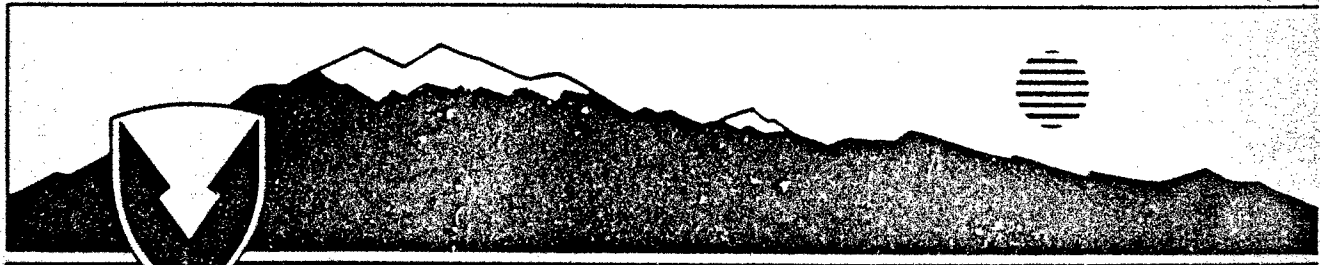


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Offpost Operable Unit  
Remedial Investigation and Chemical  
Specific Applicable or Relevant and  
Appropriate Requirements  
Final Report  
(Version 3.1)  
Volume II

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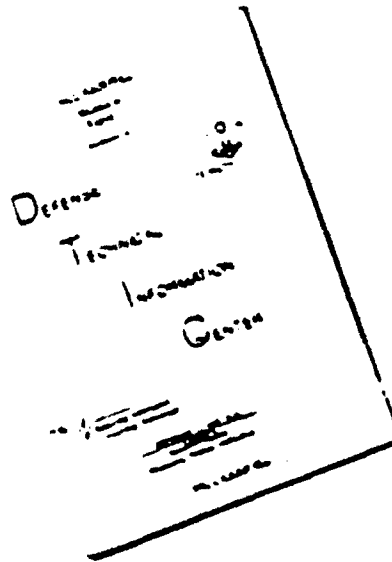
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LITIGATION TECHNICAL SUPPORT AND SERVICES

Rocky Mountain Arsenal

Offpost Operable Unit  
Remedial Investigation and Chemical  
Specific Applicable or Relevant and  
Appropriate Requirements

Final Report  
(Version 3.1)  
Volume II

December 1988

Contract Number DAAK11-84-D-0016  
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Prepared by

ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.  
HARDING LAWSON AND ASSOCIATES

Prepared for


U.S. ARMY PROGRAM MANAGER'S OFFICE FOR  
ROCKY MOUNTAIN ARSENAL

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## TABLE OF CONTENTS

Section	Page
<u>VOLUME I</u>	
EXECUTIVE SUMMARY	
1.0 INTRODUCTION	1-1
1.1 <u>CONDITIONS IN THE OFFPOST OPERABLE UNIT</u>	1-5
1.2 <u>ONGOING RESPONSE ACTIONS</u>	1-7
1.2.1 NORTH BOUNDARY: CONTAINMENT/TREATMENT	1-7
1.2.2 NORTHWEST BOUNDARY: CONTAINMENT/TREATMENT	1-8
1.2.3 IRONDALE: CONTAINMENT/TREATMENT	1-8
1.3 <u>SUMMARY OF TECHNICAL APPROACH</u>	1-9
2.0 DATA COLLECTION AND ANALYSES	2-1
2.1 <u>GROUND-WATER MONITORING PROGRAM</u>	2-2
2.1.1 <u>MONITORING NETWORK AND RATIONALE</u>	2-3
2.1.1.1 <u>Alluvial Aquifer Monitoring Network</u>	2-5
2.1.1.2 <u>Denver Fm Monitoring Network</u>	2-11
2.1.2 <u>GROUND-WATER MONITORING</u>	2-15
2.1.2.1 <u>Water Level Monitoring</u>	2-15
2.1.2.2 <u>Water Quality Monitoring</u>	2-19
2.1.3 <u>ANALYTICAL PROGRAM</u>	2-19
2.1.4 <u>AQUIFER TESTS</u>	2-23
2.1.4.1 <u>Pumping Tests</u>	2-23
2.1.4.2 <u>Slug Tests</u>	2-25
2.2 <u>SURFACE WATER MONITORING</u>	2-26
2.2.1 <u>ACCURACY OF RESULTS</u>	2-31
2.3 <u>SEDIMENT SAMPLING AND ANALYSIS</u>	2-32
2.3.1 <u>SITE LOCATIONS</u>	2-32
2.3.2 <u>FIELD SAMPLING METHODOLOGY</u>	2-34
2.3.3 <u>ANALYTICAL METHODS</u>	2-35
2.4 <u>AIR MONITORING</u>	2-35
2.4.1 <u>OFFPOST AIR MONITORING</u>	2-36
2.4.2 <u>ONPOST AIR MONITORING</u>	2-36
2.5 <u>BIOGA</u>	2-39
2.5.1 <u>METHODS OF INVESTIGATION</u>	2-41
3.0 <u>GROUND-WATER CONDITIONS</u>	3-1
3.1 <u>GEOLOGY</u>	3-1
3.1.1 <u>CHARACTERIZATION OF ALLUVIUM</u>	3-1
3.1.1.1 <u>Characterization of the Alluvium in the Offpost Operable Unit</u>	3-2
3.1.2 <u>BEDROCK SURFACE</u>	3-8
3.1.3 <u>CHARACTERIZATION OF THE DENVER FM</u>	3-13
3.1.3.1 <u>Depositional Environment</u>	3-13
3.1.3.2 <u>Stratigraphic Correlation within the Denver Fm</u>	3-16
3.1.3.3 <u>Characterization and Definition of the Denver Fm</u>	3-17

