✓ What is TDS in water well - 670 ppm
- were las parameters taken in past? YES - ~~see~~ 4 of 6 parameters posit. for bromide
- In calc of mass in soil, what is "less" category
- how was water dilution factor of '2' determined
- send copy of rpt and ACDEH ltr to CVRWQCB
- copy of DWR Bulletin 118-2

Chevron

Chevron Products Company
6001 Bollinger Canyon Road
Building L, Room 1080
PO Box 6004
San Ramon, CA 94583-0904

Philip R. Briggs
Project Manager
Site Assessment & Remediation
Phone 925 842-9136
Fax 925 842-8370

May 14, 1999

Ms. Eva Chu
Alameda County Health Care Services
Department of Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Re: Former Chevron Service Station #9-7127
Interstate 580 and Grantline Road
near Tracy , California

Mark Sullivan, Engr.
(831) 479-4511

Dear Ms. Chu:

Enclosed is a copy of the *Regulatory Response* report, dated May 13, 1999, that was prepared by our consultant RRM engineering contracting firm on the above noted site. This report was prepared to address two issues brought up by the Central Valley Regional Water Quality Board (CVRWQCB) in Alameda County Health Care Services Agency (ACHCSA) request for no further action at this site, in their letter dated February 5, 1999 (copy enclosed).

In the ACHCSA letter, the issues noted by CVRWQCB are: 1) the vertical extent of the contaminant plume must be determined and 2) active remediation appears necessary to reduce the total polluant mass in groundwater. Our consultant RRM performed a limited site investigation to provide the data necessary to address these issues.

Based on the results of their investigation, the drilling of a deep exploratory boring or the installation of a deep ground water monitoring well or boring to define the vertical extent of the dissolved petroleum hydrocarbon plume does not appear to be warranted. It is very likely that any attempt to install a well to collect a ground water sample will result in a dry hole. The report indicates that a laterally continuous aquifer does not exist in the study area, groundwater occurs in discontinuous bedrock fractures and is typically non-potable and vertical migration of lighter-than-water petroleum hydrocarbons beneath the site is impeded by low permeability bedrock. Results from over 40 sampling events conducted on the onsite water well (WSW-1) since March 1993, have shown that groundwater at depth beneath the site is not impacted by petroleum hydrocarbons. Additional groundwater sampling from an additional deep well or boring will offer negligible useful information.

May 14, 1999
Ms. Eva Chu
Former Chevron Service Station #9-7127
Page 2

confirm bioparameters; degradation occurring

This investigation determined that the majority total TPH-g mass beneath the site is present in the soil with minimal TPH-g mass in the groundwater. Given that the soils data that were used for the TPH-g mass estimate were based on site conditions when well MW-1 was installed in 1992, it is likely that the actual TPH-g mass in soils are significantly lower than predicted. In this report, it was evident that the fluctuating TPH-g concentrations in ground water are primarily the result of groundwater elevation changes. Over time, these groundwater elevations should stabilize and TPH-g will continue to degrade through the processes of natural attenuation.

As noted in this report, the low plume velocity is the result of the apparent low soil permeability and a shallow ground water gradient. These conditions inhibit the migration of petroleum hydrocarbon impacted groundwater and act to stabilize the plume. Groundwater extraction is therefore not necessary for migration control at this site.

Due to the limited TPH-g mass in shallow groundwater, limited migration potential and limited groundwater extraction abilities in the soil types underlying the site, it is apparent that active remediation is not a viable alternative at this site.

Chevron concurs with RRM that the dissolved hydrocarbon plume is adequately assessed and active remediation is not warranted. RRM recommends that a risk management plan (RMP) be prepared for this site and Chevron concurs that this would be an appropriate action for future potential commercial use.

Advise if you wish to have Chevron proceed to develop a RMP for this site, and that the site can continue toward no further action and site closer.

Thank you for extending the time to complete this investigation by 30 days. If you have any questions or comments call me at (925) 842-9136.

Sincerely,
CHEVRON PRODUCTS COMPANY

Philip R. Briggs
Site Assessment and Remediation Project Manager

Enclosure

CC. Ms. Bette Owen, Chevron

Ms. Anne Payne, Chevron

Mr. John Moody
RWQCB-Central Valley Region
3443 Routier Road
Sacramento, CA 95827-3098

Mr. Ardavan Onsori
29310 Union City Blvd.
Union City, CA 94587

Mr. & Mrs. Joe Jess
Jess Ranch
Route 5, Box 704-A
Tracy, CA 95376

Mr. Dave Reinsma
RRM Engineering Contracting
3912 Portola Drive, Suite 8
Santa Cruz, CA 95062-5267 (less report/letter)

RRM

engineering contracting firm

May 13, 1999
Project: AA51

Mr. Phil Briggs
Chevron Products Company
6001 Bollinger Canyon road, Building L
P.O. Box 5004
San Ramon, California 94583-0804

Re: *Regulatory Response*
Former Chevron Station 9-7127
Grant Line Road at Interstate 580
Tracy, California

Dear Mr. Briggs:

This document has been prepared on behalf of Chevron Products Company (Chevron) to provide information necessary to obtain no further action and case closure of the above referenced site (Figures 1 and 2). The Alameda County Health Care Services Agency (ACHSCA) responded to a request for no further action at the site in a letter dated February 5, 1999. In that letter, the ACHSCA listed two issues that did not appear to meet the Central Valley Regional Water Quality Control Board (CVRWQCB) guidance for no further action at a leaking underground storage tank (UST) site. These issues included: 1) the vertical extent of the contaminant plume must be determined and 2) active remediation appears necessary to reduce the total pollutant mass in groundwater. In response, RRM, Inc. (RRM) performed a limited site investigation to provide data necessary to address the ACHCSA issues. Presented below are discussions of the scope of work of the site investigation, findings, and a paraphrase of each ACHSCA issue followed by an RRM response.

SCOPE OF WORK

Task 1 - Complete a Survey of Water Supply Wells Within a ½-Mile Radius: The California Department of Water Resources (DWR) in Sacramento, California was contracted by RRM to complete an in-house survey of all the water supply wells or exploratory borings on record in their department files within a ½-mile radius of the site. In addition to completing the well survey, the DWR was requested to release confidential well and boring log information to RRM.

3912 Portola Drive / Suite 8 / Santa Cruz, CA 95062-5267 / Tel. 831.475.8141 / Fax. 831.475.8249

This information was released after a Well Information Release Agreement was signed by RRM and ACHSCA staff and submitted to the DWR on March 16, 1999.

Task 2 - Interview Well Owners and Verify Well Locations: Using information obtained from completing Task 1, well owners identified within the survey area were interviewed by RRM staff on April 28, 1999. Well owners were asked questions pertaining to well construction, well use, well yield, surface water use and local groundwater occurrence. Water supply wells and borings were accurately located in the field and plotted on maps.

Task 3 - Obtain Well Construction Information For The Onsite Water Supply Well, Perform a Video Survey and Prepare a Gamma Ray Log: In order to determine the total well depth, well diameter, depth to groundwater and well screen interval for the onsite water supply well, designated Well WSW-1, and obtain geophysical information on subsurface lithology surrounding the well, RRM contracted Castro Pump Service to remove the well head and pull the pump, and Welenco to video the inside of the well and prepare a gamma ray log. In addition to collecting the depth to water in Well WSW-1, water levels were recorded from wells MW-1 through MW-8 for the purpose of preparing a groundwater elevation contour map. The aforementioned work was conducted on April 28, 1999.

Task 4 - Determine If Deeper Aquifers Exist and Locate Surface Waters or Other Receptors Near The Site: To determine if deeper aquifers exist beneath the site, RRM reviewed published groundwater, geologic and hydrogeologic literature, obtained available well and boring logs from the DWR, performed field reconnaissance, accessed Well WSW-1, completed a gamma ray log, and interviewed Messrs. Joe and Connie Jess of Jess Ranch about past well drilling operations on their ranch. Surface waters or other possible receptors were identified and located via a review of published literature and through field reconnaissance conducted by RRM on April 28, 1999.

Task 5 - Estimate The Total Petroleum Hydrocarbon Mass In Soil and Groundwater: Historical soil analytical data and site specific soil bulk density data were used to calculate the approximate TPHg mass in soil beneath the site. In order to estimate the TPHg mass in groundwater, TPHg concentrations in groundwater were averaged within the area of petroleum hydrocarbon impact for 1998 groundwater sampling events.

Task 6 - Determine The Petroleum Hydrocarbon Natural Attenuation Rate In Groundwater: Determination of the natural attenuation rate in groundwater was completed using the concentration vs. distance approach (Mobil Oil Corporation, *A Practical Approach to Evaluating Intrinsic Bioremediation of Petroleum Hydrocarbons in Groundwater*, January 1995).

FINDINGS

Task 1 - Survey of Water Supply Wells Within a ½-Mile Radius

Three water supply wells, designated WSW-1, WSW-25B1, and WSW-25B2, were identified within a ½-mile radius of the site based on the well survey conducted by the DWR. Water supply well locations are shown on Figures 1 and 3 and well information is presented in Table 1. Wells WSW-25B1, and WSW-25B2 are located on the Jess Ranch property, to the southwest (upgradient) of the site, and Well WSW-1 is located onsite. All three wells are used to supply water to cattle and other livestock on the Jess Ranch.

Groundwater from the aforementioned wells is not used for human consumption by the Jess Ranch occupants. According to Ms. Connie Jess, bottled water is imported to the ranch. Well WSW-25B1 is currently not in use because the well head was damaged during earthwork grading. The DWR did not have any information on file for Well WSW-1. One exploratory boring, designated boring EB-4, was drilled within a ½-mile radius of the site. The drillers report obtained from the DWR indicates that the boring was drilled for the Division of Highways in November and December 1966, and that the proposed use was for a test well. The total depth of the boring was 360 feet with seepage noted only at 40 feet. Groundwater was not encountered to the total depth explored. Well locations are shown on Figure 1 and well and boring locations on Figure 3. Well drillers reports are presented in Attachment A.

Task 2 - Well Owner Interviews and Well Location Verification

The interview with Ms. Jess, a rancher in the area for more than 30 years, provided valuable information on well use, well yield, surface water use, local groundwater occurrence, and water quality. Groundwater in the area does not exist in sufficient quantity to rely solely on wells to meet all water needs. According to Ms. Jess, the Jess Ranch, other ranches and residences in the area obtain water from a variety of sources including streams, seeps, wells, and shallow reservoirs or catch basins. Since the 1970's, the Jess Ranch has attempted to install three other wells, designated borings EB-1 through EB-3, in addition to wells WSW-1, WSW-25B1 and WSW-25B2. Each attempt encountered dry holes to depths ranging from approximately 200 feet in borings EB-1 and EB-3 to approximately 300 feet in boring EB-2 (Figure 3). Drillers logs for borings EB-1 through EB-3 are not available.

Well construction information other than the data presented on the DWR logs was not known to Ms. Jess for the wells identified by completing Task 1. The two wells currently in use, wells WSW-1 and WSW-25B2, are used to water livestock. An additional source of water for the Jess Ranch is a 14-foot deep sump well, installed by a backhoe, which is recharged from a shallow reservoir located to the east of Well WSW-25B1 (Figure 3). After installation, the groundwater yield from wells WSW-25B1 and WSW-25B2 is low, less than 7 gallons per minute (gpm). The groundwater yield from the shallow sump well and Well WSW-1 is historically higher, and is estimated by Ms. Jess to be between 20to 30 gpm or more.

Surface water from seeps, springs or creeks is either dammed or collected in and pumped from shallow wells or sumps to water livestock. There are two dammed areas and one sump well located in the study area (the study area incorporates the territory shown on Figure 3). The bulk of the water for the Jess Ranch comes from surface water sources with the second largest source of water being pumped from Well WSW-1. With respect to water quality, Ms. Jess indicated that the surface water and groundwater contain high concentrations of dissolved solids. In fact, the dissolved solid concentration in Well WSW-25B1 was so high that the cattle would not drink the water and the well had to be turned off shortly after installation (December 1976). Because the well was not in use, it was subsequently graded over by accident several years ago.

Access to the entire Jess Ranch was afforded to RRM for the purpose of verifying the location of the water supply wells. Wells WSW-25B1 and WSW-25B2 and the shallow sump well were located in the field using a Brunton® Compass and were plotted on a United States Geological Survey (USGS) 7.5 Minute Quadrangle Map. Estimated boring locations were plotted on the USGS 7.5 Minute Quadrangle Map by Ms. Jess from memory. Well and boring locations are shown on Figure 3.

Task 3 - Well Construction Information, Video Survey and Gamma Ray Log

After the pump for Well WSW-1 was removed, RRM measured the well diameter at 8 inches, total well depth at approximately 90 feet below the top of casing (TOC) and the depth to water at approximately 23 feet below the TOC. The well casing is constructed of steel. The depth of the surface seal is not known. The well pump was placed at approximately 64 feet below the TOC. The results of the video survey conducted by Welenco revealed that the well screen was vertically slotted with perforations first being visible at 67 feet below the TOC. Because of heavy mineral encrustation and organic buildup on the steel well casing below water, it was difficult to see where the well screen top and bottom were exactly located. Welenco's field technician indicated that it is likely that the screen section starts between 60 and 70 feet below the TOC and ends at the bottom of the well.

On April 28, 1999, groundwater levels were collected from wells MW-1 through MW-8 to prepare a groundwater elevation contour map (Figure 2). The groundwater flow direction beneath the site was calculated toward the north-northeast at an approximate gradient of 0.006 foot/foot. This flow direction and gradient are consistent with historical trends. The groundwater level in Well WSW-1 appears to be at a slightly higher level (less than 1 foot higher) than the water level in Well MW-1. Well WSW-1 is not surveyed so this observation is approximate. The depth to water field data sheet is included in Attachment A.

A gamma ray log was completed for Well WSW-1 by Welenco on April 28, 1999. The gamma ray tool measures the amount of naturally occurring radioactive material in a formation. The record of gamma radiation is used as a qualitative guide for stratigraphic correlation and permeability. Certain radioactive elements occur naturally in sediments and sedimentary rocks. Low permeability clays and shales contain high concentrations of radioactive isotopes, usually potassium. Higher permeability mature sands and gravels and sandstones contain primarily silica, a stable substance, and therefore emit only very low levels of radiation (Driscoll, 1987).

When comparing the gamma ray log completed for Well WSW-1 to the boring log for Well MW-1, the low to medium gamma readings observed for the first 20 feet correlate well with the interbedded clayey sand, clayey gravel and silty gravel fill encountered in Well MW-1. From approximately 20 to 62 feet, the gamma values fluctuate between 40 and 55 American Petroleum Institute (API) Units. From the log of Well MW-1, this is the gamma signature typical of sandstone (Neroly Formation). The gamma concentrations from approximately 62 to 90 feet steadily increase (between 50 to 68 API Units) and the gamma signature is markedly different from the overlying sandstone. This signature may be from a sandy siltstone or claystone interbed of the Neroly Formation. The gamma ray log is shown on Figure 4. The well video survey report, and the gamma ray log are included in Attachment A.

Task 4 - Deeper Aquifers, Surface Waters or Other Receptors

The site is located within the Altamont Uplands as described by the DWR (Storenson, 1981). The Altamont Uplands consist primarily of nonwater-bearing marine sediments and alluvial filled basins. The nonwater-bearing rocks yield small quantities of groundwater to wells and springs. Based on regional mapping (Dibblee, 1980), the site is underlain by recent alluvial sediments. An idealized geologic map of the study area and a cross-section through Wells WSW-1, WSW-25B1 and WSW-25B2 are shown on Figures 3 and 4, respectively. A list of references is included as Attachment C.

The quantity of groundwater within the bedrock is usually poor and is unsuitable for most beneficial uses (DWR Bulletin No. 118-2, 1974). The groundwater is typical of the western fringe of the San Joaquin Groundwater Basin. The groundwater is characterized by a high concentration of dissolved solids (sodium, chloride, nitrate, sulfate, and boron), and is poorer for irrigation than the groundwater to the east, within the San Joaquin Groundwater Basin.

Based on the data obtained from the drilling of exploratory borings and water supply wells, there does not appear to be a laterally continuous groundwater aquifer at depth (between 200 and 360 feet) in the study area (Figure 3). From the interview with Ms. Jess and the review of DWR records, there have been a total of six exploratory borings drilled on the ranch for the purpose of completing a usable water supply well or test well. As mentioned previously, borings EB-1 through EB-4 were drilled to depths ranging from approximately 200 to 360 feet and were each dry to the total depth explored. The remaining two borings were completed as wells WSW-25B1 and WSW-25B2.

