APPENDIX F

RESPONSE TO COMMENTS ON THE DRAFT MARINE RESOURCES STUDY

Comments to the draft Marine Resources Study were provided to the Army both orally and in writing. Oral comments were received by the Army during the Public Meeting, held on February 24th, 2007. Formal written comments were received by the Army through the duration of the comment period, which ended on April 19th. This appendix presents the comments received by the Army and the Army's responses to those comments.

Formal written comments were provided by Mr. Doug Henkin, Dr. Jeffrey Foran and Drs. Jack Rensel and Ralph Elston. A variety of people provided oral comments during the public meeting. Both the written comments and the oral comments contained a large amount of additional text and commentary in addition to specific comments related to the draft Marine Resources Study. The Army has isolated the specific comments related to the draft Marine Resources Study, and has provided responses in a comment-response format on the following pages. The comment response format lists the comments in the order they were provided, and identifies the page, paragraph, and line the comment came from. In the case of the oral comments, the comment-response format also identifies the individual making the comment. The entire text of both the formal written comments and the transcript of the public meeting are also included in this appendix, following the responses to comments.

Responses to comments on the EIS are provided in Appendix K.

RESPONSE TO COMMENTS

RE: MAKUA MILITARY RESERVATION DRAFT ENVIRONMENTAL IMPACT STATEMENT, MR. DOUG HENKIN, APRIL 19, 2007

1. **Comment:** **Page 1, Paragraph 3, Line 1: <u>Shellfish and Other Non-Fish, Non-Limu Marine Resources</u>: The Marine Resources Study's failure to examine whether shellfish or other non-fish, non-limu marine resources near Makua Beach and in the muliwai are contaminated violates the terms of the 2007 Order, which expressly requires that shellfish and marine resources other than fish and limu be tested. 2007 Order ¶ 6. As discussed on the enclosed expert reviews, as well as in expert comments on the draft SAP, testing shellfish and other benthic or demersal invertebrates is extremely important to assess potential contamination of marine resources since these species have continual contact with sediments that may contain contaminants from activities at MMR.**

Response: The language in the 2007 order states that "As part of the preparation of the EIS for military training activities at MMR, Defendants shall complete one or more studies to determine whether fish, limu, shellfish, and other marine resources near Makua Beach and in the muliwai on which area residents rely for subsistence are contaminated by substances associated with the proposed training activities at MMR." There is nothing in this language that expressly requires that shellfish be tested, and as such, the Army is not in violation of the 2007 Order.

The results of the Marine Resources Study (MRS) indicate that relatively low levels of contamination are present in fish and limu in the Makua-area muliwai and nearshore areas, and that these levels are approximately the same as the levels detected in fish from background locations. The risk to subsistence fishermen from consuming the fish is below the levels used by USEPA for fish advisories. Furthermore, the study concludes that these contaminants are likely not coming from the MMR, because many of the chemicals are ubiquitous in the environment, and may be attributable to many different sources. Given that the fish are likely not contaminated by substances associated with the proposed training activities at MMR, that there is very little interchange between the muliwai where such substances might accumulate and the near-shore area which provides the habitat for the shellfish on which area residents rely, that any such transport of chemicals from the muliwai to the nearshore area would result in significant dilution of the chemicals, it is likely that the shellfish are not contaminated by substances associated with the proposed training activities at MMR.

Despite the conclusion that the shellfish are likely not contaminated from activities at MMR, field staff did attempt to collect shellfish and benthic invertebrates, including crabs and sea urchins, during the MRS. However, the selected method (passive traps) was not successful in capturing crabs. Additionally, because of the large number of analytes included in the chemical analytical program, field staff were unable to collect a sufficient number of sea urchins to provide enough sample mass (more than 200 grams) for all of the analyses. It is important to recognize that this project required destructive sampling of a living resource, which has the potential to negatively impact a species population in the muliwai. The Army will be developing a long-term monitoring program to evaluate potential impacts from military activities to the muliwai and nearshore areas associated with MMR, and the Army anticipates soliciting public input for the development of the long-term monitoring plan. It is possible that shellfish and benthic invertebrates will be included as species of interest in this monitoring plan if it is determined that the sampling will not have a negative impact on the species population.

2. Comment: Page 2, Paragraph 1, Line 1: The study's failure to test shellfish and other non-fish, non-limu marine resources resulted in a failure to evaluate accurately whether military activities at MMR pose a human health risk to area residents who rely on these marine resources for subsistence, in further violation of the 2007 order. To comply with its legal obligations, the Army must complete another study that focuses on potential contamination of shellfish and other non-fish, non-limu marine resources and the health risks associated with consuming those resources, put the study out for public review and comment, and incorporate its analysis into the final EIS. Id. ¶¶ 6, 11-13.

Response: As noted in the response to comment 1, there is nothing in the 2007 Order that requires the testing of shellfish. Furthermore, the results of the MRS indicate that activities at MMR likely have not resulted in the contamination of fish and limu, and therefore these activities do not pose a human health risk to area residents who rely on these marine resources for subsistence. This evaluation is consistent with the requirements of the 2007 Order. However, the Army will be developing a long-term monitoring program to continue to evaluate potential impacts from military activities to the muliwai and nearshore areas associated with MMR, and the Army anticipates soliciting public input for the development of the long-term monitoring plan. It is possible that shellfish and benthic invertebrates will be included as species of interest in this monitoring plan if it is determined that the sampling will not have a negative impact on the species population.

3. Comment: Page 2, Paragraph 2, Line 1: Fish: As discussed in Drs. Elston and Rensel's review, the study analyzed only fish species that are present at Makua during the middle of the day. The study provides no data or analysis whether fish species that can be gathered only in the early morning or at night – marine resources on which area residents rely for subsistence – are contaminated, violating the 2007 Order.

Response: The Marine Resources Study was intended to sample a representative range of species that may be consumed by subsistence and recreational fishers on the Waianae Coast. Discussions with local subsistence fishers indicate that they typically are opportunists and are not selective of species. Substantial effort was made to select and collect species that were representative of and readily available in the habitats of the Makua muliwai and near shore waters and similar watersheds where military training exercises have not occurred in the recent past. Sampling all possible species that could be eaten by subsistence fishers is an unrealistic expectation, and was beyond the scope of the study.

Since trophic level influences the potential uptake and concentration of contaminants, species from a range of trophic levels (primary producer, herbivore, omnivore, and carnivore) were targeted in the study. Since there is no clearly defined reason why a species that may be active at night would differentially uptake and concentrate contaminants, the study focused active sampling activitities during daylight hours, and employed passive methods (i.e., fish and crab traps) overnight on several occasions and in several muliwai. The only additional species collected using passive traps were a species of freshwater gobie, a shrimp (Macrobrachium grandimanus) and several crabs. Both of the gobi and the shrimp were identified as indigenous to Hawaiian waters and reportedly were non-existent in the lower reaches of streams on Oahu. Because their status was in question (i.e., protected by

state or federal government), these specimens were released back to the muliwai. The number of crabs that were collected were insufficient to be used as even a single sample for the MRS.

4. **Comment:** **Page 2, Paragraph 3, Line 1: While the study claims "the seaweed in the samples were identified to genus," review of the field notes reveals the investigators often had no idea what they were gathering. Study at ES-3. For example, the field notes refer to one sample of limu generically as "Limu 2." These unidentified limu were then composited into mixed "seaweed" samples and then analyzed for contaminants. Study at 2-3, Table 2-2. Since it's analysis is based on composites of "mystery" limu, which may have included species of limu that no one consumes, the study fails to satisfy the 2007 Order's requirement to focus on whether limu "on which area residents rely for subsistence" is contaminated. 2007 Order ¶ 6.**

Response: Attempts were made to identify the seaweed in the samples to genus subsequent to sample collection. While some of the samples could be identified, several of the samples could not. The reference to samples being identified to genus will be removed from the MRS. The Army will be developing a long-term monitoring program to evaluate potential impacts from military activities to the muliwai and nearshore areas associated with Makua Military Reservation, and the Army anticipates soliciting public input for the development of the long-term monitoring plan. It is likely that limu will be included as species of interest in this monitoring plan, and that the limu will be identified to species, if possible, to verify appropriate species of limu (i.e. limu consumed by the local population) are being collected.

5. **Comment:** **Page 2, Paragraph 4, Line 1: Having found extremely elevated levels of arsenic in limu from Makua, the investigators failed to perform standard analyses to determine whether the arsenic in the limu is present in its highly toxic, inorganic form or in the less toxic, organic form. Without this information, there was no way for the study to evaluate accurately whether consuming limu from Makua poses "a human health risk to area residents [who] rely on marine resources for subsistence," further violating the 2007 order. Id.**

Response: Concentrations of arsenic in limu from Makua are not elevated over naturally occurring levels in seaweed around the world. According to Frankenberger (2002) total arsenic concentrations in various types of seaweed around the world range from 4.5 to 140 mg/kg dry weight, whereas the samples collected from Makua ranged from 4.56 to 110 mg/kg dry weight. Since arsenic has never been measured in any of the seaweeds present in Hawaii previously, it cannot be determined at this point whether the arsenic concentrations measured are naturally occurring or elevated; however, the concentrations measured in limu from Makua are consistent with naturally occurring concentrations.

The language in the 2007 order states that "Defendants will evaluate the potential that activities at MMR have contributed or will contribute to any such contamination and whether the proposed training activities at MMR pose a human health risk to area residents that rely on marine resources for subsistence." The Marine Resources Study concluded that the activities at MMR likely did not contribute to the arsenic detected in fish and limu, and therefore the proposed training activities at MMR do not pose a human health risk to area residents that rely

on marine resources for subsistence. Based upon this information, the defendants are not in violation of the 2007 order. Given that the detected arsenic likely did not come from MMR, the defendants are under no obligation to determine if the arsenic is organic or inorganic in order to be in compliance with the 2007 order. Furthermore, the speciation of arsenic to organic vs. inorganic forms was not requested or recommended by Earthjustice or its experts during their review of the Sampling and Analysis Plan, and therefore was not included as part of the analysis program for the Marine Resources Study. The Army will be developing a long-term monitoring program to evaluate potential impacts from military activities to the muliwai and nearshore areas associated with Makua Military Reservation, and the Army anticipates soliciting public input for the development of the long-term monitoring plan. It is likely that the speciation of arsenic to organic vs. inorganic forms will be included in this monitoring plan.

6. **Comment:** **Page 2, Paragraph 5, Line 1: The study failed to analyze limu from any location other than Makua. Accordingly, as the study concedes, "it is not possible to determine whether the arsenic levels detected in seaweed at Makua Beach are elevated over background." Study at ES-3. Having made no attempt to determine the levels of arsenic contamination that would be present in the absence of military activities, the study failed to satisfy the 2007 Order's requirement to "evaluate the potential that activities at MMR have contributed or will contribute to any such contamination." 2007 Order ¶ 6.**

Response: The Marine Resources Study concluded that the activities at MMR likely did not contribute to the arsenic detected in fish and limu, and therefore the proposed training activities at MMR do not pose a human health risk to area residents that rely on marine resources for subsistence. Based upon this information, the defendants are not in violation of the 2007 order. The Army will be developing a long-term monitoring program to evaluate potential impacts from military activities to the muliwai and nearshore areas associated with Makua Military Reservation, and the Army anticipates soliciting public input for the development of the long-term monitoring plan. It is likely that collection of limu from background locations will be included in the long term monitoring plan.

7. **Comment:** **Page 3, Paragraph 1, Line 1: In their comments, Drs. Elston and Rensel detail why the study's selection of Nanakuli muliwai and Sandy Beach – both of which receive substantial inputs of anthropogenic contaminants that, in the absence of military activities, would not occur at Makua – as "background" locations was improper and rendered useless the study's analysis of human health and ecological risk from training activities at MMR. To supplement their discussion, we enclose the relevant page from an O'ahu map book, showing the location of the East Honolulu Wastewater Treatment Plant (labeled on the map as "STP" and circled in black), which is immediately across Kalaniana'ole Highway from Sandy Beach. As noted in Drs. Elston and Rensel's review, the sewage outfall is located only 400 meters offshore, at about only 12 meters in depth.**

Response: The rationale for the selection of background sites was provided in both the final SAP and the draft Marine Resources Study. In the final SAP, Section 2.2, Marine Resources Sampling Strategy, states "Background muliwai will be located on the Waianae Coast within watersheds that are not subjected to military activity." Section

2.2.3, Background Sampling, of the final SAP states "Samples will be collected from locations distant enough from Makua Valley that biota would be unlikely to be affected by target chemicals originating from MMR. Background muliwai will be located in watersheds that are not subject to military activity."

The purpose of the Marine Resources Study is to identify whether Army activities at the MMR have impacted Makua Valley resources above and beyond impacts from all other sources. Using an uncontaminated watershed for a background location would not allow the apportioning of impacts between the Army and other sources. This is a significant concern as there are many substantial sources of contamination other than the MMR. To adequately address the Army's impact alone on Makua Valley resources, an appropriate control site (i.e., background location) would be a valley where all aspects of the valley are as similar as possible to Makua. Since inter-watershed transport of contaminants is facilitated by wind and rain, the control valley should have similar wind and rain patterns as that of Makua. Biogeochemical processes affecting contaminants are a function of temperature and substrate, and these attributes should be as similar as possible to Makua Valley in order to identify impacts that can be attributed solely to Army activity. There are distinct differences in the substrate (mineralogy and age) between the different islands, making the selection of a control on another island inappropriate. Because of this, the most appropriate control watersheds are on the leeward (Waianae) coast of Oahu. As long as the background sites selected are representative of ambient conditions for the general Makua vicinity and have not received contamination from the MMR, they are considered acceptable, as per USEPA (1989, 2002a) risk assessment guidance.

8. Comment: Page 3, Paragraph 2, Line 1: We also note that, across the board, the study concluded the "non-carcinogenic hazard index estimates" from fish consumption were greater at the alleged "background" sites than at Makua, sometimes by many times. <u>See, e.g.,</u> Study at Table 4-8 (non-carcinogenic hazard index estimates from likely fish consumption rates at Nanakuli muliwai using mean contaminant concentrations more than double that at Makua); Table 4-12 (non-carcinogenic hazard index estimate from likely fish consumption rates at Sandy Beach using mean contaminant concentrations double that at Makua Beach); Table 4-13 (non-carcinogenic hazard index estimate from likely fish consumption rates at Sandy Beach using maximum contaminant concentrations more than triple that at Makua Beach); Table 4-16 (non-carcinogenic hazard index estimate from worst-case fish consumption rates at Nanakuli muliwai using mean contaminant concentrations more than double that at Makua); Table 4-20 (non-carcinogenic hazard index estimate from worst-case fish consumption rates at Sandy Beach using mean contaminant concentrations double that at Makua Beach); Table 4-21 (non-carcinogenic hazard index estimate from worst-case fish consumption rates at Sandy Beach using maximum contaminant concentrations more than triple that at Makua Beach). The study's ecological assessments similarly showed greater hazard indexes at the "background" locations than at Makua. <u>See, e.g., id.</u> at Tables 5-13, 5-15, 5-16. That contaminant hazards are <u>greater</u> at the alleged "background" sites than at Makua confirms the inappropriateness of the study's selection of reference sites.

Response: It is entirely possible that background concentrations for some metals may be higher than concentrations observed at the site. This does not automatically mean that the

background locations are not suitable. Rather, it merely indicates that there is variation in the conditions among sites, which is to be expected as the environment is not homogeneous.

The Army investigated a number of muliwai on Oahu to serve as a background location for this study. The choice of muliwai to serve as a background site was necessarily limited by a number of factors. The site, as noted above had to be physically similar to the tested area and in the same biogeographic area as Makua. This limited the locations to the leeward side of Oahu. Within this area, the Army looked at eleven different muliwai, including Kalihii, Waialaenui, Nanakuli, Wailupe, Ulehawa, Keaau, Kamilonui, Manuwai, Makaha, Kaupini, and Nuuanu. One of the characteristics of the Makua watershed is the presence of intermittent streams with a perennial mouth, and the Army sought to duplicate this condition in the background muliwai location. At the time of the sampling, a reconnaissance of these muliwai performed by the Army indicated that Nanakuli was the only other muliwai, aside from Makua, that had flowing water. As a result, the Nanakuli muliwai was selected because it was physically the most representative location available, having similar size, hydrologic, rain, wind and geochemical features as Makua.

