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MARE ISLAND
SSIC NO. 5090.3.A

DEPARTMENT OF THE NAVY
MARE ISLAND NAVAL SHIPYARD
VALLEJO, CALIFORNIA 94592

IN REPLY REFER TO:
5090
Ser 460/56
OCT 28 1985

Mr. Roger B. James
Executive Officer
California Regional Water Quality Control Board
San Francisco Bay Region
1111 Jackson Street, Room 6040
Oakland, CA 94607

Dear Mr. James:

Tasks a, b, and c as specified by Clean up and Abatement Order No. 85-019 of 18 September 1985 have been completed. Accordingly, the pertinent information is enclosed.

Sincerely,

H.R. Frauenfelder
H.R. FRAUENFELDER
CAPT, CEC, USN
Public Works Officer
By direction of the Shipyard Commander

Enclosures:
(1) Report on Task (a)
(2) Report on Task (b)
(3) Report on Task (c)

Copy to:

Mr. Mark Kamiya
United States Environmental Protection Agency
Region IX
Toxic and Waste Management Division, Code M-5
215 Fremont Street
San Francisco, CA 94105

Mr. Dwight Hoenig
Department of Health Services
Toxic Substances Control Division
5850 Shellmound Street, Room 317
Emeryville, CA 94608

October 23, 1985

AQUA TERRA Technologies

Mare Island Naval Shipyard
Public Works Department
Code 445, Stop 032
Vallejo, CA 94592

Attention: Mr. Ralph M. Lee, P.E.
Environmental Engineer

Subject: Groundwater Monitoring Well Preliminary Evaluation
RWQCB Clean-up and Abatement Order No. 85-019

Gentlemen:

As authorized by Contract N62474-85-C-0221, Aqua Terra Technologies has completed work required under Clean-up and Abatement Order No. 85-019, Task "a", issued by the San Francisco Bay Regional Water Quality Control Board (RWQCB) on September 18, 1985. This letter presents the results of the completed work.

Task "a" of the Clean-up and Abatement Order requests a certification that existing Interim Status Document (ISD) wells are designed to 1) maintain the integrity of the borehole, 2) enable groundwater sampling at depths where appropriate flow zones exist, 3) prevent contamination of samples and the groundwater, and 4) be capable of drawing clear groundwater samples. In order to determine if the certification requested by the Clean-up and Abatement Order could be provided, a preliminary assessment of the six ISD well pairs was conducted.

An outline of the proposed activities comprising the preliminary assessment was presented to, and reviewed with, RWQCB staff on September 13, 1985. A draft copy of the Clean-up and Abatement Order was also reviewed with RWQCB staff at the September 13 meeting. RWQCB staff concurred that the proposed preliminary assessment would satisfy the requirements of Task "a". A detailed description and results of the preliminary assessment are presented in the attached report prepared by our geotechnical subconsultant, Subsurface Consultants, Inc. (SCI). The four major points stated under Task "a", as outlined previously, are addressed in the SCI report.

On the basis of information obtained during the preliminary assessment as reported in the attached SCI report, certification that existing ISD well pairs 14, 15, and 16 meet the requirements of Task "a" cannot be provided. Specifically, well pairs 14, 15, and 16, located along the southwest (bay side) boundary of the monitoring area,

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Encl (1)

are not capable of providing clear groundwater samples. Additionally, an obstruction exists in well 16D which currently precludes collection of proper groundwater samples from this well. Nevertheless, well pairs 14, 15, and 16 are constructed and secured to prevent contamination, either through the well or the well boring, of groundwater and groundwater samples.

Well pairs 11, 12, and 13 satisfy the requirements of the Clean-up and Abatement Order, Task "a".

Although certification for all six ISD well pairs cannot be provided, the information required by the RWQCB in accordance with Task "a" has been obtained and is presented herewith. The purpose of the tasks in the Clean-up and Abatement Order subsequent to Task "a" is to determine the potential need for additional monitoring wells (Task "g"). The results of Task "a" suggest that additional wells will be required. However, in order to design an appropriate monitoring system, results of the hydrogeologic investigation (Tasks "c" and "d") should be evaluated prior to constructing additional wells.

If you have any questions regarding the contents of this letter or attachments, please contact me.

Sincerely,

Aqua Terra Technologies, Inc.

R. Wane Schneiter, Ph.D.
Civil Engineer 38735
Project Manager

RWS:klm
Attachment

James P. Bowles, P.E.
R. William Rudolph, P.E.

