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August 11, 2003

Barney M. Chan
Hazardous Materials Specialist
Alameda County Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-9335

Telephone: (510) 567-6765
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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

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

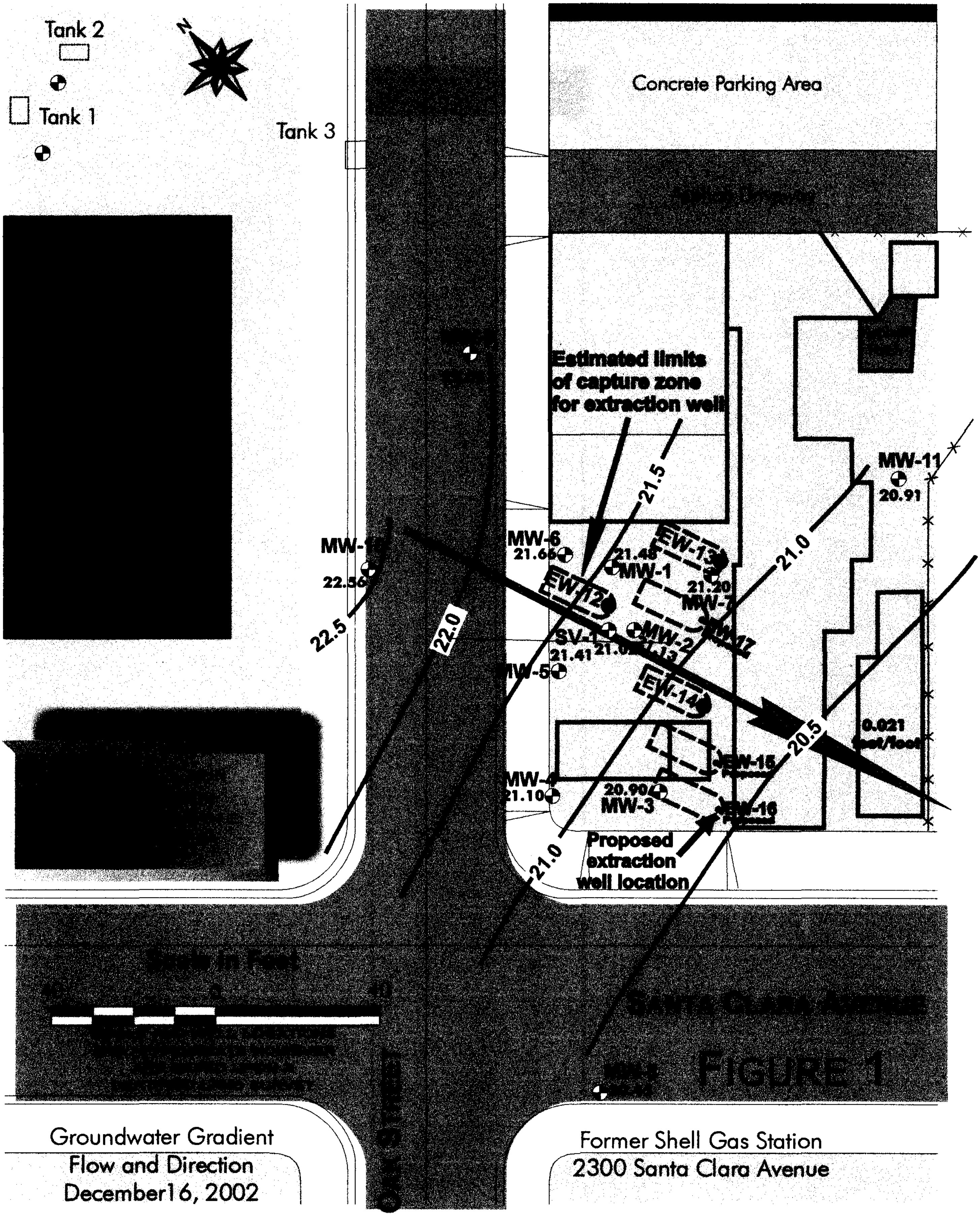
Most of the contaminant hydrocarbon mass appears to be onsite, however, some of the dissolved plume has migrated beneath the Flower Shop and perhaps as far northeast as groundwater monitoring well MW-11. The soils encountered beneath the site appear to be sandier than was anticipated and appear to be 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 engineerin g 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.



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

[redacted]

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.			0–5			
silty sand, grn, med dense, med, sl moist mild old gasoline odor	X	EW-12 5-5½ 10:30 AM 5 ppm	5			
water @ 9½'			9			
Siltier w/depth, mod gas odor very moist	X	EW-12 10-10½ 10:45 AM 15 ppm	10			
mod gas odor, wet	X	EW-12 11:15 AM 0 ppm	15			
no odor	X	11:30 AM 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				
		11:45	25			
End @ 25'		0ppm	26			
7-25' screen			27			
1' sand			28			
3' bent			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.		2⁰⁰ pm	5			
		20 ppm	6			
			7			
			8			
water @ 9½'			9			
		2²⁰				
Siltier with depth, mod strong gas odor, very moist	X	10-10½	10			
	X	10½-11	11			
		2²⁵				
		410 ppm	12			
			13			
			14			
		2⁵⁰				
mild gas odor, wet	X	15-15½	15			
	X	15½-16	16			
		2⁵⁵				
		15 ppm	17			
			18			
		EW-13	19			
		3²⁰ pm				
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			
		EW-13	24			
	X	24½-25 3⁴⁰ PM	25			
End @ 25'		0ppm	26			
Screen 7-25'			27			
Sand 6-25			28			
Bend 3-6			29			
			30			
Grout 1-3			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			
			6			
		0ppm	7			
Drilling dense @ 9'			8			
		9:30				
	X	9-9½	9			
Silty sand, grn, dense, med, moist, Strong odor @ 9-10'	X	9½-10	10			
		9:35	11			
		8ppm	12			
			13			
			14			
med strong odor of old gasoline	X	14½-15				
wet		9:45 AM	15			
		2 ppm	16			
			17			
			18			
		10:10				
	X	19-19½	19			
	X	19½-20	20			
		10:15 0ppm				

PROJECT NAME: **Chun**

ADDRESS: **2301 Santa Clara Ave Alameda, CA**

BORING number EW-14

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			
			24			
	X	24½-25' 0ppm	25			
End @ 25'			26			
Screen 25-7'			27			
Sand 25-6'			28			
Bent 6-3'			29			
Grout 1-3			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

[redacted]

A[illegible] 3

Well [illegible]port

CONFIDENTIAL

STATE OF CALIFORNIA DWR
WELL COMPLETION REPORT
(WELL LOGS)

REMOVED

[redacted]

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

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	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		Bulk density, moisture, porosity fraction of organic carbon	SOIL SAMPLE	WATER SAMPLE
EW-12		10/31/02	5:35 AM			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]	11/05/02	10:45 AM	[signature]	11-5-02	10:45 AM
[signature]	11-5-02	5:03	[signature]	11/5/02	

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

AMERICAN ANALYTICS

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

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.:	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	**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:					
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

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:					
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

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 (Oxygenates)		

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

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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

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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

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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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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

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Project Manager

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LABORATORY QA/QC REPORT

Client:	Loftin and Associates		**AA ID No:**	147861
Project Name:	Chun		**Project No.:**	NA
Method:	EPA 8015M (GRO)		**AA Project No.**	A54501
Sample ID:	Matrix Spike		**Date Analyzed:**	12/24/02
Concentration:	0.5 mg/L		**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

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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: 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) 869-0856
Phone: (707) 869-0864 [Call before Faxing]

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:

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
	12/19/02	19:45		12/19/02	19:45
	12/20/02	17:12		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, ft^2/min)

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

Avg. T ≈ 0.1 − 0.6 ft^2/min.

↑ 0.1: native?
↑ 0.6: 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 ≈ 0.001 (1×10^{-3})

Recovery Test

[redacted]

