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REGISTERED GEOLOGISTS

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FROM: Roy Butler

DATE: December 6, 1995

TO: Eva Chu
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TOTAL PAGES
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Department of Environmental Health
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RE: WORKPLAN TO PERFORM AQUIFER TEST AT 2008 FIRST STREET LIVERMORE

Dear Ms. Chu:

The following is a workplan to perform a aquifer test at former Desert 795.

Former Desert 795 is located at 2008 First Street and the intersection of South Street, in Livermore, California.

Little is know of the local hydraulic properties of the water bearing sediments (Aquifer) at this site. Because of the limited amount of information available, the aquifer test shall be performed in two phases:

Phase one. One day step draw down pump test and slug test.

Phase two. Three day constant rate pump test.

PHASE ONE

During Phase one of the test two different series of tests will be performed.

The first series of tests to be performed will be a "slug test" of each of the wells. These test will allow for the calculation of the average K (hydraulic Conductivity) value for the area of the aquifer immediately adjacent to each of the wells. This will help in understanding the variation of aquifer properties over the site. An understanding of the site K values will also allow for a better estimate of the proper pump rate for the three day pump test to be conducted in Phase Two.

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The "slug test" will be performed by placing a pressure transducer in the well to be tested. The transducer shall be calibrated by noting the difference in readings over one foot of water. Once the well has stabilized from the placement of the transducer, a metal slug will be used to displace a volume of water, and the transducer will be used to record the decline of the resulting head of displaced water. Once the water in the well has declined to the original elevation the slug will be pulled from the well and the transducer will be again used to record the waters recovery. The decline and recovery curves will be used to determine the appropriate "slug test" model to be used at the site.

The second series of tests to be performed during the Phase one of the aquifer test is a variable rate pump test. The variable rate pump test (VRP) will further determine the most advantageous pump rate at which to perform the three day pump test (Phase two).

MW2 has been chosen for the VRP due to its close location to MW6 and MW1, which will provide a greater opportunity for observation influence, than any other wells at the site. During the test, pressure transducers will be placed in MW2, MW1 and MW6. A variable flow rate Grundfos pump will be placed in MW2. The pump will be started at a low flow rate of 0.5gpm and the resulting drawdowns observed. When the well reaches equilibrium at that pump rate, the pump rate will be increased and the well will again be allowed to come to equilibrium. The pump rate will be stepped up to the point where one third of the water column has been drawn down or a pump rate of 5 gallons per minute is reached. Once this point has been reached and the well has come to equilibrium the pump will be stopped and the well recharge will be observed. After the well has returned to the starting conditions the pump will be removed.

Prior to leaving the site an observation pressure tranducer with a data logger will be placed in MW2. This transducer will be left in MW2 for the time period between the first phase and the second phase (approximately one week) in order to provide a trend to the changes in ground water elevation to be expected at the site.

Prior to performing the three day constant rate test the slug test data and the variable rate pump test data will be used to determine the expected drawdowns at certain pump rates and to determine the most beneficial pump rate for the site.

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PHASE TWO: THREE DAY PUMP TEST

The three day pump test will be carried out one to two weeks after Phase 1. The three day test shall provide data to calculate the average K for the site and to determine the aquifer storativity (S). The pump test will also provide data on the reaction of the aquifer to stress, which will be used to calibrate numeric models of the site.

The test will be performed by placing the pump in MW2 and pumping at a constant rate (to be determined in Phase 1) into a 21,000 gallon holding tank.

Prior to the start of the test, data will be collected from the data logger placed in MW2 at the end of Phase 1. Additionaly, the depth to water will be measured in all of the wells. Pressure transducers attached to data loggers will be placed in MW1, MW2, MW6 and MW5. As the test continues, depths to water will be periodically measured in all of the wells with the frequency of measurement decreasing as the test continues.

During the test the flow rates from the pump will be monitored and adjusted to maintain a constant flow rate.

Once the pumping portion of the test has been completed the pump will be turned off and the well recovery will be recorded.

Once the wells have recovered, to near prior to pump test elevations, the equipment will be removed.

After finishing the test ground water samples will be collected from each well and total disolved oxygen (TDO) content will be determined. TDO is critical in most contaminant transport and fate models.

DATA COMPUTATION AND MODELING

Examination of the boring log for the wells currently on site indicate that the aquifer properties encountered on site may be highly variable.

In MW2, the well proposed to be used as the pumping well, the aquifer is described as a sandy clay with no great differences in soil properties over the length of the water column. In this well the aquifer will most probably react to the pump test like an unconfined aquifer.

In MW3 and MW4 there are sand and gravel layers beneath the sandy clay which will probably cause the aquifers reaction to the pump test closer to that of a confined aquifer.

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The data will be read from the data loggers and then placed onto a spread sheet. The data will then be normalized as to time and date and the ground water elevations will be corrected to the measured depths taken during the pump test and to the normalized ground water trends for the site as seen recored by the MW2 pressure transducer between Phase one and two. Once the data has been normalized a number of curves will be produced.

The initial test curves to be developed will be semilog, log(time minutes) verses drawdown, used with the Cooper and Jacob straight line method. These curves will allow for the quick examination of the test data for general trends and aquifer type.

Dependent on the interpretation of the resulting curves, a decision will be made on the appropriate model to use to determine the aquifer properties for each well. The final calculations will be made using log/log curve matching methods and semilog methods as appropriate for each set of well data.

In order to help determine the fate of hydrocarbons present at the site, limited modeling will be performed on the site using a Finite-difference model, USGS, Method-Of-Characteristics Solute-Transport Model, "MOC" with a block-centered square grid.

The information developed from the Phase 1 and Phase 2 test will be entered into the model and then the model will be run for two pumping periods:

Period 1 No pumping which allows the model to stabilize before the stress of the pump test was exerted on the aquifer.

