

GW - 1

WORK PLANS



CERTIFIED MAIL # 7099 3220 0010 2242 4825

January 31, 2005

Ms. Hope Monzeglio
State of New Mexico Environmental Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303

Re: Giant Bloomfield Refinery – NMED Conditional Approval of River Terrace Area
Voluntary Corrective Measures Plan
RCRA Permit No. NMD 089416416
HWB-GRCB-04-006

Dear Ms. Monzeglio:

Giant Refining Company Bloomfield (GRCB) received the December 29, 2004 letter from the New Mexico Environmental Department (NMED) stating NMED's conditional approval of the November 24, 2004 *Voluntary Corrective Measure Plan* (VCM Plan) submitted by GRCB. The VCM Plan describes the voluntary corrective measures to be implemented by GRCB at the Bloomfield refinery at the River Terrace. The purpose of this letter is to respond to several of the conditions stated in NMED's letter.

Response to NMED Conditions of Approval

The following responses correspond to the conditions in NMED's December 29, 2004 approval letter.

1. We have provided the construction diagram and boring log for monitoring wells MW-48 and MW-49 (Attachment A).
2. Depth-to-water measurements were collected following the installation of the two monitoring wells and eight temporary well points in November 2004 (Attachment B). A survey of each River Terrace well location and top-of-casing elevation will be completed following the installation of the additional well points east of TP-3 (See Response #7). Once surveying of the River Terrace wells has been completed, groundwater elevation data will be compiled and submitted to NMED as requested.

PHONE
505-632-8013
FAX
505-632-3911

50 ROAD 4990
P.O. BOX 159
BLOOMFIELD
NEW MEXICO
87413

3. Each of the eight temporary well points (TP-1 through TP-8) was constructed using two-inch diameter five-foot hand-slotted PVC piping, extending approximately five feet below the water table. Groundwater has been detected approximately five feet below existing grade. We have provided a typical temporary well point construction drawing (Attachment C). The depth to water (bgs) in each of the locations is stated in the upper left header of the logs contained in the VCM plan.
4. Separate phase hydrocarbon (SPH) was not observed during the installation of the two monitoring wells (MW-48 and MW-49) and eight temporary well points (TP-1 through TP-8) in the River Terrace. Similarly, SPH was not observed during the two subsequent rounds of monthly sampling for December 2004 and January 2005.
5. The description of "black" in the boring logs refers to hydrocarbon staining.
6. In accordance with the agreed upon monthly sampling plan stated within the RTSPA Plan, groundwater samples were collected at monitoring wells MW-48 and MW-49 on December 27, 2004 and January 18, 2005. Samples from each well were analyzed for BTEX, TPH (GRO and DRO), and PAHs. We have provided the analytical report for the December 2004 sample results, and a table summarizing the groundwater analytical results for the River Terrace wells through December 2004 (Attachment D).

The analytical results from the January 2005 monthly sample event will be provided to NMED upon receipt of the laboratory reports.

7. In order to delineate the extent of the contamination north and east of TP-3, we propose installing five additional temporary well points (TP-9 through TP-13). We have provided a revised River Terrace Well Location Map, which includes the location of the existing and proposed monitoring and temporary well points in the River Terrace (Attachment E). The well points will be constructed using machine-slotted screen. Weather and access conditions permitting, GRCB anticipates installing the additional well points by early March 2005.
8. The following responses correspond to comments of the proposed activities No. 1-6 outlined in the RTSPA Plan.
 1. The results and findings of the 24-hours aquifer test performed on MW-48 have been summarized in the Aquifer Test Summary Report (Attachment F).
 2. The results of the capture zone analysis are summarized as part of the Aquifer Test Summary Report (Attachment F).
 3. A revised Well Location Map has been provided, which includes the location of the existing and proposed monitoring and temporary well points in the River Terrace (Attachment E).
 4. Two subsequent monthly sampling events have been completed for December 2004 and January 2005. We have provided an analytical summary table and a copy of the laboratory report for the December 2004 sampling

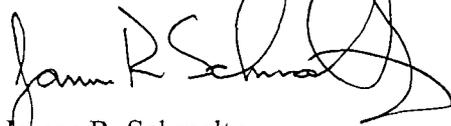
event (Attachment F). The results of the January 2005 sampling event will be submitted to NMED once the results become available from the lab.

5. In the November 24, 2004 VCM Plan, GRCB's use of the term "feasibility study" was intended to mean the evaluation, selection, and implementation of appropriate voluntary corrective measures to reduce the concentrations of fuel hydrocarbons on the refinery side of the barrier, and further mitigate fuel hydrocarbon migration to the river.
6. Based on the results of the October 2004 site investigation, it appears that the dissolved-phase hydrocarbon plume is biologically active. Therefore, the January 2005 River Terrace sampling event included an expanded suite of parameters that will allow GRCB to further evaluate the subsurface biologic activity. These data, the aquifer test data presented in Attachment F, and sampling results from the additional monitoring points (see Response #7 above) will be used to assess voluntary corrective measures alternatives. The results of the alternatives assessment and a proposed Voluntary Corrective Measure will be included in a Voluntary Corrective Measures Work Plan (VCMWP). The VCMWP will be prepared and submitted to OCD and NMED for review in April 2005.

If you have any questions in this matter, please contact me at 505-632-4171.

Sincerely,

GIANT REFINING COMPANY



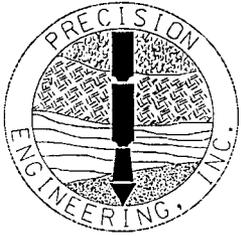
James R. Schmaltz
Environmental Manager

Cc: Denny Foust - NMED Aztec Office
Dave Cobrain - NMED Hazardous Waste Bureau
Hope Monzeglio - NMED Hazardous Waste Bureau
Bob Wilkinson - EPA
Ed Riege
Chad King

Letter to Ms. Hope Monzeglio
January 31, 2005

ATTACHMENT A

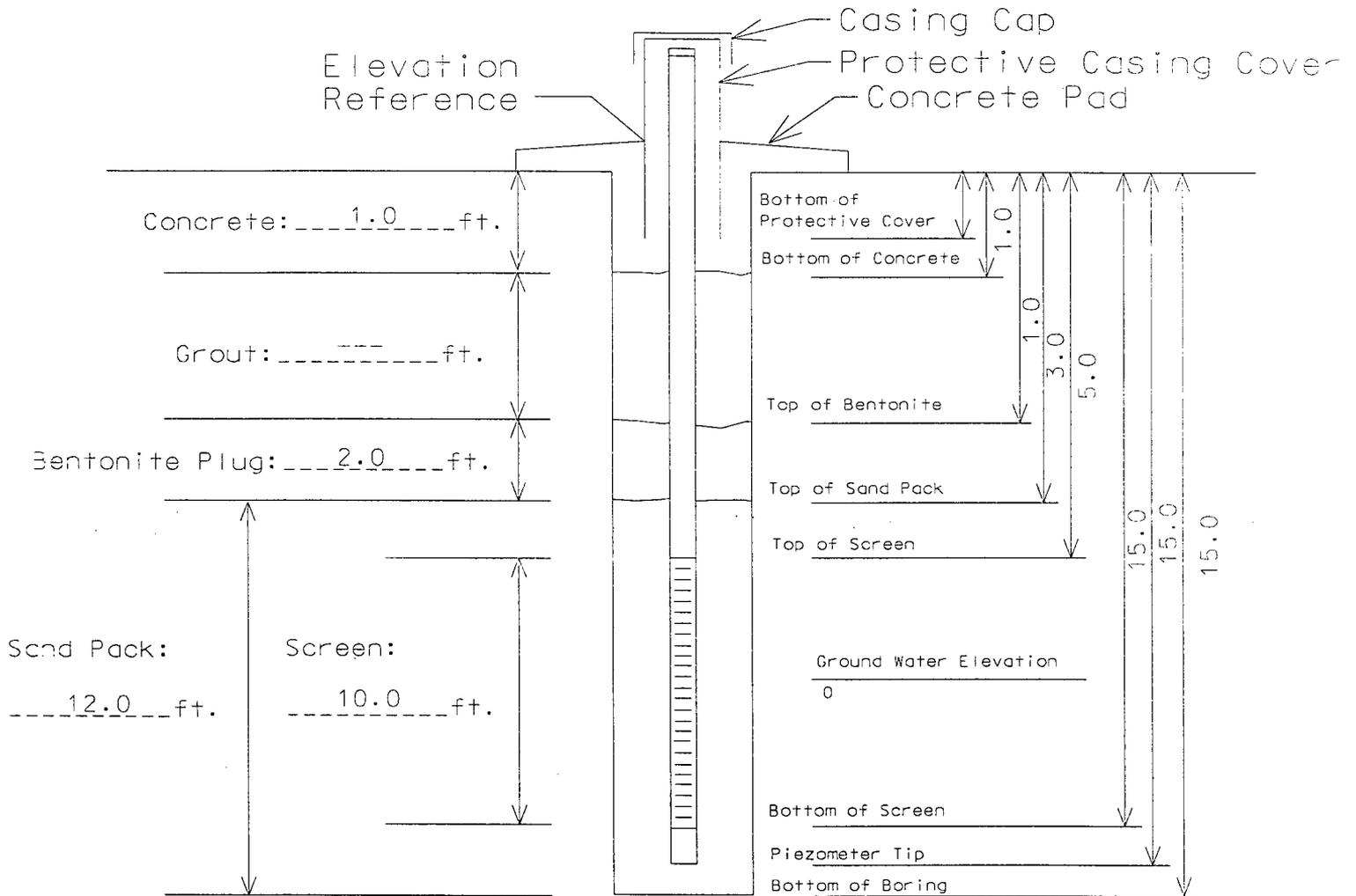
MW-48 and MW-49 Construction Diagram and Boring Log



505-523-7674

Installation Diagram

Monitoring Well No. MW-48



Boring Diameter: 12⁵/₈"

Sand Type: 8-12 Silica

Bollards, Type/Size: Steel, 3"

Bentonite: 3/8" Chips

Screen Type/Size: 4" PVC Sch. 40, 0.020" Slotted

Cement/Grout: -----

Riser Type/Size: 4" PVC Sch. 40

Water: Potable

Locking Expandable Casing Plug? Yes

Site Northing: 6204.63

Other: N/A

Bottom Cap Used? Yes

Site Easting: 2700.70

Giant Refining Co.