Well WSW-25B1 has not been used because of poor water quality (high dissolved solids concentration) and low yield. Well WSW-25B2 has been in use since it was completed on August 10, 1979. Upon completion, the pumping rate in this well was approximately 7 gpm after 1.5 hours of pumping. Ms. Jess indicated that the flow from this well decreased by approximately one half after the 1989 Loma Prieta earthquake and that now the well occasionally runs dry. This change in flow to the well likely resulted from the closure and sealing of bedrock fracture apertures during the earthquake.

or other fractures opened to divert GW flow.

With respect to surface water or other nearby receptors, the closest surface water is the small man made catch basin located several hundred feet to the east of the site and the closest receptor is the onsite water supply well (WSW-1). The second closest surface water body is the small creek which is located approximately 2,000 feet to the west of the site. The Jess Ranch has dammed the creek to provide water for livestock and to recharge a shallow sump well located down stream of the dam (Figure 3). The closest seep or spring to the site is located near Well WSW-25B1. According to Ms. Jess, who has lived in the area for more than 30 years, the aforementioned creek and seep flow intermittently or are dry during drought years and have only recently started flowing year round. Wells WSW-25B1 and WSW-25B2 are not considered to be nearby receptors because they are located approximately 2,600 feet and 1,600 feet southwest (upgradient) of the site, respectively.

The surface water located near the site is not at risk of being impacted from the shallow petroleum hydrocarbon-affected groundwater beneath the site because they are not in direct hydraulic contact. Groundwater at depth beneath the site and in Well WSW-1 is separated from the dissolved hydrocarbon plume beneath the site by approximately 30 to 35 feet of low permeability ($7x10^{-4}$ centimeter per second [cm/sec]) non-hydrocarbon-impacted bedrock. 20-25' * Attachment B contains a geologic cross-section prepared by Pacific Environmental Group, Inc. (PEG) which shows the vertical extent of petroleum hydrocarbons in soil beneath the site. Figure 4 shows the relation of Wells MW-1 and WSW-1 to each other in cross-section view.

Task 5 - Total Petroleum Hydrocarbon Mass In Soil and Groundwater: In order to estimate total petroleum hydrocarbon mass in soil, the area of soil impact was estimated at 3 depth intervals using six ellipses originating at Well MW-1 where maximum TPHg impact to soils were identified. Based on the TPHg concentrations present in soils when Well MW-1 was installed in 1992 (PEG, March 22, 1993), concentrations were estimated for these six areas at three depth intervals: from the 20 to 24 foot, from the 24 to 28 foot, and from the 28 to 30 foot. A bulk density of 2.0 grams per cubic centimeter was used for the determination of total TPHg mass in soils. Bulk density was obtained from physical data collected in 1996 by PEG.

If WSW1 is screened from ~60' bgs, and MW-1 soil contam ends at 40' bgs, then there is only ~ 20-25' of non-HC impacted bedrock between water.

Based on these calculations, it was determined that TPHg mass in the 20-to 24-foot interval was 1,032 pounds, TPHg mass in the 24-to 28-foot interval was 1,964 pounds, and total mass in the 28-to 30-foot interval was 1,897 pounds. Total TPHg mass in soils beneath the site were estimated to be 4,893 pounds. Calculations for TPHg mass estimate in soils are presented in Table 2. soil

Total petroleum hydrocarbons in groundwater were estimated based on average TPHg concentrations during 1998 (Blaine Tech Services, February 13, 1999). An ellipse was used which encompassed each well that has historically contained elevated concentrations of TPHg: wells MW-1, MW-3, MW-4, and MW-6. The area of the ellipse was calculated and the plume thickness was estimated using 1998 depth to water averages and TPHg impacted soil GW? concentrations at Well MW-1. These values were utilized to obtain an impacted groundwater volume of 166,912 cubic feet.

Based on the average concentration of 61,069 parts per billion (ppb) and an impacted volume of 166,912 cubic feet, the total TPHg mass in groundwater is estimated to be 636 pounds, or approximately 104 gallons of TPHg. Calculations for TPHg mass estimate in groundwater are presented in Table 3.

Task 6 - Petroleum Hydrocarbon Natural Attenuation Rate In Groundwater: The natural attenuation rate determination was evaluated using the concentration vs. distance approach (Mobil Oil Corporation, *A Practical Approach to Evaluating Intrinsic Bioremediation of Petroleum Hydrocarbons in Groundwater,* January 1995). This approach has been used extensively by J.T. Wilson of the U.S. Environmental Protection Agency to estimate the rate of intrinsic bioremediation in soluble plumes (Wilson and Kampbell, *Innovative Measures Distinguish Natural Bioattenuation from Dilution/Adsorption,* Ground Water Currents1992; Wilson et al, *Subsurface Bioremediation in Bioremediation of Hazardous Waste Sites: Practical Approaches to Implementation,* 1993).

The concentration vs. distance approach was utilized to determine the natural attenuation rate for petroleum hydrocarbons beneath the site. The concentration vs. distance approach uses BTEX concentrations from two or more wells located close to the plume centerline to estimate the contaminant degradation rate. This method assumes a first order decay rate; the first order decay equation can be expressed as:

$$C(t) = C_0e^{-(kt)}$$

Where:

$C(t)$ = concentration as a function of time
C_0 = concentration at time zero
k = first order decay constant

Contam. velocity $= V_c = \frac{V_x}{R_f}$ = Retardation factor

$R_f = 1 + \frac{K_{oc} \times f_{oc} \times (\text{dry bulk density})}{n_e}$

f_{oc} = fraction of organic carbon

K_{oc} = organic carbon partitioning coeff.

In order to relate time (t) to distance use:

t = x/v

Where:

t = plume travel time
x = distance traveled
v = plume velocity (assume groundwater velocity divided by retardation factor of 2) ? How did you get this?
{ seepage velocity divided by retardation coeff }

Therefore:

$C(t) = C_0 e^{-(kx/v)}$

A plot of the natural log of BTEX concentrations approximately along the plume centerline versus distance from the centerline well closest to the source should result in a straight line with the slope of the line equal to the first order decay constant k divided by the plume velocity. The first order decay constant can then be determined by multiplying the slope of the line by the plume velocity.

Written in terms of the distance between two wells (well y downgradient of the source with a BTEX concentration C_y, and well z, further downgradient with a lower BTEX concentration of C_z:

$C_z = C_y e^{-(kx/v)}$

Rearranged to solve for k:

$k = -\ln(C_z/C_y) \times (v/x)$

Where:

C_z = concentration in well more distance from source (ug/L)
C_y = concentration in well closer to source (ug/L)
k = first order decay constant (day^{-1})
v = plume velocity (feet/day) (assume groundwater velocity divided by a retardation factor of 2)
x = distance between wells (feet)

Based on data from wells located near the approximate centerline of the plume, the rate of intrinsic bioremediation between the well points were determined with the k value is approximately equal to the percentage biodegraded per day.

This concentration vs. distance approach was used to evaluate the natural attenuation rate between Wells MW-1 and MW-6 and between Wells MW-3 and MW-6. While attenuation due to dilution is not considered, dilution is a small component of attenuation at most sites, particularly those with stable plumes. Laboratory data from 1998 was used and BTEX concentrations were averaged to provide concentration data at each of Wells MW-1, MW-3, and MW-6. Where dissolved petroleum hydrocarbon concentrations in groundwater were not detected, a value of one-half of the detection limit was used. The results of this assessment, as presented in Table 4, show that the BTEX decay rate between these wells ranged from 9.01E-6 to 4.48E-6 per day.

Does this mean no natural bioattenuation? check bioparameters before ORC

The reason for the relatively low decay rate is primarily associated with the plume velocity; the low plume velocity is a product of the shallow gradient and the low soil porosity. This provides an explanation for the soil and groundwater petroleum hydrocarbon impact that remain beneath the site eight years after the USTs have been excavated and removed. While the decay rate is relatively low, these data also indicate that migration of impacted groundwater is negligible.

ACHSCA AND CVRWQCB ISSUE

1. *No existing water supply wells, deeper aquifers, surface waters or other receptors are threatened by pollutants remaining in the aquifer.*

   The onsite domestic well contained detectable levels of benzene (up to 6.4 ppb) in 1987 and 1989 (see attached table). It is assumed this well is constructed and screened deeper than the onsite groundwater monitoring wells. It must be verified that groundwater contamination has not impacted the deeper aquifer. Therefore, the vertical extent of the contaminant plume must be determined.

RRM RESPONSE

Existing Water Supply Wells

There are three water supply wells, designated WSW-1, WSW-25B1, and WSW-25B2, located within a ½-mile radius of the site. All three wells are used for the purpose of watering livestock at the Jess Ranch. The sole source of drinking water for the Jess Ranch occupants is bottled water. Well WSW-25B1 has historically not been used because of poor water quality (high dissolved solid concentration) and is currently inaccessible.

Deeper Aquifers

Published literature indicates that the bedrock beneath the site is non-water bearing and yields small quantities of groundwater to wells and springs. The groundwater is described as usually poor and unsuitable for most beneficial uses and is characterized by a high concentration of dissolved solids (sodium, chloride, nitrate, sulfate, and boron).

Based on the data obtained from the drilling of exploratory borings and water supply wells at the Jess Ranch, there does not appear to be a laterally continuous groundwater aquifer at depth (between 200 and 360 feet) in the study area. Groundwater occurrence at depth beneath the study area is likely associated with isolated fracture systems within consolidated bedrock material (sandstone and sandy siltstone and claystone). The dry holes encountered at borings EB-1 through EB-4 show that fracturing in these areas is likely negligible or that the fracture apertures, if present, have been cemented shut or resealed. Of the three wells available for use by the Jess Ranch, Well WSW-1 has historically produced the highest groundwater yield and best groundwater quality according to Ms. Jess.

Based on the results of the video survey and the comparison of the gamma ray log for Well WSW-1 against the boring log for Well MW-1, Well WSW-1 is assumed to be screened in sandy siltstone or claystone. Groundwater flow within the sandy siltstone and claystone is likely through a fracture system. Given the close proximity of Well WSW-1 to the Midway Fault and its relatively higher groundwater yield compared to wells WSW-25B1 and WSW25B2, the bedrock fracture system near Well WSW-1 is probably more extensive at depth than elsewhere in the study area. It should be noted; however, that the low permeability sandstone bedrock directly beneath the site (15-to 40-foot plus depth interval) appears to be less fractured and has impeded the downward migration of petroleum hydrocarbons to Well WSW-1.

could be sandstone

Surface Waters or Other Receptors

Surface water near the site consists of a man made catch basin used to water cattle. Water in the catch basin is seasonal and periodically dries up in the late summer. Water in the catch basin is not in direct hydraulic communication with the dissolved plume beneath the site and; therefore, is not at risk of being impacted.

The potential future degradation of deeper groundwater by the impact beneath the site is unlikely for the following reasons: 1) the site's dissolved hydrocarbon plume is naturally degrading; 2) Well WSW-1 is screened approximately 25 feet below the bottom of source area Well MW-1; 3) approximately 25 feet of low permeability ($7x10^{-4}$ cm/sec) sandstone bedrock exists between the bottom of Well MW-1 and the top of the screened interval for Well WSW-1; 4) the groundwater in Well WSW-1 appears to be confined and exhibits an upward vertical gradient; 5) petroleum hydrocarbons have not been detected in groundwater samples collected from Well WSW-1 for the past 6 years; 6) deeper groundwater appears to be localized within fractured bedrock and is laterally discontinuous; and 7) the steeply dipping Midway Fault may act as a potential barrier to groundwater flow along the entire eastern (downgradient) perimeter of the site (Figures 3 and 4).

but not biodegradation

Because the groundwater from Well WSW-1 is not used for human consumption and the current use of the property is ranch land, it does not pose a risk to human health. Cattle are the only other sensitive receptor likely to come in contact with groundwater from Well WSW-1. Humans or cattle are not likely to come in contact with shallow impacted groundwater beneath the site and future impact to Well WSW-1, as discussed above, is doubtful. Risk evaluations performed by Environmental Health Consultants (May 14, 1993) and PEG (June 27, 1997), conclude that with the current use of the site as ranch land there should be no risk to human health.

Well WSW-1 Groundwater Quality

The groundwater quality has been assessed in Well WSW-1 periodically between December 1987 and November 1998 through groundwater sample collection and analyses for the presence of TPHg; BTEX; and general mineral, physical and inorganic parameters. During the above period, groundwater from the well has been analyzed for the presence of TPHg and BTEX 60 times and general mineral, physical and inorganic parameters once on February 19, 1997. Appendix B includes copies of selected historical data summary tables and figures by others.

Benzene detection has occurred a total of 7 times during the above period at concentrations ranging from 0.8 parts per billion (ppb) to 7.0 ppb. Six out of the seven benzene detections occurred between December 1987 and April 1989, when the station was still operating. After the service station was demolished and the primary sources (USTs, dispensers, and product lines) were removed in 1991, detection of benzene in Well WSW-1 essentially ceased with only one detection at a concentration of 0.8 ppb (just above the detection limit of 0.5 ppb) on March 19, 1993. Forty sampling events, since March 1993, where benzene was not detected in Well WSW-1 verify that the dissolved petroleum hydrocarbon plume beneath the site is not impacting groundwater in Well WSW-1.

Results of general mineral, physical and inorganic analyses indicate that groundwater from Well WSW-1 is not potable. Total dissolved solids (TDS) were detected at a concentration of 670 ppm and nitrate was detected at a concentration of 46 ppm. The maximum contaminant level (MCL) for TDS is 500 ppm and nitrate is 45 ppm.

Vertical Plume Definition

The drilling of a deep exploratory boring or the installation of a deep groundwater monitoring well to define the vertical extent of the dissolved petroleum hydrocarbon plume beneath the site does not appear to be warranted. It is very likely that any attempt to install a deep boring or well for the purpose of collecting groundwater samples for chemical analyses will result in a dry hole. It has been demonstrated that a laterally continuous aquifer does not exist in the study area, groundwater occurs in discontinuous bedrock fractures and is typically non-potable, and that vertical migration of lighter-than-water petroleum hydrocarbons beneath the site is impeded by low permeability bedrock. Results from over 40 sampling events conducted on Well WSW-1 since March 1993, have shown that groundwater at depth beneath the site is not impacted by petroleum hydrocarbons. Additional groundwater sampling from an additional deep boring(s) or well(s) will offer negligible useful information.

ACHSCA AND CVRWQCB ISSUE

2. *The total pollutant mass remaining in the groundwater is decreasing at predicted rates and neither creates, nor threatens to create, a risk to human health and safety or future beneficial uses(s) of the aquifer.*

   Onsite groundwater monitoring wells MW-1 and MW-3 continue to contain measurable free product or a heavy sheen. Recent benzene levels were at 24,000 ppb. Active remediation appears necessary to reduce the total pollutant mass in groundwater.

RRM RESPONSE

Total Petroleum Hydrocarbon Mass In Soil and Groundwater

Analyses of historical groundwater and soil chemistry were utilized to estimate the petroleum hydrocarbon mass in soil and groundwater beneath the site. Based on these analyses, it was determined that approximately 4,893 pounds of TPHg were present in soil and approximately 636 pounds of TPHg were present in groundwater.

It is apparent from this analysis, that the majority of petroleum hydrocarbon mass remaining beneath the site is adhered to subsurface soils. These soils have been characterized in previous investigations as sand, clayey sand, and clay fill to depths of 2.5 to 17 feet bgs, underlain by sandstone bedrock to the total depth explored of approximately 40 feet bgs.

Human Health and Safety and Aquifer Beneficial Uses

Potential beneficial uses of groundwater beneath the site include municipal/domestic supply and agricultural supply. Based on groundwater samples collected during 1997, groundwater concentrations of nitrates and TDS exceeded the MCLs. The primary MCL for nitrate is 45 ppm; groundwater concentrations of nitrate was 46 ppm. The secondary MCL for TDS are 500 ppm; groundwater concentrations of TDS were 670 ppm.

DWR Bulletin 118-2, (1974) reports that the quality of the groundwater within the bedrock in the vicinity of the site is poor and unsuitable for most beneficial uses. The groundwater is typical of the western fringe of the San Joaquin Groundwater Basin. The groundwater is characterized by a high concentration of dissolved solids (sodium, chloride, nitrate, sulfate, and boron).

Given that the background levels of nitrates and TDS exceeded MCLs and that the DWR has characterized the groundwater as generally unsuitable for most beneficial uses, domestic/municipal and some agricultural supply uses are not appropriate at this site.