The Army investigated the HECO pier area as a nearshore background sampling location, but rejected this location because of potential impacts from the nearby power plant, and instead selected Sandy Beach as a more representative background location for the nearshore sampling.

9. Comment: Page 3, Paragraph 3, Line 1: Having failed to select appropriate background sites, the study could not accurately "evaluate the potential that activities at MMR have contributed or will contribute" to contamination of marine resources used for subsistence, violating the 2007 Order. 2007 Order ¶ 6.

Response: As discussed in the response to comment 8, the selection of background sites was appropriate for the purposes of this scientific study.

10. Comment: Page 3, Paragraph 4, Line 1: Even if the selection of Sandy Beach and/or Nanakuli muliwai as background sites were proper, the study's narrow focus on "incremental risk" (i.e., risk over background) to evaluate human health and ecological risks would still be inappropriate and unlawful. In preparing its EIS for MMR, the Army must consider cumulative impacts, which are impacts that "result[] from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." 40 C.F.R. § 1508.7; see also id. §§ 1508.8, 1508.25. Thus, the Army must evaluate the effect on human health and the marine environment of adding contaminants from proposed training and related activities (including, but not limited to, controlled burns, grass-cutting, herbicides and other ecosystem management) at MMR to whatever level of contamination already exists, including any background levels of contamination. See id. § 1508.27(b)(7) ("Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment"). Such an analysis is necessary to evaluate whether proposed training activities at MMR pose a human health risk to people relying on marine resources for subsistence, as the 2007 Order requires.

Response: USEPA (2002b) states that "a baseline risk assessment generally is conducted to characterize the current and potential threats to human health and the environment that may be posed by hazardous substances, pollutants, and contaminants at a site…. this policy recommends a baseline risk assessment approach that retains constituents that exceed risk-based screening concentrations. This approach involves addressing site-specific background issues at the end of the risk assessment, in the risk characterization. Specifically, the COPCs with high background concentrations should be discussed in the risk characterization, and if data are available, the contribution of background to site concentrations should be distinguished." Therefore, we have shown the risks from exposures to both chemicals at the site and under ambient conditions to distinguish the two and show the contribution over background from exposures at the site.

11. Comment: Page 4, Paragraph 1, Line 1: In the enclosed review, Dr. Foran details the flaws in the study's assumptions regarding fish and limu consumption rates, which render useless its human health risk assessment. In addition to Dr. Foran's comments, we note that the study inaccurately claims Sharma et al. (2003) present data for "Hawaiian fishermen in Hawai'i." Study at 4-8. In fact, Sharma et al. (2003) present data from average food consumers of Native Hawaiian ancestry, not necessarily Hawaiians who fish. Using this average consumption data "[t]o estimate the potential worst case exposures for recreational fishermen" (who, presumably, eat more fish than the average person) likely substantially underestimates human health risks. Id.

The "likely" consumption rate the study used for subsistence fishermen (100.6 g/day) also likely substantially underestimates actual consumption and, thus, health risk. That rate is only about 70% the default national value (from the 1994-1996 Continuing Survey of Food Intake by Individuals) of 142.4 g/day for subsistence fishers. (Sechena, et al., 2003). The study provides no basis for assuming that subsistence fishers on the Wai'anae Coast consume substantially less seafood than the national average.

In order to comply with its obligations under the 2007 Order, the Army must prepare a new human health assessment that is based on accurate data regarding area residents' consumption of marine resources, circulate that new assessment for public review, and incorporate the results of the new assessment in the final EIS for MMR.

Response: Fish consumption rates may vary by ethnic group, lifestyle, economic status, and geography, among other factors (OEHHA 2001). Therefore, it is desirable to use a fish consumption rate that is applicable to the receptors being evaluated. As part of the MRS, the Army reviewed the literature on fish consumption rates in Hawaii and selected the highest fish consumption rates recorded *for Hawaii. The Army believes that the fish consumptions rates used in the MRS were appropriate for the study.

References: Frankenberger, W.T. 2002. *Environmental Chemistry of Arsenic*. New York, Marcel Dekker.

RESPONSE TO COMMENTS

COMMENTS ON THE FINAL MARINE RESOURCES STUDY SAMPLING AND ANALYSIS PLAN (SAP), MAKUA MILITARY RESERVATION (MMR), OAHU, HAWAII AND THE DRAFT MARINE RESOURCES STUDY, VOLUME I, FIELD SAMPLING RESULTS AND RISK ASSESSMENT MAKUA MILITARY RESERVATION (MMR) OAHU, HAWAII, DR. JEFFREY A. FORAN, APRIL 18, 2007

1. **Comment:** **Page 7, Paragraph 2, Line 1: The draft Marine Resources Study (MRS) is poorly written and contains numerous errors and oversights. For example, data reported in Tables 3-1, 3-2, and 4-2 lack units (subsequent comments are based on my assumption that all data are reported in mg/kg wet weight).**

   Response: The units mg/kg have been added to Tables 3-1, 3-2 and 4-2.

2. **Comment:** **Page 8, Paragraph 1, Line 4 (Page 5): Because of the elevated concentrations of arsenic in both fish and limu, and because of the significantly elevated cancer risks of consuming arsenic-contaminated fish and limu, speculation regarding the form of arsenic in biological samples is inappropriate and should be replaced by analytical data that clearly quantify the concentrations of both inorganic and organic arsenic in fish and limu.**

   Response: Concentrations of arsenic in limu from Makua are not necessarily elevated over naturally occurring levels in fish or seaweed around the world. According to Frankenberger (2002), total arsenic concentrations in various types marine fish around the world range from 1.5 to 196 mg/kg dry weight, whereas the samples collected from Makua ranged from 1.46 to 53 mg/kg dry weight. Additionally, as stated in the report, a review of the published literature shows that arsenic is present almost exclusively as nontoxic organic forms in marine fish (Neff 1997; de Gieter et al. 2002; Kirby and Maher 2002; Frankenberger 2002; Kirby et al. 2002; Sloth et al. 2005). Further, according to Frankenberger (2002) total arsenic concentrations in various types of seaweed around the world range from 4.5 to 140 mg/kg dry weight, whereas the samples collected from Makua ranged from 4.56 to 110 mg/kg dry weight. Since arsenic has never been measured in any of the seaweeds present in Hawaii previously, it cannot be determined at this point whether the arsenic concentrations measured are naturally occurring or elevated; however, the concentrations measured in limu from Makua are consistent with naturally occurring concentrations. The Army will be developing a long-term monitoring program to evaluate potential impacts from military activities to the muliwai and nearshore areas associated with Makua Military Reservation, and the Army anticipates soliciting public input for the development of the long-term monitoring plan. It is likely that arsenic will be speciated to determine if it is organic or inorganic as part of the long term monitoring plan.

   .

3. **Comment:** **Page 8, Paragraph 2, Line 4: The rationale for selection of sites to provide information on background concentrations of contaminants is not described in the Final SAP or the draft MRS; therefore, it is impossible to determine whether samples collected from these sites provide data that are representative of background contaminant concentrations in fish. However, the location of a discharge outfall from the East Honolulu Wastewater Treatment Plant offshore at Sandy Beach may significantly influence contaminant loads and contaminant tissue burdens at this site. Nanakuli muliwai, which is located in the middle of an urban area and downstream from Lualualei Naval Magazine, may also be subject to significant contaminant loadings. As a result, samples collected from these sites would not represent true background (uncontaminated) conditions.**

   Response: The rationale for the selection of background sites was provided in both the final SAP and the draft Marine Resources Study. In the final SAP, Section 2.2, Marine

Resources Sampling Strategy, states "Background muliwai will be located on the Waianae Coast within watersheds that are not subjected to military activity." Section 2.2.3, Background Sampling, of the final SAP states "Samples will be collected from locations distant enough from Makua Valley that biota would be unlikely to be affected by target chemicals originating from MMR. Background muliwai will be located in watersheds that are not subject to military activity."

The purpose of the Marine Resources Study is to identify whether Army activities at the MMR have impacted Makua Valley resources above and beyond impacts from all other sources. Using an uncontaminated watershed for a background location, as suggested by Dr. Foran, would not allow the apportioning of impacts between the Army and other sources. This is a significant concern as there are many substantial sources of contamination other than the MMR. To adequately address the Army's impact alone on Makua Valley resources, an appropriate control site (i.e., background location) would be a valley where all aspects of the valley are as similar as possible to Makua. Since inter-watershed transport of contaminants is facilitated by wind and rain, the control valley should have similar wind and rain patterns as that of Makua. Biogeochemical processes affecting contaminants are a function of temperature and substrate, and these attributes should be as similar as possible to Makua Valley in order to identify impacts that can be attributed solely to Army activity. There are distinct differences in the substrate (mineralogy and age) between the different islands, making the selection of a control on another island inappropriate. Because of this, the most appropriate control watersheds are on the leeward (Waianae) coast of Oahu. As long as the background sites selected are representative of ambient conditions for the general Makua vicinity and have not received contamination from the MMR, they are considered acceptable, as per USEPA (1989, 2002a) risk assessment guidance.

4. Comment: Page 9, Paragraph 2, Line 1: Data collected from background sites are used in the draft MRS to determine contaminant concentrations (or health hazards) from military operations at MMR by subtracting "background" contaminant concentrations (or quantitative estimates of hazard associated with exposure to contaminants) from MMR contaminant concentrations (or hazard estimates). The draft MRS suggests that this approach provides an estimate of contamination or risk originating from MMR. This approach ignores the fact that reference sites are impacted from local activities, are not pristine, and do not represent true background conditions. In this case, contamination from MMR would be "excused" simply because it occurs at a level similar to another contaminated site. The approach also fails to incorporate the effects of vast differences in the physical structure of the sites on the fate and transport of contaminants derived from local sources. Use of reference sites to determine background concentrations without addressing differing fate and transport phenomena will lead to an inaccurate assessment of the extent, nature, and impact of contamination at the MMR site.

Response: USEPA (2002b) states that "a baseline risk assessment generally is conducted to characterize the current and potential threats to human health and the environment that may be posed by hazardous substances, pollutants, and contaminants at a site…. this policy recommends a baseline risk assessment approach that retains constituents that exceed risk-based screening concentrations. This approach involves addressing site-specific background issues at the end of the risk assessment, in the risk characterization. Specifically, the COPCs with high background

concentrations should be discussed in the risk characterization, and if data are available, the contribution of background to site concentrations should be distinguished." Therefore, we have shown the risks from exposures to both chemicals at the site and under ambient conditions to distinguish the two and show the contribution over background from exposures at the site. see response to Comment 3 for the selection of appropriate background sampling locations.

5. Comment: Page 11, Paragraph 3, Line 1: The draft MRS manipulates (attempts to minimize) the magnitude of risk by subtracting risk estimates derived for reference sites from risk estimates associated with consumption of fish and limu from the MMR. As discussed previously, the selection of sites to quantify contaminant background concentrations is flawed; thus, risk estimates associated with exposure to contaminants at these sites are not accurate depictions of "background risk."

Response: USEPA (2002b) states that "a baseline risk assessment generally is conducted to characterize the current and potential threats to human health and the environment that may be posed by hazardous substances, pollutants, and contaminants at a site…. this policy recommends a baseline risk assessment approach that retains constituents that exceed risk-based screening concentrations. This approach involves addressing site-specific background issues at the end of the risk assessment, in the risk characterization. Specifically, the COPCs with high background concentrations should be discussed in the risk characterization, and if data are available, the contribution of background to site concentrations should be distinguished." Therefore, we have shown the risks from exposures to both chemicals at the site and under ambient conditions to distinguish the two and show the contribution over background from exposures at the site.

6. Comment: Page 11, Paragraph 3, Line 6: Regardless of the approach to assess contaminant background concentrations, however, the assessment of risk from reference sites and reduction of MMR-associated risk by subtracting reference-site risk is inappropriate. Cancer risk estimates associated with consumption of seafood gathered from Makua are calculated and expressed as "excess risk" (risk above background). These are site-specific estimates of cancer risk above those associated with all other exposure sources and stressors such as exposure to radionuclides in drinking water, overexposure to sunlight, exposure to contaminants in food, and including exposure to contaminants at reference sites. Calculations of risk at reference sites produces estimates of excess cancer risk that are specific to those sites and in excess of all other cancer risks, including risks associated with MMR. Therefore, subtracting "reference site risk" from "MMR risk" is effectively subtracting excess risk from excess risk, an exercise that is conceptually and mathematically unsound.

Response: See response to Comment 4 for the appropriateness of subtracting the risks. No change is proposed to the methodology. However, the terminology used on page 4-11 will be changed from "R = Estimated individual excess lifetime cancer risk" to "R = Estimated individual cancer risk" to resolve this apparent contradiction. "Excess cancer risk" will also be used in the document to denote risks elevated over background.

7. **Comment:** **Page 13, Paragraph 2, Line 1: These rates represent average daily consumption for populations studied by Sechena et al. (2003) and Sharma et al. (2003). However, the draft MRS adjusts these rates by multiplying by the exposure frequency (EF), which is set at 350 (out of 365) days for subsistence consumers and 48 (out of 365) days for recreational consumers. This adjustment is incorrect, as consumption rate data from Sechena et al. (2003) and Sharma et al. (2003) are annualized rates and already incorporate consideration of fish consumption that may not occur each day of the year. That is, estimates of consumption rate (such as 242 g/day) reflect the number of meals eaten during a year and the size (mass) of each meal. Therefore, the appropriate factor for EF is 365 days (which simply provides a unit conversion in the calculation of intake), not 350 days for subsistence consumers and 48 days for recreational consumers.**

Response: The risk assessment has been revised such that the exposure frequency for both subsistence and recreational fishers is increased to 365 days/year. However, for subsistence fishers, an additional 15 days per year of exposure will result in an increase in the risk estimates of only 4% (i.e., 15/365).

8. **Comment:** **Page 13, Paragraph 3, Line 6: This inappropriate reduction in intake and resultant underestimate of risk is compounded by the use of exposure duration (ED) of 24 years to establish intake via the equation on page 4-5, which results in a further underestimation of intake and risk by a factor of 2.9 (compared with an ED of 70 years). The assumption of partial life intake (24 years rather than 70 years) is unlikely to be representative of consumption and exposure among subsistence fish consumers (and potentially among recreational anglers, particularly those who share their catch with family members). Therefore, the draft MRS should assume that exposure duration (ED) in the equation on page 4-5 is 70, unless data demonstrate clearly that an ED less than 70 more accurately represents gathering and consumption of seafood from Makua. Risk estimates for consumers of fish and limu in the draft MRS may, therefore, be underestimated by more than a factor of 20 because of these calculation and assumption errors.**

Response: It is true that 70 years is the default lifetime assumed by USEPA. However, to perform residential risk estimates, USEPA and HDOH assume that residents are present at a site for 30 years (USEPA 1989, 1997, 2002b; HDOH 2006). This is the 95th th percentile residency duration in the United States (USEPA 1997) and is the default exposure duration used by USEPA in risk assessments for residential exposure scenarios. The risk assessment presented in the MRS has been revised to evaluate residents for 30 years, in order to be consistent with USEPA and HDOH.

9. **Comment:** **Page 14, Paragraph 3, Line 1: Accurate evaluation of fish and limu consumption and contaminant intake in the local population requires a comprehensive survey of local consumers. In the absence of such a survey, worst case estimates of consumption should be based on consumption from traditional diets such as those reconstructed by Smith (2003), where rates for some populations were nearly 400 g/day. Any seasonal differences in consumption rates should also be acknowledged and incorporated in estimates of intake and risk, such as those by Loranger et al. (2002) who found that daily fish intake rates were 6 to 10 times higher for recreational**

anglers in the James Bay Territory of Canada at the end of the fishing season compared to a group that reported fish consumption on an annualized basis.

Response: The references cited by Dr. Foran are abstracts from talks that were presented at symposia. As such, they are not peer-reviewed nor in the published scientific literature. Further, their conclusions may change dramatically by the time they are published. Therefore, the information contained in these sources is considered as interesting but inappropriate for use in this study. Further, fish consumption rates vary dramatically by geography and ethnic groups, among many other factors. As part of the MRS, the Army reviewed the literature on fish consumption rates in Hawaii and selected the highest fish consumption rates recorded for Hawaii. These fish consumption rates are more appropriate for the MRS than the studies of fishers in Canada that were cited by Dr. Foran.