Project #: 03-122

Project Name: Bloomfield Wells

Elevation: not surveyed

Sheet: 1 of 1
 Bore Point: See plan
 Water Elevation: 7.70
 Boring No.: MW-48

Precision Engineering, Inc.
 P.O. Box 422
 Las Cruces, NM 88004
 505-523-7674

File #: 03-122
 Site: Bloomfield
 Giant Refining
 Elevation: Not Surveyed
 Date: 10/28/2004

Log of Test Borings

LAB #	DEPTH	BLOW COUNT	PLOT	SCALE	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, ETC.)	%M	LL	PI	CLASS.
	0-1		***-** *-O-**-		Silt , sand, very fine to fine, brown, damp, a few cobbles				
	1-15.0		*-O-**-		Sand , silty, very fine to fine, brown, damp, gravelly				
	2.0		*-O-**-	<u>2.5</u>	Black with hydrocarbon odor				
			*-O-**-						
			*****	<u>5.0</u>	medium to coarse sand				

			*****	<u>7.5</u>	water bearing				

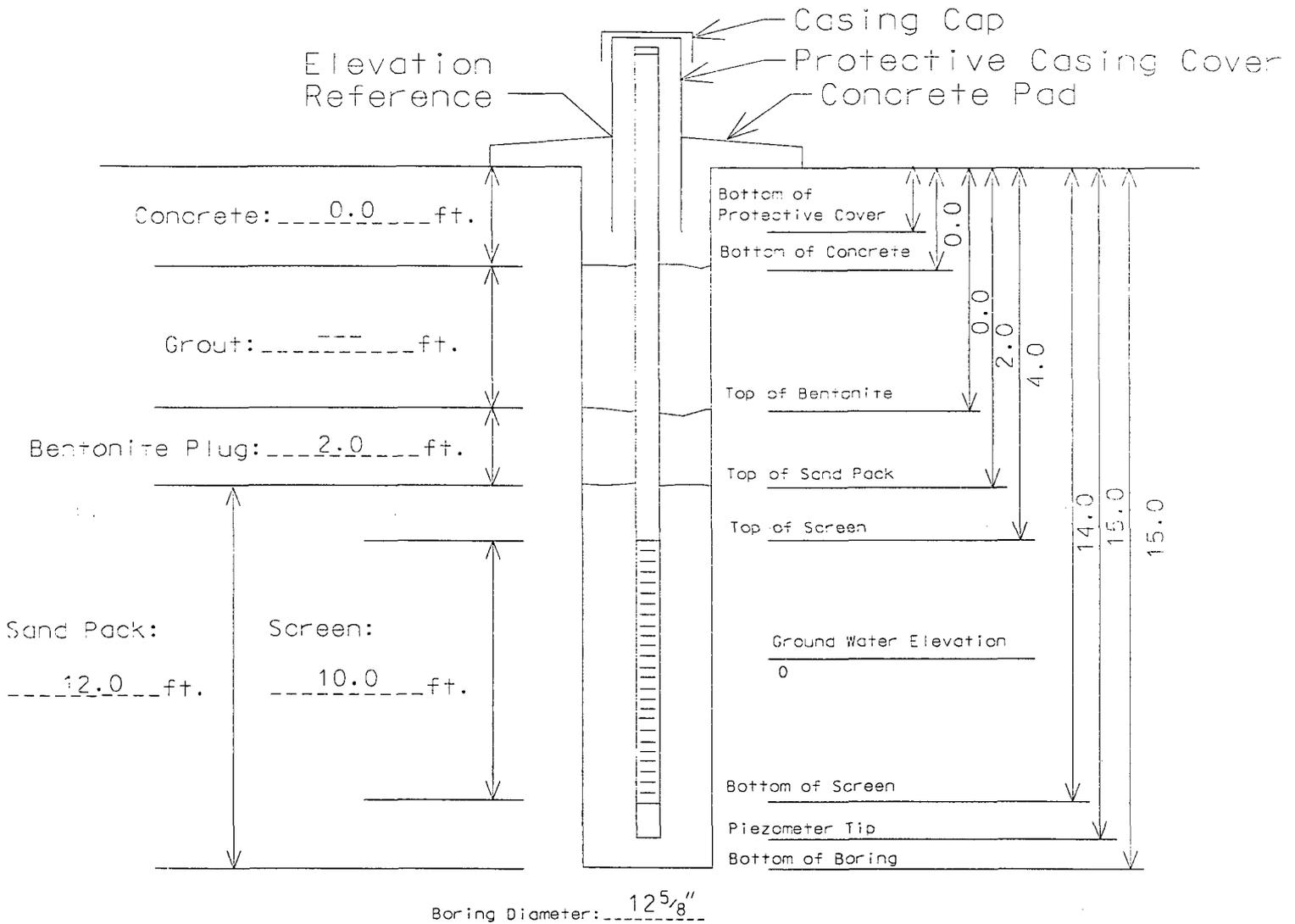
			o*	<u>10.0</u>	some gravel				
			o*						
			o*						
			o*						
			o*						
			o*						
			o*						
			o*						
			o*						
			o*	<u>15.0</u>					
					T.D. 15.0 Bottom of well 15' Placed 4" PVC, 10' factory slotted .020" screen Sanded with 8-12 Silica Sand to 3' bgs Bentonite Plug to 1' bgs				
				<u>20.0</u>					
SIZE & TYPE OF BORING: 4 1/4" ID HOLLOW STEMMED AUGER						LOGGED BY: KM			



505-523-7674

Installation Diagram

Monitoring Well No. MW-49



Boring Diameter: 12^{5/8}"

Sand Type: 8-12 Silica

Bollards, Type/Size: Steel, 3"

Bentonite: 3/8" Chips

Screen Type/Size: 4" PVC Sch. 40, 0.020" Slotted

Cement/Grout: -----

Riser Type/Size: 4" PVC Sch. 40

Water: Potable

Locking Expandable Casing Plug? Yes

Site Northing: 6196.16

Other: N/A

Bottom Cap Used? Yes

Site Easting: 2653.14

Giant Refining Co.

Project #: 03-122

Project Name: Bloomfield Wells

Elevation: Not Surveyed

Letter to Ms. Hope Monzeglio
January 31, 2005

ATTACHMENT B

River Terrace Water Level Data – December 2004

**Giant Bloomfield Refinery
River Terrace - Water Level Data
December 2004**

Well #	Date Collected	Depth to Water ⁽¹⁾ (ft)	SPH ⁽²⁾ (ft)	Well Depth ⁽³⁾ (ft)	Well Casing Height ⁽⁴⁾ (ft)	Observations
TP #1	10/28/04	5.44	0		0.9	No SPH - But have a visible sheen
TP #2	10/28/04	7.01	0		0.59	No SPH - But have a visible sheen
TP #3	10/28/04	7.02	0		1.22	No SPH - No odor or sheen
TP #4	10/28/04	6.28	0		0.9	No SPH - But have a visible sheen
TP #5	10/28/04	6.18	0		0.83	No SPH - But have a visible sheen
TP #6	10/28/04	5.96	0		1.16	No SPH - No sheen
TP #7	10/28/04	6.79	0		1.1	No SPH - Barely any water in it
TP #8	10/28/04	5.96	0		1.39	No SPH - But have a visible sheen
MW #48	11/01/04	7.73	0	17.22	2.89	
MW #49	11/01/04	9	0	16.48	3.15	

Notes:

- (1) = Depth-to-water measurements are recorded from the top of casing.
- (2) = SPH refers to separate phase hydrocarbons.
- (3) = Well depth readings are reflective of field measurements at the time of data collection.
- (4) = Well casing height refers to high of casing stick-up above existing grade.

Letter to Ms. Hope Monzeglio
January 31, 2005

ATTACHMENT C

Typical Temporary Well Point Construction Drawing

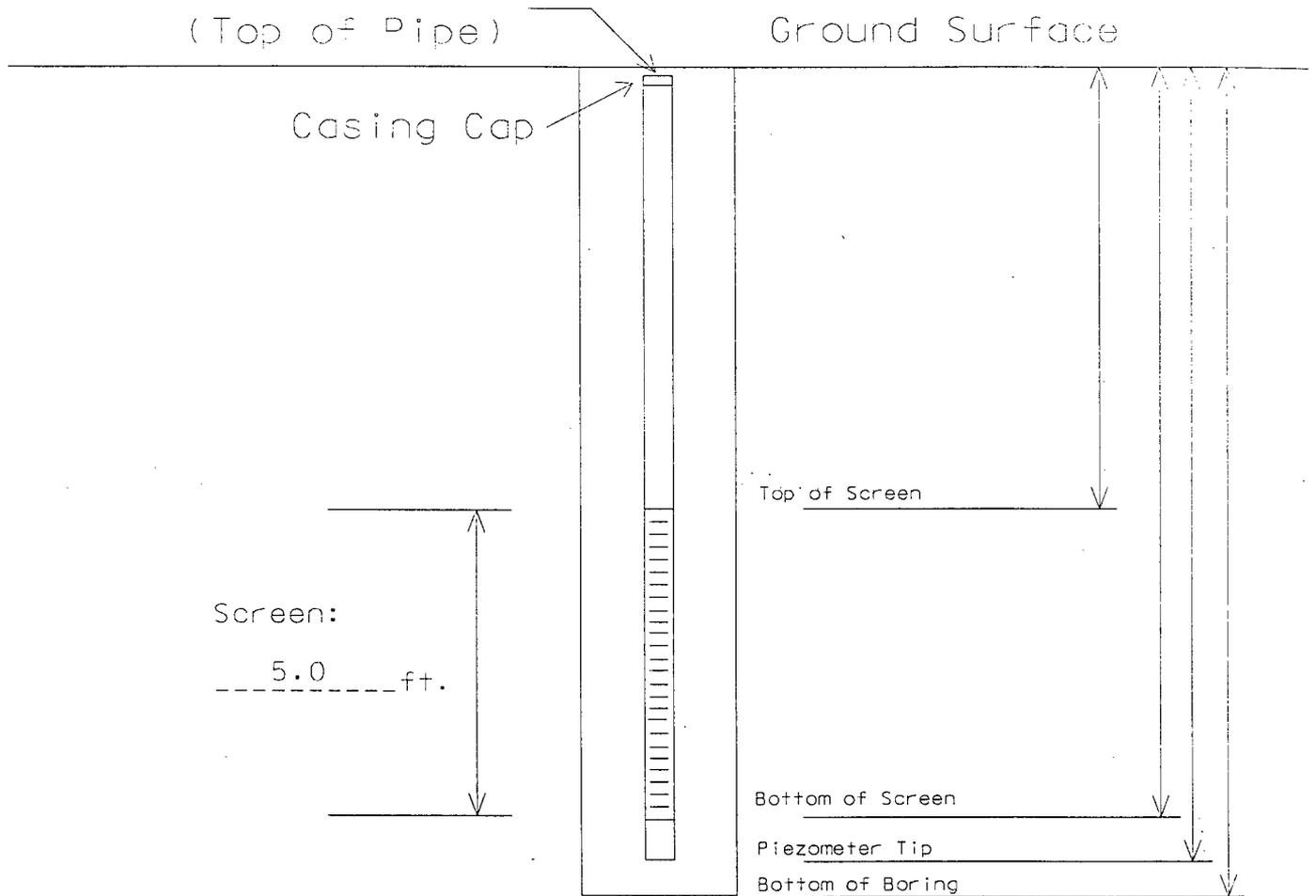


505-523-7674

Temporary Piezometer Installation - Typical

See Logs for Depth Details

Elevation Reference
(Top of Pipe)



Boring Diameter: $8\frac{5}{8}$ "

Sand Type: Native Backfill

Bollards, Type/Size: None

Bentonite: None

Screen Type/Size: 2" PVC Sch. 40, 0.060" Hand Slotted @ 3" Intervals

Cement/Grout: None

Riser Type/Size: 2" PVC Sch. 40

Water: Potable

Locking Expandable Casing Plug? No
(Slip Cap)

Site Northing: _____

Other: N/A

Bottom Cap Used? Yes

Site Easting: _____

Project #: 03-122

Project Name: Giant Refining Co. Bloomfield Wells

Elevation: _____

Letter to Ms. Hope Monzeglio
January 31, 2005

ATTACHMENT D

River Terrace Groundwater Analytical Results Summary



COVER LETTER

January 13, 2005

Cindy Hurtado
San Juan Refining
#50 CR 4990
Bloomfield, NM 87413
TEL: (505) 632-4161
FAX (505) 632-3911

RE: River Terrace - MW #48 & MW #49

Order No.: 0412237

Dear Cindy Hurtado:

Hall Environmental Analysis Laboratory received 2 samples on 12/28/2004 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent.

Reporting limits are determined by EPA methodology. No determination of compounds below these (denoted by the ND or < sign) has been made.

Please don't hesitate to contact HEAL for any additional information or clarifications.

Sincerely,

A handwritten signature in black ink, appearing to read "Andy Freeman".