Former

EW-13 | Well 30

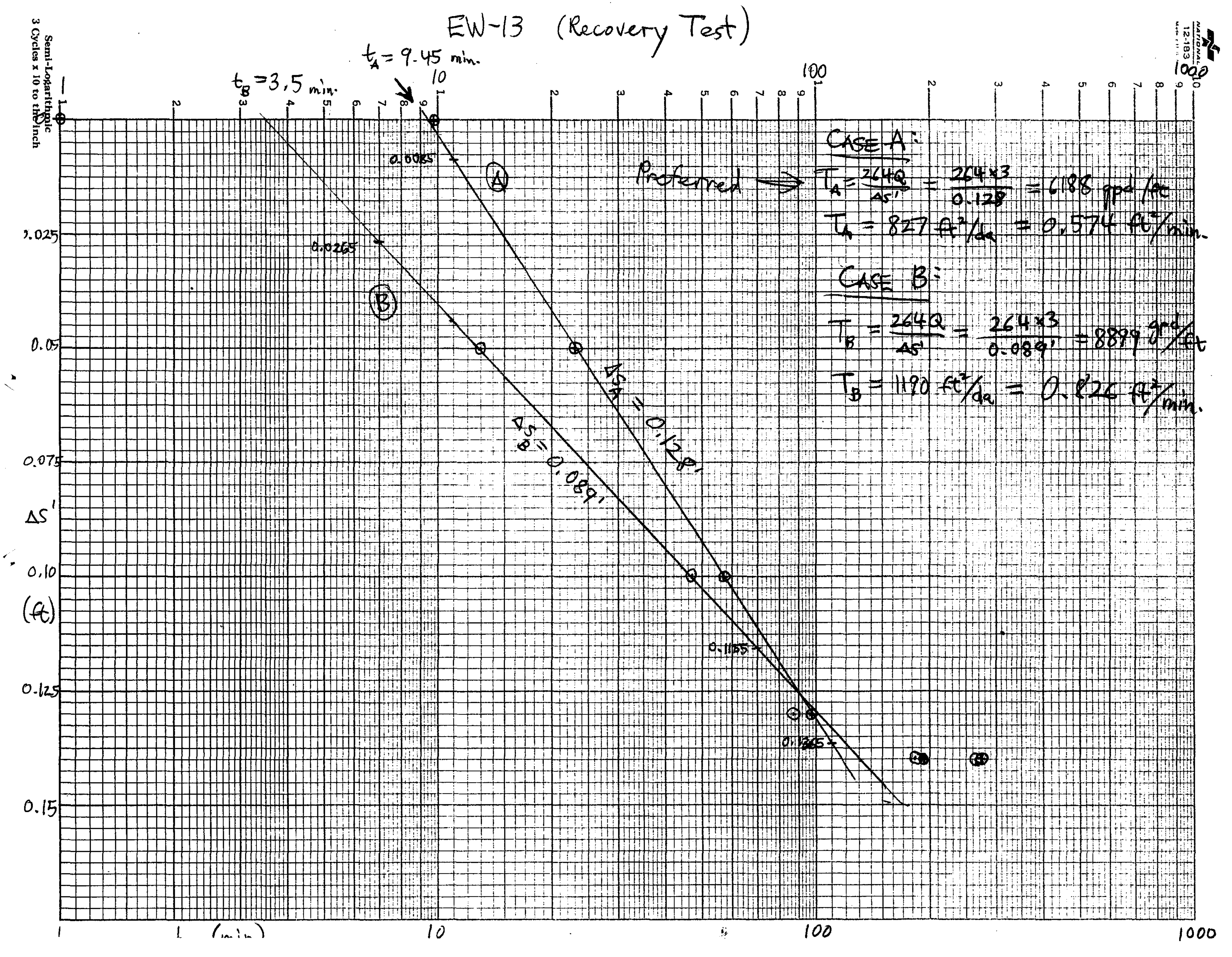
24.3 | Screened 5'-25'

Casing 4.00

Filter

Recovery | Static 7.42

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
		[redacted]	0	7.75	[redacted]	[redacted]	3	[redacted]	[redacted]			
		[redacted]	5.4	7.78	[redacted]	[redacted]	3	[redacted]	[redacted]			
	0	[redacted]	0 9.75	7.75	[redacted]	[redacted]	3	[redacted]	[redacted]			
	0.05	[redacted]	13 23	7.7	[redacted]	[redacted]	3	[redacted]	[redacted]			
	0.10	[redacted]	47 57	7.65	[redacted]	[redacted]	3	[redacted]	[redacted]			
	0.13	[redacted]	87 97	7.62	[redacted]	[redacted]	3	[redacted]	[redacted]			
	0.14	[redacted]	183 193	7.61	[redacted]	[redacted]	3	[redacted]	[redacted]			
	0.14	[redacted]	265 275	7.61	[redacted]	[redacted]	3	[redacted]	[redacted]			
		[redacted]	↑ ↑		[redacted]	[redacted]	3	[redacted]	[redacted]			
		[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			
		[redacted]	(1) [illegible]		[redacted]	[redacted]	3	[redacted]	[redacted]			
		[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			
		[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			
		[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			
		[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			
		[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			
		[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			
		[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			
		[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			

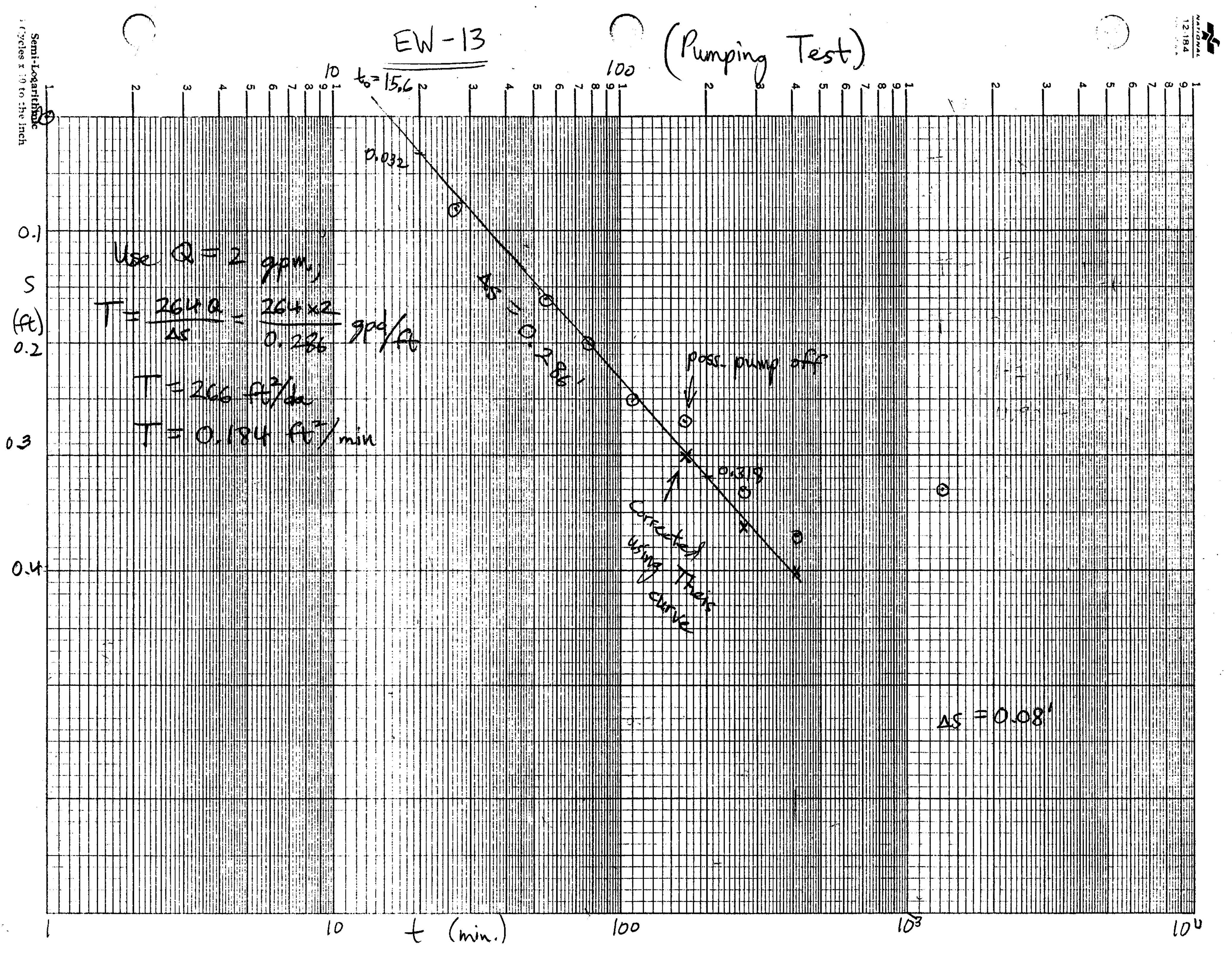


EW-13 (Recovery Test)
t_A = 9.45 min.
t_B = 3.5 min.
0.0085
0.0265
A
B
0.1155
0.1365
Δs_A = 0.128'
Δs_B = 0.089'
Preferred
CASE A:
$T_A = \frac{264Q}{\Delta s'} = \frac{264 \times 3}{0.128} = 6188$ gpd/ft
$T_A = 827$ ft²/da = 0.574 ft²/min.
CASE B:
$T_B = \frac{264Q}{\Delta s'} = \frac{264 \times 3}{0.089'} = 8899$ gpd/ft
$T_B = 1190$ ft²/da = 0.826 ft²/min.
Δs' (ft)
t (min)
Semi-Logarithmic
3 Cycles x 10 to the inch
NATIONAL 12-183

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
		[redacted]	0	7.42	[redacted]	[redacted]	3	[redacted]	[redacted]			
	0.01	[redacted]	9	7.43	[redacted]	[redacted]	3	[redacted]	[redacted]			
	0.08	[redacted]	27	7.5	[redacted]	[redacted]	3	[redacted]	[redacted]			
	0.16	[redacted]	55	7.58	[redacted]	[redacted]	3	[redacted]	[redacted]			
	0.20	[redacted]	78	7.62	[redacted]	[redacted]	3	[redacted]	[redacted]			
	0.25	[redacted]	110	7.67	[redacted]	[redacted]	3	[redacted]	[redacted]			
(0.30)	0.27	[redacted]	168	7.69	[redacted]	[redacted]	3	[redacted]	[redacted]			
(0.36)	0.33	[redacted]	266	7.75	[redacted]	[redacted]	3	[redacted]	[redacted]			
(0.40)	0.37	[redacted]	408	7.79	[redacted]	[redacted]	3	[redacted]	[redacted]			
(0.45)	0.33	[redacted]	1326	7.75	[redacted]	[redacted]	3	[redacted]	[redacted]			
		[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			
	↑	[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			
	x	[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			
		[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			
		[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			
		[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			
		[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			
		[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			
		[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			
		[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			
		[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			
		[redacted]			[redacted]	[redacted]		[redacted]	[redacted]			
		[redacted]			[redacted]	[redacted]		[redacted]	[redacted]			