Petroleum Hydrocarbon Concentrations In Site Wells (MW-1 and MW-3)

RRM recognizes that groundwater concentrations of petroleum hydrocarbons in wells MW-1 and MW-3 are currently at or near historical maximum concentrations. During the May and December 1998 groundwater monitoring events, TPHg concentrations in groundwater at Well MW-1 were 180,000 ppb and 131,000 ppb, respectively. These concentrations approach the solubility limits for TPHg. These elevated concentrations are not due to the effects of additional sources, since all known sources were removed in 1991. Nor are these elevated TPHg concentrations the effect of plume migration since these wells are former source area monitoring wells and the downgradient monitoring wells do not show similar increases.

With respect to the presence of free product or a heavy sheen in wells MW-1 and MW-3, weekly product bailing performed on Well MW-1 from December 28, 1992 through January 29, 1993, resulted in the removal of approximately 6.7 liters of free product. A passive skimmer was installed on January 29, 1993, after free product was reduced to a sheen. The amount of free product removed from the well via the skimmer was approximately 1.05 liters. Reinstallation of a passive skimmer in Well MW-1 is not recommended because most manufacture's specify that at least several inches of free product be present in the well for the skimmer to function properly. Concerning Well MW-3, RRM does not have record of free product or sheen ever being present in Well MW-3. Available reports which summarize results of historical monitor events do not indicate the presence of free product or sheen in Well MW-3 during any monitoring event.

Figures 5 and 6 present TPHg concentrations and groundwater elevations versus time for wells MW-1 and MW-3. As can be seen from these figures, there is a high degree of positive correlation between TPHg concentrations and groundwater elevations at these locations. As groundwater elevations have fluctuated over time, TPHg concentrations have also fluctuated.

Based on the positive correlation demonstrated between groundwater elevations and TPHg concentrations, the recent increase in TPHg concentrations are likely the result of the desorption of petroleum hydrocarbons from soils into the dissolved phase as groundwater elevations increase.

Petroleum Hydrocarbon Natural Attenuation Rate In Groundwater

The natural attenuation rate of petroleum hydrocarbons in groundwater were calculated to range from 7.15×10^{-6} to 3.01×10^{-6} per day. This relatively low natural attenuation rate is the product of a shallow groundwater gradient and low soil porosity. While it has been shown that natural attenuation is occurring, these data indicate that the migration potential of TPHg beneath the site is insignificant.

Active Groundwater Remediation

It has been the determination of this assessment that the total TPHg mass in groundwater beneath the site is minimal. The majority of TPHg mass beneath the site is present in soil; total estimated TPHg mass in soil is 4,893 pounds, total estimated TPHg mass in groundwater is 636 pounds. Given that the soils data that were used for the TPHg mass estimate were based on site conditions when Well MW-1 was installed in 1992, it is likely that the actual TPHg mass in soils are significantly lower than predicted.

It is evident from the TPHg/groundwater elevation versus time graphs that the fluctuating TPHg concentrations in groundwater are primarily the result of groundwater elevation changes. It is likely that the overall trend for increasing TPHg concentrations at the former source area wells are mainly due to the desorption of TPHg from soil into the dissolved phase. No similar petroleum hydrocarbon increases have been noted at wells located further from the former source areas. Over time, these groundwater elevations should stabilize and TPHg will continue to degrade through the processes of natural attenuation at the aforementioned rates.

The low plume velocity is the result of the apparent low soil permeability and a shallow groundwater gradient. These conditions inhibit the migration of petroleum hydrocarbon-impacted groundwater and act to stabilize the plume. Groundwater extraction is therefore not necessary for migration control at this site.

Due to limited TPHg mass in shallow groundwater, limited migration potential, and limited groundwater extraction abilities in the soil types underlying the site, it is apparent that active remediation is not a viable alternative at this site.

In closing, RRM concludes that the dissolved hydrocarbon plume is adequately assessed and active remediation is not warranted. RRM does recommend that a risk management plan be prepared to ready the site for future potential commercial use.

If there are any questions regarding the contents of this document, please do not hesitate to call RRM at (831) 475-8141.

Sincerely,

RRM, Inc.

Dave Reinsma
Project Manager/Geologist

Mark Sullivan
Staff Engineer

REGISTERED GEOLOGIST
STEVEN E. KRCIK
No. 4976
EXP. 9/2000
STATE OF CALIFORNIA

Steve Krcik
Senior Geologist
RG 4967

Attachments: Table 1 - Well Survey Data
Table 2 - TPHg Mass Estimate - Soils
Table 3 - TPHg Mass Estimate - Groundwater
Table 4 - Estimate of Natural Attenuation Rate
Figure 1 - ½ Mile Well Survey Map
Figure 2 - Groundwater Elevation Contour Map - April 28, 1999
Figure 3 - Geologic Map
Figure 4 - Geologic Cross-Section A-A'
Figure 5 - TPHg Concentrations/Groundwater Elevations Versus Time at Well MW-1
Figure 6 - TPHg Concentrations/Groundwater Elevations Versus Time at Well MW-3
Attachment A - Well Video Survey Report, Gamma Ray Log, DWR Water Well Drillers Reports and Field Data Sheets
Attachment B - Selected Historical Data Summary Tables and Figures
Attachment C - References

Table 1
Well Survey Data

Former Chevron Service Station 9-7127
Grant Line Road at Interstate 580
Tracy, California

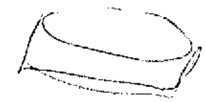
State Well ID Number	Address	Distance from Site	Owner	Well Type	Well Dia. (inches)	Total Depth (feet)	Water Depth (feet)	Date Drilled
25/3E-25B1	Jess Ranch, Grant Line Road	2850'SW	Jess Ranch	Domestic	6	78	25	12/03/76
25/3E-25B2	Jess Ranch, Grant Line Road	1550'SW	Jess Ranch	Domestic	$6^{5/8}$	--	30	09/10/79
WSW-1	Former Chevron Station, Grant Line Road @ I-580	onsite	Ardavan Onsori	Livestock	8	90	23	1970's

Table 2
TPHg Mass Estimate - Soils

Former Chevron Station 9-7127
Grant Line Road @ Interstate 580
Tracy, California

subtract interior elipse

$\rho = \frac{M}{V} \times V \times conc.$ mg/l



Area Calcluations

Area = 1/2 ellipse width x 1/2 ellipse length x pi

	ellipse width (ft)	ellipse length (ft)	area (ft^2)	less	Total Area
Area 1	10	25	196	0	196
Area 2	15	50	589	196	393
Area 3	25	75	1473	589	884
Area 4	35	100	2749	1473	1276
Area 5	45	125	4418	2749	1669
Area 6	55	150	6480	4418	2062

Mass Estimate: 20-24 Foot Interval

Assume bulk density of 2.0 grams per cm^3 (very compact subsoils)

	Calculate Soil Volumes			TPHg Conc.
	Area (ft^2)	Interval (ft)	Volume (ft^3)	(mg/kg)
Area 1	196	4	784	2500
Area 2	393	4	1572	1500
Area 3	884	4	3536	500
Area 4	1276	4	5104	250
Area 5	1669	4	6676	125
Area 6	2062	4	8248	0

Calculate TPHg Mass:
Use: TPHg soil concentration x soil volume x bulk density

	TPHg Mass (lbs)
Area 1	247
Area 2	297
Area 3	223
Area 4	161
Area 5	105
Area 6	0
Total Mass 20-24 foot interval	1032

← less? Is this ~~...~~ area of soil w/o porosity?

Mass Estimate: 24-28 Foot Interval

Assume bulk density of 2.0 grams per cm^3 (very compact subsoils)

	Calculate Soil Volumes			TPHg Conc.
	Area (ft^2)	Interval (ft)	Volume (ft^3)	(mg/kg)
Area 1	196	4	784	5000
Area 2	393	4	1572	2500
Area 3	884	4	3536	1000
Area 4	1276	4	5104	500
Area 5	1669	4	6676	250
Area 6	2062	4	8248	0

Calculate TPHg Mass:
Use: TPHg soil concentration x soil volume x bulk density

	TPHg Mass (lbs)
Area 1	493
Area 2	495
Area 3	445
Area 4	321
Area 5	210
Area 6	0
Total Mass 24-28 foot interval	1964

M

$\rho_{TPHg} = \frac{M}{V}$

$V = \frac{M_{lbs}}{\rho_{TPHg}}$

Mass Estimate: 28-30 foot Interval

Assume bulk density of 2.0 grams per cm^3 (very compact subsoils)

	Calculate Soil Volumes			TPHg Conc.
	Area (ft^2)	Interval (ft)	Volume (ft^3)	(mg/kg)
Area 1	196	2	392	8000
Area 2	393	2	786	4000
Area 3	884	2	1768	2000
Area 4	1276	2	2552	1000
Area 5	1669	2	3338	500
Area 6	2062	2	4124	250

Calculate TPHg Mass:
Use: TPHg soil concentration x soil volume x bulk density

	TPHg Mass (lbs)
Area 1	395
Area 2	396
Area 3	445
Area 4	321
Area 5	210
Area 6	130
Total Mass 28-30 foot interval	1897

Total TPHg Mass (pounds) 4893

Notes:

- ft = feet
- ft^2 = square feet
- cm^3 = cubic centimeters
- TPHg = total petroleum hydrocarbons as gasoline
- ft^3 = cubic feet
- mg/kg = milligrams per kilogram
- lbs = pounds

Table 3
TPHg Mass Estimate - Groundwater

Former Chevron Station 9-7127
Grant Line Road@ Interstate 580
Tracy, California

Assume TPHg Plume Area:

Ellipse Shape 280 feet by 100 feet

Area = 1/2 ellipse width x 1/2 eclipse length x pi = 0.5 (100) x 0.5 (280) x 3.1416 = 21,991 ft^2

Assume TPHg Plume Thickness = Average 1998 surface elevation to 35 feet below ground surface

Average Groundwater Surface Elevation:

	1998
MW-1	27.25
MW-3	26.93
MW-4	25.37
MW-6	10.07
	22.41

TPHg Plume Thickness:

30 feet - 22.41 feet = 7.59 feet

TPHg Plume Volume:

21,991 ft^2 x 7.59 ft = 166912 ft^3

Average 1998 TPHg Concentrations in Wells MW-1, MW-3, MW-4, and MW-6 (ug/L):

	1998
MW-1	156000
MW-3	87600
MW-4	635
MW-6	39
Average	61069

Total TPHg Mass in Groundwater:

$$(166912\ ft^3)\ \frac{(61069 \times 10^{-9}\ lb\ TPHg)}{(lb\ groundwater)}\ \frac{(62.4\ lb)}{(ft^3)} = 636\ lbs\ TPHg$$

Notes:

ft^2 = square feet
ft^3 = cubic feet
TPHg = total petroleum hydrocarbons as gasoline
ug/L = micrograms per liter
lbs = pounds

Table 4

Natural Attenuation Rate Estimate

(Concentration vs. Distance Approach[1])

Former Chevron Station 9-7217
I-580 and Grant Line Road
Tracy, California

The first order rate equation, written in terms of the distance between two wells:

$$C_z = C_y e^{-(kx/vp)}$$

This equation can be rearranged to solve for k:

$$k = -\ln(C_z/C_y) * (v/x)$$

Where:

C_z = concentration in well more distant from source (ug/L)
C_y = concentration in well closer to source (ug/L)
k = first order decay constant (day^{-1})
vp = plume velocity (ft/day) (assumed groundwater velocity of 6.3 X 10^{-5} feet per day divided by a retardation factor of 2)
x = distance between wells (ft)

1998 BTEX concentrations were averaged:

Well	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Xylenes (ug/L)
MW-1	19800	24350	1845	11450
MW-3	20950	12400	1200	6375
MW-6	0.46	0.38	0.22	0.27

Distance Between Wells (feet)

MW-3 and MW-6	75
MW-1 and MW-6	150

alculate BTEX Natural Attenuation Rate Between Wells (per day rate):

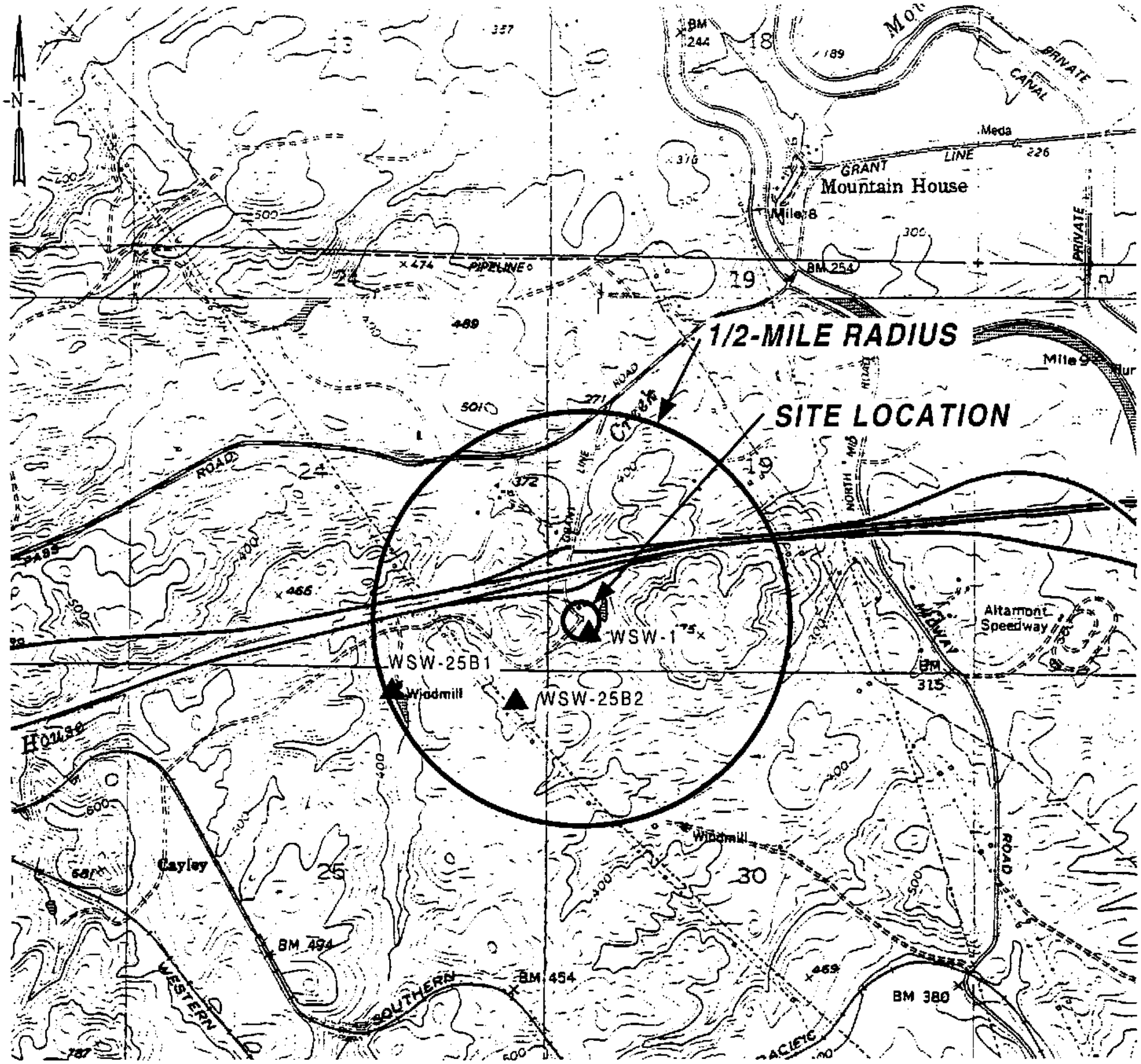
Wells	Benzene	Toluene	Ethylbenzene	Xylenes
MW-3 and MW-6	9.01E-06	8.73E-06	7.23E-06	8.46E-06
MW-1 and MW-6	4.48E-06	4.65E-06	3.79E-06	4.48E-06

This shows that the benzene attenuation rate between Wells MW-3 and MW-6 was 9.01 x 10^{-6} per day or 0.000901% degraded per day

Notes:

ug/L = micrograms per liter

1. Reference: Mobie Oil Corporation, *A Practical Approach to Evaluating Intrinsic Bioremediation of Petroleum Hydrocarbons in Groundwater*, January 1995



QUADRANGLE LOCATION

EXPLANATION

▲ WELL LOCATION

WELL ID	WELL TYPE
WSW-25B1	*Domestic*
WSW-25B2	Domestic
WSW-1	Livestock

Reference:
USGS 7.5 MIN. TOPOGRAPHIC MAP
TITLED: CLIFTON COURT FOREBAY, CALIFORNIA
REVISED: 1978
TITLED: MIDWAY, CALIFORNIA
REVISED: 1980