Andy Freeman, Business Manager
Nancy McDuffie, Laboratory Manager



Hall Environmental Analysis Laboratory

Date: 13-Jan-05

CLIENT: San Juan Refining Client Sample ID: MW #48
 Lab Order: 0412237 Collection Date: 12/27/2004 1:50:00 PM
 Project: River Terrace - MW #48 & MW #49
 Lab ID: 0412237-01 Matrix: AQUEOUS

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015B: DIESEL RANGE						Analyst: JMP
Diesel Range Organics (DRO)	ND	1.0		mg/L	1	1/3/2005 5:09:41 PM
Motor Oil Range Organics (MRO)	ND	5.0		mg/L	1	1/3/2005 5:09:41 PM
Surr: DNOP	112	58-140		%REC	1	1/3/2005 5:09:41 PM
EPA METHOD 8015B: GASOLINE RANGE						Analyst: NSB
Gasoline Range Organics (GRO)	28	5.0		mg/L	100	1/3/2005 5:34:00 PM
Surr: BFB	111	78.3-120		%REC	100	1/3/2005 5:34:00 PM
EPA METHOD 8021B: VOLATILES						Analyst: NSB
Methyl tert-butyl ether (MTBE)	ND	250		µg/L	100	1/3/2005 5:34:00 PM
Benzene	690	50		µg/L	100	1/3/2005 5:34:00 PM
Toluene	ND	50		µg/L	100	1/3/2005 5:34:00 PM
Ethylbenzene	1900	50		µg/L	100	1/3/2005 5:34:00 PM
Xylenes, Total	8200	50		µg/L	100	1/3/2005 5:34:00 PM
Surr: 4-Bromofluorobenzene	110	83.3-121		%REC	100	1/3/2005 5:34:00 PM
EPA METHOD 8310: PAHS						Analyst: BL
Naphthalene	190	13		µg/L	5	1/10/2005 12:51:57 PM
1-Methylnaphthalene	69	2.5		µg/L	1	1/7/2005 3:18:32 PM
2-Methylnaphthalene	76	2.5		µg/L	1	1/7/2005 3:18:32 PM
Acenaphthylene	ND	2.5		µg/L	1	1/7/2005 3:18:32 PM
Acenaphthene	ND	2.5		µg/L	1	1/7/2005 3:18:32 PM
Fluorene	1.1	0.80		µg/L	1	1/7/2005 3:18:32 PM
Phenanthrene	2.2	0.60		µg/L	1	1/7/2005 3:18:32 PM
Anthracene	ND	0.60		µg/L	1	1/7/2005 3:18:32 PM
Fluoranthene	ND	0.30		µg/L	1	1/7/2005 3:18:32 PM
Pyrene	ND	0.30		µg/L	1	1/7/2005 3:18:32 PM
Benz(a)anthracene	ND	0.020		µg/L	1	1/7/2005 3:18:32 PM
Chrysene	ND	0.20		µg/L	1	1/7/2005 3:18:32 PM
Benzo(b)fluoranthene	ND	0.050		µg/L	1	1/7/2005 3:18:32 PM
Benzo(k)fluoranthene	ND	0.020		µg/L	1	1/7/2005 3:18:32 PM
Benzo(a)pyrene	ND	0.020		µg/L	1	1/7/2005 3:18:32 PM
Dibenz(a,h)anthracene	ND	0.040		µg/L	1	1/7/2005 3:18:32 PM
Benzo(g,h,i)perylene	ND	0.030		µg/L	1	1/7/2005 3:18:32 PM
Indeno(1,2,3-cd)pyrene	ND	0.080		µg/L	1	1/7/2005 3:18:32 PM
Surr: Benzo(e)pyrene	81.8	54-102		%REC	1	1/7/2005 3:18:32 PM

Qualifiers: ND - Not Detected at the Reporting Limit S - Spike Recovery outside accepted recovery limits
 J - Analyte detected below quantitation limits R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank E - Value above quantitation range
 * - Value exceeds Maximum Contaminant Level

Hall Environmental Analysis Laboratory

Date: 13-Jan-05

CLIENT: San Juan Refining
 Lab Order: 0412237
 Project: River Terrace - MW #48 & MW #49
 Lab ID: 0412237-02

Client Sample ID: MW #49
 Collection Date: 12/27/2004 1:00:00 PM
 Matrix: AQUEOUS

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015B: DIESEL RANGE						Analyst: JMP
Diesel Range Organics (DRO)	ND	1.0		mg/L	1	1/4/2005 10:11:04 AM
Motor Oil Range Organics (MRO)	ND	5.0		mg/L	1	1/4/2005 10:11:04 AM
Surr: DNOP	98.2	58-140		%REC	1	1/4/2005 10:11:04 AM
EPA METHOD 8015B: GASOLINE RANGE						Analyst: NSB
Gasoline Range Organics (GRO)	0.23	0.050		mg/L	1	1/4/2005 10:13:32 AM
Surr: BFB	108	78.3-120		%REC	1	1/4/2005 10:13:32 AM
EPA METHOD 8021B: VOLATILES						Analyst: NSB
Methyl tert-butyl ether (MTBE)	ND	2.5		µg/L	1	1/4/2005 10:13:32 AM
Benzene	9.7	0.50		µg/L	1	1/4/2005 10:13:32 AM
Toluene	ND	0.50		µg/L	1	1/4/2005 10:13:32 AM
Ethylbenzene	1.9	0.50		µg/L	1	1/4/2005 10:13:32 AM
Xylenes, Total	0.52	0.50		µg/L	1	1/4/2005 10:13:32 AM
Surr: 4-Bromofluorobenzene	105	83.3-121		%REC	1	1/4/2005 10:13:32 AM
EPA METHOD 8310: PAHS						Analyst: BL
Naphthalene	ND	2.5		µg/L	1	1/7/2005 4:06:32 PM
1-Methylnaphthalene	ND	2.5		µg/L	1	1/7/2005 4:06:32 PM
2-Methylnaphthalene	ND	2.5		µg/L	1	1/7/2005 4:06:32 PM
Acenaphthylene	ND	2.5		µg/L	1	1/7/2005 4:06:32 PM
Acenaphthene	ND	2.5		µg/L	1	1/7/2005 4:06:32 PM
Fluorene	ND	0.80		µg/L	1	1/7/2005 4:06:32 PM
Phenanthrene	ND	0.60		µg/L	1	1/7/2005 4:06:32 PM
Anthracene	ND	0.60		µg/L	1	1/7/2005 4:06:32 PM
Fluoranthene	ND	0.30		µg/L	1	1/7/2005 4:06:32 PM
Pyrene	ND	0.30		µg/L	1	1/7/2005 4:06:32 PM
Benz(a)anthracene	ND	0.020		µg/L	1	1/7/2005 4:06:32 PM
Chrysene	ND	0.20		µg/L	1	1/7/2005 4:06:32 PM
Benzo(b)fluoranthene	ND	0.050		µg/L	1	1/7/2005 4:06:32 PM
Benzo(k)fluoranthene	ND	0.020		µg/L	1	1/7/2005 4:06:32 PM
Benzo(a)pyrene	ND	0.020		µg/L	1	1/7/2005 4:06:32 PM
Dibenz(a,h)anthracene	ND	0.040		µg/L	1	1/7/2005 4:06:32 PM
Benzo(g,h,i)perylene	ND	0.030		µg/L	1	1/7/2005 4:06:32 PM
Indeno(1,2,3-cd)pyrene	ND	0.080		µg/L	1	1/7/2005 4:06:32 PM
Surr: Benzo(a)pyrene	88.0	54-102		%REC	1	1/7/2005 4:06:32 PM

Qualifiers: ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 * - Value exceeds Maximum Contaminant Level

S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range

Hall Environmental Analysis Laboratory

Date: 13-Jan-05

QC SUMMARY REPORT
Method Blank

CLIENT: San Juan Refining
Work Order: 0412237
Project: River Terrace - MW #48 & MW #49

Sample ID MB-7169 Batch ID: 7169 Test Code: SW8015 Units: mg/L Analysis Date 1/3/2005 3:39:14 PM Prep Date 12/30/2004
Client ID: Run ID: FID(17A)_2_041230A SeqNo: 330395

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	ND	1									
Motor Oil Range Organics (MRO)	ND	5									
Surr: DNOP	1.194	0	1	0	119	58	140	0			

Sample ID Reagent Blank 5m Batch ID: R14198 Test Code: SW8015 Units: mg/L Analysis Date 1/3/2005 9:35:16 AM Prep Date
Client ID: Run ID: PIDFID_050103A SeqNo: 330242

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	ND	0.05									
Surr: BFB	19.09	0	20	0	95.5	78.3	120	0			

Sample ID Reagent Blank 5m Batch ID: R14206 Test Code: SW8015 Units: mg/L Analysis Date 1/4/2005 8:43:42 AM Prep Date
Client ID: Run ID: PIDFID_050104A SeqNo: 330471

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	ND	0.05									
Surr: BFB	19.24	0	20	0	96.2	78.3	120	0			

Qualifiers: ND - Not Detected at the Reporting Limit S - Spike Recovery outside accepted recovery limits B - Analyte detected in the associated Method Blank
J - Analyte detected below quantitation limits R - RPD outside accepted recovery limits

QC SUMMARY REPORT
Method Blank

CLIENT: San Juan Refining
 Work Order: 0412237
 Project: River Terrace - MW #48 & MW #49

Sample ID	Reagent Blank 5m	Batch ID: R14198	Test Code: SW8021	Units: µg/L	Analysis Date 1/3/2005 9:35:16 AM	Prep Date
Client ID:	Run ID: PIDFID_050103A	PQL	SPK value	SPK Ref Val	SeqNo: 330238	
Analyte	Result	%REC	LowLimit	HighLimit	RPD Ref Val	RPDLimit Qual
Methyl tert-butyl ether (MTBE)	ND	2.5	0	20	0	
Benzene	ND	0.5				
Toluene	ND	0.5				
Ethylbenzene	ND	0.5				
Xylenes, Total	ND	0.5				
Surr: 4-Bromofluorobenzene	19.22	96.1	83.3	121	0	

Sample ID	Reagent Blank 5m	Batch ID: R14206	Test Code: SW8021	Units: µg/L	Analysis Date 1/4/2005 8:43:42 AM	Prep Date
Client ID:	Run ID: PIDFID_050104A	PQL	SPK value	SPK Ref Val	SeqNo: 330470	
Analyte	Result	%REC	LowLimit	HighLimit	RPD Ref Val	RPDLimit Qual
Methyl tert-butyl ether (MTBE)	ND	2.5	0	20	0	
Benzene	ND	0.5				
Toluene	ND	0.5				
Ethylbenzene	ND	0.5				
Xylenes, Total	ND	0.5				
Surr: 4-Bromofluorobenzene	19.97	99.9	83.3	121	0	

Qualifiers: ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank

QC SUMMARY REPORT
Method Blank

CLIENT: San Juan Refining
 Work Order: 0412237
 Project: River Terrace - MW #48 & MW #49

Sample ID MB-7179 Batch ID: 7179 Test Code: SW8310 Units: µg/L Analysis Date 1/7/2005 12:54:33 PM Prep Date 1/3/2005
 Client ID: Run ID: HUGO_050107A SeqNo: 331224

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Naphthalene	ND	2.5									
1-Methylnaphthalene	ND	2.5									
2-Methylnaphthalene	ND	2.5									
Acenaphthylene	ND	2.5									
Acenaphthene	ND	2.5									
Fluorene	ND	0.8									
Phenanthrene	ND	0.6									
Anthracene	ND	0.6									
Fluoranthene	ND	0.3									
Pyrene	ND	0.3									
Benz(a)anthracene	ND	0.02									
Chrysene	ND	0.2									
Benzo(b)fluoranthene	ND	0.05									
Benzo(k)fluoranthene	ND	0.02									
Benzo(a)pyrene	ND	0.02									
Dibenz(a,h)anthracene	ND	0.04									
Benzo(g,h,i)perylene	ND	0.03									
Indeno(1,2,3-cd)pyrene	ND	0.08									
Surr: Benzo(e)pyrene	8.55	0	10	0	85.5	54	102	0			

Qualifiers: ND - Not Detected at the Reporting Limit S - Spike Recovery outside accepted recovery limits B - Analyte detected in the associated Method Blank
 J - Analyte detected below quantitation limits R - RPD outside accepted recovery limits

Hall Environmental Analysis Laboratory

Date: 13-Jan-05

QC SUMMARY REPORT
Laboratory Control Spike - generic

CLIENT: San Juan Refining
Work Order: 0412237
Project: River Terrace - MW #48 & MW #49

