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To:	BARNEY CHAN	Fax:	510-337-9335
From:	MARK LOFTIN	Date:	11/13/03
Re:	WAYNE CHUN – ALAMEDA PROPERTY	Pages:	2
CC:	WAYNE CHUN (925) 439-2302, FRANK GOLDMAN (707) 996-2523		

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Notes:

Mr. Chan,

Here is a stamped coversheet for the September 01, Remedial Action Plan Report for Mr. Wayne Chun's 2301 Santa Clara Ave. property. Please replace the original coversheet per our conversation last week.

Thank You.

CONFIDENTIAL

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REMEDIAL ACTION PLAN REPORT

FOR

FORMER BILL CHUN SERVICE STATION
2301 SANTA CLARA AVENUE ALAMEDA, CALIFORNIA

PREPARED BY:
LOFTIN & ASSOCIATES
1990 BRADSHIRE DRIVE
MOBILE, ALABAMA 36695
(251) 634-1960

SEPTEMBER 1, 2003

PROJECT NO. 9-01-001

REGISTERED PROFESSIONAL ENGINEER
GREGORY S. REIMER
NO. 27262
Exp. 3-31-04
11/12/03
CIVIL
STATE OF CALIFORNIA

REMEDIAL ACTION PLAN REPORT

FOR

FORMER BILL CHUN SERVICE STATION
2301 SANTA CLARA AVENUE ALAMEDA, CALIFORNIA

Alameda County
SEP 1 ? 2003
Environmental Health

From: Wayne Chun
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TABLE OF CONTENTS

I. BACKGROUND OF THE PROJECT

A. REMOVAL OF THE UNDERGROUND GASOLINE STORAGE TANKS

In the summer of 1992, Parker Environmental Services (PES) directed the excavation of two 550 gallon tanks and one 285 gallon tank (installed in 1915) from the former Bill Chun Service Station located at 2301 Santa Clara Ave. in the city of Alameda, California. PES reported that the 285 gallon tank was observed to have a two-inch diameter hole at its base. Approximately 50 cubic yards of contaminated soil was excavated along with the tanks and was subsequently removed for offsite disposal. The tanks served as gasoline storage tanks for a plurality of above ground fuel dispensing stations located at the site.

Since the station was in operation for some time before the Cal-EPA mandates for Methyl-Tertiary-Butyl Ether (MTBE) were implemented across the state, the bulk of the gasoline that leaked from the tanks is thought to be "leaded" motor fuels. However, this gas station was in operation for a brief period of time after MTBE mandates were implemented and some MTBE-containing gasolines may have been put into the 285 gallon tank. No analytical data prior to this report appears indicates the presence of MTBE or its derivatives in soil gas. However, the analytical data performed on groundwater for this report suggested very low concentrations may be present n the groundwater. This would be consistent with a general view that very little, if any, MTBE-based fuels leaked from this tank.

Since a retail gasoline station has existed at this site possibly since 1915, leaks probably existed for sometime before the tanks were excavated. The petroleum hydrocarbons likely have since migrated into the surrounding soils and dissolved to a large extent into the groundwater. Some of this contaminated soil could not be excavated due to adjacent structures. Also, the gradual flow of the groundwater away from the original location of the tanks has further spread these petroleum contaminates to adjacent areas. It is estimated that since the tanks were excavated, these contaminants have "flattened" on top of the water table and extend up to as much as 30 feet away from the original leak point at the tanks in the general direction of groundwater flow.

B. GENERAL SITE HYDROPHYSIOLOGY AND GEOLOGY

The site is approximately 30 feet above mean sea level (MSL) as reported by the U.S. Geological Survey (1980). Most of the sediments underlying the site are identified as "Merritt Sand" and are well sorted, fine to medium grained sand particles washed into the area from the nearby Diablo Range to the east. Although the elevation of the groundwater table is known to vary seasonally, Environmental Science & Engineering, Inc. (ESE) initially reported that groundwater ranged from 10 to 15 feet Below Grade Surface (BGS). Others have reported a more specific range of between 8 and 10 feet BGS with a sloping gradient extending northward and eastward at approximately 0.07 inches/foot across the site. However, much variation in gradient slope and direction has been noted over the past several years. ENSR reported in 1998 that occasional flow variation to the northeast can occur. Soil borings taken by ENSR in 1998 reported the following general soil characteristics across the site:

- 0 – 7 ft. – Moist, brown silty sands

- 7 – 8 ft. – Brown clayey sand
- 8 – 11 ft. – Moist, brown silty sand with decreasing silt content with depth
- 11 – 25 ft. – Wet to saturated course grained sands

Backfill soil was purchased to replace the contaminated soils excavated with the tanks. This backfill soil is very different in composition from the natural soils in the area and covers approximately 50-60 cubic yards around the location of the excavated tanks and extends to a lesser extent towards the former location of the fuel dispensing pumps.

For additional subsurface geology and hydrogeology information, see the report entitled "Aquifer testing Related to the Former Underground Storage Tanks…" by Franklin J Goldman in Appendix B.

C. PARKER ENVIRONMENTAL SCIENCES REPORT, SEPTEMBER 1992

In August of 1992, Parker Environmental Services performed additional soil sampling from the areas below the original three tanks (9 ft. BGS), the "service island" area (1.5-2.5 ft. BGS) and the soil pile adjacent to the tank excavation hole. The analysis of these soil samples confirmed prior observations that the 285 gallon tank was the primary leak point since the highest TPH concentrations were in the native soils around this tank. However, significant levels of TPH were found in the native soils around the other tanks, which suggests that even if the 285 gallon tank were the original source of hydrocarbons, the plume had spread fairly significantly to the northeast. Since the excavated soils did not appear to have high concentrations, it could be concluded that most of the leaked gasoline has saturated the native soils below the tanks. Also, the "service island" area did not appear to have a significant presence of gasoline hydrocarbons.

D. ENVIRONMENTAL SCIENCES PRELIMINARY SITE ASSESSMENT REPORT, MARCH 1993

In January of 1993, Environmental Sciences and Engineering, Inc. (ESE) supervised the drilling of three soil borings to a depth of approximately 25 ft. Samples were taken at approximately 5 ft. intervals. These soil borings were converted to 2 inch monitoring wells (designated MW1, MW-2 and MW-3) and were all screened from 10 feet BGS to 25 feet BGS. For the soil borings, analyses were conducted for petroleum-range hydrocarbons and organic lead. ESE noted that the highest concentrations of petroleum hydrocarbons appeared to begin at approximately 10 feet BGS. ESE's March report stated that the static groundwater levels measured at that time were 15 feet BGS. However, ESE's October 1993 report contained a section that summarized the March Report's findings and stated that the static groundwater level was approximately 9 feet BGS. It is assumed that the March report is incorrect and that the static water level was measured was actually 9 feet BGS, not 15 feet BGS. ESE also reported that no odor to "slight odor" was present at or below the depth of first groundwater.

Composite samples for each soil boring were prepared at the 10-foot interval and were reported to contain the following (TPH-g = gasoline range organics, TPH-d = diesel range organics):

- MW-1 - 640 ppm, weathered TPH-g, 10 ft. BGS
- MW-2 – 5,800 ppm TPH-g, 10 ft. BGS

- MW-3 - 2,100 ppm, weathered TPH-g, 10 ft. BGS

ESE also sampled groundwater at the 9-foot depth and analyzed it for gasoline-range organics. They reported the following data:

- MW-1 - 110 ppm TPH-g, 9 ft. BGS
- MW-2 - 85 ppm TPH-g, 9 ft. BGS
- MW-3 – 8.5 ppm weathered TPH-g, 9 ft. BGS

In addition to this analytical data, ESE also reported that no organic lead was detected in the groundwater samples and that the "preferred direction of petroleum hydrocarbon migration will be toward the west."

E. ENVIRONMENTAL SCIENCES ADDITIONAL SITE ASSESSMENT REPORT, OCTOBER 1993

ESE conducted a second round of soil investigations in September of 1993. Four additional soil borings were performed which were completed into 2" monitoring wells (MW-4, MW-5, MW-6, and MW-7) and screened from approximately 7 feet BGS to 25 feet BGS. Soil samples were collected at 5-foot intervals. ESE reported that the soil lithology across the northwest edge of the site (where MW-4, MW-5, and MW-6 were installed) contained a 4 to 9 feet thick "clayey sand" material starting at about 4 feet BGS. This was a slightly different lithology in this area than was described for MW-1, MW-2 and MW-3 in the March 1993 report.

A summary of the analytical results of soil borings are as follows (note that none of these samples were indicated as "weathered TPH-g" as was noted in the March 1993 report for MW-1 and MW-3):

- MW-4 - no TPH-g detected, 10 ft. BGS
- MW-5 - 11,000 ppm TPH-g, 10 ft. BGS
- MW-6 - 3,400 ppm, TPH-g, 10 ft. BGS
- MW-7 - 9,000 ppm TPH-g, 9.5 ft. BGS, 13,000 ppm TPH-g, 10 ft. BGS

A summary of the analytical results of groundwater samples are as follows:

- MW-1 - 28 ppm mg/l TPH-g, 1 ppm TPH-d, 9 feet BGS
- MW-2 - 140 ppm TPH-g, 8.2 ppm TPH-d, 9 feet BGS
- MW-3 - 2.8 ppm TPH-g, 2.5 ppm TPH-d, 9 feet BGS
- MW-4 - 0.44 ppm TPH-g, 0.33 ppm TPH-d, 9 feet BGS
- MW-5 - 37 ppm TPH-g, 1.7 ppm TPH-d, 9 ft. BGS
- MW-6 - 10 ppm, TPH-g, 1.4 ppm TPH-d, 9 ft. BGS
- MW-7 - 24 ppm TPH-g, 1.3 ppm TPH-d, 9 ft. BGS

ESE noted that the highest concentrations of groundwater contaminants were in MW-1, MW-2, MW-5 and MW-6, which are all down gradient (northeast) from the former UST's. The presence of contaminants in MW-3 and 4 (up gradient) suggest there is off-site migration of contaminants onto the site unrelated to the UST's removed from this property. There was also approximately 3 inches of floating gasoline detected in MW-5. However, sampling one week prior to this did not detect this floating product layer in this well.

ESE also performed a series of slug-tests in an effort to determine groundwater flow parameters, such a hydraulic conductivity and transmissivity, so that a model could be developed to predict the rate of migration of contaminants via natural groundwater flow. The results indicated hydraulic conductivity/transmissivity values of 0.0015 feet/min. and 0.02 sq. ft. /min. respectively, which are consistent with values typically found for subsurface soils similar to this site (predominantly silty sands). ESE also extrapolated this model data to suggest that a single, 1 gallon-per-minute pumping rate at MW-1 would capture the estimated groundwater plume as it was believed to exist at that time.

F. FUGRO ADDITIONAL SITE ASSESSMENT AND REMEDIATION REPORT, FEBRUARY 1995

In 1995, Fugro West issued a report covering a limited subsurface investigation, vapor extraction pilot test and limited investigation of off-site sources of hydrocarbon contaminants. A 2" soil vapor extract well was installed (SV-1) approximately 15 feet northwest of the former UST excavation area and screened from 5 to 9.5 feet BGS. Fugro also reported that the groundwater gradient was northwesterly, which is different from that generally reported by prior subsurface investigations (north to northeasterly gradient). Groundwater elevations were also studied periodically over a 4 month period at MW-5 and MW-7 (from Aug. 12, 1994 to Dec. 20, 1994). The results generally indicated that MW-5's groundwater elevation decreased from 9.8 ft. BGS to 8.6 ft. BGS over this period. MW-7's groundwater elevation also decreased from 9.8 ft. BGS to 9.1 ft. BGS with a period in November where both wells recorded a high point of 8.6 ft. BGS. Over this period, approximately 0.2 gallons of free product was recovered from these two wells.

Ten (10) soil samples were taken around the tank excavation cavity at a depth of approximately 8 feet BGS. However, since this depth is well above any previously reported zone of contamination, none of these samples indicated the presence of contaminants at this depth. Three (3) other soil samples were taken by hydropunch in the streets adjacent to the property, one along Santa Clara Ave (HP-1) and two along Oak Street (HP-2 and HP-3). These soil samples were taken at a depth of 11 feet BGS. The results were as follows:

- HP-1 - 4,600 ppm TPH-g, 11 feet BGS
- HP-2 - no TPH-g detected, 11 ft. BGS
- HP-3 - no TPH-g detected, 11 ft. BGS
- SV-1 - 8,400 ppm TPH-g, 9.5 ft. BGS

The soil vapor extraction testing conducted on SV-1, using 50 inches of w. c. vacuum at the wellhead, indicated that 10,000 ppm TPH-g (by field PID detector) was present during the first 30 minutes of extraction and gradually lowered to 7,000 ppm TPH-g over the next hour. The well flow stabilized at 13 SCFM at this wellhead pressure. A soil gas sample was collected at the end of the test and sent into the laboratory for more accurate analysis. This sample indicated 9,000 ppm was present in the soil gas from SV-1 at the end of the test. Shorter tests were conducted on MW-4, MW-6, and MW-7 as well. The overall results of this SVE testing were as follows:

- SV-1 - 13 SCFM at 50" w.c., 7,000 ppm TPH-g at 1.5 hrs by field PID
- MW-4 - 18 SCFM at 50" w.c., 10 ppm TPH-g at 10 min. by field PID
- MW-6 - 4 SCFM at 30" w.c., 950 ppm TPH-g at 10 min. by field PID
- MW-7 - 3 SCFM at 35" w.c., 10,000 ppm TPH-g at 7 min. by field PID

Lateral influence was also analyzed during this SVE test by applying a vacuum to a well and measuring the wellhead pressures in nearby wells. This type of testing can give some indication of the extent that a subsurface pressure gradient can be established, which will aid in the migration of soil gases from the surrounding soils into the extraction well. This testing generated the following results. (Note: MW-4, MW-5, MW-6 and MW-7 are screened from 7 to 25 ft. BGS. SV-1 is screened from 5 to 9.5 feet BGS.)

SV-1 – At 50" w.c. vacuum (after 90 minutes),
0.02" w.c. vacuum detected at MW-4 (40 ft. away, due west)
0.17" w.c. vacuum detected at MW-6 (21 ft. away, due north)
0.05" w.c. vacuum detected at MW-7 (31 ft. away, due east)
no vacuum detected in MW-5 (11 ft. away, due west)

MW-4 – At 30" w.c. vacuum (after 10 minutes),
0.02" w.c. vacuum detected at SV-1 (40 ft. away, due east)
no vacuum detected in SV-1, MW-5, MW-6 or MW-7

MW-6 – At 30" w.c. vacuum (after 10 minutes),
0.02" w.c. vacuum detected at SV-1 (40 ft. away, due east)
no vacuum detected in SV-1, MW-5, MW-6 or MW-7

MW-7 – At 35" w.c. vacuum (after 7 minutes),
0.03" w.c. vacuum detected at SV-1 (31 ft. away, due west)
0.02" w.c. vacuum detected at MW-4 (65 ft. away, due east)
0.37" w.c. vacuum detected at MW-6 (36 ft. away, northwest)
no vacuum detected in MW-5 (41 ft. away, due east)

Fugro also researched possible sources of off-site migration of contaminants into the monitoring wells at the site. Several former UST's were identified in the vicinity of the property that appear to have contained petroleum hydrocarbons. Although the records did indicate that most had since been removed, there were no records found indicating leaks discovered or environmental assessments performed.

In October of 1995, Fugro installed ten (10) temporary groundwater monitoring wells using a PowerPunch technology to assist in further assessment of the plume migration. Subsequently, **the analytical data was used to locate four (4) additional monitoring wells (MW-8, MW-9, MW-10 and MW-11) that were installed in November, 1995.**

F. ENSR CORRECTIVE ACTION EVALUATION AND FEASIBILITY STUDY, JUNE 1998

In 1996, Fugro prepared a workplan and addendum report (Fugro, August 1996 and October 1996) recommending four site assessment tasks. ENSR, who acquired Fugro West, Inc. in 1997, subsequently modified this assessment task list to include the preparation of a Risk-based Corrective Action study and additional exploratory soil sampling to assess the extent the plume migration.

ENSR also prepared an assessment of remediation alternatives and identified that prior SVE testing data was not usable since the applied vacuum likely lifted the water table to cover the screened interval for the extraction well. ENSR also concluded that this phenomena accounts for the relatively low soil gas flow rates indicated in the prior SVE testing. ENSR recommended the combining of vapor extraction and groundwater pumping as the recommended method of remediating this site.

G. GEOSOLVE RISK-BASED CORRECTIVE ACTION (RBCA) REPORT, NOVEMBER 2000

Geosolve prepared a RBCA report at the request of Alameda County Department of Environmental Health. The purpose of this report was to identify whether there are any sensitive receptors nearby that could be affected detrimentally by off-site migration of contaminants found at the site. The primary sensitive receptors in this case are drinking water supplies. Also, the RBCA report would attempt to determine the minimum ppm levels of target contaminants that would be required to reduce the impact to sensitive receptors to acceptable levels.

Geosolve recommended that both soil and groundwater remediation should be performed for this site with clean-up levels to 0.41 ppm benzene for soil and 3.8 ppb benzene in groundwater. Geosolve also recommended that more definitive groundwater pumping and soil vapor extraction data must first be obtained before designing a dual-phase remediation system.

II. DESCRIPTION OF THE TESTING PERFORMED

A. PUMPING / EXTRACTION TEST WELL CONFIGURATION RELATIVE TO SITE HYDROGEOLOGY

Prior to the design of a soil vapor extraction system and/or a groundwater pumping and treating, accurate data as to the expected yields of soil gas and groundwater must be precisely determined so that the surface treating equipment and piping can be properly sized. Prior field tests relating to soil gas and groundwater extraction rates were intended primarily to determine whether the subsurface conditions across the site were generally favorable to groundwater pumping and soil vapor extraction technologies. Prior environmental assessment reports indicated that dual-phase extraction, or DPE, wells (i.e., both soil gas and groundwater are simultaneously extracted from each well) would be the appropriate technology to remediate this site. The next step is to design the type of DPE well to be used and test it to determine specific performance parameters in both native and non-native soils.

Based upon past subsurface investigations, the smear zone appears to be located between 9 and 11 feet BGS and contains predominantly silty sands. The zone of silty sand below eleven (11) feet BGS are area where benzene and other soluble contaminants would migrate laterally in groundwater. A 4" PVC well design was chosen as the minimum size necessary to perform dual-phase extraction at this site. Three (3) 4" PVC wells were installed in December of 2002 under the direction of Geosolve and are designated EW-12, EW- 13 and EW-14 (See Figure 3 in Appendix A).

B. PRE-PUMPING TEST ACTIVITIES AND GENERAL PROCEDURES EMPLOYED

For a discussion of the pumping test procedures, refer to the report entitled "Aquifer testing Related to the Former Underground Storage Tanks…" by Franklin J Goldman in Appendix B.

C. SOIL VAPOR EXTRACTION TESTING ACTIVITIES AND GENERAL PROCEDURES EMPLOYED

The wellheads made for the 4" PVC well casings were secured to the casing using a rubber coupling and screw clamps. The wellheads had two 1" ports, one for the groundwater pump discharge and the other for soil vapor extraction. The wellheads also had two 3/4" ports, one for the pump power cable pass-thru and one for connecting a pressure gauge. The power cable pass-thru port was sealed using a silicon-based caulking material.

A trailer-mounted vacuum blower was rented from a local environmental testing equipment vendor. The blower selected was sized for 50 SCFM @ 40" w.c. vacuum pressure. The discharge of the blower was routed through two 55-gallon drum activated carbon canisters connected in series. The outlet of these canisters was vented to the atmosphere. Air flow measurements were taken using a hand-held anometer, which measured air velocity in the 2" air-discharge pipe from the carbon canisters. The diameter of this pipe was input to the anometer controller which converted the velocity measurements to volumetric flow in Actual Cubic Feet Per Minute (ACFM). Four-inch diameter hoses were adapted to the wellheads ports on EW-12 and EW-14. Valves were installed so that the wells could be quickly isolated from the vacuum blower as needed. Both hoses were connected to a manifold located on the vacuum blower suction.

The Soil Vapor Extraction (SVE) testing involved subjecting each well to two different levels of vacuum and measuring the corresponding air flow. The first level of vacuum was accomplished by opening the control valve at each well to full-open, which represented the maximum level of vacuum pressure the blower could deliver to the well. A lower, second level of vacuum was induced by throttling the control valve so that 50-70% of the first vacuum level was obtained at the well. The data collected would be used to generate predicted soil gas yield curves to be used in sizing the blower to be used in the permanent remediation system. A second test was performed where both wells were subjected to full vacuum pressure and the resulting total air flow rate was measured. The purpose of this test was to determine the "derating" factor to apply for multiple extraction well operation. This factor will be applied to the individual well yield curves to predict the soil gas yields when operated in multi-well "pattern" extraction modes.

D. MANAGING GROUNDWATER LIFT IN THE WELL DURING TESTING

Since water levels typically elevate when vacuum is applied to the wellhead with the water level at the normal water table level, both wells (EW-12 and EW-14) were drawn down to approximately 16-17 feet BGS and allowed to stabilize prior to operating the SVE blower.

The water level was measured using the electric water level sounder inserted through one of the 3/4" ports on the wellhead. The port was then sealed up and the vacuum blower was turned on. Both wells were continuously pumped throughout the pumping tests. When the tests were complete and the blower shut-off, one of the 3/4" port was quickly opened and the water level was checked.

In theory, assuming 40 inches of H2O vacuum translates to approximately 3 feet of water lift, at 17 feet starting water level, the screened interval of the well during testing should be approximately 7 to 14 feet below grade surface (BGS) during testing. These measurements suggested that the water level rose approximately 2-3 feet in each well while under vacuum. The exposed area of perforated casing for each well was estimated to be approximately 6.0 – 6.5 sq. ft. (Note: Prior SVE testing was believed to be erroneous because this water level lift was not accounted for during testing. The applied vacuums to the extraction wells elevated the water levels inside the well such that the perforated sections of the well casing became "blinded.")

III. GROUNDWATER PUMPING AND AQUIFER TESTING

For a discussion of the groundwater pumping test results, refer to the report entitled "Aquifer testing Related to the Former Underground Storage Tanks…" by Franklin J Goldman in Appendix B.

IV. SOIL VAPOR EXTRACTION TESTING

A. DESCRIPTION OF THE DATA COLLECTED

SUSTAINED VAPOR RATES AND WELLHEAD PRESSURES FROM EW-12 AND EW-14

Well EW-14, located within the former UST excavation area, yielded 32.2 ACFM of soil gas at a wellhead pressure of 45.5 inches of water, vacuum (inH2O(v)). The control valve was then throttled and the well yielded 20.6 ACFM at 24 inH2O(v).

Well EW-12, located adjacent to the former UST excavation area in the undisturbed native soil, yielded 9 ACFM of soil gas at a wellhead pressure of 57 inH2O(v). The control valve was then throttled and the well yielded 7.2 ACFM at 41 inH2O(v).

With both wells under vacuum and the control valves full open, the combined extraction rate was recorded as 40.6 ACFM with EW-12 showing a 39 inH2O(v) wellhead pressure and EW-14 showing 44.5 inH2O(v) wellhead pressure.

TABLE 1
SOIL GAS YIELD DATA FOR EW-12 AND EW-14

VALVE POSITION	WELLHEAD VACUUM PRESSURE IN H2O(v)	EW-12 SOIL GAS RATE ACFM	EW-14 SOIL GAS RATE ACFM
100% OPEN	45.5	-	32.2
50% OPEN	24.0	-	20.6
100% OPEN	57.0	9.0	-
50% OPEN	41.0	7.2	

TABLE 2
SOIL GAS YIELD DATA FOR EW-12 AND EW-14 COMBINED

EW-12 WELLHEAD PRESSURE IN H2O(v)	EW-14 WELLHEAD PRESSURE IN H2O(v)	COMBINED EW-12 AND EW-14 SOIL GAS RATE ACFM
39	44.5	40.6

LATERAL INFLUENCE ON ADJACENT MONITORING WELLS

Well EW-14 was subject to 43 inH2O(v) and vacuum pressures were measured at EW-12 (17 ft. away, north), MW-5 (19 ft. away, northeast), and MW-2 (13.5 ft. away, north). Well EW-12 was subjected to 57 inH2O(v) and vacuum pressures were measured at EW-14 (17 ft. away, south), SV-1 (4 ft. away, southwest), MW-2 (4.5 ft. away, south), MW-5 (10.5 ft. away, west), MW-6 (10.5 ft. away, north) and MW-7 (13.5 ft. away, east). Since MW-7 and SV-1 were fitted with devices for measuring wellhead pressure after the initial test on EW-14, a second test was performed on EW-14 to obtain data for these wells. This second test subjected EW-14 to 39 inH20(v) and vacuum pressures were measured at MW-7 (17 ft. away, northeast) and SV-1 (15.8 ft. away, north). The following table summarizes this data.

TABLE 3
LATERAL INFLUENCE TEST DATA

Well	Wellhead pressure, inH2O (vacuum)	Linear Distance to Extraction Well, ft.	Extraction Well Flow Rate (ACFM)	Est. Depth of Exposed Screened Well Casing, ft. BGS	Est. Area of Exposed Well Screen, sq. ft.
EW-14	**43**	-	**33**	7 – 13	6.3
EW-12	0.36	17	-	7 – 13	6.3
MW-5	0.06	19	-	7 – 8.5	0.8
MW-2	0.0	13.5	-	Blinded	0
EW-12	**57**	-	**9**	7 – 13	6.3
EW-14	0.09	17	-	7 – 13	6.3
SV-1	1.4	4	-	5 – 8.5	1.8
MW-2	0.0	4.5	-	Blinded	0
MW-5	0	10.5	-	7 – 8.5	0.8
MW-6	0	10.5	-	7 – 8.5	0.8
MW-7	0	13.5	-	7 – 8.5	0.8
EW-14	**39**	-	**35.6**	7 – 13	6.3
EW-12	0.66	17	-	7 – 13	6.3
MW-7	0.4	17	-	7 – 8.5	0.8
SV-1	0.26	15.8	-	5 – 8.5	1.8

ANALYTICAL DATA ON SOIL GAS SAMPLES

Two soil gas samples were collected in tedlar bags from each of the vapor extraction wells, EW-12 and EW-14. The first sample was taken approximately 5 minutes after each the well was under vacuum. The second sample was taken after observations were made from the surrounding monitoring wells. The elapsed time was approximately 20-30 minutes after the start of vapor extraction. The samples were analyzed by EPA Method 8015M (Gasoline Range organics by PID/FID detector) and EPA Method 8020 (gas BTEX and MTBE by PID/FID detector). The analytical results are presented in the table below. The Method 8020 analysis on all four samples reported the presence of MTBE. Although no presence of MTBE was reported in prior analysis by other parties, MTBE-containing gasoline may have been stored in the original UST since it was still in service when the regulations requiring the MTBE additive in gasoline were implemented.