TABLE OF CONTENTS

Section	Page
3.1.4 CHARACTERIZATION OF ARAPAHOE FM	3-31
3.2 HYDROGEOLOGY	3-32
3.2.1 ALLUVIAL AQUIFER	3-33
3.2.1.1 Water Table	3-34
3.2.1.2 Saturated Alluvial Thickness	3-43
3.2.1.3 Aquifer Parameters	3-45
3.2.1.4 Ground-Water Flow Directions and Qualities	3-50
3.2.1.5 Stresses to the Alluvial Aquifer System	3-53
3.2.2 DENVER FM	3-56
3.2.2.1 Aquifer Recharge	3-58
3.2.2.2 Denver Fm Zones	3-58
3.2.2.3 Potentiometric Surface	3-59
3.2.2.4 Hydraulic Conductivity and Transmissivity	3-64
3.2.2.5 Discharge	3-69
3.2.2.6 Aquifer Interactions	3-69
3.2.3 ARAPAHOE FM	3-72
3.3 GROUND-WATER CONTAMINATION	3-74
3.3.1 NATURE AND EXTENT OF ALLUVIAL AQUIFER CONTAMINATION	3-75
3.3.1.1 Data Presentation	3-79
3.3.1.2 DIMP	3-87
3.3.1.3 DBCP	3-88
3.3.1.4 DCPD	3-89
3.3.1.5 Organosulfur Compounds	3-89
3.3.1.6 1,4-Oxathiane and 1,4-Dithiane	3-91
3.3.1.7 Organochlorine Pesticides	3-91
3.3.1.8 Volatile Organohalogens	3-93
3.3.1.9 Volatile Aromatics	3-97
3.3.1.10 Inorganics	3-97
3.3.2 NATURE AND EXTENT OF DENVER AQUIFER CONTAMINATION	3-104
3.3.2.1 Data Presentation	3-105
3.3.2.2 Contamination in Units Identified at NBGS	3-111
3.3.2.3 Contamination Units Not Correlated to NBGS	3-120
3.3.3 QA/QC DATA	3-124
3.3.3.1 DIMP, DBCP, DCPD	3-125
3.3.3.2 1,4-Oxathiane, 1,4-Dithiane, CPMS, CPMSQ, CPMSQ2	3-134
3.3.3.3 Organochlorine Pesticides	3-134
3.3.3.4 Volatile Organohalogens	3-134
3.3.3.5 Volatile Aromatics	3-135
3.3.3.6 Inorganics	3-135
3.3.3.7 Additional Inorganics	3-135
3.3.4 GAS CHROMATOGRAPHY/MASS SPECTROMETRY RESULTS	3-135
3.3.4.1 Well Selection	3-136
3.3.4.2 GC/MS Analytical Methods	3-139
3.3.4.3 Quality Assurance/Quality Control	3-139
3.3.4.4 Confirmation of Target Analytes and Concentrations	3-142
3.3.4.5 Nontarget Compound Analytical Results	3-143
3.3.4.6 Nontarget Compound Occurrence	3-145
3.3.4.7 Conclusions	3-148
3.3.4.8 Recommendations	3-149

## TABLE OF CONTENTS

Section	Page
3.4 <u>EVALUATION OF GROUND-WATER DATA</u>	3-150
3.4.1 ALLUVIAL CONTAMINATION NORTH OF RMA NORTH BOUNDARY	3-151
3.4.1.1 <u>Effects of the NBCS</u>	3-159
3.4.1.2 <u>Effects of Surface Water Recharge</u>	3-180
3.4.2 DENVER CONTAMINATION NORTH OF RMA NORTH BOUNDARY	3-182
3.4.3 ALLUVIAL CONTAMINATION DOWNGRADIENT OF RMA NORTHWEST BOUNDARY	3-190
3.5 <u>CONTAMINANT TRANSPORT MODELING</u>	3-191
3.5.1 COMPUTER PROGRAM	3-192
3.5.2 MODEL INPUT DATA	3-192
3.5.2.1 <u>Boundary Conditions</u>	3-193
3.5.2.2 <u>Irrigation Recharge, Canal Leakage and Other Recharge/Discharge</u>	3-193
3.5.2.3 <u>Aquifer Thickness</u>	3-194
3.5.2.4 <u>Porosity and Storage Coefficient</u>	3-194
3.5.2.5 <u>Transmissivity</u>	3-195
3.5.2.6 <u>Dispersivity</u>	3-195
3.5.2.7 <u>Chemical Character</u>	3-195
3.5.2.8 <u>Mass Balance</u>	3-196
3.5.3 MODEL CALIBRATION	3-196
3.5.4 MODEL SIMULATIONS	3-197
3.5.4.1 <u>DIME</u>	3-198
3.5.4.2 <u>Dieldrin</u>	3-199
3.5.4.3 <u>Chloroform and DCPD</u>	3-199
3.5.5 CONCLUSIONS	3-200
4.0 SURFACE WATER CONDITIONS	4-1
4.1 <u>DESCRIPTION OF SURFACE DRAINAGES</u>	4-1
4.2 <u>NATURE AND EXTENT OF CONTAMINATION</u>	4-4
4.2.1 ORGANICS	4-4
4.2.2 INORGANICS	4-11
4.3 <u>CONTAMINANT PATHWAYS TO OFFPOST SURFACE WATER</u>	4-13
4.3.1 FIRST CREEK	4-13
4.3.1.1 <u>First Creek Flows From Onpost</u>	4-14
4.3.1.2 <u>Ground Water Discharge to First Creek Offpost</u>	4-18
4.3.2 O'BRIAN CANAL AND BURLINGTON DITCH	4-28
4.3.3 OVERLAND FLOODING	4-31
4.4 CONCLUSION	4-32
5.0 OFFPOST SEDIMENT CONDITIONS	5-1
5.1 <u>NATURE AND EXTENT OF CONTAMINATION</u>	5-2
5.1.1 ANALYTICAL SCHEDULE	5-2
5.1.2 RESULTS OF PREVIOUS SEDIMENT STUDY	5-4
5.1.3 RESULTS OF PRESENT SEDIMENT STUDY	5-10
5.2 <u>SEDIMENT CONTAMINATION PATHWAYS</u>	5-12
5.3 CONCLUSIONS	5-13

