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Mr. Steve Chao
U.S. Navy Base Closure Coordinator
Engineering Field Activity West
900 Commodore Drive
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Subject: Moffett Federal Airfield Final OU5 Feasibility Study Report dtd August 31, 1995

Dear Mr. Chao:

I would like to thank you for the opportunity to review and comment on the Moffett Federal Airfield Final OU5 Feasibility Study Report (FS) dated August 31, 1995.

I commend the Navy and all parties involved in the investigation activities, engineering and hydrogeologic analyses, and remedial design studies performed to date and it is my intent that the following comments address issues which remain unresolved and assist in achieving a technically-efficient and cost-effective remedial design for the proposed remedial plan. My review of the referenced document did however identify several issues which I believe are significantly important to the understanding of the local geologic and hydrogeologic conditions of Moffett Field.

1. The review of the site geology identifies that the project area is underlain by thinly-bedded lenses of permeable silty sand, sand, clayey sand, and gravelly sand within a larger low-permeable silty clay deposit (referred to as the A-1 and A-2/B-1 aquifer). Based on regional and local investigations, and review of the findings of remedial actions on locally adjacent properties, these thinly bedded lenses of more-permeable sediments are often connected and laterally continuous for several hundreds-of-feet. However, it is also common for these units to terminate within several tens-of-feet from particular borings/wells where they were observed. These thin channel units are also generally found to be sinuous in nature (as would be expended in a low-energy depositional environment of the bay margin) and not direct linear features (suggestive of higher energy depositional environments).

Similarly, the vertical connectivity of these interbedded units has also been demonstrated to exist (such that water in the sediments of the A-1 aquifer do have some communication of waters in the A-2/B-1 sediments).

With this regional and local knowledge, it is not surprising to find by review of the surficial hydrogeologic maps and cross-sections presented in the reference document that correlation of these low-permeable and higher-permeable sediments is incomplete were existing data is present. This is evidenced in-part by the apparent difficulty to extrapolate the continuity of sediments

within an area of closely spaced borings. However, it is more surprising to find that these highly interbedded and sinuous units are in-fact extrapolated as "linear" and continuous features where there is an absence of data. The "generalized interpretation" and apparent extrapolation of continuous low-permeable sediments in the area of low data, and more interestingly the absence of inclusion of higher-permeable sediments as one would expect to be present, is not consistent with the "interpretation" presented where real data exists or used elsewhere on Moffett Field.

2. The data collected to date does not provide conclusive evidence regarding the vertical connectivness of the A-1 and A-2/B-1 aquifers within the project area particularly with respect to the confidence suggested that the contaminants are hydraulically isolated in the A-1 aquifer. This irregularity is also raised by the absence of A-2/B-1 data throughout the project area and at crucial locations.

3. The "hydrogeologic model" presented to date appears to be founded upon the combined interpretations of high-data areas and low-data areas, as is typical with modeling. However, the differences in the interpretations regarding the highly interbedded nature of the sediments, the absence of inclusion of other high-permeable sediments in low-data areas, and the suggested "linearity" of the sediments and channel deposits suggests that the model does not properly reflect the highly variable site conditions. This conclusion is also suggested by the forced low-flow and no-flow boundary conditions and truncation of sediments/water flow of the model. Based on a preliminary view, the appears that the model boundary conditions were forced to equate with local conditions but is does not appear that the model as presented would generate conditions equivalent to the natural site conditions without being manipulated. This is also of concern with respect to the models ability to evaluate the connectivity of the A-1 and A-2/B-1 aquifer since there is very little data (which has been extrapolated to great extent without any verification).

4. The ground water data presented in previous reports illustrate that the existing surface water drainage ditches, drainage channels, and the airfield drainage system are primary hydraulic controls for the A-1 aquifer in portions of the project area; however, these existing hydraulic controls do not appear to have been included in the hydrogeologic model or in the proposed remedial plans. The significance of these man-made hydraulic controls seems to have been discounted; however, any change (either a decrease or increase in pumping of ground water) will have a direct impact on the hydraulic conditions beneath the project site. Since hydraulic control and protection of the underlying ground water are primary functions of the remedial design, maintenance of the man-made hydraulic controls must be accounted for in the remedial design and reflected in the cost allocations.

With these comments and concerns in mind, it is my opinion that although additional site investigation would benefit the understanding of the hydraulic conditions, provide significant information for the hydraulic model (particularly the ability to improve the agreement with natural conditions) and further demonstrate the extent of the known contaminant plume, these investigations are not necessary to proceed with remedial action. It is important, however, that the remedial system and design not be based on the "simplified" hydrogeologic conditions suggested by the hydraulic model but provide for significant variations to exist. Furthermore,

there is very little data to definitively confirm the lateral and vertical extent of the ground water plumes. These issues can be in-part resolved with the provision for additional borings and wells in the design/installation phase of work to either: (1) confirm the accuracy of the interpreted site conditions/model, (2) provide for improvements of the known/inferred stratigraphic conditions, (3) provide for the verification of the extent of contaminant plumes, and (4) to provide for installation of additional ground water extraction and/or ground water monitoring wells to improve the effectiveness of the remedial system.

It is further recommended that additional ground water monitoring wells be installed in the A-1 and A-2/B-1 aquifers to monitor the effectiveness of the proposed remedial action, since the existing wells provide for large areas where the effects of the remedial action could only be speculated upon. Speculation, let alone modeling, is not considered to be a substitute for direct verification.

With regard to the proposed re-injection of the extracted/treated ground water, it is recommended that additional re-use considerations be critically/seriously evaluated. Based on the known site conditions, re-injection of the volume of water anticipated to be derived from this system is going to be very difficult, particularly since the actual stratigraphic conditions have not been confirmed/verified.

Use of the proposed hydro-fracturing to improve flow conditions will result in changes for ground water extraction, water injection, contaminant migration, and very probably changes in the effective-stress conditions of the aquifer sediments which could result in increased regional and local settlement, soil heaving, localized settlement and generation of distress of critical structures, and other geotechnical engineering conditions not evaluated to date. It is recommended that serious consideration of the applicability of this technology for the specific project site conditions and technical studies be performed prior to proceeding further with this concept.

It is suggested that the cost estimates be critically reviewed for completeness and should include: the labor charges for technical and professional individuals necessary to be on-site to install the proposed wells, professional labor charges to oversee the installation of the remedial system, the labor charges for preparation and submittal of permits let alone the labor for filing the required boring logs and preparation of technical drawings depicting the installed system, the labor charges for preparation of installation and monitoring reports, and contractor mark-up and/or profit on materials, equipment, and subcontractors/consultants.

Thank you for the opportunity to comment on these issues and I do look forward to a sucessful and timely project.

Respectfully submitted,

David C. Glick