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U S NAVY RESPONSES TO THE U S EPA REGION I COMMENTS ON THE DRAFT REMEDIAL INVESTIGATION REPORT QUONSET DEVELOPMENT CORPORATION OUTFALL 001 FORMER NCBC DAVISVILLE RI
05/28/2015
RESOLUTION CONSULTANTS

Navy Responses to
United States Environmental Protection Agency
Comments Dated February 3, 2015
On QDC Outfall 001 Draft Remedial Investigation,
Former Naval Construction Battallion Center (NCBC) Davisville, North Kingstown, Rhode Island

(May 28, 2015)

EPA comments on the Navy's QDC Outfall 001 Draft Remedial Investigation (December 2014), are presented below. The EPA comments are presented first, followed by the Navy responses (*italics*).

1. In general EPA is disappointed that Navy submitted this RI using a non-site specific background study to determine site related risks. The approved work plan stated that if an appropriate data set was found it would be used to determine site related contamination and risks. EPA was not consulted as to the appropriateness of the background studies used and does not agree that they were appropriate based on the information provided during the BCT call on January 13, 2015 and the e-mail from Jeff Dale received January 14, 2015. Therefore, EPA rejects the specific conclusions of the determination of site related risk and the entire Appendix E. Please revise with either a site-specific background study, a qualitative evaluation of existing data, or use the site data as is in the risk assessment without any determination of "background".

The results of the HHRA, without comparison to non-site related background concentrations, and the site data comparison to ecological benchmarks provides enough information to move ahead to a feasibility study. It would be appropriate to evaluate several types of active remedial actions that would greatly improve the area that has been neglected since Navy substantially ceased operations in the 1970s.

EPA agrees with RIDEM conclusions noted in comment #31 from their February 2, 2015 letter that the data evaluation does support a CERCLA action at this OU.

Navy Response – Upon Navy's consultation with EPA and review of data suggested by EPA, Resolution will conduct a qualitative background evaluation for use in the HHRA and ERA. This qualitative background evaluation will consist of the following background data sets:

Surface Soil: The background data set will be comprised of the 18 background surface soil samples from the Phase II RI. These samples were analyzed for metals only.

Sediment: EPA suggested review of nine sediment samples based on locations on Figure 2-1 of the 1996 Facility Wide Freshwater/Terrestrial Ecological Risk Assessment. Resolution reviewed these locations and determined that several are tidally influenced. Of the nine suggested samples, four are from freshwater locations and will be used to represent qualitative background (TRC1, TRC5, TRC6, and AHW07).

The Navy may elect to revisit background conditions for the QDC Outfall 001 soil and sediment. As necessary to frame any potential risks or clean-up concentrations, a site-specific background

study may be undertaken. Any study would be conducted in consultation and agreement with EPA and RIDEM.

2. The document provides an analysis of the potential exposure and risk of ecological receptors based on an analysis through Step 3A. As stated above, the ecological risk assessment sections should be revised to remove the refinement based on background or revise the evaluation with a site-specific background study or a qualitative evaluation of background data.

Navy Response – See response to Comment 1. The ERA will be revised based on a qualitative evaluation of background data.

3. The evaluation of risk generally follows EPA Guidance. However, EPA does not concur with the interpretation of the significance of the risk as presented in the Risk Characterization and Summary and Conclusions. Please see specific comments, below.

Navy Response – The Navy acknowledges this comment. Please see responses to specific concerns in the comments as indicated by EPA, below.

4. EPA considers this area a potential drinking water source, class IIB. Rhode Island (RI) groundwater standards are NOT at all applicable to Superfund sites in RI since they are NOT an approved GSGWPP (Comprehensive State Groundwater Protection Programs) state.

Under current policy ("The Role of Comprehensive State Groundwater Protection Programs ("CSGWPPs") in EPA Remediation Programs, OSWER Directive 9283.1-09 (April 4, 1997) available at http://www.epa.gov/superfund/health/conmedia/gwdocs/pdfs/role.pdf):

"For States that have a CSGWPP that has been endorsed by EPA and has provisions for site-specific decisions, EPA will generally defer to State determinations of current and future ground-water uses . . . . For States that do not have an EPA-endorsed CSGWPP, or for CSGWPPs that do not have provisions for making site-specific determinations of ground-water use (or resource value, priority or vulnerability), the Superfund program will continue to follow guidance provided in the NCP Preamble . . . ."

The NCP Preamble "guidance" utilizes EPA's 1986 Classification Guidelines, which classify groundwater as follows: Class I - Special Groundwater (e.g., irreplaceable source or ecologically vital); Class IIA-Currently Used Drinking Water Source; Class IIB-Available for use for drinking water or other beneficial use; and Class III-Not a Potential Source of Drinking Water and of Limited Beneficial Use.

Therefore, Federal groundwater standards apply for all groundwater throughout the state (except under landfills) and the Navy must cleanup soils to protect groundwater. Federal drinking water standards (MCLs and non-zero MCLGs) are ARARs for class II waters.

Please remove references to RIDEM GB standards.

Navy Response – The QDC Outfall 001 area (OU10) is in RIDEM's GB Aquifer groundwater classification area (typically located at highly urbanized areas or in the vicinity of disposal sites for solid waste, hazardous waste, or sewerage sludge); however, this classification is not

recognized by EPA, because Rhode Island does not have an EPA-approved Comprehensive State Groundwater Protection Program (CSGWPP). The statement is factual and was included because RIDEM is a signatory of the FFA.

Therefore, the groundwater is federally classified as a drinking water source and, thus, the GA groundwater classification applies to any remedial required under CERCLA. Groundwater classified as GA is presumed suitable for public or private drinking water use without treatment (RIDEM, 2010). In addition, per EPA groundwater remediation guidance, in states without an EPA-approved CSGWPP, such as Rhode Island, CERCLA groundwater remediation must meet federal drinking water standards (i.e., Maximum Contaminant Levels [MCLs] and non-zero Maximum Contaminant Level Goals [MCLGs]) and risk-based standards, or more stringent state groundwater standards, unless the water is non-potable.

5. For consistency, Building 224 should be described as the former Building 224.

Navy Response – This change will be made in the Draft Final Report.

6. The report indicated that only six sediment samples were selected for hexavalent chromium analysis, instead of 10 as outlined in the SAP. This discrepancy does not affect data quality, but may underestimate the extent of hexavalent chromium in wetland sediment.

Navy Response – Based on the conceptual site model, there is no reason to assume the chromium present in the Outfall 001 wetland sediments is hexavalent. A sub-set of samples was analyzed for hexavalent chromium to demonstrate that assuming all chromium in sediments is hexavalent is overly conservative. The SAP indicated 10% of samples would be analyzed for hexavalent chromium. Based on the original number of samples in the SAP, 8 samples should have been analyzed. However, due to field error, only 6 samples were labeled for hexavalent chromium analysis. The error was not intentional. It is notable, however, that the majority of sediment samples analyzed for hexavalent chromium were non-detect. Should hexavalent chromium need to be addressed as part of any remedial action, additional hexavalent chromium samples may be collected, as needed, to better estimate the extent of hexavalent chromium in the wetland sediment. No changes to the RI Report are planned.

7. The Navy identified contaminants of concern (COC) based on the HH or ERA risk assessments, which used background study results from an off-site location to identify COCs. In doing so, many chemicals may have been inappropriately excluded from further analysis. Discussing only COCs identified by the risk assessments limits the assessment of the nature and extent of other chemicals detected at the site, particularly for any chemicals detected in upgradient and overlying soils and/or sediment and in down gradient groundwater.

Navy Response – The COCs identified in the human health risk assessment were selected outside the influence of background. Discussing the COCs in depth in the RI Report provides one measure for assessing the extent of risk-driving contamination in the Outfall 001 wetland. The Navy believes that providing a detailed assessment of every detected contaminant in the soils and sediments would be a large effort that would provide information in the RI that would not be equal to the effort. Even with the current background study (which is currently being updated to a qualitative evaluation), there is potential for ecological risk. Some specific

contaminants have been requested in EPA and RIDEM comments, and these will be discussed in the RI Report. As needed, additional figures may be included in the Feasibility Study.

8. The Navy should provide additional supporting information to document that both the down gradient (horizontal) and vertical boundaries of contaminated media (soil and/or sediment) have been delineated. If supporting information is not available, additional sampling beyond the current down gradient and deepest sample locations may be necessary to assess the full nature and extent of contamination, particularly beyond the distal (northeastern) end of the drainage ditch where concentrations of several chemicals were higher than upgradient and/or shallow samples.

Navy Response – The current sampling has delineated the majority of contaminants in the Outfall 001 study area. Additional sampling for the RI Report is not warranted. However, additional sampling can be conducted to support the Feasibility Study and/or pre-design work that will target specific areas, such as the north eastern edge of the draining ditch. The RI Report will be modified to provide additional supporting evidence for the horizontal and vertical delineation of contamination by the inclusion of additional graphics and figures. Where delineation is not complete, the RI Report will indicate this as a data gap to be addressed in the FS or pre-design stage of the program.

9. The soil and sediment chemical concentration maps (Figures 4-1 through 4-14) use colored dots to represent concentration gradients from 0-1 foot bgs (soil) or 0-0.5 foot bgs (sediment) depth intervals. However, in some cases, the chemical concentration is higher in the deeper interval, but this is not apparent when looking at the colored dots. While the figures do include chemical concentrations from all depth intervals, it is not a transparent methodology for the public to interpret the extent of chemical impacts. For examples of chemical concentrations that were higher at depth, see copper in soil at QF-SO11; zinc in soil at QF-SO13, QF-SO08, QF-SO10; PAH in soil at QF-SO24; trans-Chlordane in soil at QF-SO24; chromium in sediment at QF-SD26; trans-Chlordane in sediment at QF-SO29.

Navy Response –The figures will be revised to indicate chemical concentration gradients in all depths. As examples of the depiction of concentrations at depth, revised figures depicting TPH in soil and sediment have been attached for review.

10. The report mentions that overland run-off has scoured the northern border of the wetland (between the outfall and the entrance to the drainage ditch). The report should discuss whether scouring was also present near sediment sample location QF-SD10 (approximately 40 feet southeast of the outfall excavation), where elevated chemical concentrations were detected.

Navy Response – The extent of apparent scouring, as observed in the field notes and the grainsize distribution data, will be expanded to include the locations such as QF-SD10 such that a more refined conceptual site model is presented.

11. The document did not contain figures for all chemicals detected in groundwater or surface water. The final document should include these figures for chemicals also discussed in the text and chemicals detected above screening levels. The final document should also include figures for chemicals detected in catchbasin soil and groundwater samples.

Navy Response – The RI Report focuses on "risk driver" COCs. Inclusion of these figures is adequate to make the decision to move forward with any remedial actions in the wetland. Presentation of all chemicals detected in any media is not necessary. Some figures, requested specifically for a COC in a certain medium, will be added to the RI Report. Additional figures, if warranted, will be added to the FS.

12. One or more of the CED Area locations (Study Area 01, Site 02, Site 03, Study Area 04) contained shallow subsurface soils (0-2 feet bgs) contaminated with many of the same chemicals detected at the Outfall 001 Site soils. Accordingly, it is possible that migration (via overland flow and/or wind-blown) of contaminated shallow soil from the CED Area to the Outfall 001 Site could be a continuous source of contamination. Based on Tables 3-11A/B and 3-12A/B in the Navy's Draft Final Human Health Risk Evaluation for Construction Equipment Department (January 2014), the following chemicals were detected in surface soils at the upgradient CED Area at similar concentrations to the Outfall 001 Site:

i. Metals, including antimony, arsenic, cadmium, chromium, cobalt, copper, manganese, lead, and zinc
ii. VOCs, including ethylbenzene and total xylenes
iii. SVOCs, including benzo(a)pyrene, benzo(b)fluoranthene, and bis(2-ethylhexyl)phthalate
iv. Pesticides, including 4,4'-DDT, Eldrin, and Eldrin Aldedehyde
v. PCBs, including Aroclor-1260 and Aroclor-1254.

Based on this information, the Outfall 001 conceptual site model should include the CED Area contaminated shallow soil as a potential source of contaminants found at the Outfall 001 Site.

Navy Response – The land between the CED Area and the Outfall 001 Site is predominantly wooded and raised. It is highly unlikely that windblown soils or overland flow is occurring from the CED Area to the wetland. The list of contaminants provided by EPA that are similar between these two study areas is consistent with their unique operations. The contamination in the CED Area will be noted in the RI Report, but the Navy does not believe the CED Area is a former or ongoing source of contamination to the Outfall 001 wetland via either overland flow or windblown dust. The contaminants listed by EPA are common at many CERCLA sites due to their widespread prevalence and many were retained as COPCs due to low screening benchmarks. Please note that only Study Area 01 is within the drainage area of the Outfall 001.

<u>SPECIFIC COMMENTS</u>

13. Page xii: According to the EPA website: http://www.epa.gov/ttnatw01/hlthef/chlordan.html, Chlordane was used as a pesticide in the United States from 1948 to 1988. In 1988, all approved uses of chlordane in the United States were canceled. Therefore it is not possible that chlordane hits are due to uses prior to navy occupation of the CED Area. Please remove the inference.

Navy Response - The reference to potential historical agricultural use will be removed from the Draft Final Report. Please note that chlordane was used at NCBC for pest control in non-agricultural uses until 1983 (Fred C. Hart, 1984). Therefore, historic application of chlordane (for non-agricultural uses) at NCBC is documented, and the presence of this persistent compound can be expected

14. Section 1.1, page 2. The document should more specifically detail the “select data from the TetraTech Drain Line Investigation” that were used and/or excluded, or refer to the table where the selected and excluded data are found. It is acceptable if the reference is to the Tier II SAP, or to the RI Risk Assessments (for example the RI Human Health Risk Assessment, Attachment A, Tables 1-4, appears to include this information.)

Navy Response – The RI Report text will be modified to include a table and description of the TetraTech Drain Line investigation data that were used and those excluded from use.

15. Section 1.2, page 2. The document should include the RIDEM and QDC land use designations, and the definitions and restrictions for those designations, for the site.

Navy Response – The Navy expects current and future use of the OU-10 area consistent with the reuse plan. The reuse plan identified much of OU-10 and the immediate surroundings as wetlands, with the future reuse as "open space/conservation". Future activities in those areas would be subject to the regulations of the Rhode Island Coastal Zone Management Council. Some upland area of the property, adjacent to OU-10, such as the parking area for the bike trail, is proposed for "waterfront commercial" reuse. This information will be included in the Draft Final Report.

16. Section 1.2, page 2, 1st paragraph. In the groundwater flow direction discussion, the text should also mention the groundwater flow map series in Figure 2-5.

Navy Response – Reference to Figures 2.5a-d will be added in the Draft Final Report.

17. Section 1.2, page 2, 2nd paragraph. The last sentence should clarify that the residential neighborhood is located north of Marine Road and include the distance from the nearest site boundary.

Navy Response – The following text will be added to the Draft Final Report: “The residential neighborhood is located north of Marine Road. The closest residential property boundary is approximately 1,000 ft northwest from the outfall; the closest residential property boundary due north is approximately 1,850 ft from the outfall.

18. Section 1.2, page 2, 3rd paragraph. The discussion of the adjacent tidal wetland to the northeast of the site should indicate how far inland the tidal influence extends. The discussion should also describe whether the site drainage ditch becomes inundated with tidal water now that the wooden wall structure has been removed.

Navy Response – Resolution has observed the drainage ditch and wetland during extreme high tide, and flow was still towards Allen Harbor, not back towards the wetland. The approximate surface level of the wetland is 9 feet above mean sea level, or greater than the highest tidal range of approximately 4.4 feet. These observations indicate tidal waters do not reach the drainage ditch despite removal of the wooden wall structure. In addition Phragmites is not tolerant to saline water and would not be prevalent in these areas if they were tidally influenced. Furthermore, the prevalence of Soft Rush (Juncus effusus) and Sedge (Carex spp.) are also indicative of non-tidal wetlands. Discussion of these topics will be included in the Draft Final Report. The term “adjacent tidal wetland” will also be updated to just “adjacent wetland”, as the original description was not accurate.

19. Section 1.3, bullets and Figure 1-2. Two separate drainage systems at Study Area 01 connect to the Outfall 001 drain line. These two drainage systems are described later on page 6 (Section 1.4.1), "For the purposes of this RI, these two additional drainage systems are considered components of the Building 224 drainage system." These two drainage systems are shown in blue on Figure 1-3a. However, the text in Section 1.3 is unclear on whether or not these two additional drainage systems are included in the "...approximately nine storm water catch basins in the vicinity of Study Area 01..." Please clarify the text accordingly, and update Figure 2 as warranted.

For consistency, the reference in the text to the "outdoor vehicle wash pad" should match the figures, which appear to describe this area as the "truck wash pad."

The leaching field area described in the text should be noted on Figure 1-2 and/or Figure 1-3a. For an example, see Figure 2-3 in the Navy's "Final Study Area Screening Evaluation Report for CED Drum Storage Area, NCBC, Davisville, RI," dated September 1994 (Halliburton NUS Corporation).

The text and/or figure should indicate that Catch Basin CB-01 could not be found/is no longer present.

Navy Response – These changes will be made in the Draft Final Report.

20. Section 1.3, page 4, 1st paragraph. The text should more clearly clarify the "removal actions" mentioned in this sentence.

Navy Response – The removal actions will be better defined in the Draft Final Report.