October 22, 1985
SCI 157.011

Dr. R. Wane Schneiter
Aqua Terra Technologies
3490 Buskirk Avenue, Suite A
Pleasant Hill, California 94523

Interim Status Groundwater Monitoring
Program Evaluation
Task A - Clean Up and Abatement
Order No. 85-0
Mare Island Naval Shipyard
Vallejo, California

Dear Dr. Schneiter,

This letter records our services to date regarding the evaluation of the Interim Status Groundwater Monitoring Program for the Class 1 Landfill at the Mare Island Naval Shipyard. The purpose of our services was to evaluate the hydrogeologic aspects of the existing program with regard to compliance with the requirements of Federal and State regulatory agencies.

In March 1985, 12 groundwater monitoring wells were installed, under subcontract to the Navy, as part of the Interim Status Document (ISD) Program. These wells are referred to as the ISD wells and consist of 6 well pairs (one deep and one shallow). These pairs of wells are referred to as Well Pair 11 through 16. Our Task A services as outlined in the clean up and abatement order, consisted of assessing and improving the ability of the ISD wells to produce clear and representative groundwater samples. Subsequent phases of our services will include conducting a hydrogeologic assessment of the site and developing conclusions and recommendations regarding (1) the adequacy of the existing monitoring well network, and (2) future groundwater monitoring strategies, if necessary.

Existing Well Details

Our evaluation of existing well details is based on our review of boring logs prepared by Raney Geotechnical, in a letter report dated March 11, 1985. The ISD wells consist of 2-inch-diameter PVC pipes and well screens. The well screen contains

0.010 inch slots. The shallow wells extend about 10 to 13½ feet below the groundsurface; the lower 5 to 7 feet of the wells consist of slotted well screen. The deep wells extend about 30 to 40.5 feet below the groundsurface. The lower 20 feet of these wells are slotted. Above the screened sections, the wells consist of solid pipes surrounded by a cement/bentonite seal. With the exception of Well Pair 12, the wells are completed above grade in protective steel casings with locking covers. Both the shallow and deep wells at Pair 12 (subsequently referred to as 12S and 12D) are completed below grade in cast iron boxes.

The screened section of the shallow wells are completed within the clayey surface fills and the upper portion of the underlying bay deposits. The bay deposits consist of a soft silty clay, locally known as Bay Mud. The deep wells along the levee are entirely screened within the Bay Mud. The screened sections of Wells 11D and 13D extend through the Bay Mud and terminate in the underlying fine-grained silty sands. Well 12D is screened entirely in a unit of weathered Franciscan sandstone.

Well Development and Upgrading

Our services included upgrading, surging and pumping the ISD wells, measuring groundwater levels in the wells, and determining the elevation of the ISD well casing tops. In addition, 10 other existing wells, (known as the Kleinfelder wells) were upgraded by installing new steel locking caps.

The surface grout seals around the steel well covers at Well Pairs 14, 15 and 16 were removed and replaced with a new concrete seal. In addition, water tight locking caps were installed on the deep and shallow wells at Well Pair 12.

An open test boring hole existed between the shallow and deep wells at Well Pair 11. This bore hole was sealed with a cement/bentonite grout using tremmie placement methods.

Each well was surged with a steel plunger device prior to development. The purpose of the surging was to force water through the sand filter to flush out as much silt and clay as possible. After surging, a dual hose airlift pumping system was used to pump each well. All equipment was thoroughly steam cleaned prior to introduction into each well to reduce the risk of cross contamination between wells.

Well Pairs 11, 12 and 13 recharged rapidly after pumping and produced nearly clear water. However, Well Pairs 14, 15 and 16 recharged very slowly. Deionized, "pure" water from the Mare Island Power Plant was used to flush Wells 14S, 15S and 16S. At the end of flushing and pumping, the water in these wells remained relatively murky. Filter sand was pumped from Well 15S, indicating that a hole or other type opening may exist in the well screen. The amount of water removed from each well during development is shown in the following table:

Well Number	Gallons of Water Removed	Notes
11S	22	Clear water
11D	35	Clear water
12S	20	Clear water
12D	65	Clear water
13S	10	Clear water
13D	115	Clear water
14S	7	Murky water
14D	15	Murky water
15S	1	Murky water, sand
15D	10	Murky water
16S	20	Murky water
16D	9	Murky water, obstructed

An obstruction was encountered at a depth of 27 feet in Well 16D. Apparently, based on conversations with base personnel, a rubber intake hose was dropped down the well during past sampling operations. After several attempts, we were unable to retrieve the hose.