TABLE OF CONTENTS

Section	Page
6.0 AIR QUALITY CONDITIONS	6-1
6.1 CRITERIA AIRBORNE POLLUTANTS	6-1
6.2 TOXIC AIRBORNE POLLUTANTS	6-3
6.3 CONCLUSIONS	6-10
7.0 BIOTA CONDITIONS	7-1
7.1 RESULTS OF HOME RANGE STUDIES	7-1
7.1.1 RING-NECKED PHEASANTS	7-1
7.1.2 DESERT COTTON TAIL RABBITS	7-5
7.2 DISCUSSION OF HOME RANGE STUDY	7-5
7.3 EVALUATION OF BIOTA CONTAMINANT PATHWAYS	7-12
8.0 POTENTIAL CHEMICAL-SPECIFIC ARARS	8-1
9.0 CONCLUSIONS	9-1
9.1 GROUND WATER	9-1
9.2 SURFACE WATER AND SEDIMENTS	9-4
9.3 AIR	9-6
9.4 BIOTA	9-6
10.0 REFERENCES	10-1
11.0 ACRONYMS AND ABBREVIATIONS	11-1
VOLUME II	
APPENDICES	
APPENDIX A -- WELL DESIGNATION CRITERIA	
APPENDIX B -- WELL COMPLETION SUMMARIES, LITHOLOGIC LOGS, AND GEOPHYSICAL LOGS	
APPENDIX C -- WELL LOCATIONS, COMPLETION DATA AND SITE CONDITIONS, AND SITING RATIONAL	
C.1 ALLUVIAL WELLS	
C.2 DENVER WELLS	
APPENDIX D -- SLUG TESTS: COOPER TYPE CURVES AND DATA CURVES, AND AQUIFER TEST ANALYSES	
D.1 SLUG TESTS: COOPER TYPE CURVES AND DATA CURVES	
D.2 WELL 37367 AQUIFER TEST ANALYSES	

TABLE OF CONTENTS

Section	Page
<u>VOLUME III</u>	
APPENDIX E -- GEOLOGIC AND HYDROLOGIC PRODUCTS	
APPENDIX F -- CONTAMINANT DISTRIBUTION MAPS, CONTAMINANT POINT PLOTS, AND WATER QUALITY DATA	
F.1 CONTAMINANT DISTRIBUTION AND POINT PLOT MAPS	
F.2 WATER QUALITY DATA	
F.3 GC/MS ANALYTICAL RESULTS	
APPENDIX G -- CONTAMINANT TRANSPORT MODEL RESULTS	
APPENDIX H -- POTENTIAL CHEMICAL-SPECIFIC ARARS FOR OFFPOST OPERABLE UNIT ROCKY MOUNTAIN ARSENAL	
APPENDIX I -- CONTAMINANT DISTRIBUTION PLOTS FROM OFFPOST CONTAMINATION ASSESSMENT REPORT	
APPENDIX J -- COMMENTS AND RESPONSES TO THE OFFPOST OPERABLE UNIT REMEDIAL INVESTIGATION AND CHEMICAL SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, DRAFT FINAL REPORT (VERSION 2.1), AUGUST 1988	

LIST OF FIGURES

Figure		Page
1.0-1	Location Map of Rocky Mountain Arsenal	1-2
1.0-2	Offpost Operable Unit	1-3
2.1-1	Location Map of Alluvial Wells in the Offpost Operable Unit	2-6
2.1-2	New Alluvial Sites	2-7
2.1-3	Generalized Alluvial Aquifer Monitor Well Construction	2-8
2.1-4	Location Map of Denver Wells in the Offpost Operable Unit	2-12
2.1-5	New Denver Sites	2-13
2.1-6	Generalized Bedrock Aquifer Monitor Well Construction (First Sandstone)	2-16
2.1-7	Generalized Bedrock Aquifer Monitor Well Construction (Second Sandstone)	2-17
2.1-8	Idealized Diagram of Slug-in Aquifer	2-27
2.2-1	Locations for Surface Water Sampling in the Offpost Operable Unit	2-29
2.2-2	Offpost Operable Unit Surface Water Gaging Station Locations	2-30
2.3-1	Locations for Sediment Sampling in Offpost Operable Unit	2-33
3.1-1	Geologic Map of Rocky Mountain Arsenal Area	3-3
3.1-2	Quaternary Columnar Section	3-4
3.1-3	Unified Soil Classification (ASTM D-2487)	3-5
3.1-4	Generalized East-West Alluvial Cross-Section from the South Platte River to the Northeast Corner of Rocky Mountain Arsenal	3-6
3.1-5	East-West Geologic Cross-Section NB Downgradient 30.6	3-9
3.1-6	Southwest-Northeast Geologic Cross-Section NWB Downgradient 3.5	3-10
3.1-7	Bedrock Surface Elevation Map in the Offpost Operable Unit Near the Rocky Mountain Arsenal Boundaries	3-12
3.1-8	Schematic Diagrams Depicting Denver Fm Depositional Environments	3-15

## LIST OF FIGURES

Figure		Page
3.1-9	Location of Geologic Cross Sections in the Vicinity of the Offpost Operable Unit	3-18
3.1-10	Southwest-Northeast Geologic Cross Section NWB Upgradient 7.8	3-20
3.1-11	Southeast-Northwest Geologic Cross Section NWB 0.0	3-21
3.1-12	Subcrop Map of Denver Fm Zones	3-23
3.1-13	East-West Geologic Cross Section NB Slurry Wall	3-26
3.1-14	North-South Geologic Cross Section NB 0.0	3-27
3.1-15	Subcrop Map of Denver Fm Sandstone Units in the Offpost Area Downgradient of the NBCS	3-30
3.2-1	Water Table Elevation Map in the Offpost Operable Unit Near the RMA Boundaries (Spring, 1987)	3-35
3.2-2	Historical Hydrograph for Well 37309	3-38
3.2-3	Historical Hydrograph for Well 37335	3-39
3.2-4	Seasonal Hydrograph for Wells 37308 and 37309	3-41
3.2-5	1986 Seasonal Hydrograph for Well 37335	3-42
3.2-6	Saturated Thickness Map for the Alluvial Aquifer in the Offpost Operable Unit Near the Rocky Mountain Arsenal Boundaries (Summer, 1987)	3-44
3.2-7	Location of Alluvial Aquifer Tests	3-46
3.2-8	Potentiometric Surface Map of Denver Fm Zone 2 (Spring 1987)	3-61
3.2-9	Potentiometric Surface Map of Denver Fm Zone 3 (Spring 1987)	3-62
3.2-10	Potentiometric Surface Map of Denver Fm Zone 4 (Spring 1987)	3-63
3.2-11	Location of Denver Fm Aquifer Tests	3-65
3.3-1	DIMP Assessment in Alluvial Wells for Consumptive Use--Phase I and II and Revision III-360 <sup>o</sup> Programs	3-76

