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Subject: NAVAL STATION TREASURE ISLAND, HUNTERS POINT ANNEX

Encl: (1) Navy Responses to Comments on Tidal Influence Monitoring Plan, Naval Station Treasure Island, Hunters Point Annex, San Francisco, California, dated January 18, 1993

On behalf of the Navy, we are forwarding for your review and comments enclosure 1 which is delivered in accordance with the Naval Station Treasure Island, Hunters Point Annex Federal Facility Agreement.

Should you have any questions regarding these matters, the point of contact is Commander, Western Division, Naval Facilities Engineering Command (Attn: Wing Wong, Code 1811WW, (415) 244-2537).

Submit written comments, if any, to Commanding Officer (Attn: Jim Sullivan, Naval Station Treasure Island, Bldg. 1 (Code 84), San Francisco, CA 94130), with a copy to Western Division, Naval Facilities Engineering Command (Attn: Louise T. Lew, Code 1811), 900 Commodore Drive, San Bruno, CA 94066-2402.

Very truly yours,

Gary Welshans

Gary Welshans, Sc.D., P.E.
Program Manager

GW:kk

Enclosures

DISTRIBUTION:

U.S. Environmental Protection Agency (Attn: Roberta Blank) (w/2 cys of encl)
California Department of Toxic Substances Control (Attn: Bonnie Arthur) (w/2 cys of encl)
California Regional Water Quality Control Board (Attn: Dr. Barbara M. Smith)

Encl: (1) Navy Responses to Comments on Tidal Influence Monitoring Plan, Naval Station Treasure Island, Hunters Point Annex, San Francisco, California, dated January 18, 1993

Copies to:

National Oceanic and Atmospheric Administration (Attn: Denise Klimas)
U. S. Department of Interior (Attn: William Allen)
U.S. Fish & Wildlife Service (Attn: Steve Schwarzbach)
Agency for Toxic Substances and Disease Registry (Attn: Joan Davis)
California Department of Fish and Game (Attn: Mike Rugg)
Bay Area Air Quality Management District (Attn: Catherine Fortney)
Bay Conservation and Development Commission (Attn: Nancy Wakeman)
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NAVY RESPONSES TO DTSC AND EPA COMMENTS

The following are the Navy's responses to the comments of the California Department of Toxic Substances Control (DTSC) and the U.S. Environmental Protection Agency (EPA) on the *Technical Memorandum, Tidal Influence Monitoring, Hunters Point Annex, Naval Station, Treasure Island, San Francisco, California.* The comments are reproduced here exactly as in their letters of September 24 and 28, 1992, respectively.

I. DTSC COMMENTS AND NAVY RESPONSES

A. General Comments

Comment 1: **The purpose and objectives of the tidal influence monitoring are not clearly stated in the draft technical memorandum and the February 22, 1991 Tidal Influence Monitoring Plan (TIMP). More detail is required in addition to the stated objective that the TIMP results will be utilized to evaluate the effects of tidal influence on groundwater flow directions and intrusion. There are two major data gaps as follows:**

Response: The comment is acknowledged. As discussed in our technical meeting on November 3, 1992, the objectives of the Tidal Influence Monitoring Program are to:

- Delineate the approximate areas at HPA where groundwater is tidally influenced.
- Provide data on groundwater flow in the areas where tidal influence may affect contaminant fate and transport.
- Provide the information necessary to develop a conceptual model of groundwater flow at HPA.

Comment 1a: **Given the limited number of wells which are to tested during the program, it may be difficult to draw accurate groundwater contours. Soil and well logs and the aquifer testing which was performed indicate that the physical and hydraulic characteristics of the water bearing material varies greatly over short distances. Thus, the measured tidal influence on the individual wells in a given IR has little relation to the other wells in the IR. Just as groundwater flow and hydraulic characteristic are affected by this change in characteristic, tidal influence is also affected. Therefore, it is recommended that an additional set of wells be monitored over the next two quarters to better evaluate tidal influence.**

Response: The Navy acknowledges that the variability in the hydraulic properties of the water-bearing materials at HPA likely affect the magnitude and extent of tidal influences; however, the inland extent of the tidal responses observed (i.e., 200 to 400 feet) appears to be relatively uniform except in areas apparently affected by tidal flooding of storm drains. As discussed in the technical meeting on November 3, 1992, more detailed tidal influence monitoring may be performed in areas where groundwater contamination has been observed. In addition, it was agreed in that meeting that wells, sanitary sewers, and storm drains in previously unmonitored areas will be monitored for one quarter.