Groundwater Levels

Groundwater levels were measured prior to and several days after development. An electrical well sounder was used to measure the depth to the groundwater table below the well casing tops. We were able to locate water levels to within about 0.01 foot. A precision level survey was conducted to determine the elevations of the well casing tops. A self leveling level equipped with a micrometer was used to perform the level survey. We were able to accurately read the rod to 0.01 foot. These elevations are referenced to a benchmark with a recorded Elevation of 114.141 feet. The benchmark is located on the southeast corner of the Scale House, just off A Street. The relative elevation of the groundwater table within each well was then determined by subtracting the depth to groundwater below the top of each well casing from the well top elevation. The groundwater levels measured October 18, 1985 (at least 10 days after development) are summarized in the following table:

Well No.	Top of Casing Elevation (ft)	Depth to Groundwater (feet)	Groundwater Elevation (ft)
11S	115.71	7.98	107.73
11D	115.44	7.30	108.14
12S	114.25	2.65	111.60
12D	114.36	2.52	111.84
13S	111.10	6.29	104.81
13D	112.10	6.53	105.57
14S	114.49	8.14	106.35
14D	114.88	6.70	108.18
15S	115.87	9.04	106.83
15D	116.69	8.55	108.14
16S	113.86	9.62	104.24
16D	113.49	6.86	106.63

Conclusions

Well Details

Development efforts in Well Pairs 11, 12 and 13 were relatively successful. Upon completion of pumping, the wells yielded relatively clear water. However, even after additional development efforts and flushing with deionized water, Well Pairs 14, 15 and 16 (located along the levee) still produced relatively turbid water. In addition, the shallow wells along the levee (14S, 15S and 16S) contain only 1½ to 3 feet of water and well recovery rates are extremely slow. For these reasons, it is difficult to properly develop the wells, and therefore, it is questionable whether samples can be obtained. Well 16D is currently inoperative due to the obstruction.

Hydrogeology

Based on our studies to date, we have developed several preliminary conclusions regarding groundwater hydrogeology at the site. They are:

1. The fact that groundwater levels in the deep wells are higher than the adjacent shallow wells indicates that there is currently an upward flow gradient. This condition could part be due to consolidation of the Bay Mud in response to filling the area and/or artesian conditions in the materials beneath the Bay Mud.

2. Near surface groundwater levels appear to be influenced by local conditions, such as dredge pond fluid elevations.

3. Groundwater gradients are relatively flat

4. The Bay Mud appears to have a very low permeability.

These preliminary conclusions lead us to believe that the wells may not be ideally positioned nor designed to rapidly detect contaminent migration from the landfill. The relatively low permeabilities and gradients will likely result in very low migration rates. Further study is necessary to more fully understand hydrogeologic conditions in the area, and the

influence of local activities. Once the evaluation is complete, we will have a basis on which the groundwater monitoring network can be designed.

If you have any questions, please call.

Yours very truly
Subsurface Consultants, Inc.

R. William Rudolph

R. William Rudolph
Civil Engineer 32136

JNA:RWR:JPB:lmc

5 copies submitted

MARE ISLAND NAVAL SHIPYARD

HAZARDOUS WASTE (HW) MANAGEMENT
PROGRAM

GROUNDWATER MONITORING PROGRAM FOR THE MARE ISLAND SANITARY LANDFILL AND THE MARE ISLAND INDUSTRIAL WASTEWATER TREATMENT PLANT

28 October 1985

Revision of Program dated 26 March 1985:

Remove page 18 (26 March 1985)

Insert pages 18, 18a, and 18b (28 October 1985) (enclosed)

This program document has been prepared by the Shipyard Environmental Engineering Branch, Code 461, telephone (707) 646-2421 or 2432 (Autovon 253-2421/2432).

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VII. Assessment and Evaluation of Data

A. Monitoring data (detection monitoring data) shall be evaluated by the Shipyard Environmental Engineer to determine whether water quality protection or indicator parameters have been exceeded by statistically significant amounts at any point:

1. Water quality protection and indicator parameters are the values indicated in paragraph V.D.2 or background values determined in accordance with paragraph VII.A.2 below, whichever concentration is higher for each parameter.