TABLE 4
LABORATORY RESULTS OF EW-1 2 AND EW-14 SOIL GASES

Sample	TPH-g, ppmV	Benzene, ppmV	Ethylbenzene, ppmV	Toluene, ppmV	Xylenes, ppmV
EW-12-A	5,100	220	44	250	160
EW-12-B	2,800	120	20	130	69
EW-14-A	340	9.1	3.8	9.2	14
EW-14-B	320	13	4.2	16	16

B. OBSERVATIONS AND CONCLUSIONS OF THE DATA

PREDICTED SOIL GAS YIELD CURVES FOR EW-12 AND EW-14

Figures 1 and 2 show plot graphs of the soil gas flow rate as a function of the wellhead pressure. Well EW-14 was installed into the area that was excavated when the UST's were removed. The material used for back-fill constitutes the predominant soil surrounding the screened interval for this well. Therefore, it was expected that this well would generate higher soil gas yields since it was installed and screened in non-native, disturbed soils. Well EW-12, which is located in native, non-disturbed soils, showed a much reduced soil gas yield as expected. The ratio of yields from these two wells at a given wellhead vacuum is approximately 5 decreasing to 4 at higher vacuum levels. Assuming the subsurface geology is relatively similar across the site, an average factor of 4.5 could be applied to estimate vapor yields from wells installed in the excavation area relative to extraction wells installed in the native undisturbed soil at the site.

For the combined well flow test, the predicted yield curves for these well indicated that approximately 39 ACFM of soils gas should be recovered, whereas 40.6 SCFM was actually recovered. This indicates that very little "derating" effect was measured for these two wells. Several factors might explain the relative independence of these two wells including: 1) EW-14 is screened in non-native, disturbed soils whereas EW-12 is screened in native, non-disturbed soils and 2) The lateral distance between these wells is 17 feet, which is far enough away so that soil gas flow patterns are not significantly overlapping.

PREDICTED SUBSURFACE ZONES OF EFFECTIVE LATERAL INFLUENCE

The lateral "influence" of an extraction well relates to the ability of the vacuum pressure applied to the well to translate away from the well into the surrounding soils. The rate at which soil gases move toward the extraction well is dependent on the subsurface pressure gradient established, which is in turn dependent on the relative porosity of the soil particles. The greater this lateral "influence," the fewer extraction wells are required to cover the general area of contamination.

From the data shown in Table 2, two primary conclusions can be drawn:

1. EW-14 ~~has a lateral influence of approximately~~ 20 ft. This well was installed in the back-fill soils, which have a much higher porosity than the native soils. One more extraction well inside the excavation zone will likely be required to cover this area (See Figure 3, Proposed DPE Well Locations and Piping Layout for existing and new wells, EW-17.)

2. EW-12 has a lateral influence possibly up to 10 ft. and yielded much less soil gas due to the relatively low permeability of the native undisturbed soils. A minimum of three additional extraction wells to the south of the tank excavation area will likely be required for adequate coverage. (See Figure 3, Proposed DPE Well Locations and Piping Layout for existing and new wells, EW-15, EW-16 and EW-17).

Based upon the layout shown in Figure 3, a minimum of three additional wells will need to be installed along the edge of the property adjacent to the Flower Shop. Based upon the native versus non-native soil well data, the design soil gas rate for this 6-well system operating at 60 in H2O(v) would be approximately 110 cubic feet per minute.

The existing monitoring wells will be used to aid in the influx of atmospheric air into the soil. As the water table is lowered, the monitoring wells will be opened to allow ambient air to enter and replace those gases removed by the extraction wells.

V. FINAL CONCLUSIONS AND RECOMMENDATIONS

A. OVERALL REMEDIATION SYSTEM DESIGN PARAMETERS

Based upon the test data the design soil vapor extraction parameters are 110 SCFM at 60 inches of H2O(v). This design yield of soil gas should be obtained by installing three new extraction wells (EW-15, EW-16 and EW-17), one in the tank excavation area and two in the native soils to the south of the tank excavation area along the wall of the Flower Shop. The expected groundwater pumping rate for all 6 wells will be in the range of 15-20 gallons per minute (21,600-28,800 gal/day). Each well should be a dual-phase extraction type, screened from between 7 and 13 feet BGS and soil gas extraction should always occur simultaneously with groundwater pumping to keep groundwater levels below the bottom of the well screen.

B. RECOMMENDED SOIL VAPOR AND GROUNDWATER TREATMENT PROCESS

These 6 DPE wells should have electrical submersible well pumps installed and be piped to a Corrugated Plate Interceptor (CPI) vessel to allow any free hydrocarbon product and sediments to separate from the water. Any free product will be collected in an auxiliary vessel while the groundwater is disposed of through the area's industrial water sewer system pursuant to any permit conditions required by the East Bay Municipal Utility District permit. Due to the relatively low contaminant level likely to be generated by this groundwater pumping, polishing treatment at the surface may not be required. However, monitoring of benzene and total petroleum hydrocarbons will likely be required as part of the discharge permit conditions.

Soil gases should be extracted from these wells using a sparkless centrifugal vacuum blower in a special acoustic enclosure to minimize noise. The discharge of this blower should be piped to a catalytic converter where the hydrocarbons are destroyed. The exhaust gases should be cooled and discharged to the ambient area. Monitoring equipment will likely be required by the Bay Area Air Quality Management District (BAAQMD) on the incoming and outgoing soil gases from the treatment process as part of the permitting conditions. Catalytic Thermal Oxidization technology will likely be the most economical VOC destruction method to employ during the early phases of operation while the VOC concentrations are highest. The VOC treatment method can be switched to Activated Carbon Absorption once the soil gas VOC concentrations fall to lower levels.

C. NEXT PHASE OF WORK TO IMPLEMENT THIS REMEDIAL ACTION PLAN

To construct a 6-point dual-phase well system such as this, the property will need to be prepared for construction. For this property, this means that the existing Kiosk, Canopy and Garage structures will need to be removed. As shown in Figure 4, the area required to house the above mention equipment is estimated to be 16 ft. (L) x 12 ft. (H) x 12 ft. (W). The surface treating equipment and controls should be trailer-mounted and provided with remote-monitoring capabilities so that all process parameters can be observed, trended and recorded to show efficacy of contaminant removal.

Summarized below are the major steps required to implement this interim remediation plan for this site:

1. Prepare the site for construction by removing all existing old structures, such as kiosk, garage and island canopy.

2. Obtain permits from Bay Area AQMD (for the soil vapor venting), East Bay Municipal Utility District (EBMUD) (for sewer discharge permit), and all other local agencies for which permits will be required (wells, etc.)

3. Install the new extraction wells EW-15, EW-16, and EW-17, identical to EW-12, EW-13 and EW-14.

4. Prepare a detailed engineering design package of the surface treating equipment, pursuant to all permit requirements, including specifications for controls and electrical systems and issue purchase orders for all equipment and materials.

5. Prepare and issue construction contracts for the installation of the groundwater and soil gas transfer piping, electrical wiring, equipment pad, equipment hook-ups, utilities tie-ins and surface enclosures per the detailed engineering design package.

6. Prepare and issue a contract for start-up, operating monitoring and maintenance of the system.

confirmation sampling?

7. When the remediation system appears to have reached a point of minimal contaminant removal rates, have the soil and groundwater tested and submit a report to the Alameda County Health Department to request a determination of whether the clean-up has been achieved to acceptable levels.

D. REMEDIATION SYSTEM CONSTRUCTION AND OPERATION IN CONJUNCTION WITH PROPERTY DEVELOPMENT

The construction and operation of a groundwater pumping and soil gas extraction system can be implemented simultaneously with some commercial development of the property. Whether the remediation effort can be feasibly and economically integrated with the development of the property is largely dependent on 1) the size of the property (open areas available), and 2) the type of commercial development involved.

The relatively small size of this property necessitates that optimum space utilization techniques be employed in the design and construction of any commercial structures thereon. As shown in Figures 3, the anticipated size of the remediation treating and control process will occupy approximately a 16 ft. (L) x 12 ft. (H) x 12 ft. (W). The wells will be located at various points on the property and underground pipes and conduit will transfer fluids and power between the wells and the process. The remediation process area is expected to be located in the northwest corner, which might be the rear area of a building faced on to Santa Clara Ave.

For this site, the most problematic issues with simultaneous remediation and commercial development primarily concern the maintenance and monitoring of the DPE wells. Although any proposed new wells and underground piping could be installed prior to construction of any above-ground structures, the wellheads would need to be readily accessible for maintenance and repairs throughout the project. Accessibility is difficult to manage in an office structure where ceilings are relatively low and walls often limit a clear distance away from the well inside the building. Access to the excavation area may be required ~~wells will also be required~~ to perform soil borings and other sampling at the end of the remediation effort to establish the extent of contaminant removal. Any structure over the excavation area will make such sampling difficult and, in some cases, impossible.

In light of these considerations, we are recommending that this interim remediation effort be completed prior to commercial development of this property to the extent that such development renders the proposed extraction wells and tank excavation area inaccessible to further soil borings, groundwater sampling and well maintenance. If the interim remediation effort, as proposed herein, is successful at removing sufficient levels of contaminants such that no further remediation effort is required by Health Department officials, unhindered commercial development can then be pursued. If further remediation efforts are required, a method can then be chosen which is more compatible with construction of structures on the property (e.g., enhanced bio-remediation). The simultaneous remediation and commercial development for this small property will likely result in excessive costs, unfavorable design compromises and potentially unmanageable business interruptions. Nonetheless, if necessary, the remediation effort could be designed in conjunction with some commercial development. However, for this sized property and the relatively short-term duration anticipated for this interim remediation effort, simultaneous remediation and commercial development would not be preferred.

FIGURE 1
Predicted Yield Curve - EW-12
(Native Soil Well)

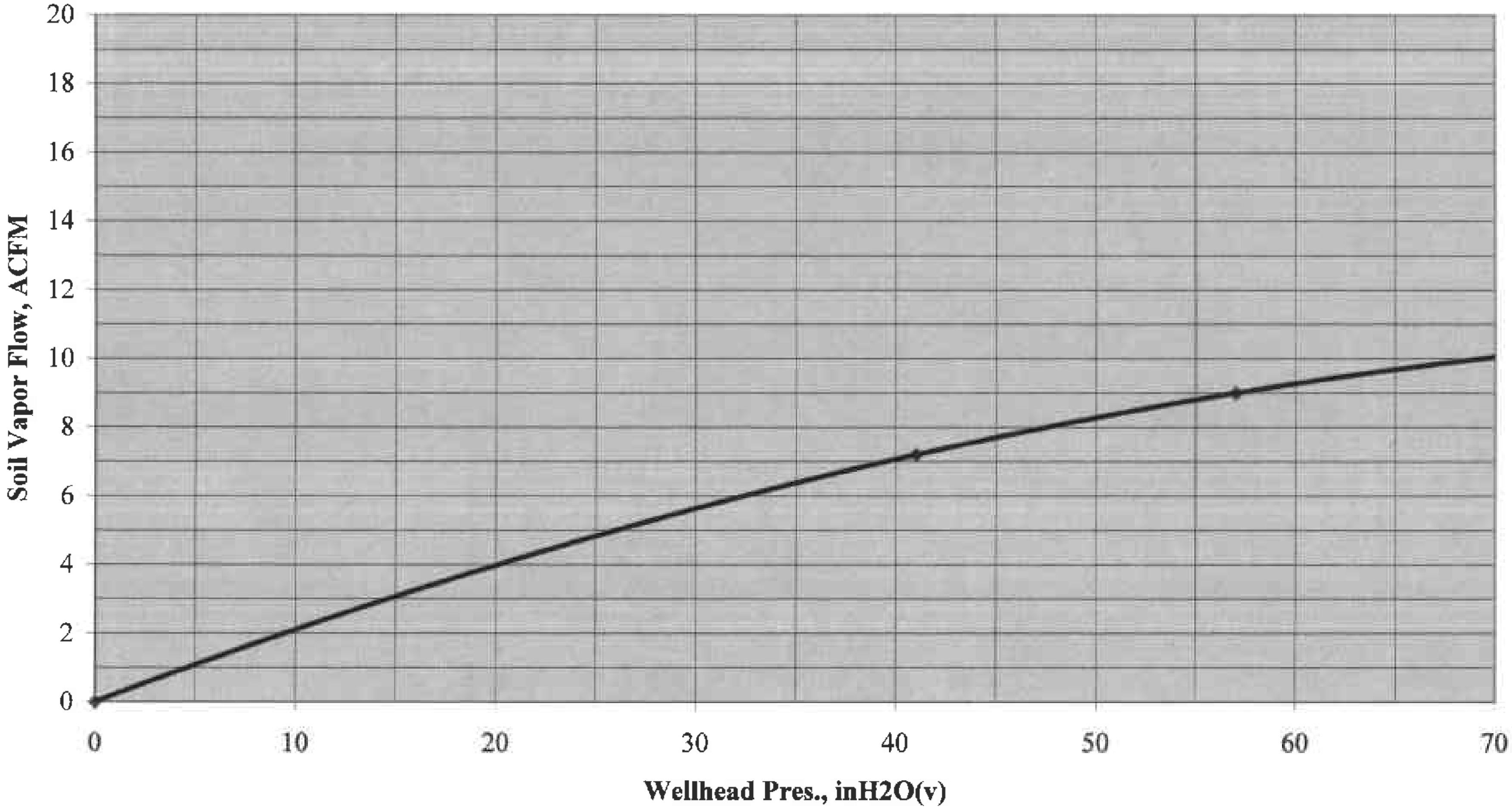


FIGURE 2
Predicted Yield Curve - Well EW-14
(Non-Native Soil)

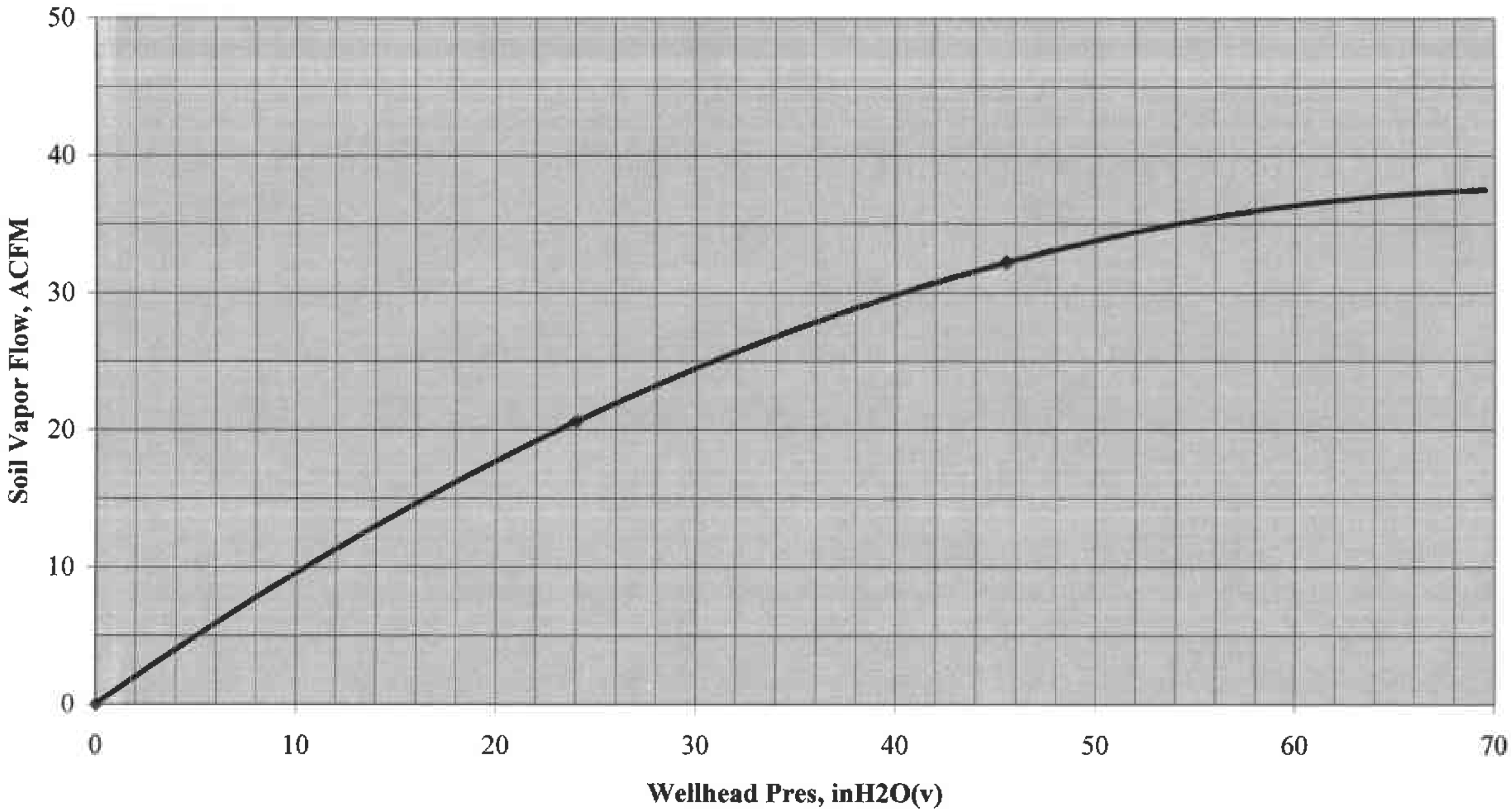


FIGURE 3
PROPOSED DPE WELL LOCATIONS AND EST. AREA OF INFLUENCE

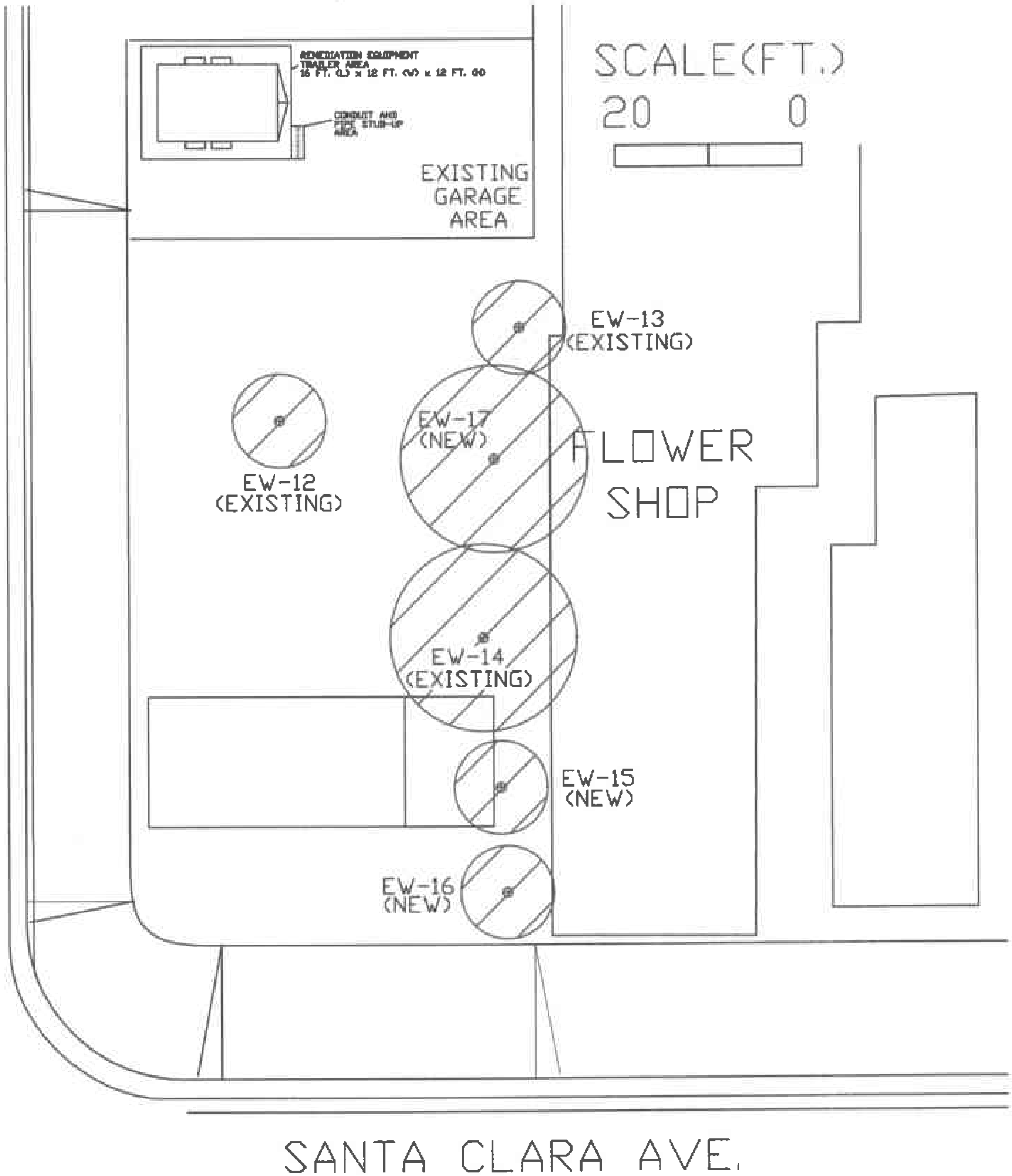
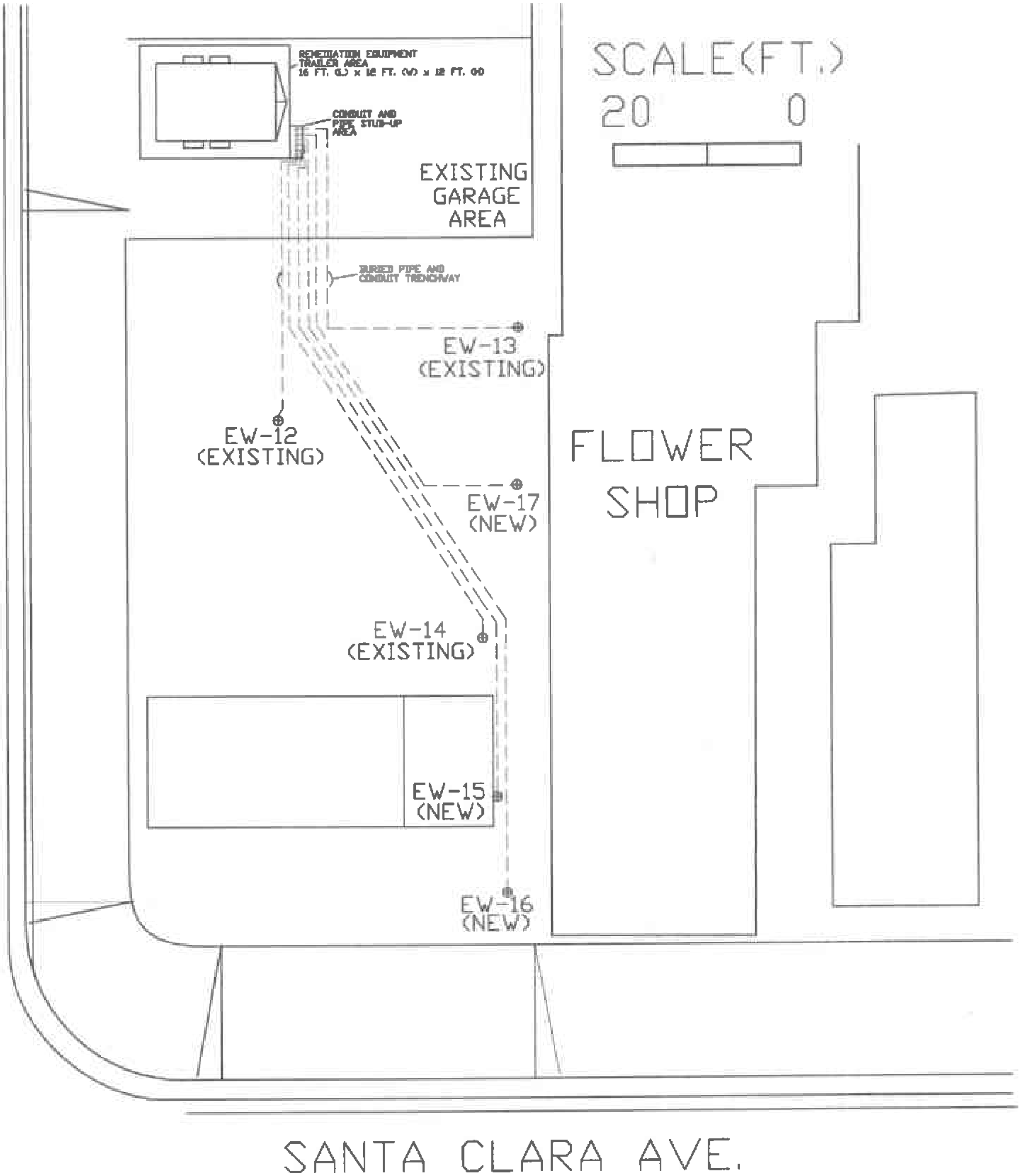


FIGURE 4
PROPOSED DPE WELL LOCATIONS AND PIPING LAYOUT



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August 11, 2003

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SUBJECT: **AQUIFER TESTING RELATED TO THE FORMER UNDERGROUND STORAGE TANKS AT THE FORMER BILL CHUN SERVICE STATION @ 2301 SANTA CLARA AVENUE, ALAMEDA, CA 94501**

Dear Barney;

This report summarizes the aquifer test field activities which took place in December 2002 in order to generate the definitive data necessary to establish an effective conceptual distribution of groundwater extraction wells to be utilized as an interim remediation measure to extract and treat the residual gasoline contaminated shallow groundwater beneath the site. The information contained herein will ultimately be incorporated into a Dual Phased Extraction Remedial Action Plan (DPE RAP) which will also include the field vapor extraction pilot testing which was performed concurrently with the pumping test in December 2002. It is my understanding that the DPE RAP will be submitted to Alameda County Environmental Health shortly after the current conceptual layout of the remediation system has been revised to accommodate new construction proposed by recent potential purchasers of the property.

Sincerely,

Franklin J. Goldman, ChG No 466

REGISTERED GEOLOGIST
FRANKLIN J. GOLDMAN
CERTIFIED HYDROGEOLOGIST
NO. 466
STATE OF CALIFORNIA

GENERAL AQUIFER CHARACTERISTICS AND ESTIMATION OF AQUIFER THICKNESS

Since it does not appear that any of the past subsurface investigations have extended below a depth of 25 feet bgs, the thickness of the confined aquifer has not been adequately defined. In addition, due to the gradational nature of the contacts between the soil horizons in the upper 25 feet bgs, physical evidence of the aquifer characteristics in terms of it being a confined, semi-confined, or unconfined was based upon less direct methods. No definitive evidence was observed, during the recent installation of groundwater extraction wells EW-12, EW-13, and EW-14 in late October 2002, for a bottom confining layer **(See Attachment A for soil boring logs)**.