21. Section 1.3, page 4, 4th and 5th paragraphs. Please indicate whether QDC contacted the Navy, EPA, or RIDEM prior to excavating soils from the "mouth of the QDC Outfall 001" in 2008. The text should also discuss the depth, area, and volume of soil excavated. (It is noted in the November 2012 Drain Line Investigation and Data Report that approximately 23 tons of soil was transported as non-hazardous waste for off-site disposal; page 1-3.) This section should also provide similar details of QDC's drainage ditch excavation and waste management.

Navy Response – QDC did not contact the Navy, EPA or RIDEM prior to the excavation of soils from the mouth of the QDC outfall. The work was being conducted at the request of the Rhode Island Coastal Resources Management Council (RICRMC). This will be noted, and the approximate depth, area and volume of soils excavated will be discussed in the Draft Final Report. Details of QDC's drainage ditch excavation and waste management will also be discussed.

22. Section 1.4.1, Page 6, last sentence. "Arsenic, chromium, cobalt, and iron were detected at concentrations above the PSLs. However, these exceedances are not believed to be associated with a release of contamination from the drain line." Please explain the source of the metal exceedances.

Navy Response – The section will be updated with the following:

"Arsenic, chromium, cobalt, and iron were detected at concentrations above the PSLs. Metals are naturally found in the earth's crust in various forms. Metals in soils may also be associated with fill at the site. The concentrations of these metals do not suggest that they originated from a release of contamination from the drain line." The text is consistent with conclusions in the Drain Line Investigation and Data Report, Tetra Tech, November 2012.

23. Section 1.4.2, page 9. The groundwater well PGU-Z3-03D and pore water/surface water location PW/PWS-17 are not displayed on Figure 2-3. While it is understood that PGU-Z3-03D was silted and could not be redeveloped during the RI, its location should be noted on the figure for clarity.

Navy Response – PGU-Z3-03D and PW/PWS-17 will be added to Figure 2-3

24. Section 1.4.4, page 10. The location of the three hand auger points where petroleum odors were observed does not appear to be shown on any of the figures.

Navy Response –The approximate locations of these samples will be added to Figure 2-2

25. Section 2.2, Page 13, paragraph 3. The 12 in. pipe could be an outfall from EBS #53. Please see the June 1998 report map which seems to show a pipe leading from former building 324. In any event this outfall needs to be evaluated and closed. In addition, there is also a storm drain system that drains the CED area including the area south of building 224. See figure 2-18 from the 2012 ACOE document.

Navy Response – In the figure referenced by EPA, it's not labeled as drainage pipe; it's just a line. While this could be drainage from EBS53, it is unlikely. The RI Report will indicate that the origin of the unknown outfall is a data gap to be addressed in the FS or pre-design stage of the program. The storm drain system that drains the CED area does not discharge to the QDC Outfall 001 wetland, but drains directly into Allen Harbor.

26. Section 2.2, page 13; Section 2.10, page 21, Table 2-1. Please define in the text the soil sample depths that are later defined as "surface" or "subsurface" samples. (It is noted the definition is provided later in Section 3.5, page 33, but the definition should be provided at first mention.)

Navy Response – Definition of surface and subsurface sample intervals will be added to section 2.2 in the Draft Final Report.

27. Section 2.2, page 13; Figure 2-1. Figure 2-1 (Soil Sample Locations) does not include the location of the five soil sample collected during the 2010 Drain Line Investigation. However, Figure 2-2 (Surface Water and Sediment Sample Locations) includes the locations of the nine sediment samples collected during the 2010 Drain Line Investigation. The RI figures for soil and sediment should be consistent regarding the inclusion of the 2010 Drain Line Investigation sample locations. This is particularly relevant for any samples collected in 2010 and included in the RI risk assessments.

Navy Response – The soil samples from the 2010 Drain Line Investigation were not included in the RI Report or the risk assessments, but the sediment samples were. The locations of the soil samples were removed during the Maintenance Cleaning when the excavation area was

shaped to construct the containment basin. Therefore these samples were deemed obsolete. The rationale will be added to the text of the RI Report.

28. Section 2.3, page 14; Section 2.10, page 21 and 22; Table 2-2. Please define in the text the sediment sample depths that are later defined as "surface" or "subsurface" samples. (It is noted the definition is provided later in Section 3.5, page 33, but the definition should be provided at first mention.)

Navy Response – Definition of surface and subsurface sample intervals will be added to section 2.3 in the Draft Final Report.

29. Section 2.5, page 16. The report should provide a brief comparison of the well screen depths for PGU-Z3-03D and the replacement well PGU-Z3-03I, such that readers can assess whether the replacement well screen intersected a similar location in the aquifer as the original well.

Navy Response – The well screen depths will be included in the Draft Final Report. The depth of PGU-Z3-03D (screened interval is unknown, but noted as 60 ft in historic reports [Johnson, 2011]) was not viable, Resolution completed installation of PGU-Z3-03I with it screened from 18-28 ft bgs. The depth interval was not meant to replicate the original purpose of the PGU-Z3-03D well (which was very deep, likely for monitoring sites upgradient of the wetland area), rather to monitor the intermediate aquifer depths for potential impacts from the wetland area itself. Given the proximity to the wetland, the 18-28 ft bgs screen of PGU-Z3-03I is depth is more suitable for monitoring potential impacts from the wetland to the intermediate aquifer based on likely limited vertical dispersion of potential contaminants in the aquifer.

30. Section 2.5.1, page 16; Figure 2-3. The location of catch basin CB-05 should be shown on Figure 2-3 to clarify the position of MW01S/I relative to CB-05.

Navy Response – This change will be made in the Draft Final Report.

31. Section 2.5.6, page 19; Figure 2-5 series. The text should provide a general description of the method used to generate the groundwater contours.

Navy Response – The RI Report will be modified to include the following text: "Groundwater contours were generated for the shallow and intermediate/deep intervals of the aquifer utilizing a kriging algorithm in Surfer® 9. Kriging is a geostatistical method of interpolation which renders statistically valid estimates of values between data points. Groundwater elevation contours were generated for shallow wells, which (generally) constituted wells with screened intervals spanning the water table. Groundwater head contours were generated for the intermediate/deep wells, which were combined to provide an appropriately sized data set to interpolate head elevations in non-shallow portions of the aquifer." The results were then reviewed using professional judgment and compared with existing potentiometric surface maps produced for the CED area and NIKE PR-58 site.

32. Section 2.10, page 22. The text indicates TPH was analyzed using modified Method 8015C DRO. Please confirm the method identified the range of alkanes from C10 to C40, as described in the SAP.

Navy Response – In accordance with the SAP, alkanes from C9 to C40 were included in the analysis.

33. Section 2.11.1, Page 24,– Please note for future reports that the following Region 1 document should be referenced regarding data validation; http://www.epa.gov/region1/oeme/pdfs/EnvironmentalDataReviewSupplement.pdf.

Navy Response – The above reference will be added to all future versions of the RI Report.

34. Section 3.5, page 32. The text refers to the "...footprint of the 2008 excavation outside the outfall..." For clarity, an existing or new figure should clearly identify this footprint.

The last paragraph on this page states, "...groundwater is not suitable for potable use." This is not consistent with EPA class IIb designation, please see general comments above. Additionally, later in the same paragraph, the text states, "...the groundwater could theoretically be suitable for potable use." Accordingly, the first sentence in this paragraph should be revised or removed, as appropriate.

Navy Response – The exact outline of the excavation footprint is not known. The work was done by QDC without notification to the Navy, and under the request of RICRMC. All applicable figures will be updated to better represent the approximate location and size of the excavation.

This paragraph will be revised to be consistent with the EPA class IIb groundwater designations. See response to Comment #4.

35. Section 3.6, page 33-34. A copy of the completed Wetland Function-Value Evaluation Form should be included with the report.

Navy Response – A copy of the Wetland Function-Value Evaluation Form and the associated report will be added as an appendix to the RI Report.

36. Section 4.0, Page 35, paragraph 1. PCBs were found above risk screening levels in soil from the 2008 excavation and equipment containing PCB oil was used in building 224. PCB containing transformers were also used by Navy across Davisville NCBC. Therefore please include PCBs as constituents that could cause risk in soil and sediment at OU10.

Navy Response – PCBs were sampled for and evaluated in the risk assessments. Based on the findings of the risk assessments, PCBs were determined to not cause adverse potential risk at OU10. However, PCBs will be added to the list of constituents identified in this paragraph: During prior investigation and maintenance activities, PCBs, PAHs, VOCs and metals were identified as constituents that could cause risk in soil and sediment at the site.

37. Section 4.0, Page 35, paragraph 3. Please define the terms "select constituents" and "primary COCs". This Chapter is prior to any risk determinations which happen in Chapter 6. This chapter should focus on detected contaminants and ones with detections over EPA or RIDEM standards or ecological benchmarks. See comments below on tables and figures.

Navy Response – The figures selected for inclusion in the RI Report are risk drivers, per the results of the risk assessments. Inclusion of all detected contaminants, or those that exceed any

screening level benchmark, would result in hundreds of maps, many of which would not add to the overall RI narrative. The Navy will add selected contaminants to the RI Report as figures. Additional figures may be included, as necessary, in the FS or pre-design phase documents.

38. Section 4.1, page 36. For several chemicals, concentrations were higher in the deeper sample depth interval in soils collected from the down gradient drainage ditch. The Navy indicates this may be due to reworking of the soils by QDC (page 38, 1st full paragraph), though suspected deposition from run-off is mentioned later in Section 7.2 (Fate and Transport Characteristics of Site Chemicals; page 58). To assess whether deposition of soil in surficial run-off occurred near the down gradient end of the drainage ditch, the boring log was reviewed for soil sample QF-SO22 (down gradient end of the drainage ditch), which indicated that silty fine sand was the primary soil type throughout the collected profile (0-4 feet bgs). This profile is generally similar throughout the drainage ditch, and appears to contain more fines compared to several upgradient soils collected near the outfall excavation (ex. QF-SO16, -18) or the catchbasins (ex. QF-SO26, -27). However, silty fine sand was also the primary soil type throughout the 0-24 foot soil boring QF-SO23 collected immediately adjacent to the drainage ditch, suggesting the drainage ditch soils might not be partially or entirely comprised of run-off deposition. Accordingly, throughout the document, the Navy should consistently indicate the transport mechanism(s) believed to be responsible for the distribution of chemicals present in the drainage ditch.

Navy Response – The soils in the drainage ditch may not be comprised entirely of run-off deposition. The RI report will be reviewed and this made clear throughout. The transport mechanism(s) suspected to be causing the distribution of contaminants in the drainage ditch may be varied, but attempts will be made to provide better description of the suspected mechanism(s). During the operation of NCBC Davisville, the drainage ditch area was re-worked several times. Evaluation of nature and extent based solely on grain size distribution may not best represent the conditions under which COPCs are detected at depth.

39. Section 4.1, Page 37, TPH – The soil TPH results in the text have the results listed in ug/Kg, but all of the tables in this report list the soil TPH results in mg/Kg. Please review and revise as appropriate.

Navy Response – The text will be revised in the Draft Final Report. The correct units are mg/kg as indicated in the tables.

40. Section 4.2, Page 38, paragraph 1 and Page 40 Section 4.3, paragraph 1. Define "key constituents". As noted above these sections should focus on detected contaminants and especially ones with detections over EPA or RIDEM standards or ecological benchmarks.

Navy Response – "Key constituents" generally includes risk drivers identified in the risk assessments, with additional parameters (e.g., TPH) added for completeness. This will be clarified in the text. Inclusion of every contaminant detected and/or greater than screening level benchmarks is not necessary to provide information needed to fulfill the RI. As needed, additional contaminants may be included in the FS or pre-design documents. All constituents detected in all media will be presented in the Tables with screening benchmarks, and shading will be used to indicate concentrations above the benchmarks. This information will provide the public with information necessary to see exceedances of benchmarks. Additional text and figures with this information do not need to be provided.

41. Section 4.1, page 38, 2nd paragraph. The Navy should provide additional supporting information showing the boundary of reworked soil related to EBS Review Item 27 earlier in the document and indicate the reworked soil area on a figure.

Navy Response – The approximate boundary of the soils re-worked related to EBS Review Item 27 will be outlined on Figure 1-2.

42. Section 4.3, Page 40, paragraph. Please note EPA does not recognize RIDEM groundwater classification of GB at this site since Rhode Island is not a GSGWPP state. EPA considers the groundwater at this site to be class IIB waters, potential drinking water, and therefore must meet MCLs or more stringent State GA standards. Please include a discussion of the detections of contaminants that are above MCLs or more stringent State GA standards.

Navy Response – No constituents in groundwater exceed MCLs or RIDEM GA standards. No edits to RI Report are necessary. The text will be clarified as follows: " Table 4-3 presents analytical results for groundwater samples collected during the RI phase, including those that do not contribute to potential site-specific risk and hence not discussed below. <u>No concentrations of constituents in groundwater exceed MCLs or RIDEM GA standards</u>."

43. Section 4.3, Groundwater, page 40. bis(2-ethylhexyl)phthalate was detected in several soil and sediment samples at concentrations above ecological risk-based screening levels, and should be plotted on a figure .

Navy Response – These figures will be added to the RI Report.

44. Chapter 4 tables, please add the ARARs or risk based numbers used for evaluation in both the HHRA & ERA to the tables so that it becomes more transparent as to what chemicals have exceeded benchmarks. Currently the concentrations are very cumbersome to evaluate.

Navy Response – The evaluation of the concentrations of contaminants relative to risk-based values is presented in both the ERA and HHRA. Screening level benchmarks used in these evaluations will be added to the tables with a footnote indicating that this exceedence of these benchmarks does not indicate risk, and a full evaluation of potential risks is presented in the risk assessments. ARARs will not be indicated in the RI, but will be identified during the FS.

45. Chapter 4 Figures, what is the significance of the concentration scale? It would be more appropriate and transparent to use 1x, 10 x or 100 x either HHRA or ERA screening levels rather than the seemingly arbitrary concentration scale noted on the figures.

Navy Response – The figures will be revised. For soil, the RIDEM R-DECs will be presented; the lowest ecological benchmark for sediments. From these benchmarks, 10-fold differences will be noted (e.g., 1X, 10X, 100X). A note will be added to the figures that states exceedence of these benchmarks does not indicate risk, and a full evaluation of potential risks is presented in the risk assessments.

46. Figure 4-3. The greater than symbol (>) should be used for samples with zinc concentrations above 100 mg/kg.

Navy Response – This change will be made in the Draft Final Report, as necessary, with additional changes as indicated in Response to Comment 45.

47. Figure 4-18. Zinc in Surface Water. The chemical name in the concentration box for sample QDC1-SW03 looks to be wrong. Please clarify.

Both nickel and bis(2-ethylhexyl)phthalate were detected in the soil samples (QF-SO26) associated with catch basin CB-09. Nickel was detected in the associated temporary groundwater monitoring well (QF-TWP-SO26) above the RIDEM GA Objective, while bis(2-ethylhexyl)phthalate was not.

bis(2-ethylhexyl)phthalate was detected throughout the soil column in samples collected near each catch basin. However, as mentioned above, bis(2-ethylhexyl)phthalate was not detected above reporting limits in the associated groundwater samples. However, in the drainage ditch, bis(2-ethylhexyl)phthalate was 485 ug/kg in soil sample QF-SO09, and the concentration in directly down gradient groundwater 18.5 ug/l at QF-TWP-SO10, suggesting transport from soil to groundwater via leaching. In groundwater further down gradient, the bis(2-ethylhexyl)phthalate concentration decreased to 3.25 ug/l at QF-TWP-SO15 and was non-detect at well pair PGU-Z3-03S/I. These data suggest bis(2-ethylhexyl)phthalate in groundwater attenuates within a short distance from the mid-section of the drainage ditch. This should be discussed in the text.

> *Navy Response – The text box for sample QDC-SW03 is correct, but that for QDC-SW05 on Figure 4-18 will be corrected from "NA" and "NAFD" to "ZINC" and "ZINC FD".*

A discussion of how groundwater BEHP concentrations relate to concentrations in the soil samples from the catch basins and drainage ditch will be added to the text. In discussing any inter-well comparisons, the difference between properly constructed permanent monitoring wells and temporary piezometer wells will need to be considered. Direct comparison may not be appropriate due to potential turbidity issues associated with temporary wells. For example, the turbidity at temporary well QF-TWP-SO10 was 79.3 NTU at the time of collection, whereas the turbidity of temporary well QF-TWP-SO15 was 5.48 NTU, suggesting the BEHP may be in large part due to the suspended solids in the temporary well point samples.

48. Section 4.3, Groundwater, page 40. The text should discuss why the nickel concentration (104 ug/l) in the central wetland groundwater sample QF-PZ02 was several times greater than surrounding groundwater samples.

Navy Response – The concentration of nickel in QF-PZ02 will be examined. In discussing any inter-well comparisons, the difference between properly constructed permanent monitoring wells and temporary piezometer wells will need to be considered. Direct comparison may not be appropriate due to potential turbidity issues associated with temporary wells. The turbidity for QF-PZ02 at the time of collection was 28.5 NTU, suggesting that suspended solids may have biased the result. This will be discussed in the Draft Final Report.

49. Section 4.4, Surface Water, page 41. Figures are presented for cadmium, copper, lead and zinc. It would be helpful to have a corresponding data map figure for cadmium in soil, sediment, and groundwater to help visualize the extent of cadmium among these other media.

Navy Response – Figures will be added for cadmium in soil, sediment, and groundwater.