RRM engineering contracting firm

SCALE: 0 FEET 2000

DRAWN BY:

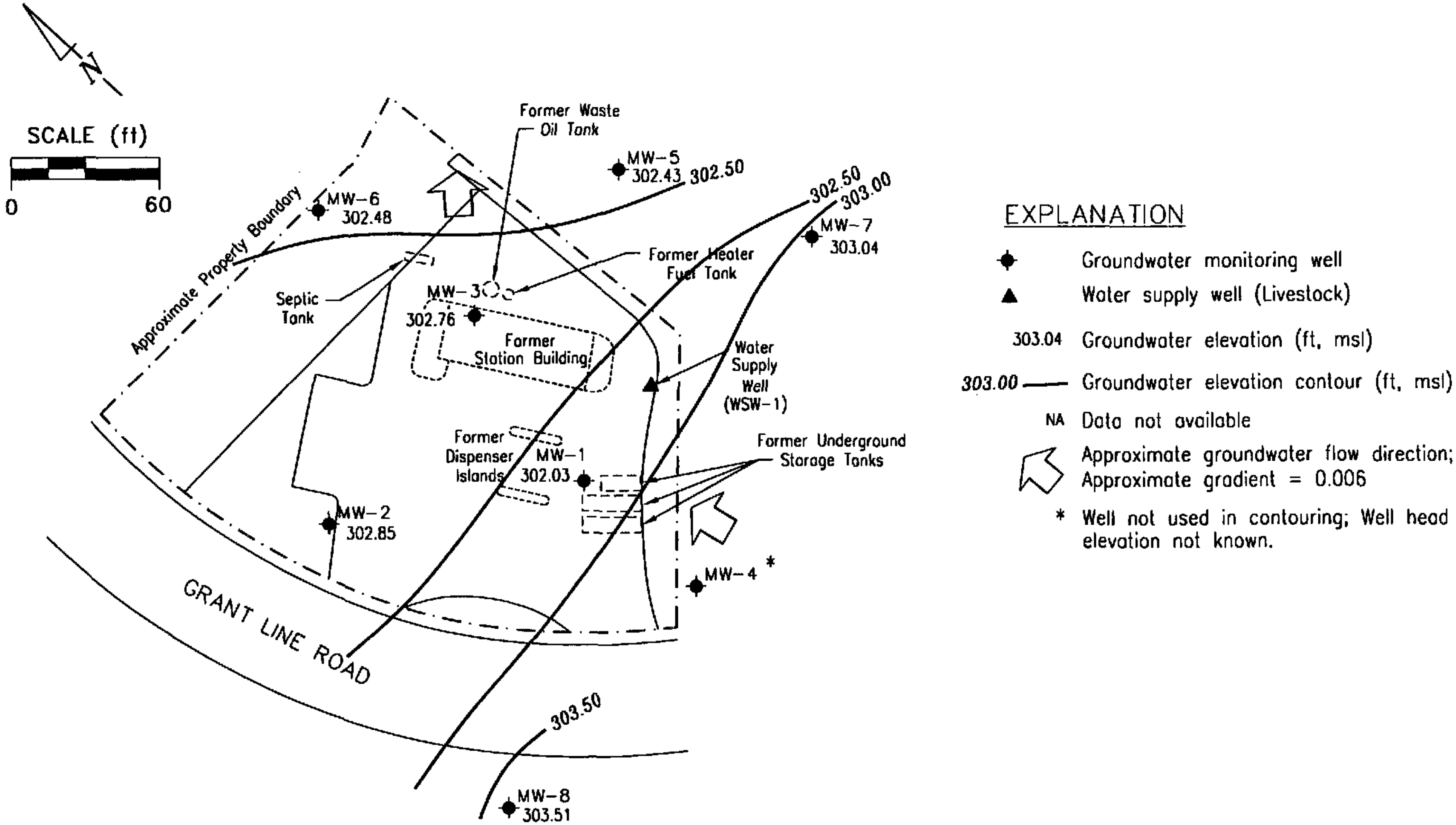
DATE: May 5, 1999

1/2-MILE WELL SURVEY MAP

Former Chevron Station 9-7127
Grant Line Road at Interstate 580
Tracy, California

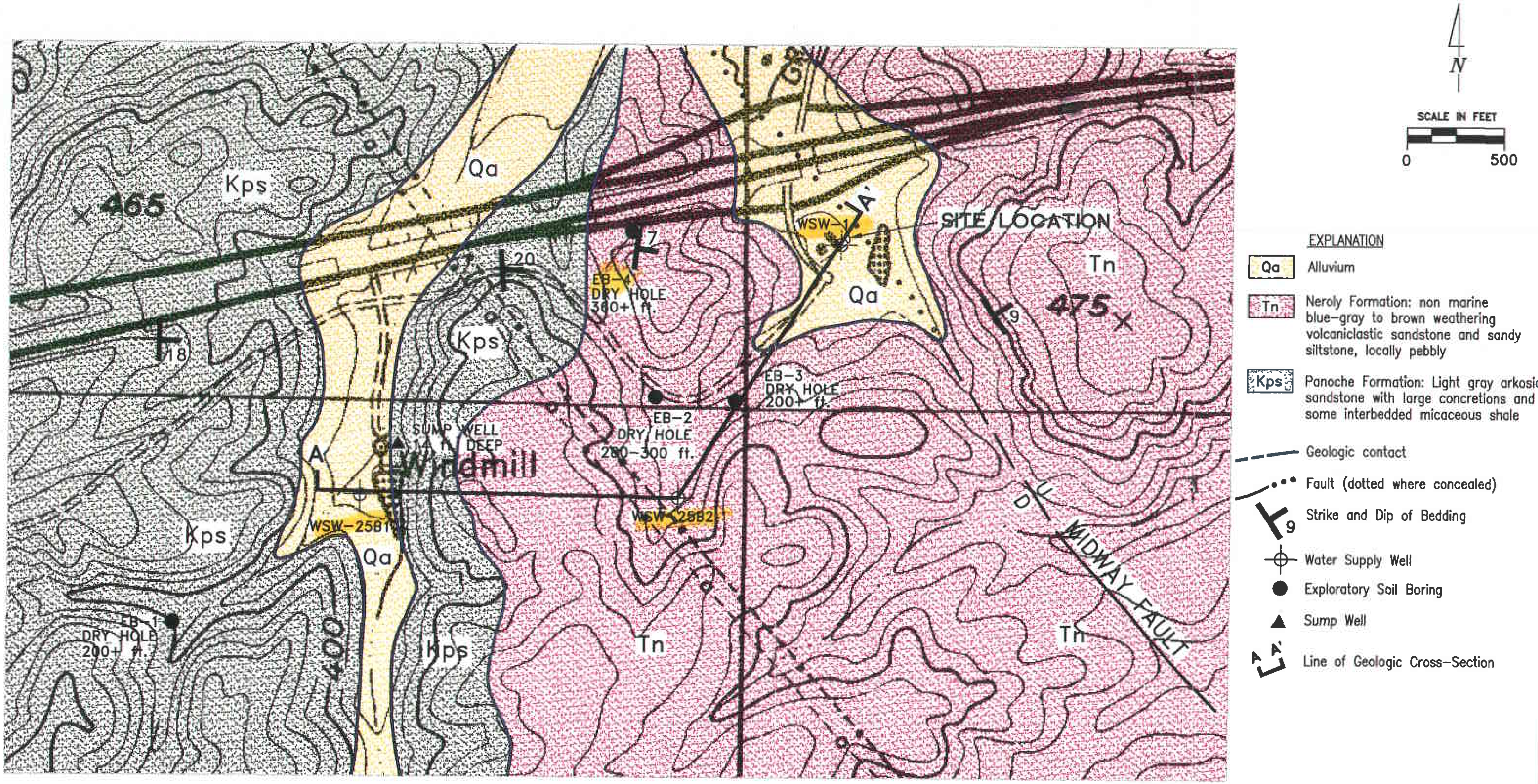
FIGURE: 1

PROJECT: AA51



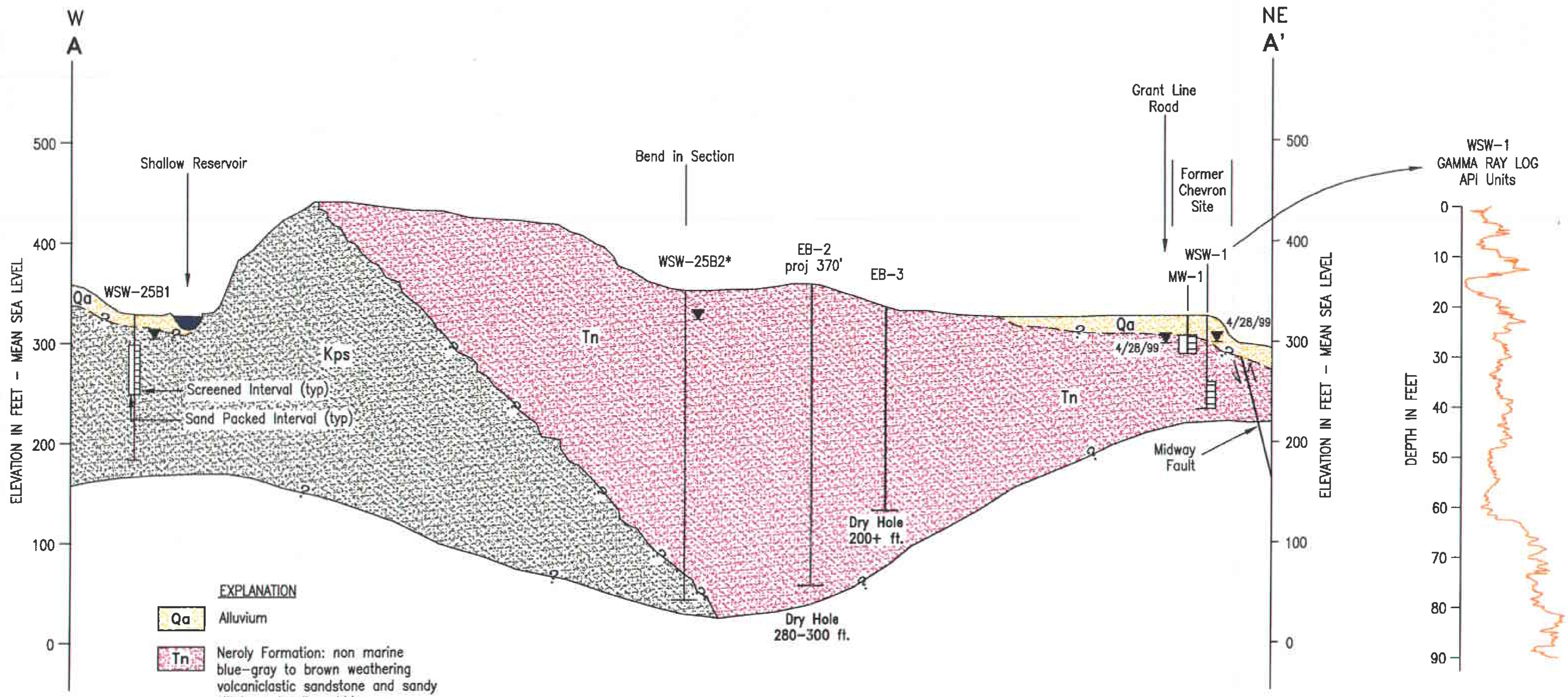
Ref. AA51/Sitemap.dwg
Basemap from Gettler-Ryan, Inc.

PREPARED BY RRM engineering contracting firm	**Former Chevron Station 9-7127** Grant Line Road at Interstate 580 Tracy, California	**GROUNDWATER ELEVATION CONTOUR MAP, APRIL 28, 1999**	FIGURE: 2 PROJECT: AA51



Ref. AA51/GEOLOGY.DWG
Topo: USGS 7.5 Minute Quadrangle Map
Titled: Midway, 1980
Geology: USGS open file report 80-535
by Thomas W. Dibblee Jr., 1980

PREPARED BY		
RRM engineering contracting firm	**GEOLOGIC MAP**	FIGURE: 3
	FORMER CHEVRON STATION 9-7127 Grant Line Road at Interstate 580 Tracy, California	PROJECT: AA51



EXPLANATION

Qa	Alluvium
Tn	Neroly Formation: non marine blue-gray to brown weathering volcaniclastic sandstone and sandy siltstone, locally pebbly
Kps	Panoche Formation: Light gray arkosic sandstone with large concretions and some interbedded micaceous shale

WSW-25B1	Water Supply Well
EB-1	Exploratory Soil Boring
▼	Static Water Level in Well
*	Well Construction Details Unknown

proj	Projected onto Line of Section
	Unconformable Geologic Contact
	Inferred Geologic Contact
	Fault

Note: Tn Local Bedding Attitudes: N7°E, 7°E to N31°W, 9°NE
Kps Local Bedding Attitudes: N2°W, 20°E to N3°W, 18°E

SCALE:
Horzontal: 1"=300'
Vertical: 1"=100'
(Vertical Exaggeration 3x)

Ref. AA51/XSEDAA.DWG
Geology: USGS open file report 80-535
by Thomas W. Dibblee Jr., 1980

PREPARED BY
RRM
engineering contracting firm

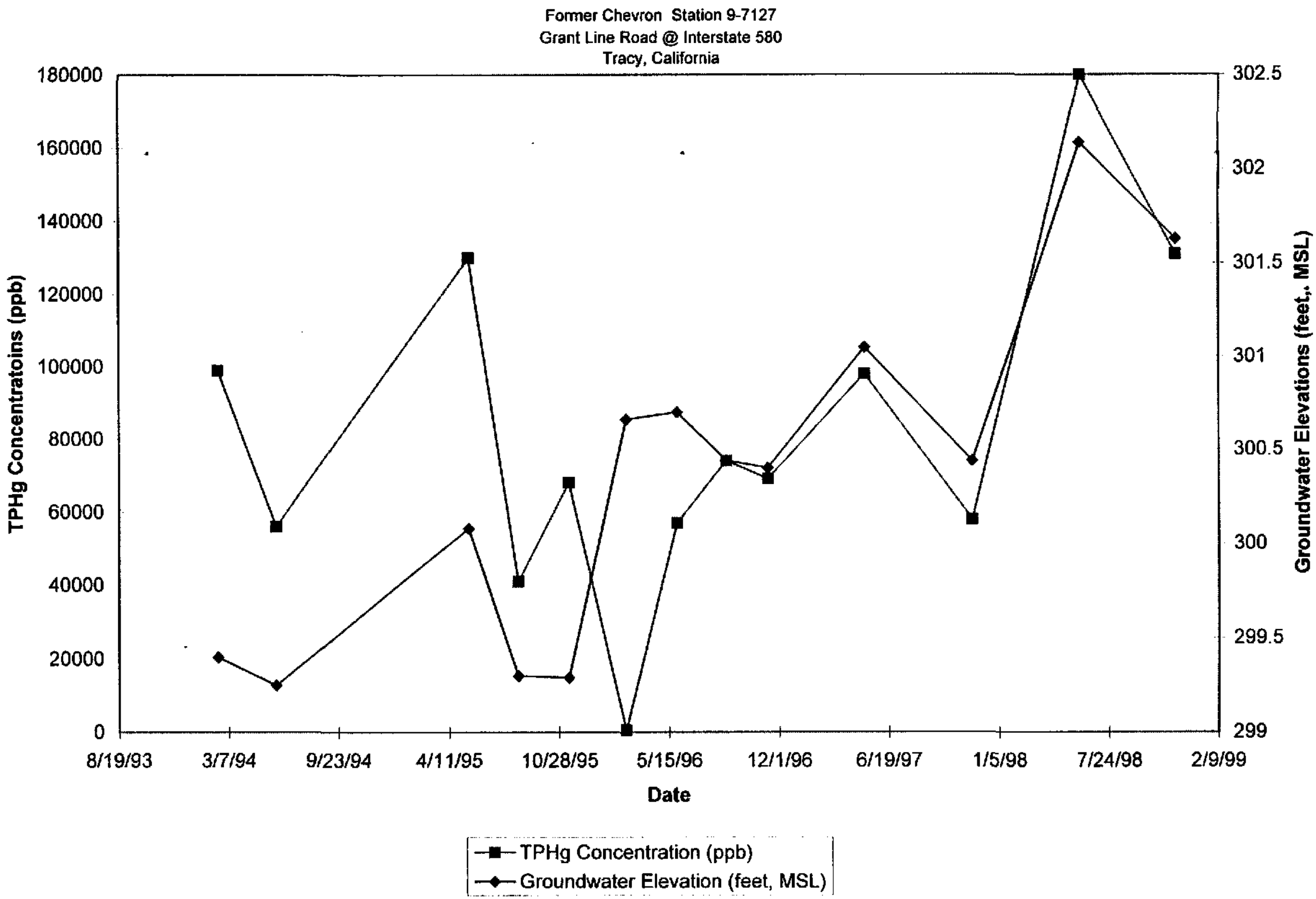
GEOLOGIC CROSS-SECTION A-A'