Most of the sediments underlying the site appear to be identified as "Merritt Sand" and are well sorted, fine to medium grained sand particles washed into the area from the nearby Diablo Range to the east (i.e. *Corrective Action Evaluation and Feasibility Study, June 17, 1998*, by ENSR, page 4). Although the elevation of the groundwater table is known to vary seasonally, Environmental Science & Engineering, Inc. (ESE) initially reported that groundwater ranged from 10 to 15 feet Below Grade Surface (BGS). Others have reported a more specific range of between 8 and 10 feet BGS with a sloping gradient extending northward and eastward at approximately 0.07 inches/foot across the site. However, much variation in gradient slope and direction has been noted over the past several years. ENSR reported in 1998 that occasional flow variation to the northeast can occur. Soil borings excavated by ENSR in 1998 reported the following general soil characteristics across the site:

0 – 7 ft.	–	Moist, brown silty sands
7 – 8 ft.	–	Brown clayey sand
8 – 11 ft.	–	Moist, brown silty sand with decreasing silt content with depth
11 – 25 ft.	–	Wet to saturated course grained sands

The 1998 ENSR report states that the soils indicative of an upper confining layer are located between 7 and 8 feet bgs and that sandier more permeable soils were identified below eight feet bgs. (i.e. *Corrective Action Evaluation and Feasibility Study, June 17, 1998*, by ENSR, page 4). In the same report, it states that a thin clay layer was encountered between six and seven feet bgs indicating the same upper confining layer (i.e. *Corrective Action Evaluation and Feasibility Study, June 17, 1998*, by ENSR, page 15).

The aforementioned excerpt implies that there is an upper confining layer from 7 to 8 feet bgs and that the location, depth, and extent of the bottom of the confined aquifer has not been defined. The upper confining layer was also described in MW-4 as a clayey sand between 4½ and 8 feet bgs in the 1998 ENSR report.

Some evidence demonstrating the lower extent of a confined aquifer is described in the soil boring log for MW-6 (i.e. *Corrective Action Evaluation and Feasibility Study, June 17, 1998*, by ENSR) which demonstrates that the bottom confining layer may have been described as a clayey sand between 23 and 25 feet bgs, beneath a silty sand observed between 13 and 23 feet bgs. Since this evidence of a bottom confining layer between 23 and 25 feet bgs is only found in one soil boring, it could just be representative of an isolated lense. A similar correlative permeable sand was identified in MW-5 between 13 and 25.

A water well driller report for a well located at 2307 Clement Ave, Alameda shows a soil horizon representative of a bottom confining layer between 30 and 35 feet bgs, yet is too far away to provide a reliable stratigraphic correlation **(See Attachment B for Well Driller's Report)**.

The Report of Findings Additional Site Assessment...., page 7, dated October 1, 1993, by ESE states that "The shallow subsurface is dominated by a silty sand unit that occurs to a total depth (approximately 25 feet bgs) in site borings. Along the northwestern margin of the site, a clayey sand unit, four to nine feet thick, was observed at approximately four feet bgs in borings MW-4, MW-5, and MW-6.

Backfill soil was used to replace the contaminated soils excavated when the underground storage tanks were removed. This backfill soil is very different in composition from the natural soils in the area and covers approximately 50-60 cubic yards around the location of the excavated tanks and extends to a lesser extent towards the former location of the fuel dispensing pumps.

Although the physical evidence necessary to establish whether or not the aquifer characteristics beneath the site are indicative of a confined aquifer are sparse (e.g. physical proof of an upper and a lower confining layer), the evaluation of the pumping test data indicates that the aquifer is more characteristically representative of a confined condition as is addressed in the following sections of this report.

Previous Aquifer Testing Provides Estimate of Aquifer Thickness

The slug testing performed by ESE on September 14, 1993 could not be used to determine storativity because no observation wells were utilized. ESE used the Bower and Rice (1976) slug test solution for unconfined aquifers and the Cooper Jacob (1967) slug test solution for confined aquifers with the AQTESOLV curve matching program to estimate K and T at 0.0015 feet/minute and 0.02 feet squared per minute, respectively (Report of Findings Additional Site Assessment....page 9, October 1, 1993, by ESE). This indicates that ESE stated that the thickness of the aquifer was assumed to be 13.3 feet where T=Kb.

ESE stated that the data obtained and evaluated indicated that the aquifer was a clean to silty sand and that the solutions for a confined aquifer worked the best.

Based upon the information available since the ESE report, however, the best estimate for aquifer thickness is approximately 17 feet (e.g. from 8 feet bgs to approximately 25 feet bgs) or greater based upon an average depth to water ranging from approximately seven to ten feet bgs. Only additional confirmation soil borings excavated to below 25 feet bgs can verify the vertical extent of the aquifer.

INFLUENCE OF GROUNDWATER GRADIENT FLOW DIRECTION ON CAPTURE ZONES

The groundwater gradient flow direction has been measured to the northeast, north, and northwest since installation of groundwater monitoring wells MW-1, MW-2, and, MW-3 on January 07, 1993. Some representative gradient flow directions are as follows:

Gradient flow direction measured as westward towards Oak Street

This gradient flow direction is suspect because it appears that the screen was placed from 10 to 25 feet in MW-1, MW-2, and MW-3 and the stabilized water table/potentiometric surface was less than 10 feet bgs inside the blank casing of the well. Also, since the three monitoring wells were installed in essentially a straight line, an accurate gradient would be difficult to establish.]

(Report of Findings Additional Site Assessment....October 1, 1993, by ESE)
(Report on Preliminary Site Assessment.......Figure 3, by ESE, March 31, 1993)

Also, reference was made to the well screening problem in MW-1, MW-2, and MW-3 in Barney Chan's correspondence to the Responsible Party on June 26, 1998.

A northeast gradient flow direction as measured after installation of MW-4, MW-5, MW-6, and MW-7 on September 07, 1993

(Report of Findings Additional Site Assessment....October 1, 1993, by ESE)

"Groundwater elevations measured in all site wells reveal that the general direction of groundwater flow beneath the site is to the northeast....."

The screens in MW-4, MW-5, MW-6, and MW-7 were constructed between 7 and 25 feet to accommodate for the shallow water level.]
(*Report of Findings Additional Site Assessment....page 9, October 1, 1993, by ESE)*

Gradient flow direction measured as due north

(Results of Additional Site Assessment......, February 07, 1995, by Fugro West)

Northeast parallel to Oak Street as measured by Fugro on November 29, 1995 [Note; Fugro stated that gradient maps generated by ESE based upon field data collected on February 3, 1994 and June 6, 1994 were incorrect due to arithmetic errors in the correction of groundwater levels in the presence of free product and that Fugro had corrected these errors in their subsequent reporting.]

(Results of Free Product Recovery......, page 11, January 30, 1996, by Fugro West)

Gradient flow direction measured as north to northwest as measured on June 30, 1998

(Corrective Action Evaluation and Feasibility Study, Figure 3, June 1998, by ENSR)

Gradient flow direction measured as east southeast as measured on July 03, 2002

(Groundwater Monitoring of Hydrocarbons.....page 2, August 05, 2002, Franklin J. Goldman, Chg).

[Note; This change in groundwater gradient would indicate that MW-11 is, at times, a down gradient well from the Subject site or that it is down gradient of the another source north of the subject site.]

This is further corroborated in a February 15, 1996 Contact Log by Barney Chan of Alameda County Health which speculates that the weathered contaminants identified in MW-11 indicates that it is downgradient of the subject site.

Gradient flow direction measured as southeast on December, 2002

The groundwater gradient flow direction was measured, prior to the Pumping test, as southeast **(See Figure 1 and Table 1)**

HYDROCARBON CONCENTRATION GRADIENT TRENDS AS INDICATOR OF THE PREDOMINANT GROUNDWATER GRADIENT FLOW DIRECTION

Aside from the concentration gradient trends which imply that the dissolved contaminants are predominantly migrating to the east from residual sources onsite, recent indicator hydrocarbon chemicals have been recently identified onsite to indicate an onsite residual secondary source (i.e. hydrocarbons which may remain in the smear zone).

During the December 2002 pumping test, water samples were collected from extraction wells EW-12 and EW-14 and analyzed for TPHg, BTEX, 5 oxygenates and 1,2DCA.

Concentrations of benzene and TPHg decreased in the pumping well and increased in the observation well over time. One sample was collected from offsite groundwater monitoring well MW-11 which revealed 140 ppb TBA and only 9.0 ppb MTBE. This suggests that the MTBE may have converted to TBA due to the extended period of time that this aged gasoline has remained beneath the site. These constituents identified in MW-11 could be associated with corresponding indicator chemicals identified in groundwater beneath the subject site.

(See Attachment C1 for Laboratory Data Sheets)
(See Table 2 for Lab results)

Furthermore, after the installation of the extraction wells in October 2002, the following oxygenates were identified in EW-13 and EW-14 in ppb:

EW-13		EW-14	
TBA	50.8	TBA	22.9
MTBE	12.2	MTBE	8.6
DIPE	ND	DIPE	1.63

(See Attachment C2 for Laboratory Data Sheets)

Therefore, low levels of MTBE with higher concentrations of TBA both on and offsite could imply an onsite source with the predominant shallow groundwater gradient flow direction which is generally to the east as exhibited by the migratory nature of the oxygenates.

MTBE was also identified beneath the south end of the site in MW-3 in 1998 which could imply an onsite source of MTBE (See *Corrective Action Evaluation and Feasibility Study, June 17, 1998*, Table 4, by ENSR).

A February 15, 1996 Contact Log by Barney Chan of Alameda County Health speculates that the weathered contaminants identified in MW-11 indicates that it is downgradient of the Subject site.

The presence of MTBE in northern wells MW-9 and MW-11 in 1997 and 1998 respectively indicates that this may be indicative of a northwest and northeast trending groundwater gradient flow direction as indicated by the leading edge of the dissolved MTBE plume or that there is another source north of the Subject site.
(See *Corrective Action Evaluation and Feasibility Study, June 17, 1998*, Table 4, by ENSR).

Reference has been made in previous reporting that the hydrocarbons identified in MW-11 (e.g. located on the opposite side of the flower shop adjacent to the subject site) may be from another source.

Fugro states that the hydrocarbons identified in P5 (i.e. also on the opposite side of the flower shop) and MW-11 were indicative of old gasoline and may be from former gasoline USTs which were located at 2305, 2314, and 2318 Santa Clara Avenue.
(Results of Free Product Recovery......, page 14, January 30, 1996, by Fugro West)

In addition, the presence of MTBE in the northern part of the site in 1998 also implies that there may be another source.

Since there are no wells between MW-11 and the Subject site, we can only speculate as to the source of the contamination identified in MW-11.

Since there has been no vertical profiling of the concentration gradient trends below 25 feet bgs, correlation between data points of MTBE and other oxygenates identified to date cannot be adequately interpolated based upon data available to date and cannot with certainty be used to establish concentration gradient trends which isolate the source locations.

In summary, although the gradient flow direction may have been to the north and northwest in the past, recent concentration gradient trends and recent groundwater monitoring events, strongly indicate that the predominant direction that the dissolved contaminants have been flowing is towards the east as demonstrated by increasing concentration gradient trends with open and undefined concentration gradient contours to the east.

EXISTING GROUNDWATER EXTRACTION WELLS

The "*Groundwater Monitoring and Extraction Well Installation Report, November 15, 2002*, reported the installation of three (3), four (4) inch diameter, groundwater extraction wells (i.e. EW-12, EW-13 and EW-14) as well as a groundwater monitoring event. The three wells were installed to be used in preparation for the vapor pilot and aquifer testing to be performed concurrently. The placement and construction of the extraction wells were also chosen to provide the most representative field data for the field testing recently completed and to provide the most effective interim remediation extraction capability to be applied to the most contaminated portions of the site for their eventual use as an integral part of a future dual phase extraction system. The soils encountered during the extraction well excavations appeared to be much sandier, from a qualitative standpoint, and thus more permeable, than those encountered during previous subsurface investigations.

GENERAL DESCRIPTION OF FIELD TESTING PERFORMED

On December 16, 2002, a four-day pilot test protocol was initiated to obtain vapor extraction and aquifer pump testing data together to more realistically simulate actual conditions which would likely exist during dual phase extraction.

Prior to the pumping test, a 6,000 gallon polypropylene tank was placed on site. Arrangements were made to transport the contaminated groundwater to a recycling facility. Prior to pumping, the static water levels were measured in all eleven (11) groundwater monitoring wells with an electric water level sounder. The test began with a 6-hour pre-pump/step test in order to calibrate equipment, measure initial changes in water levels, and to define an appropriate pumping rate. To facilitate the reading of flow rates during the testing, a manifold was constructed with multiple flow meters, pressure gauges, control valves and check valves. The flow meters were turbine-type. Three (3)-inch Grundfos electrical submersible pumps were installed into each of the three extraction test wells and connected to a flow control manifold using flexible hoses. Special wellheads were pre-fabricated to provide vapor sealing of each wellhead to each 4 inch PVC casing so that groundwater pumping, soil vapor extraction and wellhead pressure measurements could be performed simultaneously.

The three extraction wells were briefly pumped down to establish which well would yield the highest sustained pumping rate. Well EW-12 stabilized at 2.5-3.0 gpm and was ultimately selected as the groundwater test well. EW-13 stabilized at an average of 2.0 gallons per minute.

Step, Constant Discharge, and Recovery Aquifer Testing Activities

Based upon the types of hydrogeologic conditions observed at the site, the initial estimate of the drawdown time of the constant discharge aquifer test was expected to be 48 hours. However, a shorter time interval was found to be sufficient. Using the data collected, drawdown verses time data was evaluated relative to standard type curves based upon applicable methods of analysis. Hydrogeological conditions such as unconfined, confined, semi-confined, hydraulic barriers, recharge and discharge areas, etc. could then be identified during the course of the test based upon the reaction of the aquifer to pumping.

Determination of aquifer characteristics and parameters were then further refined predominantly from the water level recovery data and pumping test data. Recovery water level data was collected and evaluated to circumvent the anomalies caused by turbulent well losses in the pumping well and well bore skin effects (i.e. well loses and well bore storage), so that transmissivity could be calculated.

The frequency of water level measurements was scheduled according to standard procedural outlines established in a professional hydrogeology text by Fetter and Kruseman and Deridder and were recorded on pre-printed forms (e.g. field notes, drawdown versus time data, log-log paper, and semi log-log plots), for use in the field. Depth to water, time in minutes, pumping rate, equipment used, and significant changes in work activities were all reflected in the record.

The pumping rate for EW-12 was maintained at approximately constant 2.5-3.0 gpm rate until the water level measured in the well stabilized at about 17 feet BGS. Wells MW-2, MW-3 and MW-5 were used as observation wells. Pumping and recovery test data were also collected for EW-13 as well as the step test data. The pumping rate for EW-13 was kept at an approximately 2.0 gpm and was pumped during a separate test to assure that it did not interfere with the pumping of EW-12 and the associated observations made in MW-2, MW-3 and MW-5 .

This sustained pumping rate is expected to continuously lower the water table to an artificial static water level which will help to expose the smear zone to vapor extraction. Since Extraction Well EW-14 is situated in the old tank pit, pump testing was not performed as it would not be representative of aquifer conditions in the native soils. It will, however, likely be very effective at removing dissolved contaminants as residual contaminants tend to migrate into the old permeable tank backfill after tank removal.

EVALUATION OF PUMP TEST DATA

The drawdown verses time data was evaluated by hand drawn plots and application of Aqtesolv, a Windows based software program.

HAND DRAWN PLOTS

Pump testing revealed a confined aquifer based upon the Theis solution for confined aquifers **(See Attachment D for Tables of Data and Hand Drawn Plots for Well Test Analysis)**.

The first step in the analysis of the pump test data was to determine the type of aquifer conditions so that the proper method of analysis could be applied to determine T, S, and the areal extent of the extraction wells' capture zones.

Note that the log-log plots for the pumping tests performed for MW-5 and EW-13 have produced curves which are indicative of a confined aquifer condition as demonstrated by the Theis method of analysis.

The Theis confined method of analysis was used to evaluate the pump test data. The hand plot were evaluated by graphical straight line methods to estimate T and S.

Transmissivities (feet squared per minute) for EW-13 ranged from 0.18 for the pumping test to 0.38 and 0.54 for the recovery test at and average pumping rate of 2.0 gpm.

Transmissivities (feet squared per minute) for EW-12 ranged from 0.0.015 for the recovery test at and average pumping rate of 3.0 gpm. The initial pumping test data for this well was anomalops due to a variable pumping rate.

Transmissivities (feet squared per minute) for observation wells MW-2 and MW-5 range from 0.077 and 0.08 for the pumping test to 0.74 and 0.43 & 0.14, respectively, for the recovery test at and average pumping rate of 3.0 gpm. These transmissivities are indicative of similar aquifer conditions.

An anomaly is noted in the hand drawn plot for the MW-2 recovery test which could indicate some type of recharge in the subsurface after 50 minutes of recovery. A similar result can be observed in the hand draw plot for the recovery test for EW-12 after 30 minutes of recovery. The pumping and recovery tests for MW-5, however, demonstrate very consistent data in the hand plots as well as for the Theis curve which indicates a confined aquifer condition.

Transmissivities (feet squared per minute) for MW-3 ranged from 0.273 to 0.645 for the pumping test and 0.623 to 1.268 for the recovery test at and average pumping rate of 3.0 gpm. This increase is likely due to the fact that MW-3 is located on the opposite side of the former tank pit reflecting the higher transmissivities of a coarser grained backfill material.

In summary, an averaged T for the native soil is 0.1 and for native and backfill the T is 0.6.

Storativity was typically 0.001 which is indicative of a confined aquifer condition in most hydrogeology texts.

COMPUTER SOFTWARE GENERATED SOLUTION

The data was evaluated by analysis and hand drawn plots and application of Aqtesolv, a Windows based software program. Aqtesolv provides analytical solutions to determine the aquifer properties with automatic or visual curve matching. The present analysis was performed by automatic curve matching which is done by a non-linear weighted least-square parameter algorithm to match the curves to time-displacement data, obtained during the pumping test. The automatic curve matching is more objective and provides statistical criteria measuring the fit of a type curve on the data.

The confined Theis method of analysis was used to determine T and S for pumping test data generated from EW-12, MW-2, MW-3, and MW-5.

	T (feet squared per minute)	S
EW-12 and MW-2	1.272	0.00001
EW-12 and MW-3	2.414	0.0000000001
EW-12 and MW-5	1.735	0.000000003

Note that the transmissivities for generated by the computer program are four to 24 times greater.
(See Attachment E for Aqtesolv Well Test Analyses).

Estimates of Extraction Well Capture Zones

Although the direction of the upgradient reach of the capture zones to be generated by extraction wells onsite is influenced by the gradient flow direction, and the gradient flow direction has been variable through time, the predominant gradient flow direction has been to the east towards the flower shop as indicated by the concentration gradient contours for dissolved hydrocarbon contaminants. The capture zones for the existing three extraction wells will therefore typically reach to the west and northwest and future extraction wells should be placed to intercept dissolved contaminants based upon this scenario.**(See Attachment F for calculation estimates of width and length of capture zones for existing and proposed groundwater extraction wells for hand plotted and Aqtesolv solutions).**

Since the smallest capture zones (approximately 6 feet wide and 2 feet down gradient) were generated by Aqtesolv instead of the hand drawn graphical plots, these capture zones were used as the most conservative estimate of the effectiveness of the existing and proposed extraction wells to entrain dissolved hydrocarbons in groundwater **(See Figure 1 for extent of capture zones)**.

With this taken into account, it is likely that the capture zones are much larger considering the fact that drawdown was measured in groundwater observation wells MW-2, MW-3, and MW-5, during the pumping of extraction well EW-12. The width, and the extent down gradient, of the capture zones would therefore be more representative of the most conservative estimates for the hand drawn graphical plots (i.e. approximately 20 feet wide and 6 feet down gradient).

Although field observations indicate that EW-12 may have a larger capture zone than the computer generated solution has determined, the more conservative approach has been chosen due to the heterogeneity of the subsurface soils. For instance, EW-14 is located in sandier tank backfill. This extraction well will have a different, perhaps smaller capture zone. EW-13 could only be pumped at a lower rate of flow as compared to the pumping rate for EW-12 further indicating that each extraction well could have a significantly different capture zone after it is utilized for operation in a dual phase extraction system.

Further aquifer test analysis evaluation will be required to more accurately define the extent of the capture zones generated by the extraction wells. In addition, additional aquifer parameters such as the thickness of the aquifer will have to also be determined.

Note that the locations and distribution of the existing and proposed extraction wells are only conceptual in design as the final locations will have to be selected to accommodate future onsite construction requirements as well as optimization for capture of the current distribution of dissolved hydrocarbons for treatment.

CONCLUSIONS

Most of the contaminant hydrocarbon mass appears to be onsite, however, some of the dissolved plume has migrated beneath the Flower Shop and perhaps as far northeast as groundwater monitoring well MW-11. The soils encountered beneath the site appear to be sandier than was anticipated and appear to be more conducive to groundwater extraction remediation efforts as well. The groundwater extraction will serve to lower the water table to expose some of the most contaminated horizons of the smear zone for better contact with vapor extraction. Due to the low pumping rate, however, the only significant extraction of contaminated groundwater will occur at the onset of the remediation process, especially in the vicinity of the old tank backfill. The groundwater extraction wells will also help to limit further migration of dissolved contaminants offsite. In addition, the variable groundwater gradient flow direction may, at times, redirect the extraction well capture zones so that they may extract from less contaminated shallow groundwater zones for extended periods of time.

RECOMMENDATIONS

Install three additional exploratory soil borings below 25 feet bgs with a conductor casing to prevent cross contamination to verify the vertical extent of the shallow aquifer. Install three (3) groundwater extraction wells to provide additional areal extraction coverage over the more contaminated portions of the site to entrain and contain more of the dissolved plume onsite. Install a dual phase extraction system onsite to remove residual gasoline contamination which is likely still leaching out of the smear zone beneath the site.

LIMITATIONS

This report has been prepared in accordance with generally accepted environmental, geological and engineering practices. No warranty, either expressed or implied, is made as to the professional advice presented herein. The analyses, conclusions and recommendations contained in this report are based upon site conditions as they existed at the time of the investigation and they are subject to change. The conclusions presented in this report are professional opinions based solely upon visual observations made within individual soil excavations and of the site and vicinity as well as on interpretations of available information as designated in this report. Franklin J. Goldman, maintains that the limited scope of services performed in the execution of this investigation may not be sufficient to satisfy the needs, and/or requirements of all regulatory agencies or other users. Any use or reuse of this document, its findings, its conclusions and/or recommendations presented herein, is done so at the sole risk of the said user.

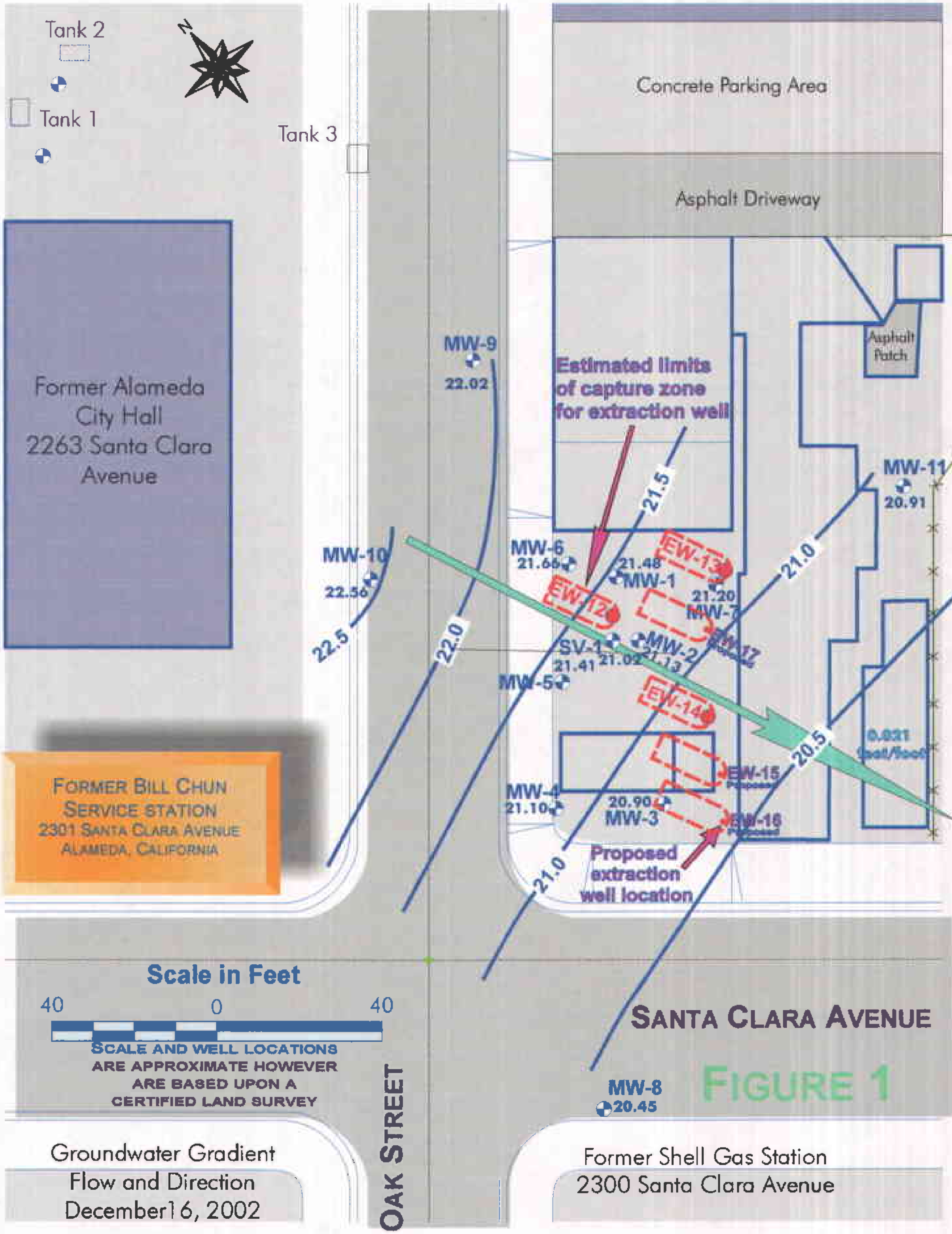
Tank 2
Tank 1
Tank 3
N
Concrete Parking Area
Asphalt Driveway
Asphalt Patch
Former Alameda City Hall 2263 Santa Clara Avenue
MW-9
22.02
Estimated limits of capture zone for extraction well
21.5
MW-11
20.91
21.0
MW-10
22.56
22.5
22.0
MW-6
21.66
21.48
MW-1
21.20
MW-7
EW-13
EW-12
EW-17
SV-1
21.41
21.02
MW-2
21.73
MW-5
EW-14
20.5
0.021 feet/foot
FORMER BILL CHUN SERVICE STATION 2301 SANTA CLARA AVENUE ALAMEDA, CALIFORNIA
MW-4
21.10
20.90
MW-3
EW-15
EW-16
Proposed extraction well location
21.0
Scale in Feet
40
0
40
SCALE AND WELL LOCATIONS ARE APPROXIMATE HOWEVER ARE BASED UPON A CERTIFIED LAND SURVEY
SANTA CLARA AVENUE
MW-8
20.45
FIGURE 1
OAK STREET
Groundwater Gradient Flow and Direction December16, 2002
Former Shell Gas Station 2300 Santa Clara Avenue