## LIST OF FIGURES

Figure		Page
3.3-2	Generalized Pre-system Alluvial Flow Pathways (February-March, 1978 water table)	3-86a
3.3-3	Water Chemistry Data for Denver Fm Unit NBW#1A, Summer Quarter, 1987	3-107
3.3-4	Water Chemistry Data for Denver Fm Unit NBW#1, Spring and Summer Quarters, 1987	3-108
3.3-5	Water Chemistry Data for Denver Fm Unit NBW#2, Summer Quarter, 1987	3-109
3.3-6	Water Chemistry Data for Offpost Denver Fm Wells Not Correlated to Sandstone Units Identified at NBCS	3-110
3.3-7	Location of Offpost Wells Sampled for GC/MS Analyses	3-138
3.4-1	Scatter Diagram Comparing Organic Carbon Concentrations Versus Medium Grain Size	3-158
3.4-2	Historical DIMP Concentrations for Well 37307	3-165
3.4-3	Historical DCPD Concentrations for Well 37307	3-166
3.4-4	Historical DIMP Concentrations for Well 37308	3-168
3.4-5	Historical DCPD Concentrations for Well 37308	3-169
3.4-6	Historical Dieldrin Concentrations for Well 37308	3-170
3.4-7	Historical DIMP Concentrations for Well 37309	3-172
3.4-8	Historical DCPD Concentrations for Well 37309	3-173
3.4-9	Historical DBCP Concentrations for Well 37309	3-174
3.4-10	Historical DIMP Concentrations for Well 37312	3-175
3.4-11	Historical DCPD Concentrations for Well 37312	3-177
3.4-12	Historical Dieldrin Concentrations for Well 37312	3-178
3.4-13	Historical DIMP Concentrations for Well 37313	3-179
4.1-1	Locations of Offpost Surface Water Sampling Locations	4-2
4.2-1	Organic Contaminants Observed in Multiple Samples at Offpost Surface Water Stations	4-8
4.2-2	Relationship Between First Creek Discharges and DIMP Concentrations	4-10

LIST OF FIGURES

Figure		Page
4.3-1	First Creek Water Quality Stations Onpost	4-16
4.3-2	Zones of Potential Ground-Water Discharge to First Creek Onpost	4-17
4.3-3	DIMP Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	4-19
4.3-4	Monthly Discharge Values at First Creek Gaging Stations	4-22
4.3-5	Change In First Creek Flows Offpost Versus Discharge at Highway 2 Station	4-24
4.3-6	Flow Frequency Histogram For First Creek at Highway 2 Station (July 1986 through August 1987)	4-25
4.3-7	Estimated Ground-Water Elevations Along First Creek from the RMA North Boundary to Highway 2	4-27
4.3-8	Estimated Ground-Water Elevations Versus Stream Bed Elevations for O'Brian Canal and Burlington Ditch	4-30
4.3-9	Surface Water Drainage Basins at RMA and in Offpost Operable Unit	4-33
5.1-1	Contaminant Volatility Versus Sorption	5-3
5.1-2	Offpost Sediment Sampling Locations (April 1986)	5-8
7.1-1	Home Ranges of Ring-necked Pheasants	7-4
7.1-2	Home Ranges of Cottontail Rabbits	7-10
7.2-1	Preliminary Vegetation Map of Rocky Mountain Arsenal	7-13
E-1	East-West Geologic Cross-Section NB Downgradient 59.0 (104th Avenue)	
E-2	Bedrock Elevation Map	
E-3	Net Sand Isopach Contour Map of Regional Denver Formation Zone 2	
E-4	Net Sand Isopach Contour Map of Regional Denver Formation Zone 3	
E-5	Net Sand Isopach Contour Map of Regional Denver Formation Zone 4	
E-6	Isopach Map of the NBW#1A and NBE#1 Sandstone Units	

## LIST OF FIGURES

Figure		Page
E-7	Isopach Map of the NBW#1 Sandstone Unit	
E-8	Isopach Map of the NBW#2 Sandstone Unit	
E-9	Isopach Map of the NBW#3 Sandstone Unit	
E-10	Water Table Elevation Map, Spring 1987	
E-11	Water Table Elevation Map, Summer 1987	
E-12	Historical Hydrograph for Well 37308	
E-13	Historical Hydrograph for Well 37334	
E-14	Saturated Thickness Map for Alluvial Aquifer	
E-15	Potentiometric Surface Map of Denver Fm Unit NBW#1A, February 1988	
E-16	Potentiometric Surface Map of Denver Fm Unit NBW#1, February 1988	
E-17	Potentiometric Surface Map of Denver Fm Unit NBW#2, February 1988	
E-18	Potentiometric Surface Map of Denver Fm Unit NBW#3, February 1988	
F-1	DIMP Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-2	DIMP Concentration Distribution, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-3	DBCP Concentration Distribution, ug/l 3rd Quarter, FY87, Alluvial Aquifer	
F-4	DBCP Concentration Distribution, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-5	DCPD Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-6	DCPD Concentration Distribution, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-7	CPMSO2 Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-8	CPMSO2 Concentration Distribution, ug/l, 4th Quarter, FY87,	

LIST OF FIGURES

Figure		Page
	Alluvial Aquifer	
F-9	CPMSO Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-10	CPMSO Concentration Distribution, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-11	CPMS Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-12	CPMS Concentration Distribution, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-13	1,4-Dithiane Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-14	1,4-Dithiane Concentration Distribution, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-15	1,4-Oxathiane Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-16	1,4-Oxathiane Concentration Distribution, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-17	Dieldrin Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-18	Dieldrin Concentration Distribution, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-19	Endrin Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-20	Endrin Concentration Distribution, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-21	Organochlorine Pesticides Concentrations Exceeding Certified Reporting Limits, ug/l, p,p-DDE, p,p-DDT, Aldrin, Isodrin, 3rd Quarter, FY87, Alluvial Aquifer	
F-22	Organochlorine Pesticides Concentrations Exceeding Certified Reporting Limits, ug/l, p,p-DDE, p,p-DDT, Aldrin, Isodrin, 4th Quarter, FY87, Alluvial Aquifer	
F-23	Chloroform Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-24	Chloroform Concentration Distribution, ug/l, 4th Quarter, FY87, Alluvial Aquifer	