Sample ID	LCS-7169	Batch ID	7169	Test Code	SW8015	Units	mg/L	Analysis Date	1/3/2005 4:09:07 PM	Prep Date	12/30/2004			
Client ID:		Run ID:	FID(17A) 2_041230A	SeqNo:	330396									
Analyte		Result		PQL	SPK value	SPK Ref Val		%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)		5.595	1	5	0	112	81.2	149	0					
Sample ID	LCSD-7169	Batch ID	7169	Test Code	SW8015	Units	mg/L	Analysis Date	1/3/2005 4:39:01 PM	Prep Date	12/30/2004			
Client ID:		Run ID:	FID(17A) 2_041230A	SeqNo:	330397									
Analyte		Result		PQL	SPK value	SPK Ref Val		%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)		5.657	1	5	0	113	81.2	149	5.595	1.10	23			
Sample ID	GRO std 2.5ug	Batch ID	R14198	Test Code	SW8015	Units	mg/L	Analysis Date	1/3/2005 10:05:01 AM	Prep Date				
Client ID:		Run ID:	PIDFID_050103A	SeqNo:	330248									
Analyte		Result		PQL	SPK value	SPK Ref Val		%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)		0.5244	0.05	0.5	0	105	82.6	114	0					
Sample ID	GRO std 2.5ug	Batch ID	R14198	Test Code	SW8015	Units	mg/L	Analysis Date	1/3/2005 6:33:51 PM	Prep Date				
Client ID:		Run ID:	PIDFID_050103A	SeqNo:	330252									
Analyte		Result		PQL	SPK value	SPK Ref Val		%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)		0.4968	0.05	0.5	0	99.4	82.6	114	0.5244	5.41	8.39			
Sample ID	GRO std 2.5ug	Batch ID	R14206	Test Code	SW8015	Units	mg/L	Analysis Date	1/4/2005 11:13:21 AM	Prep Date				
Client ID:		Run ID:	PIDFID_050104A	SeqNo:	330473									
Analyte		Result		PQL	SPK value	SPK Ref Val		%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)		0.5016	0.05	0.5	0	100	82.6	114	0					

Qualifiers: ND - Not Detected at the Reporting Limit S - Spike Recovery outside accepted recovery limits B - Analyte detected in the associated Method Blank
 J - Analytic detected below quantitation limits R - RPD outside accepted recovery limits

QC SUMMARY REPORT
Laboratory Control Spike - generic

CLIENT: San Juan Refining
Work Order: 0412237
Project: River Terrace - MW #48 & MW #49

Sample ID	BTEX Ics 100ng	Batch ID: R14198	Test Code: SW8021	Units: µg/L	Analysis Date	1/3/2005 5:04:03 PM	Prep Date				
Client ID:	Run ID: PIDFID_050103A	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Analyte	Result										
Methyl tert-butyl ether (MTBE)	43.46	2.5	40	0	109	64.5	133	0			
Benzene	20.36	0.5	20	0	102	88.7	114	0			
Toluene	20.01	0.5	20	0	100	89.3	112	0			
Ethylbenzene	20.64	0.5	20	0	103	88.6	113	0			
Xylenes, Total	60.06	0.5	60	0	100	89.4	112	0			

Sample ID	BTEX std 100ng	Batch ID: R14208	Test Code: SW8021	Units: µg/L	Analysis Date	1/4/2005 7:42:37 PM	Prep Date				
Client ID:	Run ID: PIDFID_050104A	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Analyte	Result										
Methyl tert-butyl ether (MTBE)	38.09	2.5	40	0	95.2	64.5	133	0			
Benzene	20.16	0.5	20	0	101	88.7	114	0			
Toluene	19.44	0.5	20	0	97.2	89.3	112	0			
Ethylbenzene	20.19	0.5	20	0	101	88.6	113	0			
Xylenes, Total	59.17	0.5	60	0	98.6	89.4	112	0			

Quantifiers: ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
B - Analyte detected in the associated Method Blank

QC SUMMARY REPORT

Laboratory Control Spike - generic

CLIENT: San Juan Refining

Work Order: 0412237

Project: River Terrace - MW #48 & MW #49

Sample ID LCS-7179 Batch ID: 7179 Test Code: SWB310 Units: µg/L Analysis Date 1/7/2005 1:42:33 PM Prep Date 1/3/2005

Client ID: Run ID: HUGO_060107A SeqNo: 331225

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Naphthalene	32.35	2.5	40	0	80.9	20.939	111.211	0			
1-Methylnaphthalene	32.39	2.5	40.1	0	80.8	22.016	110.385	0			
2-Methylnaphthalene	31.65	2.5	40	0	79.1	21.098	111.261	0			
Acenaphthylene	30.78	2.5	40.1	0	76.8	23.852	116.857	0			
Acenaphthene	31.39	2.5	40	0	78.5	27.524	111.73	0			
Fluorene	3.02	0.8	4.01	0	75.3	31.046	113.32	0			
Phenanthrene	1.75	0.6	2.01	0	87.1	42.279	115.749	0			
Anthracene	1.66	0.6	2.01	0	82.6	43.767	118.693	0			
Fluoranthene	3.46	0.3	4.01	0	86.3	55.334	117.461	0			
Pyrene	3.49	0.3	4.01	0	87.0	57.722	120.632	0			
Benz(a)anthracene	0.34	0.02	0.401	0	84.8	70.18	113.452	0			
Chrysene	1.69	0.2	2.01	0	84.1	43.942	141.404	0			
Benzo(b)fluoranthene	0.42	0.05	0.501	0	83.8	71.192	103.368	0			
Benzo(k)fluoranthene	0.22	0.02	0.25	0	88.0	75.336	107.209	0			
Benzo(a)pyrene	0.46	0.02	0.251	0	87.6	74.556	100.742	0			
Dibenz(a,h)anthracene	0.44	0.04	0.501	0	91.8	80.693	106.931	0			
Benzo(g,h,i)perylene	0.44	0.03	0.5	0	88.0	55.168	135.014	0			
Indeno(1,2,3-cd)pyrene	0.91	0.08	1.002	0	90.8	79.328	104.794	0			

Qualifiers: ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank

QC SUMMARY REPORT

Laboratory Control Spike Duplicate

CLIENT: San Juan Refining
 Work Order: 0412237
 Project: River Terrace - MW #48 & MW #49

Sample ID	LCSD-7179	Batch ID: 7179	Test Code: SW6310	Units: µg/L	Analysis Date	17/2005 2:30:33 PM	Prep Date	1/3/2005				
Client ID:	Run ID:	HUGO_050107A	POL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Naphthalene	2.5	40	0	20.939	111.211	69.3	32.35	32.35	15.4	32.1		
1-Methylnaphthalene	2.5	40.1	0	22.016	110.385	73.6	32.39	32.39	9.27	32.7		
2-Methylnaphthalene	2.5	40	0	21.098	111.261	72.3	31.65	31.65	9.05	34		
Acenaphthylene	2.5	40.1	0	23.852	116.857	73.1	30.78	30.78	4.86	38.8		
Acenaphthene	2.5	40	0	27.524	111.73	77.0	31.39	31.39	1.96	38.6		
Fluorene	0.8	4.01	0	31.046	113.32	75.1	3.02	3.02	0.332	39.3		
Phenanthrene	0.6	2.01	0	42.279	115.749	88.1	1.75	1.75	1.14	25		
Anthracene	0.6	2.01	0	43.767	118.693	84.6	1.66	1.66	2.38	23.9		
Fluoranthene	0.3	4.01	0	55.334	117.461	91.3	3.46	3.46	5.62	15.7		
Pyrene	0.3	4.01	0	57.722	120.832	86.8	3.49	3.49	0.287	15.3		
Benz(a)anthracene	0.02	0.401	0	70.18	113.452	87.3	0.34	0.34	2.90	119		
Chrysene	0.2	2.01	0	43.942	141.404	85.6	1.69	1.69	1.76	16.6		
Benzo(b)fluoranthene	0.05	0.501	0	71.192	103.368	83.8	0.42	0.42	0	21.7		
Benzo(k)fluoranthene	0.02	0.25	0	75.336	107.209	92.0	0.22	0.22	4.44	19.4		
Benzo(a)pyrene	0.02	0.251	0	74.556	100.742	87.6	0.22	0.22	0	16.7		
Dibenz(a,h)anthracene	0.04	0.501	0	80.693	106.931	91.8	0.46	0.46	0	17.3		
Benzo(g,h,i)perylene	0.03	0.5	0	55.168	135.014	86.0	0.44	0.44	2.30	118		
Indeno(1,2,3-cd)pyrene	0.08	1.002	0	79.328	104.794	90.8	0.91	0.91	0	17.7		

Qualifiers: ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 B - Analyte detected in the associated Method Blank

Hall Environmental Analysis Laboratory

Sample Receipt Checklist

Client Name SJR

Date and Time Received:

Work Order Number 0412237

Received by AMG

Checklist completed by [Signature] 12/28/07
Signatures Date

Matrix

Carrier name UPS

- Shipping container/cooler in good condition? Yes [checked] No [] Not Present []
Custody seals intact on shipping container/cooler? Yes [] No [] Not Present [checked] Not Shipped []
Custody seals intact on sample bottles? Yes [] No [] N/A [checked]
Chain of custody present? Yes [checked] No []
Chain of custody signed when relinquished and received? Yes [checked] No []
Chain of custody agrees with sample labels? Yes [checked] No []
Samples in proper container/bottle? Yes [checked] No []
Sample containers intact? Yes [checked] No []
Sufficient sample volume for indicated test? Yes [checked] No []
All samples received within holding time? Yes [checked] No []
Water - VOA vials have zero headspace? No VOA vials submitted [] Yes [checked] No []
Water - pH acceptable upon receipt? Yes [] No [] N/A [checked]

Container/Temp Blank temperature? 5° 4° C ± 2 Acceptable
If given sufficient time to cool.

COMMENTS:

Client contacted _____ Date contacted: _____ Person contacted _____

Contacted by: _____ Regarding _____

Comments: _____

Corrective Action _____

River Terrace Groundwater Analytical Results Summary
Giant Refinery - Bloomfield, NM

	MW-49 (River Side)		MW-48 (Pisat Side)		TP#1		TP#2		TP#3		TP#4		TP#5		TP#6		TP#7		TP#8			
	Collected 11/1/04	DF	Collected 12/27/04	DF	Collected 11/1/04	DF	Collected 12/27/04	DF	Collected 10/28/2004	DF	Collected 12/27/04	DF	Collected 10/28/2004	DF	Collected 12/27/04	DF	Collected 10/28/2004	DF	Collected 12/27/04	DF	Collected 10/28/2004	DF
Lead	<0.050 mg/L	(1)	NS	---	0.014 mg/L	(1)	NS	---														
Manganese	2.1 mg/L	(1)	NS	---	0.55 mg/L	(1)	NS	---														
Selenium	<0.05 mg/L	(1)	NS	---	<0.05 mg/L	(1)	NS	---														
Silver	<0.005 mg/L	(1)	NS	---	<0.005 mg/L	(1)	NS	---														
Uranium	<0.10 mg/L	(1)	NS	---	<0.10 mg/L	(1)	NS	---														
Zinc	0.0089 mg/L	(1)	NS	---	0.026 mg/L	(1)	NS	---														
EPA METHOD 6010: TOTAL RECOVERABLE METALS																						
Arsenic	<0.02 mg/L	(1)	NS	---	<0.02 mg/L	(1)	NS	---														
Barium	0.48 mg/L	(1)	NS	---	0.33 mg/L	(1)	NS	---														
Cadmium	<0.002 mg/L	(1)	NS	---	<0.002 mg/L	(1)	NS	---														
Calcium	160 mg/L	(1)	NS	---	130 mg/L	(1)	NS	---														
Chromium	<0.006 mg/L	(1)	NS	---	<0.006 mg/L	(1)	NS	---														
Iron	19 mg/L	(10)	NS	---	19 mg/L	(10)	NS	---														
Lead	0.014 mg/L	(1)	NS	---	0.023 mg/L	(1)	NS	---														
Magnesium	31 mg/L	(1)	NS	---	23 mg/L	(1)	NS	---														
Manganese	4.4 mg/L	(1)	NS	---	2.4 mg/L	(1)	NS	---														
Potassium	7.9 mg/L	(1)	NS	---	6.9 mg/L	(1)	NS	---														
Selenium	<0.05 mg/L	(1)	NS	---	<0.05 mg/L	(1)	NS	---														
Silver	<0.005 mg/L	(1)	NS	---	<0.005 mg/L	(1)	NS	---														
Sodium	330 mg/L	(10)	NS	---	400 mg/L	(10)	NS	---														
Uranium	<0.10 mg/L	(1)	NS	---	<0.10 mg/L	(1)	NS	---														
Zinc	0.061 mg/L	(1)	NS	---	0.056 mg/L	(1)	NS	---														
EPA METHOD 150.1: pH																						
pH	7.73 pH units	(1)	NS	---	7.88 pH units		NS	---														
EPA METHOD 160.1: TDS																						
Total Dissolved Solids	1400 mg/L	(1)	NS	---	1500 mg/L		NS	---														

NOTE:
(1) The below list includes analytes detected within at least one of the collected samples.