Table 1 - Groundwater Elevations for Chun

Well ID	GW Depth [Ft]	Surface Elevation [FtAMSL]	GW Elevation [FtAMSL]
MW-1	7.01	28.49	21.48
MW-2	7.34	28.47	21.13
MW-3	7.88	28.78	20.9
MW-4	7.43	28.53	21.1
MW-5	6.92	28.33	21.41
MW-6	6.70	28.36	21.66
MW-7	7.24	28.44	21.2
MW-8	7.72	28.17	20.45
MW-9	5.43	27.45	22.02
MW-10	4.76	27.32	22.56
MW-11	7.65	28.56	20.91
SV-1	7.40	28.42	21.02
EW-12	17.15		
EW-13	7.42		
EW-14	8.52		

Table 2
Hydrocarbons in Groundwater in ppb
During Aquifer Test for Chun

Sample ID	Date & Time	TPH(g)⁺	Benzene	Toluene	Ethyl-benzene	Xylenes
EW-12A	12-18-02 1:09 pm	1,600	70	110	65	310
EW-12B	12-18-02 3:45 pm	1,600	72	110	70	330
EW-12C	12-18-02 6:30 pm	1,600	70	130	74	360
EW-12D	12-19-02 7:45 am	1,200	64	140	66	320
MW-11	12-19-02 9:10 am	64,000	14,000	2,600	2,400	10,800
EW-14-12A	12-19-02 1:30 pm	4,900	760	1,200	200	1,130
EW-14-12B	12-19-02 3:30 pm	23,000	2,200	4,300	680	3,220
EW-14-12C	12-19-02 4:30 pm	10,000	2,100	4,200	850	4,100

Sample	Date & Time	TBA	MTBE	Di-isopropyl ether	tert Butyl ethyl ether	TAME	1,2 DCA
EW-12A	12-18-02 1:09 pm	ND	ND	ND	ND	ND	0.59
EW-12B	12-18-02 3:45 pm	ND	ND	ND	ND	ND	0.98
EW-12C	12-18-02 6:30 pm	ND	ND	ND	ND	ND	0.93
EW-12D	12-19-02 7:45 am	ND	ND	ND	ND	ND	0.83
MW-11	12-19-02 9:10 am	140	9.0	ND	ND	ND	32
EW-14-12A	12-19-02 1:30 pm	ND	ND	ND	ND	ND	4.6
EW-14-12B	12-19-02 3:30 pm	ND	ND	ND	ND	ND	7.8
EW-14-12C	12-19-02 4:30 pm	ND	ND	ND	ND	ND	11

Attachment A

Soil Boring Logs

EXPLORATORY BORING LOG

DRILL COMPANY: Clear Heart	SURFACE ELEVATION:	LOGGED BY: Frank Goldman
DEPTH TO GROUNDWATER:	BORING DIAMETER:	DRILLING METHOD: HSA

LITHOLOGIC DESCRIPTION	SAMPLE INTERVALS	LITHOLOGIC LOG	DEPTH	WATER LEVEL	WELL CONSTRUCTION DETAIL	USCS SYMBOLS
Silty Sand, ~~med~~ red brn, med dense, med, sl moist.			1			
			2			
			3			
			4			
silty sand, grn, med dense, med, sl moist mild old gasoline odor	X	EW-12 5-5½ 10:30 AM 5 ppm	5			
			6			
			7			
			8			
water @ 9½'			9			
siltier w/depth, mod gas odor very moist	X	EW-12 10-10½ 10:45 AM 15 ppm	10			
			11			
			12			
			13			
			14			
mod gas odor, wet	X	EW-12 11:15 AM 0 ppm	15			
			16			
			17			
			18			
		11:30 AM	19			
no odor	X	EW-12 20-20½ 0 ppm	20			

EW-12

PROJECT NAME: Chun

ADDRESS: 2301 Santa Clara Ave Alameda, CA

BORING number ~~MW-12~~

DATE: 10/24/02

EXPLORATORY BORING LOG

DRILL COMPANY: Clear Heart	SURFACE ELEVATION:	LOGGED BY: Frank Goldman
DEPTH TO GROUNDWATER:	BORING DIAMETER:	DRILLING METHOD: HSA

LITHOLOGIC DESCRIPTION	SAMPLE INTERVALS	LITHOLOGIC LOG	DEPTH	WATER LEVEL	WELL CONSTRUCTION DETAIL	USCS SYMBOLS
			21			
			22			
			23			
		EW-12	24			
	X	24½-25	25			
End @ 25'		11^45				
7-25' screen		0ppm	26			
1', sand			27			
3' bent			28			
			29			
			30			
			31			
			32			
			33			
			34			
			35			
			36			
			37			
			38			
			39			
			40			

PROJECT NAME: Chun

ADDRESS: 2301 Santa Clara Ave
Alameda, CA

BORING number EW-12

DATE: 10/24/02

EXPLORATORY BORING LOG

DRILL COMPANY: Clear Heart	SURFACE ELEVATION:	LOGGED BY: Frank Goldman
DEPTH TO GROUNDWATER:	BORING DIAMETER:	DRILLING METHOD: HSA

LITHOLOGIC DESCRIPTION	SAMPLE INTERVALS	LITHOLOGIC LOG	DEPTH	WATER LEVEL	WELL CONSTRUCTION DETAIL	USCS SYMBOLS
Silty sand, red brn, med dense, med, sl moist to moist			1			
			2			
			3			
			4			
	X	4½-5				
Silty sand, grn, med dense, med sl moist to moist; mod strong gas odor.		2:00 pm	5			
		20 ppm	6			
			7			
			8			
Water @ 9½'			9			
		2:20				
Siltier with depth, mod strong gas odor, very moist	X	10-10½	10			
	X	10½-11				
		2:25	11			
		410 ppm	12			
			13			
			14			
		2:50				
mild gas odor, wet	X	15-15½	15			
	X	15½-16	16			
		2:55				
		15 ppm	17			
			18			
		EW-13				
		3:20 pm	19			
No odor	X	19½-20	20			
		0 ppm				

PROJECT NAME: Chun

ADDRESS: 2301 Santa Clara Ave
Alameda, CA

BORING number EW-13

DATE: 10/24/02

EXPLORATORY BORING LOG

DRILL COMPANY: Clear Heart	SURFACE ELEVATION:	LOGGED BY: Frank Goldman
DEPTH TO GROUNDWATER:	BORING DIAMETER:	DRILLING METHOD: HSA

LITHOLOGIC DESCRIPTION	SAMPLE INTERVALS	LITHOLOGIC LOG	DEPTH	WATER LEVEL	WELL CONSTRUCTION DETAIL	USCS SYMBOLS
			21			
			22			
			23			
	X	EW-13 24½-25 3[40] PM	24			
			25			
End @ 25'		0ppm	26			
Screen 7-25'			27			
Sand 6-25			28			
Bend 3-6			29			
Grout 1-3			30			
			31			
			32			
			33			
			34			
			35			
			36			
			37			
			38			
			39			
			40			

PROJECT NAME: Chun	BORING number EW-13
ADDRESS: 2301 Santa Clara Ave Alameda, CA	DATE: 10/24/92

EXPLORATORY BORING LOG

DRILL COMPANY: Clear Heart	SURFACE ELEVATION:	LOGGED BY: Frank Goldman
DEPTH TO GROUNDWATER:	BORING DIAMETER:	DRILLING METHOD: HSA

LITHOLOGIC DESCRIPTION	SAMPLE INTERVALS	LITHOLOGIC LOG	DEPTH	WATER LEVEL	WELL CONSTRUCTION DETAIL	USCS SYMBOLS
Silty sand, med brn, ~~slightly dense~~ loose, med/sl moist; no odor			1			
Drilling easy to 9', likely tank backfill.			2			
			3			
		EW-14	4			
No odor →	X	4½-5				
	X	9[20] 5-5½ 9[25]	5			
		0ppm	6			
			7			
Drilling dense @ 9'		9[30]	8			
	X	9-9½	9			
Silty sand, grn, dense, med, moist, Strong odor @ 9-10'	X	9½-10	10			
		9[35] 8ppm	11			
			12			
			13			
			14			
med strong odor of old gasoline wet	X	14½-15 9[45] AM 2ppm	15			
			16			
			17			
		10[10]	18			
	X	19-19½	19			
	X	19½-20 10[15] 0ppm	20			

PROJECT NAME: Chun	BORING number EW-14
ADDRESS: 2301 Santa Clara Ave Alameda, CA	DATE: 10/25/02

EXPLORATORY BORING LOG

DRILL COMPANY: Clear Heart	SURFACE ELEVATION:	LOGGED BY: Frank Goldman
DEPTH TO GROUNDWATER:	BORING DIAMETER:	DRILLING METHOD: HSA

LITHOLOGIC DESCRIPTION	SAMPLE INTERVALS	LITHOLOGIC LOG	DEPTH	WATER LEVEL	WELL CONSTRUCTION DETAIL	USCS SYMBOLS
			21			
			22			
			23			
	X	24½-25	24			
End @ 25'		0ppm	25			
Screen 25-7'			26			
Sand 25-6'			27			
Bent 6-3'			28			
Grout 1-3			29			
			30			
			31			
			32			
			33			
			34			
			35			
			36			
			37			
			38			
			39			
			40			

PROJECT NAME: Chun

ADDRESS: 2301 Santa Clara Ave
Alameda, CA

BORING number 10/25/02

DATE: EW-14

Attachment B

Well Driller Report

CONFIDENTIAL

STATE OF CALIFORNIA DWR
WELL COMPLETION REPORT
(WELL LOGS)

REMOVED

Attachment C1

Laboratory Data Sheets

WATER • WASTE WATER • HAZARDOUS WASTE • FUEL • AIR • SOIL

DELTA

ENVIRONMENTAL LABORATORIES, Ltd

Client:
Franklin J. Goldman
PO Box 9390
Santa Rosa, CA95405

Client Project ID:
Chun

Ref.:	R7419_oxyw
Method	8260B
Sampled:	10/31/02
Received:	11/5/02
Matrix:	Water
Analyzed:	11/7/02
Reported:	11/12/02
Units:	ug/L
QC Batch:	110302

Attention:Franklin J. Goldman

Laboratory Results for Oxygenates & lead Excavengers Analysis

Analyte	**Detection Limit ug/L**	**Results**		
		Sample ID		
		EW-12	**EW-13**	**EW-14**
		7419-1	**7419-2**	**7419-3**
ter-Butyl alcohol(t-Butanol)	20	ND	50.8	22.9
Methyl ter-butyl ether(MTBE)	0.5	ND	12.2	8.60
Di-isopropyl ether	0.5	ND	ND	1.63
ter-Butyl ethyl ether	0.5	ND	ND	ND
ter-Amyl methyl ether	0.5	ND	ND	ND
Lead Excavengers				
1,2-Dibromoethane (EDB)	0.5	ND	ND	1.86
1,2-Dichloethane (1,2-DCA)	0.5	1.48	14.7	34.9
Surrogate	Conc	% Recovery		
Toluene-d8	20.0	101	103	103

ND:Not Detected

Delta Environmental Laboratories
Hossein Khosh Khoo, Ph.D.

WATER • WASTE WATER • HAZARDOUS WASTE • FUEL • AIR • SOIL

DELTA

ENVIRONMENTAL LABORATORIES, Ltd

Quality Control Report

Client:
Franklin J. Goldman
PO Box 9390
Santa Rosa, CA95405

Client Project ID:
Chun

Ref.	Q7419_oxy
Sampled:	1031/02
Received:	11/5/02
Matrix:	Water
Analyzed:	11/7/02
Reported:	11/12/02
Units:	ug/L

Surrogate Standard Recovery Summary
Method : EPA 8260B

Date Analyzed	Lab Id.	Percent Recovery Toluene d8
	Blank	98
	Blank	100
QC limit:		81-117

Date Analyzed: 11/7/02
Sample Spiked:Blank

Matrix Spike Recovery

Analyte	Spike Added ug/L	Matrix Spike %Recovery	Matrix Spike Dup % Recovery	Relative % Difference RPD
Methyl ter-butyl ether(MTBE)	20	108	120	11
Di-isopropyl ether	20	101	107	5.8
ter-Butyl ethyl ether	20	101	110	8.5
ter-Amyl methyl ether	20	101	112	10

H.Khosh Khoo, PhD.,
Laboratory Director/President

Franklin J. Goldman
PO BOX 9390, Santa Rosa, CA 95405 (by US mail)
Phone: (707) 869-0850
Phone: (707) 869-0864 [Call before Faxing]

7419

CHAIN OF CUSTODY RECORD

Laboratory Analysis P.O. No.________

Laboratory Please Call Accounts Payable for P.O. No.

Date: 10/31/02 Sheet 1 of 1

Project Name: Chun
Project Number:
Address: 2301 Santa Clara Ave, Alameda, CA

Sampler's Name: Frank Goldman
Sampler's Signature: [signature]

Laboratory Delivery Location
Delta Environmental Laboratory
685 Stone Road, #11
Benicia, CA 94553
Phone: (707) 747-6081
FAX: (707) XXX-XXX

Phone Turnaround Time: ☐ Rush ☐ 24 Hour ☐ 48 Hour ☒ 5-Day

Repeat to: Frank

Parameters

Sample Number / Location	Date	Time	TPH as Gasoline 8015	TPH as Diesel 8015	TPH-g/BTEX 8015/8020	BTEX & EPA 8020	Oil and Grease 5520	Volatile Organics (8010)	CAM Metals (17)	Pr. Pollutant Metals (13)	Base/Neu/Acids (Organic)	Pesticides 8140/8141	Method 8260b for 5 oxygenates & 2 lead scavengers		Bulk density, moisture, porosity fraction of organic carbon	SOIL SAMPLE	WATER SAMPLE
EW-12	10/31/02	5:35 pm			X								X				
EW-13	10/31/02	6:15 pm			X								X				
EW-14	10/31/02	7:05 pm			X								X				

Comments

Don't run until you receive payment from Chun; Contact Wayne Chun @ 925 439-2302

FAX lab results to (818)908-9365

Relinquished By	Date	Time	Received By	Date	Time
[signature] Franklin J. Goldman	11/05/02	10:45 am	[signature]	11-5-02	10:45 am
[signature]	11-5-02	5:03	[signature]	11/05/02	

Dispatched By	Date	Time	Received In Lab By	Date	Time

Total Number of Containers this Sheet:

Method of Shipment:

Special Shipment/Handling or Storage Requirements: **Keep on Ice**

Attachment C2

Laboratory Data Sheets

LABORATORY ANALYSIS RESULTS

Client: Loftin and Associates
Project No.: NA
Project Name: Chun
Sample Matrix: Water
Method: EPA 8015M (GRO)

AA Project No.: A54501
Date Received: 12/20/02
Date Reported: 01/10/03
Units: mg/L

AA I.D. No.	Client I.D. No.	Date Sampled	Date Analyzed	DF	Results	MRL
147854	EW-12A	12/18/02	12/24/02	1.0	**1.6**	0.1
147855	EW-12B	12/18/02	12/24/02	1.0	**1.6**	0.1
147856	EW-12C	12/18/02	12/24/02	1.0	**1.6**	0.1
147857	EW-12D	12/18/02	12/24/02	1.0	**1.2**	0.1
147858	MW-11	12/18/02	12/24/02	1.0	**64**	0.1
147859	EW-14-12A	12/18/02	12/24/02	1.0	**4.9**	0.1
147860	EW-14-12C	12/18/02	12/24/02	1.0	**23**	0.1
147861	EW-14-12B	12/18/02	12/24/02	1.0	**10**	0.1

MRL: Method Reporting Limit J: Estimated Value DF: Dilution Factor

NOTES:

GRO: Gasoline Range Organics

Viorel Vasile
Project Manager

AMERICAN ANALYTICS

LABORATORY ANALYSIS RESULTS

Client:	Loftin and Associates	**AA Project No.:**	A54501
Project No.:	NA	**Date Received:**	12/20/02
Project Name:	Chun	**Date Reported:**	01/10/03
Sample Matrix:	Water	**Units:**	ug/L
Method:	EPA 8260B		

Date Sampled:	**12/18/02**	**12/18/02**	**12/18/02**	**12/18/02**	
Date Analyzed:	**12/24/02**	**12/24/02**	**12/24/02**	**12/24/02**	
AA ID No.:	**147854**	**147855**	**147856**	**147857**	
Client ID No.:	**EW-12A**	**EW-12B**	**EW-12C**	**EW-12D**	
Dilution Factor:	**1.0**	**1.0**	**1.0**	**1.0**	**MRL**
Compounds:					
Acetone	<10	<10	<10	<10	10
Benzene	**70**	**72**	**70**	**64**	0.5
Bromobenzene	<0.5	<0.5	<0.5	<0.5	0.5
Bromochloromethane	<0.5	<0.5	<0.5	<0.5	0.5
Bromodichloromethane	<0.5	<0.5	<0.5	<0.5	0.5
Bromoform	<0.5	<0.5	<0.5	<0.5	0.5
Bromomethane	<0.5	<0.5	<0.5	<0.5	0.5
2-Butanone	<10	<10	<10	<10	10
Butylbenzene	**5.2**	**5.1**	**5.2**	**3.1**	0.5
Carbon disulfide	**4.2**	**3.7**	**3.0**	**1.3**	0.5
Carbon tetrachloride	<0.5	<0.5	<0.5	<0.5	0.5
Chlorobenzene	<0.5	<0.5	<0.5	<0.5	0.5
Chloroethane	<0.5	<0.5	<0.5	<0.5	0.5
Chloroform	<0.5	<0.5	<0.5	<0.5	0.5
Chloromethane	<0.5	<0.5	<0.5	<0.5	0.5
2-Chlorotoluene	<0.5	<0.5	<0.5	<0.5	0.5
4-Chlorotoluene	<0.5	<0.5	<0.5	<0.5	0.5
1,2-Dibromo-3-chloropropan	<1	<1	<1	<1	1
Dibromochloromethane	<0.5	<0.5	<0.5	<0.5	0.5
1,2-Dibromoethane	<0.5	<0.5	<0.5	<0.5	0.5
Dibromomethane	<0.5	<0.5	<0.5	<0.5	0.5
1,2-Dichlorobenzene	<0.5	<0.5	<0.5	<0.5	0.5
1,3-Dichlorobenzene	<0.5	<0.5	<0.5	<0.5	0.5
1,4-Dichlorobenzene	<0.5	<0.5	<0.5	<0.5	0.5
Dichlorodifluoromethane	<0.5	<0.5	<0.5	<0.5	0.5
1,1-Dichloroethane	<0.5	<0.5	<0.5	<0.5	0.5
1,2-Dichloroethane	**0.59**	**0.98**	**0.93**	**0.83**	0.5
1,2-Dichloroethene-(cis)	<0.5	<0.5	<0.5	<0.5	0.5
1,2-Dichloroethene-(trans)	<0.5	<0.5	<0.5	<0.5	0.5
1,1-Dichloroethene	<0.5	<0.5	<0.5	<0.5	0.5
1,2-Dichloropropane	<0.5	<0.5	<0.5	<0.5	0.5
1,3-Dichloropropane	<0.5	<0.5	<0.5	<0.5	0.5
2,2-Dichloropropane	<0.5	<0.5	<0.5	<0.5	0.5
1,3-Dichloropropene-(cis)	<0.5	<0.5	<0.5	<0.5	0.5

Viorel Vasile
Project Manager

LABORATORY ANALYSIS RESULTS

Client:	Loftin and Associates	**AA Project No.:**	A54501
Project No.:	NA	**Date Received:**	12/20/02
Project Name:	Chun	**Date Reported:**	01/10/03
Sample Matrix:	Water	**Units:**	ug/L
Method:	EPA 8260B		

Date Sampled:	**12/18/02**	**12/18/02**	**12/18/02**	**12/18/02**	
Date Analyzed:	**12/24/02**	**12/24/02**	**12/24/02**	**12/24/02**	
AA ID No.:	**147854**	**147855**	**147856**	**147857**	
Client ID No.:	**EW-12A**	**EW-12B**	**EW-12C**	**EW-12D**	
Dilution Factor:	**1.0**	**1.0**	**1.0**	**1.0**	**MRL**
Compounds:					
1,3-Dichloropropene-(trans)	<0.5	<0.5	<0.5	<0.5	0.5
1,1-Dichloropropene	<0.5	<0.5	<0.5	<0.5	0.5
Ethylbenzene	**65**	**70**	**74**	**66**	0.5
Hexachlorobutadiene	<1	<1	<1	<1	1
2-Hexanone	<10	<10	<10	<10	10
Isopropylbenzene	**12**	**4.3**	**12**	**7.1**	0.5
Isopropyltoluene	**0.94**	<1	<1	<1	1
Methyl tert-Butyl Ether	<2	<2	<2	<2	2
4-Methyl-2-pentanone	<10	<10	<10	<10	10
Methylene chloride	<5	<5	<5	<5	5
Naphthalene	**65**	**40**	**51**	**30**	2
Propylbenzene	**24**	**25**	**27**	**17**	0.5
Styrene	<0.5	<0.5	<0.5	<0.5	0.5
1,1,1,2-Tetrachloroethane	<0.5	<0.5	<0.5	<0.5	0.5
1,1,2,2-Tetrachloroethane	<0.5	<0.5	<0.5	<0.5	0.5
Tetrachloroethene	<0.5	<0.5	<0.5	<0.5	0.5
Toluene	**110**	**110**	**130**	**140**	0.5
1,2,3-Trichlorobenzene	<0.5	<0.5	<0.5	<0.5	0.5
1,2,4-Trichlorobenzene	<0.5	<0.5	<0.5	<0.5	0.5
1,1,1-Trichloroethane	<0.5	<0.5	<0.5	<0.5	0.5
1,1,2-Trichloroethane	<0.5	<0.5	<0.5	<0.5	0.5
Trichloroethene	<0.5	<0.5	<0.5	<0.5	0.5
Trichlorofluoromethane	<0.5	<0.5	<0.5	<0.5	0.5
1,2,3-Trichloropropane	<0.5	<0.5	<0.5	<0.5	0.5
1,2,4-Trimethylbenzene	**85**	**87**	**84**	**66**	0.5
1,3,5-Trimethylbenzene	**29**	**30**	**27**	**21**	0.5
Vinyl chloride	<0.5	<0.5	<0.5	<0.5	0.5
m,p-Xylenes	**200**	**220**	**230**	**210**	1
o-Xylene	**110**	**110**	**130**	**110**	0.5
sec-Butylbenzene	**2.7**	**2.7**	**2.4**	**1.5**	0.5
tert-Butylbenzene	<0.5	<0.5	<0.5	<0.5	0.5

Viorel Vasile
Project Manager

AMERICAN ANALYTICS

LABORATORY ANALYSIS RESULTS

Client: Loftin and Associates
Project No.: NA
Project Name: Chun
Sample Matrix: Water
Method: EPA 8260B

AA Project No.: A54501
Date Received: 12/20/02
Date Reported: 01/10/03
Units: ug/L

Date Sampled:	**12/18/02**	**12/18/02**	**12/18/02**	**12/18/02**	
Date Analyzed:	**12/24/02**	**12/24/02**	**12/24/02**	**12/24/02**	
AA ID No.:	**147858**	**147859**	**147860**	**147861**	
Client ID No.:	**MW-11**	**EW-14-12A**	**EW-14-12C**	**EW-14-12B**	
Dilution Factor:	**1.0**	**1.0**	**1.0**	**1.0**	**MRL**
Compounds:					
Acetone	<10	<10	**24**	**14**	10
Benzene	**14000**	**760**	**2100**	**2200**	0.5
Bromobenzene	<0.5	<0.5	<0.5	<0.5	0.5
Bromochloromethane	<0.5	<0.5	<0.5	<0.5	0.5
Bromodichloromethane	<0.5	<0.5	<0.5	<0.5	0.5
Bromoform	<0.5	<0.5	<0.5	<0.5	0.5
Bromomethane	<0.5	<0.5	<0.5	<0.5	0.5
2-Butanone	<10	<10	<10	<10	10
Butylbenzene	**36**	**4.6**	**16**	**9.4**	0.5
Carbon disulfide	<0.5	**2.5**	**4.7**	**5.1**	0.5
Carbon tetrachloride	<0.5	<0.5	<0.5	<0.5	0.5
Chlorobenzene	<0.5	<0.5	<0.5	<0.5	0.5
Chloroethane	<0.5	<0.5	<0.5	<0.5	0.5
Chloroform	<0.5	<0.5	<0.5	<0.5	0.5
Chloromethane	<0.5	<0.5	<0.5	<0.5	0.5
2-Chlorotoluene	<0.5	<0.5	<0.5	<0.5	0.5
4-Chlorotoluene	<0.5	<0.5	<0.5	<0.5	0.5
1,2-Dibromo-3-chloropropan	<1	<1	<1	<1	1
Dibromochloromethane	<0.5	<0.5	<0.5	<0.5	0.5
1,2-Dibromoethane	**0.77**	<0.5	<0.5	<0.5	0.5
Dibromomethane	<0.5	<0.5	<0.5	<0.5	0.5
1,2-Dichlorobenzene	<0.5	<0.5	<0.5	<0.5	0.5
1,3-Dichlorobenzene	<0.5	<0.5	<0.5	<0.5	0.5
1,4-Dichlorobenzene	<0.5	<0.5	<0.5	<0.5	0.5
Dichlorodifluoromethane	<0.5	<0.5	<0.5	<0.5	0.5
1,1-Dichloroethane	<0.5	<0.5	<0.5	<0.5	0.5
1,2-Dichloroethane	**32**	**4.6**	**11**	**7.8**	0.5
1,2-Dichloroethene-(cis)	<0.5	<0.5	<0.5	<0.5	0.5
1,2-Dichloroethene-(trans)	<0.5	<0.5	<0.5	<0.5	0.5
1,1-Dichloroethene	<0.5	<0.5	<0.5	<0.5	0.5
1,2-Dichloropropane	**0.89**	<0.5	<0.5	<0.5	0.5
1,3-Dichloropropane	<0.5	<0.5	<0.5	<0.5	0.5
2,2-Dichloropropane	<0.5	<0.5	<0.5	<0.5	0.5
1,3-Dichloropropene-(cis)	<0.5	<0.5	<0.5	<0.5	0.5

Viorel Vasile
Project Manager

AMERICAN ANALYTICS

LABORATORY ANALYSIS RESULTS

Client: Loftin and Associates
Project No.: NA
Project Name: Chun
Sample Matrix: Water
Method: EPA 8260B

AA Project No.: A54501
Date Received: 12/20/02
Date Reported: 01/10/03
Units: ug/L