Period 2 The pump test, which will be modeled for the same time period as the 72 hour pump test. The observed drawdowns in the wells will then be compared with the actual drawdowns at the site.

The model will be adjusted and rerun until good agreement between the model and the actual pump test is reached.

In order to model the transportation of hydrocarbons, aquifer parameters developed with MOC will be placed in the the ground water model Bioplume. Bioplume will be used to model the hydrocarbon transportation and the natural biodegradation occurring at the site. Bioplume is a modification of the MOC. In addition to the contaminant transport, it simultaneously solves the transport equations for dissolved oxygen. The basic assumption of the model is that any hydrocarbon in contact with dissolved oxygen will biodegrade until it has used all available oxygen. Bioplume is available from the Center for Subsurface Modeling Support, Robert S. Kerr Environmental Research Laboratory, US EPA, P.O. Box 1198, Ada, OK 74820.

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TIME FRAME

Start Phase one, one week after approval of workplan.

Start Phase two, one week after finish Phase one.

Report results of pump test and ground water modeling, four weeks after end pump test.

Roy Butler
Project Geologist

Jack E. Napper
Reg. Geologist #3037

CC. Mr. John Rutherford
Director, Environmental Affairs
Desert Petroleum Inc.
P.O. Box 1601
Oxnard, CA 93032

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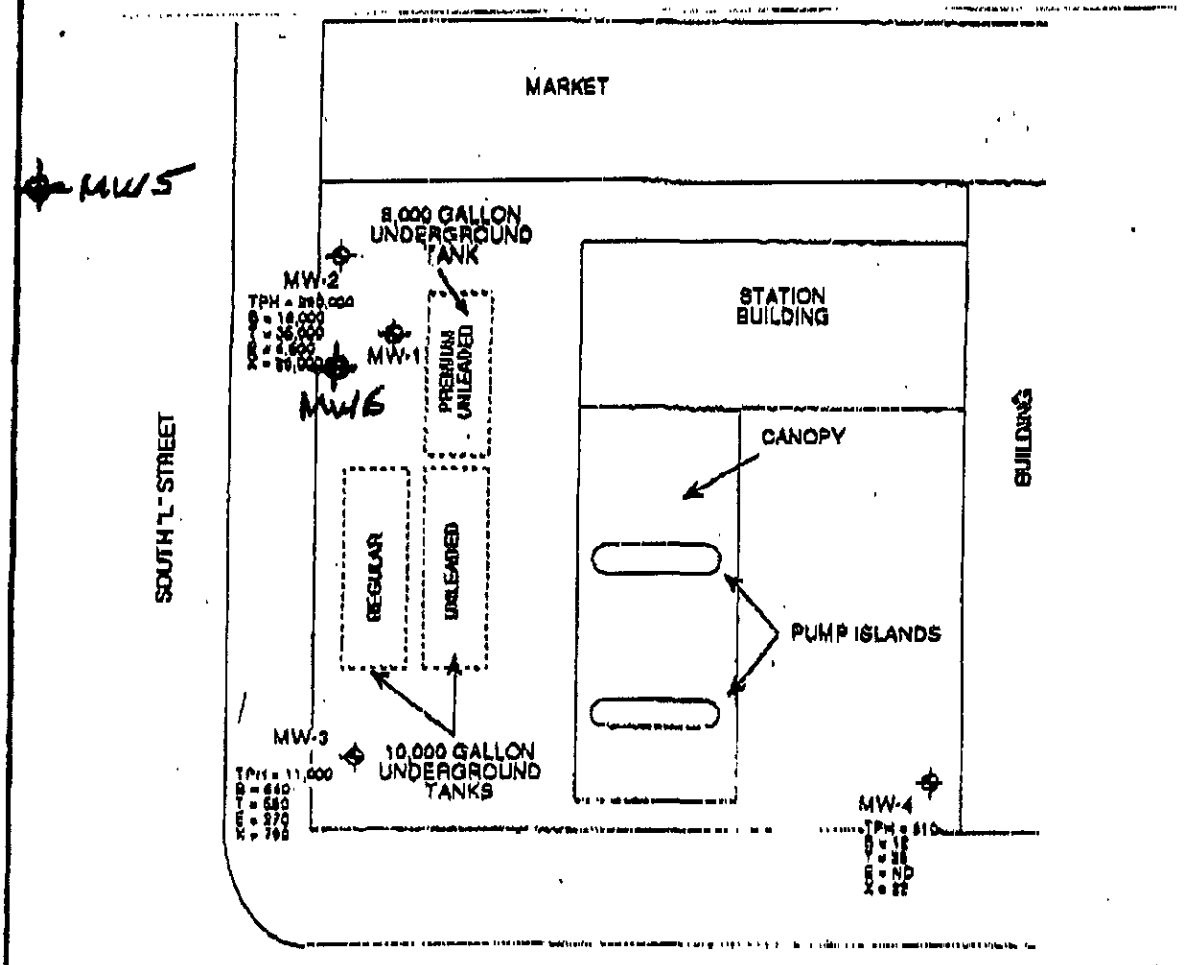
MW5 & RECENTLY INSTALLED

N



MAP NOT TO SCALE.
SURVEYED DISTANCE BETWEEN WELLS, 1" = 25'.

LEGEND

TPH = ND
B = ND
T = ND
E = ND
X = ND
GROUNDWATER MONITORING WELL LOCATION WITH TPH & BTEX CONCENTRATIONS IN µg/L

2008 FIRST STREET,
LIVERMORE CA 94550

FIGURE 5 PLOT PLAN WITH GROUNDWATER ANALYTICAL RESULTS
JUNE 19, 1994

RSI REMEDIATION SERVICE, INT'L

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