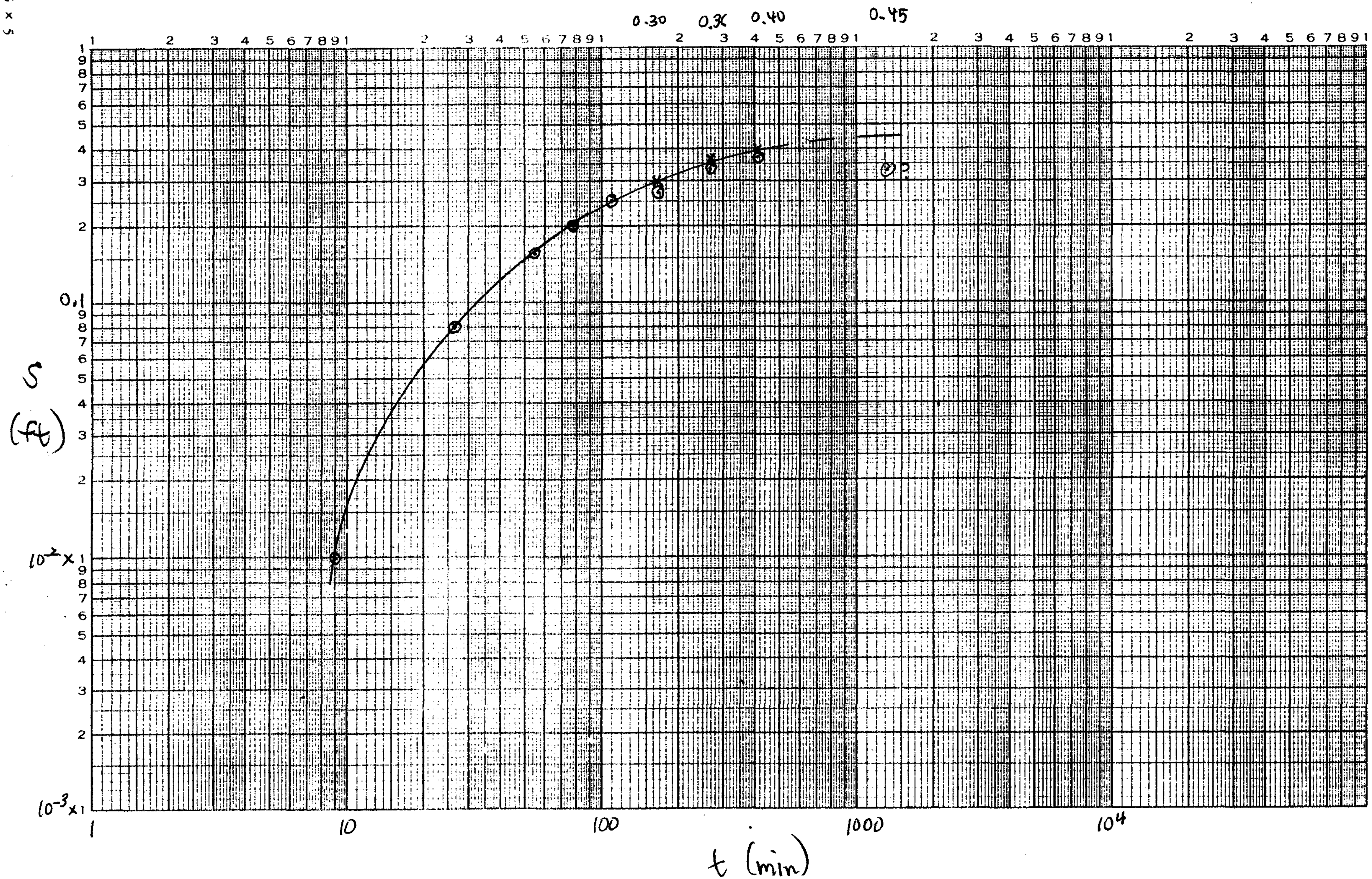
[redacted] **Former** [redacted]


EW-13
(Pumping Test)
$t_0 = 15.6$
0.032
$\Delta s = 0.286'$
Use Q = 2 gpm,
$T = \frac{264 Q}{\Delta s} = \frac{264 \times 2}{0.286}$ gpd/ft
$T = 266$ ft²/da
$T = 0.184$ ft²/min
poss. pump off
0.318
Corrected using Theis curve
$\Delta s = 0.08'$
s (ft)
t (min.)
Semi-Logarithmic
5 Cycles x 10 to the inch
12-184