10. Comment: Page 15, Paragraph 2, Line 1: Finally, the draft MRS suggests that risk calculations may be overestimated as contaminant concentrations in whole fish were analyzed. (Concentrations of organic contaminants, excluding methyl mercury, in skin-off fillets may be lower than concentrations in whole fish as some organic contaminants concentrate disproportionately in fatty tissue.) The final SAP and draft MRS do not thoroughly describe methods to prepare fish for contaminant analysis. However, many fish from MMR contaminated sites are eaten whole (including head, skin, and bones) and in some cases internal organs are consumed as well (Vince Dodge, personal communication). Therefore, assumptions that contaminant analysis of whole fish results in overestimates of risk are not accurate or appropriate.

Response: The MRS did not assume that use of the whole fish analysis resulted in an overestimate of risk. The intent of the cited text was to identify an area of potential uncertainty in the risk assessment, and to indicate that the most conservative assumption (use of whole fish analysis) was used in performing the data analysis and risk assessment.

References:

Frankenberger, W.T. 2002. *Environmental Chemistry of Arsenic*. New York, Marcel Dekker.

de Gieter, M., M. Leermakers, R. Van Ryssen, J. Noyen, L. Goeyens, and W. Baeyens. 2002. "Total and toxic arsenic levels in North Sea fish." Arch. Environ. Contam. Toxicol. 43: 406-417.

Hawai'i Department of Health (HDOH). 2006. Screening For Environmental Concerns at Sites With Contaminated Soil and Groundwater. Interim Final – August 2006.

Kirby, J., and W. Maher. 2002. "Tissue accumulation and distribution of arsenic compounds in three marine fish species: relationship to trophic position." Applied Organometalic Chemistry 16: 108-115.

Kirby, J., W. Maher, and D. Spooner. 2002. "Arsenic occurrence and species in nearshore macroalgae-feeding marine animals." Environmental Science and Technology 39: 5999-6005.

Neff, J. M. 1997. "Ecotoxicology of arsenic in the marine environment." Environmental Toxicology and Chemistry 16(5): 917-927.

Sloth, J. J., E. H. Larsen, and K. Julshamn. 2005. "Survey of Inorganic Arsenic in Marine Animals and Marine Certified Reference Materials by Anion Exchange High-Performance Liquid Chromatography-Inductively Coupled Plasma Mass Spectrometry." Journal of Agricultural and Food Chemistry 53:6011-6018

U.S. Environmental Protection Agency (USEPA). 1989. Risk Assessment Guidance for Superfund (RAGS). Human Health Evaluation Manual Part A. Office of Emergency and Remedial Response. EPA/540/1-89/002.

U.S. Environmental Protection Agency (USEPA). 1991. Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions. OSWER Directive 9355.0-30.

U.S. Environmental Protection Agency (USEPA). 1997. Exposure Factors Handbook. Office of Research and Development, National Center for Environmental Assessment. EPA/600/P-95/002Fa.

U.S. Environmental Protection Agency (USEPA). 2002a. Guidance for comparing background and chemical concentrations in soil for CERCLA sites. Office of Emergency and Remedial Response. EPA 540-R-01-003. OSWER 9285.7-41.

U.S. Environmental Protection Agency (USEPA). 2002b. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. Solid Waste and Emergency Response. OSWER 9355.4-24

RESPONSE TO COMMENTS

REVIEW OF FIELD WORK AND ENVIRONMENTAL RISKS PORTIONS OF: DRAFT MARINE RESOURCES STUDY: FIELD SAMPLING RESULTS AND RISK ASSESSMENT, MAKUA MILITARY RESERVATION OAHU, HAWAII, DR. J.E JACK RENSEL AND DR. RALPH ELSTON, APRIL 19, 2007

1. **Comment:** **Page 7, Paragraph 5, Line 1: Missing entirely are important reviews of nearshore hydrographic conditions such as currents, wave, alongshore transport of sediments, physical characterization of the environment, characterization of the reference (termed "background") sites and how they compare with the Makua sites, exact fishing or capture areas in either the muliwai or nearshore areas, etc. Such factors must be considered to properly design a study involving contaminants that are transported and accumulated as a result of the site-specific conditions.**

   Response: The objective of the Marine Resources Study (MRS) was to evaluate if military activities at the Makua Military Reservation (MMR) have contributed to contaminant concentrations in area fish, and if such activities present a health risk to area fishermen who rely on the fish for subsistence. While the additional studies suggested by the reviewers may be of interest, they were not included as part of the scope of work presented in the Final SAP, and are not essential to achieving the objectives of the MRS. Data presented in the MRS indicate that relatively low levels of contaminants were detected in fish and limu in the muliwai and near-shore areas near the MMR. However, the data indicate that it is unlikely that the MMR is the source of most of these contaminants. Based upon these data, the report concludes that activities at the MMR do not present a health risk to area fishermen who rely on the fish for subsistence.

2. **Comment:** **Page 7, Paragraph 6, Line 4: We pointed out in our prior review that other seafood species such as urchins were more likely to be a conservative sampling target, easily obtained and more likely to be contaminated than either fish or lobsters.**

   Despite our comments and provision of detailed information regarding subsistence use of invertebrate and other species by local community members, the final plan and field study entirely neglected <u>all</u> macrofauna invertebrates (including lobsters) and provided no explanation for the oversight or reasons for changes from the draft SAP. We find this omission unacceptable and on this account alone the study is, in our opinion, incomplete and inadequate.

   Response: Although the Final Sampling and Analysis Plan (SAP) did not included invertebrates as species of interest, attempts were made to collect invertebrates for analysis as part of the Marine Resources Study (MRS), in order to address the concerns of the public. Sea urchins were collected from the nearshore area, however because of the extensive analytical suite included in the Final SAP, the total tissue mass needed for a single sample for all of the analyses exceeded 200 grams. The field team determined that continued collection of sea urchins might negatively impact the population of sea urchins in the nearshore area, and stopped sea urchin collection. Crab traps were set in the muliwai for several days, and although some crabs were collected in this manner, the field team was unable to collect crabs in sufficient numbers for even a single sample to be analyzed for the complete list of analytes.

3. **Comment:** **Page 7, Paragraph 8, Line 1: The final SAP calls for sampling of fishes and limu only, and includes no documentation of critical facts regarding the selection of target species. For example, nothing is said regarding the extent of the home range of nearshore fishes that were collected.**

Response: Target species were selected based on their likely presence in known near shore habitats, and the use of these species by fishermen for subsistence. Determination of the exact home range of these fish was beyond the scope of work for the MRS, and while this determination may be of academic interest, it is of little concern to the fishermen who consume these fish for subsistence.

4. Comment: Page 8, Paragraph 2, Line 1: The executive summary of the draft field report and risk assessment begins by stating:

"Tetra Tech conducted a marine resources study to determine if marine resources near Makua Beach and in the Makua muliwai are contaminated with constituents primarily associated with <u>proposed training activities</u> at Makua Military Reservation." **(Emphasis added)**

What are the "proposed training activities" and what contaminants would be involved compared to those from previous training?

Response: The proposed training activities include live fire training exercises. Target contaminants anticipated from these training activities are similar to target contaminants from previous training activities, including the explosives compounds and lead.

5. Comment: Page 8, Paragraph 4, Line 1: The draft field sampling objectives do not mention an ecological risk assessment, but an ecological risk assessment (albeit a flawed one) is included in the report.

Response: The screening level ecological risk assessment was performed to provide additional data to evaluate if proposed training activities at MMR pose a human health risk to area residents that rely on marine resources for subsistence.

6. Comment: Page 8, Paragraph 5, Line 1: Next we note that the study claims to include assessment of "marine resources," which in the draft SAP included invertebrates, fish and limu (seaweed). The invertebrates, including commonly collected and utilized urchins and mollusks, are not included in the final study, but no explanation or justification for this omission is provided.

Response: Although the Final Sampling and Analysis Plan (SAP) did not included invertebrates as species of interest, attempts were made to collect invertebrates for analysis as part of the Marine Resources Study (MRS), in order to address the concerns of the public. Sea urchins were collected from the nearshore area, however because of the extensive analytical suite included in the Final SAP, the total tissue mass needed for a single sample for all of the analyses exceeded 200 grams. The field team determined that continued collection of sea urchins might negatively impact the population of sea urchins in the nearshore area, and stopped sea urchin collection. Crab traps were set in the muliwai for several days, and although some crabs were collected in this manner, the field team was unable to collect crabs in sufficient numbers for even a single sample to be analyzed for the complete list of analytes.

7. Comment: Page 8, Paragraph 8, Line 1: The contaminant status of important ecosystem components such as the surficial sediments of muliwai and nearshore areas

remains either inadequately evaluate due to application of inappropriate methods, in the case of the muliwai (where excessively deep sampling and extensive compositing could have easily diluted the results), or completely unknown and not investigated, in the case of the nearshore areas. We discussed the inadequacy of the prior studies upon which the draft and final SAP relied in this regard, pointing out that the food web (including invertebrates and demersal fish) is affected by the shallow surface sediment layers to a few centimeters depth, while prior Tetra Tech sampling relied upon subsurface samples to greater than one meter depth in some cases. No explanation is provided for this inappropriate sampling method.

Response: The reviewers are correct that most benthic invertebrates and demersal fish are exposed within the top 10 to 15 centimeters (0.3 to 0.5 feet) of sediments. Some surface sediment samples were collected. However, all data (both surface and subsurface) were used in the determination of sediment UCL_{95} sediment concentrations. Uncertainties stemming from the inclusion of deeper sediment data (i.e., 1 to 3 feet) in the calculation of UCL_{95} concentrations are discussed in the MRS.

8. Comment: Page 9, Paragraph 2, Line 2: The prior muliwai sediment sampling data were <u>not</u> representative of the biologically active surface layers that would directly affect the aquatic food web. The risk assessment also utilizes inappropriate background or reference locations, which may bias the comparison of what is "normal" in terms of contaminant load in the region. If the underlying data are biased or non-representative, the ecological risk assessment is precluded from being accurate or representative of the actual risks. The complete lack of any data from the nearshore sediments compounds the problem, an issue that is acknowledged in the draft field report and risk assessment but not explained or mitigated.

Response: All data (both surface and subsurface) were used in the determination of sediment UCL_{95} sediment concentrations. Uncertainties stemming from the inclusion of deeper sediment data (i.e., 1 to 3 feet) in the calculation of UCL_{95} concentrations are discussed in the MRS.

We believe that the background locations selected for the MRS were appropriate. The objective of the MRS is to identify whether Army activities at the MMR have impacted Makua Valley resources above and beyond impacts from all other sources. To adequately address the Army's impact alone on Makua Valley resources, an appropriate control site (i.e., background location) is a valley where all aspects of the valley are as similar as possible to Makua. Since inter-watershed transport of contaminants is facilitated by wind and rain, the control valley should have similar wind and rain patterns as that of Makua. Biogeochemical processes affecting contaminants are a function of temperature and substrate, and these attributes should be as similar as possible to Makua Valley in order to identify impacts that can be attributed solely to Army activity. There are distinct differences in the substrate (mineralogy and age) between the different islands, making the selection of a control on another island inappropriate. Because of this, the most appropriate control watersheds are on the leeward (Waianae) coast of Oahu. As long as the background sites selected are representative of ambient conditions for the general Makua vicinity and have not received contamination from the MMR, they are considered acceptable, as per USEPA (1989, 2002a) risk assessment guidance.

9. Comment: Page 9, Paragraph 5, Line 1: No specific sampling location data were recorded or reported with the nearshore samples. It was simply one general area or another. The specific sampling area could have made a difference for some species of fish and for most invertebrates, but no data were collected in this regard. If a series of samples had been taken at increasing distance from the MMR nearshore a trend might have been detected, but this was not done.

Response: Nearshore fish were collected using a hook and line, typically from an area beyond the shore break. Using this methodology, the maximum distance from the shoreline for the nearshore sample collection was approximately 100 feet, and typically samples were collected within 50 feet of the shore break.

10. Comment: Page 9, Paragraph 6, Line 1: Apparently large- and small-sized fish were sometimes composited to construct single samples, masking any size and age specific trends that might have been present.

Response: USEPA (2000) guidance on sampling fishes was followed. All fish used for sample analysis were within 25% of the total length of the largest caught fish. Establishing size and age specific trends in contaminant concentrations is not generally the goal of fish sampling for risk assessment (USEPA 2000).

11. Comment: Page 10, Paragraph 1, Line 1: The choice of reference (background) areas, as pointed out in our review of the draft SAP, was inappropriate and not supported by information or data regarding surrounding land and aquatic use. It is possible, in our opinion, that there are <u>no</u> pristine muliwai on the Wai'anae coast of O'ahu to allow for meaningful reference comparison. This possibility is not directly addressed in the SAPs and draft report, which make an invalid comparison between what the effects of the MMR may have produced versus effects of urbanization, transportation, industry and military use on the Nanakuli muliwai. There are many areas that could have served as appropriate nearshore area reference sites on the leeward coast. These could have included any of a number of areas of similar physical exposure, without significant human residential populations on septic or sewer systems and not subject to direct drainage from agricultural or urban development. We believe that a reference area to compare to the MMR areas should be, if possible, on the leeward coast as other remote areas may have different marine species assemblages and recruitment and physical factors may be significantly different too.

Response: Background locations were selected to be representative of Makua in the absence of releases from the Makua MMR. However, that does not mean that background sites are required to be free of any anthropogenic influence, as this is impossible. As long as the background sites selected are representative of ambient conditions for the general Makua vicinity, they should be considered as acceptable (as per USEPA guidance).

12. Comment: Page 10, Paragraph 2, Line 1: The report authors selected Sandy Beach in an entirely different region of the island as a nearshore reference area. We judge Sandy Beach an inappropriate reference site because it is the site of a major sewage treatment plant and nearshore outfall. It is also a relatively great geographic distance from the MMR, possibly subject to different physical

processes. There are likely differing biological dynamics resulting from the markedly different physical processes between the southeast coast of the island and the westward, leeward shore.

Response: Background locations were selected to be representative of Makua in the absence of releases from the Makua MMR. However, that does not mean that background sites are required to be free of any anthropogenic influence, as this is impossible. As long as the background sites selected are representative of ambient conditions for the general Makua vicinity, they should be considered as acceptable (as per USEPA guidance).

13. Comment: Page 10, Paragraph 3, Line 1: No sediment sampling was conducted in the nearshore area to allow for trend estimation or risk analysis. Incremental distance sampling from the areas adjacent to the MMR muliwai to distant locations could have been conducted, but was not.

Response: Sediment sampling in the nearshore area was not part of the scope for the MRS that was outlined in the SAP. Because of the many possible sources of contamination to nearshore sediments (exhaust from automobiles, trash in the ocean, etc.), evaluation of nearshore sediment contaminant concentrations would have provided little useful information to evaluate potential impacts to human health from Army activities at MMR.

14. Comment: Page 10, Paragraph 4, Line 1: As previously pointed out, the fishes that were assess may include species that are far-ranging in their home range and geographic distribution. We would not expect these fishes to be significantly affected by contaminated sediments, limu and other habitat features near the MMR if they were essentially "passing through" the area and thus had only very limited exposure to possible contaminants from the MMR sample sites.

Response: The objective of the MRS, as outlined in the Settlement Agreement was to "…evaluate the potential that activities at MMR have contributed or will contribute to any such contamination (of marine resources) and whether the proposed training activities at MMR pose a human health risk to area residents that rely on marine resources for subsistence." The target species were selected based upon discussions with local fishermen regarding the fish that are used for subsistence. If fish were used by local fishermen for subsistence, they were included in the MRS, to the extent possible, whether or not they were far-ranging fish. This approach was consistent with the objectives of the study, as outlined in the Settlement Agreement.

15. Comment: Page 10, Paragraph 5, Line 1: The draft report's next conclusion is not supported by the data. It states:

"Samples from the muliwai locations tended to have higher concentrations of metals than the nearshore samples, although the nearshore samples typically had higher concentrations of arsenic."

This conclusion involves a comparison that is inappropriate for several reasons. Section 3.4 of the draft report describes results of metals sampling and points to Table 2-2, a summary of species sampled within general locations. Table 3-2 reports average concentrations of metals by subarea

(again, ostensibly for fish tissue) but these averages represent a mixture of different species with unequal representations among areas. Moreover, there were no samples from nearshore waters near the reference muliwai at Nanakuli, and there is no data from muliwai near Sandy Beach.