Date Sampled:	12/18/02	12/18/02	12/18/02	12/18/02	
Date Analyzed:	12/24/02	12/24/02	12/24/02	12/24/02	
AA ID No.:	147858	147859	147860	147861	
Client ID No.:	MW-11	EW-14-12A	EW-14-12C	EW-14-12B	
Dilution Factor:	1.0	1.0	1.0	1.0	**MRL**
Compounds:					
1,3-Dichloropropene-(trans)	<0.5	<0.5	<0.5	<0.5	0.5
1,1-Dichloropropene	<0.5	<0.5	<0.5	<0.5	0.5
Ethylbenzene	**2400**	**200**	**850**	**680**	0.5
Hexachlorobutadiene	<1	<1	<1	<1	1
2-Hexanone	<10	<10	<10	<10	10
Isopropylbenzene	**79**	**8.8**	**40**	**26**	0.5
Isopropyltoluene	<1	<1	<1	<1	1
Methyl tert-Butyl Ether	**9.0**	<2	<2	<2	2
4-Methyl-2-pentanone	<10	<10	<10	<10	10
Methylene chloride	<5	<5	<5	<5	5
Naphthalene	**160**	**100**	**170**	**92**	2
Propylbenzene	**130**	**20**	**66**	**51**	0.5
Styrene	**13**	<0.5	<0.5	<0.5	0.5
1,1,1,2-Tetrachloroethane	<0.5	<0.5	<0.5	<0.5	0.5
1,1,2,2-Tetrachloroethane	<0.5	<0.5	<0.5	<0.5	0.5
Tetrachloroethene	<0.5	<0.5	<0.5	<0.5	0.5
Toluene	**2600**	**1200**	**4200**	**4300**	0.5
1,2,3-Trichlorobenzene	<0.5	<0.5	<0.5	<0.5	0.5
1,2,4-Trichlorobenzene	<0.5	<0.5	<0.5	<0.5	0.5
1,1,1-Trichloroethane	<0.5	<0.5	<0.5	<0.5	0.5
1,1,2-Trichloroethane	<0.5	<0.5	<0.5	<0.5	0.5
Trichloroethene	<0.5	<0.5	<0.5	<0.5	0.5
Trichlorofluoromethane	<0.5	<0.5	<0.5	<0.5	0.5
1,2,3-Trichloropropane	<0.5	<0.5	<0.5	<0.5	0.5
1,2,4-Trimethylbenzene	**1500**	**120**	**570**	**490**	0.5
1,3,5-Trimethylbenzene	**460**	**50**	**120**	**86**	0.5
Vinyl chloride	<0.5	<0.5	<0.5	<0.5	0.5
m,p-Xylenes	**8000**	**800**	**2900**	**2300**	1
o-Xylene	**2800**	**330**	**1200**	**920**	0.5
sec-Butylbenzene	**17**	<0.5	**6.4**	**3.8**	0.5
tert-Butylbenzene	<0.5	<0.5	<0.5	<0.5	0.5

Viorel Vasile
Project Manager

LABORATORY ANALYSIS RESULTS

Client:	Loftin and Associates			**AA Project No.:**	A54501
Project No.:	NA			**Date Received:**	12/20/02
Project Name:	Chun			**Date Reported:**	01/10/03
Sample Matrix:	Water			**Units:**	ug/L
Method:	EPA 8260B				

Date Sampled:	**12/18/02**	**12/18/02**	**12/18/02**	**12/18/02**	
Date Analyzed:	**12/24/02**	**12/24/02**	**12/24/02**	**12/24/02**	
AA ID No.:	**147858**	**147859**	**147860**	**147861**	
Client ID No.:	**MW-11**	**EW-14-12A**	**EW-14-12C**	**EW-14-12B**	
Dilution Factor:	**1.0**	**1.0**	**1.0**	**1.0**	**MRL**
Compounds:					

MRL: Method Reporting Limit J: Estimated Value

Viorel Vasile
Project Manager

AMERICAN ANALYTICS

LABORATORY ANALYSIS RESULTS

Client: Loftin and Associates
Project No.: NA
Project Name: Chun
Sample Matrix: Water
Method: EPA 8260B (Oxygenates)

AA Project No.: A54501
Date Received: 12/20/02
Date Reported: 01/10/03
Units: ug/L

Date Sampled:	12/18/02	12/18/02	12/18/02	12/18/02	
Date Analyzed:	12/24/02	12/24/02	12/24/02	12/24/02	
AA ID No.:	147854	147855	147856	147857	
Client ID No.:	EW-12A	EW-12B	EW-12C	EW-12D	
Dilution Factor:	1.0	1.0	1.0	1.0	**MRL**
Compounds:					
Di-isopropyl Ether	<2	<2	<2	<2	2
Ethyl tert-Butyl Ether	<2	<2	<2	<2	2
Methyl tert-Butyl Ether	<2	<2	<2	<2	2
Tert-Amyl Methyl Ether	<2	<2	<2	<2	2
Tert-Butanol	<10	<10	<10	<10	10

Viorel Vasile
Project Manager

AMERICAN ANALYTICS

LABORATORY ANALYSIS RESULTS

Client: Loftin and Associates
Project No.: NA
Project Name: Chun
Sample Matrix: Water
Method: EPA 8260B (Oxygenates)

AA Project No.: A54501
Date Received: 12/20/02
Date Reported: 01/10/03
Units: ug/L

Date Sampled:	**12/18/02**	**12/18/02**	**12/18/02**	**12/18/02**	
Date Analyzed:	**12/24/02**	**12/24/02**	**12/24/02**	**12/24/02**	
AA ID No.:	**147858**	**147859**	**147860**	**147861**	
Client ID No.:	**MW-11**	**EW-14-12A**	**EW-14-12C**	**EW-14-12B**	
Dilution Factor:	**1.0**	**1.0**	**1.0**	**1.0**	**MRL**
Compounds:					
Di-isopropyl Ether	<2	<2	<2	<2	2
Ethyl tert-Butyl Ether	<2	<2	<2	<2	2
Methyl tert-Butyl Ether	**9.0**	<2	<2	<2	2
Tert-Amyl Methyl Ether	<2	<2	<2	<2	2
Tert-Butanol	**140**	<10	<10	<10	10

MRL: Method Reporting Limit

J: Estimated Value

Viorel Vasile
Project Manager

LABORATORY QA/QC REPORT

Client: Loftin and Associates
Project Name: Chun
Method: EPA 8015M (GRO)
Sample ID: Reagent Blank

Project No.: NA
AA Project No.: A54501
Date Analyzed: 12/24/02
Date Reported: 01/10/03

Compounds	Results mg/L	MRL
Gasoline Range Organics	<0.1	0.1

MRL: Method Reporting Limit

NOTES:

GRO: Gasoline Range Organics

Viorel Vasile
Project Manager

American Analytics • 9765 Eton Avenue, Chatsworth, California 91311
Tel: (818) 998 - 5547 • • Fax: (818) 998 - 7258

LABORATORY QA/QC REPORT

Client: Loftin and Associates
Project Name: Chun
Method: EPA 8260B (Oxygenates)
Sample ID: Reagent Blank

Project No.: NA
AA Project No.: A54501
Date Analyzed: 12/24/02
Date Reported: 01/10/03

Compounds	Results ug/L	MRL
Di-isopropyl Ether	<2	2
Ethyl tert-Butyl Ether	<2	2
Methyl tert-Butyl Ether	<2	2
Tert-Amyl Methyl Ether	<2	2
Tert-Butanol	<10	10

MRL: Method Reporting Limit

Viorel Vasile
Project Manager

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LABORATORY QA/QC REPORT

Client: Loftin and Associates
Project Name: Chun
Method: EPA 8015M (GRO)
Sample ID: Laboratory Control Standard
Concentration: 0.5 mg/L

Project No.: NA
AA Project No. A54501
Date Analyzed: 12/24/02
Date Reported: 01/10/03

Compounds	Recovered Amount (mg/L)	Recovery (%)	Acceptable Range (%)
Gasoline Range Organics	0.53	106.0	48.0 - 152

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Project Manager

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LABORATORY QA/QC REPORT

Client: Loftin and Associates
Project Name: Chun
Method: EPA 8260B (Oxygenates)
Sample ID: Laboratory Control Standard
Concentration: 20 ug/L

Project No.: NA
AA Project No. A54501
Date Analyzed: 12/24/02
Date Reported: 01/10/03

Compounds	Recovered Amount (ug/L)	Recovery (%)	Acceptable Range (%)
Methyl tert-Butyl Ether	17.9	90	50 - 150

Viorel Vasile
Project Manager

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LABORATORY QA/QC REPORT

Client: Loftin and Associates
Project Name: Chun
Method: EPA 8015M (GRO)
Sample ID: Matrix Spike
Concentration: 0.5 mg/L

AA ID No: 147861
Project No.: NA
AA Project No. A54501
Date Analyzed: 12/24/02
Date Reported: 01/10/03

Compounds	Result (mg/L)	Spike Recovery (%)	Dup. Result (mg/L)	Spike/Dup. Recovery (%)	RPD (%)	Accept. Rec. Range (%)
Gasoline Range Organics	0.55	110.0	0.52	104.0	5.6	51.0 - 149

Viorel Vasile
Project Manager

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LABORATORY QA/QC REPORT

Client: Loftin and Associates
Project Name: Chun
Method: EPA 8260B (Oxygenates)
Sample ID: Matrix Spike
Concentration: 20 ug/L

AA ID No: 147854
Project No.: NA
AA Project No. A54501
Date Analyzed: 12/24/02
Date Reported: 01/10/03

Compounds	Result (ug/L)	Spike Recovery (%)	Dup. Result (ug/L)	Spike/Dup. Recovery (%)	RPD (%)	Accept. Rec. Range (%)
Methyl tert-Butyl Ether	0	0	0	0	0	50 - 150

Viorel Vasile
Project Manager

Franklin J. Goldman
PO BOX 2217, Guerneville, CA 95446
Phone: (707) 869-0850
Phone: (707) 869-0884 [Call before Faxing]

A 54501

CHAIN OF CUSTODY RECORD

Laboratory Analysis P.O. No.________

Laboratory Please Call Accounts Payable for P.O. No.

Date: 12/19/02 Sheet 1 Of 2

Project Name: Chun
Project Number:
Address: 2301 Santa Clara Ave, Alameda, CA
Sampler's Name: Frank Goldman
Sampler's Signature: [signature]

Laboratory Delivery Location:
Delta Environmental Laboratory
685 Stone Road, #11
Benicia, CA 94553
Phone: (707) 747-6081
FAX: (707) XXX-XXX
Phone

Turnaround Time: ☐ Rush ☐ 24 Hour ☐ 48 Hour ☒ 5-Day

Repeat to: Frank

Sample Number Location	Date	Time	TPH as Gasoline 8015	TPH as Diesel 8015	TPH-g/BTEX 8015/8020 & MTBE	BTEX & EPA 8020	Oil and Grease 5520	Volitile Organics (8010)	CAM Metals (17)	Pr. Pollutant Metals (13)	Base/Neu/Acids (Organic)	Pesticides 8140/8141	Method 8260b for 5 oxygenates & 2 lead scavengers (1)	TPHg BTEX (2)	Bulk density, moisture, porosity fraction of organic carbon	SOIL SAMPLE	WATER SAMPLE	Comments
EW-12A 147854	12/18/02	13:09											X	X			X	(1) analyze for EPA 8260B
EW-12B 147855	12/18/02	15:45											X	X			X	including fuel oxygenates
EW-12C 147856	12/18/02	18:30											X	X			X	(2) analyze for TPHg
EW-12D 147857	12/19/02	7:45											X	X			X	(Gasoline range Organics)
MW-11 147858	12/19/02	9:10											X	X			X	by EPA 8015M; BTEX will
EW-14-12A 147859	12/19/02	13:30											X	X			X	be reported via EPA 8260B
EW-14-12C 147860	12/19/02	16:30											X	X			X	(per client request
EW-14-12B 147861	12/19/02	15:30											X	X			X	on 12/20/02) V.V.

Relinquished By	Date	Time	Received By	Date	Time
[signature]	12/19/02	19:45	[signature]	12/19/02	19:45
[signature]	12/20/02	17:12	[signature]	12/20/02	17:12

Dispatched By	Date	Time	Received in Lab By	Date	Time

Total Number of Containers this Sheet: #32

Method of Shipment:

Special Shipment/Handling or Storage Requirements: **Keep on Ice**

Attachment D

Tables of Data and Hand Drawn Plots for Well Test Analysis

Transmissivity (T, ft²/min)

Well	Pumping test	Recovery test
EW-12	?	0.015 / 0.064
EW-13	0.18 (2gpm)	~~0.574~~ ~0.38 / (0.826) ←3 gpm (~0.545 ←2 gpm)
MW-2	0.077	0.074 / (0.430)
MW-3 (← other side of fill)	0.273 / 0.645	0.623 / 1.268
MW-5	0.08	0.14

Avg. T ≈ 0.1 – 0.6 ft²/min.

↑ native? ↑ native + fill?

Storativity (S)

Well	Pumping test	Recovery test
MW-2	0.0012	0.0010 / (4×10^{-8})
MW-3	0.0011 / 0.00087	0.00084 / 0.00093
MW-5	0.0034	0.0030

$S \approx 0.001 \quad (1 \times 10^{-3})$

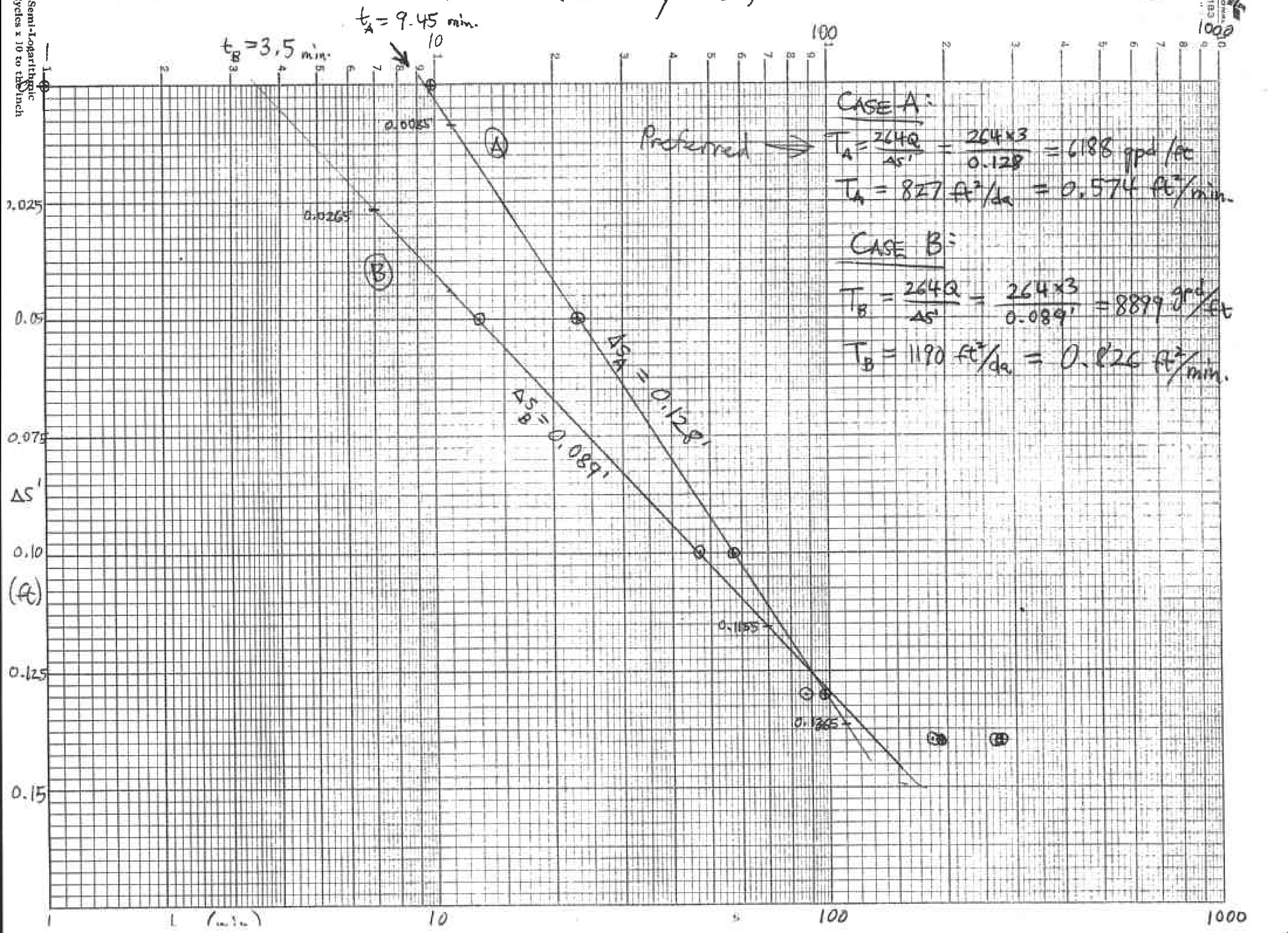
Recovery Test

AQUIFER

Address	Former		
Well	EW-13	Well	30
Total	24.3	Screened	5'-25'
Boring		Casing	4.00
Perforati		Filter	
Type of	Recovery	Static	7.42 Feet

Hr	~~Min~~ 5 (ft)	Time	Ellapsed min	Depth to GW	GW Elevation	Change [Ft/min]	Water Meter	Gal/min	Gal/min	Notes	Field Reading	Meter Reading
		12:00:00 am	0	7.75	22.25		3	3.00	ERR			
		12:00:00 am	5.4	7.78	22.22		3	3.00	0.00			
	0	12:00:00 am	0 9.75	7.75	22.25		3	3.00	0.00			
	0.05	12:00:00 am	13 23	7.7	22.3	-0.00	3	3.10	0.00			
	0.10	12:00:00 am	47 57	7.65	22.35	-0.00	3	0.00	0.00			
	0.13	12:00:00 am	87 97	7.62	22.38	-0.00	3	0.00	0.00			
	0.14	12:00:00 am	183 193	7.61	22.39	-0.00	3	0.00	0.00			
	0.14	12:00:00 am	265 275	7.61	22.39	0.00	3	0.00	0.00			
		12:00:00 am	↑ ↑		30	0.03	3	-0.01	ERR			
		12:00:00 am			30	ERR	3	ERR	ERR			
		12:00:00 am	⊙ ⊕		30	ERR	3	ERR	ERR			
		12:00:00 am			30	ERR	3	ERR	ERR			
		12:00:00 am			30	ERR	3	ERR	ERR			
		12:00:00 am			30	ERR	3	ERR	ERR			
		12:00:00 am			30	ERR	3	ERR	ERR			
		12:00:00 am			30	ERR	3	ERR	ERR			
		12:00:00 am			30	ERR	3	ERR	ERR			
		12:00:00 am			30	ERR	3	ERR	ERR			
		12:00:00 am			30	ERR	3	ERR	ERR			

EW-13 (Recovery Test)

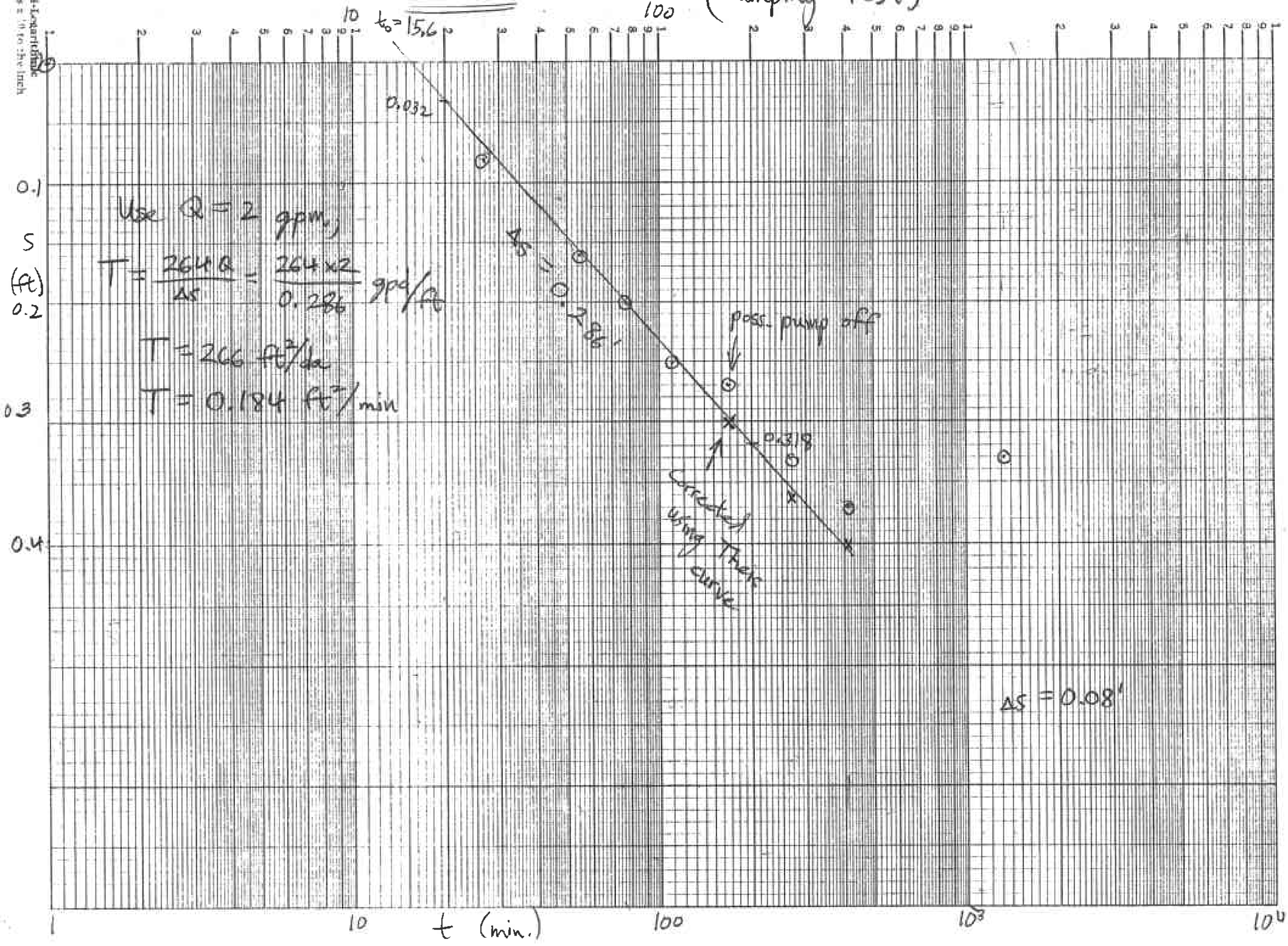


EW-13 Pumping Test

Hr	Min	Time	Ellapsed min	Depth to GW	GW Elevation	Change [Ft/min]	Water Meter	Gal/min	Gal/min	Notes	Field Reading	Meter Reading
		12:00:00 am	0	7.42	22.58		3	3.00	ERR			
	0.01	12:00:00 am	9	7.43	22.57		3	3.00	0.00			
	0.08	12:00:00 am	27	7.5	22.5		3	3.00	0.00			
	0.16	12:00:00 am	55	7.58	22.42	0.00	3	3.10	0.00			
	0.20	12:00:00 am	78	7.62	22.38	0.00	3	0.00	0.00			
	0.25	12:00:00 am	110	7.67	22.33	0.00	3	0.00	0.00			
(0.30)	0.27	12:00:00 am	168	7.69	22.31	0.00	3	0.00	0.00			
(0.36)	0.33	12:00:00 am	266	7.75	22.25	0.00	3	0.00	0.00			
(0.40)	0.37	12:00:00 am	408	7.79	22.21	0.00	3	0.00	0.00			
(0.45)	0.33	12:00:00 am	1326	7.75	22.25	-0.00	3	0.00	0.00			
		12:00:00 am			30	0.01	3	0.00	ERR			
	↑	12:00:00 am			30	ERR	3	ERR	ERR			
	x	12:00:00 am			30	ERR	3	ERR	ERR			
		12:00:00 am			30	ERR	3	ERR	ERR			
		12:00:00 am			30	ERR	3	ERR	ERR			
		12:00:00 am			30	ERR	3	ERR	ERR			
		12:00:00 am			30	ERR	3	ERR	ERR			
		12:00:00 am			30	ERR	3	ERR	ERR			
		12:00:00 am			30	ERR	3	ERR	ERR			
		12:00:00 am			30	ERR	3	ERR	ERR			
		12:00:00 am			30	ERR	3	ERR	ERR			

Address AQUIFER Former Correction

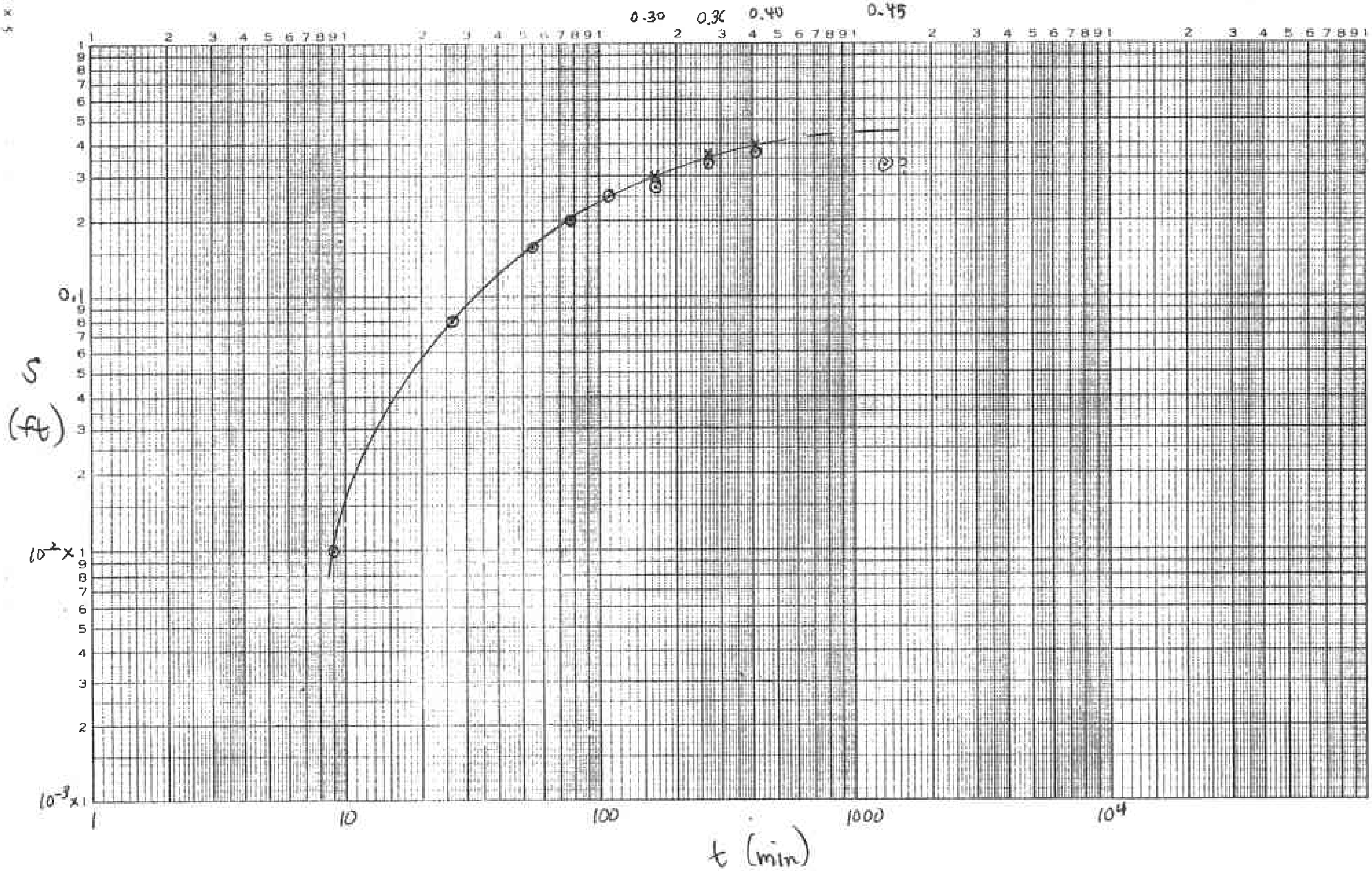
EW-13 (Pumping Test)