2. Background levels of groundwater monitoring parameters shall be determined from early monitoring data in accordance with reference (a), Part 264.97(g) and (h), and reference (b), paragraph 2555(h).

3. The following statistical procedure, or an equivalent procedure approved by the EPA Reginal Administrator, shall be used to determine whether water quality parameters or background values have been exceeded (reference (a), Part 264.97(h), and reference (b), paragraph 2555(h)):

a. If the background concentration of a parameter is based upon data having a sample coefficient of variation of less than 1.00, at least 4 portions from a sample shall be analyzed, and the mean concentration shall be determined. If the mean concentration exceeds the background concentration by an amount that is significant at the 0.05 level using the Cochran's Approximation to the Behren's Fisher Students t-test as described in reference (a), Part 264, Appendix IV (enclosure (13)), then the analysis shall be repeated with a fresh sample. If the repeat sample indicates a concentration that exceeds the background concentration by an amount that is statistically significant at the 0.05 level, the analysis shall be considered to have exceeded background criteria by a statistically significant amount.

b. If the background sample coefficient of variation is 1.00 or greater, the Environmental Engineer shall coordinate with representatives of the EPA Regional Administrator and the Regional Water Quality Control Board to determine a compatible statistical procedure (reference (a), Part 264.97(h)(i)(ii), and reference (b), paragraph 2555(h)(2)).

B. If assessment of detection monitoring data indicates that water quality or indicator criteria are exceeded, a verification monitoring program shall be instituted by the Shipyard Environmental Engineer to determine whether groundwater has been degraded. Verification monitoring shall consist of the following as required:

1. Field data and SI/FCCR documents shall be reviewed, and the analyses shall be discussed with field and laboratory personnel to determine any potential sources of inaccuracy. This review shall include the methods of sampling and analysis.

2. Monitoring well conditions shall be checked to determine any physical damage or deterioration. Correction of deficiencies or replacement of wells shall be accomplished as necessary. Deficiencies shall be promptly reported to the agencies indicated in paragraph VIII, and a schedule shall be negotiated with the California Reginal Water Quality Control Board.

3. Collection and analysis of samples shall be repeated.

a. Replicate samples shall be collected for the parameter(s) for indicating noncomplying data.

b. A certified control sample shall be included for analysis.

4. If repeat sampling and analysis tend to confirm detection of noncomplying data, field inspection and unsaturated zone monitoring shall be conducted immediately to detect potential localized sources of contamination. If noncomplying data occurs only in shallow monitoring wells, this effort will be emphasized.

a. Visual field inspection shall be conducted throughout a radius of 100 yards about the site of any noncomplying data.

b. Unsaturated zone monitoring shall initially consist of one time sampling and analysis of soil samples. The locations and types of samples shall be negotiated with the California Regional Water Quality Control Board. The initial Shipyard proposal is to collect and analyze 12 grab samples of soil collected by a certified laboratory or geotechnical technician at depths of 0, 2, and 6 feet and at four locations within 25 feet of the site of the noncomplying data.

5. If detection of noncomplying data appears to be confirmed and is not attributable to localized sources, the following procedures shall be implemented:

a. Wastestream information shall be assessed to determine any obvious relationships between identified wastes and noncomplying data.

b. Waste management units, operations, and records shall be thoroughly inspected to determine any apparent sources of escape of contaminants.

c. A verification monitoring program -- a modification of this Groundwater Monitoring Program, including additional monitoring wells and accelerated monitoring schedules -- shall be prepared for approval by the California Regional Water Quality Control Board.

(1) Locations and depths of additional wells shall be prescribed to determine the areal and vertical extent of contamination.

(2) Monitoring of the additional wells shall include precision elevation and recharge data which can indicate the direction(s) and rate(s) of movement of contaminants.

(3) The monitoring schedule for the verification monitoring program shall be negotiated with the California Regional Water Quality Control Board. Anticipated monitoring requirements include 24 hour continuous monitoring of groundwater level and conductivity (one time to confirm tidal influence) and monthly monitoring of other parameters.

C. If detection monitoring criteria have been exceeded and groundwater degradation has been confirmed through verification monitoring, a corrective action plan shall be instituted by the Shipyard Environmental Engineer. A written proposal shall be provided to the agencies identified in paragraph VIII.