LIST OF FIGURES

Figure		Page
F-25	Tetrachloroethene Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-26	Tetrachloroethene Concentration Distribution, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-27	Trichloroethene Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-28	Trichloroethene Concentration Distribution, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-29	1,2-Dichloroethene Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-30	1,2-Dichloroethene Concentration Distribution, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-31	Chlorobenzene Concentrations Exceeding Certified Reporting Limits, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-32	Chlorobenzene Concentrations Exceeding Certified Reporting Limits, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-33	Volatile Organohalogens (CCL4, 12DCE, 11DCLE, 111TCE, 12TCE, CH2CL2) Exceeding Certified Reporting Limits, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-34	Volatile Organohalogens (CCL4, 12DCE, 11DCLE, 111TCE, 12TCE, CH2CL2) Exceeding Certified Reporting Limits, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-35	Benzene Concentrations Exceeding Certified Reporting Limits, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-36	Benzene Concentrations Exceeding Certified Reporting Limits, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-37	Volatile Aromatics (Ethylbenzene, m-Xylene, o,p-Xylene) Exceeding Certified Reporting Limits, ug/l, 3rd Quarter, Alluvial Aquifer	
F-38	Chloride Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-39	Chloride Concentration Distribution, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-40	Fluoride Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	

LIST OF FIGURES

Figure		Page
F-41	Fluoride Concentration Distribution, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-42	Arsenic and Mercury Concentrations Exceeding Certified Reporting Limits, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-43	Arsenic and Mercury Concentrations Exceeding Certified Reporting Limits, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-44	Sulfate Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-45	Sulfate Concentration Distribution, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-46	Calcium Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-47	Calcium Concentration Distribution, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-48	Potassium Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-49	Potassium Concentration Distribution, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-50	Sodium Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-51	Sodium Concentration Distribution, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-52	Magnesium Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-53	Magnesium Concentration Distribution, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-54	Nitrate Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-55	Nitrate Concentration Distribution, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-56	Zinc Concentration Distribution, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-57	Zinc Concentration Distribution, ug/l, 4th Quarter, FY87, Alluvial Aquifer	

## LIST OF FIGURES

Figure		Page
F-58	Cadmium Concentrations Exceeding Certified Reporting Limits, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-59	Cadmium Concentrations Exceeding Certified Reporting Limits, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-60	Lead Concentrations Exceeding Certified Reporting Limits, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-61	Lead Concentrations Exceeding Certified Reporting Limits, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-62	Chromium Concentrations Exceeding Certified Reporting Limits, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-63	Chromium Concentrations Exceeding Certified Reporting Limits, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-64	Copper Concentrations Exceeding Certified Reporting Limits, ug/l, 3rd Quarter, FY87, Alluvial Aquifer	
F-65	Copper Concentrations Exceeding Certified Reporting Limits, ug/l, 4th Quarter, FY87, Alluvial Aquifer	
F-66	Water Chemistry Data for Denver Fm Unit NBW#1A, Spring Quarter, 1987	
F-67	Water Chemistry Data for Denver Fm Unit NBW#2, Spring Quarter, 1987	
F-68	Water Chemistry Data for Denver Fm Unit NBW#3, Spring and Summer Quarters, 1987	
F-69	Water Chemistry Data for Denver Fm Unit NBE#2, Spring and Summer Quarters, 1987	
F-70	Water Chemistry Data for Denver Fm Units NBE#3 and NBE#4, Spring and Summer Quarters, 1987	
F-71	Nontarget Compounds (Bis (2-ethylhexyl) pthalate, Caprolactum) Identified by GC/MS Analysis, ug/l, Task 4 and Task 44, Alluvial Aquifer	
F-72	Nontarget Compound (Dichlorobenzene) Identified by GC/MS Analysis, ug/l, Task 4 and Task 44, Alluvial Aquifer	
C-1	Index Map of Model Area	
C-2	Finite Element Mesh	

LIST OF FIGURES

Figure		Page
G-3	Water Balance of Model Area	
G-4	Aquifer Thickness Map	
G-5a	Transmissivity Map: Contour Interval 1,000-5,000 ft <sup>2</sup> /day	
G-5b	Transmissivity Map: Contour Interval 5,000-25,000 ft <sup>2</sup> /day	
G-6	Measured Spring 1987 Water Table Map	
G-7	Model Calculated Steady State Water Table Map	
G-8a	DIMP 1987 Concentrations: Contour Interval 20-100 ug/l	
G-8b	DIMP 1987 Concentrations: Contour Interval 100-200 ug/l	
G-8c	DIMP 1987 Concentrations: Contour Interval 200-1,000 ug/l	
G-9a	DIMP Concentrations in 1992 (5 years) with Existing North Boundary Recharge Operations: Contour Interval (20-100 ug/l)	
G-9b	DIMP Concentrations in 1992 (5 years) with Existing North Boundary Recharge Operations: Contour Interval (100-200 ug/l)	
G-9c	DIMP Concentrations in 1992 (5 years) with Existing North Boundary Recharge Operations: Contour Interval (200-800 ug/l)	
G-10a	DIMP Concentrations in 1997 (10 years) with Existing North Boundary Recharge Operations: Contour Interval (20-100 ug/l)	
G-10b	DIMP Concentrations in 1997 (10 years) with Existing North Boundary Recharge Operations: Contour Interval (100-700 ug/l)	
G-11a	DIMP Concentrations in 2007 (20 years) with Existing North Boundary Recharge Operations: Contour Interval (20-100 ug/l)	
G-11b	DIMP Concentrations in 2007 (20 years) with Existing North Boundary Recharge Operations: Contour Interval (100-300 ug/l)	
G-12	DIMP Concentrations in 2017 (30 years) with Existing North Boundary Recharge Operations: Contour Interval (20-180 ug/l)	

## LIST OF FIGURES

Figure	Page
G-13a	DIMP Concentrations in 1992 (5 years) with North Boundary Recharge Operation for Natural Flow Conditions: Contour Interval (20-100 ug/l)
G-13b	DIMP Concentrations in 1992 (5 years) with North Boundary Recharge Operation for Natural Flow Conditions: Contour Interval (100-200 ug/l)
G-13c	DIMP Concentrations in 1992 (5 years) with North Boundary Recharge Operation for Natural Flow Conditions: Contour Interval (200-800 ug/l)
G-14a	DIMP Concentrations in 1997 (10 years) with North Boundary Recharge Operation for Natural Flow Conditions: Contour Interval (20-100 ug/l)
G-14b	DIMP Concentrations in 1997 (10 years) with North Boundary Recharge Operation for Natural Flow Conditions: Contour Interval (100-700 ug/l)
G-15a	DIMP Concentrations in 2007 (20 years) with North Boundary Recharge Operation for Natural Flow Conditions: Contour Interval (20-100 ug/l)
G-15b	DIMP Concentrations in 2007 (20 years) with North Boundary Recharge Operation for Natural Flow Conditions: Contour Interval (100-300 ug/l)
G-16	DIMP Concentrations in 2017 (30 years) with North Boundary Recharge Operation for Natural Flow Conditions: Contour Interval (20-180 ug/l)
G-17a	DIMP Concentrations in 1992 (5 years) with Existing South Adams County Well Field: Contour Interval (20-100 ug/l)
G-17b	DIMP Concentrations in 1992 (5 years) with Existing South Adams County Well Field: Contour Interval (100-200 ug/l)
G-17c	DIMP Concentrations in 1992 (5 years) with Existing South Adams County Well Field: Contour Interval (200-800 ug/l)
G-18a	DIMP Concentrations in 1997 (10 years) with Existing South Adams County Well Field: Contour Interval (20-100 ug/l)
G-18b	DIMP Concentrations in 1997 (10 years) with Existing South Adams County Well Field: Contour Interval (100-700 ug/l)
G-19a	DIMP Concentrations in 2007 (20 years) with Existing South Adams County Well Field: Contour Interval (20-100 ug/l)