FORMER CHEVRON STATION 9-7127
Grant Line Road at Interstate 580
Tracy, California

FIGURE: 4
PROJECT: AA51

Figure 5

TPHg Concentrations/Groundwater Elevations Versus Time at Well MW-1

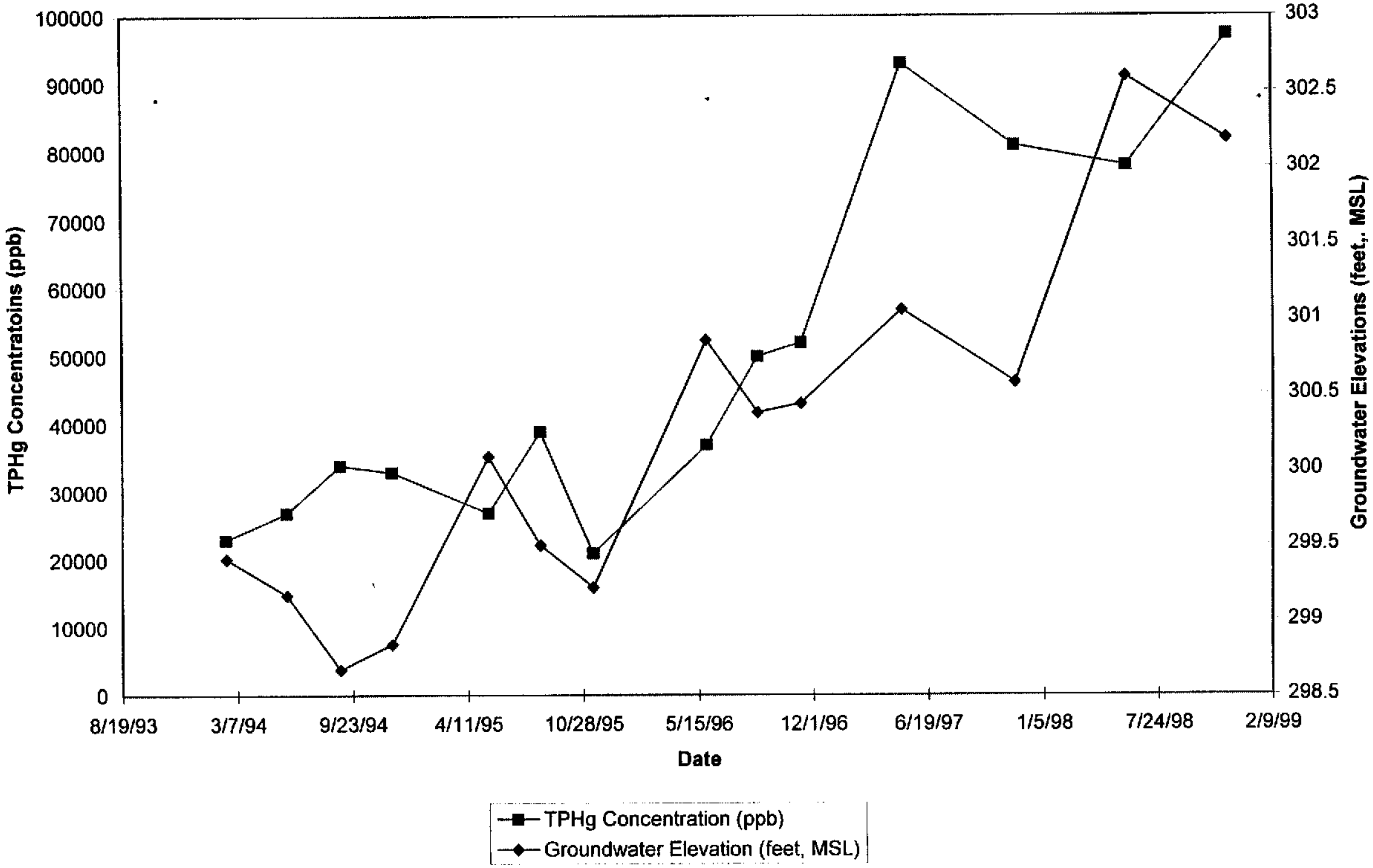


AA51.MW-1

5/6/99

Figure 6
TPHg Concentrations/Groundwater Elevations Versus Time at Well MW-3

Former Chevron Service Station 9-7127
Grant Line Road @ Interstate 580
Tracy, California



AA51.MW-3

5/6/99

ATTACHMENT A

WELL VIDEO SURVEY REPORT, GAMMA RAY LOG, DWR WATER WELL DRILLERS REPORTS AND FIELD DATA SHEETS

welenco
VIDEO SURVEY REPORT

(800) 445-9914

• Bakersfield • Salinas • Claremont • Arizona • Sacramento • Washington

RECEIVED MAY 03 1999

Customer RRM INC.	Job No. 31034 Run No. ONE
Address 3912 PORTOLA DR. STE 8	Well No. WATER SUPPLY WELL Date 04-28-1999
City SANTA CRUZ State CA Zip 95062	Location ABOUT 300 FT SOUTH OF I-580 AND GRANT LINE RD.
Request By DAVE REINSMA Cust. P.O. AA 51	TRACY, CA.
Copy To	
Reason for Survey GENERAL INSPECTION	Zero Datum TOP OF CASING
	Survey By BOBINSKI Truck No. L-17

DEPTH	REMARKS
0 FT	CAMERA ZEROED AT TOP OF CASING
23	STATIC WATER LEVEL
67	FIRST VERTICAL SLOTS VISIBLE
	57, 62, 67, 69, 73, 77, 81 - JOINTS
86	VISIBILITY WORSENS TO ZERO
89	BOTTOM OF WELL
	OK

NOTE: INCRUSTATION HEAVY. VERY FEW PERFORATIONS VISIBLE. TOP OF PERFORATIONS PROBABLE SOMEWHERE BETWEEN 60 AND 67 FEET

CASING CONDITION:

ID at Surface 8" Reduces to ______ at ______ : ______ at ______ : ______ at ______

Diameter Reference: ☐ Caliper Survey ☐ Estimate from TV/Photo Survey ☐ Well Records

Corrosion/Incrustation Build-up ☐ Light ☐ Moderate ☐ Heavy ☐ Increases with Depth

Recommendation: ☐ Clean ☐ Swage ☐ Liner(s) welenco

GAMMA RAY LOG

FILING NO.	COMPANY	ERM, INC.
	WELL	WATER SUPPLY WELL
	FIELD	TRACY
	COUNTY	ALAMEDA — STATE CALIFORNIA
JOB NO. 31034	LOCATION: I-580 & GRANT LINE RD. SEC TWP RGE	OTHER SERV: VIDEO

PERMANENT DATUM: TOP OF CASING. ELEV: N/A

LOG MEASURED FROM TOC 0 FT ABOVE PERM DATUM

DRILLING MEASURED FROM N/A

ELEVATION: KB. DF. GL.

DATE	04-28-1989		
TYPE OF LOG	GAMMA RAY		
RUN NO.	ONE		
DEPTH - DRILLER	N/A		
DEPTH - LOGGER	89'		
BOTTOM LOGGED INT	89'		
TOP LOGGED INT	0'		
TYPE FLUID IN HOLE	WATER		
FLUID LEVEL	20'		
MAX TEMP DEG F	N/A		
OPERATING RIG TIME	N/A		
EQUIP. LOCATION	L17 BFL		
OPERATOR	BOBINSKI		
WITNESSED BY	D. REINSMA		

RUN NO.	BORE HOLE RECORD			CASING RECORD			
	BIT	FROM	TO	SIZE	TYPE	FROM	TO
				8"	STEEL	0	BOTTOM

EQUIPMENT DATA

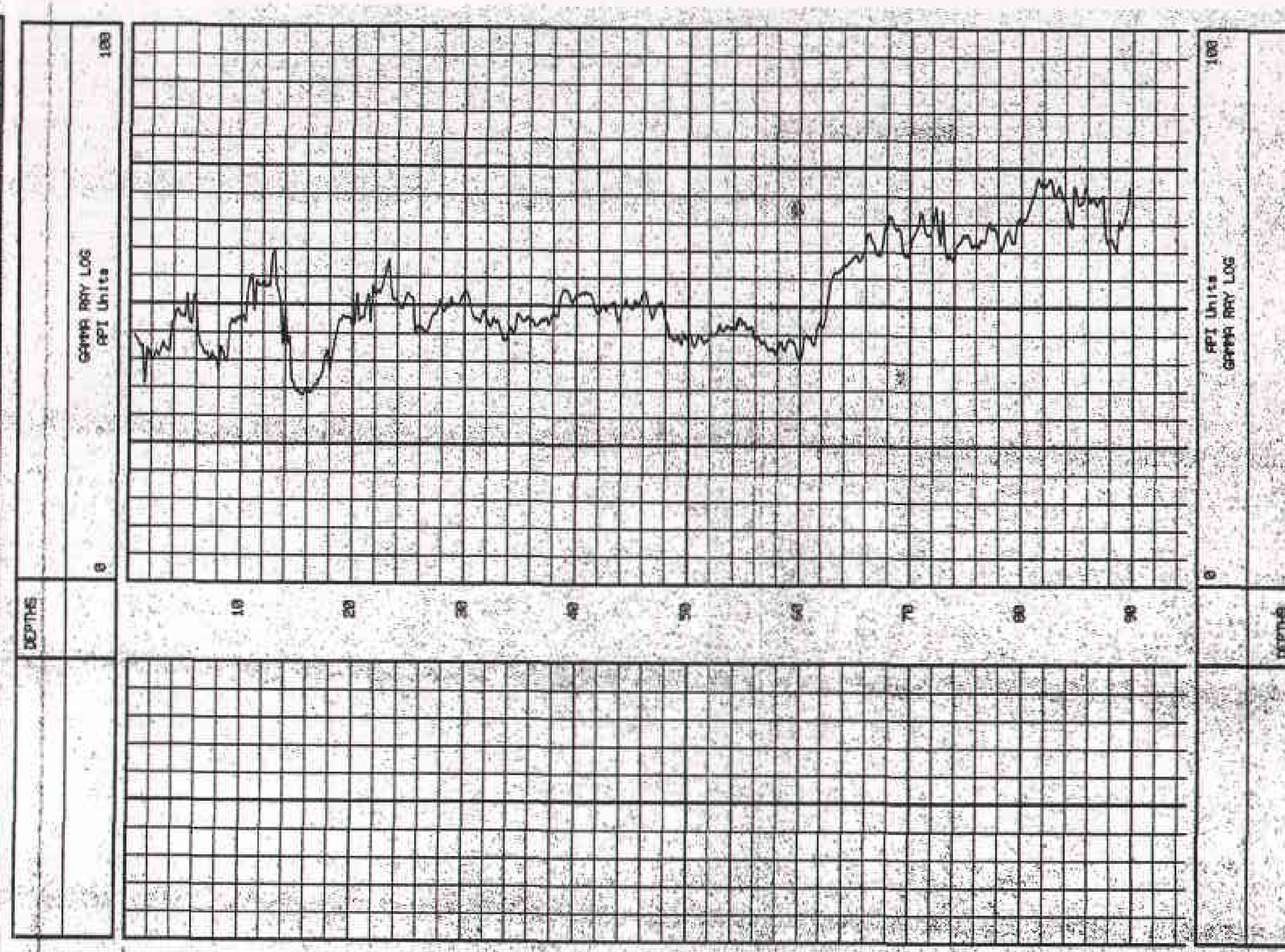
LOG TYPE	GAMMA RAY		
RUN NO.	ONE		
TOOL MODEL NO.	WGRPT1		
TOOL SERIAL NO.			
DIAMETER	3-1/2"		
DETECTOR TYPE	SCINT.		
DETECTOR LENGTH	16"		
UNITS/DIV.	5 API		
SENSITIVITY	500/250		
TIME CONSTANT	1 SEC		
ZERO DIV L OR R	N/A		
SPEED-FPM	10 FPM		
DATA SAMPLES/FT	5		
FORMATION FACTOR	N/A		
PUMP RATE-GPM	N/A		
PUMP RATE-GPM	N/A		
PUMP RATE-GPM	N/A		

SOURCE TYPE	STRENGTH	SPACING	MODEL NO	SERIAL NO.
N/A				

PERFORATIONS: TOP ABOUT 67 FEET

REMARKS:

NOTICE:

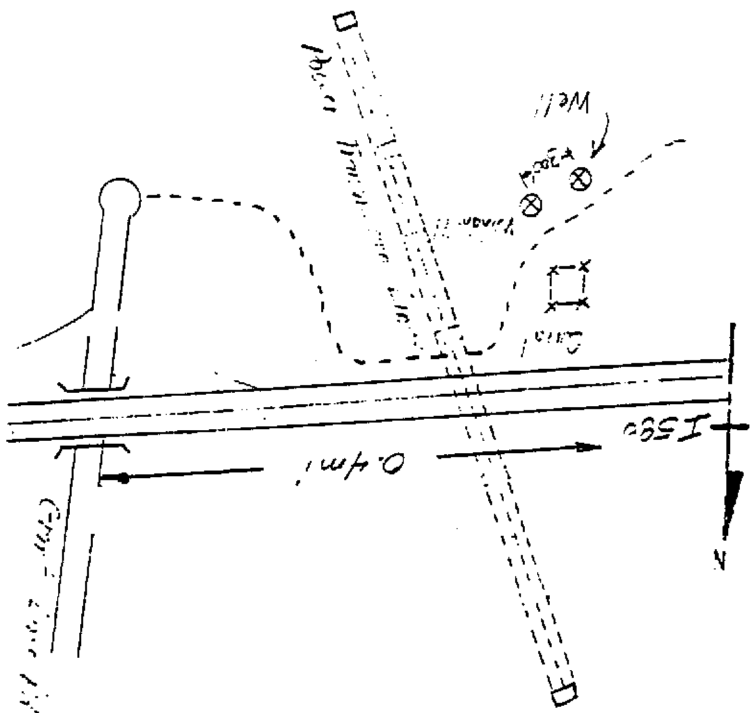


CONFIDENTIAL

STATE OF CALIFORNIA DWR
WELL COMPLETION REPORT
(WELL LOGS)

REMOVED

RECEIVED
FEB 11 1977
SAN JOAQUIN DISTRICT



SKETCH
No scale
ACFC & WCD

CONFIDENTIAL

STATE OF CALIFORNIA DWR
WELL COMPLETION REPORT
(WELL LOGS)

REMOVED

CONFIDENTIAL

STATE OF CALIFORNIA DWR
WELL COMPLETION REPORT
(WELL LOGS)

REMOVED

FIELD DATA

DEPTH TO GROUNDWATER/SEPARATE-PHASE HYDROCARBON REMOVAL FORM

DATE: 4/28/99 SITE ADDRESS: I-580 @ Grant Line Road

STATION/PROJECT NO.: AASI / 9-7127 CITY/COUNTY/STATE: Tracy/Alameda/CA FIELD TECH: DR/JQ

PROBE TYPE

☐ Oil/Water Interface Probe
☑ Other: ELEC. IND.

Dtw Ord	Well ID	Time (2400 hr)	Total Depth (feet)	First Depth to Water (feet) TOB/TOC	WELL ELEV. Second Depth to Water (feet) TOB/TOC	SPH Depth (feet) TOB/TOC	G/W ELEV. SPH Thickness (feet)	SEPARATE-PHASE HYDROCARBON (SPH) QUALITATIVE DESCRIPTION: COLOR Clear	COLOR Light	COLOR Dark	COLOR Other	VISCOSITY Light	VISCOSITY Medium	VISCOSITY Heavy	LIQUID REMOVED SPH	LIQUID REMOVED Water	Well Integrity Notes
8	MW-1			27.14	329.17	NO SPH	302.03										Needs new LOCK
6	MW-2			24.37	327.22		302.85										
7	MW-3			26.52	329.28		302.76										
5	MW-4			23.44	329.44		~~306.00~~		NOT TO BE used								
4	MW-5			10.45	312.88		302.43										
3	MW-6			9.72	312.20		302.48										
2	MW-7			10.32	313.36		303.04										
1	MW-8			26.40	329.91		303.51										Needs new LOCK
	Water Supply		94'	23.19		NO SPH											8" dia steel

Comments/Notes: The water supply well is 94 feet deep from TOC, is 8" in Diameter and has a screen section from 67' to 94'. The pump is set at approx. 63'. Based on the video log of the water supply well by Welenco, the screen section starts between 60-67 feet.