Comment 1b: More detail is required about how the tidal influence data will be analyzed. Plate 2 shows boundary lines which define the approximate area of "direct" tidal influence, however, the rationale for drawing the boundary lines is not provided in the technical memorandum. Please indicate how the information will be analyzed to ensure that the measured groundwater elevation in each of the wells is related to a given time period (i.e. at high-high tide, low-low tide, etc.). By doing this, the relative groundwater contours at low-low tide could be compared to the relative groundwater contours at high-high tide and the effects of tidal influence on gradients can be graphically shown. (Note that the July-August 1991 issue of "Ground Water Journal" presents one such method of adjusting groundwater contours affected by tidal influence, although such a complicated method is not necessarily required.)

Response: The tidal influence monitoring data were evaluated by constructing hydrographs for each monitoring location and comparing the observed water levels to tidal data. Three general trends in water-level fluctuations were identified and categorized as follows:

None: Water levels were not influenced by tidal fluctuations (i.e., the hydrographs were flat).

Direct: Water levels were influenced by flow through porous media and tidal loading. The hydrographs had repeated, periodic fluctuations that correlated with tidal fluctuations, but the hydrographs were not always sinusoidal.

Indirect: Water levels were likely influenced by suspected leaky sanitary sewer or storm drains. The hydrographs were irregular but showed some correlation with tidal fluctuations.

To date, the evaluation of the tidal influence monitoring data has been primarily qualitative for the purpose of approximating the inland extent of tidal influences at monitoring wells and selected sanitary sewer and storm drain locations. Quantitative analyses of water-level elevations such as those described by Serfes (*1991*) will be performed for areas where tidal influence is evident and the transport of contaminated groundwater

is of concern. The results of such analyses will be presented in future RI reports, if appropriate.

Serfes, M.E., 1991. *Determining the Mean Hydraulic Gradient of Ground Water Affected by Tidal Fluctuations.* Ground Water 29 (4): 549-555.

B. Deviations from the TIMP

Comment 2: **Section 4.2.3 of the TIMP states that each of the wells to be tested for tidal influence will be sampled quarterly for TDS and salinity. The wells at the Site were only tested for TDS and salinity during one quarter.**

Response: Wells were sampled for TDS and salinity in both the first and second quarters of monitoring; however, the second-quarter results were not available during the preparation of the TIMP Technical Memorandum and were, therefore, not included. Those and subsequent analytical results will be presented in future RI reports.

Comment 3a. **Page 6: Please define "direct" and "indirect" tidal influence.**

Response: The comment is acknowledged. See the response to Comment 1b.

Comment 3b. **In the third paragraph the first sentence states "Indirect tidal influence may occur when (Bay water enters) the storm drains at high tide and recharges groundwater through leakage...". As evidence of this, the paragraph cites the hydrographs for Well IR04MW40A. Please correct as the hydrograph for 11-18-91 shows no tidal response in IR04MW40A, and the hydrograph for 2-1-92 indicates that the transducer slipped during the test and "floated" during the course of the test.**

Response: The comment is acknowledged; however, storm drain flooding did occur at SD-5, the storm drain near Well IR04MW40A (Plate B-6). Another although not as pronounced example of suspected storm drain flooding in a monitoring well is shown on the hydrograph for Well IR13MW10A (Plates A-76 and A-77).

Comment 4. **Page 8: Since neither the TIMP nor the technical memorandum states how the data will be analyzed or used in future documents, the Department does not agree with this statement at this time.**

Response: It is unclear which statement on page 8 this comment addresses; however, the use of these data to develop a conceptual model of groundwater flow was discussed at the November 3, 1992, technical meeting.