50. Section 4.4, Surface Water, 2nd paragraph, page 41. The text describes one sample from the western portion with higher concentrations, but the sample and chemical are not defined, or is the reference to divalent metals? Please clarify.

Navy Response – This will be clarified in the Draft Final Report.

51. Page 43, Section 5.0, paragraph 1. Define "significantly". This section should focus on detections above standards rather than COCs determined by the risk assessment discussed in the next chapter.

Navy Response – The Navy disagrees. Risk drivers are the focus of the RI Report, and providing a discussion of these COCs is adequate to define any additional RI or FS work in the QDC Outfall 001 wetland.

52. Section 5.0, pages 43-47. The Contaminant Fate and Transport describes the geochemical interactions for several chemicals detected at the site. However, this section is generally vague on the specific fate and transport mechanism(s) for chemicals from the former Building 224 area to the site. This section should be revised accordingly to describe the transport mechanism(s) and whether chemical migration may continue via these mechanism(s) if no action is taken.

Additionally, the Contaminant Fate and Transport section should include a discussion of the fate and transport mechanism(s) of chemicals within and beyond the site. For example, in soil the concentration of trans-chlordane is highest at the northeastern end of the drainage ditch (QF-SO22). The text does not appear to discuss the fate of this and other chemicals beyond this point.

It is noted that information regarding fate and transport is provided much later in the Summary and Conclusions in Section 7.2 (page 58); this information should be provided for each of the appropriate chemicals.

> *Navy Response – Text will be added discussing possible transport mechanisms and whether chemical migration may continue via these mechanism(s) if no action is taken. A discussion of the fate and transport mechanism(s) of chemicals within and beyond the site will also be included.*

53. Section 5.1, pages 43. The text should include a discussion about the transport process(es) for these low solubility metals from the vehicle washing and maintenance area to the site soils and sediments.

Navy Response – Text will be added discussing possible transport mechanisms of metals from the vehicle washing and maintenance area to the QDC Outfall 001 wetland.

54. Section 5.1, page 43. The text describes the sorption of dissolved divalent metals to clay particles. However, it is unclear whether the Navy is suggesting that soil and sediment at the site contain clay. Accordingly, the text should be clarified with site-specific information, as warranted.

Navy Response –The text will be updated in Sections 3 and 4 to discuss the results of the grain-size analysis. Section 5, the fate and transport discussion, will elaborate on the role clay and other soils have on the fate and transport of metals and other chemicals at the site.

55. Section 5.1, page 43. The text should indicate whether the pH range mentioned in this section (5.5-6.5) applies to soil and sediment collected from the outfall excavation, drainage ditch, and wetland. Additionally, it is unclear whether sediment samples were analyzed for pH, which is not reported in Table 4-3.

Navy Response – Sediment surface samples (0-0.5 feet) were analyzed for pH, as outlined in table 2-2.

56. Section 5.2, 1st paragraph, page 44. The text should discuss the transport process(es) for PAHs from the vehicle washing and maintenance area to the site soils and sediments, and within and beyond the site.

Navy Response – Text will be added discussing possible transport mechanisms of PAHs from the vehicle washing and maintenance area to the QDC Outfall 001 wetland.

57. Section 5.3, 2nd paragraph, page 45. The text should discuss the potential for transport of trans-chlordane in soil beyond the far northeastern end of the drainage ditch, where trans-chlordane concentrations were highest.

Navy Response –Section 5 will be updated to reflect the trans-chlordane concentrations in the ditch relative to the sampling limits. The following text will be included:

"The concentrations of trans-chlordane are high in this area; however, based on the tendency for the chemicals to persist due to their tendency to sorb to soil and sediments, migration from these soils to off-site locations is not expected assuming no remedial action."

58. Section 5.4, page 45-46. The text should discuss the transport process(es) for PCBs from the vehicle washing and maintenance area to the site soils and sediments, and within and beyond the site.

Navy Response – Text will be added discussing transport of PCBs from the vehicle washing and maintenance area to the QDC Outfall 001 wetland via the Building 224 drainage system. Similar text to that presented in the response to comment 57 above will also be included to address the potential transport beyond the site.

59. Section 5.5, pages 46-47. The text describes the geochemical interactions for arsenic and iron, but apart from pH provides no site-specific geochemical information at the site. The Navy should provide additional information regarding the applicable geochemical conditions in soil, sediment, surface water, and groundwater, relative to the fate and transport of these chemicals.

Navy Response –The fate and transport section will be expanded to provide more detail on the primary mechanisms for fate and transport of chemicals in the soils and sediments.

60. Section 6.1 and 6.2. Revise the interpretation and conclusions in these sections to be consistent with comments provided on both risk assessments.

Navy Response – The text will be revised to be consistent with comments/responses on the risk assessments.

61. Section 7.2, page 58 and 59. The text indicates that "key constituents" do not appear to be leaching into groundwater. However, additional discussion in section 5 Fate and Transport should assess leaching as secondary transport mechanism for selected chemicals that were present in soil and/or sediment and also in groundwater, including but not limited to bis(2-ethylhexyl)phthalate, arsenic, and trans-chlordane. It is noted that the total concentration of alpha- and trans-chlordane (1,509 ug/kg) in sediment (QF-SD19) exceeded the RIDEM GA Leachability Criteria of 1,400 ug/kg for Chlordane in soil. Trans-chlordane was detected in groundwater at 0.043 ug/l at QF-PZ02, which was located near this sediment sample location in the north central portion of the wetland.

Navy Response – While leaching may be a secondary transport mechanism and will be acknowledged, RIDEM GA Leachability Criteria do not apply to sediment.

62. Section 7.2 Page 59 & 60. Please revise the conclusions of the human health risk assessment and the ecological risk assessment to be consistent with EPA comments on Appendices C & D.

Navy Response – This text will be updated to reflected edits made to Appendices C and D.

SPECIFIC COMMENTS ON APPENDIX C, HUMAN HEALTH RISK ASSESSMENT

63. TCE Risk Calculations and Use of ADAF Corrections: The risk calculations for trichloroethene (TCE) do use the proper Age Dependent Adjustment Factors (ADAF) for kidney cancer (mutagenic mode of action) vs. non-Hodgkins lymphoma and liver cancer (non-mutagenic). The calculations in Attachment H are not transparent. The notes in Tables 7.8 through 7.12 for both RME and CT describe the calculations used for TCE, but the tables themselves just show the final result. It appears that the ADAF corrections may be in the "formula line" of the Excel Spreadsheet. It is recommended that the entire calculation be shown on the spreadsheet.

Navy Response – As the RAGS D spreadsheet layout is being followed, additional tables will be added which provide further transparency to the calculation. Example calculation detail tables have been attached.

64. Toxicity Factors Used for Aroclor 1260: The HHRA did use Toxicity Factors for Aroclor 1254 to assess risk from exposure to Aroclor 1260 for both cancer risk and chronic non-cancer risk. However, the value used for the subchronic RfD cannot be validated. Table 5.1 lists the subchronic RfD as 6E-05 mg/kg•day. The source is listed as IRIS. This value cannot be located in IRIS unless it was back-calculated based on the uncertainty factor used to estimate the chronic RfD from a less than chronic study. The method used to estimate the subchronic RfD should be addressed in the HHRA. A subchronic RfD surrogate of 3E-05 is cited in the Risk Assessment Information System with the source listed as ATSDR.

Navy Response – As described in the text (Section 4.4.1), "Subchronic toxicity values are not found in IRIS. Instead, subchronic toxicity values have been developed from chronic toxicity values. According to USEPA guidance (USEPA, 1989), if a chronic toxicity value has been developed based on subchronic data, a subchronic toxicity value may be developed by removal of the uncertainty factor used to extrapolate from subchronic to chronic exposures (typically a factor of 10)." Based on the studies performed for Aroclor 1254, a factor of 3 was applied, resulting in the subchronic RfD presented. The table notes will include this factor for clarification.

65. Aroclor 1254 Surrogate RfD: The HHRA notes "A published noncancer RfD is not available for Aroclor-1260. Therefore, the RfD for Aroclor-1254 was used as a surrogate toxicity value to evaluate Aroclor-1260. However, there are uncertainties associated with using Aroclor-1254 as a surrogate for Aroclor-1260. Since the PCB composition at Davisville may differ from the PCB composition for which the noncancer RfD for Aroclor-1254 is based, producing different toxicological responses, uncertainty is introduced by using this as a surrogate RfD." The HHRA should document why PCB Congener analysis was not used given these uncertainties regarding PCB composition at the site.

Navy Response – The text will be revised to include reference to SAP comments and responses which discussed the potential need for analysis of PCB congeners at the site. The following text will be included in the uncertainty section:

" As discussed in the Navy response to EPA comments on the SAP dated January 8, 2014 (Resolution, 2014c), PCB congener analysis was not performed at the site as congeners are more appropriate for sites where fish ingestion is a complete exposure pathway. Congener analysis is typically not necessary/applicable for upland sites such as the Davisville site. In an EPA letter to Navy discussing the response to EPA comments, dated January 28, 2014 (USEPA, 2014g), it is stated that if total PCBs are high in the first round of sampling, EPA may require Navy resample and perform PCB congener analysis/evaluation. However, PCB Aroclor analysis did not find significant detections at the site justifying congener analysis."

66. Chromium Dermal Exposure: Dermal exposure to metals other than arsenic in soil is not evaluated in the HHRA. The document does not explain why dermal exposure, particularly to chromium, was not included. Hexavalent chromium is a skin sensitizer and it also can be absorbed dermally.

Navy Response – Text will be added to further clarify dermal exposures to metals in soil/sediment. EPA has not yet provided formal guidance whereby hexavalent chromium exposures should include dermal absorption. The most recent RSL tables (January 2015) do not account for dermal absorption for hexavalent chromium. At this time, the contribution of hexavalent chromium dermal absorption will not be included in risk calculations, but the uncertainty section will include discussion of this exposure as presented below:

"Dermal absorption fractions (DAFs) for metals are limited based on the research performed to date. Of the metals evaluated in soil and sediment at the Davisville site, only arsenic currently has an established DAF typically used in dermal risk calculations. While hexavalent chromium is a skin sensitizer which can also be absorbed dermally, EPA has not yet provided formal guidance whereby hexavalent chromium exposures should include dermal absorption. While

the remaining metals without established DAFs (aluminum, cobalt, iron, lead, and manganese) are not currently considered to be absorbed dermally at a significant level. Until DAFs are formally established for hexavalent chromium and the remaining metals noted, risk may be underestimated."

67. Assessment of Non-cancer Effects of PAH: Although RfDs are not available in IRIS for the carcinogenic PAH the HHRA should describe at least qualitatively the potential impact on HI from exposure to PAH in soil and sediment.

Navy Response – Text is presented in the uncertainty section which qualitatively discusses the potential impact on noncancer hazards by PAHs: "For example, there are no non-carcinogenic toxicity values (i.e., RfDs) for the carcinogenic PAHs. However, the noncarcinogenic effects of these chemicals are likely to be adequately protected against by the evaluation of carcinogenic risks (i.e., carcinogenic effects appear at a lower dose than non-carcinogenic effects). The lack of toxicity values for some COPCs contributes to an underestimation of risk and hazard."

68. Risk Calculation Check: EPA cannot duplicate some of the risk calculations in Attachment H. We selected a few at random and found that we get a slightly different answer with several variances by a factor of 2. Without seeing the formula line in the Excel Spreadsheet it is not possible to determine if there is a correction factor that Navy used. In addition, the variances between hand calculations (ELCR = LADD x SF) were not constant on a single spreadsheet. We get a different ELCR for one or two COPCs but not for the others. The calculations should be checked to ensure that there are no errors introduced by copying a line incorrectly.
'

Navy Response – The calculations have been checked and are correct. Similar to comment 63 above, it appears that inclusion of ADAFs in the cell formula may be the reason for the variances in the hand calculations. While the notes at the end of the table describe the calculations performed, additional tables will be included which provide further transparency to the calculations. Example calculation detail tables have been attached.

69. HHRA, Appendix C, Section 2.2.2, page 11, 2nd paragraph. It is unclear why duplicates were treated differently for the combined intervals compared with duplicates for all other samples (as described on page 9 under "Treatment of Duplicates"). Please explain.

Navy Response – The combination of two sample intervals (i.e., 0-0.5' and 0.5-1') to make a single sample (0-1') is not the same as combining duplicates to get one representative sample for a location. The combination of two sample intervals can be considered collecting one sample from 0-1' and placing the soil/sediment in a bowl for homogenization prior to putting the soil in a jar for analysis. The resulting concentrations would typically be averages of the soil collected. The following text will be included in the uncertainty section:

"As discussed in Section 2.2.2, historical sediment samples were only collected from a single interval (0 to 1 ft bgs) per location, while the 2014 RI samples were collected from two intervals per location (i.e., 0 to 0.5 ft and 0.5 to 1 ft). To establish consistency between data sets and to reduce bias which would occur in the locations with two sample intervals, the two sample intervals were combined to create a 0 to 1 ft bgs result. The combination of intervals where one or both intervals were non-detected was performed similarly to the resolution of duplicates described above. However, the combination of two detected sample intervals (i.e., 0 to 0.5 ft

and 0.5 to 1 ft) to make a single sample (0 to 1 ft) is not the same as treatment of duplicates (i.e., higher concentration selected) to get one representative sample for a location. Field duplicates are collected from identical intervals to provide an estimate of error in field sampling procedures, not to provide estimates of concentrations from two separate units/intervals. The combination of two sample intervals can be considered collecting one sample from 0 to 1 ft and placing the soil/sediment in a bowl for homogenization prior to putting the soil/sediment in a jar for analysis. The resulting concentrations would typically be averages of the soil/sediment collected. However, as with all soil/sediment sampling, it is possible that higher or lower concentrations could also be detected and there may be an under- or overestimate of risk."

SPECIFIC COMMENTS ON APPENDIX D, ECOLOGICAL RISK ASSESSMENT

70. Page 4, Section 2.0, Paragraph 4. Please clarify what excavation activity since 2010 would have affected samples collected in 2010. Elsewhere the RI states that excavation occurred in 2008.

Navy Response – The locations of the soil samples were removed during the Maintenance Cleaning and were therefore deemed obsolete. This information will be added to the RI and the ERA.

71. Page 7. Section 2.1, last Paragraph, first sentence. Please specify how many sediment samples were analyzed for hexavalent chromium. Table 2 indicates only 3 of 31 samples had CrVI analysis, while the RI report (Section 2.3, page 15) states six sediment samples were analyzed for CrVI.

Navy Response – The Table is correct that 2 of the 20 surface soil samples and 3 of the 31 surface sediment samples were analyzed for hexavalent chromium. These counts will be added to the text of Section 2.1. As stated in Section 2.1, hexavalent chromium was not detected in surface sediment, but was detected in the two surface soil samples. In those two samples, hexavalent chromium composed 15% to 53% of the total chromium concentrations. Hexavalent chromium was also analyzed in sub-surface samples which were not evaluated in the ERA (but were discussed in the RI). Section 5.1 of the RI report will include a statement about the ratio of hexavalent chromium to total chromium in the surface and sub-surface data.

72. Page 10, Section 3.1.1, Paragraph 2, Second sentence. Please verify the reference to only Figure 2;

Navy Response – The sentence will be revised to refer to Figures 1 and 2 since both show the location of the culvert.

73. Figure 1 and Figure 2 together provide an overview and focused view, respectively, of the culvert location.

Navy Response – Comment noted.

74. Page 18, Section 3.1.6, third Paragraph, first sentence. Define SEV (screening ecotoxicity values) at its first occurrence in the text.

Navy Response – The acronym will be defined in the text. No changes to the ERA necessary.

75. Page 20, Section 3.1.6, last line. Please indicate the source of the site-specific hardness value. Based on the groundwater alkalinity results (for bicarbonate), the alkalinity ranged from <1 to a maximum of 30.6 mg/l, with an average of 13 mg/l using 9 samples. It is unclear if the Navy used alkalinity (bicarbonate) to represent hardness.

Navy Response – Calcium and magnesium were analyzed in the 2014 surface water samples and were used to calculate the site-specific average water hardness. The calculation will be added to Attachment A and will be referenced in Section 3.1.6.

76. Page 44, Section 4.3.2, Second bullet. Clarify in the text that the ED < 1 was also used for Marsh Wren.

Navy Response – The text will be edited as requested.

77. Page 46, Section 4.3.7, Paragraph 3 and Attachment H, Table 4. Please provide a statement to clarify how the LOAEL TRVs used in the BERA models were selected from the literature sources. For example, the LOAEL for copper and lead reference the corresponding Eco SSL documents, but the method for selection of the LOAEL utilized in the ERA was not clearly stated in either the text or in footnotes to Table 4 of Attachment H. The only note is found in the footnote in Table 5 of Attachment C.

Navy Response – The text and footnotes will be updated to reflect that the LOAELs from the Eco-SSL documents represented the geometric mean of the LOAELs for growth and reproduction and that additional LOAELs were identified in Sample et al (1996) and in other literature sources used to identify the NOAEL-based TRVs.

78. Page 47, Section 4.4.1. As stated in preliminary comments from EPA, please remove this discussion of refinement based on background or revise with a site-specific background study or a qualitative evaluation of existing sediment background data.

Navy Response – See response to Comment 1. The ERA will be revised based on a qualitative evaluation of background data.