Letter to Ms. Hope Monzeglio
January 31, 2005

ATTACHMENT E

River Terrace Well Location Map (Revised)

Giant Bloomfield Refinery River Terrace Well Location Map



Notes: ■ = Proposed location of additional temporary wells.

Letter to Ms. Hope Monzeglio
January 31, 2005

ATTACHMENT F

Aquifer Test Results Summary Report

AQUIFER TEST RESULTS SUMMARY REPORT
San Juan River Terrace Site
Giant Refinery, Bloomfield, NM

GENERAL

This report describes the aquifer (pump) test that was performed in December 2004 on well MW-48 at the Giant Refinery Facility located in Bloomfield, New Mexico. The purpose of the pump test was to obtain aquifer hydraulic properties of the river terrace alluvial aquifer below the refinery. Monitoring well MW-48 was pump tested at a constant pumping rate of 4.7 gallons per minute for a period of over 17 hours. Water levels were monitored in the test well, well MW-49, and six piezometers throughout the test. A temporary staff gage was placed in the San Juan River located adjacent to well MW-49 and hourly stage river level readings were recorded. Once the pump test was terminated, water level recovery measurements were recorded in the test well and 2 piezometers for a period of approximately 5 hours. The locations of the wells and piezometers are shown on Figure 1.

The test well and piezometers are located on the San Juan River floodplain located at the Giant refinery. Well MW-48 was drilled and installed in October 28, 2004. The well consists of a 4-inch diameter, schedule 40 well casing and 0.020-inch slotted screen. The well extends to a depth of 15-feet and is gravel packed with Colorado Silica 8 -12 sand. The screen length is 10 feet and is positioned 5 to 15-feet below ground surface. The lithologic materials encountered during drilling and installation of the well ranged from fine sands to gravel and cobbles. Observation of nearby bluff exposures along the river suggests that bedrock is present at a depth of about 15 to 20 feet below ground surface at the terrace.

Well MW-48 is located approximately 65 feet east and 100 feet south of the San Juan River. An exposed bedrock (Nacimiento Formation) bluff face is located about 65 feet to the south. The barrier wall was installed in the early 1990s, and is located approximately 15 to 20 feet east of the San Juan River. The barrier wall is approximately 150 to 180 feet in length, beginning near the bedrock bluff to the south, running north and parallel to the San Juan River. Well MW-48 is located approximately 40 feet east of the barrier wall, 100 feet south from the San Juan River, and approximately 70 feet north of the bedrock bluff.

A pre-pump test "kick off" meeting was held prior to the pump test with Malcolm Pirnie (MPI), Giant, and Envirotech, Inc. personnel. Pump test procedures, personnel duties, individual assignments, equipment checks, and other requirements for the test were

finalized at that time. A geologist was assigned to manage the test and that person was responsible for the operation of the pumping test.

EQUIPMENT

Envirotech Inc. provided the pump, discharge equipment, generator, piping and related accessories to perform the test. Envirotech personnel operated the pump throughout the testing activities. A 4-inch, 3/4 horsepower pump capable of pumping 25 gallons per minute was installed in well MW-48. The discharge water was piped to and contained in a temporary 16,000 gallon tank provided by Giant. The tank was located approximately 25 feet from well MW-48. The outlet for the discharge pipe entered the tank from the top.

Refer to Table 1 for the list of equipment used during the pre-pumping and final pump tests. In addition to the equipment listed, a micro processor-based data acquisition system (In-Situ) was utilized to collect water level information during the pumping periods in piezometers TP-6 and TP-8. In all observation wells identified for monitoring, water levels were measured using battery-powered water level sensing devices.

TABLE 1 Equipment List	
◦ Pump test forms (Write-in-Rain™ paper)	◦ Log Paper – 3-cycle semi-log graph
◦ Ruler – Engineer Scale	◦ Flashlights (with extra batteries)
◦ Water Level Measuring Devices (with assigned number on each device)	◦ Metal Clipboard (with cover)
◦ Extra batteries with each device	◦ Stop Watches
◦ Calculator	◦ Base Map of pumping well & observation wells
◦ Pencils and Erasers	◦ Boring logs and Piezometer Construction Details
◦ Table and Chair	

MONITORING LOCATIONS

Water levels were monitored in the pumping well and seven observation wells (six piezometers and one monitoring well) throughout the pumping test. The piezometers included TP-1, TP-2, TP- 5, TP-6, TP-7, and TP-8. Monitoring well MW-49, located on the river side of the existing barrier wall, was also monitored. A temporary staff gage was placed in the river adjacent to well MW-49 and was monitored hourly throughout the test. The locations of all observation wells are shown on Figure 1.

Pre-pumping Test

One day prior to the pump test, a 10- to 30-minute pre-pumping test was run in the pumping well. The objectives of the pre-pumping test were as follows:

- Select a pumping rate for the optional final pumping test.
- Determine the expected drawdown in the test well at various pumping rates.
- Calibrate and verify the operational capacity of all equipment being used in pump test.

These trial runs were needed to make final adjustments to the pump test plan, which included making final decisions on equipment changes and measurement of water levels. The pre-pump test procedures were as follows:

- Coordinate installation of the test pump, power supply, discharge line, and flow meter with Envirotech.
- Install battery-powered electrical depth gages in all observation wells to measure groundwater levels during the test.
- Install In-Situ data acquisition system and transducers (mini trolls) in piezometers TP-6 and TP-8 to monitor groundwater levels during the test.
- Start the pre-test, measuring pump discharge during the test. At least three pumping rates were run to determine the optimum pumping rate for the long-term pump test.
- Collect water level readings at 5-minute levels to the nearest 0.01 foot. The depth to water was referenced from the top of the monitoring well casing.

CONSTANT-RATE PUMP TEST

A 17-hour Constant-Rate Pump Test was performed in well MW-48. The constant rate aquifer test began at 1:15 PM on December 9, 2004. All of the equipment, including pumping, discharge piping, water flow, and water depth measuring equipment, was assembled, proven operational, and inspected the day before initiation of the constant rate drawdown test.

Scheduling, Planning, and Coordination

A meeting of all pump test field personnel was held at the test well site one hour prior to commencing the pump test. The data acquisition and transducer systems were checked and proven operational. Personnel were given a final brief on their individual duties and responsibilities and a final equipment check was conducted at that time, including synchronization of stop watches.

Rest Period

Static non-pumping water level readings were recorded at least one hour prior to the start of pumping. The last readings were recorded immediately before starting the pump.

Data Collection

The pumping test was started at 1:15 PM on December 9, 2004. Any adjustments of the pumping rate required to maintain a nearly constant pumping rate throughout the test were noted on the field forms. The exact time of each recorded measurement was documented on the pumping well and observation well forms. As discussed above, the depth-to-water level measurements were referenced from the top of the monitoring well or top of the steel casing. Measurements were made to the nearest 0.01 foot. MPI, Giant, and Envirotech personnel assisted in recording water level measurement readings. In addition, river stage readings were recorded on an hourly basis.

Pumping Rate

The well was pumped at a constant pumping rate of 4.7 gpm determined from the pre-test pumping. The pumping rate remained constant for the duration of the pumping test. The pumping rate was measured by using both a totalizing flow meter and using the "bucket test".

Recovery Period

After completion of the pump test, we recorded the exact time of pump shutdown, and the rate of recovery of the water levels in wells being monitored and recorded these levels for a 5-hour period.

FIELD REDUCTION OF DATA

During the pump test, the field data was compiled and reduced to estimate drawdown and calculated recovery in the pumping well. Drawdown and recovery measurements for the pumping well and piezometers are presented in Appendix A.

The distances from test well MW-48 to well MW-49 and all the piezometers were measured in the field using a 100-foot tape measure. Table 2 shows a summary of the distances from MW-48 to each respective well or piezometer.

TABLE 2
Summary of Well / Piezometer Distances from MW-48

Well / Piezometer ID	Distance from MW-48 (ft)	Location
MW-49	53	Outside Barrier Wall
TP-1	66	Inside Barrier Wall
TP-2	52	Adjacent to Bluff
TP-5	99	East of Well MW-48
TP-6	44	East of Well MW-48
TP-7	96	North End of Barrier Wall
TP-8	42	Inside Barrier Wall

AQUIFER TEST RESULTS

Drawdown was measured in pumping well MW-48 and piezometers TP-1, TP-2, TP-5, TP-6, TP-7, and TP-8 (Appendix A). The pumping test ran for approximately 1,050 minutes until the generator failed. Recovery measurements began shortly thereafter.

The following is a summary of the results observed after 1,000 minutes of pumping:

- The drawdown observed in MW-48 showed a water level decline of approximately 2.5 feet.
- The maximum drawdown observed in all piezometers was 0.45 feet measured in TP-8.
- A minimum drawdown observed in the piezometers was 0.10 feet in TP-6.
- The staff gage showed no significant change in river stage height (>0.10 foot of decline) during the test.
- No drawdown was observed in well MW-49, except for a slight decline measured near the end of the test. The water level declined <0.05 feet. The water level fully recovered prior to terminating the pumping test, suggesting the decline was caused by a variation in river stage height.

Recovery water levels were taken in well MW-48 and piezometers TP-6 and TP-8 for approximately 5 hours after the pump test was terminated. The water level in the test well MW-48 recovered 2.24 feet, or 88% of recovery to static level after 5 hours. Water levels in TP-6, located east of pumping well MW-48, did not recover during that period. Water levels in piezometer in TP-8 recovered 0.16 feet, or 36 % of recovery from static water level.

AQUIFER TEST INTERPRETATION

Data from the aquifer test was utilized from both the pumping and recovery phases. The aquifer test data was used to estimate hydraulic conductivity of the aquifer. The drawdown data was plotted on a semi-log cycle graph and analyzed over a single time log cycle. The transmissivity was determined from the Cooper and Jacob (1946) equation, $T = 264 Q / \Delta s$, and the hydraulic conductivity was calculated using a 10-foot aquifer thickness.

Analysis of the drawdown data revealed two distinct types of curves. These curves indicate the presence of distinct hydraulic boundaries in the vicinity of each well. At TP-8, the slope of the drawdown curve increases sharply as the test progresses, while TP-6 remains relatively flat. The response at TP-8 is characteristic of an impermeable boundary (i.e. barrier wall and/or bedrock face). The results from TP-6 are more characteristic of a recharging boundary (i.e. San Juan River).

For piezometers TP-1 and TP-2, the slopes of the drawdown curves "steepen" or increase throughout the test. These piezometers are located adjacent to either the barrier wall or to the bedrock face. The increased drawdown observed is typically encountered when the cone of depression reaches an impermeable boundary, causing the rate of drawdown to increase in that direction.