LIST OF FIGURES

Figure		Page
G-19b	DIMP Concentrations in 2007 (20 years) with Existing South Adams County Well Field: Contour Interval (100-300 ug/l)	
G-20	DIMP Concentrations in 2017 (30 years) with Existing South Adams County Well Field: Contour Interval (20-180 ug/l)	
G-21a	DIMP Concentrations in 1992 (5 years) for Proposed South Adams County Well Field: Contour Interval (20-100 ug/l)	
G-21b	DIMP Concentrations in 1992 (5 years) for Proposed South Adams County Well Field: Contour Interval (100-200 ug/l)	
G-21c	DIMP Concentrations in 1992 (5 years) for Proposed South Adams County Well Field: Contour Interval (200-800 ug/l)	
G-22a	DIMP Concentrations in 1997 (10 years) for Proposed South Adams County Well Field: Contour Interval (20-100 ug/l)	
G-22b	DIMP Concentrations in 1997 (10 years) for Proposed South Adams County Well Field: Contour Interval (100-700 ug/l)	
G-23a	DIMP Concentrations in 2007 (20 years) for Proposed South Adams County Well Field: Contour Interval (20-100 ug/l)	
G-23b	DIMP Concentrations in 2007 (20 years) for Proposed South Adams County Well Field: Contour Interval (100-300 ug/l)	
G-24	DIMP Concentrations in 2017 (30 years) for Proposed South Adams County Well Field: Contour Interval (20-180 ug/l)	
G-25	Dieldrin 1987 Concentrations	
G-26	Dieldrin Concentrations in 1992 (5 years) with Existing North Boundary Recharge Operations	
G-27	Dieldrin Concentrations in 1997 (10 years) with Existing North Boundary Recharge Operations	
G-28	Dieldrin Concentrations in 2007 (20 years) with Existing North Boundary Recharge Operations	
G-29	Dieldrin Concentrations in 2017 (30 years) with Existing North Boundary Recharge Operations	
G-30	Dieldrin Concentrations in 1992 (5 years) with North Boundary Recharge Operation for Natural Flow Conditions	
G-31	Dieldrin Concentrations in 1997 (10 years) with North Boundary Recharge Operation for Natural Flow Conditions	

## LIST OF FIGURES

Figure		Page
G-32	Dieldrin Concentrations in 2007 (20 years) with North Boundary Recharge Operation for Natural Flow Conditions	
G-33	Dieldrin Concentrations in 2017 (30 years) with North Boundary Recharge Operation for Natural Flow Conditions	
G-34	Dieldrin Concentrations in 1992 (5 years) with Existing South Adams County Well Field	
G-35	Dieldrin Concentrations in 1997 (10 years) with Existing South Adams County Well Field	
G-36	Dieldrin Concentrations in 2007 (20 years) with Existing South Adams County Well Field	
G-37	Dieldrin Concentrations in 2017 (30 years) with Existing South Adams County Well Field	
G-38	Dieldrin Concentrations in 1992 (5 years) for Proposed South Adams County Well Field	
G-39	Dieldrin Concentrations in 1997 (10 years) for Proposed South Adams County Well Field	
G-40	Dieldrin Concentrations in 2007 (20 years) for Proposed South Adams County Well Field	
G-41	Dieldrin Concentrations in 2017 (30 years) for Proposed South Adams County Well Field	
G-42	Chloroform Concentrations for 1987	
G-43	Chloroform Concentrations in 1992 (5 years) with Existing South Adams County Well Field	
G-44	Chloroform Concentrations in 1997 (10 years) with Existing South Adams County Well Field	
G-45	Chloroform Concentrations in 2007 (20 years) with Existing South Adams County Well Field	
G-46	Chloroform Concentrations in 2017 (30 years) with Existing South Adams County Well Field	
G-47	DCPD Concentrations in 1987	
G-48	DCPD Concentrations in 1992 (5 years) with Existing South Adams County Well Field	
G-49	DCPD Concentrations in 1997 (10 years) with Existing South Adams County Well Field	

## LIST OF FIGURES

Figure		Page
G-50	DCPD Concentrations in 2007 (20 years) with Existing South Adams County Well Field	
G-51	DCPD Concentrations in 2017 (30 years) with Existing South Adams County Well Field	
I-1	Aromatic and Halogenated Aliphatic Solvent Assessment RMA Offpost First Quarter Sampling of Wells	
I-2	Aromatic and Halogenated Aliphatic Solvent Assessment RMA Offpost Second Quarter Sampling of Wells	
I-3	Chlorinated Pesticide Assessment RMA Offpost First Quarter Sampling of Wells	
I-4	Chlorinated Pesticide Assessment RMA Offpost Second Quarter Sampling of Wells	
I-5	Organosulfur Compounds Assessment RMA Offpost First Quarter Sampling of Wells	
I-6	Organosulfur Compounds Assessment RMA Offpost Second Quarter Sampling of Wells	
I-7	DBCP Assessment RMA Offpost First Quarter Sampling of Wells	
I-8	DBCP Assessment RMA Offpost Second Quarter Sampling of Wells	
I-9	DCPD Assessment RMA Offpost First Quarter Sampling of Wells	