This is confined aquifer curve

EW-13 Pumping Test

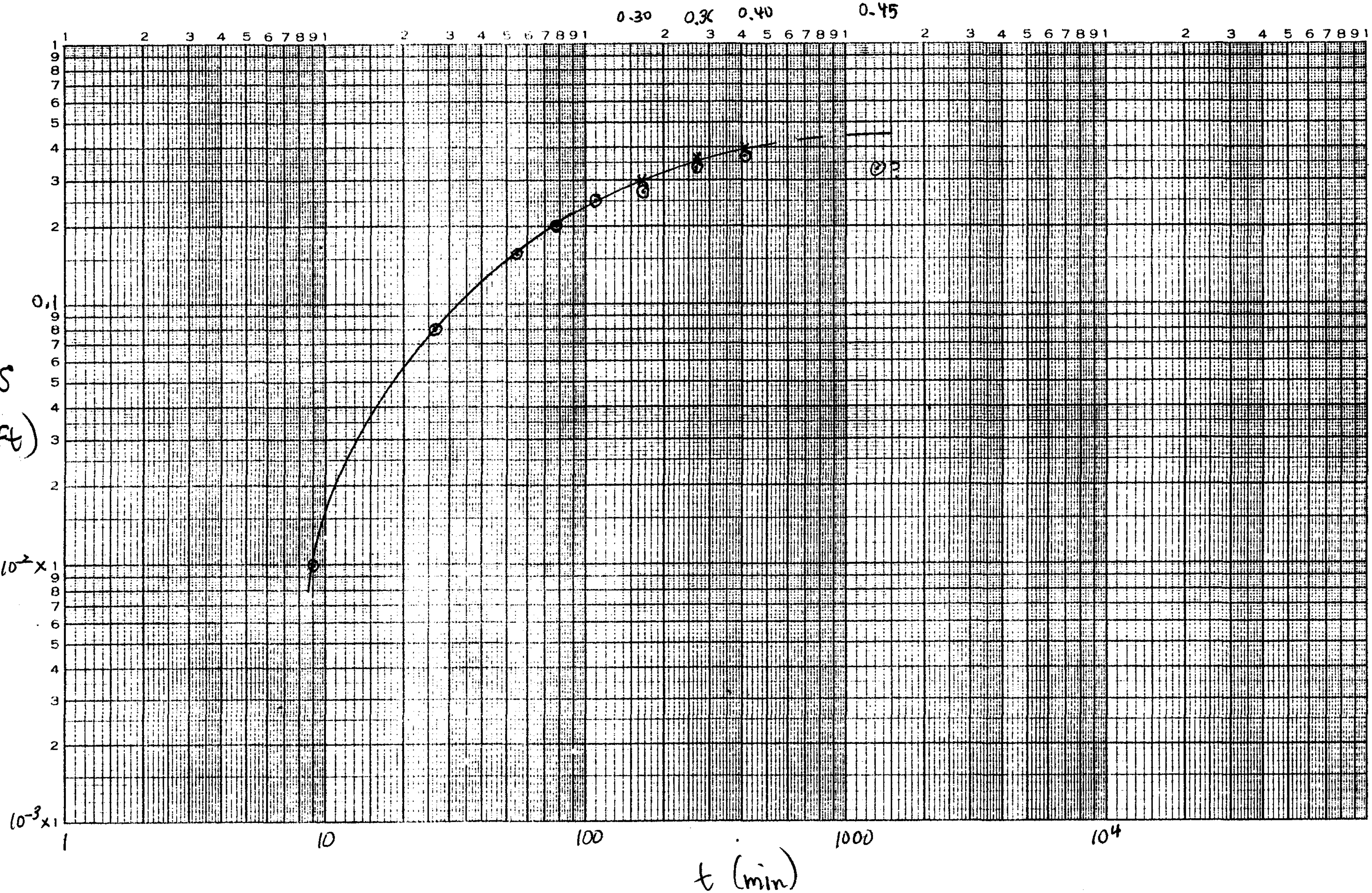
Theis curve



This is confined aquifer curve

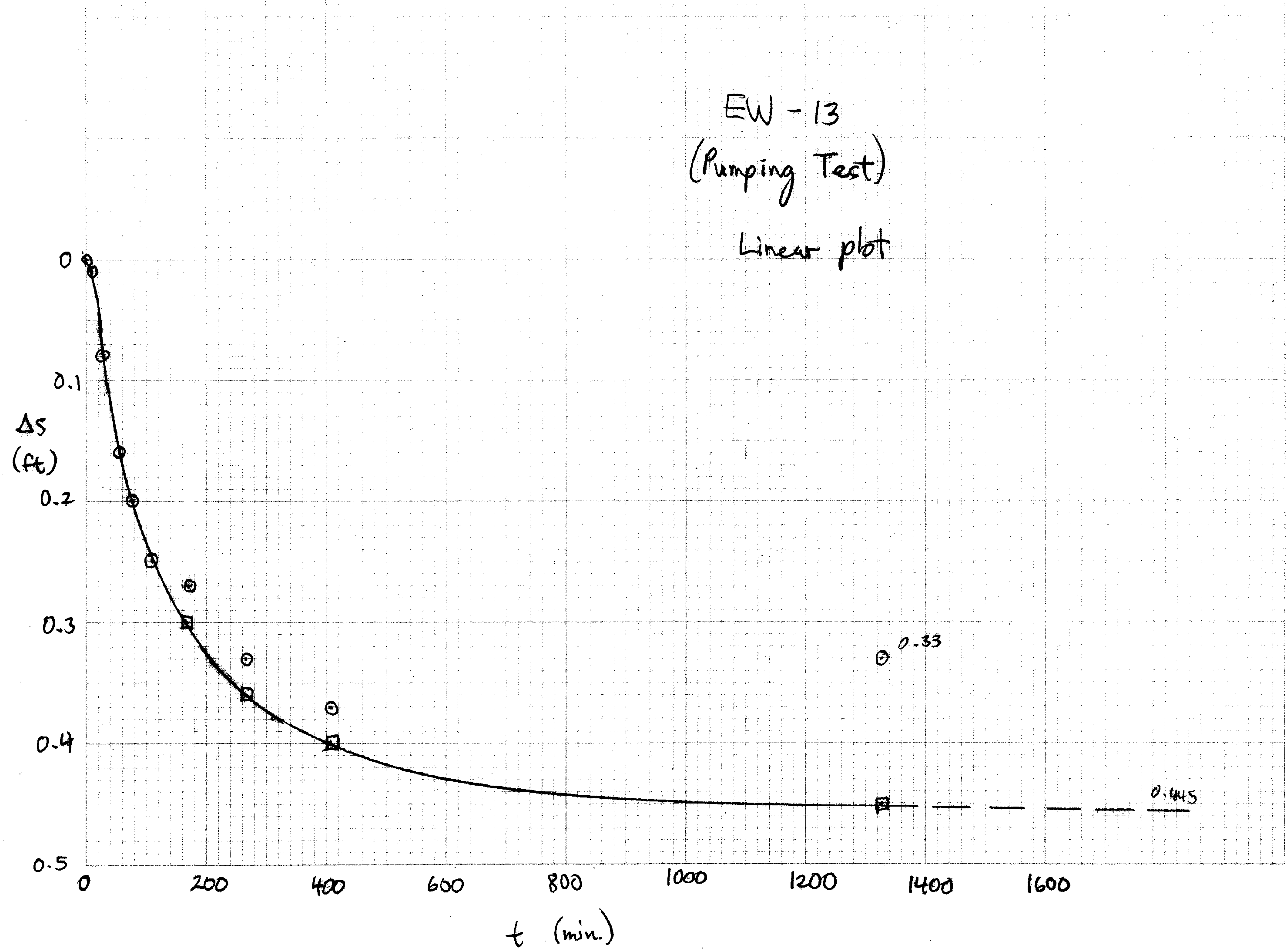
EW-13 Pumping Test

Theis curve



Full Logarithmic, 3 × 5

12-191


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

[redacted]

Former [redacted]

EW-12 | Well 30

24.71 | Screened 5'-25'

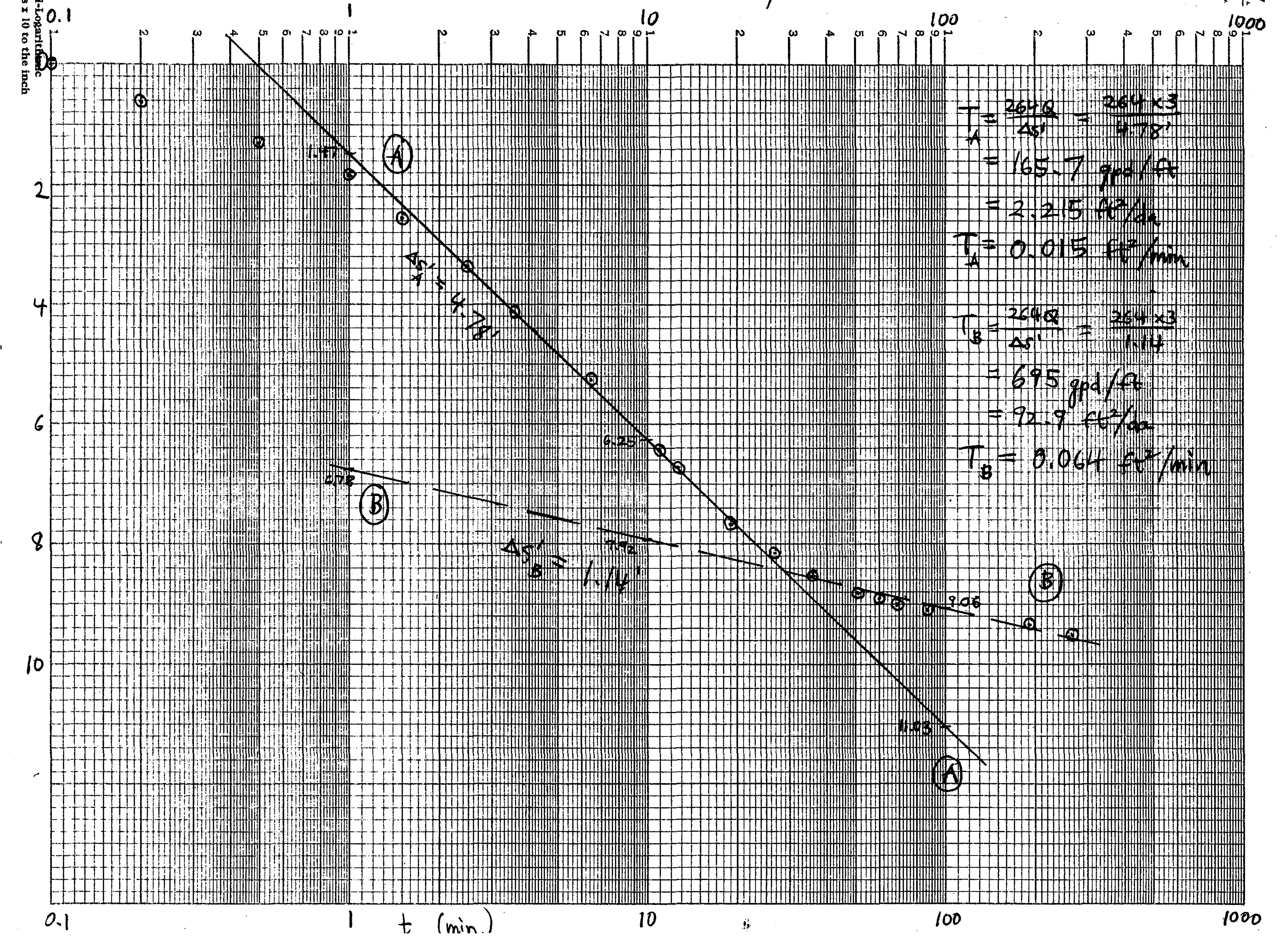
Casing 4.00

Filter

Recovery | Static 16.15'? 17.15

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	[redacted]	0	25.92	[redacted]	[redacted]	3	[redacted]	[redacted]		18.5	
0.62	9.15	[redacted]	0.2	25.3	[redacted]	[redacted]	3	[redacted]	[redacted]		18.5	
1.30	8.47	[redacted]	0.5	24.62	[redacted]	[redacted]	3	[redacted]	[redacted]		18.78	
1.83	7.94	[redacted]	1	24.09	[redacted]	[redacted]	3	[redacted]	[redacted]		19.34	
2.57	7.20	[redacted]	1.5	23.35	[redacted]	[redacted]	3	[redacted]	[redacted]		20.02	
3.38	6.39	[redacted]	2.5	22.54	[redacted]	[redacted]	3	[redacted]	[redacted]		21	
4.14	5.63	[redacted]	3.6	21.78	[redacted]	[redacted]	3	[redacted]	[redacted]		22.05	
5.23	4.54	[redacted]	6.5	20.69	[redacted]	[redacted]	3	[redacted]	[redacted]		21.19	
6.43	3.34	[redacted]	11	19.49	[redacted]	[redacted]	3	[redacted]	[redacted]		23.19	
6.73	3.04	[redacted]	12.75	19.19	[redacted]	[redacted]	3	[redacted]	[redacted]		24.57	
7.66	2.11	[redacted]	19	18.26	[redacted]	[redacted]	3	[redacted]	[redacted]		25.47	
8.16	1.61	[redacted]	26.75	17.76	[redacted]	[redacted]	3	[redacted]	[redacted]		26.85	
8.52	1.25	[redacted]	35.5	17.4	[redacted]	[redacted]	3	[redacted]	[redacted]		26.63	
8.81	0.96	[redacted]	51	17.11	[redacted]	[redacted]	3	[redacted]	[redacted]		26.62	
8.89	0.88	[redacted]	60	17.03	[redacted]	[redacted]	3	[redacted]	[redacted]		27.29	
9.00	0.77	[redacted]	69	16.92	[redacted]	[redacted]	3	[redacted]	[redacted]		26.97	
9.09	0.68	[redacted]	87	16.83	[redacted]	[redacted]	3	[redacted]	[redacted]		23.98	
9.35	0.42	[redacted]	191	16.57	[redacted]	[redacted]	3	[redacted]	[redacted]		26.62	
9.50	0.27	[redacted]	267	16.42	[redacted]	[redacted]	3	[redacted]	[redacted]		25.62	