SIGNATURE: [signature]

RRM, Inc.

ATTACHMENT B

SELECTED HISTORICAL DATA SUMMARY TABLES AND FIGURES

(1987 - 1989)

TABLE 3

SUMMARY OF GROUND-WATER ANALYTICAL DATA
CHEVRON SERVICE STATION #7127
TRACY, CALIFORNIA

SAMPLE DATE	SAMPLING POINT	BENZENE (ppb)	TOLUENE (ppb)	TOTAL XYLENES (ppb)	ETHYLBENZENE (ppb)	TPH (ppm)
12/21/87	T-1	2	ND	ND	ND	NT
01/05/88	T-2	4	ND	ND	ND	NT
01/08/88	T-2	1	ND	ND	ND	NT
01/08/88	T-2	1.1	ND	ND	ND	NT
01/21/88	Well	ND	ND	ND	ND	NT
02/19/88	T-1	ND	ND	ND	ND	ND
02/19/88	T-1	ND	ND	ND	ND	ND
02/19/88	Well	ND	ND	ND	ND	ND
02/19/88	TB	ND	ND	ND	ND	ND
03/14/89	Well #	3.7	0.8	NT	NT	ND
03/14/89	Well *	ND	ND	ND	NT	ND
03/14/89	T-2 #	2.7	0.4	NT	NT	ND
03/14/89	T-2 *	ND	ND	NT	NT	ND
03/14/89	T-3 #	1.4	0.4	NT	NT	ND
03/14/89	T-3 *	ND	ND	NT	NT	ND
03/14/89	TB *	ND	ND	NT	NT	ND
04/05/89	Well *	7	3	ND	NT	ND
04/05/89	Well #	6.4	2.3	1	NT	ND
04/05/89	T-2 *	6	3	3	NT	ND
04/05/89	T-2 #	5	1.5	0.7	NT	ND
04/05/89	T-3 *	2	ND	ND	NT	ND
04/05/89	T-3 #	2.3	0.6	ND	NT	ND
04/05/89	TB #	ND	ND	0.6	NT	ND
Detection Limit		0.5	0.5	0.5	0.5	1

TB = Trip Blank
NT = not tested
ppm = parts per million
ppb = parts per billion
* Analyzed by Med-Tox Associates, Inc.
# Analyzed by Clayton Environmental Consultants, Inc.
Well = samples collected from domestic well-head.

(Note: See Plate 4 for sampling point locations.)

TABLE 1

ANALYTICAL RESULTS OF WATER SAMPLES
CHEVRON, TRACY
concentrations in $\mu g/l$ (ppb)

Sample Location	Sample Date	Purge Well Volumes	TPH as Gasoline	Benzene	Total Xylene	Toluene	Ethyl Benzene
Wellhead	3-14-89	3	ND (ND)	ND (3.7)	ND (ND)	ND (0.8)	ND (ND)
	4-5-89	0	ND	ND	ND	ND	ND
		3	ND	ND	ND	ND	ND
		6	ND (ND)	7.0 (6.4)	ND (1.0)	3.0 (2.3)	ND (ND)
	4-28-89	5	NT	5.0	ND	2.0	ND
	5-18-89	5	NT	ND	ND	ND	ND
Tap-2 (T-2)	3-14-89	3	ND (ND)	ND (2.7)	ND	ND (0.4)	ND
	4-5-89	0	ND	ND	ND	ND	ND
		3	ND	ND	ND	ND	ND
		6	ND (ND)	6.0 (5.0)	3.0 (0.7)	3.0 (1.5)	ND (ND)
	4-28-89	5	NT	4.0	ND	2.0	ND
	5-18-89	5	NT	ND	ND	ND	ND
Tap-3 (T-3)	3-14-89	3	ND (ND)	ND (1.4)	ND	ND (0.4)	ND (ND)
	4-5-89	0	ND	ND	ND	ND	ND
		3	ND	ND	ND	ND	ND
		6	ND (ND)	2.0 (2.3)	ND (ND)	ND (0.6)	ND (ND)
	4-28-89	5	NT	1.0	ND	ND	ND
	5-18-89	5	NT	ND	ND	ND	ND
Travel Blank	3-14-89	-	ND	ND	ND	ND	ND
	4-5-89	-	ND (ND)	ND (ND)	ND (0.6)	ND (ND)	ND (ND)
	4-28-89	-	NT	ND	ND	ND	ND
	5-18-89	-	NT	ND	ND	ND	ND
Detection Limit	-	-	100 (50)	0.5 (0.4)	2.0 (0.4)	0.5 (0.3)	0.5 (0.3)

ND = Not detected at or above laboratory limits of detection
NT = Compound not tested for in specific sampling round
Results and detection limits of duplicate analyses are shown in parentheses
Duplicate analyses were performed by Clayton Environmental. All other analyses were performed by Med-Tox Associates.

Table 1
Water Well Analytical Data
Total Petroleum Hydrocarbons
(TPH as Gasoline and BTEX Compounds)

Former Chevron U.S.A. Service Station 9-7127
Highway I-580 at Grant Line Road
Tracy, California

Sample Date	TPH as Gasoline (ppb)	Benzene (ppb)	Toluene (ppb)	Ethylbenzene (ppb)	Xylenes (ppb)
12/10/92	ND	ND	ND	ND	ND
01/07/93	ND	ND	ND	ND	ND
01/22/93	ND	ND	ND	ND	ND
01/29/93	ND	ND	8	ND	2
02/04/93	ND	ND	ND	ND	ND
02/12/93	ND	ND	ND	ND	ND
02/19/93	ND	ND	ND	ND	ND
02/26/93	ND	ND	ND	ND	ND
03/04/93	ND	ND	ND	ND	ND
03/11/93	ND	ND	ND	ND	ND
03/19/93	ND	0.8	ND	ND	ND
03/25/93	ND	ND	ND	ND	ND
04/01/93	ND	ND	ND	ND	ND
04/08/93	ND	ND	ND	ND	ND
04/15/93	ND	ND	ND	ND	ND
04/23/93	ND	ND	ND	ND	ND
04/29/93	ND	ND	ND	ND	ND
05/07/93	ND	ND	ND	ND	ND
05/13/93	ND	ND	ND	ND	ND
05/20/93	ND	ND	ND	ND	ND
05/21/93	ND	ND	ND	ND	ND
06/04/93	ND	ND	ND	ND	ND
06/11/93	ND	ND	ND	ND	ND
06/18/93	ND	ND	ND	ND	ND
06/24/93	ND	ND	ND	ND	ND
07/01/93	ND	ND	ND	ND	ND
07/08/93	ND	ND	ND	ND	ND
07/16/93	ND	ND	ND	ND	ND
07/23/93	ND	ND	ND	ND	ND
07/29/93	ND	ND	ND	ND	ND
08/05/93	ND	ND	ND	ND	ND

November 22, 1993

3250402/TABLE1

Table 1 (continued)
Water Well Analytical Data
Total Petroleum Hydrocarbons
(TPH as Gasoline and BTEX Compounds)

Former Chevron U.S.A. Service Station 9-7127
Highway I-580 at Grant Line Road
Tracy, California

Sample Date	TPH as Gasoline (ppb)	Benzene (ppb)	Toluene (ppb)	Ethylbenzene (ppb)	Xylenes (ppb)
08/12/93	ND	ND	ND	ND	ND
08/19/93	ND	ND	ND	ND	ND
08/26/93	ND	ND	ND	ND	ND
09/02/93	ND	ND	ND	ND	ND
09/09/93	ND	ND	ND	ND	ND
09/17/93	ND	ND	ND	ND	ND
09/23/93	ND	ND	ND	ND	ND
10/01/93	ND	ND	ND	ND	ND
10/07/93	ND	ND	ND	ND	ND
10/15/93	ND	ND	ND	ND	ND
10/21/93	ND	ND	ND	ND	ND
10/28/93	ND	ND	ND	ND	ND
11/05/93	ND	ND	ND	ND	ND
11/12/93	ND	ND	ND	ND	ND
Detection Limits:	50	0.5	0.5	0.5	0.5

ppb = Parts per billion
ND = Not detected at or above limit of detection
* The trip blank (TB-1) also contained detectable xylenes at 0.9 ppb.

Cumulative Table of Well Data and Analytical Results

Vertical Measurements are in feet. Volumetric Measurements are in gallons. Analytical results are in parts per billion (ppb)

DATE	Well Head Elev.	Ground Water Elev.	Depth To Water	SPH Thickness	SPH Removed	Total SPH Removed	Notes	TPH-Gasoline	Benzene	Toluene	Ethyl-Benzene	Xylene	MTBE
MW-8													
12/30/95	329.91	299.61	30.30	--	--	--	--	--	--	--	--	--	--
01/29/96	329.91	300.35	29.56	--	--	--	--	--	--	--	--	--	--
02/27/96	329.91	301.23	28.68	--	--	--	--	<50	<0.5	<0.5	<0.5	<5.0	<5.0
03/05/96	329.91	301.16	28.75	--	--	--	--	--	--	--	--	--	--
04/23/96	329.91	301.66	28.25	--	--	--	--	--	--	--	--	--	--
05/30/96	329.91	301.47	28.44	--	--	--	--	<50	<0.5	<0.5	<0.5	<0.5	<5.0
06/19/96	329.91	301.40	28.51	--	--	--	--	--	--	--	--	--	--
07/15/96	329.91	301.24	28.67	--	--	--	--	--	--	--	--	--	--
08/27/96	329.91	300.99	28.92	--	--	--	--	<50	<0.5	<0.5	<0.5	<0.5	<5.0
09/06/96	329.91	300.92	28.99	--	--	--	--	--	--	--	--	--	--
10/28/96	329.91	300.85	29.06	--	--	--	--	--	--	--	--	--	--
11/11/96	329.91	300.93	28.98	--	--	--	--	--	--	--	--	--	--
05/06/97	329.91	301.77	28.14	--	--	--	--	<50	3.6	3.1	0.7	2.5	<5.0
07/27/97	329.91	301.36	28.55	--	--	--	*	--	--	--	--	--	--
11/18/97	329.91	301.11	28.80	--	--	--	--	--	--	--	--	--	--
05/31/98	329.91	303.34	26.57	--	--	--	*	<50	<0.3	<0.3	<0.3	<0.6	<10
11/23/98	329.91	302.95	26.96	--	--	--	Sampled annually	--	--	--	--	--	--
SUPPLY WELL													
11/15/95	--	--	--	--	--	--	--	<50	<0.5	<0.5	<0.5	<0.5	<5.0
11/11/96	--	--	--	--	--	--	--	<50	<0.5	<0.5	<0.5	<0.5	<5.0
07/27/97	--	--	--	--	--	--	*	--	--	--	--	--	--
11/18/97	--	--	--	--	--	--	--	<50	<0.5	<0.5	<0.5	<0.5	<2.5
05/31/98	--	--	--	--	--	--	--	--	--	--	--	--	--
11/23/98	--	--	--	--	--	--	--	<50	<0.5	<0.5	<0.5	<0.5	<2.0

* See Table of Additional Analyses.

Table 1

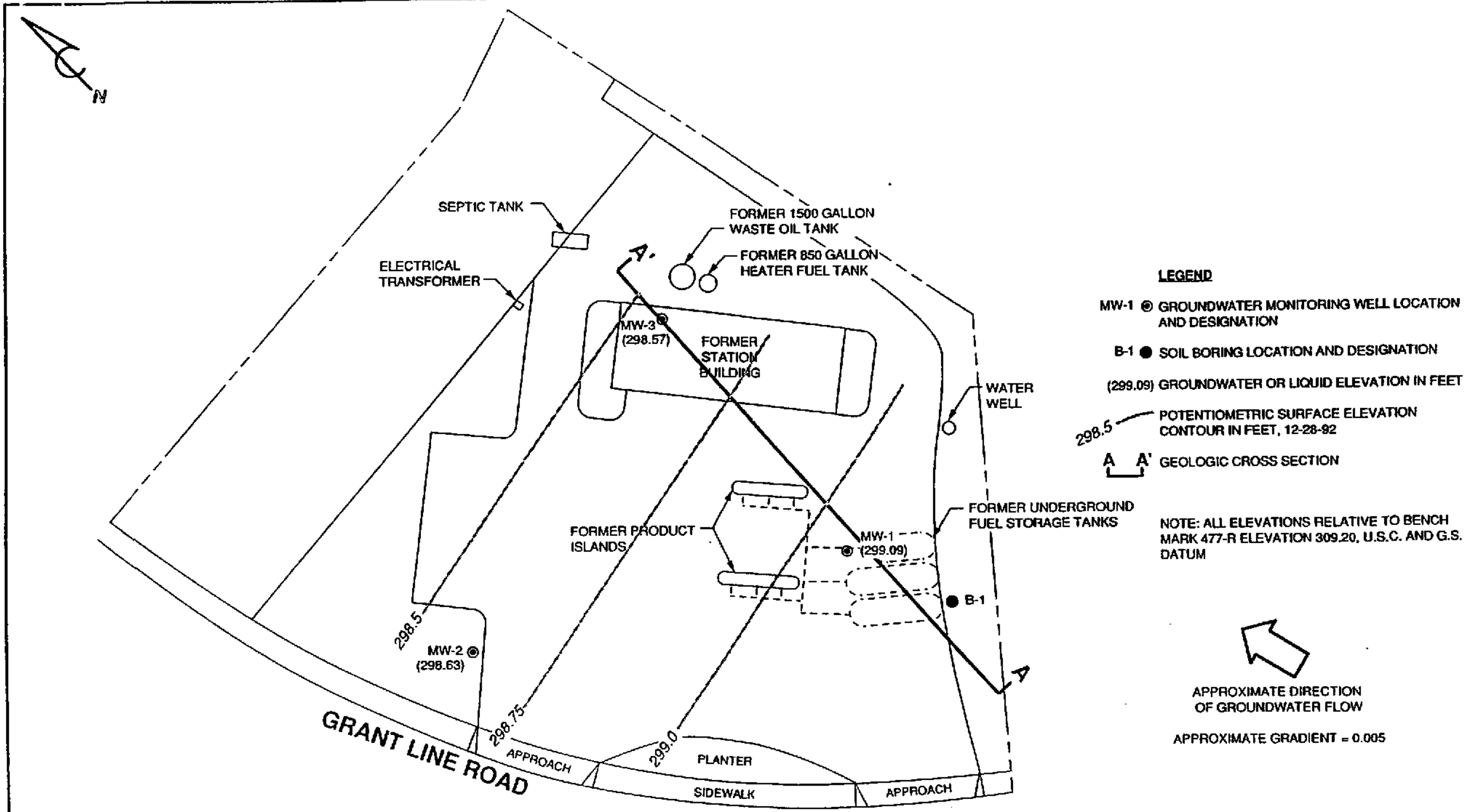
Former Chevron Service Station #9-7127
Interstate 580 & Grant Line Road
Tracy, California

SUPPLY WELL
GENERAL MINERAL, PHYSICAL & INORGANIC CHEMICAL ANALYSES
(Drinking Water Standards)
Sampled February 19, 1997