## LIST OF TABLES

Table		Page
2.1-1	Aquifer Designations for Wells in Offpost Operable Unit	2-9
2.1-2	Completion Data for New Alluvial Wells	2-14
2.1-3	Completion Data for New Denver Wells	2-18
2.1-4	Chemical Analyses--Offpost Operable Unit Analytical Program	2-21
2.4-1	Summary of Previous Air Quality Monitoring Programs at RMA	2-38
3.2-1	Transmissivity (T), Hydraulic Conductivity (K), and Apparent Specific Yield (SYA) from Pumping Tests	3-48
3.2-2	Hydraulic Conductivity of Combined Soil Groups in the Alluvial Aquifer	3-51
3.2-3	Slug Test Results for Denver Fm Units Near the North Boundary of RMA	3-66
3.2-4	Water Elevations for Well Cluster Sites in the Offpost Operable Unit	3-71
3.3-1	Frequency of Detection and Range of Concentrations for Target Analytes--Spring 1987	3-80
3.3-2	Frequency of Detection and Range of Concentrations for Target Analytes--Summer 1987	3-82
3.3-3	Representative Concentrations for Naturally Occurring Constituents in Upgradient Alluvial Wells	3-98
3.3-4	Typical Background Water Chemistry From the Denver Fm	3-118
3.3-5	Additional Inorganic Parameters for Wells 37379 and 37380, Spring and Summer 1987	3-121
3.3-6	Field QA/QC Procedures	3-126
3.3-7	Duplicate Data: DIMP, DBCP, DCPD, (ug/l)	3-127
3.3-8	Duplicate Data: 1,4-Oxathiane, 1,4-Dithiane, CPMS, CPMSO, CPMSO2 (ug/l)	3-128
3.3-9	Duplicate Data: Organochlorine Pesticides (ug/l)	3-129
3.3-10	Duplicate Data: Volatile Organohalogens (ug/l)	3-130
3.3-11	Duplicate Data: Volatile Aromatics (ug/l)	3-131

## LIST OF TABLES

Table	Page
3.3-12 Duplicate Data: Inorganics (ug/l)	3-132
3.3-13 Duplicate Data: Additional Inorganics (ug/l)	3-133
3.3-14 Offpost Wells from which Water Samples were Collected and Submitted for GC/MS Analysis	3-137
3.3-15 GC/MS Target Analytes	3-140
3.3-16 Certified Reporting Limit for GC Analyses and Apparent Method Detection Limit for GC/MS Analyses	3-141a
3.3-17 Frequency of Detection for Tentatively Identified Compounds	3-146
3.4-1 Estimated Range of $K_d$ Values	3-156
3.4-2 Comparison of Chloride Concentrations Upgradient and Downgradient of Irrigation Canals (mg/l)	3-183
3.4-3 Selected Organic Contaminant Concentrations in Task 39 Cluster Wells (ug/l)	3-184
3.4-4 Benzene and Chlorobenzene Concentrations in Task 39 Cluster Wells (ug/l)	3-185
3.4-5 Fluoride, Chloride, and Sulfate Concentrations in Task 39 Cluster Wells (ug/l)	3-186
4.1-1 Comparison of Average Monthly Flows for South Platte River, Burlington Ditch, O'Brian Canal, and First Creek in the RMA Offpost Operable Unit (All Values in Acre-Feet)	4-3
4.2-1 Summary of Organic Contaminant Concentrations in Offpost Surface Water	4-5
4.2-2 Inorganic Concentration Ranges at Offpost Surface Water Sampling Stations (ug/l)	4-7
4.3-1 Summary of Organic Contaminant Concentrations Onpost in First Creek and Its Potential Tributaries	4-15
5.1-1 Analyte Schedule and Certified Reporting Limits for Sediment Analyses Performed for Offpost Contamination Assessment Report	5-5
5.1-2 Metal Concentrations in Offpost Sediment Samples from Offpost Contamination Assessment Report	5-7
5.1-3 Sediment Analyses (April 14, 1988 Sampling)	5-11

LIST OF TABLES

Table		Page
5.2-1	Representative Metals Concentrations in Wastewater Sludge (ug/g)	5-14
5.3-1	Metal Concentrations Commonly Found in Uncontaminated Freshwater Sediments (ug metal/gm dry sediment)	5-15
6.1-1	Summary of Air Quality Parameters in the Vicinity of the Rocky Mountain Arsenal	6-2
6.2-1	Airborne Organic Compounds at Rocky Mountain Arsenal	6-4
6.2-2	Airborne Metals at the Rocky Mountain Arsenal	6-9
7.1-1	Pheasant Home Range Estimates	7-2
7.1-2	Final Status of Animal and Transmitter	7-6
7.1-3	Cottontail Home Range Estimates	7-9

APPENDIX A  
WELL DESIGNATION CRITERIA

APPENDIX A  
WELL DESIGNATION CRITERIA

WELL DESIGNATION CATEGORY	CRITERIA
1	Wells with screen bottom less than 3.0 ft below bedrock where bedrock is siltstone or shale.
2	Wells with screen bottom less than 3.0 ft below bedrock where bedrock is sandstone and less than 20 percent of screen length is below bedrock contact. or Well with screen bottom between 3.1 ft and 6.0 ft below bedrock contact where bedrock is sandstone and between 50 percent screened in bedrock.
3	Wells with screen bottom less than 3.0 ft below bedrock contact where bedrock is sandstone and between 20 and 50 percent of screen length is below bedrock contact. or Wells with screen bottom between 3.1 ft and 6.0 ft below bedrock contact where bedrock is siltstone or shale and more than 50 percent of the screen is below bedrock. or Wells with the screened more than 6.0 ft below the bedrock contact where bedrock is siltstone or shale.

WELL DESIGNATION CATEGORY

CRITERIA

4

Wells with screen bottom less than 3.0 ft below bedrock contact where bedrock is sandstone and more than 50 percent of screen length is below bedrock contact.

or

Wells with screens more than 3.0 ft below the bedrock contact where bedrock is sandstone

5

Well is screened entirely within Denver Fm.

NOTE: If alluvium was consistently unsaturated at well site and well was screened within Denver Fm, well was considered as a Denver Fm well and data evaluated for inclusion into Denver Fm potentiometric maps and water chemistry maps.