EW-12 (Recovery Test)

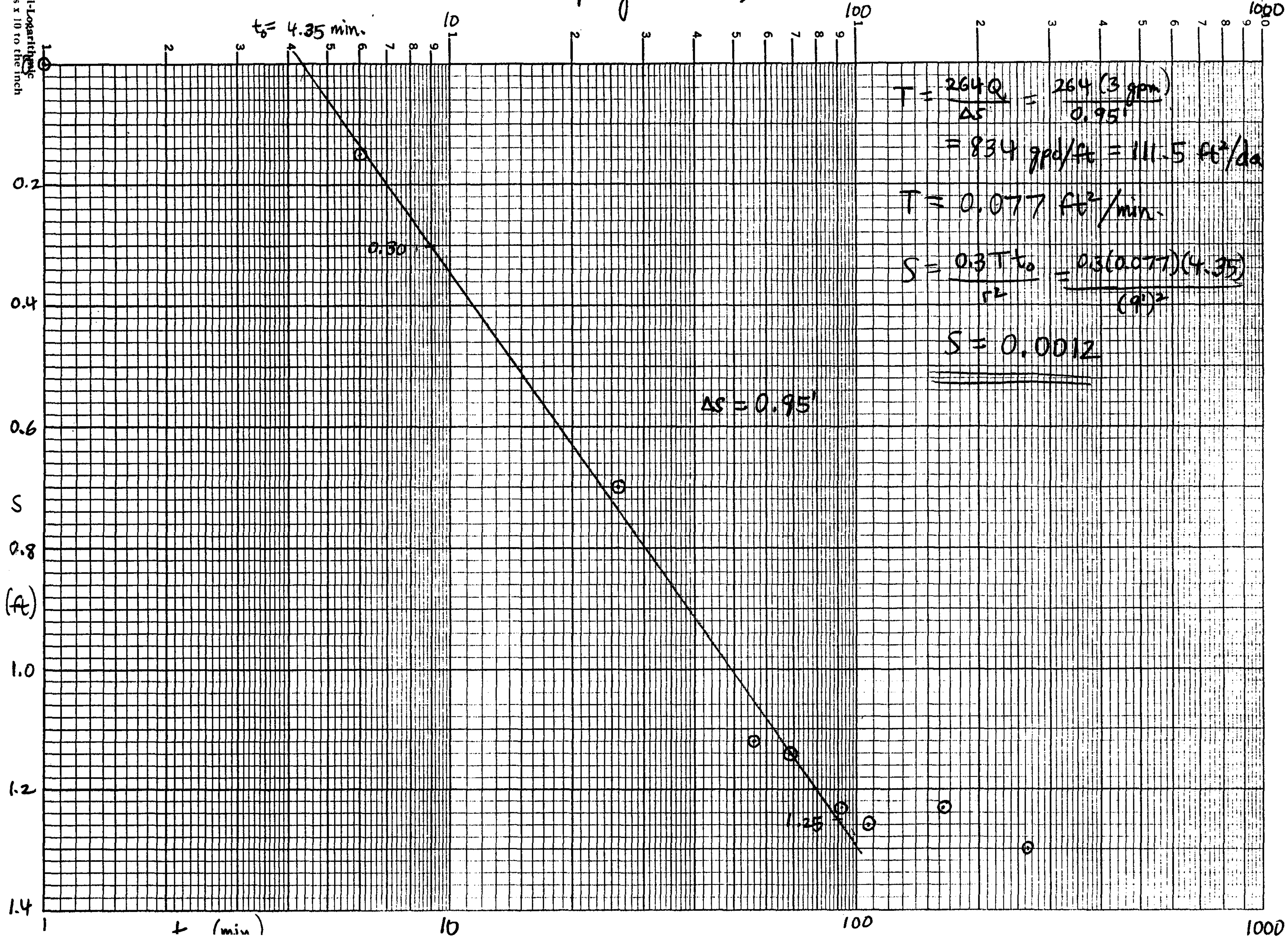


Pumping Test

Former			
MW-2		Well	10
25.19		Screened	
		Casing	from 2.00
		Filter	Recovery
Drawdow		Static	Test page 7.34 ~~8.52~~

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
	0.15		6	7.49			3					
	0.70		26	8.04			3					
	1.12		56	8.46			3					
	1.14		69	8.48			3					
	1.23		92	8.57			3					
	1.26		107	8.6			3					
	1.23		164	8.57			3					
	1.30		264	8.64			3					
	1.23		1322	8.57			3					

MW-2 (Pumping Test)



[redacted]

Former

MW-2 — Well 10

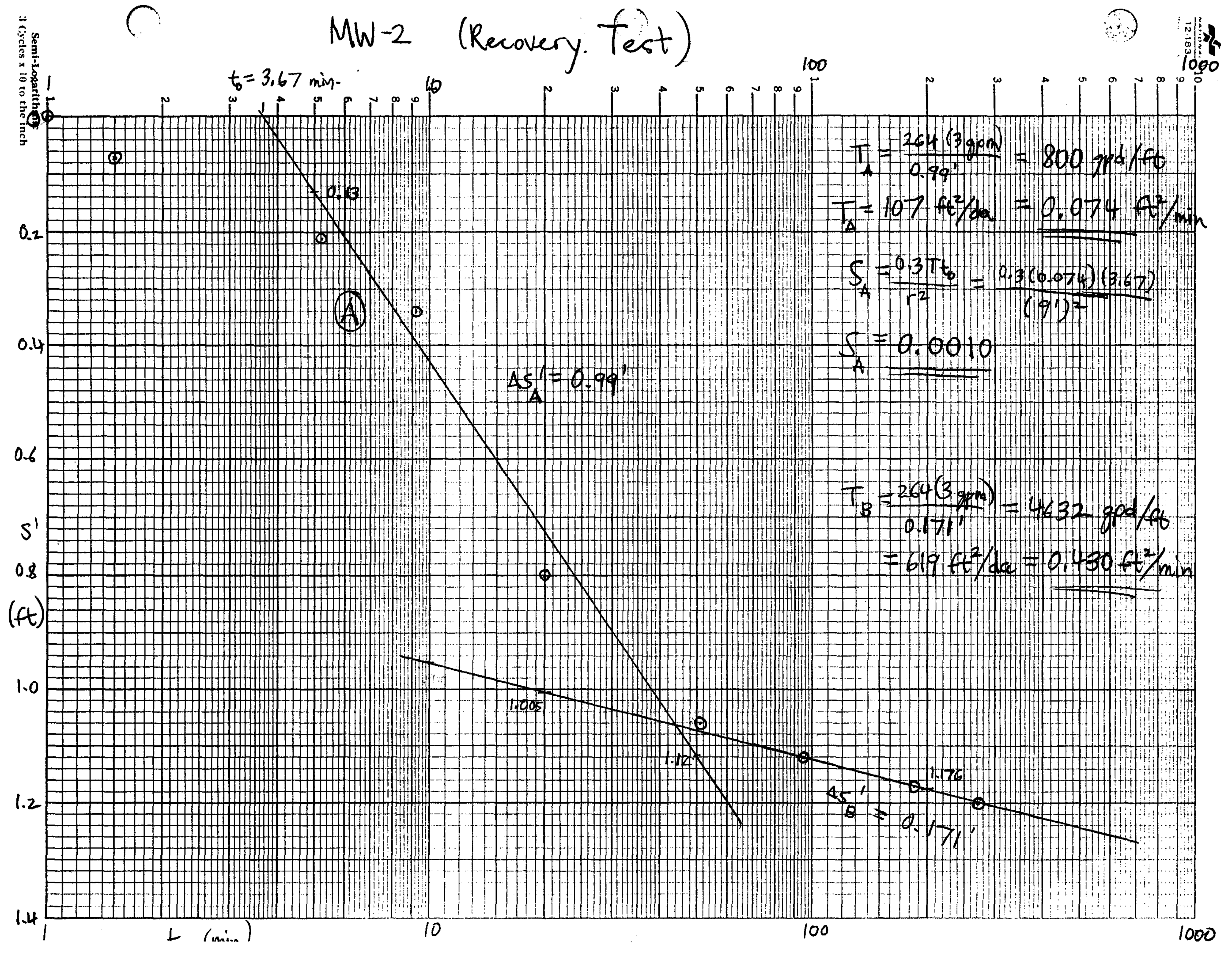
25.19 — Screened

Casing 2.00

Filter

Recovery — Static 7.34

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	[redacted]	0	8.57	[redacted]	[redacted]		[redacted]	[redacted]			
0	0	1324	1.29	[redacted]	1.5	8.63	[redacted]	[redacted]		[redacted]	[redacted]			
0.07	1.5	1325	1.22	[redacted]	3	8.56	[redacted]	[redacted]		[redacted]	[redacted]			
0.21	5.25	1329	1.08	[redacted]	6.75	8.42	[redacted]	[redacted]		[redacted]	[redacted]			
0.34	9.25	1333	0.95	[redacted]	10.75	8.29	[redacted]	[redacted]		[redacted]	[redacted]			
0.80	20	1344	0.49	[redacted]	21.5	7.83	[redacted]	[redacted]		[redacted]	[redacted]			
1.06	51	1374	0.23	[redacted]	52	7.57	[redacted]	[redacted]		[redacted]	[redacted]			
1.12	95	1418	0.17	[redacted]	96	7.51	[redacted]	[redacted]		[redacted]	[redacted]			
1.17	184	1507	0.12	[redacted]	185	7.46	[redacted]	[redacted]		[redacted]	[redacted]			
1.20	272	1595	0.09	[redacted]	273	7.43	[redacted]	[redacted]		[redacted]	[redacted]			
				[redacted]			[redacted]	[redacted]		[redacted]	[redacted]			
				[redacted]			[redacted]	[redacted]		[redacted]	[redacted]			
				[redacted]			[redacted]	[redacted]		[redacted]	[redacted]			
				[redacted]			[redacted]	[redacted]		[redacted]	[redacted]			
				[redacted]			[redacted]	[redacted]		[redacted]	[redacted]			
				[redacted]			[redacted]	[redacted]		[redacted]	[redacted]			
				[redacted]			[redacted]	[redacted]		[redacted]	[redacted]			
				[redacted]			[redacted]	[redacted]		[redacted]	[redacted]			
				[redacted]			[redacted]	[redacted]		[redacted]	[redacted]			