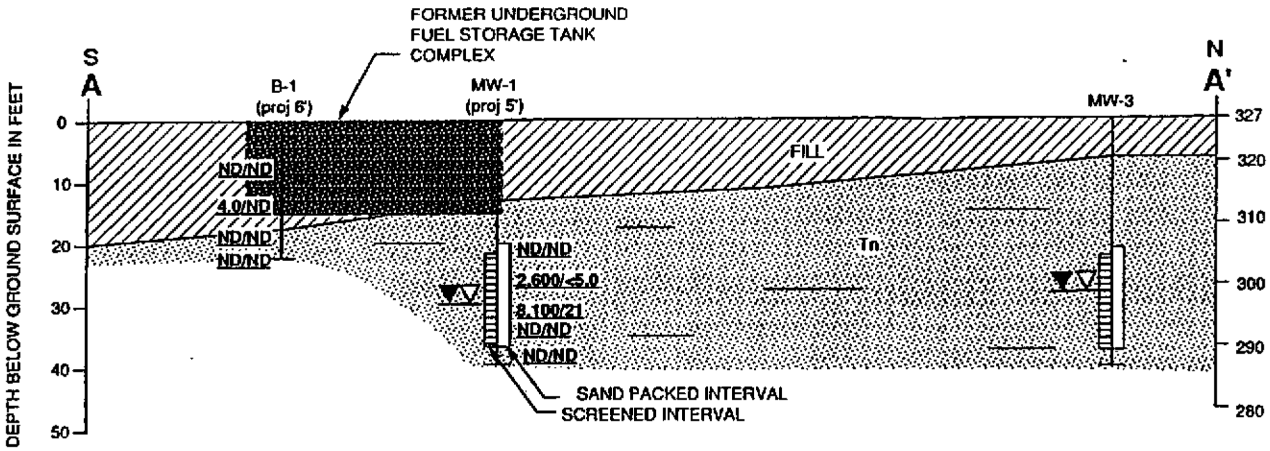
Constituent	*(Actual)* Result	Maximum Contaminant Level (MCL)	Detection Limit for Reporting
Chloride (CI)	150 mg/L	250 mg/L+	2.0 mg/L
Nitrate	46 mg/L	45 mg/L	2.0 mg/L
Specific Conductance (E.C.)	1000 μmho/cm	900μmho/cm+	1.0 μmho/cm
Total Filterable Residue @ 180 C (TDS)	670 mg/L	500 mg/L+	1.0 mg/L
Iron (Fe)	0.47 μg/L	300 μg/L	100 μg/L
Manganese (MN)	0.11 μg/L	50 μg/L	30 μg/L
Total Coliform	Absent	---	---

+ = Indicates Secondary Drinking Water Standards

mg/L = miligram per liter/parts per million
μg/L = micrgram per liter/parts per billion
μmho/cm = Micromhos/per centimeter



PACIFIC ENVIRONMENTAL GROUP, INC.	SCALE 0 30 60 FEET	FORMER CHEVRON USA SERVICE STATION 9-7127 I-580 at Grant Line Road Tracy, California SITE MAP	FIGURE: 2 PROJECT: 325-04.01



LEGEND

TANK COMPLEX BACKFILL

FILL INTERBEDDED COARSE AND FINE GRAINED DEPOSITS

Tn SANDSTONE WITH INTERBEDDED SANDY CLAYSTONE

MW-3 GROUNDWATER MONITORING WELL LOCATION AND DESIGNATION

B-1 SOIL BORING LOCATION AND DESIGNATION

▽ FIRST ENCOUNTERED WATER

▼ STATIC GROUNDWATER LEVEL

proj PROJECTED ONTO LINE OF SECTION (FEET)

4.0/ND TPH-g/BENZENE CONCENTRATION IN SOIL, IN MILLIGRAMS PER KILOGRAM, 12-28-92

ND NOT DETECTED

NOTE: CROSS SECTION IS SUBPARALLEL TO STRIKE WHICH HAS BEEN MEASURED IN OUTCROP TO RANGE FROM 150° TO 175° AND DIP FROM HORIZONTAL TO 27° EAST.

PACIFIC ENVIRONMENTAL GROUP, INC.

SCALE

HORIZONTAL : 1" = 20'
VERTICAL : 1" = 20'

FORMER CHEVRON USA SERVICE STATION 9-7127
I-580 at Grant Line Road
Tracy, California

GEOLOGIC CROSS-SECTION A-A'

FIGURE: 3

PROJECT: 325-04.01

ATTACHMENT C

REFERENCES

REFERENCES

Blaine Tech Services, Inc., Fourth Quarter 1998 Groundwater Monitoring, Chevron Service Station No. 9-7127, I-580 & Grantline, Tracy, California, February 23, 1999.

California Department of Water Resources, Evaluation of Ground Water Resources: Livermore and Sunol Valleys, Bulletin No. 118-2, June 1974.

Dibblee, T.W., Jr., Preliminary Geologic Map of the Midway Quandrangle, Alameda and San Joaquin Counties, USGS Open File Report 80-535, 1980.

Environmental Health Consultants, Letter Report to Mr. Steven Krcik of Pacific Environmental Group providing a limited health risk evaluation concerning benzene, toluene and xylenes found in ground water at former Chevron service station 9-7127, I-580 & Grantline, Tracy, California, September 20, 1993.

Gettler-Ryan, Inc., Water Treatment System Sampling Report, Chevron Service Station 9-7127, I-580 & Grantline, Tracy, California, October 1, 1990.

Getler-Ryan, Inc., Water Treatment System Sampling Report, Chevron Service Station 9-7127, I-580 & Grantline, Tracy, California, October 1, 1990.

Gettler-Ryan, Inc., Water Treatment System Sampling Report, Chevron Service Station 9-7127, I-580 & Grantline, Tracy, California, April 9, 1991.

Mobil Oil Corporation, A Practical Approach to Evaluating Intrinsic Bioremediation of Petroleum Hydrocarbons in Groundwater, January, 1995.

Pacific Environmental Group, Inc., Soil and Groundwater Investigation, Chevron Service Station 9-7127, I-580 & Grantline, Tracy, California, March 22, 1993.

Pacific Environmental Group, Inc., Well Installation Report, Chevron Service Station 9-7127, I-580 & Grantline, Tracy, California, December 3, 1993.

Pacific Environmental Group, Inc., Groundwater Investigation Report, Chevron Service Station 9-7127, I-580 & Grantline, Tracy, California, January 25, 1996.

Pacific Environmental Group, Inc., Risk-Based Corrective Action- Tier 2 Evaluation, Chevron Service Station 9-7127, I-580 & Grantline, Tracy, California, June 27, 1997.

Page, B.M., Geology of the Coast Ranges of California, Geology of Northern California: California Division of Mines and Geology Bulletin 190.

Sorenson, S.K., Chemical Quality of Groundwater in San Joaquin and Part of Contra Costa Counties, California, in USGS Water Resources Investigation 81-26, June 1981.

Weiss Associates, Comprehensive Site Evaluation and Proposed Future Action Plan, Chevron Service Station 9-7127, I-580 & Grantline, Tracy, California, October 13, 1994.

Wilson and Kampbell, Innovative Measures Distinguish Natural Bioattenuation from Dilution/Adsorption, Ground Water Currents, 1992.

Wilson et al, Subsurface Bioremediation in Bioremediation of Hazardous Waste Sites: Practical Approaches to Implementation, 1993.

ALAMEDA COUNTY
HEALTH CARE SERVICES
AGENCY
DAVID J. KEARS, Agency Director

COPI 9-7/27
P.R.B.
99

ENVIRONMENTAL HEALTH SERVICES
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577
(510) 567-6700
(510) 337-9335 (FAX)

StID 4100

February 5, 1999

Mr. Phil Briggs
Chevron, Building L
P.O.Box 5004
San Ramon, CA 94583-0804

RE: Vertical Extent of Groundwater Contamination at the Former Chevron Service Station at I-580 and Grant Line Road, Tracy, CA

Dear Mr. Briggs:

I have completed the review of the case file for the above referenced site to determine what issues may need to be addressed before the site can be designated a low risk groundwater case. There appears to be two criteria that does not meet the Central Valley RWQCB's guidance for no further action at a leaking underground storage tank site (the draft Appendix B is enclosed). The two issues that need further interpretation or characterization are:

1. *No existing water supply wells, deeper aquifers, surface waters or other receptors are threatened by pollutants remaining in the aquifer.*

   The onsite domestic well contained detectable levels of benzene (up to 6.4ppb) in 1987 and 1989 (see attached table). It is assumed this well is constructed and screened deeper than the onsite groundwater monitoring wells. It must be verified that groundwater contamination has not impacted the deeper aquifer. Therefore, the vertical extent of the contaminant plume must be determined.

2. *The total pollutant mass remaining in the groundwater is decreasing at predicted rates and neither creates, nor threatens to create, a risk to human health and safety or future beneficial uses(s) of the aquifer.*

   Onsite groundwater monitoring wells MW-1 and MW-3 continues to contain measurable free product or a heavy sheen. Recent benzene levels were at 24,000ppb. Active remediation appears necessary to reduce the total pollutant mass in groundwater.

A workplan and/or discussion to address the above issues should be submitted to this office for review within 60 days of the date of this letter, **or by April 9, 1999**. If you have any questions, I can be reached at (510) 567-6762.

eva chu
Hazardous Materials Specialist

enclosures

chvrontracy12

TABLE 3

SUMMARY OF GROUND-WATER ANALYTICAL DATA
CHEVRON SERVICE STATION #7127
TRACY, CALIFORNIA

SAMPLE DATE	SAMPLING POINT	BENZENE (ppb)	TOLUENE (ppb)	TOTAL XYLENES (ppb)	ETHYLBENZENE (ppb)	TPH (ppm)
12/21/87	T-1	2	ND	ND	ND	NT
01/05/88	T-2	4	ND	ND	ND	NT
01/08/88	T-2	1	ND	ND	ND	NT
01/08/88	T-2	1.1	ND	ND	ND	NT
01/21/88	Well	ND	ND	ND	ND	NT
02/19/88	T-1	ND	ND	ND	ND	ND
02/19/88	T-1	ND	ND	ND	ND	ND
02/19/88	Well	ND	ND	ND	ND	ND
02/19/88	TB	ND	ND	ND	ND	ND
03/14/89	Well #	3.7	0.8	NT	NT	ND
03/14/89	Well *	ND	ND	ND	NT	ND
03/14/89	T-2 #	2.7	0.4	NT	NT	ND
03/14/89	T-2 *	ND	ND	NT	NT	ND
03/14/89	T-3 #	1.4	0.4	NT	NT	ND
03/14/89	T-3 *	ND	ND	NT	NT	ND
03/14/89	TB *	ND	ND	NT	NT	ND
04/05/89	Well *	7	3	ND	NT	ND
04/05/89	Well #	6.4	2.3	1	NT	ND
04/05/89	T-2 *	6	3	3	NT	ND
04/05/89	T-2 #	5	1.5	0.7	NT	ND
04/05/89	T-3 *	2	ND	ND	NT	ND
04/05/89	T-3 #	2.3	0.6	ND	NT	ND
04/05/89	TB #	ND	ND	0.6	NT	ND
Detection Limit		0.5	0.5	0.5	0.5	1

TB = Trip Blank
NT = not tested
ppm = parts per million
ppb = parts per billion
* Analyzed by Med-Tox Associates, Inc.
# Analyzed by Clayton Environmental Consultants, Inc.
Well = samples collected from domestic well-head.

(Note: See Plate 4 for sampling point locations.)

APPENDIX B

TRI - REGIONAL BOARD STAFF

RECOMMENDATIONS

FOR PRELIMINARY INVESTIGATION AND

EVALUATION OF UNDERGROUND TANK SITES

NO FURTHER ACTION REQUESTS

1 MARCH 1994

(DRAFT REVISION OCTOBER 1996)

Prepared by Staff of the

Central Valley Regional Water Quality Control Board

State of California
REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

3443 Routier Road, Suite A
Sacramento, California 95827-3098

Phone: (916) 255-3000
CALNET: 8-494-3000

CENTRAL VALLEY REGIONAL WATER QUALITY CONTROL BOARD

STAFF RECOMMENDATIONS FOR NO FURTHER ACTION REQUESTS

The Central Valley Underground Tank Program (Program) is implemented to achieve the goals of State policies, regulations, and procedures adopted by the State Water Resources Control Board, the Porter-Cologne Water Quality Act (California Water Code) and the Regional Board's Basin Plans. To provide consistency in the Program, the Central Valley Regional Board staff developed the *Tri-Regional Board Staff Recommendations for Preliminary Investigation and Evaluation of Underground Tank Sites* and its Appendix A, which, both based on concepts originally developed in 1981, are revised periodically to accommodate statutory, regulation and policy changes. Appendix A prescribes minimum report contents which are to be submitted for review and approval. Appendix A streamlines the process for investigation and cleanup of sites to assure the discharger that the remediation system proposed is appropriate for the site subsurface conditions.

Appendix B for site *NO FURTHER ACTION REQUESTS*, is necessary to complete the documentation process before a request for no further action can be processed. The request must include signatures of registered individuals as required by the California Business and Professions Code. The purpose for a no further action report is to provide a document upon which the regulator may make an objective decision regarding the requested closure. The report and the Board's (or Local Implementing Agency) summary memo supporting the request will remain on file in the Regional Board office for public review.

This staff report also addresses the classification of "low risk" cases and the application of active or passive remediation measures at these sites. The applications and measures are discussed in the Lawrence Livermore National Laboratory Report: *Recommendations to Improve the Cleanup Process for California's Leaking Underground Fuel Tanks, October 16, 1995,* and the 8 December 1995 State Water Resources Control Board letter[1], respectively.

If you have any questions regarding Appendix B, please call the Underground Tank Unit at (209) 445-5116 (Fresno), (916) 224-4845 (Redding), or (916) 255-3000 (Sacramento).

GORDON LEE BOGGS
Underground Tank Program Manager

[1] Letter from Walt Pettit, Executive Director, to all Regional Board Chairpersons and Executive Officers and all Local Oversight Agency (LOP) Directors, dated 8 December 1995.

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INTRODUCTION

Central Valley Regional Board staff recognize that total cleanup of a site, although generally possible, is not always feasible or warranted ("site" includes on- and/or off-site problems resulting from the release of underground storage tank contents). Therefore, no further action required at a site may be unconditional if the site has been remediated successfully, or with conditions that "no further action is required at this time" when total cleanup can not be achieved. **Regardless of the action requested, an Appendix B report is required for Regional Board review.** The report is to document whether complete remediation of the site has been achieved, or that a "no further action" of a site is warranted and that some soil or ground water contaminants will remain.

The report must discuss the site history, existing conditions, and rationale why the site may no longer require remediation and contamination remain on- or off-site. The rationale must include a finding about future impacts on water quality and human health and safety. The supporting data and summary checklist (Table 1) is to be completed and submitted with the report by the Responsible Party(ies) or their designee. If it has been determined that only soil has been impacted, evidence substantiating the condition must be submitted.

DETERMINING WHEN LUST SITES POSE A LOW RISK TO HEALTH, SAFETY AND THE ENVIRONMENT

The following recommendations are to be applied only to sites contaminated with petroleum hydrocarbon fuels, i.e., gasoline, diesel, fuel oil, aviation fuel mixtures and their additives.

For each case, site characterization is required to determine the extent of contamination, the risk to human health and the environment[1], and the impact on existing and probable future beneficial uses of water resources. Site monitoring must show that the remedial measure(s) applied by the Discharger is reducing or removing the petroleum hydrocarbons at the rate and in the time schedule projected. The Discharger must demonstrate that the selected remedial measure(s) are effective.

CASE EVALUATION

Each site is evaluated on a case-by-case basis to determine if it is a "low risk" case. Upon determining that the case meets the criteria for "low risk", a "no further action required" (NFAR) letter will be issued. Sites with a significant mass of petroleum hydrocarbons left in place are not precluded from consideration of low risk. A case may be a low risk site by definition or, by active or passive remediation, achieve a low risk status.

[1] "Environment" includes the unsaturated or vadose zone, and surface water and ground water.

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Cases may qualify as "low risk" when the lead agency finds that:

1. accurate documentation provided shows the criteria below for Vadose Zone or Ground Water cases have been met;
2. remediation and monitoring verify the criteria will be achieved; and,
3. State and local standards for monitoring well closure have been met and verified.

FOUNDATION DOCUMENTS

Foundation documents for defining site problems and appropriate responses include: State Board Policy No. 92-49: *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304*, as amended; The Water Quality Control Plans (Basin Plans) for the California Regional Water Quality Control Board, Central Valley Region; Title 23, Division 3, Chapter 16 Article 11 of California Code of Regulations, Underground Storage Tank Regulations; and Title 23, Division 3, Chapter 15, Sections 2511(d) and 2550.4 of the California Code of Regulations, Discharges of Waste to Land Regulations.

These documents and the following recommendations are not new, but rather, protocol and procedures that have been available to a tank owner or operator since inception of the Central Valley Regional Board LUST program.

VADOSE ZONE CASES

"Vadose zone" cases are those where fuel hydrocarbons or additives have not reached, and will not reach, the ground water or capillary fringe.

CRITERIA FOR LOW RISK VADOSE ZONE DESIGNATION

All the following must be demonstrated in order to designate a case as a "low risk":

1. **Demonstrate that only the vadose zone has been affected.**

See the Tri-Regional Recommendations, Page nine, Figure 1 and Tables 1 &2, and Appendix A to the Tri-Regional Recommendations.