Comment 5. **Table 4: The Department does not agree with the conclusions in this table for the following reasons:**

Comment 5a. **The table lists thirteen wells which are directly affected by tidal influence. Assuming that direct influence means the fluctuations in the well are directly related to fluctuations in the Bay, at least five of these wells do not meet this criteria; IR07MW23A showed minor response, and IR01MW48A, IR02MWB-2 and B-3 and IR03MW218A1 had delayed response which indicates indirect influence.**

Response: Although slight, the water-level fluctuations in Well IR07MW23A appear to be tidally influenced. The delayed responses in the other wells mentioned are tidal lag effects related to groundwater flow through the porous media of the aquifer.

Comment 5b. **At least four of the wells which are listed to have indirect response had only a slight and/or noncyclical response, which may or may not be related to tidal influence.**

Response: It is unclear as to which wells the DTSC is referring; however, the response to Comment 1b should clarify the types of tidal influence and the wells in question.

Comment 5c. **The Department questions the validity of several of the tests on the wells listed as having indirect response. For example, only one test was done on IR02MW114A. During this test, water levels rose 0.75' in the well at a steady rate (the steady rate indicates no tidal response). Also, in IR08MW40A, a 4.5' maximum tide caused greater tidal influence that a 6.5' tide, even though the initial water levels in the well during the test were the same.**

Response: In the context of the response to Comment 1b, the Navy acknowledges that the hydrograph for Well IR02MW114A1 does not show an indirect tidal response. At this time, it is uncertain what caused the steady water-level rise during the monitoring period; however, manual measurements made before and after the monitoring period verify the transducer measurements, which indicate that water levels increased during the monitoring period.

The hydrographs for Well IR08MW40A (Plates A56 and A57) indicate that tidal influences on groundwater levels were slightly greater in the second quarter of monitoring than in the first. This was apparently related to a greater difference between the tidal elevation and the groundwater elevation at Well IR08MW40A in the second quarter of monitoring. The elevation differences were probably due to the normal day-to-day variations in tidal amplitude.

Comment 5d. **Twelve of the fourteen storm drain and sanitary sewer monitoring points are listed as being tidally influenced. However, the hydrographs indicate that only four are tidally influenced (SD-2, SD-4, SD-5 and SS-PS1). The others showed inconclusive results or had monitoring point elevations which were far above the high-high tide level. For example, SS-PSA is**

listed as being tidally influenced. However, the peak water levels do not correspond to the peak tidal cycles and the elevation of the monitoring point is at least seven feet above the high-high tide.

Response: Twelve of the 14 storm drain and sanitary sewer monitoring locations were reported in Table 4 as having indirect tidal influence because the hydrographs show "some correlation with tidal fluctuations" (see response to Comment 1b).

Water-level elevations at Location SS-PSA and the other sanitary sewer monitoring locations except Location SS-1 were probably results of pumpage from the sanitary sewer system.

Comment 6. **Plate 2:**

Comment 6a. **It would be helpful if the individual IRs are outlined on the map.**

Response: The comment is acknowledged. Future reports will include IR site boundaries on the maps.

Comment 6b. **The rationale for the shaded area indicating the approximate area of tidal influence should be stated in the report. Also, the line should be shown as dotted since it is based on preliminary data. (For example, wells IR02MW114A and IR02MWC5-W showed no tidal response, but are included with the boundary of direct tidal influence.)**

Response: The shaded area on Plate 2 is meant to indicate an *approximate* area of direct tidal influence.

Comment 6c. **Storm and sanitary sewer flow lines should be included on the map.**

Response: The comment is acknowledged. Future reports will include storm drain and sanitary sewer lines on the maps.

Comment 7. **Comments on the Recommendations Section: The recommendations are premature. The stated objective of the tidal influence monitoring program is to evaluate the effects of the tidal fluctuations on groundwater flow directions and (saltwater?) intrusion. While the extent of salt water intrusion has roughly been determined, the effect on groundwater flow has not. It is also necessary to indicate how measured tidal influence data will be converted to determine its effects on groundwater flow.**

Response: See the responses to Comments 1, 1a, and 1b.