An accurate comparison would need to compare "apples and apples," or in this case, the same fish species within the muliwai and in the nearshore. This was not done. The comparison cannot be made because some of these fish represent different tropic niches, and several (e.g., tilapia and striped mullet) are omnivores but have differing food habits. Their feeding habits are a critical determinant of bioaccumulation or bio-magnification because contaminants may occur in higher tropic level niches depending on the exposure rates in the lower level niches.

Response: The italicized statement cited by the reviewers was from Section 6 (Conclusions), page 6-2 of the MRS. The statement referred to the fish tissue results for the Makua-area nearshore and muliwai sampling locations. It is not clear why the reviewers discusses the reference muliwai and near-shore sampling location in regard to the conclusion, since the conclusion only referred to the Makua-area sample results. The intent of the conclusion was to evaluate tissue concentrations detected in the muliwai fish vs. the tissue concentrations in the near-shore fish.

16. Comment: Page 11, Paragraph 2, Line 1: The comparison among muliwai is also not valid because unequal numbers of different species were collected from each muliwai (see Table 2-2). The data were collected (Table 3-1) to make a general comparison by species and subarea, but such a comparison was not done. A statistical test is not possible because of the compositing that was performed and the resulting loss of variability estimates, but summarizing these data could provide useful information.

Response: We agree with the reviewer's comment that summarizing the data provides useful information, which is consistent with the intent of this section of the report. However, we disagree with the reviewers that the data were collected to make a general comparison by species. The objective of the MRS was not to perform rigorous statistical analysis of contaminant concentrations in different species, but rather to evaluate if military activities at MMR have contributed to contaminant concentrations in area fish, and if such activities present a health risk to area fishermen who rely on the fish for subsistence. Our discussions with area fishermen indicated they are opportunistic fishermen, who consume most species of fish they are able to catch. The methodology of the MRS was consistent with this approach, and is reflective of the conditions the fishermen encounter. It is not necessary to conduct rigorous statistical analysis to achieve the objectives of the study, and therefore the study was not designed to collect data in order to perform this type of statistical analysis.

17. Comment: Page 11, Paragraph 3, Line 1: In the draft field report narratives and summaries, elevated concentrations of contaminates are reported but the significance of this is dismissed on the grounds that it is not different from one or both of the background areas. Reference (or background-comparison) areas in the present context are needed to attempt to discern possible differences between levels of contamination at Makua with or without effects of military activities. In doing so, it is important to consider what is "normal"

in areas with similar physical and biological characteristics. If the background areas are subject to elevated levels of contamination, they are not suitable for comparison to the MMR areas. Because of prior use by the military and urban effects (for the Nanakuli muliwai) and because of a major sewage discharge source (Sandy Beach) we believe that the choices were not conservative or justified.

Response: Background locations were selected to be representative of Makua in the absence of releases from the Makua MMR. However, that does not mean that background sites are required to be free of any anthropogenic influence, as this is impossible. As long as the background sites selected are representative of ambient conditions for the general Makua vicinity, they should be considered as acceptable (as per USEPA guidance).

18. Comment: Page 11, Paragraph 4, Line 1: One of the most serious flaws in the study plans and draft report deals with selection of target organisms or species of interest. The draft SAP clearly stated that specific mollusks, crustaceans and fish would be collected for analyses. However, only fish were collected and analyzed, and there is no justification or rationale provided for this alteration in the final sample plan. No invertebrates were analyzed, although the field data (included in the appendix) indicate that some were collected.

Response: Although the final SAP did not included invertebrates as species of interest, attempts were made to collect invertebrates for analysis as part of the MRS, in order to address the concerns of the public. Sea urchins were collected from the nearshore area, however because of the extensive analytical suite included in the final SAP, the total tissue mass needed for a single sample for all of the analyses exceeded 200 grams. The field team determined that continued collection of sea urchins might negatively impact the population of sea urchins in the nearshore area, and stopped sea urchin collection. Crab traps were set in the muliwai for several days, and although some crabs were collected in this manner, the field team was unable to collect crabs in sufficient numbers for even a single sample to be analyzed for the complete list of analytes.

19. Comment: Page 12, Paragraph 1, Line 8: This is highly critical as pelagic, far-ranging fish are not suitable to provide meaningful data for a human or environmental risk analysis. For the muliwai, benthic invertebrates or macroinvertebrates such as crabs should have been included as they have continual contact with contaminants associated with the sediments.

Response: Pelagic, far-ranging fish were not included in the samples analyzed as part of the MRS. Although the final SAP did not included invertebrates as species of interest, attempts were made to collect invertebrates for analysis as part of the MRS, in order to address the concerns of the public. Sea urchins were collected from the nearshore area, however because of the extensive analytical suite included in the Final SAP, the total tissue mass needed for a single sample for all of the analyses exceeded 200 grams. The field team determined that continued collection of sea urchins might negatively impact the population of sea urchins in the nearshore area, and stopped sea urchin collection. Crab traps were set in the muliwai for several days, and although some crabs were collected in this manner, the field team was unable to collect crabs in sufficient numbers for even a single sample to be analyzed for the complete list of analytes.

20. Comment: Page 12, Paragraph 3, Line 1: Seaweed: As noted in the draft report, the species of limu were not identified in the analysis but there were references to *Codium edule* and *Gracilaria coronopifolia* as species of interest. Apparently no taxonomic identification of samples was performed. This was a significant omission as it remains unknown if the samples were from edible limu likely to be consumed.

Response: The Army will be developing a long-term monitoring program to evaluate potential impacts from military activities to the muliwai and nearshore areas associated with Makua Military Reservation, and the Army anticipates soliciting public input for the development of the long-term monitoring plan. It is likely that identification of limu to species will be included in the long term monitoring plan.

21. Comment: Page 12, Paragraph 4, Line 1: The draft report does not identify trophic levels of the "species of interest" (an important planning and analysis consideration we discussed in the draft SAP review) or even discuss results of contaminant load by species. Table 3-2 presents the raw data by composite sample and subarea, but only a limited summarization of the data are provided. At a minimum, there should be a listing of averages for contaminants of higher concentrations. Such information would be useful for the community members, as presently they fish in the muliwai for tilapia and medaka. If these species are contaminated at a risk quotient of about 1.0 or above, the community should be informed. Tables 4-8, 4-9, 4-12, 4-13, 4-16, 4-17, 4-20, 4-21 of the draft report indicate such elevated risk, at least for the composite of all COPC (chemicals of potential concern) within an area.

Response: Table 3-2 presents the average concentrations of metals and organochlorine pesticides, by fishing area (i.e. muliwai and nearshore areas). These are generally the contaminants that contributed the greatest cumulative risk to the risk calculations. Therefore, the type of data requested by the reviewer is already presented in the MRS. Table 3-1 presents the raw data by sample.

The objective of the MRS was to evaluate if military activities at MMR have contributed to contaminant concentrations in area fish, and if such activities present a health risk to area fishermen who rely on the fish for subsistence. While the additional analysis requested by the reviewer may be of interest, it was not included as part of the scope of work presented in the Final SAP, and is not essential to achieving the objectives of the MRS.

22. Comment: Page 13, Paragraph 1, Line 1: For the nearshore fishes, it appears that the samples collected were species of convenience, i.e., what was available to the samplers on the day(s) they attempted to sample. Sampling was apparently conducted during mid-day, but fishing is often done at night or early morning when other species are more commonly available, and thus the analysis may be biased if the sampled fish do not represent the other fish in terms of contaminant load. If the sampled fish do not represent the other fishes, both the ecological and human risk assessment would be flawed on this account.

Response: Target species were selected based on their likely presence in known near shore habitats, and the use of these species by fishermen for subsistence. Our discussions

with area fishermen indicated they are opportunistic fishermen, who consume most species of fish they are able to catch. The methodology of the MRS was consistent with this approach, and is reflective of the conditions the fishermen encounter.

23. Comment: Page 13, Paragraph 1, Line 8: Additionally, there was no report or analysis of body fat levels within or among species that could influence contaminant burden (as discussed and recommended in our review of the draft SAP).

Response: Lipids were measured in all samples. The information will be provided, as requested. However, the proponents should note that only some contaminants are lipophilic.

24. Comment: Page 13, Paragraph 3, Line 1: For the muliwai, no ʻoʻopu (various stream fishes) or awa (milkfish) were reported to be sampled, although they were included on the community's list of muliwai species that are commonly eaten.

Response: Target species were selected based on their likely presence in the muliwai, and the use of these species by fishermen for subsistence. Our discussions with area fishermen indicated they are opportunistic fishermen, who consume most species of fish they are able to catch. Although we were unable to catch every single species of fish that were identified as being consumed by the community, the fish that were caught and analyzed from the muliwai (tilapia, stripped mullet, medaka and Hawaiian flagtail) were also identified on the community's list of muliwai species that are commonly eaten.

25. Comment: Page 13, Paragraph 4, Line 1: In regard to the muliwai samples, page 3-1 of the final SAP states: *"Each muliwai sample will consist of a composite of five to seven individual specimens."* This statement appears to have been written after the fact to match what was actually done because the investigators selected an odd and variable number of samples. A balanced sampling plan with equal numbers of fish from the same species is always preferable to some variable or inexact number should any type of statistical assessment be attempted (i.e., that allows for use of more robust statistical analysis).

Response: The italicized statement listed above was included in the July 2006 version of the SAP, which was used to guide the field activities, and was not written after the fact. In some cases, more than 10 fish were included in the composite samples. In many instances, compositing this number of fish was necessary in order to obtain sufficient mass for the entire suite of analyses. Furthermore, with more individual samples composited, the closer the measured value will be to the true mean. Therefore, compositing samples was deemed appropriate and follows USEPA (2000) guidance for collecting fish samples for use in risk assessments. The objective of the MRS was not to perform rigorous statistical analysis of contaminant concentrations in different species, or to perform statistical comparisons between sites or to establish age/length relationships, but rather to evaluate if military activities at MMR have contributed to contaminant concentrations in area fish, and if such activities present a health risk to area fishermen who rely on the fish for subsistence.

26. Comment: Page 13, Paragraph 6, Line 1: Section 3-1 of the draft report states, *"The individuals will be collected from within a limited target region"* but no reporting of what constituted those regions appears other than some very

large scale maps with no details. Whether the fish were collected from the immediate nearshore or from farther offshore and whether there was a fixed shore location for casting or several different locations must be specified. As pointed out previously, these details matter if one is to conduct a representative and conservative assessment.

Response: Nearshore fish were collected using a hook and line, typically from an area beyond the shore break. Using this methodology, the maximum distance from the shoreline for the nearshore sample collection was approximately 100 feet, and typically samples were collected within 50 feet of the shore break.

27. Comment: Page 13, Paragraph 7, Line 1: Similarly, no estimates of the approximate home range of the fish species collected or of their general food habits are provided. There is no way to be sure which fish species is more or less risky based on its probable range of movement near and far from the potentially affected areas. Several of the fish (e.g., medaka, tilapia, and striped mullet) are omnivorous and may eat plant or animal matter. But this does not mean they eat everything all the time as feeding ecology studies sometimes indicate that some fish species focus on one type of food at a time. Some other fishes are more exclusively plankton feeders (e.g., Hawaiian flagtail) and those captured in the muliwai may have been feeding on plankton introduced by seawater overtopping that occurs periodically as a result of larger than normal waves. Alternatively, they may have been feeding on some combination of the externally-recruited plankton and internally-reproduced plankton. Since plankton are potentially transported and advected great distances by water currents, plankton feeders likely would be non-conservative choices for the study as the plakton would be unlikely to be affected by nearshore contamination associated with sediments. We believe that the report should have considered these and other food web factors to properly direct the sampling and frame the results. This was not done.

Response: The objective of the MRS was to evaluate if military activities at MMR have contributed to contaminant concentrations in area fish, and if such activities present a health risk to area fishermen who rely on the fish for subsistence. While the additional analysis requested by the reviewer may be of interest, it was not included as part of the scope of work presented in the Final SAP, and is not essential to achieving the objectives of the MRS.

28. Comment: Page 14, Paragraph 2, Line 1: Reference (or background) areas are important because they potentially provide some basis for comparison of the nearshore and muliwai areas near MMR with what might be considered "normal" or "average" in the absence of military activities. The draft field report and risk assessment goes further with the comparisons by calculating hazard indices for both types of areas and then terming the difference among contrasted pairs as an "incremental risk." The results of this process show the hazard indices for individual COPC among areas vary considerably. Total hazard indices were generally similar between areas near MMR and the comparison ("background") areas but usually greater for the latter for non-carcinogenic hazards compared to carcinogenic hazards. This is not explained or discussed in the draft.

Response: The requested information is already presented in the MRS. Section 4 of the MRS presents the results and interpretation of the human health risk assessment. Section 4 of the MRS discusses both the carcinogenic and non-carcinogenic hazards, and the information presented in this section indicates that the non-carcinogenic hazards are usually greater than the carcinogenic hazards at each location. Section 4 also presents information indicating that the non-carcinogenic hazards were generally greater at the background locations as compared to the MMR locations.

29. Comment: Page 14, Paragraph 3, Line 1: In our experience, characterization and selection of appropriate reference areas for aquatic studies is often a challenging task that requires exploration and pre-study. To serve as an accurate basis for comparison, a reference area should be physically similar in depth, exposure, flushing rates, orientation, etc. and within the same biogeographic range as the affected area. If a reference area is too distant from an affected area, the food web composition and energy fluxes may be different. There may be different patterns of juvenile recruitment, timing and species dominance. In order to demonstrate similarity of physical conditions, at least some minimal types of measurements must be taken or utilized and site characterizations performed. As pointed out in our review of the draft SAP, to compare contaminant loads among sediment from different areas, leading governmental jurisdictions such as the Washington Department of Ecology require investigators to collect sediment grain size and total organic carbon content concurrently. It is well known that concentrations of many contaminant metals positively co-vary with the amount of silt and clay and total organic carbon, hence it is always important to normalize the contaminant results with these measurements.

Response: The rationale for the selection of background sites was provided in both the final SAP and the draft Marine Resources Study. In the final SAP, Section 2.2, Marine Resources Sampling Strategy, states "Background muliwai will be located on the Waianae Coast within watersheds that are not subjected to military activity." Section 2.2.3, Background Sampling, of the final SAP states "Samples will be collected from locations distant enough from Makua Valley that biota would be unlikely to be affected by target chemicals originating from MMR. Background muliwai will be located in watersheds that are not subject to military activity." As long as the background sites selected are representative of ambient conditions for the general Makua vicinity and have not received contamination from the MMR, they are considered acceptable, as per USEPA (1989, 2002a) risk assessment guidance.

30. Comment: Page 15, Paragraph 2, Line 1: First, the Nanakuli muliwai reference area for fish collection is within an urbanized area with probable prior military base effects. The watershed includes drainage from the relatively large Navy Lualualei ammunition magazine, active since 1934. Because of the age extensive size of this facility, selection of the Nanakuli muliwai as a MMR reference area would require extensive pre-study and justification. Older military facilities in the US were often subject to on-site dumping of contaminated waste products such as spent cleaning solvents, petroleum lubricants, and other wastes. Burning of waste solids and liquids, land use practices such as the use of highly persistent and toxic pesticides, inadequate wastewater collection and treatment are but a few of the documented problems at some older military facilities. No justification or explanation is offered in either of the SAPs or the draft report for selection of this muliwai,

other than that it was unlikely to be affected by MMR activities. While that may be true, the relevant question is whether the Nanakuli site is a suitable reference area to compare with the muliwai near MMR. The latter are in a relatively remote, non-urbanized area, and again the goal is to know what they would be like without military impacts.

Response: The rationale for the selection of background sites was provided in both the final SAP and the draft Marine Resources Study. In the final SAP, Section 2.2, Marine Resources Sampling Strategy, states "Background muliwai will be located on the Waianae Coast within watersheds that are not subjected to military activity." Section 2.2.3, Background Sampling, of the final SAP states "Samples will be collected from locations distant enough from Makua Valley that biota would be unlikely to be affected by target chemicals originating from MMR. Background muliwai will be located in watersheds that are not subject to military activity." As long as the background sites selected are representative of ambient conditions for the general Makua vicinity and have not received contamination from the MMR, they are considered acceptable, as per USEPA (1989, 2002a) risk assessment guidance.

31. Comment: Page 15, Paragraph 4, Line 1: In general, there appears to be relatively little background information on fish tissue contamination near O'ahu, but the draft report should have included at least some general information on important prior studies or databases before selecting the Sandy Beach area as a reference area. As previously noted it is also on the opposite side of the island near the windward coast and therefore subject to different physical and biological pressures.