At some sites, natural biodegradation may be occurring at rates sufficient to provide a rationale for not actively remediating the site or for reducing the degree of active remediation. The Discharger must provide technical documentation for the passive measure and project a time schedule for the remediation to clean up the vadose

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zone soil and/or ground water to acceptable levels. Monitoring must demonstrate that natural biodegradation is occurring at a rate sufficient to protect human health and the environment, after source abatement has been accomplished, and the vadose zone soil and/or ground water will not be used or needed in the projected time schedule.

2. **The release or leak has been stopped and source(s) of hydrocarbons in the vadose zone have been removed or permanently contained.**

"Source(s)" includes non-aqueous phase liquids and any petroleum hydrocarbons and additives in the vadose zone which may be mobile (or could be mobilized) under natural conditions, during construction, or other physical disturbance of the site. The source must be removed and/or contained, to the extent practicable, to prevent further spread of pollutants.

3. **Petroleum hydrocarbons remaining in the vadose zone (or surface soils) do not impact or threaten waters of the State.**

For any mobile constituents remaining in the vadose zone, the rate of potential pollutant migration, fluctuating ground water levels and the depth of pollutants in the vadose zone must be determined. Using fate and transport modeling, leachability studies, or other verification tools, information must be provided to show that there is no impact or threat to surface or ground water quality. Erosion and surface runoff, which may impact surface waters, are prohibited.

4. **No significant risk to human health and safety exists or is anticipated following remediation.**

Risk includes direct physical contact, entry to basements, homes or office buildings and subsurface utilities.

MANAGEMENT STRATEGY

A NFAR letter may be issued when the vadose zone only site conforms to all the above criteria. Changes in land use may require reevaluation of the site conditions and additional remediation measures may be appropriate. The upper soils should be remediated, as appropriate, for current and anticipated land use(s). Documentation of results must be provided in accordance with Appendix B to the Tri-Regional Recommendations.

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GROUND WATER CASES

Central Valley aquifers are unique because they constitute the State's largest aquifer with about 75% of the available water storage in California. Additionally, much of the Central Valley's surface waters are exported for use in Southern California and the San Francisco Bay area, leaving ground waters to provide the majority of Central Valley municipal and domestic use. Considering California's historic growth and growth projections, it is apparent that water demands already exceed the surface water supplies.

Ground water cases are those where petroleum hydrocarbons have reached the ground water or capillary fringe, and include the pollutants in the vadose zone. Water found in tank pits during "tank pulls" may result from local storm events and, so, must be sampled, analyzed and pumped out. If water seeps into the pit after pumping, it is ground water.

CRITERIA FOR LOW RISK GROUND WATER DESIGNATION

All the following criteria must be met:

1. Contaminants remaining in the vadose zone must not reverse or threaten to reverse the mass reduction rate of ground water pollutants discussed in #4 below.

Aquifer water levels may rise in response to rainfall events and, thereby, be impacted by the hydrocarbon contaminants remaining in the vadose zone. Information must be supplied to show that this will not reverse the mass reduction rate.

2. Separate phase product has been removed to the extent practicable.

See Title 23, CCR, Section 2655, Article 5 of the Underground Storage Tank Regulations which requires removal of "free product to the maximum extent practicable" to minimize "the spread of contamination into previously uncontaminated zones."

3. No existing water supply wells, deeper aquifers, surface waters or other receptors are threatened by pollutants remaining in the aquifer.

Water supply wells include municipal, local service or private wells, agricultural and industrial wells. Central Valley aquifers generally are not segregated into discrete units, but are subject to vertical and horizontal migration of water and any pollutants carried by or in the water, often by local pumping. Other receptors include basements, buildings, subsurface utilities, wildlife, etc.

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At times, petroleum hydrocarbon discharges to surface waters occur from nearby ground water seeps or fuel saturated soils. Such discharges are prohibited and must be stopped and prevented from recurring. Until the discharge to surface water is stopped, the site will not be considered for "low risk" designation.

4. **The total pollutant mass remaining in the ground water is decreasing at predicted rates and neither creates, nor threatens to create, a risk to human health and safety or future beneficial use(s) of the aquifer.**

Fate and transport modeling, (including breakdown rates and travel distances, risk based corrective action data and tests, and petroleum hydrocarbon breakdown products resulting from active or passive remediation), may be included in the rationale for determining that the case is "low risk". The rates predicted must be verified with sufficient monitoring.

MANAGEMENT STRATEGY

The existing and potential impact of leaving pollutants in aquifers designated for *Municipal* beneficial uses must be determined by completing a site characterization, remediation and monitoring program. The determination must demonstrate to the lead agency that, at a minimum, by the time the ground water is anticipated to be used, water quality objectives will be achieved and beneficial uses will be protected. The Responsible Party must provide sufficient evidence and rationale to show that the remaining petroleum hydrocarbons may be left in place and are in compliance with applicable statutes, regulations, plans and policies. Documentation of results must be provided in accordance with Appendix B to the Tri-Regional Recommendations. A NFAR letter be issued only when the above work has been completed and site characteristics are shown to meet or exceed the above criteria.

With few exceptions, all waters of the Central Valley are designated in the Basin Plans for the highest uses requiring protection and remediation; i.e. municipal and domestic supply. For these reasons it is imperative that pollution sites be adequately characterized and remediated as appropriate to protect ground water for its designated beneficial uses. From a water quality perspective, the main goal of remediation is the restoration of the beneficial uses of the water within a reasonable period of time, i.e., by the time the water has the probability of being used. To restore beneficial uses, cleanup must at least achieve water quality objectives (limits prescribed in the Central Valley Regional Water Quality Control Plans for the reasonable protection of beneficial uses).

Staff considers economic and technical feasibility constraints for remediation alternatives for protecting waters for their existing and future beneficial uses. Therefore, it is necessary to determine when petroleum hydrocarbons in the environment can be considered or achieve a "low risk" status to remain in place

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while natural processes reduce the adverse impacts in ground water. In considering whether the time anticipated for passive bioremediation is reasonable, several factors may affect the determination. These factors include a comparison to the time anticipated for active remediation, existing use of the ground water and the time for probable use of the aquifer. Thus, if existing or near-term uses of the ground water are impaired, passive bioremediation might not be appropriate. On the other hand, if currently-used waters are not affected, and the pollutants are not expected to migrate to waters that will be used before the remediation is effective, then passive bioremediation may be appropriate. Using either passive or active remediation measures, the end result should be the same: i.e., protection of beneficial uses and achieving compliance with water quality objectives.

All proposals for remediation, whether active or passive, require support by technical reports with rationale demonstrating that the remediation proposed is appropriate and will achieve compliance with the water quality objectives within a reasonable time period. If existing or near-term uses are impaired, more rapid cleanup should be required. If the pollution does not affect currently used aquifers and is not expected to migrate to waters that are currently used, or used the the near future, then cleanup to water quality objectives could be allowed to occur over a longer time frame. In cases where it has been determined that a longer time is appropriate, passive cleanup measures may be considered. Passive cleanup measures do not require a change in the ultimate goal of cleanup—restoration of beneficial uses by reducing pollutants to levels that are lower than applicable water quality objectives. Passive measures are risk based. Risks to beneficial uses drive both cleanup levels and time schedules for cleanup.

NO FURTHER ACTION REQUIRED DOCUMENTATION

The minimum information required in the report is included in Table 1. Submit the data and check-off Table 1 with "yes", "no" or "NA" (not applicable), as appropriate.

Additional information submitted, such as risk assessments or fate and transport modeling, must include the assumptions used.

Upon review, when Board staff determines that the No Further Action Required Report substantiates the request, remedial and monitoring activities may cease. At that time, Board staff will prepare a memo summarizing the remediated site conditions and a No Further Action Required letter issued by the Executive Officer of this Board (or Local Implementing Agency or Local Oversight Program county with concurrence by Regional Board staff).

When soil and ground water pollution remains on site, nothing in the no further action required determination shall constitute or be construed as a satisfaction or

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release from liability for any conditions or claims arising as a result of past, current, or future operations at the location. Nothing in the determination is intended or shall be construed to limit the rights of any parties with respect to claims arising out of or relating to deposit or disposal at any other location of substances removed from the site. Nothing in the determination is intended or shall be construed to limit or preclude the Board or any other agency from taking any further enforcement actions.

The letter does not relieve the tank owner of any responsibilities mandated under the California Health and Safety Code and California Water Code if existing, additional, or previously unidentified contamination at the site causes or threatens to cause pollution or nuisance or is found to pose a threat to public health or water quality. Changes in land use may require further assessment and mitigation.

TABLE 1 - CHECKLIST OF REQUIRED DATA FOR NO FURTHER ACTION REQUESTS AT UNDERGROUND TANK SITES

te Name and Location: ______________________________

__ Distance to production wells for municipal, domestic, agriculture, industry and other uses within 2000 feet of the site;

__ Site maps, to scale, of area impacted showing locations of former and existing tank systems, excavation contours and sample locations, boring and monitoring well elevation contours, gradients, and nearby surface waters, buildings, streets, and subsurface utilities;

__ Figures depicting lithology (cross section), treatment system diagrams;

__ Stockpiled soil remaining on-site or off-site disposal (quantity);

__ Monitoring wells remaining on-site, fate;

__ Tabulated results of all groundwater elevations and depths to water;

__ Tabulated results of all sampling and analyses:

- __ Detection limits for confirmation sampling
- __ Lead analyses

__ Concentration contours of contaminants found and those remaining in soil and groundwater, both on-site and off-site:

- __ Lateral extent of soil contamination
- __ Vertical extent of soil contamination
- __ Lateral extent of groundwater contamination
- __ Vertical extent of groundwater contamination

__ Zone of influence calculated and assumptions used for subsurface remediation system and the zone of capture attained for the soil and groundwater remediation system;

0. __ Reports / Information

- __ Unauthorized Release Form (URF)
- __ QMRs (Dates) ________ ________ ________ ________
- __ PAR
- __ FRP
- __ Other (report name) ______________________
- __ Well and boring logs

11. __ Best Available Technology (BAT) used or an explanation for not using BAT;
12. __ Reasons why "background" was/is unattainable using BAT;
13. __ Mass balance calculation of substance treated versus that remaining;
14. __ Assumptions, parameters, calculations and model used in risk assessments, and fate and transport modeling;
15. __ Rationale why conditions remaining at site will not adversely impact water quality, health, or other beneficial uses; and
16. __ WET or TCLP results

Comments: ______________________________

____

____

By:
Date:

FIGURE II-2

GROUNDWATER BODIES AND BENEFICIAL USES

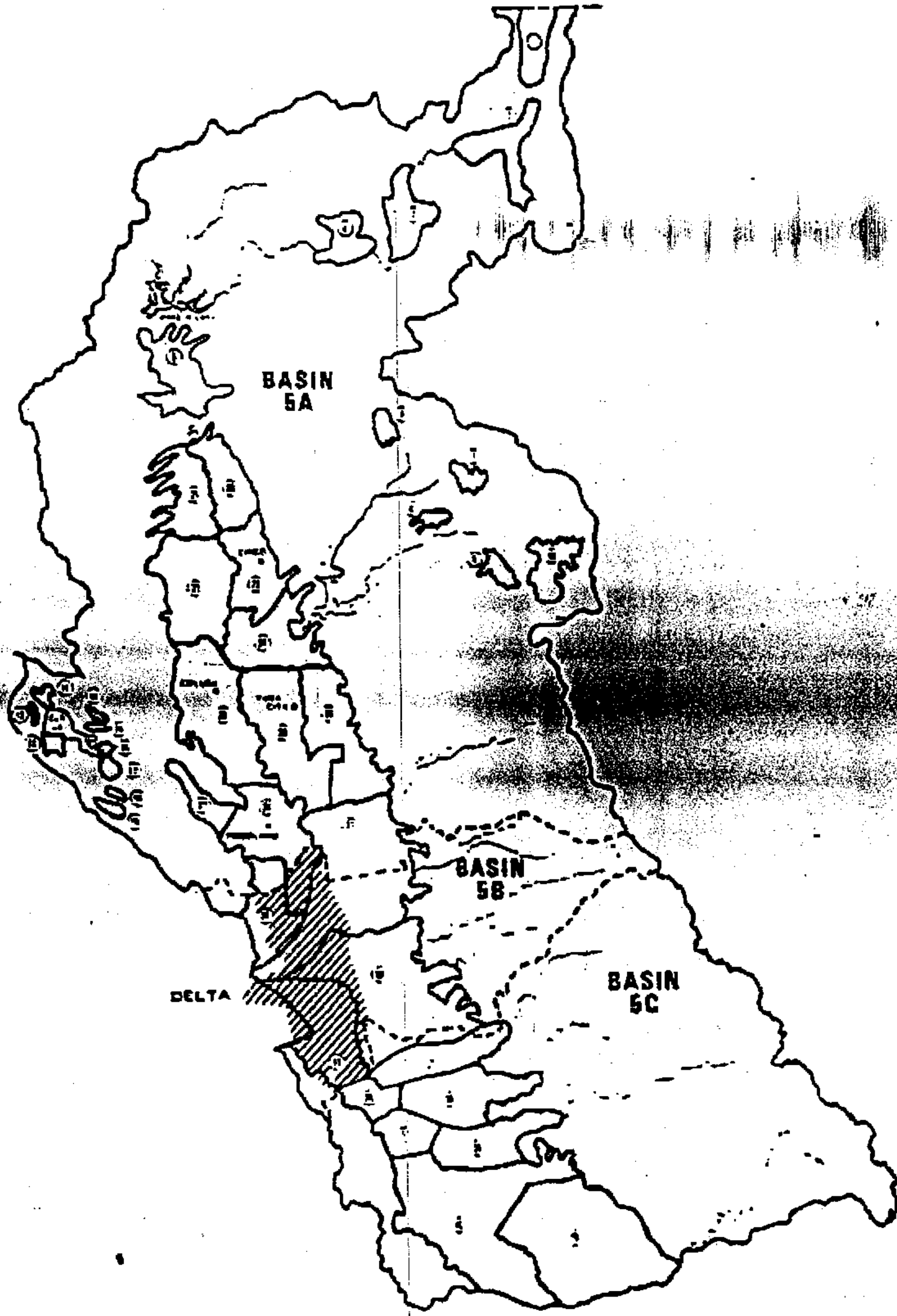

TABLE II-2

GROUND WATER BODIES AND BENEFICIAL USES

		MUNICIPAL AND DOMESTIC	IRRIGATION	STOCK WATERING	PROCESS	SERVICE SUPPLY
1.	GOOSE LAKE VALLEY	●	●	●		
2.	ALTURAS BASIN	●	●	●		
3.	BIG VALLEY	●	●	●		
4.	FALL RIVER VALLEY	●	●	●		
5.	REDDING BASIN	●	●	●	●	
6.	LAKE ALMANOR VALLEY	●	●			
7.	INDIAN VALLEY	●	●			
8.	AMERICAN VALLEY	●	●	●		
9.	MOHAWK VALLEY	●	●	●		
10.	SIERRA VALLEY	●	●	●		
11.	UPPER LAKE VALLEY	●	●	●		
12.	SCOTT VALLEY	●	●	●		
13.	KELSEYVILLE VALLEY	●	●	●	●	
14.	LONG VALLEY	●	●	●		
15.	HIGH VALLEY	●	●	●		
16.	BURNS VALLEY	●	●	●		
17.	LOWER LAKE VALLEY	●	●	●		
18.	COYOTE VALLEY	●	●	●		
19.	COLLAYOMI VALLEY	●	●	●		
20.	EAST TEHAMA CO. & NW CORNER OF BUTTE CO.	●	●	●		
21.	TEHAMA CO. WEST OF SACRAMENTO RIVER	●	●	●		
22.	NORTH BUTTE CO.	●	●	●		
23.	GLENN CO	●	●	●		
24.	SOUTH BUTTE CO	●	●	●		
25.	COLUSA CO. & NORTH YOLO CO	●	●	●		
26.	SOUTH YOLO CO.	●	●	●	●	
27.	CAPAY VALLEY	●	●	●		
28.	SOLANO CO.	●	●	●	●	
29.	PLACER CO. & YUBA CO.	●	●	●	●	
30.	SUTTER CO.	●	●	●		
31.	SACRAMENTO CO.	●	●	●	●	●
32.	SAN JOAQUIN CO.	●	●	●	●	●
33.	CONTRA COSTA CO.	●	●	●	●	●
34.	=*	●	●	●	●	●
35.	I & G	●	●	●		
36.	F	●	●	●	●	
37.	E	●	●	●	●	
38.	D	●	●	●		
39.	A & B	●	●	●	●	●
40.	C	●	●	●	●	

*RECENT DWR DESIGNATION OF GROUNDWATER BODIES IN SAN JOAQUIN BASIN (31-37)