II. EPA COMMENTS AND NAVY RESPONSES

Comment 1: **The objective of this study, as stated in Section 1.1,"...is to evaluate the effects of tidal fluctuations on groundwater flow directions,..." An assessment should be provided of whether the data presented in this report support this objective.**

Response: The comment is acknowledged. Please refer to the response to DTSC Comment 1.

Comment 2: **Section 3.1 states that data were evaluated to determine maximum water level fluctuations, TDS, and salinity relative to the distance from the Bay, storm drains, and sanitary sewers. This evaluation is not presented in the report. This report should be revised to present these evaluations.**

Response: As discussed in the technical meeting on November 3, 1992, it was not within the scope of the technical memorandum to present a comprehensive evaluation of tidal monitoring data. Such an evaluation will be presented in future RI reports.

Comment 3: **The discussion presented in Section 3.2 regarding rainfall infiltration, sanitary sewer pumping, and barometric pressure changes as they affect water level fluctuations should be supported with specific arguments referring to observed pressure changes, etc. No data on rainfall during the monitoring periods is presented. The water level rise in well IR02MW114A1 cannot be attributed to rainfall. It is much more likely due to transducer drift.**

Response: The comment is acknowledged. See the responses to Comment 2 and DTSC Comment 1b with regard to the evaluation of tidal monitoring data and to DTSC Comment 5c with respect to water-level trends in Well IR02MW114A1.

Comment 4: **Page 6, Section 3.2 paragraph 2 and Appendix C. The influence of barometric pressure is not discussed. In order to determine the possible influence of barometric pressure on water level fluctuations, the barographs presented in the appendix should have a vertical scale which represents typical atmospheric pressure variations, i.e., 33 to 35 feet of water.**

Response: The comment is acknowledged. In future reports, barometric pressure data will be shown on a scale that better shows fluctuations.

Comment 5: **Page 6, Section 3.2 paragraph 4. The reader may infer that there was rainfall during the period of tidal influence monitoring at Well IR02MW114A1. However, it is not specifically stated that there was rainfall during this period and no rain gauge data is provided to indicate the amount of rainfall, if any. If rain gauge data is available it should be presented. If it is not available the argument should be withdrawn.**

Response: See the response to DTSC Comment 5c.

Comment 6: **Page 6, Section 3.2 last paragraph and Table 4. Wells evaluated as having no tidal influence are grouped solely based on water level fluctuation. Water quality may also reflect tidal influence and should be considered when assessing tidal influence.**

Response: The comment is acknowledged. The water-quality criteria TDS and salinity were evaluated relative to tidal influence; however, water quality may also be affected by bay water/groundwater mixing, which results from inland groundwater flow. This inland groundwater flow may not be related exclusively to short-term tidal fluctuations but other influences such as pumpage from the sanitary sewer system.

Comment 7: **Page 7, Section 3.3, paragraph 2. Hem in *U.S. Geol. Survey Water Supply Paper 1473,* 1970 classifies water with TDS of 3,000-10,000 mg/l as moderately saline and water with TDS of 10,000-35,000 mg/l as very saline. The use of 10,000 mg/l TDS or salinity to indicate bay water mixing with groundwater is not appropriate. This limit is an indication of brackish water with impacts on aquatic life or drinking water quality. Groundwater with no bay water influence probably has much lower TDS and salinity.**

Response: The comment is acknowledged. The 10,000 mg/l TDS level was not intended to be used as a definitive indicator of bay water/groundwater mixing but as a general indicator of areas where tidal influences on groundwater were most pronounced.