79. Page 48, Section 4.4.2, Paragraph 2. Remove the discussion of the refinement based on background.

Navy Response – See response to Comment 1. The ERA will be revised based on a qualitative evaluation of background data.

80. Page 48, Section 4.4.2, Paragraph 3, third sentence. This sentence indicates that the HQ for invertebrates in soil was > than 1.0 for vanadium. However, Table 16 indicates that no SEV was available for vanadium. Please correct the text.

Navy Response – Vanadium will be deleted from the referenced sentence because no screening value is available.

81. Page 52, Section 4.4.6, third paragraph, last sentence. Remove the conclusion regarding comparison to background.

Navy Response – See response to Comment 1. The ERA will be revised based on a qualitative evaluation of background data. The text will be updated to reflect the new qualitative evaluation.

82. Page 53, Section 4.4.6, first paragraph. Remove the conclusion regarding comparison to background.

Navy Response – See response to Comment 1. The ERA will be revised based on a qualitative evaluation of background data. The text will be updated to reflect the new qualitative evaluation.

83. Page 54, Section 4.5, 5th paragraph. Please remove or revise the statement regarding the presence of Phragamites in the wetland. The statement implies that a higher concentration of contaminants should be acceptable since the wetland is dominated by a pollution-tolerant species. The converse argument could also be made that the presence of contaminants contributes to the ability of Phragmites to dominate the wetland community and the absence of more sensitive species.

Navy Response – The statement will be revised. The statement occurs within the uncertainty section and is intended to show that, although elevated HQs occur for plants, a pollution-tolerant species is currently surviving under conditions that the SEVs would indicate should be toxic. The text will be revised to indicate that although the SEVs may over-estimate risks to pollution-tolerant species, they are more applicable to sensitive species.

84. Page 56, Section 4.6, paragraph 3. Revise the discussion of the risk to plants and invertebrates. The bioavailability in soils is not characterized well enough in soils to dismiss the potential toxicity of divalent metals.

Navy Response – The text will be revised. It is recognized that the SEM, AVS, TOC evaluation reflects one line of evidence for bioavailability and that additional lines of evidence (e.g., toxicity testing) are not available. However, as indicated in this paragraph, there are several uncertainties in the benchmark screening that likely overestimate risks to plants and invertebrates (e.g., conservative nature of the benchmarks [same SEVs used in the SRA], low confidence in most benchmarks, weathered metals likely less bioavailable than metals used in laboratory to derive SEVs) The text will be revised to indicate that, although most of the samples indicate that divalent metals are unlikely to be bioavailable, there are uncertainties associated with this approach since the SEM, AVS, TOC approach was derived for benthic invertebrates in sediment and may not be as applicable to seasonally saturated soils. Risks will not be eliminated solely on the basis of the SEM, AVS, TOC evaluation, but this line of evidence will be considered in the risk characterization.

85. Page 56, Section 4.6, paragraphs 4 and 5. Revise the discussion of the risk to plants and invertebrates. The exceedances of benchmarks indicate potential risk to receptors in a limited number of sampling locations. However, it cannot be concluded that the site-wide risks are over-estimated. The average EPC is not the most representative value to evaluate risk to invertebrates or plants. Change the conclusion to state that exceedances of HQs indicate a number of locations or limited area of the site show a low or uncertain risk to these receptors.

Navy Response – The conclusions will be revised to indicate the potential for adverse effects in a limited number of sampling locations.

86. Page 56, Section 4.6, paragraph 5. Remove or replace the last sentence.

Navy Response – The statement will be removed. The statement regarding site-wide risk was simply included to indicate that HQs were not necessarily elevated across the site, but in specific locations (as indicated in the sample-by-sample tables).

87. Page 57, Section 4.6, Paragraph 2. Please include a discussion on PCBs. In sediments, PCBs were detected in 17 of 34 samples with a maximum total PCB concentration at SD19 (a short distance out in the wetland from the outfall) of 2.5 ppm. PCBs were subsequently eliminated since the calculated RME (95% UCL) was 0.64 ppm and resulted in an HQ < 1.0 for invertebrates using a PEC of 0.94 ppm. Three locations (SD19, SD09, and SD13) had total PCB values above 0.94 ppm. Based on this it could be argued that there was potential risk to invertebrates at three of 34 locations.

Navy Response – A discussion of PCBs will be added to indicate that although the UCL is below the PEC and risks were not indicated based on the Tier 2 Step 3A evaluation, several individual locations in the vicinity of the outfall have concentrations above the PEC.

88. Page 57, Section 4.6, Paragraph 4, second sentence. Please revise the text description of samples QF-SD13, QF-SD14 and QF-SD19 as the center of the wetland. These samples are located closer to the western edge of the wetland, closer to the outfall.

Navy Response – The text will be revised to indicate that these three locations are in the western portion of the wetland but outside the immediate vicinity of the outfall.

89. Page 58, Section 4.6, description of categories of risk (1-3). Please revise the wording as follows:

- replace "no unacceptable risk exists" with "adverse effects are unlikely"
- replace "risk is unlikely" with "adverse effects are unlikely"
- replace "there is potential for risk" with "there is potential for adverse effects"

Navy Response – The suggested language for the first two bullets is the same. The categories as written in the ERA are consistent with language included in other recent Navy ERAs in Rhode Island (i.e., MRP Site 1 and IR Site 22 at Newport Naval Station). The following statement will be added to the second bullet to be consistent with the other ERAs: "This situation is described as posing indeterminate risk."

90. Page 58, Section 4.6, paragraph following numbered items. Please change text and Tables 19 and 20 to remove the refinements based on background.

Navy Response – See response to Comment 1. The ERA will be revised based on a qualitative evaluation of background data. The text and tables will be updated to reflect the new qualitative evaluation.

91. Page 61, Section 4.7, Paragraph 3. Please change text and Tables 20 through 22 to remove the refinements based on background.

Navy Response – See response to Comment 1. The ERA will be revised based on a qualitative evaluation of background data. The text and tables will be updated to reflect the new qualitative evaluation.

92. Page 61, Section 4.7, Paragraph 4. Please revise the conclusions for wetland/benthic invertebrates. EPA does not concur that, without direct effects evaluation, such as toxicity testing, the risks to invertebrates in the wetland can be conclusively eliminated. The uncertainly in the bioavailability and the background comparisons is too high to allow these lines of evidence to be sufficient to dismiss potential effects on invertebrates from exposure to sediment.

Navy Response – See response to Comment 1. The ERA will be revised based on a qualitative evaluation of background data. The text will be updated to reflect the new qualitative evaluation. The conclusion will be revised to indicate the potential for adverse effects on benthic invertebrates in certain locations.

93. Page 62, Section 4.7, Paragraph 1, last sentence. Please remove the argument that growth of Phragmites indicates a lack of impact. This result is inconclusive; the presence of Phragmites indicates a disturbed habitat, which could be a physical disturbance, and/or a result of the chemical conditions in the sediment. As stated in previous comments, the converse argument could also be made that the presence of contaminants contributes to the ability of Phragmites to dominate the wetland community and the absence of more sensitive species.

Navy Response – As stated in Comment 83 the discussion of the Phragmites occurs within the context of a discussion of the uncertainties associated with the wetland plant evaluation. Due to the disturbed nature of the wetland, it is likely that Phragmites would dominate the system even in the absence of COPCs (un-impacted wetlands in the vicinity of the QDC wetland are also dominated by Phragmites). The text will be revised to state that "The emergent wetland currently contains a dense stand of Phragmites with no evidence of adverse impacts (e.g., stunted growth, bare areas); however, risks to more sensitive plant species cannot be eliminated".

94. Page 62, Section 4.7, Paragraph 2, second sentence. Remove the text after the word "outfall." ("and the risk estimates may be overly conservative because the wetland does not support a fish population and most of the benchmarks are protective of fish (in addition to other aquatic receptors).")

Navy Response – The referenced text is simply referring to a potential source of uncertainty in the surface water screen. The text will remain as written.

95. Page 62, Section 4.7, Paragraph 3, second sentence. Please revise the conclusion for the Marsh Wren. Although there is some uncertainty in the bioavailabiliy of divalent metals, the assumptions of the TIER 2, Step 3A models were not conservative, and indicated potential adverse effects to Marsh Wren. Based on the results of the food-chain model with no site-specific invertebrate tissue data, EPA would expect the conclusion of the ERA is that there is

potential for adverse effects on small birds foraging in the wetland, driven by the concentrations of metals in the vicinity of the outfall and the western portion of the wetland.

Navy Response – The conclusion will be revised to indicate that based on the currently available data, there is potential for adverse effects on small birds foraging in the wetland with the risks driven by the concentrations of metals in the vicinity of the outfall and the western portion of the wetland. Collection of site-specific invertebrate tissue was not considered in the SAP or in the planning of the SAP and should therefore not be indicated in comments as a deficiency.

96. Page 62, Section 4.7, Paragraph 3, last sentence. EPA does not concur with the conclusion that risks to Marsh Wren are unlikely. See previous comment.

Navy Response – The conclusion will be revised to indicate the potential for adverse effects on small birds foraging in the wetland with the risks driven by the concentrations of metals in the vicinity of the outfall and the western portion of the wetland.

97. Page 62, Section 4.7, Last Paragraph, first sentence. Remove the text after "...SEV Comparisons." ("but that risks are likely to be over-estimated due to the conservative nature of the SEVs and concentrations similar to background conditions.")

Navy Response – The text will be revised as requested.

98. Page 62, Section 4.7, Last Paragraph. Remove the last two sentences. ("Based on the presence of vegetation throughout the wetland, risks to wetland plants are not expected. Risks to wildlife receptors are not expected based on the evaluation of the average EPCs and the LOAELs in the food web model.")

Navy Response – The text will be revised as requested. The text regarding risks to wildlife will be revised to indicate the potential for adverse effects on small birds foraging in the wetland.

99. Table 8. The result for a Food Ingestion Rate (FIR) for shrew calculated by the formula in the footnotes is 0.0023 kg-dw/day for a Maximum body weight. However, EPA (2007) for a high end (conservative) estimate uses a value of 0.209 g dw/g bw/d) which would correspond to 0.004 kg/dw/day FIR (using maximum body weight of 19.2 g). If species-specific FIR data are available in EPA (2007), these data should be used in preference over general allometric equations from unrelated species. Correct these values in the table and subsequent models, or provide a justification for the values used.

Navy Response – The use of the allometric equations from Nagy (2001) was identified in the Risk Assessment Work Plan Technical Memorandum included in the SAP and reviewed by EPA and RIDEM. The use of the allometric equation with the maximum body weight provides a high end value for use in the SRA (which assumes the minimum body weight for the risk estimates). The allometric equation is based on data for 14 insectivorous mammals which identified a statistically significant relationship between body weight and food ingestion rates (on a dry weight basis) with an R^2 of 0.89. Therefore, this equation is a reasonable approach to determining a relevant ingestion rate in the food web model.

The value of 0.209 g dw/g bw/d identified in EPA (2007) is the average of 5 "high end" ingestion rates which ranged from 0.098 to 0.384 g dw/g bw/d. However, none of these "high end" rates were actually measured values. They are simply a typical rate multiplied by an adjustment factor to estimate an upper end value. Therefore, the use of the statistically significant allometric equation will be used to estimate food ingestion rates in the food web model.

100. Table 8. The source of the soil ingestion rate for Robin and Marsh Wren should be changed. The values presented are based on the 50th and 90th percentiles for shrew. The values for Woodcock (also an avian invertivore) would be more appropriate to use as a surrogate for Marsh Wren. The 50th and 90th percentile for Woodcock were 6.4% and 16.4%, respectively.

Navy Response – The use of the soil ingestion rate for the shrew as a surrogate for the robin and marsh wren was identified in the Risk Assessment Work Plan Technical Memorandum included in the SAP and reviewed by EPA and RIDEM and is consistent with evaluations of the robin in other ERAs conducted by the Navy at Newport Naval Station (the marsh wren has not been evaluated at Newport Naval Station). The soil ingestion rate for the marsh wren will be updated to reflect the values based on the woodcock.

101. Attachment D, Table 8. Please provide footnotes to indicate the location in other tables for the wetland invertebrate tissue concentrations (Table 2).

Navy Response – The individual risk tables within the food web model attachment will be updated to include a footnote indicating that the media concentrations are provided in Table 2 of the attachment.

102. Attachment H, Table 2. Please confirm that the water-to-aquatic invertebrate uptake factors from EPA (1999) result in tissue concentrations in mg/kg wet weight.

Navy Response – It has been confirmed that the water-to-aquatic invertebrate uptake factors from EPA (1999) result in tissue concentrations in mg/kg wet weight

Navy Responses To
Rhode Island Department Of Environmental Management
Comments Dated February 2, 2015
On QDC Outfall 001 Draft Remedial Investigation,
Former Naval Construction Battallion Center (NCBC) Davisville, North Kingstown, Rhode Island

(MAY 28, 2015)

RIDEM comments on the Navy's QDC Outfall 001 Draft Remedial Investigation (December 2014), are presented below. The RIDEM comments are presented first, followed by the Navy responses (*italics*).

1. Page xi & xii, Executive Summary, RI Evaluation, Bullet 1 – It is noted that trans-chlordane may have originated from other sources such as historical agricultural use. While there was agricultural use of this land prior to Navy ownership that ended by 1940 when all this land was part of the Naval Construction Battalion Center. Trans-chlordane was not introduced to this country until 1948 and its agricultural use was banned in 1983. Thus, it is unlikely that trans-chlordane is due to historical agricultural use. Please revise accordingly.

Navy Response - The word "agricultural" will be removed from the Draft Final Report. Please note that chlordane was used at NCBC for pest control in non-agricultural uses until 1983 (Fred C. Hart, 1984). Therefore, historic application of chlordane (for non-agricultural uses) at NCBC is documented, and the presence of this persistent compound can be expected.

2. Page xii, Executive Summary, RI Evaluation, Wetland Ecological Risks - This section references a background study which is presumably the one contained in Appendix E of this document. This study was conducted for the NUSC (Naval Undersea Systems Center) site at NETC (Naval Education & Training Center) during the 2006 time frame. RIDEM does not accept this study as background for the QDC Outfall 001 site for the following reasons;

- Only seven soil samples were included. Section 8.06(C) of the RIDEM Remediation Regulations, Amended 2011 require a minimum of 20 samples.
- Section 8.06(B) of the above referenced regulations requires samples be collected in the same type of soil as is being investigated. It is not clear if this is the case.
- The sediment samples are over 10 years old (October 2004), new ones should be taken.
- The submitted study was specific to the NUSC Site at NETC. Background studies should be site specific, though data from another site can be used, if appropriate.
- RIDEM did not approve the NUSC background study, mainly due to the location of some of the samples.
- Page 8, Confirmatory Soil Samples, Paragraph 2 references the background study in the NCBC Draft Final Remedial Investigation Report from TRC in 1994. Please explain why the NETC background study was selected over this study.
- Section 2.1 (Soil) of Appendix E, Background Data Evaluation states that soil samples were available from comparable soil types. The QDC Outfall 001 site primarily consists of soil type QoC (Quonset C gravely, sandy loam) which is excessively drained. A small portion of the site may also consist of UD (Urban Disturbed) soil. The QoC soil does not appear at the NETC site. Major soil types at NETC include Pm (Pittstown Silt Loam), PmB (Pottstown Silt Loam) both moderately well drained, , Se (Stissing Silt Loam), Ma

(Mansfield Mucky Silt Loam) both poorly drained soils, NP (Newport Silt Loam) and UD. Thus, RIDEM does not agree that the soil types in the NETC study are comparable to the soil at the QDC Outfall 001 site.

Navy Response – Upon Navy's consultation with EPA and review of data suggested by EPA, Resolution will conduct a qualitative background evaluation for use in the HHRA and ERA. This qualitative background evaluation will consist of the following background data sets:

Surface Soil: The background data set will be comprised of the 18 background surface soil samples from the Phase II RI. These samples were analyzed for metals only.

Sediment: EPA suggested review of nine sediment samples based on locations on Figure 2-1 of the 1996 Facility Wide Freshwater/Terrestrial Ecological Risk Assessment. Resolution reviewed these locations and determined that several are tidally influenced. Of the nine suggested samples, four are from freshwater locations and will be used to represent qualitative background (TRC1, TRC5, TRC6, and AHW07).

The Navy reserves the right to revisit background conditions for the QDC Outfall 001 soil and sediment. As necessary to frame any potential risks or clean-up concentrations, a site-specific background study may be undertaken. Any study would be conducted in consultation and agreement with EPA and RIDEM.

3. Page 2, Section 1.2, Site Description, Paragraph 2 – This paragraph states that the parking area for the Quonset Bike Path is about 600 feet northwest of QDC Outfall 001. Based on Figures 1-2 and 2-1 the pavement for the parking area is about 250 feet away from the outfall. Please correct the statement.

Navy Response – This text will be update in the Draft Final Report.

4. Page 11, Section 1.5, Maintenance cleaning, Paragraph 1 – This paragraph states that catch basins CB-02, 06 and 09 were identified as needing additional investigation during the remedial investigation. It is noted that temporary well points were placed immediately down gradient of catch basins CB-02 and CB-09, but not CB-06. Based on the shallow groundwater map (Fig 2-5a) CB-06 is down gradient of CB-02. It would have been interesting to see what the concentrations of constituents are between the two locations. Beyond what is noted here please describe what other activities took place to investigate these three catch basins.

Navy Response – Borings were advanced due to the deteriorated condition of catch basins. The objectives and results of sampling each catch basin will be better described. There were no other activities to investigate these three catch basins.