The drawdown curves for piezometer TP-5 and well MW-49, like TP-6, indicate an opposite effect. The drawdown response is relatively flat, which reflects recharge effects from the San Juan River. Piezometers TP-5 and TP-6 are located upgradient of the pumping well, between well MW-48 and the river. Very little drawdown was observed at these two locations and at MW-49 until the later portion of the aquifer test. The observed drawdown in MW-49 was likely due to a slight change in river stage near the end of the pumping test.

Distribution of Drawdown

The semi-log drawdown curves for piezometers located near the barrier wall and the bluff face (TP-1,-2 and -8) show continuous drawdown when pumping at 4.7 gpm. As the cone of depression from the pumping well spreads laterally and intercepts the barrier wall and bedrock face, drawdown increases in these areas due to their impermeable characteristics (lack of available water for the well to draw in). In contrast, the water levels east or upgradient of well MW-48 only slightly declined during the test.

Impermeable Boundary Effects

The semi-log drawdown curves for the three piezometers by the barrier wall and the bluff face show nearly 0.5 feet of drawdown after 17 hours of pumping. The drawdown data

suggests the barrier wall and bluff face (impermeable boundary) have a large affect on water level declines in TP-1, TP-2, TP-6 and TP-7. After several hundred minutes of pumping, the drawdown curves show an increasing rate of drawdown. The drawdown curves, if extrapolated out to several days and weeks, suggest drawdown would likely accelerate due to the effects of the impermeable boundaries.

River Recharge Effects

The semi-log drawdown curves for the two piezometers (TP-5 and TP-6) and well MW-49 show little to effect from pumping well MW-48. A slight drawdown was observed after several hours of pumping in all three observation points. However, when recovery levels measured in TP-6 were reviewed, no recovery was evident as the water level had stabilized for 5 hours, suggesting the San Juan River stage had decreased about 0.10 foot. This drop likely caused aquifer levels to drop in response to the change. It appears that the area east of pumping well MW-48 is affected by recharge from the river.

Parameter Estimation Results

Transmissivity (T) and hydraulic conductivity (K) were calculated for well MW-48 and piezometers TP-1, TP-2, and TP-8 using the Jacob method (semi-log straight line method). Drawdown and recovery curves were analyzed. Each curve yielded a different hydraulic conductivity. An aquifer thickness of 10 feet (bedrock is shallow below the alluvial aquifer) was assumed. T and K values calculated for each well or piezometer decreased significantly from early time to late time analyses. Average T and K values were calculated as follows:

- Early Time : $T=1,200 \text{ ft}^2/\text{day}$; $K= 120 \text{ ft/d}$
Boundary effects are absent in the early time response.
- Mid-Late Time: $T =500 \text{ ft}^2/\text{day}$; $K=50 \text{ ft/d}$
Boundary effects are significant during late time response.

CAPTURE ZONE ANALYSIS

The hydraulic conductivities determined from the pump test analysis were used to estimate the capture zone for a pumping well located on the river terrace. A groundwater spreadsheet (D.K. Todd. Groundwater Hydrology. *John Wiley and Sons, Inc., New York, 1990, 2nd Edition.*) was used to calculate and model the area of capture. The formulas in the spreadsheet assume an aquifer of uniform thickness that is homogeneous, isotropic and infinite in aerial extent.

The hydraulic conductivity input was evaluated based on the proximity of the pumping well to a hydraulic boundary. As the boundary conditions were observed to drive the

hydraulic response of the aquifer during the pump test, similarly the capture zone of a pumping well will be affected by the boundaries.

In addition to the hydraulic conductivity, a pumping rate, aquifer thickness and hydraulic gradient were input parameters for the capture model. A sensitivity analysis of each parameter revealed various capture zone shapes and sizes. The hydraulic gradient was determined from a topographic map of the San Juan river basin, and ranged from 0.0005 foot per foot (ft/ft) to 0.001 ft/ft. The aquifer thickness was varied between 10 feet and 15 feet, and the pumping rate was varied between 1 gpm and 5 gpm. In this range of inputs, the area of capture for a pumping well located on the river terrace extended as far as 500 feet downgradient, 1600 feet upgradient and 3000 feet wide.

After running multiple iterations of the capture zone model, Malcolm Pirnie determined that an adequate capture zone can be obtained at a pumping rate of 2 to 5 gpm.

FIGURE 1

River Terrace Well Location Map

Giant Bloomfield Refinery
River Terrace Well Location Map

Figure 1

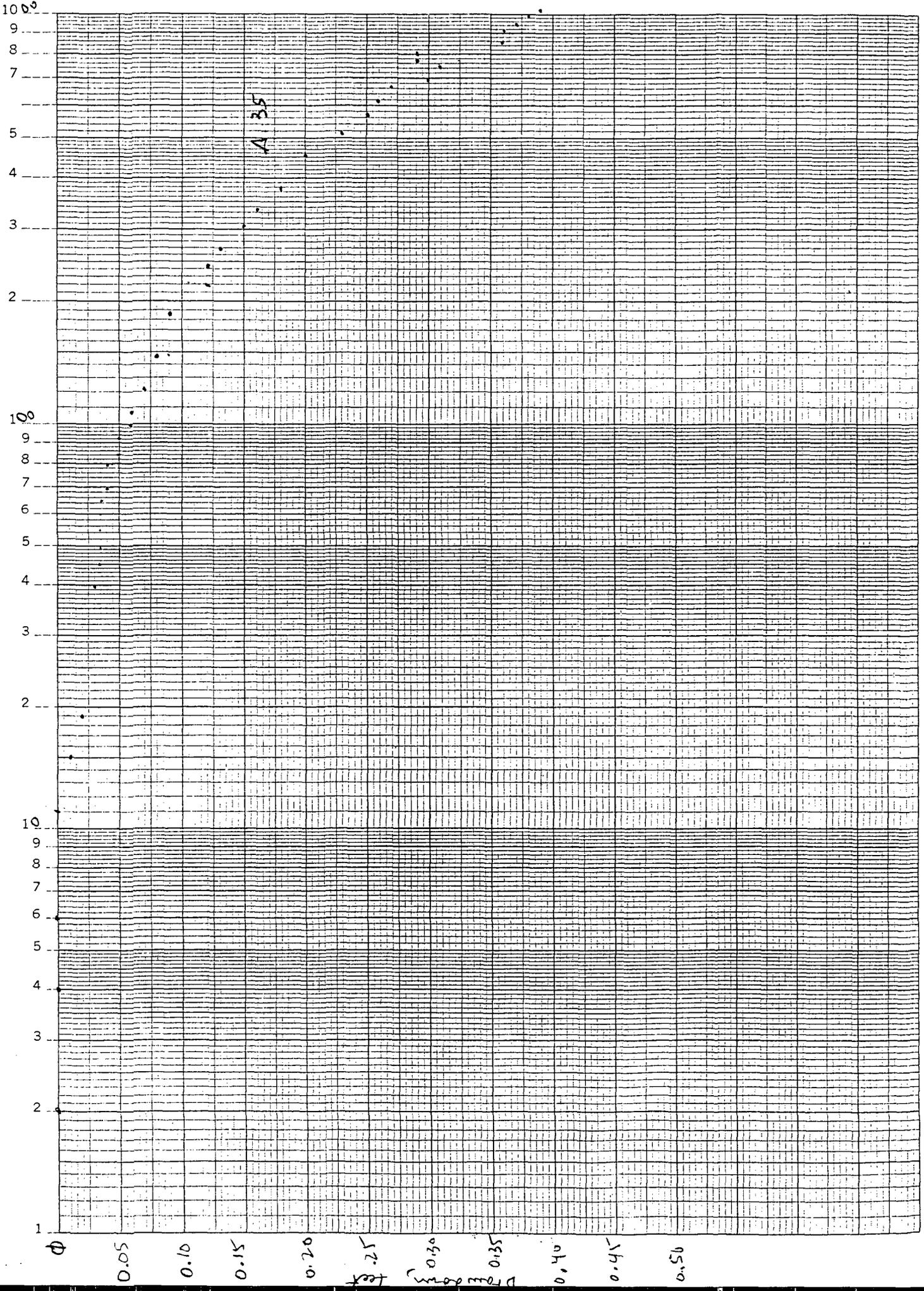


APPENDIX A

Drawdown and Recovery Graphs

TP-1 GRAPH 46 5813

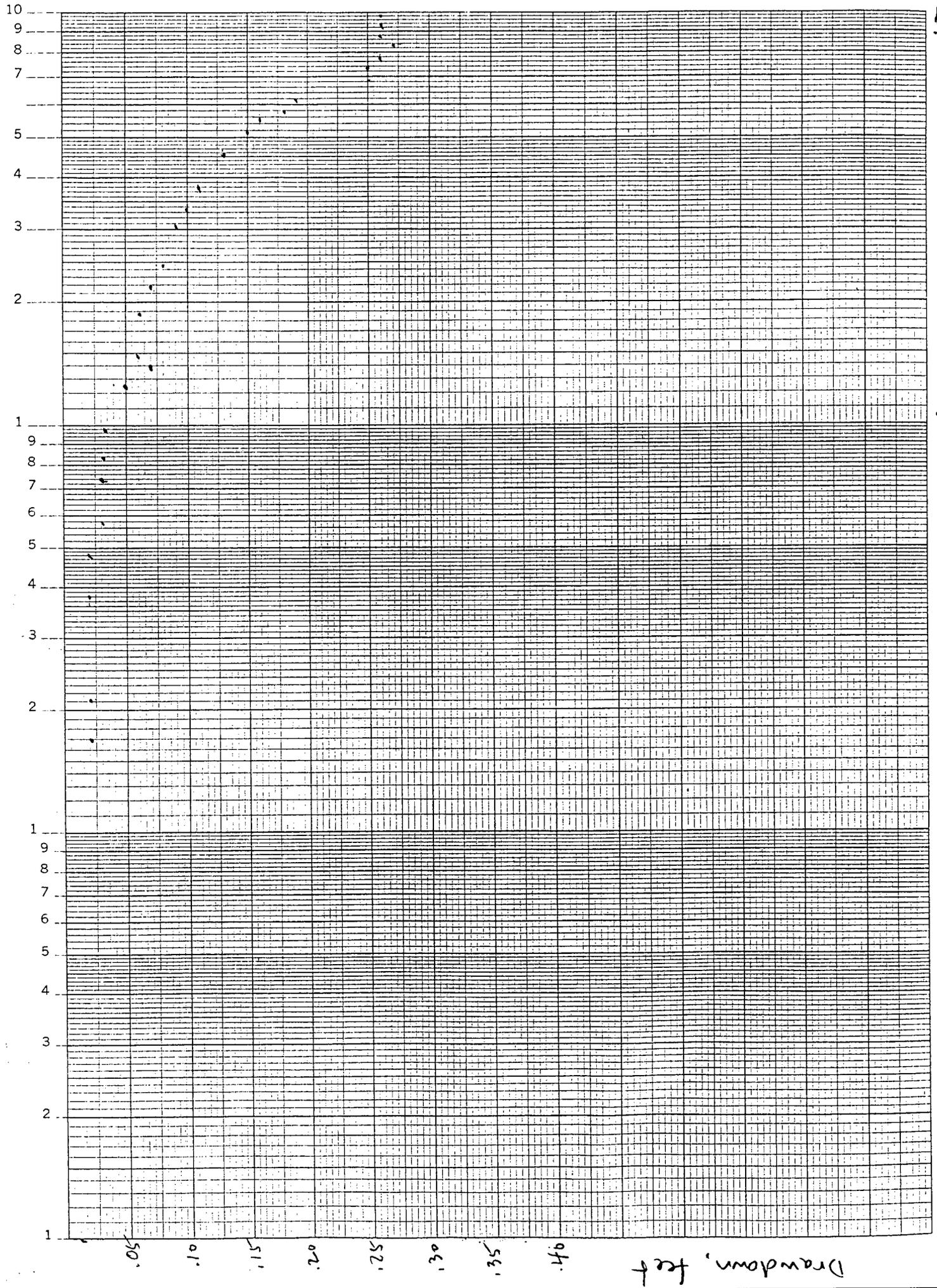
66 to 1000



Time minutes

TP-2 GRAPH 52' to MW-48

SEMI-LOGARITHMIC 3 CYCLES x 140 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.