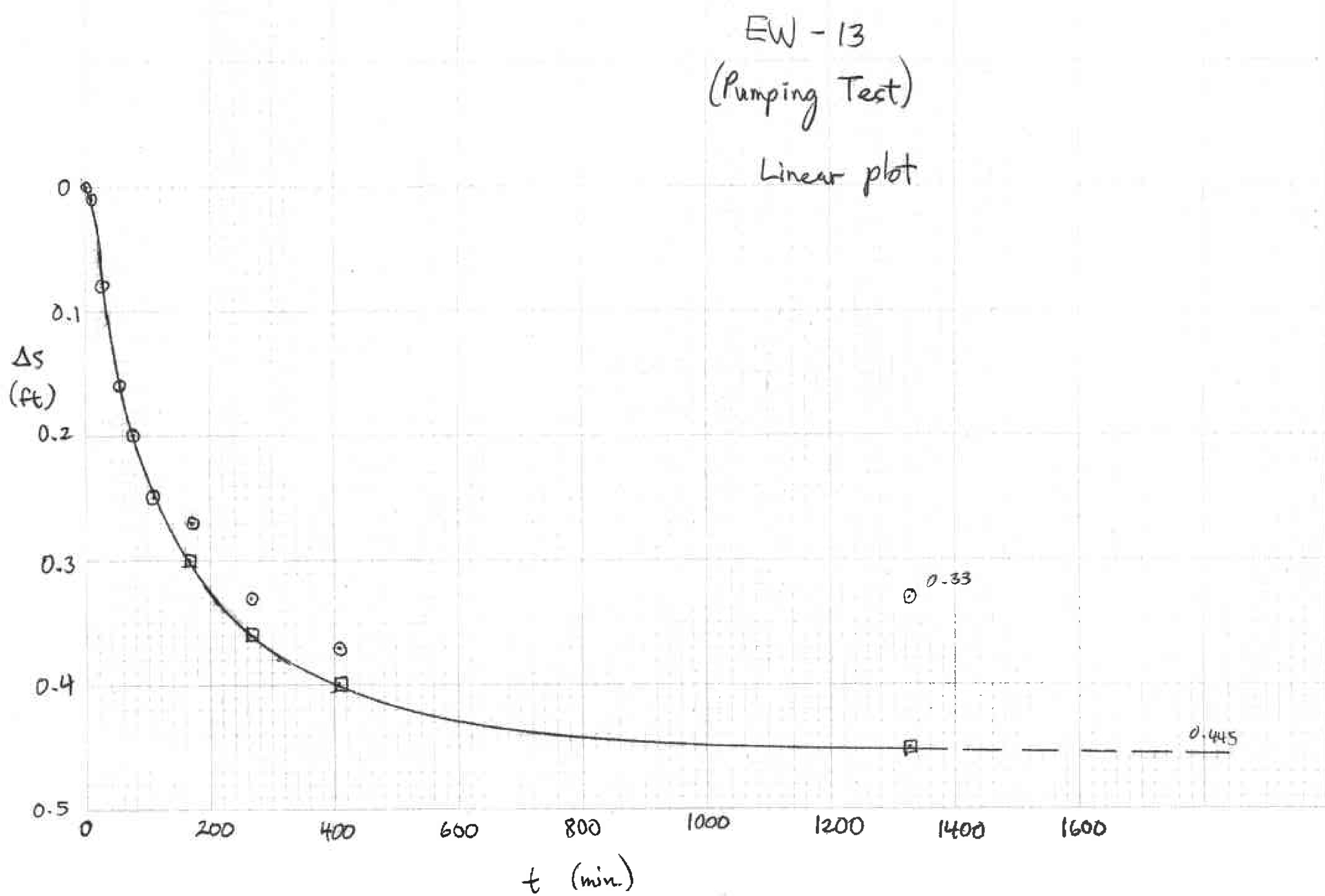


This is confined aquifer curve

EW-13 Pumping Test

Theis curve

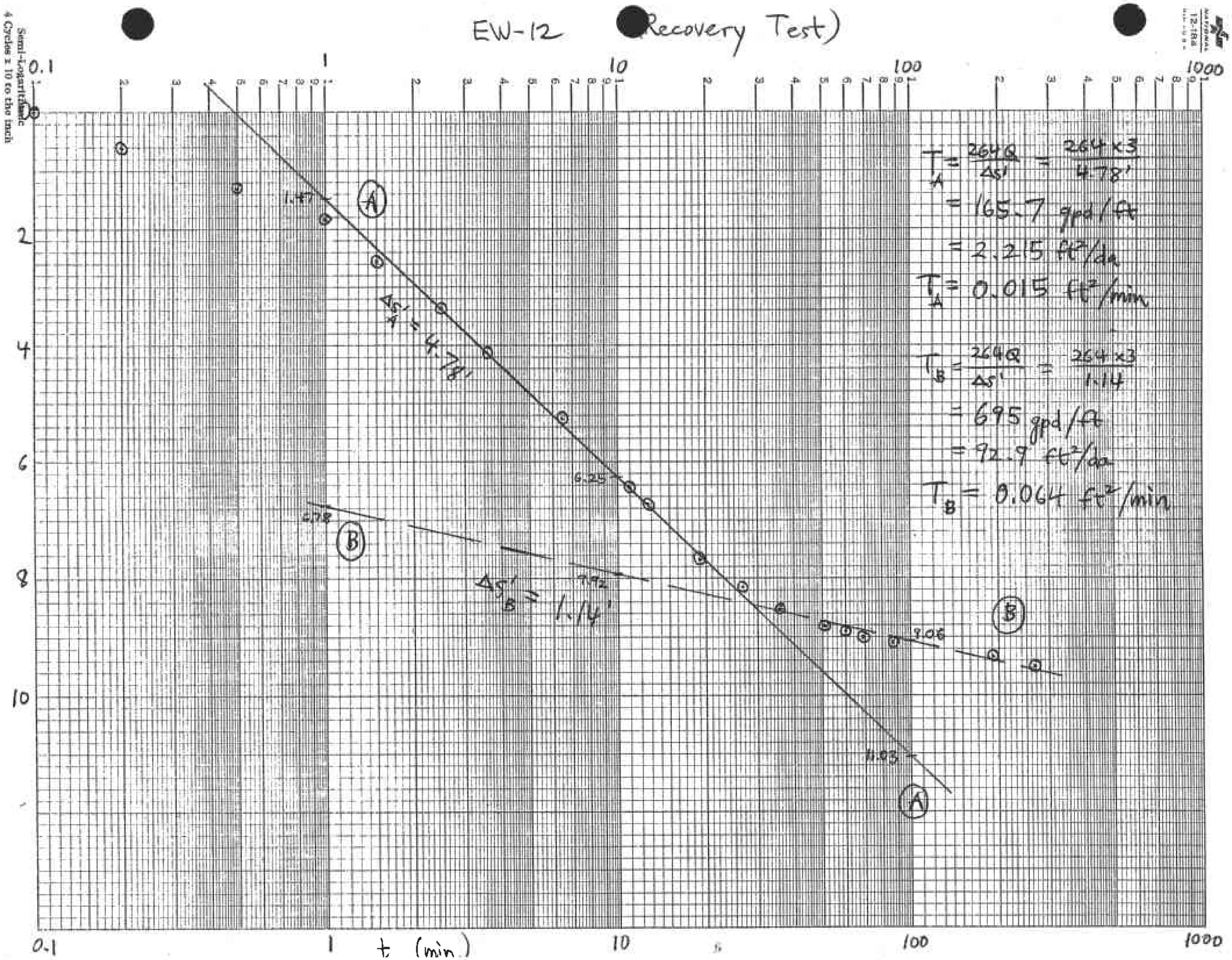



EW - 13
(Pumping Test)
Linear plot
Δs (ft)
0
0.1
0.2
0.3
0.4
0.5
0.33
0.445
0
200
400
600
800
1000
1200
1400
1600
t (min.)

AQUIFER

Address	Former		
Well	EW-12	Well	30
Total	24.71	Screened	5'-25'
Boring		Casing	4.00
Perforati		Filter	
Type of	Recovery	Static	16.15'? 17.15 Feet

ΔS' ~~Hr~~ (ft)	ΔS ~~Min~~ (ft)	Time	Ellapsed min	Depth to GW	GW Elevation	Change [Ft/min]	Water Meter	Gal/min	Gal/min	Notes	Field Reading	Meter Reading
0	9.77	12:00:00 am	0	25.92	4.08		3	3.00	ERR		18.5	
0.62	9.15	12:00:00 am	0.2	25.3	4.7		3	3.00	0.00		18.5	
1.30	8.47	12:00:10 am	0.5	24.62	5.38		3	3.00	0.00		18.78	
1.83	7.94	12:00:00 am	1	24.09	5.91	-1.06	3	3.10	0.00		19.34	
2.57	7.20	12:00:00 am	1.5	23.35	6.65	-1.48	3	0.00	0.00		20.02	
3.38	6.39	12:00:00 am	2.5	22.54	7.46	-0.81	3	0.00	0.00		21	
4.14	5.63	12:00:00 am	3.6	21.78	8.22	-0.69	3	0.00	0.00		22.05	
5.23	4.54	12:00:00 am	6.5	20.69	9.31	-0.38	3	0.00	0.00		21.19	
6.43	3.34	12:00:00 am	11	19.49	10.51	-0.27	3	0.00	0.00		23.19	
6.73	3.04	12:00:00 am	12.75	19.19	10.81	-0.17	3	0.00	0.00		24.57	
7.66	2.11	12:00:00 am	19	18.26	11.74	-0.15	3	0.00	0.00		25.47	
8.16	1.61	12:00:00 am	26.75	17.76	12.24	-0.06	3	0.00	0.00		26.85	
8.52	1.25	12:00:00 am	35.5	17.4	12.6	-0.04	3	0.00	0.00		26.63	
8.81	0.96	12:00:00 am	51	17.11	12.89	-0.02	3	0.00	0.00		26.62	
8.89	0.88	12:00:00 am	60	17.03	12.97	-0.01	3	0.00	0.00		27.29	
9.00	0.77	12:00:00 am	69	16.92	13.08	-0.01	3	0.00	0.00		26.97	
9.09	0.68	12:00:00 am	87	16.83	13.17	-0.01	3	0.00	0.00		23.98	
9.35	0.42	12:00:00 am	191	16.57	13.43	-0.00	3	0.00	0.00		26.62	
9.50	0.27	12:00:00 am	267	16.42	13.58	-0.00	3	0.00	0.00		25.62	



EW-12 (Recovery Test)
Semi-Logarithmic
4 Cycles x 10 to the inch
0.1
1
10
100
1000
2
4
6
8
10
1.47
(A)
$\Delta s'_A = 4.78'$
6.25
2.78
(B)
7.92
$\Delta s'_B = 1.14'$
9.06
(B)
11.03
(A)
$T_A = \frac{264Q}{\Delta s'} = \frac{264 \times 3}{4.78'}$
= 165.7 gpd/ft
= 2.215 ft²/da
T_A = 0.015 ft²/min
$T_B = \frac{264Q}{\Delta s'} = \frac{264 \times 3}{1.14}$
= 695 gpd/ft
= 92.9 ft²/da
T_B = 0.064 ft²/min
t (min)

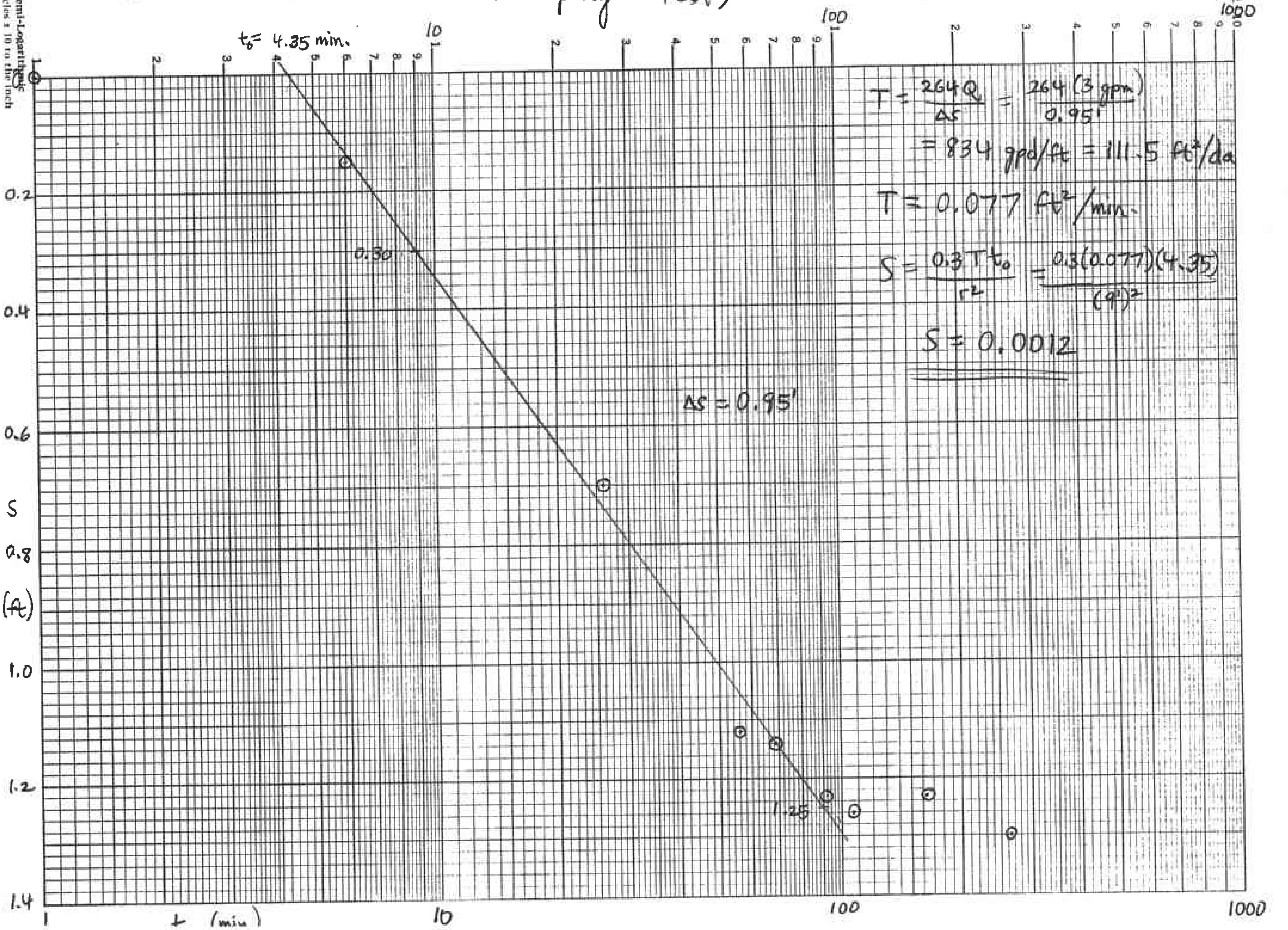
Pumping Test

AQUIFER

Address	Former	Well	10
Well	MW-2	Screened	
Total	25.19	Casing	2.00
Boring		Filter	
Perforati			
Type of	Drawdow	Static	from Recovery Test page 7.34 ~~8.52~~ Feet

Hr	5 ~~Min~~ (ft)	Time	Ellapsed min	Depth to GW	GW Elevation	Change [Ft/min]	Water Meter	Gal/min	Gal/min	Notes	Field Reading	Meter Reading
	0.15	12:00:00 am	6	7.49	2.51	1.24833	3		24.33			
	0.70	12:00:00 am	26	8.04	1.96	ERR	3					
	1.12	12:00:00 am	56	8.46	1.54	0.01400	3					
	1.14	12:00:00 am	69	8.48	1.52	0.00154	3		0.00			
	1.23	12:00:00 am	92	8.57	1.43	0.00391	3	0.00	0.00			
	1.26	12:00:00 am	107	8.6	1.4	0.00200	3	0.00	0.00			
	1.23	12:00:00 am	164	8.57	1.43	-0.00053	3	0.00	0.00			
	1.30	12:00:00 am	264	8.64	1.36	0.00070	3	0.00	0.00			
	1.23	12:00:00 am	1322	8.57	1.43	-0.00007	3	0.00	0.00			
		12:00:00 am			10	0.00648		0.00	ERR			
		12:00:00 am			10	ERR		ERR	ERR			
		12:00:00 am			10	ERR		ERR	ERR			
		12:00:00 am			10	ERR		ERR	ERR			

MW-2 (Pumping Test)

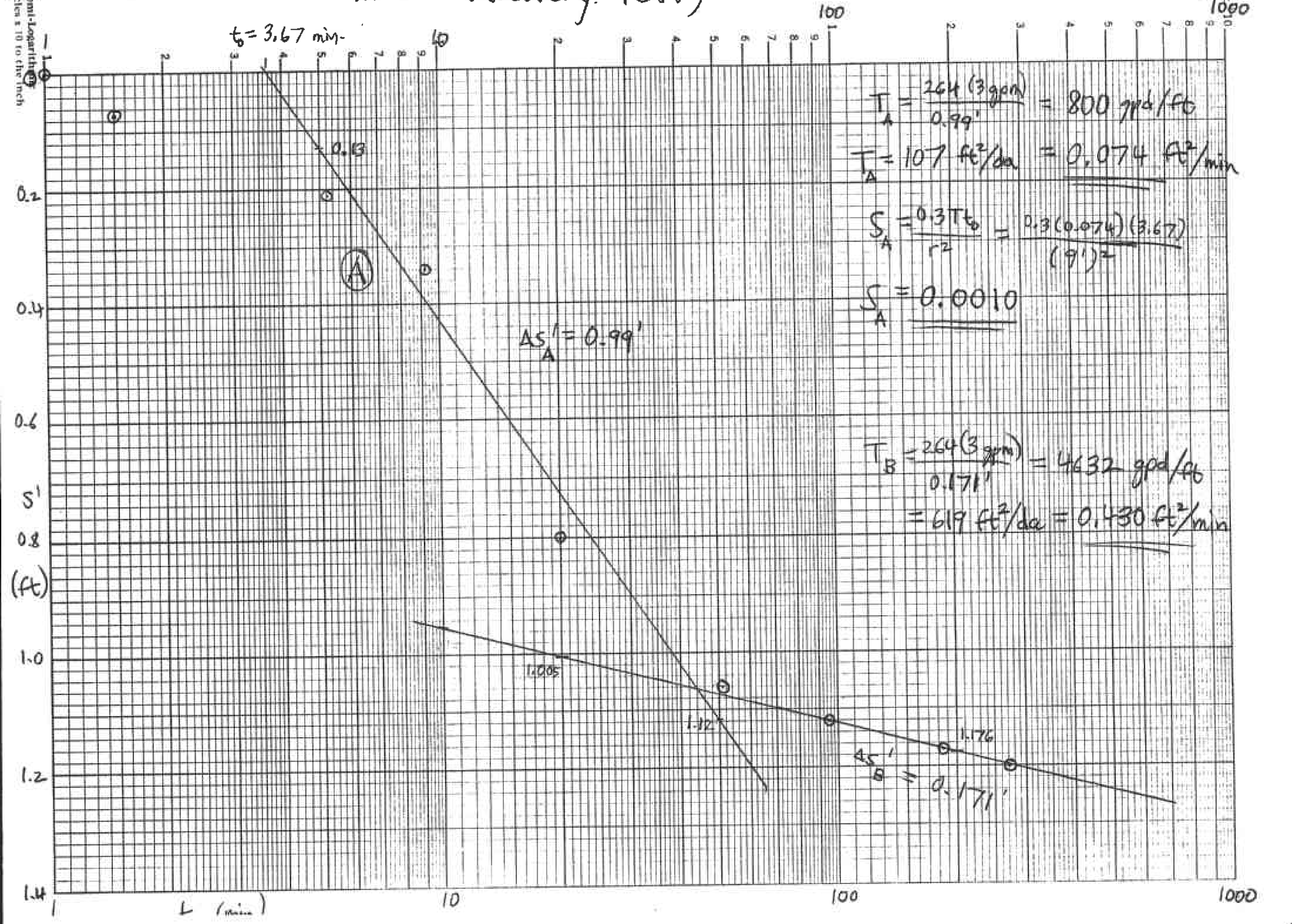


AQUIFER

Address	Former			
Well	MW-2	Well	10	
Total	25.19	Screened		
Boring		Casing	2.00	
Perforati		Filter		
Type of	Recovery	Static	7.34	Feet

s-s' (ft)	t'	Min ~~Hr~~	s ~~Min~~ (ft)	Time	Ellapsed min	Depth to GW	GW Elevation	Change [Ft/min]	Water Meter	Gal/min	Gal/min	Notes	Field Reading	Meter Reading
		1322	1.23	12:00:00 am	0	8.57	1.43	0.00000			ERR			
0	0	1324	1.29	12:00:00 am	1.5	8.63	1.37	0.04000						
0.07	1.5	1325	1.22	12:00:00 am	3	8.56	1.44	-0.04667						
0.21	5.25	1329	1.08	12:00:00 am	6.75	8.42	1.58	-0.03733			0.00			
0.34	9.25	1333	0.95	12:00:00 am	10.75	8.29	1.71	-0.03256		0.00	0.00			
0.80	20	1344	0.49	12:00:00 am	21.5	7.83	2.17	-0.04279		0.00	0.00			
1.06	51	1374	0.23	12:00:00 am	52	7.57	2.43	-0.00852		0.00	0.00			
1.12	95	1418	0.17	12:00:00 am	96	7.51	2.49	-0.00136		0.00	0.00			
1.17	184	1507	0.12		185	7.46	2.54	-0.00056						
1.20	272	1595	0.09	12:00:00 am	273	7.43	2.57	-0.00045		0.00	0.00			
				12:00:00 am			10	0.02722		-0.00	ERR			
				12:00:00 am			10	ERR		ERR	ERR			
				12:00:00 am			10	ERR		ERR	ERR			
				12:00:00 am			10	ERR		ERR	ERR			
				12:00:00 am			10	ERR		ERR	ERR			
				12:00:00 am			10	ERR		ERR	ERR			
				12:00:00 am			10	ERR		ERR	ERR			
				12:00:00 am			10	ERR		ERR	ERR			

MW-2 (Recovery Test)



MW-2 (Recov. Test) — Case B

t (log cycle)	s'
10	0.954
1	0.783
0.1	0.612
10^{-2}	0.441
10^{-3}	0.270
10^{-4}	0.099
10^{-5}	-0.072
10^{-6}	

t_o is between 10^{-4} + 10^{-5}

$t_o \approx 2.6 \times 10^{-5}$

To projection beyond graph to find intercept time t_o, note that s' changes by 0.171 ft each log cycle

$$S = \frac{0.3\,T\,t_o}{r^2} = \frac{0.3\,(0.43\ ft^2/min)(2.6\times10^{-5}\ min)}{(9\ ft)^2}$$

$$S = 4.1 \times 10^{-8}$$

AQUIFER

Address	Former		
Well	MW-3	Well	10
Total	19.22	Screened	
Boring		Casing	2.00
Perforati		Filter	
Type of	Recovery	Static	7.88 Feet

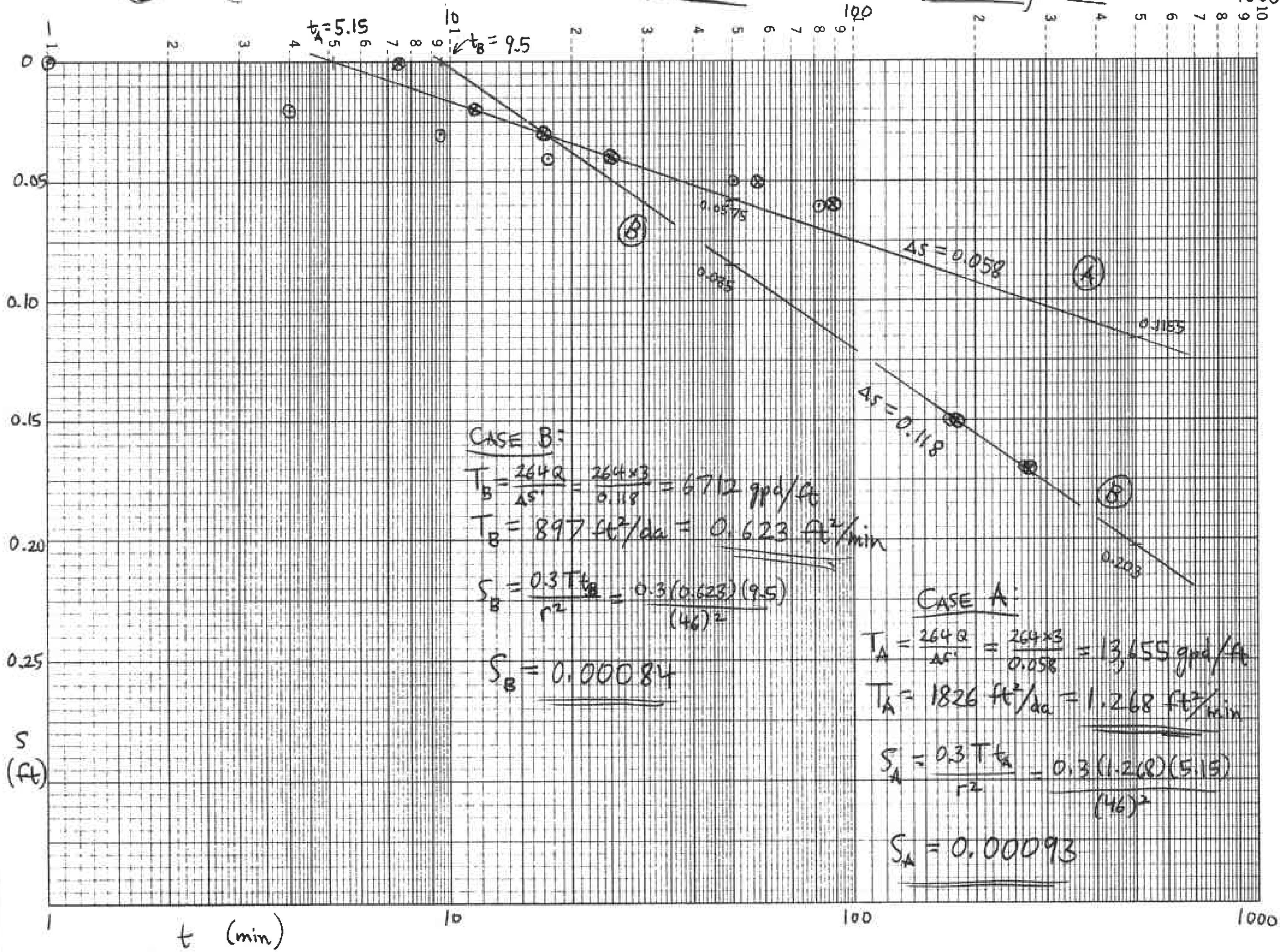
s' (ft)	t (Min)	Time	Ellapsed min	Depth to GW	GW Elevation	Change [Ft/min]	Water Meter	Gal/min	Gal/min	Notes	Field Reading	Meter Reading
		12:00:00 am	0	8.02	1.98				ERR			
0	0	12:00:00 am	7.5	8.02	1.98							
0.02	4	12:00:00 am	11.5	8	2							
0.03	9.5		17	7.99	2.01							
0.04	17.5	12:00:00 am	25	7.98	2.02	-0.00			0.00			
0.05	50.5	12:00:00 am	58	7.97	2.03	-0.00		0.00	0.00			
0.06	82	12:00:00 am	89	7.96	2.04	-0.00		0.00	0.00			
0.15	173	12:00:00 am	180	7.87	2.13	-0.00		0.00	0.00			
0.17	264	12:00:00 am	271	7.85	2.15	-0.00		0.00	0.00			
		12:00:00 am			10	0.03		-0.00	ERR			
	↑	12:00:00 am	↑		10	ERR		ERR	ERR			
	0	12:00:00 am	⊗	-9	19	ERR		ERR	ERR			
		12:00:00 am		-9	19	ERR		ERR	ERR			
		12:00:00 am		-9	19	ERR		ERR	ERR			
		12:00:00 am		-9	19	ERR		ERR	ERR			
		12:00:00 am		-9	19	ERR		ERR	ERR			