The following test will be added: "Per the SAP, soil borings were advanced adjacent to catch basins that were noted to be deteriorated, or have compromised bottoms. Boring were advanced to the water table and grab groundwater samples collected. Due to a field error, a grab groundwater sample was not collected at CB-06."

5. Page 20, Section 2.7, Drum Remnants – Please state if the drum remnants were removed or not. If not, then please state why not. If they were removed please state where they were disposed of.

Navy Response – The drum remnants were not removed, but plans have been made to remove the drum remnants when Tetra Tech EC removes an empty drum from the nearby Snake Pit and an empty drum at Site 7.

6. Page 28, Section 3.1, Demography and Land Use – This paragraph states what the land associated with this site is not used for as well as uses of land to the north and northeast of the site. This paragraph also states that the land associated with the subject site is currently undeveloped. Please state how QDC's master plan envisions the use of this land in the future.

Navy Response – The Navy expects current and future use of the OU-10 area consistent with the reuse plan. The reuse plan identified much of OU-10 and the immediate surroundings as wetlands, with the future reuse as "open space/conservation". Future activities in those areas would be subject to the regulations of the Rhode Island Coastal Zone Management Council. Some upland area of the property, adjacent to OU-10, such as the parking area for the bike trail, is proposed for "waterfront commercial" reuse. This information will be included in the Draft Final Report.

7. Page30, Section 3.4 Surface /Groundwater Hydrology, Study Area Hydrology, Paragraph 2, Sentence 1 – This sentence states that shallow groundwater generally flows from west to east and intermediate groundwater flows from southwest to northeast. Based on inspection of Figures 2-5a – d both the shallow and intermediate groundwater seem to flow from southwest to northeast. Please revise.

Navy Response – The groundwater flow discussion will be corrected.

8. Figure 3-1, Potential Exposure Pathways – Please include the following pathways for evaluation:

- For surface water please include dermal/direct contact for avian and mammalian communities as there are many animals that can spend a significant amount of time in water such as birds and beavers.
- For surface water please include dermal/direct contact for the wetland plant community as there are many plants that grow in areas that are inundated with water.

Navy Response – The exposure pathways were previously presented in the SAP. Due to the presence of feathers and fur, dermal exposure to surface water (like sediment and soil) is expected to be an insignificant exposure pathway. The exposure pathway between water and plants is also expected to be insignificant relative to the sediment exposure pathway. These pathways will be discussed in the text but will not be evaluated quantitatively in the ERA.

9. Page 32, Section 3.5, Potential Receptors and Exposure Pathways, Human Receptors, Last Paragraph, First Sentence – Please change "Groundwater underlying the site is not suitable for potable use." to "Groundwater underlying the site is not suitable for potable use based on the latest sampling data." or eliminate this sentence entirely as the second sentence adequately describes GB groundwater.

Navy Response – This text "Groundwater underlying the site is not suitable for potable use." *will be deleted in the Draft Final Report.*

10. Figure 4-1, Total Chromium Concentrations in Soil – RIDEM considers surface soil to be the top two feet of soil, not just the top foot. Thus locations QF-SO15, QF-SO21 and QF-SO25 would also be orange as they have concentrations of chromium greater than 10 mg/kg, though none of the detected values exceed the RIDEM RDEC. These are located just east of marine road, at the outfall and in the drainage ditch, respectively.

Navy Response – Comment Noted. The figures will indicate that the dots represent 0-1 ft, not "surface soil". Figures are currently being revised to display all depth horizons, example figures are included with this response to comments.

11. Figure 4-2, Copper Concentrations in Soil – RIDEM considers the surface soil to be the top two feet of soil, not just the top foot. Thus locations QF-SO08, QF-SO12, QF-SO13, QF-SO14 and QF-SO15 would also be orange as they have concentrations of copper above 15 mg/kg, though none of the detected values exceed the RIDEM RDEC. All these locations are within the drainage ditch.

Navy Response – See response to Comment #10.

12. Figure 4-3, Zinc Concentrations in Soil – RIDEM considers the surface soil to be the top two feet of soil, not just the top foot. Thus locations QF-SO13 & QF-SO14 would also be orange as they have concentrations of zinc above 50 mg/kg, though none of the detected values exceed the RIDEM RDEC. All these locations are within the drainage ditch.

Navy Response – See response to Comment #10.

13. Figure 4-5, TPH Concentrations in Soil – RIDEM considers the surface soil to be the top two feet of soil, not just the top foot. Thus, locations QF-SO08, QF-SO10, QF-SO13 and QF-SO24 would also be maroon as they have TPH concentrations above 1000 mg/kg in the top two feet of soil. Locations QF-SO - 6, 7, 8, 9, 10, 11, 13, 14, 15, 18 & 19 have exceedances of RIDEM RDEC of 500 mg/kg and locations QF-SO14 and 24 have exceedances of RIDEM GB Leachability Criteria of 2500 mg/kg. QF-SO24 also exceeds RIDEM I/CDEC of 2500 mg/kg.

Navy Response – See response to Comment #10.

14. Figure 4-12, TPH Concentrations in Sediment – The following locations have exceedances of RIDEM GB Leachability Criteria of 2500 mg/kg: QF-SD06, 07, 08, 09, 10,11, 13, 14, 15, 18, 19, 20 and 24 ranging from 2,730 to 15,000 mg/kg. The following locations have exceedances of RIDEM upper concentration limits of 30,000 mg/kg: QF-SD14, 19 and 20 ranging from 38,100 to 118,000 mg/kg. Irrespective of the results of the risk assessments, TPH contamination must be addressed.

Navy Response – The RIDEM GB Leachability Criteria are not applicable to sediment. TPH contamination will be addressed in the FS.

15. Page 35, Section 4.0, Nature and Extent of Contamination, Paragraph 3 – This paragraph references Figures 4-1 thru 4-18. A Figure should be added for lead in sediment. Of the 31 locations sampled 14 exceed the RIDEM RDEC and 10 exceed the I/CDEC (RIDEM does not have sediment criteria, however, sediment is very similar to soil). These locations are

primarily in the immediate vicinity of the outfall (within 80') with the exception of location QF-SD25. This figure should be included in the report. Also please add to bullet 1 on this page. It should also be noted that the one location for the exceedance for lead in soil is at QF-SO24 which is at Outfall 001 at 522 mg/kg for the 0-1' interval and 493 mg/kg for the 1' – 2' interval which exceed the I/CDEC and RDEC respectively.

Navy Response – RIDEM RDEC or I/CDEC are soil values and not completely applicable to sediment. New figures are being generated that will compare sediment concentrations on the maps to ecological screening benchmarks. Among the new figures will be lead in sediment.

16. Page 39, Section 4.2, Sediment, TPH, Sentence 2 – This sentence states that TPH concentrations near the outfall are slightly lower reflecting the potential of the main channel and area near the outfall to be scoured during high flow events. Not that scouring does not occur, but it would seem that since TPH is lighter than water that it would float on the water surface thus settling out at the point where water flow subsides. This would help explain why the highest concentrations are found in the wetland. When the wetland is at capacity it then outflows through the drainage ditch which is why we also see TPH there.

Navy Response – The RI Report nature and extent text will be edited. Among the changes will be a discussion of TPH similar to that presented here by RIDEM.

17. Page 43, Section 5.0, Contaminant Fate and Transport, Bullet 1 – Lead in sediment should be added. See Comment 15.

Navy Response – Lead in sediment will be included in the Draft Final Report.

18. Appendix C, Human Health Risk Assessment, Page 1, Introduction, Paragraph 1, Sentence 5 – See comment #3 regarding distance of Outfall 001 from parking lot.

Navy Response – This text will be updated in the Draft Final Report.

19. Appendix C, Human Health Risk Assessment, Page 6, Sediment, Paragraph 1 – "TPH data were not evaluated in the HHRA due to lack of relevant screening levels." While there may not be screening levels for TPH, RIDEM as well as many other states have standards for TPH. Consideration of the standards would also give a good indication if there is a risk to human health or not. This should be noted in the document.

Navy Response – As stated in the text, "Impacts due to petroleum products are assessed using the relevant individual petroleum-related VOC (e.g., benzene, toluene, ethylbenzene, and xylene) and polycyclic aromatic hydrocarbon (PAH) data." Additional discussion of TPH, which discusses any impacts not accounted for using the relevant individual petroleum-related analytes, will be included in the uncertainty section as follows:

"As noted in Section 2.0, TPH data were not evaluated in the HHRA due to a lack of relevant screening levels and that impacts due to petroleum products are assessed using the relevant individual petroleum-related VOC (e.g., benzene, toluene, ethylbenzene, and xylene) and PAH data. It is possible that additional petroleum-related analytes which contribute to a detected TPH concentration may not be included in the VOC and PAH analyte lists. This could result in an underestimate of risk."

20. Appendix C, Human Health Risk Assessment, Page 7, Section 2.1, Background – RIDEM does not accept the background study for this report. See comment #2.

Navy Response – The HHRA does not eliminate COPCs based on a comparison to background concentrations, but rather uses comparison to background exposures as a line of evidence when discussing uncertainty in results. The background study discussed in the HHRA is being revised to a qualitative evaluation (see earlier comment responses). The background data will continue to be used qualitatively in the HHRA.

21. Appendix C, Human Health Risk Assessment, Page 11, Section 2.2.2, Analysis Via Multiple Methods, Paragraph 2 – This paragraph states that for sediment, samples were taken from the 0 – 0.5' and 0.5' to 1.0' interval and the results were averaged to create a 0 – 1' interval for the risk assessment. RIDEM does not accept the averaging of results. The higher of the two values should have been used.

Navy Response – The combination of two sample intervals (i.e., 0-0.5' and 0.5-1') to make a single sample (0-1') is not the same as combining duplicates to get one representative sample for a location. The combination of two sample intervals can be considered collecting one sample from 0-1' and placing the soil/sediment in a bowl for homogenization prior to putting the soil in a jar for analysis. The resulting concentrations would typically be averages of the soil collected. The following text will be included in the uncertainty section, but no changes to the data treatment will be done:

"As discussed in Section 2.2.2, historical sediment samples were only collected from a single interval (0 to 1 ft bgs) per location, while the 2014 RI samples were collected from two intervals per location (i.e., 0 to 0.5 ft and 0.5 to 1 ft). To establish consistency between data sets and to reduce bias which would occur in the locations with two sample intervals, the two sample intervals were combined to create a 0 to 1 ft bgs result. The combination of intervals where one or both intervals were non-detected was performed similarly to the resolution of duplicates described above. However, the combination of two detected sample intervals (i.e., 0 to 0.5 ft and 0.5 to 1 ft) to make a single sample (0 to 1 ft) is not the same as treatment of duplicates (i.e., higher concentration selected) to get one representative sample for a location. Field duplicates are collected from identical intervals to provide an estimate of error in field sampling procedures, not to provide estimates of concentrations from two separate units/intervals. The combination of two sample intervals can be considered collecting one sample from 0 to 1 ft and placing the soil/sediment in a bowl for homogenization prior to putting the soil/sediment in a jar for analysis. The resulting concentrations would typically be averages of the soil/sediment collected. However, as with all soil/sediment sampling, it is possible that higher or lower concentrations could also be detected and there may be an under- or overestimate of risk."

22. Appendix C, Human Health Risk Assessment, Page 17, Section 4.1, Paragraph 2, Sentences 2 & 3 –These sentences state that hot spot locations were looked for, but none were found. Based on Figures 4-8 through 4-14 the area extending from the outfall to about 80' from the outfall into the wetland consistently shows the highest concentrations of contaminates in the sediment. The soil associated with the outfall also consistently has the highest concentrations of contaminates. These areas should be considered as "hot spots".

Navy Response – The pattern/distribution/extent of contamination does not suggest a hot spot which would be evaluated separately for most receptors, but rather a progressive pattern of decreasing concentrations from the outfall to the furthest extents in the wetland. However, while most of the receptors evaluated are assumed to be exposed to the entire area evaluated, a construction worker installing a utility line through the wetland might have exposures limited to the higher concentration area of contamination. The HHRA will be updated to include evaluation of the construction worker exposed to a subset of the sediment samples closer to the outfall which include the higher contaminant concentrations.

23. Appendix C, Human Health Risk Assessment, Page 31, Current Young Child/Adult Trespasser/Recreational User, Paragraph 1 - "As discussed in Section 2.1, multiple COPCs were determined to be non-site-related, including PAHs and arsenic, due to their similarity to background." RIDEM does not accept the background study thus it is not clear that PAHs, arsenic or any other constituent is similar to background.

Navy Response – The HHRA does not eliminate COPCs based on a comparison to background concentrations, but rather uses comparison to background exposures as a line of evidence when discussing uncertainty in results. The background study discussed in the HHRA is being revised to a qualitative evaluation (see earlier comment responses). The background data will continue to be used qualitatively in the HHRA. Text will be revised accordingly based on the results of the revised qualitative evaluation.

24. Appendix D, Ecological Risk Assessment, Page 10, Section 3.1.1, Ecological Setting, Paragraph 3 – See comment #3 regarding distance of Outfall 001 from parking lot.

Navy Response – This text will be update in the Draft Final Report.

25. Appendix D, Ecological Risk Assessment, Page 17, Section 3.1.4, Exposure Pathway Analysis, Bullets – Please include the scenario where wildlife consumes plants that uptake contaminates through the soil or sediment.

Navy Response – The text will be updated to indicate that ingestion of contaminated plants and prey items was already considered in the ERA.

26. Appendix D, Ecological Risk Assessment, Figure 5 – See Comment #8 regarding potential exposure pathways for the conceptual site model.

Navy Response – See response to Comment #8.

27. Appendix D, Ecological Risk Assessment, Page 43, Section 4.3.1 Refinement of the EPC, Paragraph 1, Sentence 2 – This sentence states that in addition to the maximum concentration the average of the detected concentrations were used. RIDEM does not accept the averaging of results as this would tend to mask hot spots.

Navy Response – Comment noted. The Tier 2, Step 3a Risk Characterization section also provides sample-by-sample screens to further refine the risk evaluations and identify discrete areas that could be adversely impacted.

28. Appendix D, Ecological Risk Assessment, Page 47, Section 4.4.1, Background Evaluation – RIDEM does not accept the background study used to eliminate ecological COPCs. See Comment #2.

Navy Response – See response to Comment 2. The current quantitative background study in the ERA is being updated to a qualitative evaluation which will not be used as a basis for elimination of ecological COPCs. The Navy may elect to conduct a new site-specific background study that may be used to refine COPCs.

29. Appendix D, Ecological Risk Assessment, Page 47, Section 4.4.2 Soil Invertebrates and Terrestrial Plants, Paragraph 1, Sentence 1 – "Table 16 presents a refined evaluation of the terrestrial plant and soil invertebrate endpoints using the refined maximum EPC and the average EPC." Please see Comment #27. The average EPC tends to mask hot spots.

Navy Response – Comment noted. See response to Comment #27.

30. Appendix E, Ecological Risk Assessment, Page 2, Section 2.1, Soil – This Section references the background study for soil. Please see Comment #2.

Navy Response – See response to Comment 2. The current quantitative background study in the ERA is being updated to a qualitative evaluation. The text will be updated.

31. General Comment – Based on a review of this remedial investigation the site is in a recreational area. The results of the human health risk assessment show cancer risks greater than 1 x 10-4 under a reasonable maximum exposure (RME) scenario for the current and future recreational user, both child and adult, of the site for surface soil, subsurface soil, sediment and surface water. The same holds true for a hypothetical resident of the site, again both child and adult. For groundwater, evaluated for the hypothetical future on-site resident scenario, well QDC1-MW-03I, located near the drainage ditch, showed a cancer risk greater than 1 x 10-4 based on a RME and a non-cancer risk greater than 1 for both the RME central tendency (CT) . Well QDC1-MW003S, next to QDC1-MW03I, and well QDC1-MW02S located at the outfall has hazard indices greater than 1. For ecological risks many hazard quotients are greater than 1.

For soil, contamination seems to be associated with the outfall and drainage ditch. For the outfall the main contaminants, located at QF-SO24, appear to be lead at 522 mg/kg in the 0-1' range and TPH at 583 mg/kg in the 0-1', 1700 mg/kg in the 1'-2' and 7380 mg/kg in the 0-4' range. At location QF-SO19 Benzo(a)pyrene at 413 mg/kg and TPH at 1450 mg/kg and at location QF-SO18 TPH at 558 mg/kg. For QF-SO18 & 19 the results are from the 0-1' range. All these results exceed the RIDEM RDEC. The lead (522) in the 0-1' range and the TPH (7380) in the 0-4' range at QF-SO24 exceed the I/CDEC.