MW-2 (Recovery Test)
t_0 = 3.67 min.
0.13
A
$\Delta s'_A$ = 0.99'
1.005
1.12'
1.176
$\Delta s'_B$ = 0.171'
$T_A = \frac{264 (3 gpm)}{0.99'}$ = 800 gpd/ft
T_A = 107 ft²/da = 0.074 ft²/min
$S_A = \frac{0.3 T t_0}{r^2} = \frac{0.3(0.074)(3.67)}{(91')^2}$
S_A = 0.0010
$T_B = \frac{264 (3 gpm)}{0.171'}$ = 4632 gpd/ft
= 619 ft²/da = 0.430 ft²/min
s' (ft)
t (min)
Semi-Logarithmic
3 Cycles x 10 to the inch
12-183

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_0 is between 10^{-4} + 10^{-5}

$t_0 \approx 2.6 \times 10^{-5}$

To projectionbeyond graph to find intercept time t_0, note that s' changes by 0.171 ft each log cycle

$$S = \frac{0.3\,T\,t_0}{r^2} = \frac{0.3\,(0.43\ \text{ft}^2/\text{min})\,(2.6 \times 10^{-5}\ \text{min})}{(9\ \text{ft})^2}$$

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

[redacted]

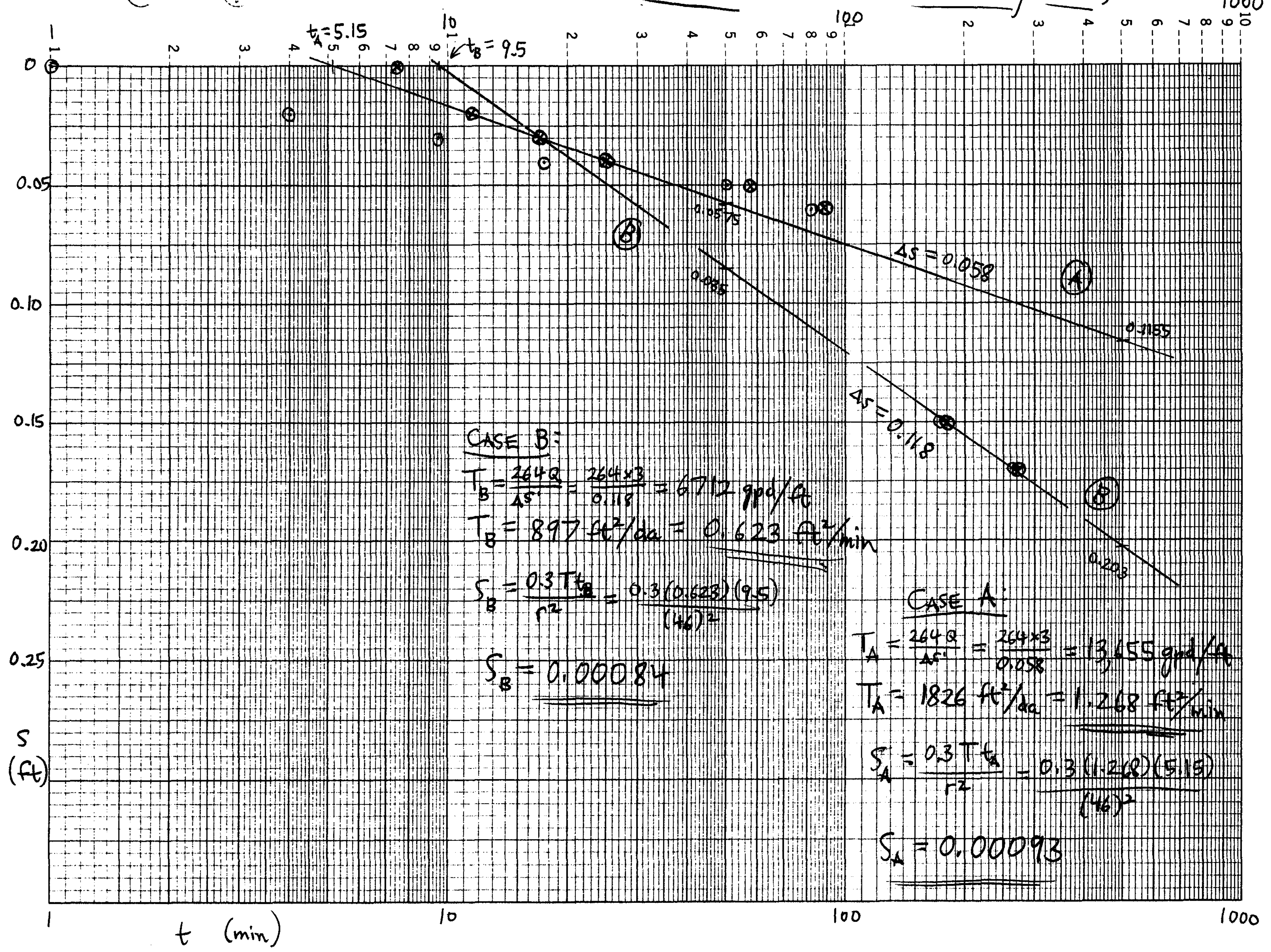
Former [redacted]		[redacted]	[redacted]
MW-3		Well	10
	19.22	Screened	[redacted]
[redacted]		Casing	2.00
		Filter	[redacted]
Recovery		Static	7.88

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
		[redacted]	0	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
0	0	[redacted]	7.5	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
0.02	4	[redacted]	11.5	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
0.03	9.5	[redacted]	17	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
0.04	17.5	[redacted]	25	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
0.05	50.5	[redacted]	58	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
0.06	82	[redacted]	89	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
0.15	173	[redacted]	180	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
0.17	264	[redacted]	271	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
		[redacted]		[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
	↑	[redacted]	↑	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
	⊙	[redacted]	⊗	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
		[redacted]		[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
		[redacted]		[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
		[redacted]		[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
		[redacted]		[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
		[redacted]		[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
		[redacted]		[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			

[redacted]

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

MW-5 46 5490 (Recovery Test)



		[redacted]			[redacted]		[redacted]				[redacted]
		[redacted]			[redacted]		[redacted]				[redacted]
		[redacted]			[redacted]		[redacted]				[redacted]
		[redacted]			[redacted]		[redacted]				[redacted]
		[redacted]			[redacted]		[redacted]				[redacted]
		[redacted]			[redacted]		[redacted]				[redacted]

[redacted]

Pumping Test

[redacted]

Former	[redacted]		
MW-3		Well	10
19.22		Screened	
		Casing	2.00
		Filter	
Drawdow		Static	7.88

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	[redacted]	0	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
	0.03	[redacted]	17.5	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
	0.06	[redacted]	31	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
	0.09	[redacted]	58	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
	0.12	[redacted]	80	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
	0.16	[redacted]	111	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			
(0.21)	0.14	[redacted]	170	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]			