K+E SEMI-LOGARITHMIC • 3 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

W-3

46 5490

(Recovery Test)



		12:00:00 am			10	ERR		ERR	ERR			
		12:00:00 am			10	ERR		ERR	ERR			
		12:00:00 am			10	ERR		ERR	ERR			
		12:00:00 am			10	ERR		ERR	ERR			

Pumping Test

AQUIFER

Address	Former		
Well	MW-3	Well	10
Total	19.22	Screened	
Boring		Casing	2.00
Perforati		Filter	
Type of	Drawdow	Static	7.88 Feet

Hr	5 ~~Min~~ (ft)	Time	Ellapsed min	Depth to GW	GW Elevation	Change [Ft/min]	Water Meter	Gal/min	Gal/min	Notes	Field Reading	Meter Reading
	0	12:00:00 am	0	7.88	2.12				ERR			
	0.03	12:00:00 am	17.5	7.91	2.09							
	0.06	12:00:00 am	31	7.94	2.06							
	0.09	12:00:00 am	58	7.97	2.03	0.00			0.00			
	0.12	12:00:00 am	80	8	2	0.00		0.00	0.00			
	0.16	12:00:00 am	111	8.04	1.96	0.00		0.00	0.00			
(0.21)	0.14	12:00:00 am	170	8.02	1.98	-0.00		0.00	0.00			

MW-3 Pumping Test (Cont.)

s (ft)

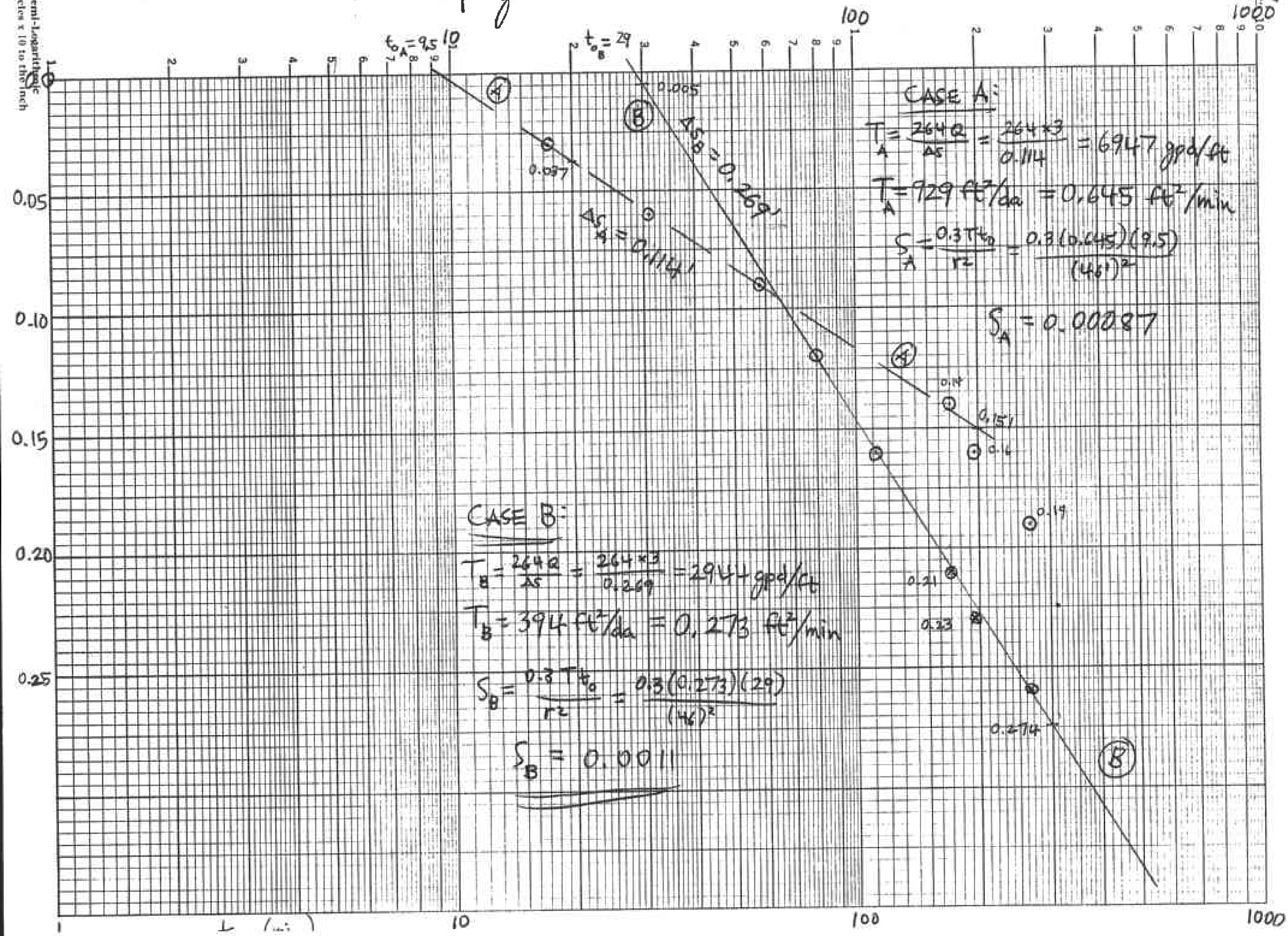
(0.23)	0.16	12:00:00 am	196	8.04	1.96	0.00		0.00	0.00			
(0.26)	0.19	12:00:00 am	267	8.07	1.93	0.00		0.00	0.00			
—	0.14	12:00:00 am	1327	8.02	1.98	-0.00		0.00	0.00			
		12:00:00 am		-9	19	0.01		0.00	ERR			
		12:00:00 am		-9	19	ERR		ERR	ERR			
		12:00:00 am		-9	19	ERR		ERR	ERR			
		12:00:00 am		-9	19	ERR		ERR	ERR			
		12:00:00 am		-9	19	ERR		ERR	ERR			

AQUIFER

Address	Former		
Well	MW-4	Well	10
Total	20.81	Screened	
Boring		Casing	
Perforati		Filter	
Type of	Drawdow	Static	7.43 Feet

Hr	Min	Time	Ellapsed min	Depth to GW	GW Elevation	Change [Ft/min]	Water Meter	Gal/min	Gal/min	Notes	Field Reading	Meter Reading
		12:00:00 am	0	7.43	2.57				ERR			

MW-3 (Pumping Test)



CASE A:

$$T_A = \frac{264Q}{\Delta s} = \frac{264 \times 3}{0.114} = 6947 \text{ gpd/ft}$$

$$T_A = 929 \text{ ft}^2/\text{da} = 0.645 \text{ ft}^2/\text{min}$$

$$S_A = \frac{0.3 T t_0}{r^2} = \frac{0.3(0.645)(9.5)}{(46')^2}$$

$$S_A = 0.00087$$

CASE B:

$$T_B = \frac{264Q}{\Delta s} = \frac{264 \times 3}{0.269} = 2944 \text{ gpd/ft}$$

$$T_B = 394 \text{ ft}^2/\text{da} = 0.273 \text{ ft}^2/\text{min}$$

$$S_B = \frac{0.3 T t_0}{r^2} = \frac{0.3(0.273)(29)}{(46)^2}$$

$$S_B = 0.0011$$

		12:00:00 am	18	7.45	2.55								
		12:00:00 am	30	7.48	2.52								
		12:00:00 am	58	7.54	2.46	0.00			0.00				
		12:00:00 am	80	7.55	2.45	0.00		0.00	0.00				
		12:00:00 am	112	7.6	2.4	0.00		0.00	0.00				
		12:00:00 am	171	7.62	2.38	0.00		0.00	0.00				
		12:00:00 am	198	7.62	2.38	0.00		0.00	0.00				
		12:00:00 am	268	7.66	2.34	0.00		0.00	0.00				
		12:00:00 am	412	7.68	2.32	0.00		0.00	0.00				
		12:00:00 am	1327	7.6	2.4	0.00		0.00	0.00				
		12:00:00 am			10	0.01		-0.00	ERR				
		12:00:00 am			10	ERR		ERR	ERR				
		12:00:00 am			10	ERR		ERR	ERR				
		12:00:00 am			10	ERR		ERR	ERR				
		12:00:00 am			10	ERR		ERR	ERR				
		12:00:00 am			10	ERR		ERR	ERR				
		12:00:00 am			10	ERR		ERR	ERR				

Pumping Test

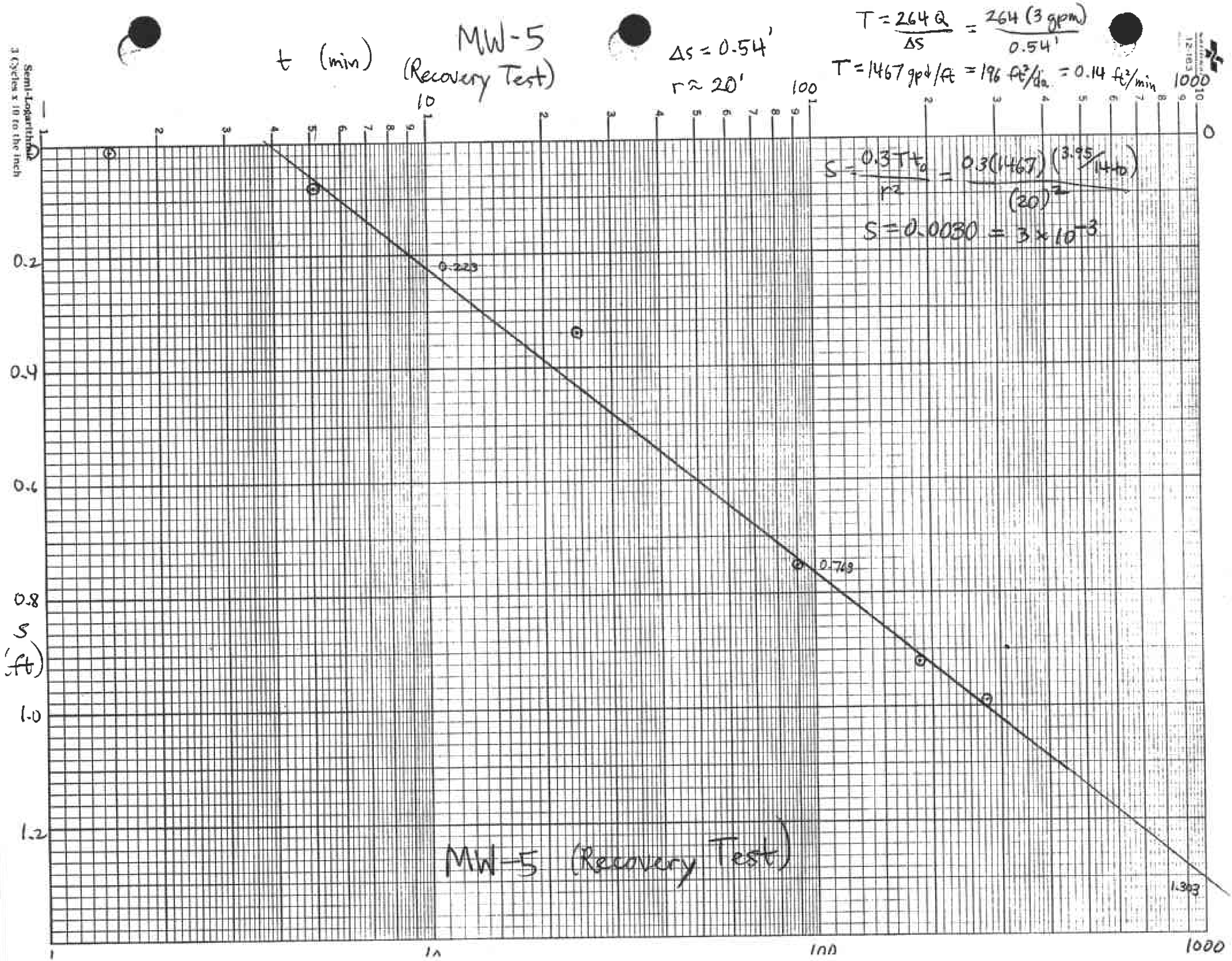
AQUIFER

Address	Former		
Well	MW5	Well	10
Total	21.66	Screened	
Boring		Casing	2.00

AQUIFER

Address	Former			
Well	MW5	Well	10	
Total	21.66	Screened		
Boring		Casing	2.00	
Perforati		Filter		
Type of	Recovery	Static	6.92	Feet

ΔS (ft)	t (min)	~~Hr~~ min	s (ft) ~~Min~~	Time	Ellapsed min	Depth to GW	GW Elevation	Change [Ft/min]	Water Meter	Gal/min	Gal/min	Notes	Field Reading	Meter Reading
		1323	0.99	12:00:00 am	0	7.91	2.09		3		ERR			
0	0	1325	1.05	12:00:00 am	2	7.97	2.03		3					
0.01	1.5	1327	1.04	12:00:00 am	3.5	7.96	2.04		3					
0.08	5.1	1330	0.97	12:00:00 am	7.1	7.89	2.11	-0.02	3		0.00			
0.34	24.6	1350	0.71	12:00:00 am	26.5	7.63	2.37	0.01	3	0.00	0.00			
0.75	90	1415	0.30	12:00:00 am	92	7.22	2.78	-0.01	3	0.00	0.00			
0.92	185	1510	0.13	12:00:00 am	187	7.05	2.95	-0.00	3	0.00	0.00			
0.99	275	1600	0.06	12:00:00 am	277	6.98	3.02	-0.00	3	0.00	0.00			
				12:00:00 am				0.03	3	-0.00	ERR			
				12:00:00 am				ERR	3	ERR	ERR			
				12:00:00 am				ERR	3	ERR	ERR			
				12:00:00 am			10	ERR		ERR	ERR			
				12:00:00 am			10	ERR		ERR	ERR			
				12:00:00 am			10	ERR		ERR	ERR			
				12:00:00 am			10	ERR		ERR	ERR			
				12:00:00 am			10	ERR		ERR	ERR			
				12:00:00 am			10	ERR		ERR	ERR			



MW-5
(Recovery Test)
t (min)
Δs = 0.54'
r ≈ 20'
T = 264 Q / Δs = 264 (3 gpm) / 0.54'
T = 1467 gpd/ft = 196 ft²/da = 0.14 ft²/min
S = 0.3 T t₀ / r² = 0.3(1467)(3.95/1440) / (20)²
S = 0.0030 = 3 × 10⁻³
0.223
0.769
1.303
s (ft)
0
0.2
0.4
0.6
0.8
1.0
1.2
1
10
100
1000
Semi-Logarithmic
3 Cycles x 10 to the inch
MW-5 (Recovery Test)

Pumping Test MW-5 Pumping well = EW-12

Perforati Type of

Drawdow

Filter Static 6.92 Feet

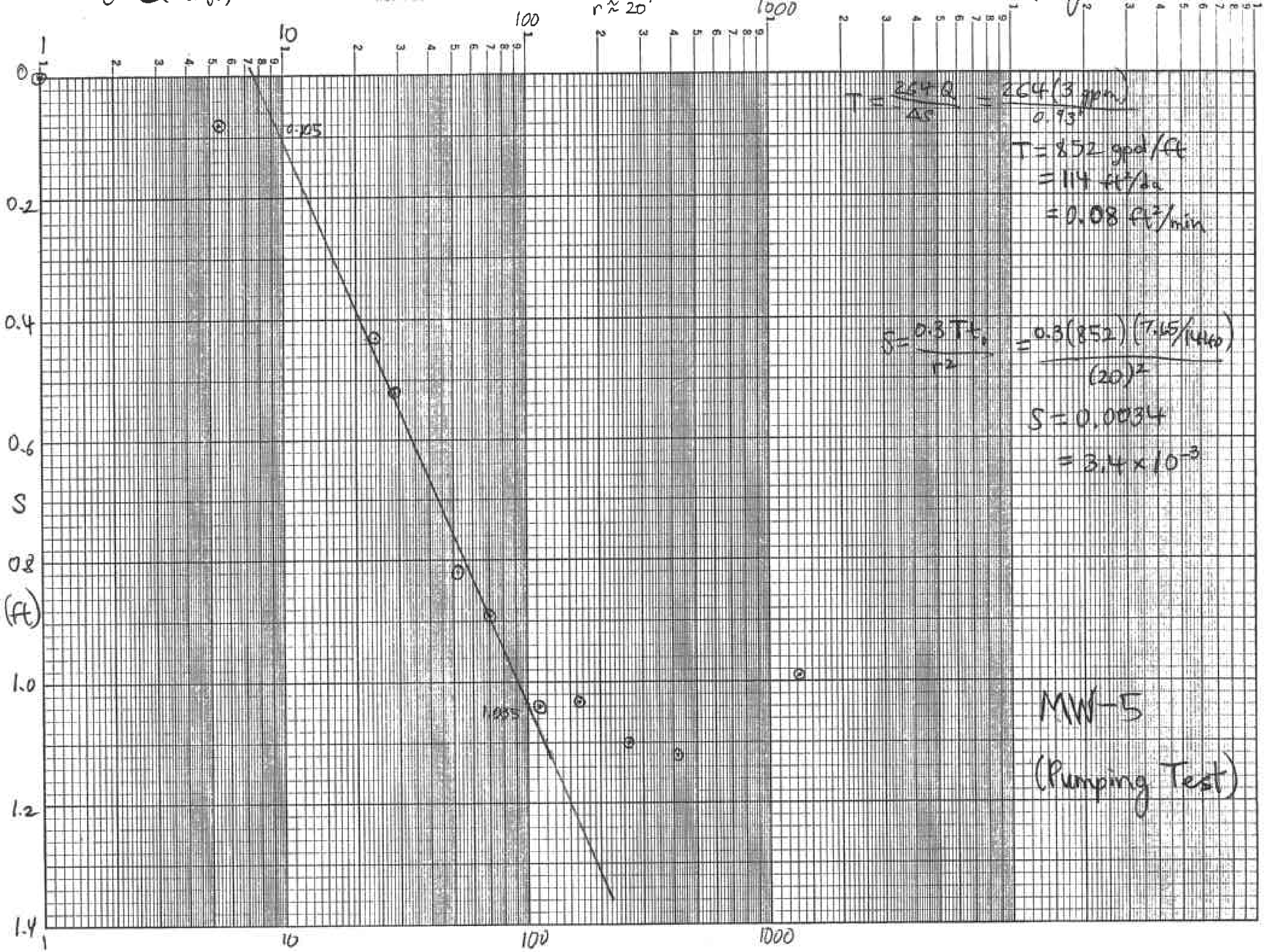
Hr	5 ~~Min~~ (ft)	Time	Ellapsed min	Depth to GW	GW Elevation	Change [Ft/min]	Water Meter	Gal/min	Gal/min	Notes	Field Reading	Meter Reading
	0	12:00:00 am	0	6.92	3.08		3		ERR			
	0.08	12:00:00 am	5.5	7	3		3					
	0.43	12:00:00 am	24	7.35	2.65		3					
	0.52	12:00:00 am	29	7.44	2.56	0.02	3		0.00			
	0.82	12:00:00 am	52	7.74	2.26	0.01	3	0.00	0.00			
	0.89	12:00:00 am	70	7.81	2.19	0.00	3	0.00	0.00			
	1.04	12:00:00 am	113	7.96	2.04	0.00	3	0.00	0.00			
	1.03	12:00:00 am	165	7.95	2.05	0.00	3	0.00	0.00			
	1.10	12:00:00 am	263	8.02	1.98	0.00	3	0.00	0.00			
	1.12	12:00:00 am	405	8.04	1.96	0.00	3	0.00	0.00			
	0.99	12:00:00 am	1323	7.91	2.09	-0.00	3	0.00	0.00			
		12:00:00 am			10	0.01		0.00	ERR			
		12:00:00 am			10	ERR		ERR	ERR			
		12:00:00 am			10	ERR		ERR	ERR			
		12:00:00 am			10	ERR		ERR	ERR			
		12:00:00 am			10	ERR		ERR	ERR			
		12:00:00 am			10	ERR		ERR	ERR			

t [redacted] (min.)

K+E SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS KEUFFEL & ESSER CO. 46 6210 MADE IN U.S.A.

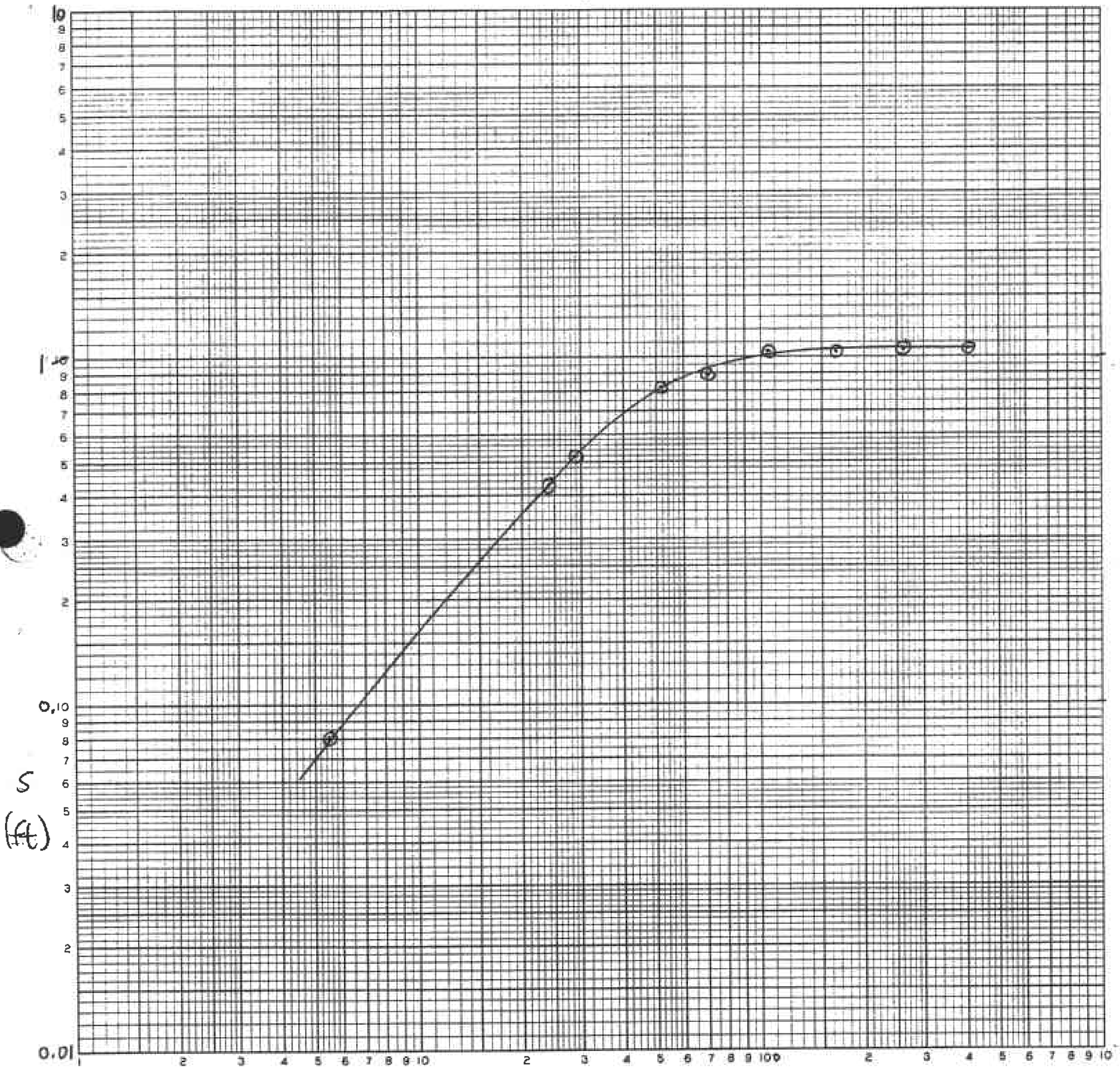
Δs = [redacted] 3'
r ≈ 20'

MW-5 (Pumping Test) [redacted]



confined aquifer curve

MW-5 (Pumping Test)



Full Logarithmic, 3 × 3 Cycles

Attachment E

Aqtesolv Well Test Analysis

Data Set:
Date: 07/11/03
Time: 20:02:51

PROJECT INFORMATION

Company: Geosolv, LLC.
Client: Former Chun Service Station
Location: 2301 Santa Clara Avenue,
Test Date: December 19, 2002
Test Well: EW12

AQUIFER DATA

Saturated Thickness: 17. ft
Anisotropy Ratio (Kz/Kr): 1.

PUMPING WELL DATA

Number of pumping wells: 1

Pumping Well No. 1: EW-12

X Location: 169.5 ft
Y Location: 183.5 ft

No. of pumping periods: 7

Pumping Period Data

Time (min)	Rate (cu. ft/min)	Time (min)	Rate (cu. ft/min)	Time (min)	Rate (cu. ft/min)
0.	3.	23.5	3.1	276.	3.
6.	3.	57.5	3.		
10.	3.	194.	3.		