In the drainage ditch soil contamination appears to be mainly PAHs and TPH primarily located at QF-SO10 and 15. For QF-SO15 in both the 0-1' and 1' – 2' depths Benzo(a) Anthracene, Benzo(a)Pyrene. Benzo(b)Flouranthene, Benzo(g,h,i)perylene, and Benzo(k)Flouranthene all exceed RDEC. The same holds true for QF-SO10, but is limited to the 0-1' depth interval. There are minor exceedances of PAHs in the 0-1' depth interval at locations QF-SO07, 08 and 14. At the outfall location, for soil, QF-SO24 exceeds the RDEC for the aforementioned compounds in the 2' – 4' depth interval. TPH exceeds the RDEC in the 0 – 2' interval at locations QF-SO06, 07,

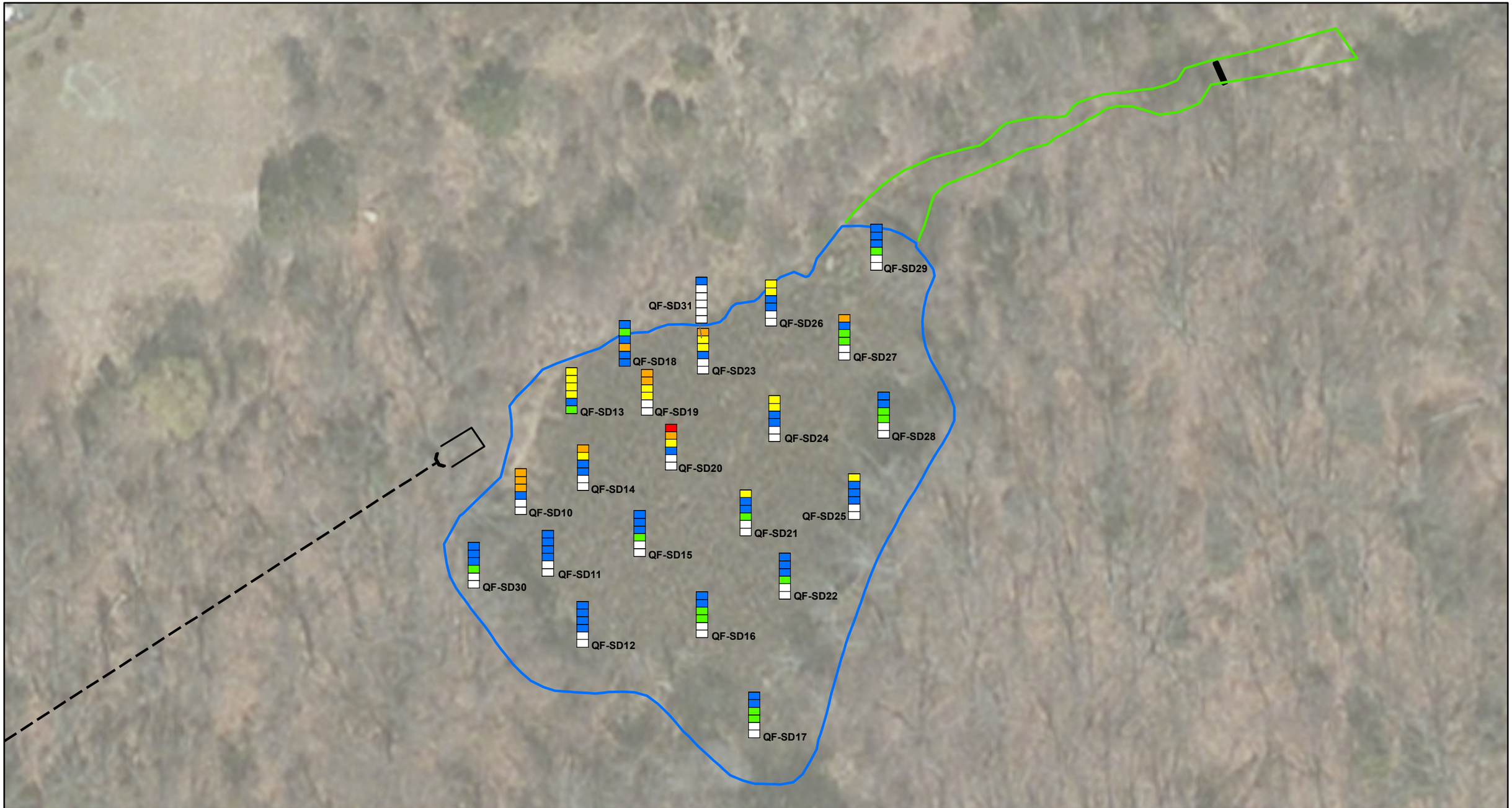
08, 09, 10, 11, 13, 15 18, 19 and 24. THP exceeds the I/CDEC at locations QF-SO14 at 2520 mg/kg in the 2' – 4' depth and at QF-SO24 in the 0 – 4' depth at 7380 mg/kg.

For sediment, TPH appears to be the main contaminate of concern. 16 locations (QF-SD01, 02, 03, 04, 05, 07, 08, 10, 13, 14, 18, 19, 20, 23 and 27) exceed the RIDEM I/CDEC and GB Leachability Criteria. Three locations (QF-SD14, 19 and 20) exceed RIDEM upper concentration limits with a maximum concentration of 118,000 mg/kg at QF-SD20. Most, but not all TPH contamination appears to be in the top foot of sediment and located in the northern portion of the wetland. RIDEM also has a concern with lead as many locations (QF-SD01, 02, 04, 07, 08, 10, 13, 14, 19 and 20) exceed I/CDEC. A few others (QF-SD03, 05, 06, and 25) exceed RDEC for lead. The lead appears to be co-located with the TPH.

RIDEM believes that some form of remediation should be undertaken to address contaminated soils associated with the outfall and drainage ditch as well as the contaminated sediments in the wetland as described above.

Navy Response – The HHRA indicates that all non-groundwater exposure pathways evaluated are either within/below USEPA's target cancer risk range of 10-4 to 10-6 or do not exceed the non-cancer target hazard index of 1. The RI conclusions will be edited to more clearly state this information.

The following text will be added: "The Navy agrees that some form of remediation may be undertaken to address ecological risks in soils related to the outfall and drainage ditch and sediment in the wetland. Risk-based cleanup levels and ARARs, as appropriate, will be taken into account when developing RAOs and cleanup levels in the FS."



RESOLUTION CONSULTANTS

Drawn:	JB	03/16/2015
Approved:	KD	03/16/2015
Project #:	60273164	

Legend

- QDC Outfall 001
- Former Wooden Structure and Plugged Culvert
- QDC Outfall 001 Wetland
- Drainage Ditch
- 2008 Excavation
- CED Area

Benchmark = (RIDEM R/DEC)

Note
Screening benchmarks presented for information only.
Exceedence of a benchmark does not indicate risk.
See the risk assessments in Appendices C and D for evaluation of potential risks.

- Not Sampled
- Not Detected
- Detect Below Screening Benchmark
- Detect Over 1X Screening Benchmark
- Detect Over 10X Screening Benchmark
- Detect Over 100X Screening Benchmark

Depth Intervals (feet)
0-0.5
0.5-1
1-2
2-4
4-6
6-8

Screening Benchmark (mg/kg)
1X: 500
10x: 5000
100x: 50,000

N

0 20 40
Scale in Feet

FIGURE X
TPH CONCENTRATIONS IN SEDIMENT (MG/KG)
QDC OUTFALL 001 RI, NCBC DAVISVILLE
NORTH KINGSTOWN, RHODE ISLAND

Path: \\Uswtf1fp001\Govt\Govt\Projects\Navy CLEAN AECOM-EnSafe JV\Davisville\GIS\Projects\Wetland_RI_Report\MXD\TAG MAPS\SEDIMENT\TPH\TPH stack\TPH SE\TPH_DRO_Sediment.mxd

RESOLUTION CONSULTANTS

Drawn:	JB	03/16/2015
Approved:	KD	03/16/2015
Project #:	60273164	

Legend

- QDC Outfall 001 Wetland
- Drainage Ditch
- Former Wooden Structure and Plugged Culvert
- QDC Outfall 001
- 2008 Excavation
- Former Building 224 Drainline

Benchmark = (RIDEM R/DEC)

Note
Screening benchmarks presented for information only.
Exceedence of a benchmark does not indicate risk.
See the risk assessments in Appendices C and D for evaluation of potential risks.

- Not Sampled
- Not Detected
- Detect Below Screening Benchmark
- Detect Over 1X Screening Benchmark
- Detect Over 10X Screening Benchmark
- Detect Over 100X Screening Benchmark

Depth Intervals (feet)
0-1
1-2
2-4
4-6
6-8

Screening Benchmark (mg/kg)
1X: 500
10x: 5000
100x: 50,000

N

0 35 70
Scale in Feet

FIGURE X
TPH CONCENTRATIONS IN SOIL
(MG/KG)
QDC OUTFALL 001 RI, NCBC DAVISVILLE
NORTH KINGSTOWN, RHODE ISLAND

Path: \\Uswtf1fp001\Govt\Govt\Projects\Navy CLEAN AECOM-EnSafe JV\Davisville\GIS\Projects\Wetland_RI_Report\MXD\TAG MAPS\SOIL\TPH\TPH stack\TPH SO\TPH_DRO_Soil_Stackchart.mxd

TABLE 7.1.RME

CALCULATION OF CANCER RISK FOR CHEMICALS WITH A MUTAGENIC MODE OF ACTION

REASONABLE MAXIMUM EXPOSURE

DAVISVILLE - OUTFALL 001

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations										
					Value	Units	Intake/Exposure Concentration		Age-Dependent Intake/Exposure Concentration [1]		Age-Dependent Adjustment Factor (ADAF) [2]		CSF/Unit Risk		Cancer Risk	Cancer Risk	Cumulative Cancer Risk
							Value	Units	Ages 7-16	Ages 17-26	Ages 7-16	Ages 17-26	Value	Units	Ages 7-16 [3]	Ages 17-26 [3]	Ages 7-26 [4]
Soil	Surface Soil (< 1 ft)	Davisville Outfall	Ingestion														
				BENZO[A]ANTHRACENE	2E+00	mg/kg	1.0E-07	mg/kg-day	5.2E-08	5.2E-08	3.0E+00	1.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	1.1E-07	3.8E-08	1.5E-07
				BENZO[A]PYRENE	1E+00	mg/kg	6.6E-08	mg/kg-day	3.3E-08	3.3E-08	3.0E+00	1.0E+00	7.3E+00	(mg/kg-day) $^{-1}$	7.2E-07	2.4E-07	9.6E-07
				BENZO[B]FLUORANTHE	2E+00	mg/kg	1.1E-07	mg/kg-day	5.6E-08	5.6E-08	3.0E+00	1.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	1.2E-07	4.1E-08	1.6E-07
				BENZO[K]FLUORANTHE	2E+00	mg/kg	9.4E-08	mg/kg-day	4.7E-08	4.7E-08	3.0E+00	1.0E+00	7.3E-02	(mg/kg-day) $^{-1}$	1.0E-08	3.4E-09	1.4E-08
				DIBENZ[A,H]ANTHRACE	5E-01	mg/kg	2.7E-08	mg/kg-day	1.4E-08	1.4E-08	3.0E+00	1.0E+00	7.3E+00	(mg/kg-day) $^{-1}$	3.0E-07	1.0E-07	4.0E-07
				INDENO[1,2,3-CD]PYREN	9E-01	mg/kg	4.4E-08	mg/kg-day	2.2E-08	2.2E-08	3.0E+00	1.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	4.8E-08	1.6E-08	6.4E-08
				CHROMIUM, TOTAL	2E+01	mg/kg	1.1E-06	mg/kg-day	5.3E-07	5.3E-07	3.0E+00	1.0E+00	5.0E-01	(mg/kg-day)	8.0E-07	2.7E-07	1.1E-06
			Exp. Route Total														3E-06
			Dermal														
				BENZO[A]ANTHRACENE	2E+00	mg/kg	5.7E-08	mg/kg-day	2.8E-08	2.8E-08	3.0E+00	1.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	6.2E-08	2.1E-08	8.3E-08
				BENZO[A]PYRENE	1E+00	mg/kg	3.6E-08	mg/kg-day	1.8E-08	1.8E-08	3.0E+00	1.0E+00	7.3E+00	(mg/kg-day) $^{-1}$	4.0E-07	1.3E-07	5.3E-07
				BENZO[B]FLUORANTHE	2E+00	mg/kg	6.2E-08	mg/kg-day	3.1E-08	3.1E-08	3.0E+00	1.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	6.8E-08	2.3E-08	9.0E-08
				BENZO[K]FLUORANTHE	2E+00	mg/kg	5.1E-08	mg/kg-day	2.6E-08	2.6E-08	3.0E+00	1.0E+00	7.3E-02	(mg/kg-day) $^{-1}$	5.6E-09	1.9E-09	7.5E-09
				DIBENZ[A,H]ANTHRACE	5E-01	mg/kg	1.5E-08	mg/kg-day	7.5E-09	7.5E-09	3.0E+00	1.0E+00	7.3E+00	(mg/kg-day) $^{-1}$	1.6E-07	5.5E-08	2.2E-07
				INDENO[1,2,3-CD]PYREN	9E-01	mg/kg	2.4E-08	mg/kg-day	1.2E-08	1.2E-08	3.0E+00	1.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	2.6E-08	8.8E-09	3.5E-08
				CHROMIUM, TOTAL	2E+01	mg/kg	N/A	N/A	N/A	N/A	3.0E+00	1.0E+00	2.0E+01	(mg/kg-day)	N/A	N/A	N/A
			Exp. Route Total														1E-06
			Inhalation of fugitive dust														
				BENZO[A]ANTHRACENE	2E+00	mg/kg	7.6E-09	ug/m3	3.8E-09	3.8E-09	3.0E+00	1.0E+00	1.1E-04	(ug/m3) $^{-1}$	1.3E-12	4.2E-13	1.7E-12
				BENZO[A]PYRENE	1E+00	mg/kg	4.8E-09	ug/m3	2.4E-09	2.4E-09	3.0E+00	1.0E+00	1.1E-03	(ug/m3) $^{-1}$	8.0E-12	2.7E-12	1.1E-11
				BENZO[B]FLUORANTHE	2E+00	mg/kg	8.3E-09	ug/m3	4.1E-09	4.1E-09	3.0E+00	1.0E+00	1.1E-04	(ug/m3) $^{-1}$	1.4E-12	4.6E-13	1.8E-12
				BENZO[K]FLUORANTHE	2E+00	mg/kg	6.9E-09	ug/m3	3.4E-09	3.4E-09	3.0E+00	1.0E+00	1.1E-04	(ug/m3) $^{-1}$	1.1E-12	3.8E-13	1.5E-12
				DIBENZ[A,H]ANTHRACE	5E-01	mg/kg	2.0E-09	ug/m3	1.0E-09	1.0E-09	3.0E+00	1.0E+00	1.2E-03	(ug/m3) $^{-1}$	3.6E-12	1.2E-12	4.8E-12
				INDENO[1,2,3-CD]PYREN	9E-01	mg/kg	3.2E-09	ug/m3	1.6E-09	1.6E-09	3.0E+00	1.0E+00	1.1E-04	(ug/m3) $^{-1}$	5.3E-13	1.8E-13	7.1E-13
				CHROMIUM, TOTAL	2E+01	mg/kg	7.8E-08	ug/m3	3.9E-08	3.9E-08	3.0E+00	1.0E+00	8.4E-02	(ug/m3) $^{-1}$	9.9E-09	3.3E-09	1.3E-08
			Exp. Route Total														1E-08
		Exposure Point Total															4E-06
	Exposure Medium Total																N/A
Medium Total																	N/A

TABLE 7.1.RME

CALCULATION OF CANCER RISK FOR CHEMICALS WITH A MUTAGENIC MODE OF ACTION

REASONABLE MAXIMUM EXPOSURE

DAVISVILLE - OUTFALL 001

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations										
					Value	Units	Intake/Exposure Concentration		Age-Dependent Intake/Exposure Concentration [1]		Age-Dependent Adjustment Factor (ADAF) [2]		CSF/Unit Risk		Cancer Risk	Cancer Risk	Cumulative Cancer Risk
							Value	Units	Ages 7-16	Ages 17-26	Ages 7-16	Ages 17-26	Value	Units	Ages 7-16 [3]	Ages 17-26 [3]	Ages 7-26 [4]
Sediment	Sediment (< 1 ft)	Davisville Outfall 001	Ingestion														
				BENZO[A]ANTHRACENE	8E+00	mg/kg	4.2E-07	mg/kg-day	2.1E-07	2.1E-07	3.0E+00	1.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	4.6E-07	1.5E-07	6.1E-07
				BENZO[A]PYRENE	7E+00	mg/kg	3.6E-07	mg/kg-day	1.8E-07	1.8E-07	3.0E+00	1.0E+00	7.3E+00	(mg/kg-day) $^{-1}$	3.9E-06	1.3E-06	5.2E-06
				BENZO[B]FLUORANTHE	4E+00	mg/kg	1.8E-07	mg/kg-day	9.2E-08	9.2E-08	3.0E+00	1.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	2.0E-07	6.7E-08	2.7E-07
				BENZO[K]FLUORANTHE	6E+00	mg/kg	3.2E-07	mg/kg-day	1.6E-07	1.6E-07	3.0E+00	1.0E+00	7.3E-02	(mg/kg-day) $^{-1}$	3.5E-08	1.2E-08	4.6E-08
				DIBENZ[A,H]ANTHRACE	6E-01	mg/kg	2.9E-08	mg/kg-day	1.4E-08	1.4E-08	3.0E+00	1.0E+00	7.3E+00	(mg/kg-day) $^{-1}$	3.2E-07	1.1E-07	4.2E-07
				INDENO[1,2,3-CD]PYREN	5E+00	mg/kg	2.4E-07	mg/kg-day	1.2E-07	1.2E-07	3.0E+00	1.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	2.6E-07	8.6E-08	3.4E-07
				CHROMIUM, TOTAL	7E+01	mg/kg	3.6E-06	mg/kg-day	1.8E-06	1.8E-06	3.0E+00	1.0E+00	5.0E-01	(mg/kg-day)	2.7E-06	9.1E-07	3.6E-06
			Exp. Route Total														1E-05
			Dermal														
				BENZO[A]ANTHRACENE	8E+00	mg/kg	1.0E-06	mg/kg-day	5.2E-07	5.2E-07	3.0E+00	1.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	1.1E-06	3.8E-07	1.5E-06
				BENZO[A]PYRENE	7E+00	mg/kg	8.9E-07	mg/kg-day	4.5E-07	4.5E-07	3.0E+00	1.0E+00	7.3E+00	(mg/kg-day) $^{-1}$	9.8E-06	3.3E-06	1.3E-05
				BENZO[B]FLUORANTHE	4E+00	mg/kg	4.6E-07	mg/kg-day	2.3E-07	2.3E-07	3.0E+00	1.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	5.0E-07	1.7E-07	6.6E-07
				BENZO[K]FLUORANTHE	6E+00	mg/kg	7.9E-07	mg/kg-day	3.9E-07	3.9E-07	3.0E+00	1.0E+00	7.3E-02	(mg/kg-day) $^{-1}$	8.6E-08	2.9E-08	1.1E-07
				DIBENZ[A,H]ANTHRACE	6E-01	mg/kg	7.2E-08	mg/kg-day	3.6E-08	3.6E-08	3.0E+00	1.0E+00	7.3E+00	(mg/kg-day) $^{-1}$	7.8E-07	2.6E-07	1.0E-06
				INDENO[1,2,3-CD]PYREN	5E+00	mg/kg	5.9E-07	mg/kg-day	2.9E-07	2.9E-07	3.0E+00	1.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	6.4E-07	2.1E-07	8.6E-07
				CHROMIUM, TOTAL	7E+01	mg/kg	N/A	N/A	N/A	N/A	3.0E+00	1.0E+00	2.0E+01	(mg/kg-day)	N/A	N/A	N/A
			Exp. Route Total														2E-05
		Exposure Point Total															3E-05
	Exposure Medium Total																N/A
Medium Total																	N/A
														Total of Receptor Risks Across All Media			N/A