Response: see response to Comment 11.

32. Comment: Page 16, Paragraph 3, Line 3: No accounting for differing silt/clay properties was conducted, and, as we stated in our review of the draft SAP, subsurface sampling and compositing of sediment samples obfuscated and potentially skewed the results.

Response: The objective of the Marine Resources Study (MRS) was to evaluate if military activities at the Makua Military Reservation (MMR) have contributed to contaminant concentrations in area fish, and if such activities present a health risk to area fishermen who rely on the fish for subsistence. As such, the study was focused on the collection of marine resources (fish and limu) tissue data, an evaluation of the presence of the contaminants in these tissue samples, an evaluation if military activities had contributed or were likely to contribute contaminants to these marine resources, and if contaminants detected in the tissue samples that were related to military activities at MMR posed a threat to human health through the consumption of these marine resources. While an evaluation of differing silt/clay properties of the sediments in the various sampling locations may be of academic interest, these data were not necessary to achieve the objectives of the study, and therefore were not collected during the study.

33. Comment: Page 16, Paragraph 4, Line 1: The draft field report is also very unclear regarding sediment sampling. Nowhere in the draft or final SAP or elsewhere in the draft report is there a description of sampling or reference areas for sediments, but unexpectedly we see on page 5-4: *"Four sediment samples were collected from each of the north and south background areas (Figure 2-*

1). These samples were from one to two feet deep All samples were analyzed for metals and explosives." **There are no north and south reference areas shown in Figure 2-1 of the draft report. There were north and south reference stations from creek mouths shown in Figure 2-1 of a prior report (Tetra Tech 2005b) regarding muliwai sampling, but that report indicates only three samples were taken in each reference area. In any event, the sampling for the earlier study was minimal (three samples per area versus up to 22 for the muliwai) and too deep to be of the significance to biological organisms such as benthic invertebrates and epifauna. The draft report provides no analyses or discussion of the applicability or results of these samples, so the reader is left with no information to judge.**

Response: The MRS incorrectly referenced Figure 2-1. The correct reference is to Figure 2-2, and this reference has been changed in the MRS. A total of four samples (three primary and one duplicate) were collected from each of the north and south reference locations. The MRS clearly states that the sediment samples were collected in 2003 and references the appropriate document from 2005. A sentence has been added to this section to clarify that the sediment data evaluated in Section 5 came from the 2005 Muliwai Sediment Study Report, which is included as an appendix to the EIS.

34. Comment: Page 16, Paragraph 5, Line 1: Limu (seaweed) was collected, but it was not identified to any useful taxonomic level in the report.

Response: The Army will be developing a long-term monitoring program to evaluate potential impacts from military activities to the muliwai and nearshore areas associated with Makua Military Reservation, and the Army anticipates soliciting public input for the development of the long-term monitoring plan. It is likely that identification of limu to the taxonomic level will be included in the long term monitoring plan.

35. Comment: Page 16, Paragraph 6, Line 4: As the limu identifications were not performed and pooling may have included species that are not consumed, the risk assessment involving seaweed is not valid for determining risk to local residents.

Response: The Army will be developing a long-term monitoring program to evaluate potential impacts from military activities to the muliwai and nearshore areas associated with Makua Military Reservation, and the Army anticipates soliciting public input for the development of the long-term monitoring plan. It is likely that identification of limu to the taxonomic level will be included in the long term monitoring plan.

36. Comment: Page 17, Paragraph 1, Line 7: In addition, because the total arsenic levels found in the draft study are relatively high, an analysis of inorganic vs. organic arsenic content should be conducted using appropriate collection and analysis procedures in order to be able to evaluate the effects on humans or marine life.

Response: Concentrations of arsenic in limu from Makua are not elevated over naturally occurring levels in seaweed around the world. According to Frankenberger (2002) total arsenic concentrations in various types of seaweed around the world range from 4.5 to 140 mg/kg dry weight, whereas the samples collected from Makua ranged from 4.56 to 110 mg/kg dry weight. Since arsenic has never been measured

in any of the seaweeds present in Hawaii previously, it cannot be determined at this point whether the arsenic concentrations measured are naturally occurring or elevated; however, the concentrations measured in limu from Makua are consistent with naturally occurring concentrations. The Army will be developing a long-term monitoring program to evaluate potential impacts from military activities to the muliwai and nearshore areas associated with Makua Military Reservation, and the Army anticipates soliciting public input for the development of the long-term monitoring plan. It is likely that the speciation of arsenic to organic vs. inorganic forms will be included in this monitoring plan.

37. Comment: **Page 17, Paragraph 2, Line 1: Compositing of fish samples was implemented, thus eliminating the possibility of assaying differences among fishes. We understand the rationale for pooling specimens in that it achieves a broader representation of average results, but pooling specimens is valid only if the pooling represents single species of similar age and size. In the present study, compositing was not conducted correctly for limu (because pooling involved potentially different species) or for fish (because there is no evidence that similar age cohorts were composited; see Table B-1 of the draft report for size information). The draft final report justifies compositing by stating that it was necessary to do so to get sufficient sample volume for analyses (200 grams or less than 1/2 pound). This is a valid justification for small specimens but many of the single fish specimens reported in Table B-1 would meet this goal.**

Response: The reference to Table B-1 in the MRS was made in error – this table was never completed, and was not intended to be included in the MRS. The reference to Table B-1 has been removed from the MRS. The version of the table that was provided to Earthjustice and its' technical experts following the February 24, 2007 public meeting was an incomplete table that was used for internal purposes.

The lengths of collected fish were measured in the field, and these measured lengths were recorded on field data sheets, which are presented in Appendix A of the MRS. It is unclear how the reviewers determined the mass of the single fish specimens reported in the table and on the field sheets in Appendix A, since the fish were only weighed once they were received at the laboratory. Individual fish specimens that met the 200 gram criteria for sample analysis were not composited, and were analyzed as individual fish.

38. Comment: **Page 17, Paragraph 3, Line 1: The compositing led to other questionable practices. For example, page 5-12 of the draft field report describes the use of the maximum detected concentrations in composite fish samples for the exposure point concentrations (EPCs). This is not valid or logical because there were few composites from each sampling area and, by definition, compositing produces an average value with no representation of the high end variability. The report claims that this is a more conservative method than using the UCL_{95} (95th percent confidence limit value results), but this claim cannot be assessed given the lack of variance data.**

Response: A UCL95 can be calculated for the composite samples. As stated in the report, using the maximum detected value provides a more health-protective estimate of the risks than using the UCL95 of the composite data.

39. Comment: **Page 18, Paragraph 2, Line 1: As one yardstick to measure the efficacy and accuracy of the ERA we refer to EPA (1998, Guidelines for Ecological Risk Assessment), which is a pertinent and appropriate reference. This document states in section 5.1.1:**

"While field studies may best represent reality, as with other kinds of studies they can be limited by (1) a lack of replication, (2) bias in obtaining representative samples, or (3) failure to measure critical components of the system or random variations. Further, a lack of observed effects in a field survey may occur because the measurements lack the sensitivity to detect ecological effects."

The present study lacked replication, which is explained by the nature of the study, a screening study. A screening study is not an adequate basis on which to conduct a risk assessment.

Response: The reviewers were not specific about the lack of replication in the data used for the ERA (e.g., numbers of samples at particular sites or in particular media). A total of 12 and 22 sediment samples were collected from the south and north muliwai, respectively. Five to seven composite samples of fish tissues were analyzed from each muliwai or the Makua nearshore area. The muliwai are generally the size of small ponds, having a maximum water surface area of less than one acre. Based on the limited sizes of the muliwai, the numbers of samples are considered adequate for the risk assessment.

A screening-level ERA can provide risk managers with adequate information for decision making, particularly if no significant hazards are identified. Screening-level and higher tier ERAs vary in their levels of detail and complexity, conservatism, and uncertainty. Although screening-level ERAs typically use a more limited data set than higher tier ERAs, they also incorporate a greater level of protectiveness in their methodology. The screening-level ERA for the MMR applied a number of protective assumptions1 in the exposure and effects assessments to minimize the likelihood of underestimating ecological hazards. Higher tier ERAs beyond a screening assessment may be considered by risk managers to verify and provide more detail on any key hazards identified in the screening assessment, or to reduce uncertainties resulting from the protective assumptions used in the screening assessment (U.S. EPA 1998).

40. Comment: **Page 18, Paragraph 4, Line 1: As noted previously, it appears that the muliwai reference area was arbitrarily selected without any field pre-study, or consideration of prior military or urban uses and contaminant loading in the watershed. In our opinion, the lack of an appropriate reference site for the muliwai near MMR renders the ERA fatally flawed. This is because a number of significant hazard quotients were detected for the marine resources near MMR, but these are simply dismissed as inconsequential and**

[1] These protective assumptions included the decision criteria for metal background comparisons, the use of maximum detected or 95 percent upper confidence limit (UCL_{95}) on the mean concentrations for exposure point concentrations, and the selection of no-effect level and threshold effect level toxicity reference values for fish and benthic invertebrates, respectively.

a result of background conditions. The potential alternative of no appropriate reference muliwai on O'ahu was not considered or discussed.

Response: A number of hazard quotients exceeding 1 for fish tissues were not considered to represent s significant potential for hazard. The lack of incremental hazards above background conditions was one factor used in this determination.

41. Comment: Page 18, Paragraph 7, Line 1: For the nearshore, the situation is similarly inappropriate as the reference area is the site of a major wastewater discharge and not in the same geographic zone as the MMR, but rather on the opposite side of the island. The complete lack of any nearshore sediment analysis in the area near MMR is a significant omission and flaw in the study.

Response: The objective of the MRS was to evaluate if military activities at the Makua Military Reservation MMR have contributed to contaminant concentrations in area fish, and if such activities present a health risk to area fishermen who rely on the fish for subsistence. As such, the study was focused on the collection of marine resources (fish and limu) tissue data, an evaluation of the presence of the contaminants in these tissue samples, an evaluation if military activities had contributed or were likely to contribute contaminants to these marine resources, and if contaminants detected in the tissue samples that were related to military activities at MMR posed a threat to human health through the consumption of these marine resources. While nearshore sediment analysis may provide some interesting data, it is not essential to achieve the objectives of the MRS.

42. Comment: Page 19, Paragraph 2, Line 1: The importance of this reference area discussion is highlighted by a quote from the draft field report as follows:

"Metals at concentrations equivalent to or lower than background concentrations do not need to be considered in the risk assessment. Therefore, the metals **[chemicals of potential ecological concerns (COPECs)]** ***were selected by comparing metal concentrations detected in muliwai sediments to local background metal concentrations..."***

By selecting reference areas with inappropriately high contamination (i.e., Nanakuli muliwai and Sandy Beach), the analysis greatly discounts risk from contaminants that otherwise may be considered unacceptably high.

Response: The quoted text describes the methodology for the selection of sediment COPECs using sediment data from the north and south background sites. Fish tissue data from the Nanakuli muliwai and nearshore at Sandy Beach background sites were not used to screen out COPECs in fish tissues. These data were used to calculate background risks to fish. Overall background risks to fish as indicated by fish tissue hazard indices (HIs) were higher at the Nanakuli muliwai and nearshore at Sandy Beach background sites than at the MMR muliwai and nearshore sites. The background HIs were driven primarily by higher concentrations of aluminum and vanadium (Nanakuli muliwai and Sandy Beach) and chromium and copper (Sandy Beach only) detected in fish tissues from the background sites (Tables 5-13, 5-15, and 5-16).

43. Comment: Page 19, Paragraph 4, Line 1: It would have been feasible to collect sediment samples near the MMR nearshore and then compare those results to a

reference area physically "upstream" of the MMR. But no prevailing alongshore current information was offered or collected. This reflects the lack of site characterization that we stressed as important in our review of the draft SAP.

Response: The objective of the MRS was to evaluate if military activities at the Makua Military Reservation MMR have contributed to contaminant concentrations in area fish, and if such activities present a health risk to area fishermen who rely on the fish for subsistence. As such, the study was focused on the collection of marine resources (fish and limu) tissue data, an evaluation of the presence of the contaminants in these tissue samples, an evaluation if military activities had contributed or were likely to contribute contaminants to these marine resources, and if contaminants detected in the tissue samples that were related to military activities at MMR posed a threat to human health through the consumption of these marine resources. While nearshore sediment analysis may provide some interesting data, it is not essential to achieve the objectives of the MRS.

44. Comment: Page 19, Paragraph 6, Line 1: An ecological conceptual site model (CSM) was used in the draft field report to assess exposure risks to fish and invertebrates using measured and estimated exposure rates of contaminants. Even if such a model were appropriate for the present case, it would be only as good as the site specific and calibration data, which are doubtful because of:

- **the absence of surficial sediment samples in any of the subject areas to properly measure sediment contaminant concentrations;**
- **inadequate and unexplained sampling of reference areas for sediments as discussed above;**
- **lack of sampling of benthic or aquatic organisms, despite the stated requirements of the model for appropriate "ecological receptors" (see bottom of page 5-8 of the draft field report) and**
- **lack of analysis or presentation of the trophic level and relative importance of the ecological receptors (fish) that were selected despite the state requirements of the model.**

Response: Comment noted.

45. Comment: Page 20, Paragraph 1, Line 1: This is a conceptual model and, by that description, is potentially useful for considering pathways and general processes, but it is not a numerical, stochastic model. Nor does the conceptual model as presented necessarily represent reality. Note in Figure 4-1 of the draft field report that the model suggests no possible ingestion exposure of benthic invertebrates to contaminants present in sediments. How is that known? Due to the lack of site-specific information, this must be considered speculation.

Response: The reviewers are correct that benthic invertebrates may ingest chemicals present in sediments, however please note that exposures of benthic invertebrates were assessed using total sediment concentrations (as per the sediment toxicity benchmarks, which are based on total exposures from sediments), not ingestion doses specifically. Figure 4-1 has been revised to show ingestion exposure of benthic invertebrates.

46. Comment: **Page 20, Paragraph 2, Line 1: Potential risks to benthic invertebrates were not evaluated by any meaningful or accurate methods. First, no samples of invertebrates were collected. Instead, the authors relied on prior sediment core data for contaminant concentration data. As we pointed out in the review of the draft SAP, prior sediment studies included mostly subsurface sediments that are not appropriate for testing if one is interested in effects on infauna, epifauna, demersal or pelagic organisms, which are exposed only to sediments within a few centimeters of the surface. In other words, the biota is never exposed to the deep sediments, and few samples were taken from top few centimeters as recommended by EPA for such studies. Therefore the foundation of the ecological risk assessment is faulty, and all the subsequent analyses are seriously flawed.**

Response: The assessment of potential hazards to benthic invertebrates using site-specific sediment data, as opposed to invertebrate tissue data, is standard practice in screening-level ERAs. Comparison of sediment data to sediment screening benchmarks is the preferred approach because (1) sediment screening benchmarks are conservative and based on large numbers of sediment bioassay results, and (2) relatively limited standardized, effect-based tissue concentrations for invertebrates are available.

47. Comment: **Page 20, Paragraph 3, Line 1: Second, even if the above is overlooked, there are no data or assessments of risks to different trophic levels of the food web. It cannot be assumed that highest trophic levels are automatically the most at risk. Some contaminants may be converted to non-toxic forms upon transfer up the food web; for example, macroalgae may contain proportionately higher levels of toxic inorganic arsenic but become organic forms when grazed.**

Response: The ecological receptors selected for the ERA were aquatic plants including seaweed, benthic invertebrates, aquatic invertebrates, and fish. As stated in the ERA, potential hazards to aquatic plants and aquatic invertebrates could not be quantified due to the lack of surface water data or seaweed tissue-based toxicity data. However, the categories of benthic invertebrates and fish include several trophic levels. Specific trophic levels within invertebrates and fish were not evaluated separately because the sediment screening benchmarks and fish tissue-based TRVs apply to all benthic invertebrates and fish, and are protective of all trophic levels. However, a conceptual food web will be provided in the ERA to illustrate the trophic levels included within the fish receptor category.

48. Comment: **Page 20, Paragraph 4, Line 1: The ERA and field study do not address aquatic invertebrates in the nearshore areas, and no credible justification is given for not sampling either the sediments or the invertebrates in these areas. Pelagic and benthic invertebrates are present, although the report claims that risk analysis was not implemented for the former due to "the absence of surface water data." This is illogical, as the organisms were there to sample, and water quality data (to estimate exposure risks) would be a poor substitute for the actual tissue data. No excuse is given for not sampling benthic or epibenthic invertebrates including commonly collected seafood species.**

Response: Although neither surface water data nor invertebrate tissue data were collected from the nearshore areas, tissue data would be a less preferred basis for evaluating potential risks. Relatively limited standardized, effect-based tissue concentration data for invertebrates are available in the literature. Demonstrating bioaccumulation in tissues does not necessarily indicate adverse effects.