OBSERVATION WELL DATA

Number of observation wells: 1

Observation Well No. 1: MW2

X Location: 175.5 ft
Y Location: 178. ft

No. of observations: 10

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.1	1.43	10.75	1.71	185.	2.54
1.5	1.37	21.5	2.17	273.	2.57
3.	1.44	52.	2.43		

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
6.75	1.58	96.	2.49		

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	1.413	ft^2/min
S	1.146E-05	

AUTOMATIC ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	Std. Error	
T	1.272	0.2137	ft^2/min
S	1.623E-05	2.65E-05	

Parameter Correlations

	T	S
T	1.00	-0.97
S	-0.97	1.00

Residual Statistics

for weighted residuals

Sum of Squares.... 0.4163 ft^2
Variance.......... 0.05203 ft^2
Std. Deviation...... 0.2281 ft
Mean.............. -0.0003863 ft
No. of Residuals ... 10.
No. of Estimates ... 2

Data Set:
Date: 07/09/03
Time: 16:50:26

PROJECT INFORMATION

Company: Geosolv, LLC.
Client: Former Chun Service Station
Location: 2301 Santa Clara Avenue,
Test Date: December 19, 2002
Test Well: EW12

AQUIFER DATA

Saturated Thickness: 17. ft
Anisotropy Ratio (Kz/Kr): 1.

PUMPING WELL DATA

Number of pumping wells: 1

Pumping Well No. 1: EW-12

X Location: 169.5 ft
Y Location: 183.5 ft

No. of pumping periods: 7

Pumping Period Data

Time (min)	Rate (cu. ft/min)	Time (min)	Rate (cu. ft/min)	Time (min)	Rate (cu. ft/min)
0.	3.	23.5	3.1	276.	3.
6.	3.	57.5	3.		
10.	3.	194.	3.		

OBSERVATION WELL DATA

Number of observation wells: 1

Observation Well No. 1: MW3

X Location: 181.7 ft
Y Location: 138.7 ft

No. of observations: 9

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.1	1.98	17.	2.01	89.	2.04
7.5	1.98	25.	2.02	180.	2.13
11.5	2.	58.	2.03	271.	2.15

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	2.414	ft^2/min
S	1.E-10	

AUTOMATIC ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	Std. Error	
T	2.414	0.7846	ft^2/min
S	1.E-10	6.224E-10	

Parameter Correlations

	T	S
T	1.00	-0.04
S	-0.04	0.00

Residual Statistics

for weighted residuals

Sum of Squares.... 0.3175 ft^2
Variance........... 0.04535 ft^2
Std. Deviation...... 0.213 ft
Mean.............. 0.04148 ft
No. of Residuals ... 9.
No. of Estimates ... 2

Data Set: C:\008110~1\CHUN\EW12-MW5.AQT
Date: 08/13/03
Time: 09:23:08

PROJECT INFORMATION

Company: Geosolv, LLC.
Client: Former Chun Service Station
Location: 2301 Santa Clara Avenue,
Test Date: December 19, 2002
Test Well: EW12

AQUIFER DATA

Saturated Thickness: 17. ft
Anisotropy Ratio (Kz/Kr): 1.

PUMPING WELL DATA

Number of pumping wells: 1

Pumping Well No. 1: EW12

X Location: 169.5 ft
Y Location: 183.5 ft

No. of pumping periods: 7

Pumping Period Data

Time (min)	Rate (cu. ft/min)	Time (min)	Rate (cu. ft/min)	Time (min)	Rate (cu. ft/min)
0.	3.	23.5	3.1	276.	3.
6.	3.	57.5	3.		
10.	3.	194.	3.		

OBSERVATION WELL DATA

Number of observation wells: 1

Observation Well No. 1: MW5

X Location: 164.5 ft
Y Location: 163.7 ft

No. of observations: 8

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.1	2.09	7.1	2.11	187.	2.95
2.	2.03	26.5	2.37	277.	3.02

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
3.5	2.04	92.	2.78		

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	1.735	ft^2/min
S	2.836E-09	

AUTOMATIC ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	Std. Error	
T	1.735	0.4276	ft^2/min
S	2.836E-09	1.164E-08	

Parameter Correlations

	T	S
T	1.00	-0.77
S	-0.77	0.61

Residual Statistics

for weighted residuals

Sum of Squares .... 0.3392 ft^2
Variance .... 0.05653 ft^2
Std. Deviation ...... 0.2378 ft
Mean .... 0.000914 ft
No. of Residuals.... 8.
No. of Estimates ... 2

Attachment F

Calculation estimate of width and length of capture zones

Boundary conditions (Fetter, 1994, p. 502)

1. The distance from the pumping well downstream to the stagnation point that marks the end of the capture zone is given by

$$X_0 = -Q/(2\pi Kbi) \qquad (11\text{-}17)$$

where x_0 is the distance from the pumping well to the down-gradient edge of the capture zone (L; ft or in).

2. The maximum width of the capture zone as x approaches infinity is given by

$$Y_{max} = \pm Q/(2Kbi) \qquad (11\ 18)$$

where Y_{max} is the half-width of the capture zone as x approaches infinity.

Calculations

Q=577ft^3/day (3gpm)	is the pumping rate (L3IT; ft3/day or m3/day)
T=(2.414+1.735+1.272)/3=1.807 ft^2/min	
K= 1.807/17=0.106294117 ft/min = 153 ft/day is the hydraulic conductivity (LIT; ft/day or rn/day)	
b=17 ft	is the initial saturated thickness of the aquifer (L; ft or m)
I=1/53=0.0189 ft/ft	is the hydraulic gradient of the flow field in the absence of the pumping well (dimensionless)

$X_0 = -Q/(2\pi Kbi)$=-577/(2*3.14*153*17*0.0189)=-1.87 ft – point of stagnation
$Y_{max} = \pm Q/(2Kbi)$ = ±577/(2*153*17*0.0189 =±5.87 ft - maximum width

CAPTURE ZONE

From Fetter (3rd ed., '94), p. 502,

$$x_0 = \frac{-Q}{2\pi Kbi} = \frac{-Q}{2\pi Ti}$$

where $i \approx 0.017$ (from Fig. 1, site map)

$Q = 3$ gpm $= 0.4\ ft^3/min$

$T \approx 0.6\ ft^2/min$

$$x_0 = \frac{-0.4}{2\pi(0.6)(0.017)}\ ft = \underline{6.3\ ft}$$

$$y_{max} = \frac{\pm Q}{2Kbi} = \frac{\pm Q}{2Ti}$$

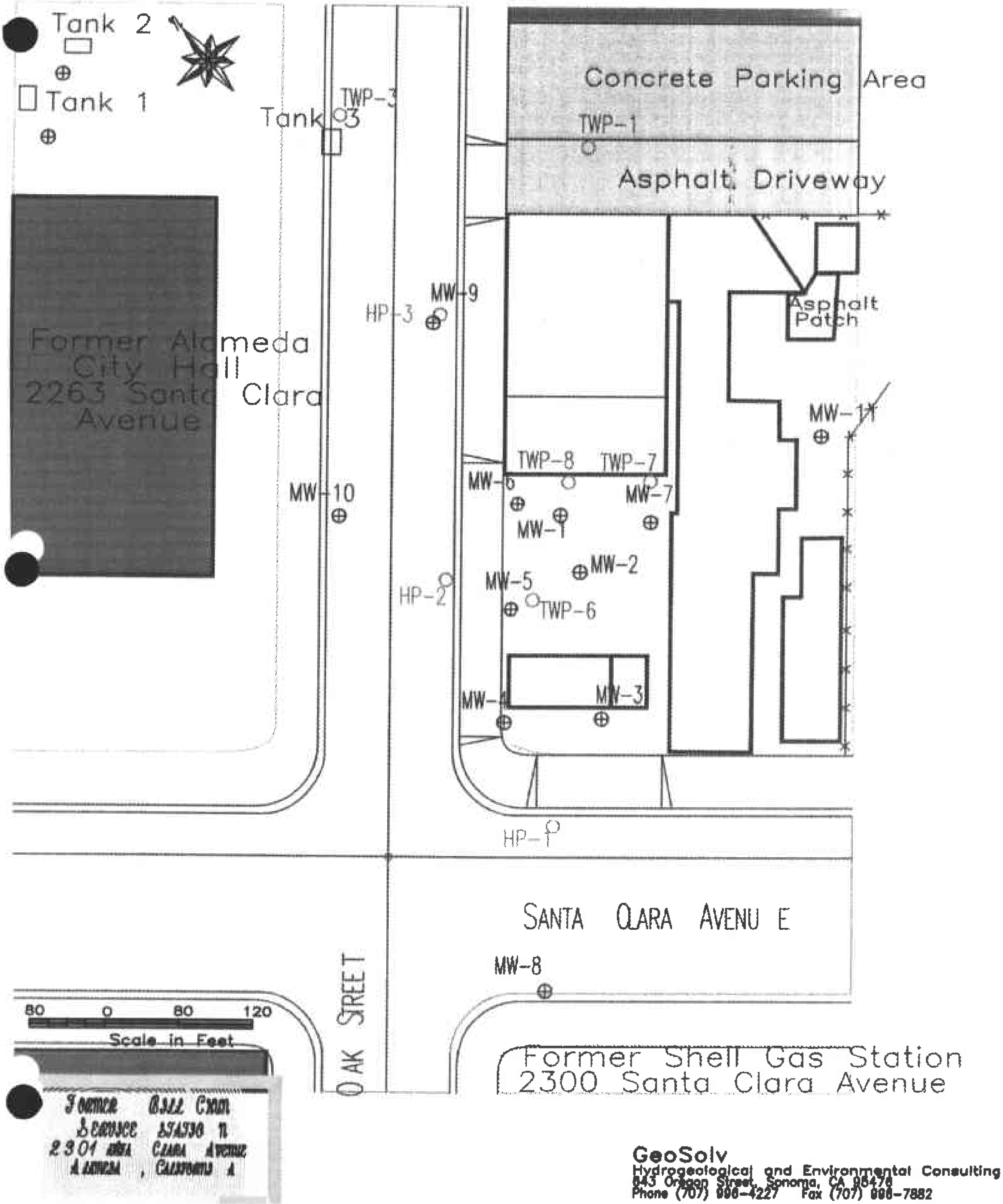
$$y_{max} = \frac{\pm 0.4}{2(0.6)(0.017)}\ ft = \underline{19.7\ ft}$$

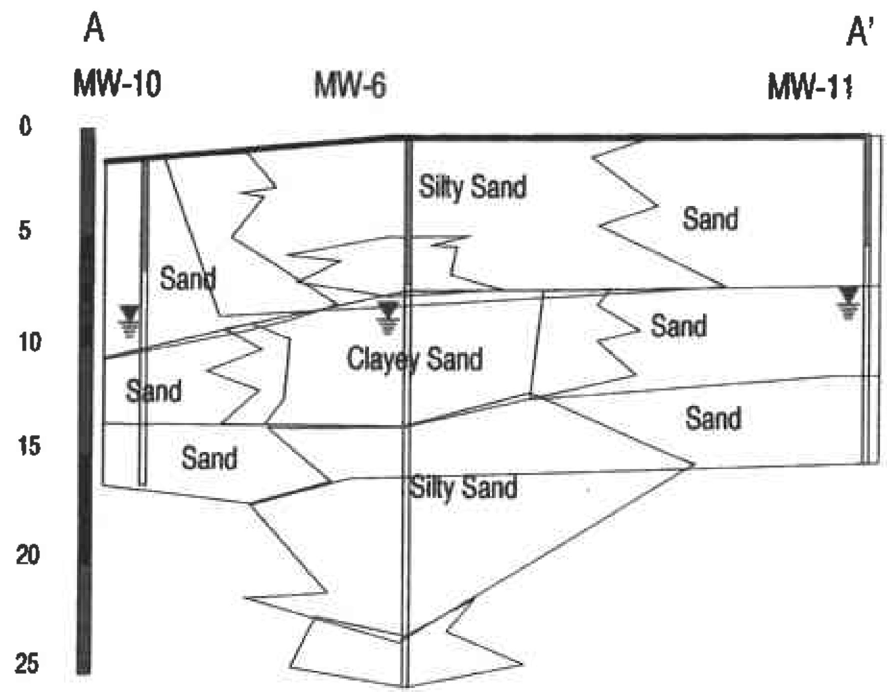
If $T \approx 0.1\ ft^2/min.$,

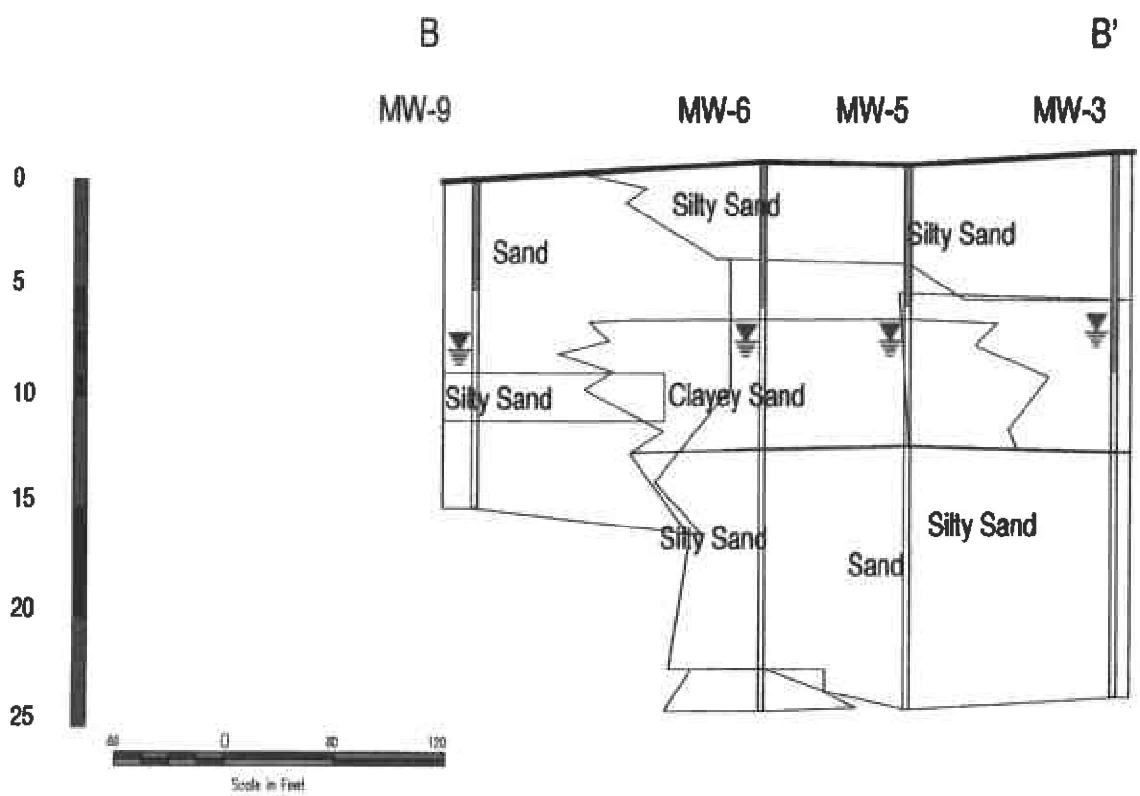
$$x_0 = \frac{-0.4}{2\pi(0.1)(0.017)}\ ft = \underline{37.5\ ft}$$

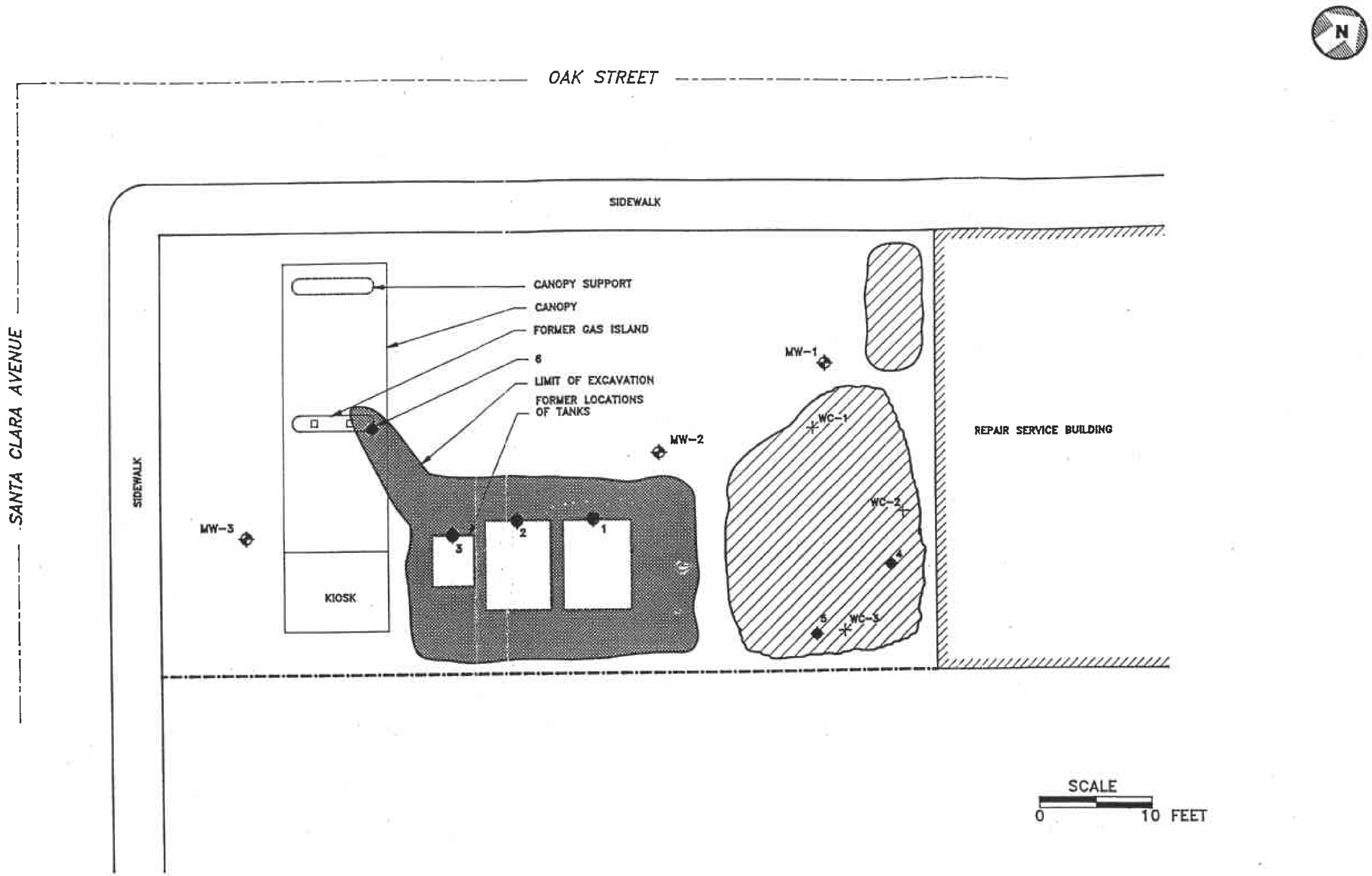
$$y_{max} = \frac{\pm 0.4}{2(0.1)(0.017)} = \underline{112\ ft}$$

This seems very unlikely.


Tank 2
Tank 1
Tank 3
TWP-3
Concrete Parking Area
TWP-1
Asphalt Driveway
Asphalt Patch
MW-9
HP-3
Former Alameda City Hall
2263 Santa Clara Avenue
MW-11
TWP-8
TWP-7
MW-6
MW-7
MW-10
MW-1
MW-2
MW-5
HP-2
TWP-6
MW-4
MW-3
HP-1
SANTA CLARA AVENUE
MW-8
OAK STREET
80 0 80 120
Scale in Feet
Former Shell Gas Station
2300 Santa Clara Avenue
GeoSolv
Hydrogeological and Environmental Consulting
843 Oregon Street, Sonoma, CA 95476
Phone (707) 996-4227 Fax (707) 996-7882


A
A'
MW-10
MW-6
MW-11
0
5
10
15
20
25
Silty Sand
Sand
Sand
Sand
Clayey Sand
Sand
Sand
Sand
Silty Sand


B
B'
MW-9
MW-6
MW-5
MW-3
0
5
10
15
20
25
Sand
Silty Sand
Silty Sand
Silty Sand
Clayey Sand
Silty Sand
Sand
Silty Sand
Scale in Feet



LEGEND

- ESE Monitoring Well Location
- Sampling point. Samples collected by Parker Enviromental on July 31, 1992
- Stockpiled soil sampling point, samples collected by ESE on December 10, 1992
- Property Boundary
- Soil Pile

ESE Environmental Science & Engineering, Inc.
A CILCORP Company

4090 NELSON AVENUE, SUITE J
CONCORD, CA 94520

DATE 1/93	PROJ. NO. 6-92-5005
DRAWN BY DWR	CAD FILE 50051002
APPROVED BY	REVISED 2/93 MEQ

CHUN'S SERVICE STATION
2301 SANTA CLARA AVENU
ALAMEDA, CALIFORNIA

FIGURE 2
SITE MAP

LABORATORY ANALYSIS RESULTS

Client:	Loftin and Associates	**AA Project No.:**	A54502
Project No.:	NA	**Date Received:**	12/20/02
Project Name:	Chun	**Date Reported:**	01/10/03
Sample Matrix:	Vapor	**Units:**	ppmV
Method:	MTBE (EPA 8020)		

AA I.D. No.	Client I.D. No.	Date Sampled	Date Analyzed	DF	Results	MRL
147862	EW12Ag	12/19/02	12/21/02	1.0	**250**	0.5
147863	EW14Ag	12/19/02	12/21/02	1.0	**29**	0.5
147864	EW12Bg	12/19/02	12/21/02	1.0	**150**	0.5
147865	EW14Bg	12/19/02	12/21/02	1.0	**28**	0.5

MRL: Method Reporting Limit J: Estimated Value DF: Dilution Factor

NOTES:

A confirmatory run by GCMS on sample EW12Ag indicated that MTBE was not present in the sample at or above a concentration of 10 ppmV.
This information strongly suggest that the reported concentrations in the above samples may not be due to the presence of MTBE but a light hydrocarbon constituent of gasoline eluting at the MTBE retention time.
The confirmatory run was performed beyond the recommended holding time (72 hours) and was used for the qualitative identification of MTBE only.

Viorel Vasile
Project Manager

LABORATORY ANALYSIS RESULTS

Client:	Loftin and Associates	**AA Project No.:**	A54502
Project No.:	NA	**Date Received:**	12/20/02
Project Name:	Chun	**Date Reported:**	01/10/03
Sample Matrix:	Vapor	**Units:**	ppmV
Method:	MTBE (EPA 8260B)		

AA I.D. No.	Client I.D. No.	Date Sampled	Date Analyzed	DF	Results	MRL
147862	EW12Ag	12/19/02	01/07/03	10.0	<10	1

MRL: Method Reporting Limit J: Estimated Value DF: Dilution Factor

NOTES:

This run was performed beyond the recommended holding time (72 hours) and was used for the qualitative identification of MTBE only.

Viorel Vasile
Project Manager

LABORATORY ANALYSIS RESULTS

Client: Loftin and Associates
Project No.: NA
Project Name: Chun
Sample Matrix: Vapor
Method: EPA 8015M(Gasoline)

AA Project No.: A54502
Date Received: 12/20/02
Date Reported: 01/10/03
Units: ppmV

AA I.D. No.	Client I.D. No.	Date Sampled	Date Analyzed	DF	Results	MRL
147862	EW12Ag	12/19/02	12/21/02	1.0	**5100**	5
147863	EW14Ag	12/19/02	12/21/02	1.0	**340**	5
147864	EW12Bg	12/19/02	12/21/02	1.0	**2800**	5
147865	EW14Bg	12/19/02	12/21/02	1.0	**320**	5

MRL: Method Reporting Limit J: Estimated Value DF: Dilution Factor

Viorel Vasile
Project Manager

American Analytics • 9765 Eton Avenue, Chatsworth, California 91311
Tel: (818) 998 - 5547 • • Fax: (818) 998 - 7258

LABORATORY ANALYSIS RESULTS

Client:	Loftin and Associates	**AA Project No.:**	A54502
Project No.:	NA	**Date Received:**	12/20/02
Project Name:	Chun	**Date Reported:**	01/10/03
Sample Matrix:	Vapor	**Units:**	ppmV
Method:	EPA 8020 (BTEX)		

Date Sampled:	**12/19/02**	**12/19/02**	**12/19/02**	**12/19/02**	
Date Analyzed:	**12/21/02**	**12/21/02**	**12/21/02**	**12/21/02**	
AA ID No.:	**147862**	**147863**	**147864**	**147865**	
Client ID No.:	**EW12Ag**	**EW14Ag**	**EW12Bg**	**EW14Bg**	
Dilution Factor:	**1.0**	**1.0**	**1.0**	**1.0**	**MRL**
Compounds:					
Benzene	**220**	**9.1**	**120**	**13**	0.1
Ethylbenzene	**44**	**3.8**	**20**	**4.2**	0.1
Toluene	**250**	**9.2**	**130**	**16**	0.1
Xylenes	**160**	**14**	**69**	**16**	0.2

MRL: Method Reporting Limit J: Estimated Value

Viorel Vasile
Project Manager

American Analytics • 9765 Eton Avenue, Chatsworth, California 91311
Tel: (818) 998 - 5547 • • Fax: (818) 998 - 7258

Franklin J. Goldman
PO BOX 2217, Guerneville, CA 95446
Phone: (707) 869-0850
Phone: (707) 869-0864 [Call before Faxing]

A 54502

CHAIN OF CUSTODY RECORD

Laboratory Analysis P.O. No.__________

Laboratory Please Call Accounts Payable for P.O. No.

Date: 12/19/02 Sheet 2 Of 2

Project Name: Chun

Project Number:

Address: 2301 Santa Clara Ave, Alameda, CA

Sampler's Name: Frank Goldman

Sampler's Signature: [signature]

Laboratory Delivery Location
Delta Environmental Laboratory
685 Stone Road, #11
Benicia, CA 94553
Phone: (707) 747-6081
FAX: (707) XXX-XXX
Phone

Turnaround Time: ☐ Rush ☐ 24 Hour ☐ 48 Hour ☒ 5-Day

Repeat to: Frank

Sample Number Location	Date	Time	TPH as Gasoline 8015	TPH as Diesel 8015	TPH-g/BTEX 8015/8020 & MTBE	BTEX & EPA 8020	Oil and Grease 5520	Volitile Organics (8010)	CAM Metals (17)	Pr. Pollutant Metals (13)	Base/Neu/Acids (Organic)	Pesticides 8140/8141	Method 8260b for 5 oxygenates & 2 lead scavengers	MTBE by GCMS	Bulk density, moisture, porosity fraction of organic carbon	SOIL SAMPLE	WATER SAMPLE	Comments
EW12Ag 147862	12/19/02	16:45			(X)									(X)				(X): per client request on 12/20/02 V.V.
EW14Ag 147863	12/19/02	16:55			(X)													
EW12Bg 147864	12/19/02	17:30			(X)													
EW14Bg 147865	12/19/02	17:45			(X)													(X): per client request on 01/06/03 V.V.

Relinquished By	Date	Time	Received By	Date	Time
[signature]	12/19/02	19:45	[signature]	12/19/02	19:45
[signature]	12/20/02	17:12	[signature]	12/20/02	17:12

Dispatched By	Date	Time	Received In Lab By	Date	Time

Total Number of Containers this Sheet: 4

Method of Shipment:

Special Shipment/Handling or Storage Requirements: **Keep on Ice**