Notes

Early-life cancer risk calculations for carcinogenic PAHs and chromium (VI) calculated by multiplying the age-dependent intake/exposure concentration by the appropriate default age-dependent adjustment factor (ADAF) and the appropriate cancer slope factor (CSF) according to the following formula:

Cancer Risk = Intake (mg/kg-day) x CSF (mg/kg-day)$^{-1}$ x ADAF

[1] Age-dependent intake/exposure concentration determined by multiplying the intake/exposure concentration by the fraction of years related to default ADAFs: 10/20 of the value for ages 7-16 and 10/20 of the value for ages 17-26

[2] ADAFs: 3 for ages 7-16 and 1 for ages 17-26

[3] Age-dependent cancer risk calculated by multiplying the age-dependent intake/exposure concentration by the appropriate ADAF and cancer slope factor.

[4] Cumulative cancer risk calculated by adding the age-dependent cancer risk results together.

TABLE 7.2.RME

CALCULATION OF CANCER RISK FOR CHEMICALS WITH A MUTAGENIC MODE OF ACTION

REASONABLE MAXIMUM EXPOSURE

DAVISVILLE - OUTFALL 001

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations										
					Value	Units	Intake/Exposure Concentration		Age-Dependent Intake/Exposure Concentration [1]		Age-Dependent Adjustment Factor (ADAF) [2]		CSF/Unit Risk		Cancer Risk	Cancer Risk	Cumulative Cancer Risk
							Value	Units	Ages 1-2	Ages 3-6	Ages 1-2	Ages 3-6	Value	Units	Ages 1-2 [3]	Ages 3-6 [3]	Ages 1-6 [4]
Soil	Surface Soil (< 1 ft)	Davisville Outfall	Ingestion														
				BENZO[A]ANTHRACENE	2E+00	mg/kg	3.3E-07	mg/kg-day	1.1E-07	2.2E-07	1.0E+01	3.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	8.1E-07	4.8E-07	1.3E-06
				BENZO[A]PYRENE	1E+00	mg/kg	2.1E-07	mg/kg-day	7.0E-08	1.4E-07	1.0E+01	3.0E+00	7.3E+00	(mg/kg-day) $^{-1}$	5.1E-06	3.1E-06	8.2E-06
				BENZO[B]FLUORANTHEN	2E+00	mg/kg	3.6E-07	mg/kg-day	1.2E-07	2.4E-07	1.0E+01	3.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	8.8E-07	5.3E-07	1.4E-06
				BENZO[K]FLUORANTHEN	2E+00	mg/kg	3.0E-07	mg/kg-day	1.0E-07	2.0E-07	1.0E+01	3.0E+00	7.3E-02	(mg/kg-day) $^{-1}$	7.3E-08	4.4E-08	1.2E-07
				DIBENZ[A,H]ANTHRACEN	5E-01	mg/kg	8.8E-08	mg/kg-day	2.9E-08	5.9E-08	1.0E+01	3.0E+00	7.3E+00	(mg/kg-day) $^{-1}$	2.1E-06	1.3E-06	3.4E-06
				INDENO[1,2,3-CD]PYREN	9E-01	mg/kg	1.4E-07	mg/kg-day	4.7E-08	9.4E-08	1.0E+01	3.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	3.4E-07	2.1E-07	5.5E-07
				CHROMIUM, TOTAL	2E+01	mg/kg	3.4E-06	mg/kg-day	1.1E-06	2.3E-06	1.0E+01	3.0E+00	5.0E-01	(mg/kg-day)	5.7E-06	3.4E-06	9.1E-06
			Exp. Route Total														2E-05
			Dermal														
				BENZO[A]ANTHRACENE	2E+00	mg/kg	1.0E-07	mg/kg-day	3.4E-08	6.8E-08	1.0E+01	3.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	2.5E-07	1.5E-07	4.0E-07
				BENZO[A]PYRENE	1E+00	mg/kg	6.5E-08	mg/kg-day	2.2E-08	4.3E-08	1.0E+01	3.0E+00	7.3E+00	(mg/kg-day) $^{-1}$	1.6E-06	9.5E-07	2.5E-06
				BENZO[B]FLUORANTHEN	2E+00	mg/kg	1.1E-07	mg/kg-day	3.7E-08	7.4E-08	1.0E+01	3.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	2.7E-07	1.6E-07	4.3E-07
				BENZO[K]FLUORANTHEN	2E+00	mg/kg	9.3E-08	mg/kg-day	3.1E-08	6.2E-08	1.0E+01	3.0E+00	7.3E-02	(mg/kg-day) $^{-1}$	2.3E-08	1.4E-08	3.6E-08
				DIBENZ[A,H]ANTHRACEN	5E-01	mg/kg	2.7E-08	mg/kg-day	9.0E-09	1.8E-08	1.0E+01	3.0E+00	7.3E+00	(mg/kg-day) $^{-1}$	6.6E-07	4.0E-07	1.1E-06
				INDENO[1,2,3-CD]PYREN	9E-01	mg/kg	4.3E-08	mg/kg-day	1.4E-08	2.9E-08	1.0E+01	3.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	1.1E-07	6.4E-08	1.7E-07
				CHROMIUM, TOTAL	2E+01	mg/kg	N/A	N/A	N/A	N/A	1.0E+01	3.0E+00	2.0E+01	(mg/kg-day)	N/A	N/A	N/A
			Exp. Route Total														5E-06
			Inhalation of fugitive dust														
				BENZO[A]ANTHRACENE	2E+00	mg/kg	2.3E-09	ug/m3	7.6E-10	1.5E-09	1.0E+01	3.0E+00	1.1E-04	(ug/m3) $^{-1}$	8.4E-13	5.0E-13	1.3E-12
				BENZO[A]PYRENE	1E+00	mg/kg	1.5E-09	ug/m3	4.8E-10	9.7E-10	1.0E+01	3.0E+00	1.1E-03	(ug/m3) $^{-1}$	5.3E-12	3.2E-12	8.5E-12
				BENZO[B]FLUORANTHEN	2E+00	mg/kg	2.5E-09	ug/m3	8.3E-10	1.7E-09	1.0E+01	3.0E+00	1.1E-04	(ug/m3) $^{-1}$	9.1E-13	5.5E-13	1.5E-12
				BENZO[K]FLUORANTHEN	2E+00	mg/kg	2.1E-09	ug/m3	6.9E-10	1.4E-09	1.0E+01	3.0E+00	1.1E-04	(ug/m3) $^{-1}$	7.6E-13	4.6E-13	1.2E-12
				DIBENZ[A,H]ANTHRACEN	5E-01	mg/kg	6.0E-10	ug/m3	2.0E-10	4.0E-10	1.0E+01	3.0E+00	1.2E-03	(ug/m3) $^{-1}$	2.4E-12	1.5E-12	3.9E-12
				INDENO[1,2,3-CD]PYREN	9E-01	mg/kg	9.7E-10	ug/m3	3.2E-10	6.5E-10	1.0E+01	3.0E+00	1.1E-04	(ug/m3) $^{-1}$	3.6E-13	2.1E-13	5.7E-13
				CHROMIUM, TOTAL	2E+01	mg/kg	2.4E-08	ug/m3	7.8E-09	1.6E-08	1.0E+01	3.0E+00	8.4E-02	(ug/m3) $^{-1}$	6.6E-09	4.0E-09	1.1E-08
			Exp. Route Total														1E-08
		Exposure Point Total															3E-05
	Exposure Medium Total																N/A
Medium Total																	N/A

TABLE 7.2.RME

CALCULATION OF CANCER RISK FOR CHEMICALS WITH A MUTAGENIC MODE OF ACTION

REASONABLE MAXIMUM EXPOSURE

DAVISVILLE - OUTFALL 001

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations										
					Value	Units	Intake/Exposure Concentration		Age-Dependent Intake/Exposure Concentration [1]		Age-Dependent Adjustment Factor (ADAF) [2]		CSF/Unit Risk		Cancer Risk	Cancer Risk	Cumulative Cancer Risk
							Value	Units	Ages 1-2	Ages 3-6	Ages 1-2	Ages 3-6	Value	Units	Ages 1-2 [3]	Ages 3-6 [3]	Ages 1-6 [4]
Sediment	Sediment (< 1 ft)	Davisville Outfall 001	Ingestion														
				BENZO[A]ANTHRACENE	8E+00	mg/kg	1.3E-06	mg/kg-day	4.4E-07	8.9E-07	1.0E+01	3.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	3.2E-06	1.9E-06	5.2E-06
				BENZO[A]PYRENE	7E+00	mg/kg	1.2E-06	mg/kg-day	3.8E-07	7.7E-07	1.0E+01	3.0E+00	7.3E+00	(mg/kg-day) $^{-1}$	2.8E-05	1.7E-05	4.5E-05
				BENZO[B]FLUORANTHEN	4E+00	mg/kg	5.9E-07	mg/kg-day	2.0E-07	3.9E-07	1.0E+01	3.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	1.4E-06	8.6E-07	2.3E-06
				BENZO[K]FLUORANTHEN	6E+00	mg/kg	1.0E-06	mg/kg-day	3.4E-07	6.7E-07	1.0E+01	3.0E+00	7.3E-02	(mg/kg-day) $^{-1}$	2.5E-07	1.5E-07	3.9E-07
				DIBENZ[A,H]ANTHRACEN	6E-01	mg/kg	9.2E-08	mg/kg-day	3.1E-08	6.1E-08	1.0E+01	3.0E+00	7.3E+00	(mg/kg-day) $^{-1}$	2.2E-06	1.3E-06	3.6E-06
				INDENO[1,2,3-CD]PYREN	5E+00	mg/kg	7.6E-07	mg/kg-day	2.5E-07	5.0E-07	1.0E+01	3.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	1.8E-06	1.1E-06	2.9E-06
				CHROMIUM, TOTAL	7E+01	mg/kg	1.2E-05	mg/kg-day	3.9E-06	7.7E-06	1.0E+01	3.0E+00	5.0E-01	(mg/kg-day)	1.9E-05	1.2E-05	3.1E-05
			Exp. Route Total														9E-05
			Dermal														
				BENZO[A]ANTHRACENE	8E+00	mg/kg	4.7E-07	mg/kg-day	1.6E-07	3.1E-07	1.0E+01	3.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	1.1E-06	6.9E-07	1.8E-06
				BENZO[A]PYRENE	7E+00	mg/kg	4.1E-07	mg/kg-day	1.4E-07	2.7E-07	1.0E+01	3.0E+00	7.3E+00	(mg/kg-day) $^{-1}$	9.9E-06	6.0E-06	1.6E-05
				BENZO[B]FLUORANTHEN	4E+00	mg/kg	2.1E-07	mg/kg-day	6.9E-08	1.4E-07	1.0E+01	3.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	5.1E-07	3.0E-07	8.1E-07
				BENZO[K]FLUORANTHEN	6E+00	mg/kg	3.6E-07	mg/kg-day	1.2E-07	2.4E-07	1.0E+01	3.0E+00	7.3E-02	(mg/kg-day) $^{-1}$	8.7E-08	5.2E-08	1.4E-07
				DIBENZ[A,H]ANTHRACEN	6E-01	mg/kg	3.3E-08	mg/kg-day	1.1E-08	2.2E-08	1.0E+01	3.0E+00	7.3E+00	(mg/kg-day) $^{-1}$	8.0E-07	4.8E-07	1.3E-06
				INDENO[1,2,3-CD]PYREN	5E+00	mg/kg	2.7E-07	mg/kg-day	8.9E-08	1.8E-07	1.0E+01	3.0E+00	7.3E-01	(mg/kg-day) $^{-1}$	6.5E-07	3.9E-07	1.0E-06
				CHROMIUM, TOTAL	7E+01		N/A	N/A	N/A	N/A	1.0E+01	3.0E+00	2.0E+01	(mg/kg-day)	N/A	N/A	N/A
			Exp. Route Total														2E-05
		Exposure Point Total															1E-04
	Exposure Medium Total																N/A
Medium Total																	N/A
														Total of Receptor Risks Across All Media			N/A

Notes

Early-life cancer risk calculations for carcinogenic PAHs and chromium (VI) calculated by multiplying the age-dependent intake/exposure concentration by the appropriate default age-dependent adjustment factor (ADAF) and the appropriate cancer slope factor (CSF) according to the following formula:

Cancer Risk = Intake (mg/kg-day) x CSF (mg/kg-day)$^{-1}$ x ADAF

[1] Age-dependent intake/exposure concentration determined by multiplying the intake/exposure concentration by the fraction of years related to default ADAFs: 2/6 of the value for ages 1-2 and 4/6 of the value for ages 3-6

[2] ADAFs: 10 for ages 1-2 and 3 for ages 3-6

[3] Age-dependent cancer risk calculated by multiplying the age-dependent intake/exposure concentration by the appropriate ADAF and cancer slope factor.

[4] Cumulative cancer risk calculated by adding the age-dependent cancer risk results together.