49. Comment: Page 21, Paragraph 1, Line 1: There is no basis for the report's conclusion that fish in the nearshore MMR area are not significantly more contaminated than fish from other nearshore regions of O'ahu. As discussed above, the nearshore reference area the study selected is the site of a major sewage discharge outfall. As there are many beaches on O'ahu not subject to the potential influences of direct sewage discharge, the choice of this reference area is among the least appropriate of all possible choices.

Response: Background locations were selected to be representative of Makua in the absence of releases from the Makua MMR. However, that does not mean that background sites are required to be free of any anthropogenic influence, as this is impossible. As long as the background sites selected are representative of ambient conditions for the general Makua vicinity, they should be considered as acceptable (as per USEPA guidance).

50. Comment: Page 21, Paragraph 2, Line 1: Similarly, the selection of the Nanakuli muliwai as a background or reference area is not appropriate due to long-term use by a large Navy ammunition magazine in the upstream watershed, as well as impacts associated with urbanization. No water, sediment or fish tissue descriptions from other locations on O'ahu, from the study or the literature, are offered to justify the reference area choice. The report does not discuss the alternative of no suitable reference muliwai on the island, or whether there were other muliwai on neighbor islands that could have served in this regard.

Response: The purpose of the Marine Resources Study is to identify whether Army activities at the MMR have impacted Makua Valley resources above and beyond impacts from all other sources. Using an uncontaminated watershed for a background location would not allow the apportioning of impacts between the Army and other sources. This is a significant concern as there are many substantial sources of contamination other than the MMR. To adequately address the Army's impact alone on Makua Valley resources, an appropriate control site (i.e., background location) would be a valley where all aspects of the valley are as similar as possible to Makua. Since inter-watershed transport of contaminants is facilitated by wind and rain, the control valley should have similar wind and rain patterns as that of Makua. Biogeochemical processes affecting contaminants are a function of temperature and substrate, and these attributes should be as similar as possible to Makua Valley in order to identify impacts that can be attributed solely to Army activity. There are distinct differences in the substrate (mineralogy and age) between the different islands, making the selection of a control on another island inappropriate. Because of this, the most appropriate control watersheds are on the leeward (Waianae) coast of Oahu. As long as the background sites selected are representative of ambient conditions for the general Makua vicinity and have not received contamination from the MMR, they are considered acceptable, as per USEPA (1989, 2002a) risk assessment guidance.

51. Comment: **Page 21, Paragraph 3, Line 1: The assessment was supposed to evaluate human health risks to area residents who rely on "marine resources" for subsistence, but the investigators completely ignored important invertebrate seafood used by local people. Lacking actual appropriate sampling data, no method of modeling or estimation will identify what the actual risk is from consuming shellfish and other invertebrates from the muliwai and nearshore waters at Makua.**

Response: The results of the MRS indicate that relatively low levels of contamination are present in fish and limu in the Makua-area muliwai and nearshore areas, and that these levels are approximately the same as the levels detected in fish from background locations. The risk to subsistence fishermen from consuming the fish is below the levels used by USEPA for fish advisories. Furthermore, the study concludes that these contaminants are likely not coming from the MMR, because many of the chemicals are ubiquitous in the environment, and may be attributable to many different sources. Given that the fish are likely not contaminated by substances associated with the proposed training activities at MMR, that there is very little interchange between the muliwai where such substances might accumulate and the near-shore area which provides the habitat for the invertebrates on which area residents rely, that any such transport of chemicals from the muliwai to the nearshore area would result in significant dilution of the chemicals, it is likely that the shellfish are not contaminated by substances associated with the proposed training activities at MMR.

52. Comment: **Page 21, Paragraph 4, Line 1: Limu (seaweed) data shows high levels of arsenic that could be dangerous to human consumers, but the authors failed to sample reference areas for comparison, did not conduct taxonomic identifications, and did not differentiate between toxic and no toxic forms of that dangerous contaminant. Thus, the study fails to resolve questions about the risks to human health or marine life from arsenic-contaminated limu.**

Response: The speciation of arsenic to organic vs. inorganic forms was not requested or recommended by the experts during their review of the SAP, and therefore was not included as part of the analysis program for the MRS. The Army will be developing a long-term monitoring program to evaluate potential impacts from military activities to the muliwai and nearshore areas associated with Makua Military Reservation, and the Army anticipates soliciting public input for the development of the long-term monitoring plan. It is likely that the speciation of arsenic to organic vs. inorganic forms, the collection of limu from reference areas and the identification of the limu will be included in this monitoring plan.

53. Comment: **Page 21, Paragraph 5, Line 1: Much of the risk assessment was based on use of suspect sediment data, which, as we previously pointed out, were collected from far too deep below the surface to represent the biologically active surface zone. The samples were also composited from different depths, so, if there were a stratum of contamination, it would have been diluted in the process. Discrete samples of the biologically active surficial sediment zone should have been used instead.**

Response: Comment noted.

54. Comment: Page 21, Paragraph 6, Line 1: As a result of the errors and biases in sampling, species and site selection, the environmental risk assessment has significant bias. Even when relatively high hazard quotients are found for some contaminants, the report authors simply point to the potentially contaminated reference areas to claim the hazard quotients are normal for O'ahu. This flawed study provides no valid support for this conclusion.

Response: The ERA provides an overall protective assessment of the potential for adverse effects resulting from past releases from the MMR. This screening-level evaluation applied a number of conservative assumptions to the selection of COPECs, quantification of exposure point concentrations, and selection of toxicity reference values. The collective effect of these assumptions was to minimize the likelihood of underestimating ecological hazards. To further address the reviewers' concerns, uncertainties resulting from the use of deeper sediment depth intervals to estimate exposures to benthic invertebrates will be discussed in the ERA. Calculated hazards for the background sites indicate that there are no incremental hazards to fish at the two muliwai and the nearshore area off MMR. The background sites represent relevant ambient conditions for the sites.

References:

Frankenberger, W.T. 2002. *Environmental Chemistry of Arsenic*. New York, Marcel Dekker.

USEPA. 2000. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Volume 1: Fish Sampling and Analysis, Third Edition. Office of Water, Washington, DC. EPAUSEPA 823-B-00-007.

RESPONSE TO COMMENTS

DR. FRED DODGE, APRIL 1, 2007

1. **Comment:** **4 (a) Original S & A plan was flawed. Most recommendations by community and our consultants were not followed.**

   Response: The Army solicited comments from the community on the draft Marine Resource Sampling and Analysis Plan, and modified the plan as a result of the comments. However, the Army is ultimately responsible for ensuring that the scope of the study is feasible, appropriate to the study's objectives, and is cost effective. Unfortunately, not all recommendations could be implemented within these limits. Specific comments are addressed elsewhere in this document.

2. **Comment:** **4 (b) Nanakuli muliwae (known to local people as "stink pond") is a poor and unacceptable choice for the control muliwae. It's in an urban drainage area (e.g. from a four lane heavily used highway) as well as gets drainage from Nanakuli Ranch. Therefore it is obviously contaminated. This goes also for Sandy Beach. The area was used for military training in the past. You should have a better control muliwai, even if you have to go to an outer island - one where there is no history of military training, ranch, or urban area runoff.**

   Response: As discussed in response to similar comments by others, the background sites were selected from locations on the Waianae Coast, within watersheds that are not subjected to military activity, and distant enough from Makua Valley to be unlikely to be affected by target chemicals originating from Makua Valley. The purpose of the background sites is to compare to a reference unaffected by activities in Makua Valley, not necessarily to compare to a pristine environment.

3. **Comment:** **4 (c) Limu study found high levels of arsenic. The next obvious test was not done, i.e., to determine percentage of inorganic (toxic) vs. percentage of organic (safe) levels. Will you do it ? All limu samples need to be identified--not only by scientific but also by local names. The limu sample was too small. Needs to be larger.**

   Response: The objectives of the study have to do with determining the impacts attributable to activities at MMR, not with determining the relative safety of consuming marine resources. The comment highlights what may be a common misconception concerning the objectives of the studies conducted in response to the settlement agreement - namely that all hazards should be quantified, whether attributable to training activities at MMR or not. The presence of what appear to be elevated concentrations of arsenic in limu, whether toxic to humans or not, is not within the scope of the study to quantify, because neither the concentrations nor the form of the arsenic are related to or affected by activities at MMR.

4. **Comment:** **4 (d) Were the field notes redone to be clearly legible? Were all tables and information included in the appendices?**

   Response: Copies of original field notes are presented in the report, consistent with standard practice. The appendices contain the complete record of relevant data supporting the study. Between Section 7 and the Figures is a section containing tables. These figures are not considered part of the appendices.

5. **Comment:** **4 (e) Re fish catch: didn't include eels (puhi) which was strongly recommended in scopings. Need to do night fishing as well as diving both**

day and night. Fish sample was too small, only 34 gms. <u>EPA recommends 258 gms. Analysis of fish samples should be segregated by species.</u>

Response: Please see response to Comment 1, regarding inclusion of some species such as eels. Adequate quantities of fish tissue were collected, for a representative range of species, and did not necessitate night fishing. There is no particular reason to suspect that fish that are more easily caught at night would contain significantly different amounts of chemicals of concern than fish that forage during the day.

Users of the report can easily estimate the dose of a chemical of concern that would result from any daily rate of consumption of fish desired, based on the data provided in the report. For example, if it were assumed that the daily rate of fish consumption was 258 grams (about one-half pound), then the chemical dose would simply be multiplied by a factor of 7.6. The average daily fish consumption rate used to calculate the doses presented in the report is an accepted standard supported by the citations presented in the report.

As indicated in response to Comment 3, the purpose of the study was not to identify the all hazards, but to determine if activities at MMR would impact the health of people who depend on fish for a significant portion of their diet. There is no evidence that the local population of consumers of fish relies on only one species of fish.

6. Comment: **4 (f) Molluscs (shellfish) and crustaceans are supposed to be included in this study; e.g. crabs in muliwai and urchins near shore and benthic organisms. Please do it.**

Response: An unsuccessful attempt was made to collect sufficient numbers of specimens of shellfish for analysis. Based on the lack of evidence supporting a significant impact on human health from the most common and readily available edible species of fish and limu, the Army considers it unlikely that analysis of additional species would alter the initial conclusion that human health is not currently impacted by chemicals resulting from activities at MMR. The fact that it was difficult to obtain sufficient numbers of individuals to meet the analytical requirements of the study suggests that it would be equally difficult for local subsistence fishermen to consume the vast quantities of individuals of these species necessary to result in a significant impact on human health.

7. Comment: **4 (g) "There was a potential hazard to benthic invertebrates from 2,3,7,8-TCDD in sediments in the south muliwai" (Page 6-3 near the bottom). It is unlikely that dioxin found in the muliwai came from "burning of household waste." More likely, is the burning that occurred in the former OB/OD site. Please refer to my testimony on February 24, 2007 and the photo I took of the OB/OD site in 1979 and exhibited at that meeting. That information should be included in the revision. Dioxin/furans were also found in the "Halliburton" study of the OB/OD site (1994, I believe). This is important information regarding the cumulative effects which are supposed to be included in the EIS. Please so note in your revised report.**

Response: As discussed in the hydrogeologic investigation report, the muliwai investigation report, and in the marine resources investigation report, dioxins and furans are ubiquitous in Hawaii and throughout the world in low concentrations. The source

of these low levels is combustion. The concentrations observed in media at or near MMR are consistent with background concentrations. Regardless of whether past activities related to the OB/OD area may have contributed to the concentrations observed at MMR, the observed concentrations do not significantly differ from background levels.

8. Comment: **4 (h) Re: Draft Marine Resources Study (page 6-2) you state "there is no obvious pattern of deposition of explosive related chemicals." Yet you stated that perchlorate was found in surface water and detected in six samples of fish from the muliwai. That appears to be a pattern to me. The dioxin/furans may not show "obvious pattern" but were widely distributed" in the environment tested. Therefore, there could be a less obvious and more subtle pattern. You reported that xylene was detected in fish samples. This is disturbing and again raises more questions. Your study has raised more questions than it has answered. The critique by our consultants goes into more detail and needs to be addressed.**

Response: Additional discussion of perchlorate in fish tissue will be provided. Perchlorate was detected at highly variable concentrations in the fish samples. The concentrations in fish from the South Muliwai ranged from below the detection limit, to 160 parts per billion. One background fish sample from Sandy Beach contained 110 parts per billion. The large variability in the concentrations, and the similarity in the range of concentrations detected in the samples from both the muliwai and Sandy Beach suggests that a low level of accuracy resulting from one or more sources of error. At least one study, which investigated concentrations of perchlorate in tissues of freshwater species of fish collected near the former Naval Weapons Industrial Reserve Plant in McGregor, Texas, found elevated perchlorate concentrations in fish heads, even when the concentrations were not detected in fillets (US Army Corps of Engineers 2004). The study also found perchlorate in tissues of fish collected from watersheds thought to be isolated from sources of perchlorate. Perchlorate is a highly water-soluble salt, and would be expected to mix rapidly and disperse in a nearshore environment. Finally, although perchlorate is a constituent of rocket propellants and could be present in some munitions used in training activities at MMR, the amount of unburned rocket propellant released to the environment at MMR is expected to be very low. Therefore, although perchlorate was reported in samples of fish tissue, there is at least some reason to suspect that the reported concentrations may not accurately reflect the actual concentrations in the fish, or that perchlorate may be sequestered in certain tissues. Although the results of the study raise interesting questions for future research, the concentrations observed in the fish tissues are not of a magnitude that would present a significant threat to human health.

9. Comment: **4 (i) I quote from your Appendix C page 7 paragraph C.4.1:**

"A significant number of organochlorine data were disqualified because They could not be accurately quantified. Additionally, nitroglycerine and RDX data from three samples were disqualified. This resulted in a reduced number of valid data with which to use in the project assessment".

Your honesty is appreciated—I would expect nothing less. However, this appears to be a "significant" gap and deficiency in your data. This study needs to be redone!!!

Response: It would be unusual if environmental investigations of the broad scope and complexity of those conducted at MMR did not generate a number of interesting questions worthy of further research. However, the Army is required to consider the benefit versus the cost to the taxpayer to achieve improved confidence in analytical results that are below concentrations associated with significant human health effects. Despite the invariable uncertainty associated with detecting trace concentrations of COPCs in fish and limu tissues, the Marine Resources Study has achieved one of its primary objectives, which is to determine whether the concentrations of chemicals associated with training activities at MMR present a significant health threat to persons for whom fish represents a significant dietary input. The results of the study suggest that the threat is negligible. While additional monitoring may be warranted to confirm these results when training is resumed, the study results indicate that under current conditions, no significant adverse health effects will result from consuming fish and limu collected near MMR relative to other comparable coastal sites.

References:

U.S. Army Corps of Engineers. 2004. Final Report: Bosque and Leon River Watersheds Study. Fort Worth District. Available online at: http://www.swf.usace.army.mil/pubdata/ppmd/perchlorate/index.html. Accessed on June 6, 2007.

RESPONSE TO COMMENTS

TRANSCRIPT FROM PUBLIC MEETING HELD FEBRUARY 24, 2007

1. **Comment:** **David Henkin, Page 17, Line 6: ...field notes for the marine study are in many cases completely illegible, not suggesting anyone did anything intentional but you need to make the copies darker so one can actually read what species was collected where, and that information should be promptly provided to the public because we have a limited amount of time to comment.**

   Response: Darker copies of the field notes, which are easier to read, were provided to the public subsequent to the public meeting. Darker copies of the field notes have been included in the final Marine Resources Study (MRS).

2. **Comment:** **David Henkin, Page 17, Line 17: ...there's a table B, as in boy, one that was supposed to be in appendix B that would set forth how the samples were composited, in other words, how different fish and limu species were mixed together. I couldn't find it, I looked through every page of appendix B, hundreds of pages, I couldn't find it, so, again, that information just needs to be provided.**

   Response: The reference to Table B-1 in the MRS was made in error – this table was never completed, and was not intended to be included in the MRS. The reference to Table B-1 has been removed from the MRS. A version of the table was provided to Earthjustice and its' technical experts following the February 24, 2007 public meeting, however this was an incomplete table that was used for internal purposes.