1000

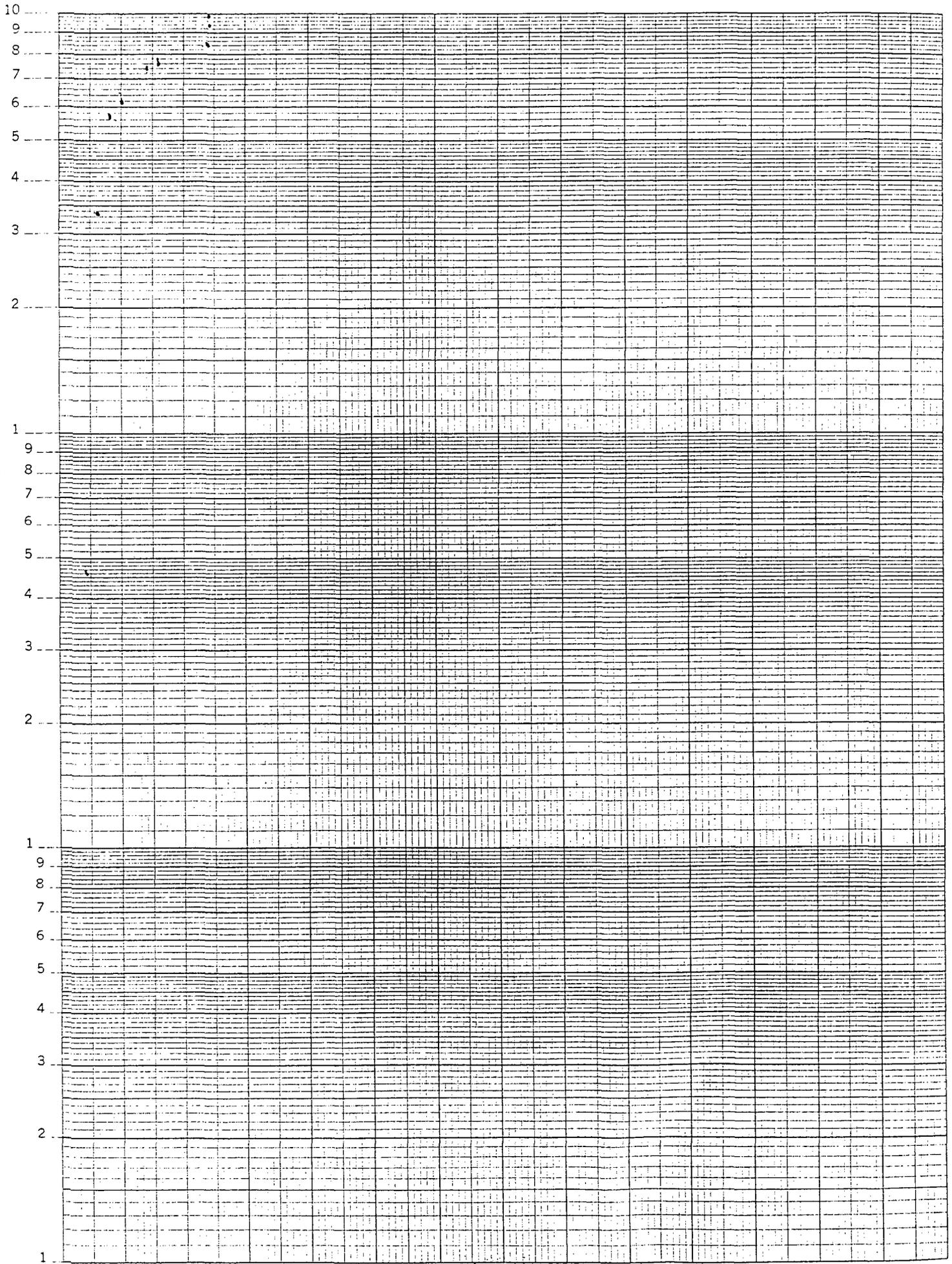
100

10

1

TP-5 GRAPH 46 5813

K&E SEMI-LOGARITHMIC 3 CYCLES x 140 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.



100

01

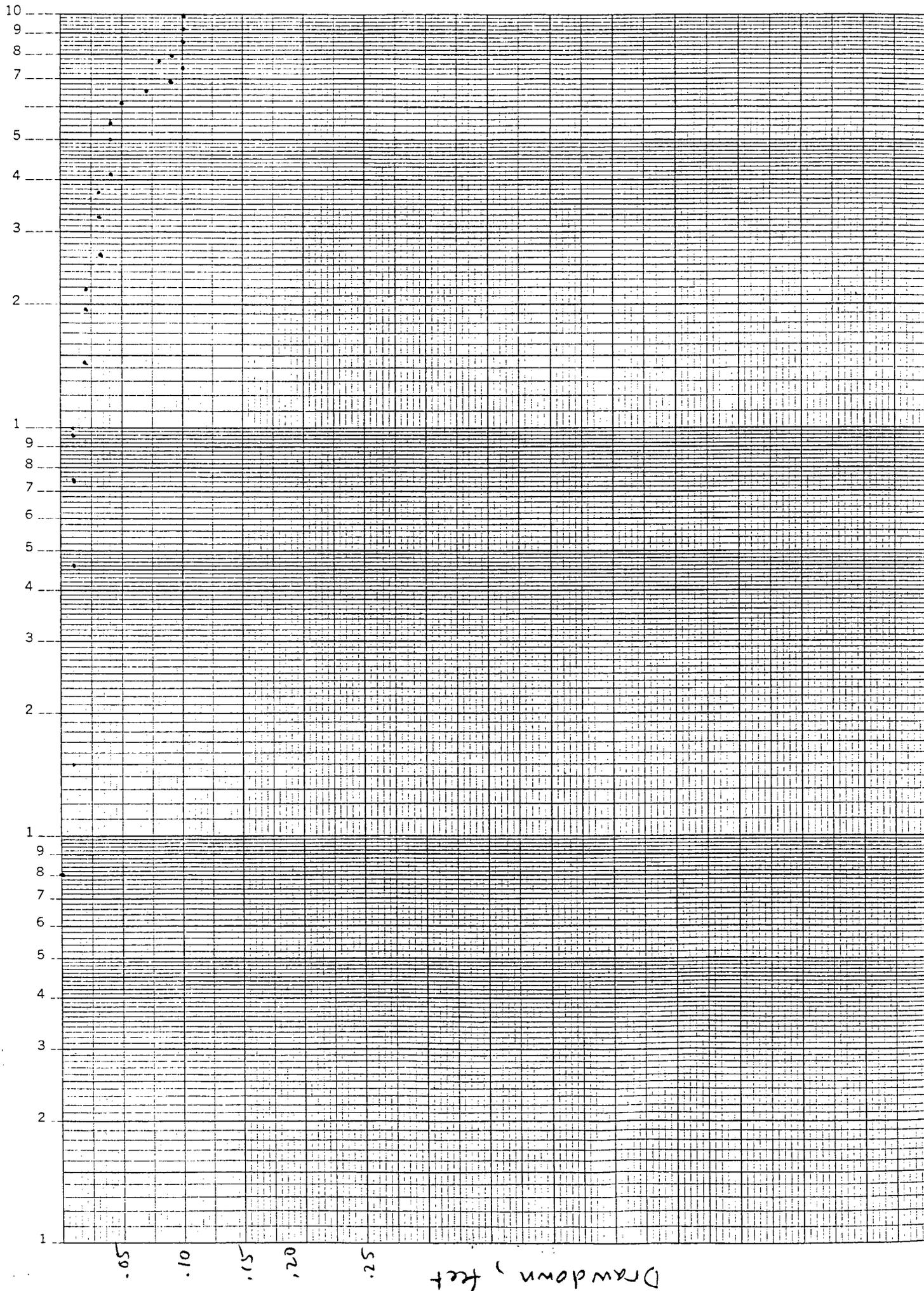
.05

.10

44 10 MIN - 70

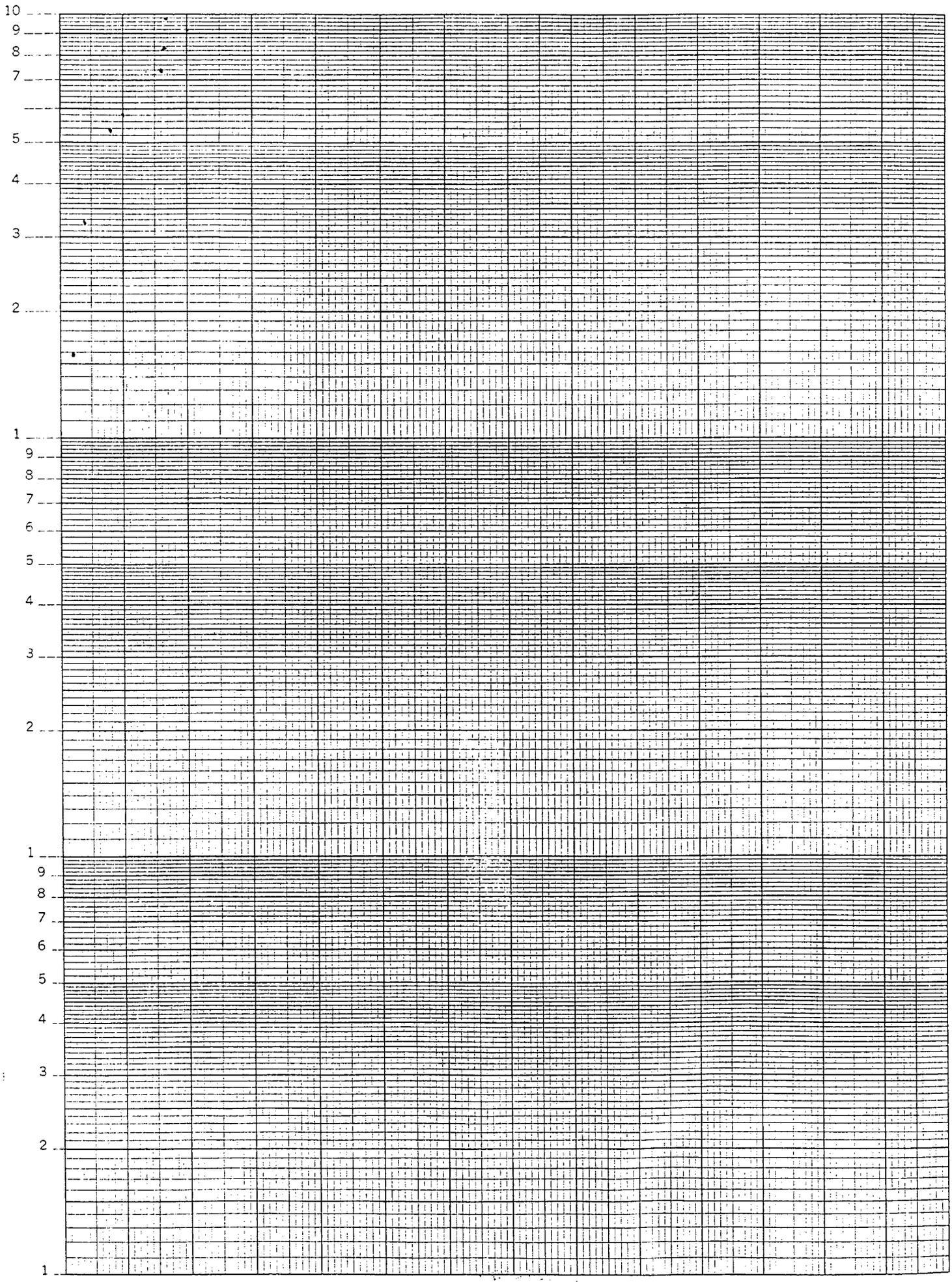
TP-6 GRAPH 46 5813

K&E SEMI-LOGARITHMIC 3 CYCLES x 140 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.