TABLE 7.9.RME

CALCULATION OF CANCER RISK FOR CHEMICALS WITH A MUTAGENIC MODE OF ACTION

REASONABLE MAXIMUM EXPOSURE

DAVISVILLE - OUTFALL 001

Scenario Timeframe: Future
Receptor Population: On-Site Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations												
					Value	Units	Intake/Exposure Concentration		Age-Dependent Intake/Exposure Concentration [1]		Age-Dependent Adjustment Factor (ADAF) [2]		CSF/Unit Risk		Cancer/Mutagenic Adjustment Factors (CAF/MAF) [3]		Cancer Risk	Cancer Risk	Cumulative Cancer Risk
							Value	Units	Ages 7-16	Ages 17-26	Ages 7-16	Ages 17-26	Value	Units	CAF	MAF	Ages 7-16 [4]	Ages 17-26 [4]	Ages 7-26 [5]
Groundwater	Groundwater	Davisville Outfall 001 - PGU-Z3-03I	Ingestion	TRICHLOROETHENE	3E-01	ug/L	2.9E-06	mg/kg-day	1.5E-06	1.5E-06	3.0E+00	1.0E+00	4.6E-02	(mg/kg-day) $^{-1}$	8.0E-01	2.0E-01	9.5E-08	6.8E-08	1.6E-07
			Exp. Route Total																2E-07
			Dermal	TRICHLOROETHENE	3E-01	ug/L	5.0E-07	mg/kg-day	2.5E-07	2.5E-07	3.0E+00	1.0E+00	4.6E-02	(mg/kg-day) $^{-1}$	8.0E-01	2.0E-01	1.6E-08	1.2E-08	2.8E-08
			Exp. Route Total																3E-08
			Inhalation	TRICHLOROETHENE	3E-01	ug/L	4.7E-02	ug/m3	2.3E-02	2.3E-02	3.0E+00	1.0E+00	4.1E-06	(ug/m3) $^{-1}$	7.6E-01	2.4E-01	1.4E-07	9.6E-08	2.4E-07
			Exp. Route Total																2E-07
		Exposure Point Total																	4E-07
		Davisville Outfall 001 - PGU-Z3-03S	Ingestion	TRICHLOROETHENE	3E-01	ug/L	2.8E-06	mg/kg-day	1.4E-06	1.4E-06	3.0E+00	1.0E+00	4.6E-02	(mg/kg-day) $^{-1}$	8.0E-01	2.0E-01	9.0E-08	6.4E-08	1.5E-07
			Exp. Route Total																2E-07
			Dermal	TRICHLOROETHENE	3E-01	ug/L	5.0E-07	mg/kg-day	2.5E-07	2.5E-07	3.0E+00	1.0E+00	4.6E-02	(mg/kg-day) $^{-1}$	8.0E-01	2.0E-01	1.6E-08	1.2E-08	2.8E-08
			Exp. Route Total																3E-08
			Inhalation	TRICHLOROETHENE	3E-01	ug/L	4.4E-02	ug/m3	2.2E-02	2.2E-02	3.0E+00	1.0E+00	4.1E-06	(ug/m3) $^{-1}$	7.6E-01	2.4E-01	1.3E-07	9.1E-08	2.3E-07
			Exp. Route Total																2E-07
		Exposure Point Total																	4E-07
		Davisville Outfall 001 - QDC1-MW02I	Ingestion	TRICHLOROETHENE	5E-01	ug/L	4.3E-06	mg/kg-day	2.2E-06	2.2E-06	3.0E+00	1.0E+00	4.6E-02	(mg/kg-day) $^{-1}$	8.0E-01	2.0E-01	1.4E-07	1.0E-07	2.4E-07
			Exp. Route Total																2E-07
			Dermal	TRICHLOROETHENE	5E-01	ug/L	5.0E-07	mg/kg-day	2.5E-07	2.5E-07	3.0E+00	1.0E+00	4.6E-02	(mg/kg-day) $^{-1}$	8.0E-01	2.0E-01	1.6E-08	1.2E-08	2.8E-08
			Exp. Route Total																3E-08
			Inhalation	TRICHLOROETHENE	5E-01	ug/L	7.0E-02	ug/m3	3.5E-02	3.5E-02	3.0E+00	1.0E+00	4.1E-06	(ug/m3) $^{-1}$	7.6E-01	2.4E-01	2.1E-07	1.4E-07	3.5E-07
			Exp. Route Total																4E-07
		Exposure Point Total																	6E-07

TABLE 7.9.RME

CALCULATION OF CANCER RISK FOR CHEMICALS WITH A MUTAGENIC MODE OF ACTION

REASONABLE MAXIMUM EXPOSURE

DAVISVILLE - OUTFALL 001

Scenario Timeframe: Future
Receptor Population: On-Site Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations												
					Value	Units	Intake/Exposure Concentration		Age-Dependent Intake/Exposure Concentration [1]		Age-Dependent Adjustment Factor (ADAF) [2]		CSF/Unit Risk		Cancer/Mutagenic Adjustment Factors (CAF/MAF) [3]		Cancer Risk	Cancer Risk	Cumulative Cancer Risk
							Value	Units	Ages 7-16	Ages 17-26	Ages 7-16	Ages 17-26	Value	Units	CAF	MAF	Ages 7-16 [4]	Ages 17-26 [4]	Ages 7-26 [5]
		Davisville Outfall 001 - QDC1-MW03I	Ingestion	TRICHLOROETHENE	3E-01	ug/L	3.0E-06	mg/kg-day	1.5E-06	1.5E-06	3.0E+00	1.0E+00	4.6E-02	(mg/kg-day) $^{-1}$	8.0E-01	2.0E-01	9.7E-08	6.9E-08	1.7E-07
			Exp. Route Total																2E-07
			Dermal	TRICHLOROETHENE	3E-01	ug/L	5.0E-07	mg/kg-day	2.5E-07	2.5E-07	3.0E+00	1.0E+00	4.6E-02	(mg/kg-day) $^{-1}$	8.0E-01	2.0E-01	1.6E-08	1.2E-08	2.8E-08
			Exp. Route Total																3E-08
			Inhalation	TRICHLOROETHENE	3E-01	ug/L	4.8E-02	ug/m3	2.4E-02	2.4E-02	3.0E+00	1.0E+00	4.1E-06	(ug/m3) $^{-1}$	7.6E-01	2.4E-01	1.5E-07	9.8E-08	2.4E-07
			Exp. Route Total																2E-07
		Exposure Point Total																	4E-07
	Exposure Medium Total																		N/A
Medium Total																			N/A
							Total of Receptor Risks Across All Media												N/A

Notes

Ingestion/Dermal:

Early-life cancer risk calculations for trichloroethene calculated by multiplying the age-dependent intake/exposure concentration by the appropriate default age-dependent adjustment factor (ADAF) and the appropriate cancer slope factor (CSF), but only for exposure to the kidneys. This requires splitting the cancer slope factor (CSF) by tumor effects [kidney CSF = 9.3E-03 (mg/kg-day)$^{-1}$ and non-Hodgkins lymphoma (NHL)+Liver CSF = 3.7E-2 (mg/kg-day)$^{-1}$]. Use of the adult-based CSF [4.6E-2 (mg/kg-day)$^{-1}$] results in development of a cancer adjustment factor (CAF) = NHL+Liver CSF/adult-based CSF = 0.804 and a mutagenic adjustment factor (MAF) = kidney CSF/adult-based CSF = 0.202.

Ingestion/dermal early-life cancer risk = [intake/exposure concentration (mg/kg-day) x adult-based CSF (mg/kg-day)$^{-1}$ x MAF (0.202) x 3 + intake/exposure concentration (mg/kg-day) x adult-based CSF (mg/kg-day)$^{-1}$ x CAF (0.804)] x 10/20 +
[intake/exposure concentration (mg/kg-day) x adult-based CSF (mg/kg-day)$^{-1}$ x MAF (0.202) x 1 + intake/exposure concentration (mg/kg-day) x adult-based CSF (mg/kg-day)$^{-1}$ x CAF (0.804)] x 10/20

Inhalation:

Early-life cancer risk calculations for trichloroethene calculated by multiplying the age-dependent intake/exposure concentration by the appropriate default age-dependent adjustment factor (ADAF) and the appropriate cancer slope factor (CSF), but only for exposure to the kidneys. This requires splitting the unit risk factor (URF) by tumor effects [kidney URF = 1E-06 (ug/m^3)$^{-1}$ and non-Hodgkins lymphoma (NHL)+Liver URF = 3.1E-6 (ug/m^3)$^{-1}$]. Use of the adult-based URF [4.1E-6 (ug/m^3)$^{-1}$] results in development of a cancer adjustment factor (CAF) = NHL+Liver URF/adult-based URF = 0.756 and a mutagenic adjustment factor (MAF) = kidney URF/adult-based URF = 0.244.

Inhalation early-life cancer risk = [intake/exposure concentration (ug/m^3) x adult-based URF (ug/m^3)$^{-1}$ x MAF (0.244) x 3 + intake/exposure concentration (ug/m^3) x adult-based URF (ug/m^3)$^{-1}$ x CAF (0.756)] x 10/20 +
[intake/exposure concentration (ug/m^3) x adult-based URF (ug/m^3)$^{-1}$ x MAF (0.244) x 1 + intake/exposure concentration (ug/m^3) x adult-based URF (ug/m^3)$^{-1}$ x CAF (0.756)] x 10/20

[1] Age-dependent intake/exposure concentration determined by multiplying the intake/exposure concentration by the fraction of years related to default ADAFs: 10/20 of the value for ages 7-16 and 10/20 of the value for ages 17-26

[2] ADAFs: 3 for ages 7-16 and 1 for ages 17-26

[3] CAF: Ingestion/Dermal - 0.804; Inhalation - 0.756
MAF: Ingestion/Dermal - 0.202; Inhalation - 0.244

[4] Age-dependent cancer risk calculated by multiplying the age-dependent intake/exposure concentration by the appropriate ADAF, the cancer slope factor and the MAF, and then adding it to the product of the age-dependent intake/exposure concentration, the cancer slope factor and the CAF.

[5] Cumulative cancer risk calculated by adding the age-dependent cancer risk results together.

TABLE 7.10.RME

CALCULATION OF CANCER RISK FOR CHEMICALS WITH A MUTAGENIC MODE OF ACTION

REASONABLE MAXIMUM EXPOSURE

DAVISVILLE - OUTFALL 001

Scenario Timeframe: Future
Receptor Population: On-Site Resident
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations												
					Value	Units	Intake/Exposure Concentration		Age-Dependent Intake/Exposure Concentration [1]		Age-Dependent Adjustment Factor (ADAF) [2]		CSF/Unit Risk		Cancer/Mutagenic Adjustment Factors (CAF/MAF) [3]		Cancer Risk	Cancer Risk	Cumulative Cancer Risk
							Value	Units	Ages 1-2	Ages 3-6	Ages 1-2	Ages 3-6	Value	Units	CAF	MAF	Ages 1-2 [4]	Ages 3-6 [4]	Ages 7-26 [5]
Groundwater	Groundwater	Davisville Outfall 001 - PGU-Z3-03I	Ingestion	TRICHLOROETHENE	3E-01	ug/L	1.5E-06	mg/kg-day	4.9E-07	9.7E-07	1.0E+01	3.0E+00	4.6E-02	(mg/kg-day) $^{-1}$	8.0E-01	2.0E-01	6.3E-08	6.3E-08	1.3E-07
			Exp. Route Total																1E-07
			Dermal	TRICHLOROETHENE	3E-01	ug/L	N/A	N/A	N/A	N/A	1.0E+01	3.0E+00	4.6E-02	(mg/kg-day) $^{-1}$	8.0E-01	2.0E-01	N/A	N/A	N/A
			Exp. Route Total																0E+00
			Inhalation	TRICHLOROETHENE	3E-01	ug/L	1.4E-02	ug/m3	4.7E-03	9.3E-03	1.0E+01	3.0E+00	4.1E-06	(ug/m3) $^{-1}$	7.6E-01	2.4E-01	6.1E-08	5.7E-08	1.2E-07
			Exp. Route Total																1E-07
		Exposure Point Total																	2E-07
		Davisville Outfall 001 - PGU-Z3-03S	Ingestion	TRICHLOROETHENE	3E-01	ug/L	1.4E-06	mg/kg-day	4.6E-07	9.2E-07	1.0E+01	3.0E+00	4.6E-02	(mg/kg-day) $^{-1}$	8.0E-01	2.0E-01	6.0E-08	6.0E-08	1.2E-07
			Exp. Route Total																1E-07
			Dermal	TRICHLOROETHENE	3E-01	ug/L	N/A	N/A	N/A	N/A	1.0E+01	3.0E+00	4.6E-02	(mg/kg-day) $^{-1}$	8.0E-01	2.0E-01	N/A	N/A	N/A
			Exp. Route Total																0E+00
			Inhalation	TRICHLOROETHENE	3E-01	ug/L	1.3E-02	ug/m3	4.4E-03	8.8E-03	1.0E+01	3.0E+00	4.1E-06	(ug/m3) $^{-1}$	7.6E-01	2.4E-01	5.8E-08	5.4E-08	1.1E-07
			Exp. Route Total																1E-07
		Exposure Point Total																	2E-07
		Davisville Outfall 001 - QDC1-MW02I	Ingestion	TRICHLOROETHENE	5E-01	ug/L	2.2E-06	mg/kg-day	7.2E-07	1.4E-06	1.0E+01	3.0E+00	4.6E-02	(mg/kg-day) $^{-1}$	8.0E-01	2.0E-01	9.4E-08	9.4E-08	1.9E-07
			Exp. Route Total																2E-07
			Dermal	TRICHLOROETHENE	5E-01	ug/L	N/A	N/A	N/A	N/A	1.0E+01	3.0E+00	4.6E-02	(mg/kg-day) $^{-1}$	8.0E-01	2.0E-01	N/A	N/A	N/A
			Exp. Route Total																0E+00
			Inhalation	TRICHLOROETHENE	5E-01	ug/L	2.1E-02	ug/m3	7.0E-03	1.4E-02	1.0E+01	3.0E+00	4.1E-06	(ug/m3) $^{-1}$	7.6E-01	2.4E-01	9.1E-08	8.5E-08	1.8E-07
			Exp. Route Total																2E-07
		Exposure Point Total																	4E-07

TABLE 7.10.RME

CALCULATION OF CANCER RISK FOR CHEMICALS WITH A MUTAGENIC MODE OF ACTION

REASONABLE MAXIMUM EXPOSURE

DAVISVILLE - OUTFALL 001

Scenario Timeframe: Future
Receptor Population: On-Site Resident
Receptor Age: Young Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations												
					Value	Units	Intake/Exposure Concentration		Age-Dependent Intake/Exposure Concentration [1]		Age-Dependent Adjustment Factor (ADAF) [2]		CSF/Unit Risk		Cancer/Mutagenic Adjustment Factors (CAF/MAF) [3]		Cancer Risk	Cancer Risk	Cumulative Cancer Risk
							Value	Units	Ages 1-2	Ages 3-6	Ages 1-2	Ages 3-6	Value	Units	CAF	MAF	Ages 1-2 [4]	Ages 3-6 [4]	Ages 7-26 [5]
		Davisville Outfall 001 - QDC1-MW03I	Ingestion	TRICHLOROETHENE	3E-01	ug/L	1.5E-06	mg/kg-day	5.0E-07	9.9E-07	1.0E+01	3.0E+00	4.6E-02	(mg/kg-day) $^{-1}$	8.0E-01	2.0E-01	6.5E-08	6.4E-08	1.3E-07
			Exp. Route Total																1E-07
			Dermal	TRICHLOROETHENE	3E-01	ug/L	N/A	N/A	N/A	N/A	1.0E+01	3.0E+00	4.6E-02	(mg/kg-day) $^{-1}$	8.0E-01	2.0E-01	N/A	N/A	N/A
			Exp. Route Total																0E+00
			Inhalation	TRICHLOROETHENE	3E-01	ug/L	1.4E-02	ug/m3	4.8E-03	9.6E-03	1.0E+01	3.0E+00	4.1E-06	(ug/m3) $^{-1}$	7.6E-01	2.4E-01	6.3E-08	5.8E-08	1.2E-07
			Exp. Route Total																1E-07
		Exposure Point Total																	3E-07
	Exposure Medium Total																		N/A
Medium Total																			N/A
							Total of Receptor Risks Across All Media												N/A

Notes

Ingestion/Dermal:

Early-life cancer risk calculations for trichloroethene calculated by multiplying the age-dependent intake/exposure concentration by the appropriate default age-dependent adjustment factor (ADAF) and the appropriate cancer slope factor (CSF), but only for exposure to the kidneys. This requires splitting the cancer slope factor (CSF) by tumor effects [kidney CSF = 9.3E-03 (mg/kg-day)$^{-1}$ and non-Hodgkins lymphoma (NHL)+Liver CSF = 3.7E-2 (mg/kg-day)$^{-1}$]. Use of the adult-based CSF [4.6E-2 (mg/kg-day)$^{-1}$] results in development of a cancer adjustment factor (CAF) = NHL+Liver CSF/adult-based CSF = 0.804 and a mutagenic adjustment factor (MAF) = kidney CSF/adult-based CSF = 0.202.

Ingestion/dermal early-life cancer risk = [intake/exposure concentration (mg/kg-day) x adult-based CSF (mg/kg-day)$^{-1}$ x MAF (0.202) x 10 + intake/exposure concentration (mg/kg-day) x adult-based CSF (mg/kg-day)$^{-1}$ x CAF (0.804)] x 2/6 +
[intake/exposure concentration (mg/kg-day) x adult-based CSF (mg/kg-day)$^{-1}$ x MAF (0.202) x 3 + intake/exposure concentration (mg/kg-day) x adult-based CSF (mg/kg-day)$^{-1}$ x CAF (0.804)] x 4/6

Inhalation:

Early-life cancer risk calculations for trichloroethene calculated by multiplying the age-dependent intake/exposure concentration by the appropriate default age-dependent adjustment factor (ADAF) and the appropriate cancer slope factor (CSF), but only for exposure to the kidneys. This requires splitting the unit risk factor (URF) by tumor effects [kidney URF = 1E-06 (ug/m^3)$^{-1}$ and non-Hodgkins lymphoma (NHL)+Liver URF = 3.1E-6 (ug/m^3)$^{-1}$]. Use of the adult-based URF [4.1E-6 (ug/m^3)$^{-1}$] results in development of a cancer adjustment factor (CAF) = NHL+Liver URF/adult-based URF = 0.756 and a mutagenic adjustment factor (MAF) = kidney URF/adult-based URF = 0.244.

Inhalation early-life cancer risk = [intake/exposure concentration (ug/m^3) x adult-based URF (ug/m^3)$^{-1}$ x MAF (0.244) x 10 + intake/exposure concentration (ug/m^3) x adult-based URF (ug/m^3)$^{-1}$ x CAF (0.756)] x 2/6 +
[intake/exposure concentration (ug/m^3) x adult-based URF (ug/m^3)$^{-1}$ x MAF (0.244) x 3 + intake/exposure concentration (ug/m^3) x adult-based URF (ug/m^3)$^{-1}$ x CAF (0.756)] x 4/6

[1] Age-dependent intake/exposure concentration determined by multiplying the intake/exposure concentration by the fraction of years related to default ADAFs: 2/6 of the value for ages 1-2 and 4/6 of the value for ages 3-6

[2] ADAFs: 10 for ages 1-2 and 3 for ages 3-6

[3] CAF: Ingestion/Dermal - 0.804; Inhalation - 0.756
MAF: Ingestion/Dermal - 0.202; Inhalation - 0.244

[4] Age-dependent cancer risk calculated by multiplying the age-dependent intake/exposure concentration by the appropriate ADAF, the cancer slope factor and the MAF, and then adding it to the product of the age-dependent intake/exposure concentration, the cancer slope factor and the CAF.

[5] Cumulative cancer risk calculated by adding the age-dependent cancer risk results together.