3. **Comment:** **David Henkin, Page 18, Line 1: …even the hard copies that were provided today of the document, and it's appreciated the effort, if you look at it, and I don't know what's going on with the word processing program, but look, for example, on page 4-6, there are boxes instead of numbers, so certain numbers are coming through as boxes. So, you know, for example, if you want to, you know, they say later, USEPA guidance provides a mean uncooked fish consumption rate for the general U.S. population of box, 2.59 grams per day, and, anyway, there's boxes all over the place, so you actually don't even have the numbers, so we need to correct that.**

   Response: A printing error was responsible for mistakes cited in the comment. Electronic copies of the MRS, which did not have the errors cited in the comment, were provided to the public during the public meeting. Revised hard copies of the MRS were provided to the public following the public meeting.

4. **Comment:** **David Henkin, Page 18, Line 13[Due to missing data (see comments 6 and 7)]:…and I think we need to extend the comment period, there's a 60 day comment period as required under the settlement agreement so that people can actually review the information.:**

   Response: The comment period was extended to April 19, 2007, in response to a request from the public.

5. **Comment:** **William Alila, Page 24, Line 12: Regarding the marine study, sample size is too small.**

   Response: The Marine Resources Study was intended to sample a representative range of species that may be consumed by subsistence and recreational fishers on the Waianae Coast. Sampling all possible species that could be eaten by subsistence

fishers is an unrealistic expectation, and was beyond the scope of the study. However, the Army will be developing a long-term monitoring program to continue to evaluate potential impacts from military activities to the muliwai and nearshore areas associated with MMR, and the Army anticipates soliciting public input for the development of the long-term monitoring plan. Additional fish samples will likely be collected as part of this long-term monitoring plan.

6. Comment: William Alila, Page 24, Line 13: The Nanakuli Muliwai, I think we told you ahead of time that that was not a good choice to use because of the past military uses in Nanakuli, so it's not like you weren't told ahead of time don't use it, and you still went ahead and used it, so the results are mixed, the results are unsubstantiated, the results have failed to comply with our request for reasonable study.

Response: The rationale for the selection of background sites was provided in both the final SAP and the draft Marine Resources Study. In the final SAP, Section 2.2, Marine Resources Sampling Strategy, states "Background muliwai will be located on the Waianae Coast within watersheds that are not subjected to military activity." Section 2.2.3, Background Sampling, of the final SAP states "Samples will be collected from locations distant enough from Makua Valley that biota would be unlikely to be affected by target chemicals originating from MMR. Background muliwai will be located in watersheds that are not subject to military activity."

The purpose of the Marine Resources Study is to identify whether Army activities at the MMR have impacted Makua Valley resources above and beyond impacts from all other sources. Using an uncontaminated watershed for a background location would not allow the apportioning of impacts between the Army and other sources. This is a significant concern as there are many substantial sources of contamination other than the MMR. To adequately address the Army's impact alone on Makua Valley resources, an appropriate control site (i.e., background location) would be a valley where all aspects of the valley are as similar as possible to Makua. Since inter-watershed transport of contaminants is facilitated by wind and rain, the control valley should have similar wind and rain patterns as that of Makua. Biogeochemical processes affecting contaminants are a function of temperature and substrate, and these attributes should be as similar as possible to Makua Valley in order to identify impacts that can be attributed solely to Army activity. There are distinct differences in the substrate (mineralogy and age) between the different islands, making the selection of a control on another island inappropriate. Because of this, the most appropriate control watersheds are on the leeward (Waianae) coast of Oahu. As long as the background sites selected are representative of ambient conditions for the general Makua vicinity and have not received contamination from the MMR, they are considered acceptable, as per USEPA (1989, 2002a) risk assessment guidance.

7. Comment: William Alila, Page 24, Line 24: A more reasonable alternative would be to look at the baseline of a pristine muliwai, that baseline is closer to Makua 70 years ago than Nanakuli is, you're comparing apples with oranges. The baseline that we need to be looking at is the baseline that occurred before the military showed up and started bombing and started burning and started dumping and started doing OBOD disposal there, that's the baseline, not the baseline for the last 20 years, the baseline is what occurred before the military showed up and evicted people from Makua Valley, that's the baseline. That

should always be the baseline, whether it's archeological, whether it's chemical, whether it's hydrological, whether it's sociological.

Response: The rationale for the selection of background sites was provided in both the final SAP and the draft Marine Resources Study. In the final SAP, Section 2.2, Marine Resources Sampling Strategy, states "Background muliwai will be located on the Waianae Coast within watersheds that are not subjected to military activity." Section 2.2.3, Background Sampling, of the final SAP states "Samples will be collected from locations distant enough from Makua Valley that biota would be unlikely to be affected by target chemicals originating from MMR. Background muliwai will be located in watersheds that are not subject to military activity."

The purpose of the Marine Resources Study is to identify whether Army activities at the MMR have impacted Makua Valley resources above and beyond impacts from all other sources. Using an uncontaminated watershed for a background location would not allow the apportioning of impacts between the Army and other sources. This is a significant concern as there are many substantial sources of contamination other than the MMR. To adequately address the Army's impact alone on Makua Valley resources, an appropriate control site (i.e., background location) would be a valley where all aspects of the valley are as similar as possible to Makua. Since inter-watershed transport of contaminants is facilitated by wind and rain, the control valley should have similar wind and rain patterns as that of Makua. Biogeochemical processes affecting contaminants are a function of temperature and substrate, and these attributes should be as similar as possible to Makua Valley in order to identify impacts that can be attributed solely to Army activity. There are distinct differences in the substrate (mineralogy and age) between the different islands, making the selection of a control on another island inappropriate. Because of this, the most appropriate control watersheds are on the leeward (Waianae) coast of Oahu. As long as the background sites selected are representative of ambient conditions for the general Makua vicinity and have not received contamination from the MMR, they are considered acceptable, as per USEPA (1989, 2002a) risk assessment guidance.

8. Comment: William Alila, Page 25, Line 14: The marine study clearly states in several places in the executive summary about uncertainties, uncertainties of baselines by which to make comparisons, uncertainties of order of magnitude of effect, uncertainties based on assumptions which translate into risk assessment, and what we asked for was some certainty, not more uncertainty when we requested the muliwai study, we want to know with certainty, is the fish safe to eat, are the crabs safe to eat, is the limu safe to eat?

Response: According to USEPA (1989) guidance, "Uncertainties in the risk assessment must be evaluated and discussed, including uncertainties in the physical setting definition of the site, in the models used, in the exposure parameters, and in the toxicity assessment." Knowing the uncertainties in the information used to write the report allows a better evaluation of the information presented in the report and is required by both federal and state regulators.

9. Comment: William Alila, Page 26, Line 4: Is the arsenic organic or inorganic? Gee, I don't know, maybe I should stop eating the limu but until you guys tell me, because if it's inorganic, then chances are I'm going to die of cancer. You guys knew when you were doing the study that there are two forms of

arsenic, why didn't you just figure out what the percentage was in the limu and the fish instead of coming back with our report that's full of uncertainty.

Response: The Marine Resources Study concluded that the activities at MMR likely did not contribute to the arsenic detected in fish and limu, and therefore the proposed training activities at MMR do not pose a human health risk to area residents that rely on marine resources for subsistence. Given that the detected arsenic likely did not come from MMR, the Army is under no obligation to determine if the arsenic is organic or inorganic. Furthermore, the speciation of arsenic to organic vs. inorganic forms was not requested or recommended by the public or Earthjustice or its' experts during their review of the Sampling and Analysis Plan, and therefore was not included as part of the analysis program for the Marine Resources Study. However, the Army will be developing a long-term monitoring program to evaluate potential impacts from military activities to the muliwai and nearshore areas associated with Makua Military Reservation, and the Army anticipates soliciting public input for the development of the long-term monitoring plan. It is likely that the speciation of arsenic to organic vs. inorganic forms will be included in this monitoring plan.

10. Comment: William Alila, Page 26, Line 13: The choice of Sandy Beach as an alternate control site, wow, who came up with that one? They should have gone back and checked the records. Alan Davis was used to house military folks, there were military activities that occurred at Alan Davis, Alan Davis is another name for Sandy Beach. So you compare an area that has been used for military activities with an area that is being used for military activities and, guess what, the difference shouldn't be that much, so does that make it okay? More appropriate, and we said this in our comments to you before you designed the study, we said, use someplace where there's been no military influence, use Haena on Kauai, use someplace on the North Shore of Molokai, that's the baseline, that's the appropriate baseline in which to make comparisons because you guys not going to eat the fish, you guys going to serve two years over here and you guys going to leave, but we got to eat the fish and we got to eat the limu.

Response: The rationale for the selection of background sites was provided in both the final SAP and the draft Marine Resources Study. In the final SAP, Section 2.2, Marine Resources Sampling Strategy, states "Background muliwai will be located on the Waianae Coast within watersheds that are not subjected to military activity." Section 2.2.3, Background Sampling, of the final SAP states "Samples will be collected from locations distant enough from Makua Valley that biota would be unlikely to be affected by target chemicals originating from MMR. Background muliwai will be located in watersheds that are not subject to military activity."

The purpose of the Marine Resources Study is to identify whether Army activities at the MMR have impacted Makua Valley resources above and beyond impacts from all other sources. Using an uncontaminated watershed for a background location would not allow the apportioning of impacts between the Army and other sources. This is a significant concern as there are many substantial sources of contamination other than the MMR. To adequately address the Army's impact alone on Makua Valley resources, an appropriate control site (i.e., background location) would be a valley where all aspects of the valley are as similar as possible to Makua. Since inter-

watershed transport of contaminants is facilitated by wind and rain, the control valley should have similar wind and rain patterns as that of Makua.

11. Comment: William Alila, Page 28, Line 2: where did those chemicals that are associated with Heptachlore and pesticide use, agriculture pesticide use end up in fish in Makua?

Response: The purpose of the Marine Resources Study is to identify whether Army activities at the MMR have impacted Makua Valley resources above and beyond impacts from all other sources. There are a wide variety of potential sources of contaminants in the fish that were outlined in the MRS, and it is not part of the scope of the MRS to determine the source of all of these contaminants. The data collected from the Makua Military Reservation during several environmental investigations, combined with the fish tissue data collected during the MRS indicate that the Army is likely not the source of the contaminants detected in the fish.

12. Comment: Vince Dodge, Page 41, Line 6: which brings me back to the marine study because the marine study is about food, and I love my 'ia, I love my fish, and one of the things that I noticed is missing in that study, and Gary from Tetra Tech was kind enough to tell me that they spent five weeks catching fish, they didn't catch too many species, they only fished in the daytime, they didn't fish early in the morning, they didn't fish at night, they didn't go diving, so their methodology and their window of, you know, trying to catch fish was pretty limited, you know, and as fishermen we know there's certain things you catch in the middle of the day and there's certain things you got to go in the morning early or you got to go at night, and you got to throw palu, you know.

Response: The MRS was intended to sample a representative range of species that may be consumed by subsistence and recreational fishers on the Waianae Coast. Sampling all possible species that could be eaten by subsistence fishers is an unrealistic expectation, and was beyond the scope of the study. Since trophic level influences the potential uptake and concentration of contaminants, species from a range of trophic levels (herbivore, omnivore and carnivore) were targeted in the study. Since there is no clearly defined reason why a species that may be active at night would differentially uptake and concentrate contaminants, the study focused active sampling activities during daylight hours, and employed passive methods (i.e., fish and crab traps) overnight on several occasions and in several muliwai. However, these passive traps were not successful in catching sufficient numbers of fish or invertebrates to use as even a single sample. However, the Army will be developing a long-term monitoring program to continue to evaluate potential impacts from military activities to the muliwai and nearshore areas associated with MMR, and the Army anticipates soliciting public input for the development of the long-term monitoring plan. Additional fish samples will likely be collected as part of this long-term monitoring plan.

13. Comment: Vince Dodge, Page 42, Line 1:...when I look at that marine study, I'm like either these guys are not good fishermen and/or there's just no fish in the ocean anymore, but one of the things that they did not catch and they did not make any real effort to catch, was the puhi, the eel, and in the scoping meetings, as folks that live down here, as folks that fish and eat fish, you know, we strongly recommended many times that they catch puhi because

the puhi is a creature that eats near shore, inshore fish and crustaceans, and he's at the top of the food chain, pretty much, you know, and he lives in the area, and he's going be to the one that if there are toxins he's going to be one that you're going to find the concentration in, you're not going to find concentration in oholiholi that are this big, you know, moana that are like eight inches, I mean, that's a fish that's maybe a year or two old, that's not an old fish but a nice big puhi, one of the green ones or a big white eel, that fish, that fish has been around for awhile, he's eaten a lot of things and we'd get some, it would be a good indicator.

Response: The MRS was intended to sample a representative range of species that may be consumed by subsistence and recreational fishers on the Waianae Coast. Sampling all possible species that could be eaten by subsistence fishers is an unrealistic expectation, and was beyond the scope of the study. Since trophic level influences the potential uptake and concentration of contaminants, species from a range of trophic levels (herbivore, omnivore and carnivore) were targeted in the study. The primary methods used for catching fish were various nets and hook and line. A variety of other methods used by local fishermen, including spear fishing, were not used in the study, because of the potential to introduce metals and other types of contamination into the fish. However, the Army will be developing a long-term monitoring program to continue to evaluate potential impacts from military activities to the muliwai and nearshore areas associated with MMR, and the Army anticipates soliciting public input for the development of the long-term monitoring plan. Additional fish samples will likely be collected as part of this long-term monitoring plan.

14. Comment: Dr. Jonathan Deenik, Page 44, Line 20: So here is, I think, a basic flaw in this study is the number of samples that were gathered. Now, maybe it was constrained by money, well, that's fair enough, you know, we have to operate within a budget, but if you were to look at this and say that decisions are being made on four samples of limu, that's at least what's said in the paper there, well, then, of course, you're going to have a lot of uncertainty and you cannot, anybody in their right mind can't make, you know, a good prediction of what is the health hazard on four samples. So that's a pretty fundamental basic baseline.

Response: The Army will be developing a long-term monitoring program to continue to evaluate potential impacts from military activities to the muliwai and nearshore areas associated with MMR, and the Army anticipates soliciting public input for the development of the long-term monitoring plan. Additional limu samples will likely be collected as part of this long-term monitoring plan.

15. Comment: Dr. Jonathan Deenik, Page 45, Line 8: The other important question is what are we comparing this to, so there's always in any kind of study a control group and an affected group, so Mr. Aila clearly pointed out the flaws associated with the control group. I don't think the study needed to select a control within the Waianae Coast, that was never one of our suggestions during the scoping meeting, so where do you go find an area that has not been affected by military use? Well, Oahu, it's not easy to find an area that hasn't been impacted by military activity, in fact, I still think there are two or three super fund sites associated with military activity on this island, so you're going to have to go somewhere else, Molokai, that's a fair enough

comparison, same type of sediments in east Molokai as Makua, similar, at least, make a comparison. That becomes a real control, and then you can say with a little bit more certainty, well, there is an impact or there isn't an impact.

Response: The rationale for the selection of background sites was provided in both the final SAP and the draft Marine Resources Study. In the final SAP, Section 2.2, Marine Resources Sampling Strategy, states "Background muliwai will be located on the Waianae Coast within watersheds that are not subjected to military activity." Section 2.2.3, Background Sampling, of the final SAP states "Samples will be collected from locations distant enough from Makua Valley that biota would be unlikely to be affected by target chemicals originating from MMR. Background muliwai will be located in watersheds that are not subject to military activity."

The purpose of the Marine Resources Study is to identify whether Army activities at the MMR have impacted Makua Valley resources above and beyond impacts from all other sources. Using an uncontaminated watershed for a background location would not allow the apportioning of impacts between the Army and other sources. This is a significant concern as there are many substantial sources of contamination other than the MMR. To adequately address the Army's impact alone on Makua Valley resources, an appropriate control site (i.e., background location) would be a valley where all aspects of the valley are as similar as possible to Makua. Since inter-watershed transport of contaminants is facilitated by wind and rain, the control valley should have similar wind and rain patterns as that of Makua. Biogeochemical processes affecting contaminants are a function of temperature and substrate, and these attributes should be as similar as possible to Makua Valley in order to identify impacts that can be attributed solely to Army activity. There are distinct differences in the substrate (mineralogy and age) between the different islands, making the selection of a control on another island inappropriate. Because of this, the most appropriate control watersheds are on the leeward (Waianae) coast of Oahu. As long as the background sites selected are representative of ambient conditions for the general Makua vicinity and have not received contamination from the MMR, they are considered acceptable, as per USEPA (1989, 2002a) risk assessment guidance.

