | OWNER NUMBER — |
| CHECKED BY A. BERNHARDT DATE 04/24/08 | SAMPLE LOCATIONS WITH EXCEEDANCES OF PROBABLE EFFECTS CONCENTRATIONS<br>AREA A WETLAND<br>NAVAL SUBMARINE BASE NEW LONDON<br>GROTON, CONNECTICUT | APPROVED BY — | DATE — |
| COST/SCHEDULE-AREA | | APPROVED BY — | DATE — |
| SCALE AS NOTED | | DRAWING NO. FIGURE 1 | REV 0 |