D. Data and results of evaluation shall be reported as indicated in paragraph VIII.

October 23, 1985

AQUA TERRA Technologies

Mare Island Naval Shipyard
Public Works Department
Code 445, Stop 032
Vallejo, CA 94592

Attention: Mr. Ralph M. Lee, P.E.
Environmental Engineer

Subject: Proposal - Hydrogeologic Investigation
RWQCB Clean-up and Abatement Order No. 85-019

Gentlemen:

As required under Clean-up and Abatement Order No. 85-019, Task "c", issued by the San Francisco Bay Regional Water Quality Control Board (RWQCB) on September 18, 1985, this letter presents a proposal and time schedule for a hydrogeologic investigation in the vicinity of the Mare Island Naval Shipyard (MINSY) Sanitary Landfill. The hydrogeologic investigation will be performed by Aqua Terra Technologies in accordance with Contract N62474-85-C-0221.

PROPOSED SCOPE OF WORK

The proposed hydrogeologic investigation will be performed by three tasks as described below.

Task 1 - Saturated Zone Characteristics

To evaluate hydrogeologic characteristics of the saturated zone soils, a search of MINSY files will be conducted to obtain all available documentation of the landfill area. Information obtained from the files is expected to include test boring details, well logs, land use descriptions, landfill construction details, and dredge spoils ponds and canal construction details. A review of topographic data of the area will be conduted to evaluate and/or confirm surface water drainage patterns and their potential impact on groundwater surface levels.

The hydrologic characteristics of soils in the landfill area will be evaluated by conducting in-situ permeability tests. The permeability tests will provide an estimate of the average permeability of the soil corresponding to the screened interval in each well tested. The permeability tests will include slug tests in the relatively impermeable Bay Mud, and packer type tests in the sandy natural soils and fill. All permeability tests will be conducted in existing groundwater monitoring wells. Six tests will be conducted; two in each geologic unit

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(i.e., the fill material, Bay Mud, and underlying sandy soil). The slug tests will employ pore pressure transducers to monitor the groundwater level recovery. Clean, de-ionized water will be used for the packer tests, with pressure and flow rate monitored.

The existing groundwater monitoring wells in the landfill area are situated at relatively large distances from one another and are screened in a variety of materials. For these reasons, pump tests in these wells will likely not be very informative or useful. As a result, pump tests will not be performed during this phase of the investigation.

Task 2 - Groundwater Gradient Characteristics

In addition to the groundwater level measurements obtained during the preliminary assessment of the six Interim Status Document (ISD) well pairs, a series of groundwater level measurements will be made to evaluate the groundwater gradient. The evaluation will include effects of the seasons and the tide, as well as the influence of the dredge spoils ponds. In addition to the six ISD well pairs, the ten Kleinfelder wells will be included in groundwater level measurements. A total of 22 wells will be included in the evaluation.

To assess the combined influence of the seasons and the dredge spoils ponds on the groundwater gradient, groundwater levels will be measured in the 22 study wells once monthly for a 12 month period beginning with the October 18, 1985 measurements. Measurements of dredge spoils pond water levels will coincide with the groundwater level measurements. These data will be reviewed on a monthly basis to allow incorporation of the data into monitoring system design and operation.

The tidal influence will be assessed by measuring the groundwater levels in the 22 study wells at one-half hour intervals during a 14 hour period. The tidal variation will be measured at the southwest (Bay side) of the site during the same time period and corresponding intervals as the groundwater level measurements.

Groundwater levels will be measured using a weighted probe conductivity meter with calibrated line. Tidal variations and dredge spoils pond level measurements will be made using calibrated staff gages which were

installed and surveyed during the preliminary assessment of the ISD wells.

Task 3 - Hydrogeologic Investigation Report

The results of the investigation will be summarized in a written report, complete with gradient maps, survey data, field test results, and our conclusions. The report will include a detailed description of field procedures and engineering analyses. The adequacy of the existing well network will be discussed with emphasis placed on checking that the landfill is adequately monitored, given the on-site soil and hydrogeologic conditions. Recommendations regarding additional well locations, screened intervals, and other well details will be provided, as necessary. The report will include data from seasonal influences on groundwater gradient collected to the time of report preparation.

PROPOSED SCHEDULE

The hydrogeologic investigation, excluding the evaluation of seasonal influences on groundwater gradient, will be completed within 45 days following the requirement to commence work under Task "d" of the Clean-up and Abatement Order.

If you have any questions regarding the contents of this letter, please contact me.

Sincerely,

Aqua Terra Technologies, Inc.

R. Wane Schneiter, Ph.D., P.E.
Project Manager

RWS:klm