16. Comment: David Henkin, Page 48, Line 11: So when you do a study based on very limited sampling size such that the uncertainties are so great that you cannot say anything meaningful about the potential for contamination by substances associated with proposed training at Makua, you haven't done what the court order said, you haven't done what you agreed to do, so money in this case really is not relevant, what's relevant is what the Army voluntarily entered into and what the court ordered.

Response: According to USEPA (1989) guidance, "Uncertainties in the risk assessment must be evaluated and discussed, including uncertainties in the physical setting definition of the site, in the models used, in the exposure parameters, and in the toxicity assessment." Knowing the uncertainties in the information used to write the report allows a better evaluation of the information presented in the report and is required by both federal and state regulators. The Army will be developing a long-term monitoring program to continue to evaluate potential impacts from military activities to the muliwai and nearshore areas associated with MMR, and the Army anticipates soliciting public input for the development of the long-term monitoring

plan. Additional limu samples will likely be collected as part of this long-term monitoring plan.

17. Comment: David Henkin, Page 48, Line 21: The emphasis here is marine resources, limu, shell fish, fish on which area residents rely for subsistence. That goes to the point that Vince Dodge raised, people fish at night, people dive, people eat a variety of things out of the ocean, these are the things that the Army agreed to and is obliged to study, and that's not what we got.

Response: The MRS was intended to sample a representative range of species that may be consumed by subsistence and recreational fishers on the Waianae Coast. Sampling all possible species that could be eaten by subsistence fishers is an unrealistic expectation, and was beyond the scope of the study. Since trophic level influences the potential uptake and concentration of contaminants, species from a range of trophic levels (herbivore, omnivore and carnivore) were targeted in the study. Since there is no clearly defined reason why a species that may be active at night would differentially uptake and concentrate contaminants, the study focused active sampling activities during daylight hours, and employed passive methods (i.e., fish and crab traps) overnight on several occasions and in several muliwai. However, these passive traps were not successful in catching sufficient numbers of fish or invertebrates to use as even a single sample. The Army will be developing a long-term monitoring program to continue to evaluate potential impacts from military activities to the muliwai and nearshore areas associated with MMR, and the Army anticipates soliciting public input for the development of the long-term monitoring plan. Additional fish samples will likely be collected as part of this long-term monitoring plan.

18. Comment: David Henkin, Page 49, Line 20: Well, the study assumed that for recreational fishermen, so people that are not subsistence, that a meal of fish is 34 grams, 28 grams is an ounce, so we're talking a little bit more than a couple of bites, that was the, obviously, how much of something you eat has a strong correlation to the likelihood you're going to get poisoned by it or it's going to contribute to cancer rates, so if you start with an unrealistically low assumption that people take a bite of fish and that's their fish meal and that's what you're going to evaluate, you're going to get inaccurate results that are not reliable because the point of the exercise really is not to, we didn't enter into this to try and prove that marine resources at Makua are unhealthy, because that would really be damaging to this community if that were the truth, we'd like to have good data that proved that marine resources at Makua are healthy because the fact of the matter is, that healthy or unhealthy, people are going to be keep eating them... So when you do a study that assumes that we only eat an ounce of fish at a meal, that doesn't give us good information.

Response: Fish consumption rates may vary by ethnic group, lifestyle, economic status, and geography, among other factors (OEHHA 2001). Therefore, it is desirable to use a fish consumption rate that is applicable to the receptors being evaluated. As part of the MRS, the Army reviewed the literature on fish consumption rates in Hawaii and selected the highest fish consumption rates recorded for Hawaii. The Army believes that the fish consumptions rates used in the MRS were appropriate for the study. The recreational fishermen consumption rate used in this report was the average

fish consumption rate from a survey of 13,629 Hawaiian fishermen in Hawai`i (Sharma et al. 2003).

19. Comment: David Henkin, Page 51, Line 23: Now, for a subsistence fisherman, now this is someone who is relying on this area to really survive, I mean, they're not going to the supermarket for their fish, this is survival, they consume 110 grams, so that's about a four ounce portion, it's a quarter pound of meat, so those who go get a quarter pounder, not very much, again. So in terms of what the experts who do this over at EPA, EPA assumes that an average fish sized meal is 227 grams, so over twice as much they consume for subsistence fishermen or about half a pound, and based on my own experience and 41 years on this earth, that's kind of more like what people tend to eat when they sit down to eat fish, so we need studies that are based on good data, and we're entitled to them.

Response: Fish consumption rates may vary by ethnic group, lifestyle, economic status, and geography, among other factors (OEHHA 2001). Therefore, it is desirable to use a fish consumption rate that is applicable to the receptors being evaluated. As part of the MRS, the Army reviewed the literature on fish consumption rates in Hawaii and selected the highest fish consumption rates recorded for Hawaii. The fish ingestion rate of 100.6 grams/day used in this report was the 95th percentile fish consumption rate from a survey of 13,629 Hawaiian fishermen in Hawai`i (Sharma et al. 2003). USEPA guidance indicates that much lower fish consumption rates should be used in risk assessments (with the exception of Native American subsistence fishermen), as stated in the report "The USEPA Superfund Program guidance assumes an ingestion rate of 54 grams of fish per day (g/day) for high consumers of locally caught fish (USEPA 1991a). For the general US population, the USEPA Exposure Factors Handbook recommends a mean marine fish consumption rate of 14.1 g/day for the general US population and a mean of 70 g/day and 95th percentile of 170 g/day fish consumption rate for Native American subsistence populations (USEPA 1997a)." It is not clear where the reviewer obtained the estimate of 227 grams for an average fish sized meal, but in any case it should be noted that the assumption used in the MRS was that the subsistence fisherman was eating 100.6 grams/day every day for 30 years. Based upon this information, the Army believes that the fish consumption rates used in the MRS were appropriate for the study.

20. Comment: David Henkin, Page 52, Line 14: One of the big issues that's totally unresolved in this study is the likelihood that people are eating toxic levels of arsenic. They came out in the study with extremely high levels of arsenic in the fish and the limu, the problem is they don't tell us whether the arsenic is organic arsenic, which has a lower toxicity, or inorganic arsenic, which has a very high toxicity, there's no reason for that. You can analyze a sample and determine the proportion that's organic and inorganic.

Response: The Marine Resources Study concluded that the activities at MMR likely did not contribute to the arsenic detected in fish and limu, and therefore the proposed training activities at MMR do not pose a human health risk to area residents that rely on marine resources for subsistence. Given that the detected arsenic likely did not come from MMR, the Army is under no obligation to determine if the arsenic is organic or inorganic. Furthermore, the speciation of arsenic to organic vs. inorganic forms was not requested or recommended by the public or Earthjustice or its'

experts during their review of the Sampling and Analysis Plan, and therefore was not included as part of the analysis program for the Marine Resources Study. However, the Army will be developing a long-term monitoring program to evaluate potential impacts from military activities to the muliwai and nearshore areas associated with Makua Military Reservation, and the Army anticipates soliciting public input for the development of the long-term monitoring plan. It is likely that the speciation of arsenic to organic vs. inorganic forms will be included in this monitoring plan.

21. Comment: **David Henkin, Page 53, Line 4: ...they didn't analyze whether the arsenic was organic or inorganic, they looked at studies that said worldwide, most fish has organic arsenic in it, therefore, we assume that all of the arsenic that we found is organic. Well, that doesn't follow logically because most fish aren't in a near shore area where we have surface water studies that the Army has done that inorganic arsenic is flowing in the streams into the water, so you can't just sort of assume, you know, sort of Socrates was a man, that type of logic. Unless you study the specific fish that people are going down and eating to determine whether it's organic arsenic or inorganic arsenic, you're not going to get good data. Same thing with limu, limu had very high levels of arsenic, they did not go into any analysis of whether it was organic or inorganic, that's information that we need, that's information that we're…**

Response: The Marine Resources Study concluded that the activities at MMR likely did not contribute to the arsenic detected in fish and limu, and therefore the proposed training activities at MMR do not pose a human health risk to area residents that rely on marine resources for subsistence. Given that the detected arsenic likely did not come from MMR, the Army is under no obligation to determine if the arsenic is organic or inorganic. Furthermore, the speciation of arsenic to organic vs. inorganic forms was not requested or recommended by the public or Earthjustice or its' experts during their review of the Sampling and Analysis Plan, and therefore was not included as part of the analysis program for the Marine Resources Study. However, the Army will be developing a long-term monitoring program to evaluate potential impacts from military activities to the muliwai and nearshore areas associated with Makua Military Reservation, and the Army anticipates soliciting public input for the development of the long-term monitoring plan. It is likely that the speciation of arsenic to organic vs. inorganic forms will be included in this monitoring plan.

22. Comment: **David Henkin, Page 53, Line 22: Also, with limu, I'll get into a little bit later the references that were used for these various studies, but for limu they did not sample limu anywhere else in the Hawaiian islands, in fact, anywhere else at all, they just looked at the chemical constituents that are in this limu that people are eating, people are gathering, people are eating, I've eaten it, there's no comparison, so we don't know what pristine limu would have, maybe it is that all limu in Hawaiian waters have elevated levels of arsenic, and even if you go to pristine areas on neighbor islands that are not affected not only by military activities, and I'll get into this, but by any urbanization or human input, any anthropogenic input, maybe that's just the way our limu is, well, that would be a meaningful study, that would provide meaningful information, that this is the level arsenic that you get in limu.**

Response: The Marine Resources Study concluded that the activities at MMR likely did not contribute to the arsenic detected in fish and limu, and therefore the proposed training activities at MMR do not pose a human health risk to area residents that rely on marine resources for subsistence. Given that the detected arsenic likely did not come from MMR, the Army is under no obligation to determine if the arsenic is organic or inorganic. Furthermore, the speciation of arsenic to organic vs. inorganic forms was not requested or recommended by the public or Earthjustice or its' experts during their review of the Sampling and Analysis Plan, and therefore was not included as part of the analysis program for the Marine Resources Study. However, the Army will be developing a long-term monitoring program to evaluate potential impacts from military activities to the muliwai and nearshore areas associated with Makua Military Reservation, and the Army anticipates soliciting public input for the development of the long-term monitoring plan. It is likely that the speciation of arsenic to organic vs. inorganic forms will be included in this monitoring plan.

23. Comment: David Henkin, Page 55, Line 1: There's nothing in this study about shell fish, they didn't gather shell fish, whether it's crabs in the muluwai or urchin in the inshore areas, there's no study of shell fish at all, none. So they have failed to comply with their agreement and the court order to study shell fish, they need to do that.

Response: The language in the 2007 order states that "As part of the preparation of the EIS for military training activities at MMR, Defendants shall complete one or more studies to determine whether fish, limu, shellfish, and other marine resources near Makua Beach and in the muliwai on which area residents rely for subsistence are contaminated by substances associated with the proposed training activities at MMR." There is nothing in this language that expressly requires that shellfish be tested, and as such, the Army is not in violation of the 2007 Order.

The results of the Marine Resources Study (MRS) indicate that relatively low levels of contamination are present in fish and limu in the Makua-area muliwai and nearshore areas, and that these levels are approximately the same as the levels detected in fish from background locations. The risk to subsistence fishermen from consuming the fish is below the levels used by USEPA for fish advisories. Furthermore, the study concludes that these contaminants are likely not coming from the MMR, because many of the chemicals are ubiquitous in the environment, and may be attributable to many different sources. Given that the fish are likely not contaminated by substances associated with the proposed training activities at MMR, that there is very little interchange between the muliwai where such substances might accumulate and the near-shore area which provides the habitat for the shellfish on which area residents rely, that any such transport of chemicals from the muliwai to the nearshore area would result in significant dilution of the chemicals, it is likely that the shellfish are not contaminated by substances associated with the proposed training activities at MMR.

Despite the conclusion that the shellfish are likely not contaminated from activities at MMR, field staff did attempt to collect shellfish and benthic invertebrates, including crabs and sea urchins, during the MRS. However, the selected method (passive traps) was not successful in capturing crabs. Additionally, because of the large number of analytes included in the chemical analytical program, field staff were unable to collect a sufficient number of sea urchins to provide enough sample mass

(more than 200 grams) for all of the analyses. It is important to recognize that this project required destructive sampling of a living resource, which has the potential to negatively impact a species population in the muliwai. The Army will be developing a long-term monitoring program to evaluate potential impacts from military activities to the muliwai and nearshore areas associated with MMR, and the Army anticipates soliciting public input for the development of the long-term monitoring plan. It is possible that shellfish and benthic invertebrates will be included as species of interest in this monitoring plan if it is determined that the sampling will not have a negative impact on the species population.

24. Comment: David Henkin, Page 57, Line 2: You need to look at a non-contaminated muluwai, which is what Makua would be, and determine what the background levels are.

Response: The rationale for the selection of background sites was provided in both the final SAP and the draft Marine Resources Study. In the final SAP, Section 2.2, Marine Resources Sampling Strategy, states "Background muliwai will be located on the Waianae Coast within watersheds that are not subjected to military activity." Section 2.2.3, Background Sampling, of the final SAP states "Samples will be collected from locations distant enough from Makua Valley that biota would be unlikely to be affected by target chemicals originating from MMR. Background muliwai will be located in watersheds that are not subject to military activity."

The purpose of the Marine Resources Study is to identify whether Army activities at the MMR have impacted Makua Valley resources above and beyond impacts from all other sources. Using an uncontaminated watershed for a background location would not allow the apportioning of impacts between the Army and other sources. This is a significant concern as there are many substantial sources of contamination other than the MMR. To adequately address the Army's impact alone on Makua Valley resources, an appropriate control site (i.e., background location) would be a valley where all aspects of the valley are as similar as possible to Makua. Since inter-watershed transport of contaminants is facilitated by wind and rain, the control valley should have similar wind and rain patterns as that of Makua. Biogeochemical processes affecting contaminants are a function of temperature and substrate, and these attributes should be as similar as possible to Makua Valley in order to identify impacts that can be attributed solely to Army activity. There are distinct differences in the substrate (mineralogy and age) between the different islands, making the selection of a control on another island inappropriate. Because of this, the most appropriate control watersheds are on the leeward (Waianae) coast of Oahu. As long as the background sites selected are representative of ambient conditions for the general Makua vicinity and have not received contamination from the MMR, they are considered acceptable, as per USEPA (1989, 2002a) risk assessment guidance.

25. Comment: David Henkin, Page 58, Line 16: Sandy Beach, there's been questions raised whether that's an appropriate background for the fish and so, in general, you need to address how you selected the locations because if they're not free of human input, if they're not pristine areas, they don't tell us what the effects are of the military being there.

Response: The rationale for the selection of background sites was provided in both the final SAP and the draft Marine Resources Study. In the final SAP, Section 2.2, Marine Resources Sampling Strategy, states "Background muliwai will be located on the

Waianae Coast within watersheds that are not subjected to military activity." Section 2.2.3, Background Sampling, of the final SAP states "Samples will be collected from locations distant enough from Makua Valley that biota would be unlikely to be affected by target chemicals originating from MMR. Background muliwai will be located in watersheds that are not subject to military activity."

The purpose of the Marine Resources Study is to identify whether Army activities at the MMR have impacted Makua Valley resources above and beyond impacts from all other sources. Using an uncontaminated watershed for a background location would not allow the apportioning of impacts between the Army and other sources. This is a significant concern as there are many substantial sources of contamination other than the MMR. To adequately address the Army's impact alone on Makua Valley resources, an appropriate control site (i.e., background location) would be a valley where all aspects of the valley are as similar as possible to Makua. Since inter-watershed transport of contaminants is facilitated by wind and rain, the control valley should have similar wind and rain patterns as that of Makua. Biogeochemical processes affecting contaminants are a function of temperature and substrate, and these attributes should be as similar as possible to Makua Valley in order to identify impacts that can be attributed solely to Army activity. There are distinct differences in the substrate (mineralogy and age) between the different islands, making the selection of a control on another island inappropriate. As long as the background sites selected are representative of ambient conditions for the general Makua vicinity and have not received contamination from the MMR, they are considered acceptable, as per USEPA (1989, 2002a) risk assessment guidance.