Comment 8: **Page 8, Section 4.0 and 5.0. The conclusion that tidal influence has been sufficiently characterized appears to have resulted in reduction of the full program from four rounds of monitoring to three rounds. This does not seem appropriate as several of the sampling points have had mechanical problems and two rounds of data may not be sufficient. The data for two quarters of tidal influence monitoring for some wells provides different information. For example, at least two wells, IR01MW02B and IR01MW43A, that are proposed for elimination from further monitoring, showed small, but discernable, regular water level fluctuations during the second quarter which appear to be tide related. For both wells, the first quarter of water level data showed little or no obvious pattern within the total 0.1 to 0.12 foot of change observed.**

Response: As discussed in the technical meeting on November 3, 1992, the first and second quarters of monitoring appear to have adequately characterized the tidal influences in the areas monitored. Although some mechanical difficulties were encountered at least one quarter of data was obtained from each well monitored.

Comment 9: **Plate 2 should be annotated to include maximum observed water level fluctuations at each monitoring location. Different symbols should be**

used to indicate locations were fluctuations were observed and locations were fluctuations were not observed. The under lying map should be the underground utilities map.

Response: The comment is acknowledged. The changes will be considered in future reports.

Comment 10: The differences between measured values of TDS and salinity should be discussed. Are they significant with respect to the objectives of this activity?

Response: TDS values are direct measurements of the total dissolved solids in a water sample including dissolved cations, anions, and neutrally charged solutes. Salinity values are indirect measurements of dissolved positively and negatively charged solutes based on electrical conductivity and conversion to the Practical Salinity Scale using an empirical formula. As a result, differences between TDS and salinity measurements may be attributed to salinity measurements that do not account for neutrally charged dissolved solutes or variability introduced by direct versus indirect measurement techniques. The differences between the measured values of TDS and salinity are not considered relative to the TIMP objectives.

Comment 11: The present focus on IR sites may necessitate additional monitoring when site or OU wide modelling is necessary. This should be considered when planning additional monitoring.

Response: The comment is acknowledged. The relationship of tidal influence monitoring to the development of a facility-wide conceptual model of groundwater flow was discussed during the technical meeting on November 3, 1992.

Comment 12: The data on maximum water level fluctuations is impossible to interpret without information on the subsurface lithology and well depths. See, for example, the cluster of wells, IR03MW228B, IR03MW218A1, and IR03MW218A3. The reported maximum water level fluctuation observed in these three wells is 3.66', 0.47', and 0.97', respectively. Why do they differ?

Response: The difference in water-level responses is likely due to the heterogeneity of the aquifer and the degree of confinement of the aquifer in which the wells are screened. Well IR03MW228B is screened in the confined B aquifer; therefore, the water-level response was due to tidal loading rather than flow through porous media. Well IR03MW218A1 is screened in the uppermost portion of the unconfined A-aquifer and is the shallowest of the wells mentioned. Well IR03MW218A3 is also screened in the A-aquifer, but the aquifer materials in this area may be locally confined, which may account for the greater tidal response in this well.

Comment 13: The Navy should provide additional support for its argument that water level fluctuations in inland wells are due to leaking storm drains and/or sanitary sewers. Specific arguments should be made to eliminate the possibility of direct tidal influence in these locations.

Response: The comment is acknowledged. Storm drains and sanitary sewers will be investigated as described in the SI Work Plan (*HLA, 1992*).

Harding Lawson Associates (HLA), 1992. *Site Inspection Work Plan: PA Other Areas/Utilities, Volume I of III: Underground Utilities, Naval Station, Treasure Island, Hunters Point Annex, San Francisco, California.* March 26.

Comment 14: A specific definition should be provided for "direct tidal influence" and "indirect tidal influence".

Response: The comment is acknowledged. Please refer to the response to DTSC Comment 1b.

Comment 15: It is premature to conclude that water level fluctuations observed at IR-4, IR-8, IR-9, IR-13, and IR-14 are due to broken storm drains and/or sanitary sewer lines.

Response: The statement in the Technical Memorandum associating water-level fluctuations observed at Sites IR-4, IR-8, IR-9, IR-13, and IR-14 with broken storm drains or sanitary sewer lines is speculative. The available data do indicate, however, that water-level fluctuations may result from the influences of storm drains and sanitary sewers.