17- + GRAPH 46 5813

KE SEMI-LOGARITHMIC 3 CYCLES x 140 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.



Drainage, in feet

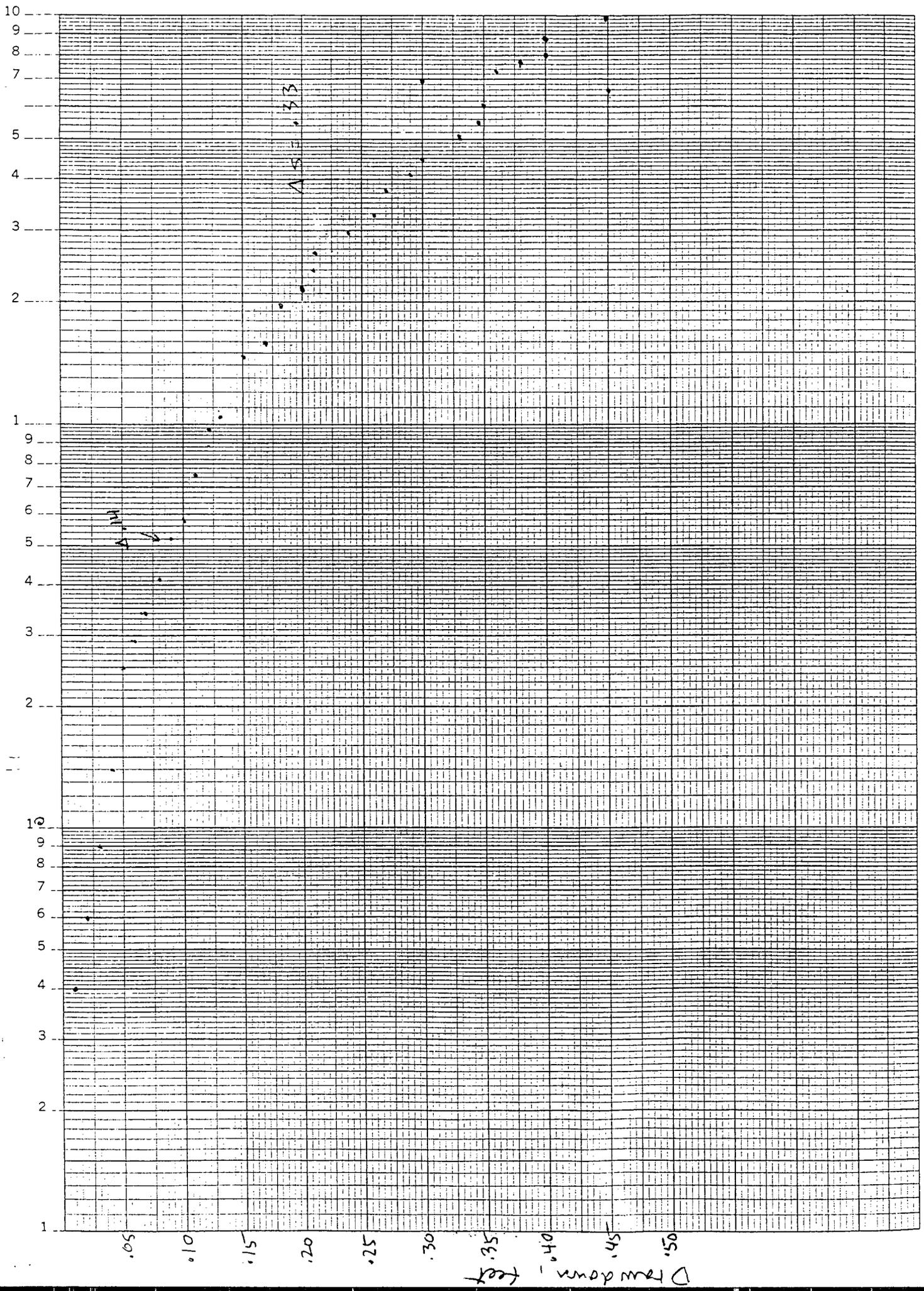
50
10
15

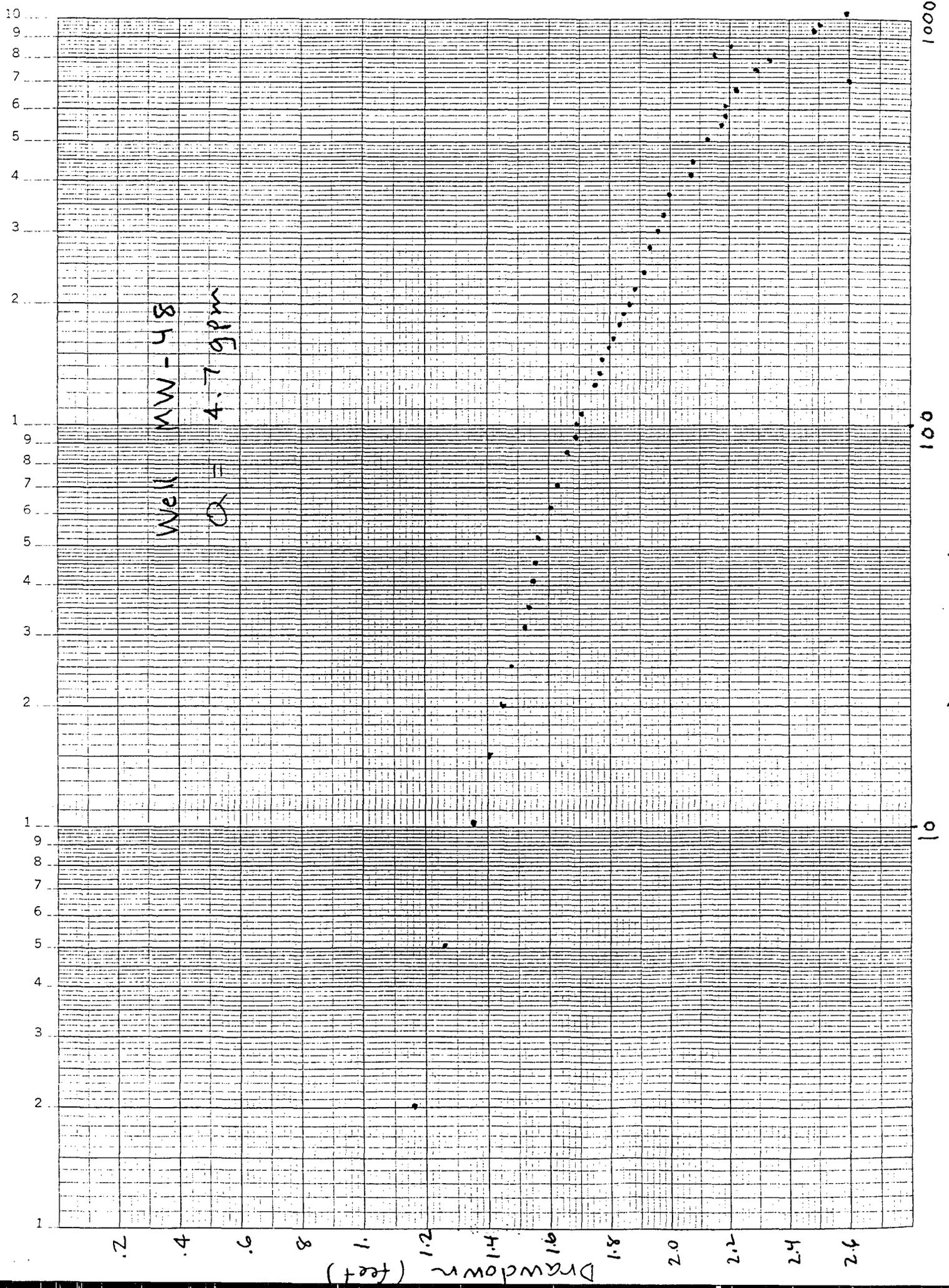
100

100

10

Time, in minutes





1000

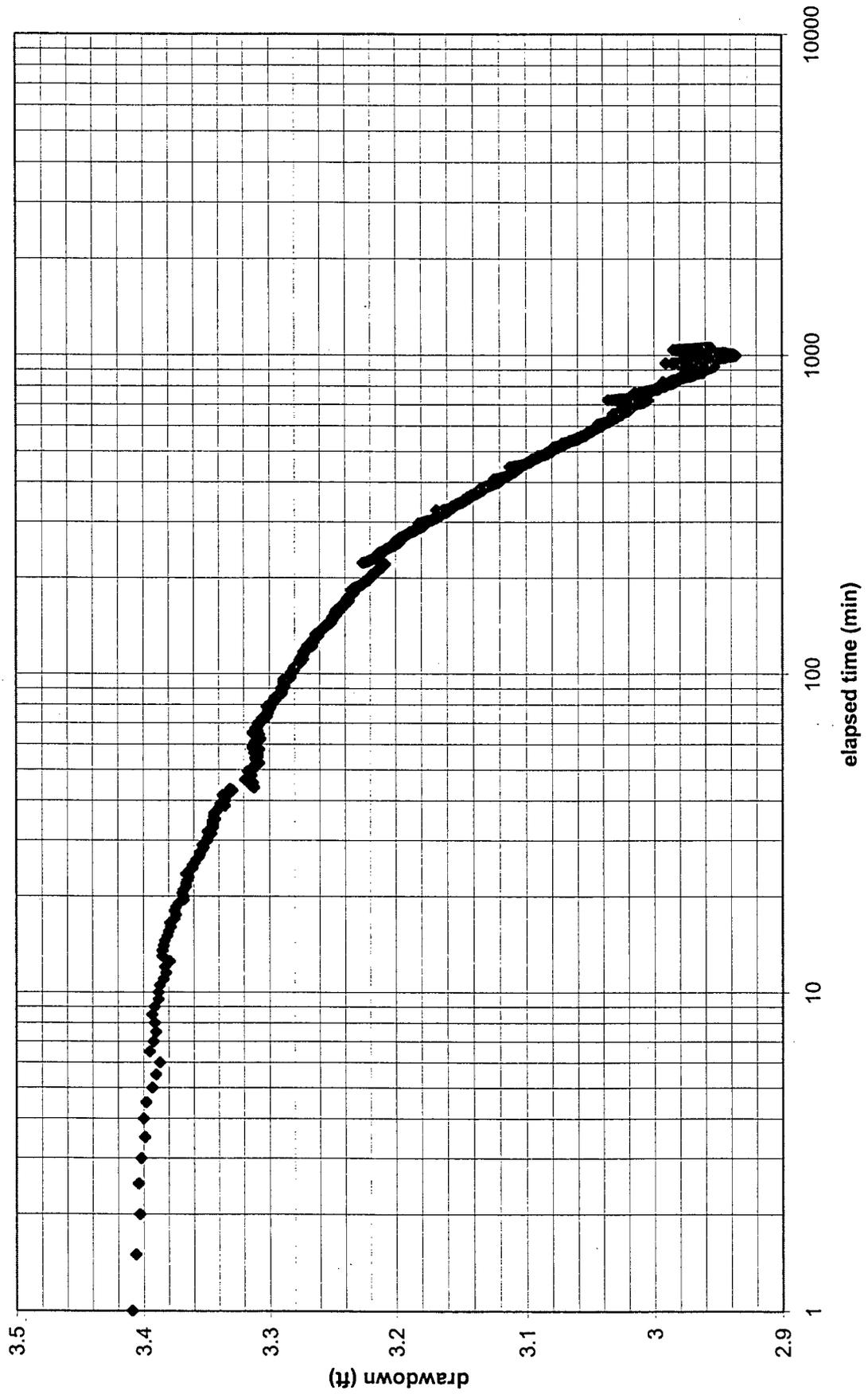
100

10

Time (min)

Drawdown (feet)

TP-8 Pump Test



TP-8 Recovery Test