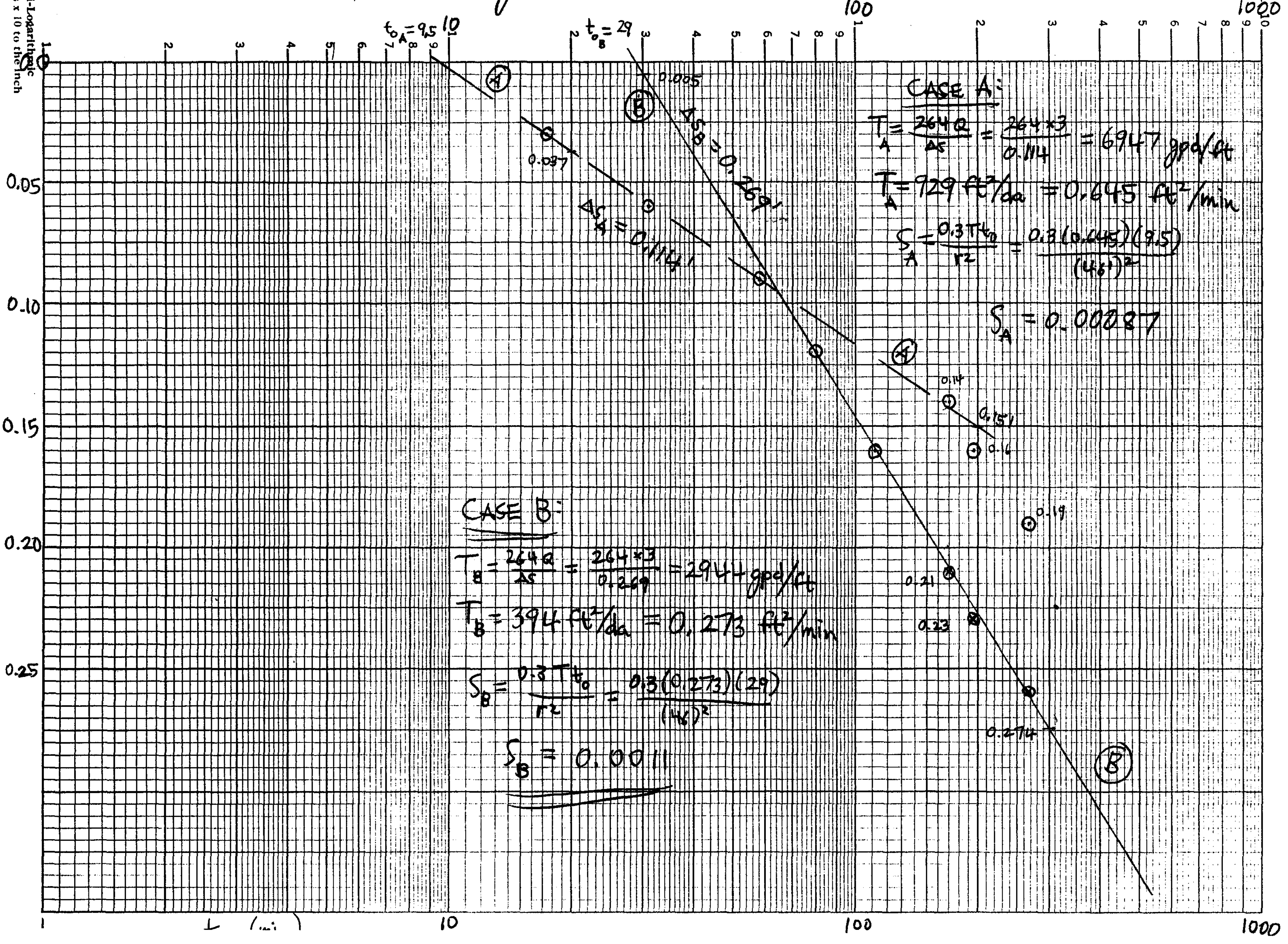
MW-3 Pumping Test (Cont.)

	s (ft)											
(0.23)	0.16		196									
(0.26)	0.19		267									
—	0.14		1327									

Former			
MW-4		Well	10
20.81		Screened	
		Casing	
		Filter	
Drawdow		Static	7.43

Hr	Min	Time	Ellapsed min	Depth to GW	GW Elevation	Change [Ft/min]	Water Meter	Gal/min	Gal/min	Notes	Field Reading	Meter Reading
			0	7.43								

MW-3 (Pumping Test)



		[redacted]	18	7.45	[redacted]		[redacted]				[redacted]
		[redacted]	30	7.48	[redacted]		[redacted]				[redacted]
		[redacted]	58	7.54	[redacted]		[redacted]				[redacted]
		[redacted]	80	7.55	[redacted]		[redacted]				[redacted]
		[redacted]	112	7.6	[redacted]		[redacted]				[redacted]
		[redacted]	171	7.62	[redacted]		[redacted]				[redacted]
		[redacted]	198	7.62	[redacted]		[redacted]				[redacted]
		[redacted]	268	7.66	[redacted]		[redacted]				[redacted]
		[redacted]	412	7.68	[redacted]		[redacted]				[redacted]
		[redacted]	1327	7.6	[redacted]		[redacted]				[redacted]
		[redacted]			[redacted]		[redacted]				[redacted]
		[redacted]			[redacted]		[redacted]				[redacted]
		[redacted]			[redacted]		[redacted]				[redacted]
		[redacted]			[redacted]		[redacted]				[redacted]
		[redacted]			[redacted]		[redacted]				[redacted]
		[redacted]			[redacted]		[redacted]				[redacted]
		[redacted]			[redacted]		[redacted]				[redacted]
		[redacted]			[redacted]		[redacted]				[redacted]
		[redacted]			[redacted]		[redacted]				[redacted]

[redacted]

Pumping Test

[redacted]

[redacted]	**Former**		[redacted]	
	MW5	**Well**	10	[redacted]
	21.66	**Screened**		
		Casing	2.00	

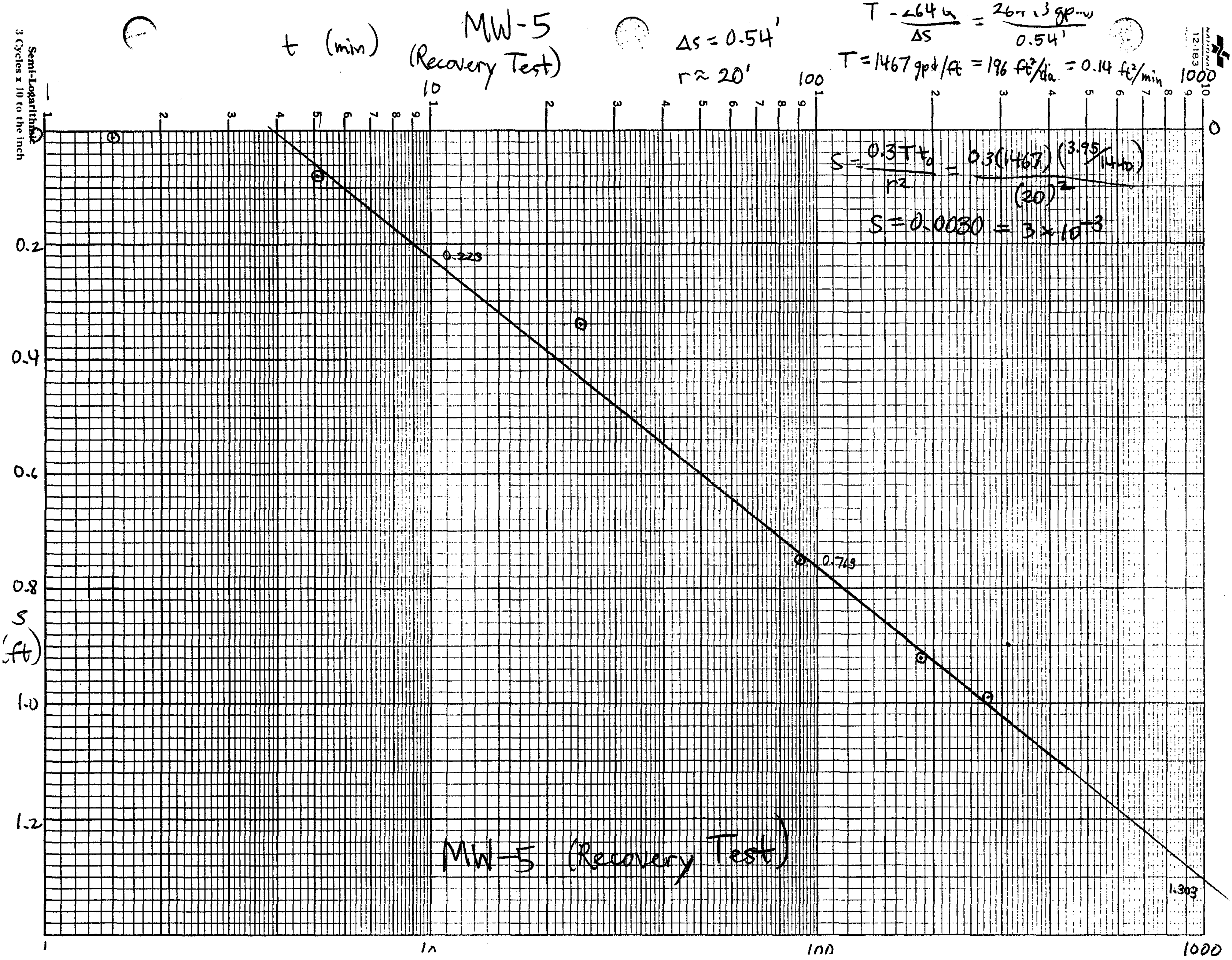
[redacted]

Former
MW5
21.66

Recovery

Well 10
Screened
Casing 2.00
Filter
Static 6.92

ΔS (ft)	t (min)	~~Hr~~ min	~~Min~~ s (ft)	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	[redacted]	0	7.91	[redacted]	[redacted]	3	[redacted]	[redacted]			
0	0	1325	1.05	[redacted]	2	7.97	[redacted]	[redacted]	3	[redacted]	[redacted]			
0.01	1.5	1327	1.04	[redacted]	3.5	7.96	[redacted]	[redacted]	3	[redacted]	[redacted]			
0.08	5.1	1330	0.97	[redacted]	7.1	7.89	[redacted]	[redacted]	3	[redacted]	[redacted]			
0.34	24.6	1350	0.71	[redacted]	26.5	7.63	[redacted]	[redacted]	3	[redacted]	[redacted]			
0.75	90	1415	0.30	[redacted]	92	7.22	[redacted]	[redacted]	3	[redacted]	[redacted]			
0.92	185	1510	0.13	[redacted]	187	7.05	[redacted]	[redacted]	3	[redacted]	[redacted]			
0.99	275	1600	0.06	[redacted]	277	6.98	[redacted]	[redacted]	3	[redacted]	[redacted]			
				[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			
				[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			
				[redacted]			[redacted]	[redacted]	3	[redacted]	[redacted]			


t (min)
MW-5
(Recovery Test)
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
0.2
0.4
0.6
0.8
1.0
1.2
s (ft)
1
10
100
1000
MW-5 (Recovery Test)
Semi-Logarithmic
3 Cycles x 10 to the inch
12-183

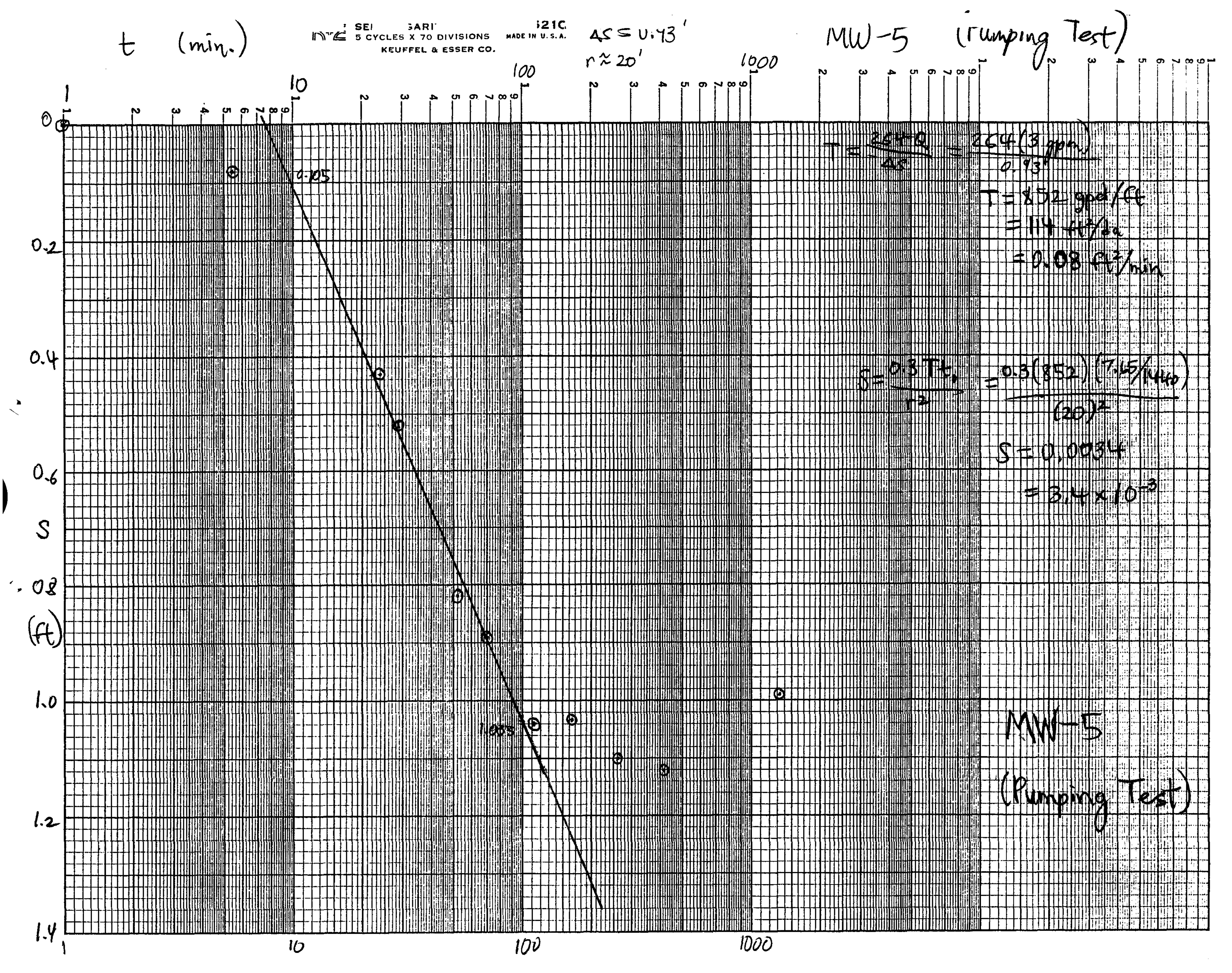
Pumping Test MW-5 Pumping well = EW-12

Drawdow

Filter

Static 6.92

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
	0		0	6.92			3					
	0.08		5.5	7			3					
	0.43		24	7.35			3					
	0.52		29	7.44			3					
	0.82		52	7.74			3					
	0.89		70	7.81			3					
	1.04		113	7.96			3					
	1.03		165	7.95			3					
	1.10		263	8.02			3					
	1.12		405	8.04			3					
	0.99		1323	7.91			3					

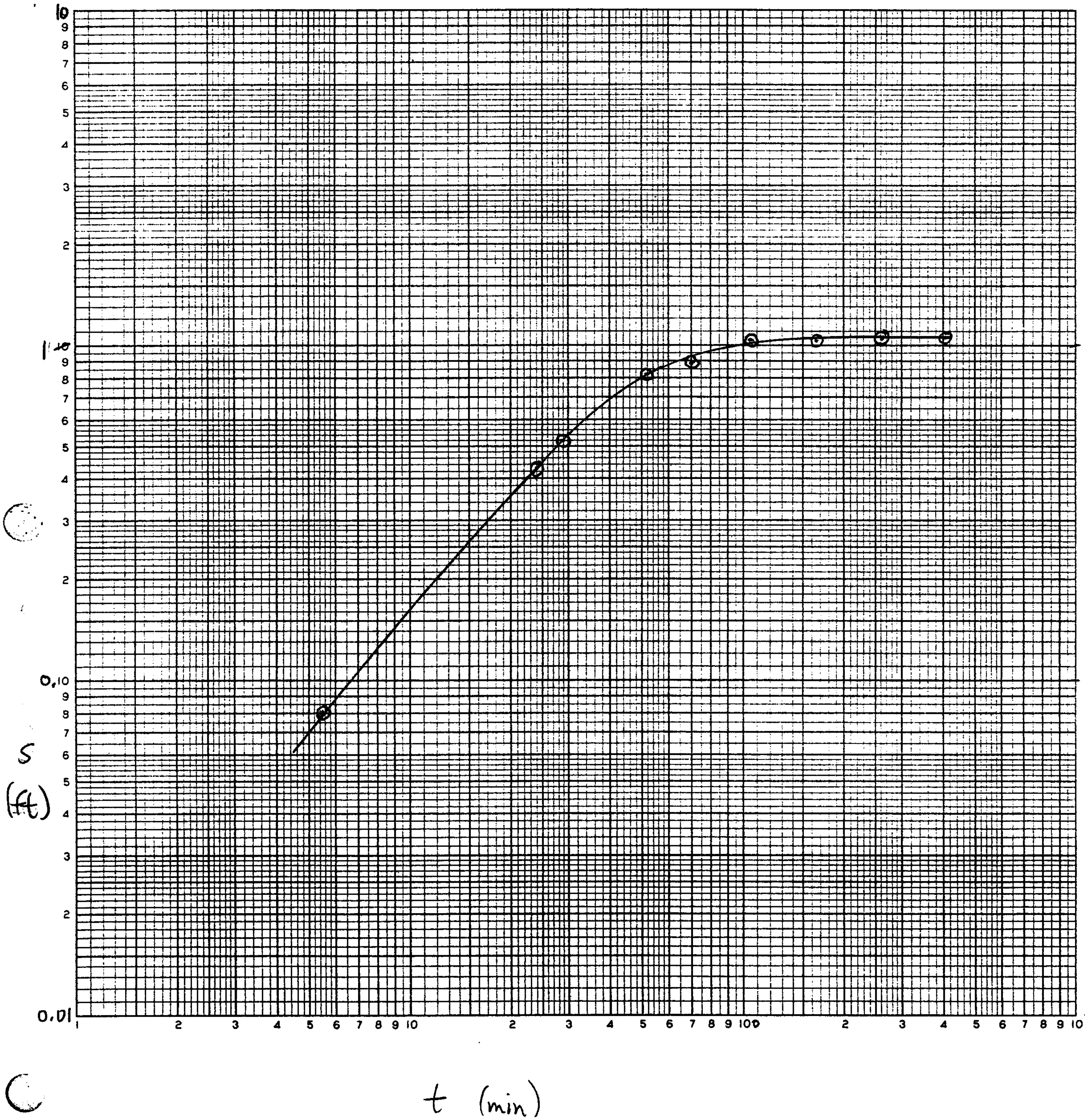


MW-5 (Pumping Test)
t (min.)
SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO.
MADE IN U.S.A.
46 5210
Δs = 0.93'
r ≈ 20'
s (ft)
0.105
1.005
T = 264 Q / Δs = 264 (3 gpm) / 0.93
T = 852 gpd/ft
= 114 ft²/da
= 0.08 ft²/min
S = 0.3 T t₀ / r² = 0.3 (852) (7.45/1440) / (20)²
S = 0.0034
= 3.4 x 10⁻³
MW-5
(Pumping Test)

NATIONAL 12-081

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

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

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

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

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

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

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

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

This seems very unlikely.