APPENDIX B  
WELL COMPLETION SUMMARIES, LITHOLOGIC LOGS, AND GEOPHYSICAL LOGS

WELL CONSTRUCTION SUMMARY

Borehole E34D Well 39 37376  
 Project Name and Location T36 Well Installation, 9626 Ave Project Number 17053 07410  
 Drilling Company Byles Driller S Roach Rig Number Failing 25  
 Drilling Method(s) continuous core

Borehole Diameter ~~7 7/8~~ in. \_\_\_\_\_ cm. <sup>20</sup> 33 ft. \_\_\_\_\_ cm. to 55 ft. \_\_\_\_\_ cm.  
12 1/4 in. \_\_\_\_\_ cm. 0 ft. \_\_\_\_\_ cm. to 33 ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) <u>12 1/4" blade bit</u> <u>7 7/8"</u>	Sampling Method(s) <u>Core</u>
Size and Type PVC <u>4" schedule 40</u>	Date/Time Start Drilling <u>2-18-87 1145</u>
Total Borehole Depth <u>51</u> ft. _____ cm.	Date/Time Finish Drilling <u>2-19-87 1106</u>
Depth to Bedrock <u>31</u> ft. _____ cm.	Date/Time Start Completion <u>2-19-87 1152</u>
Depth to Water <u>NA</u> ft. _____ cm.	Date/Time Cement Protective Casing <u>2-19-87 1410</u>
Water Level Determined By <u>NA</u>	Materials Used _____
Length Plain PVC (total) <u>42</u> ft. _____ cm.	Plain PVC <u>45.17' total (4x10' ; 1x5')</u>
Length of Screen <u>10.7</u> ft. _____ cm.	Slotted PVC <u>10.7' total (1x10')</u>
Total Length of Well Casing <u>52.7</u> ft. _____ cm.	Bentonite Pellets <u>1 1/4 buckets</u>
PVC Stick Up <u>1.7</u> ft. _____ cm.	Bentonite Granular _____
Depth to Bottom of Screen <u>51</u> ft. _____ cm.	Cement <u>85 bags</u>
Depth to Top of Screen <u>40.3</u> ft. _____ cm.	Sand <u>3 bags</u>
Depth to Top of Sand <u>39</u> ft. _____ cm.	Water added during completion <u>-</u>
Depth to Top of Bentonite <u>345</u> ft. _____ cm.	Water added during drilling <u>-</u>
	Total Gallons of water added <u>-</u>

Drill Site Geologist C Bensch Date 2-20-87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 4-7-87/1500/K. Pacheco, M. Westcott  
 Date/Time/Personnel Casing Painted 6/14/87/1300/Ken Pacheco & Mark Westcott  
 Date/Time/Personnel Numbers Painted 4/15/87 J. J. BAE 0947

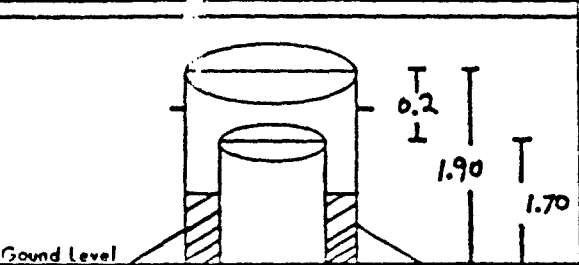
Materials Used 13 bags quickrete cement, 1/2 bag portland cement & 1/2 silicon for internal m

Top of Protective Casing to Top of PVC	<u>0.2</u> ft. _____ cm.	COMMENT/NOTES
Top of Protective Casing to Weep Hole	<u>1.22</u> ft. _____ cm.	
Top of Protective Casing to Internal Mortar	<u>1.23</u> ft. _____ cm.	
Top of Protective Casing to Top of Cement Pad	<u>1.57</u> ft. _____ cm.	
Top of Protective Casing to Ground Level	<u>1.90</u> ft. _____ cm.	

Reviewed By Joseph L. Reed Date 6/10/87  
 Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

Borehole: E34D

Well: 37376

Depth-feet	Soil/Rock Type	Well Completion	Description
			
5		0.5 joint	
10		10.11 joint	
15			
20		20.19 joint	
25			
30		30.25 joint	
35		34.5	TOP OF BENTONITE SEAL
40		39	TOP OF SAND PACK
		40.3	TOP OF SCREEN
45		45.7 stabilizer	
50			
55		51'	total depth of boring

Drill Site Geologist: C. Fausch Date: 2.20.87  
 Reviewed By: Joseph Reed Date: 6/10/87

**BOREHOLE SUMMARY LOG**

Borehole E-34 Well 37376  
Project Name and Location MW Installation Project Number 17053 07410  
Drilling Company Boyles Driller Roach Rig Number Failing 25  
Drilling Method(s) Rotary - water used

Size(s) and type(s) of bit(s) 12 1/4" rock, 7 3/8" tricone  
Borehole Diameter 12 1/4 in. \_\_\_\_\_ cm. 0 ft. \_\_\_\_\_ cm. to 32 ft. \_\_\_\_\_ cm.  
7 3/8 in. \_\_\_\_\_ cm. 82 ft. \_\_\_\_\_ cm. to 95 ft. \_\_\_\_\_ cm.

Sampling Methods Continuous core  
Total Number Soil Sampling Tubes NA

Total Number Core Boxes 0  
Number of Gallons Lost Drilling Fluid 0

Date/Time Started Drilling 2-17-87 0948  
Date/Time Completed Drilling 2-17-87 1230

Total Borehole Depth 55 ft. \_\_\_\_\_ cm.  
Depth to Bedrock 28 ft. \_\_\_\_\_ cm.  
Depth to Water \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Water Level Determined By? not determined - drilling with water  
Borehole Completed as Monitoring Well? NO

Date/Time Grouting Completed 2-18-87 0856  
Depth of Tremmie Pipe 55'

Gallons of Grout 30  
Materials Used 3 bags cement, 30 gal. water

Comments hole grouted to surface, casing breaking <sup>CO2</sup> broken off below surface

Wellsite Geologist C. Blum Date 3-23-87  
Checked for Grout Settlement on 1/28/87 by JLR  
Amount of Grout Added \_\_\_\_\_

All Measurements from Ground Level  
Reviewed by Joseph L. Reed Date 4/28/87  
Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

DEPTH Feet	Rec. Int.		Structure/Bedding		Hardness		Perm.			Mineralogy		Color		Tests/Grain Size			Lith. Char.	Lith. Class	Description/Comments
	U	S	Angle	Desc	S	H	10	20	Min	Major	M	G	0.1	10	100	Fe			
32																		CORING BEGINS AT 32'	
34				slightly fissile															
36				1-2 frac/ft.															
38																			
40																			
42				3-10 frac/ft.															
44				2-4 frac/ft.															
46				6-8/ft.															
48				2-4/ft.															

E, Inc. BORE E-340 WELL(S) \_\_\_\_\_

DEPTH Feet	Box No.	U	S	Structure/Bedding		Hardness		Perm.		Mineralogy		Color	Texture/Grain Size Clas. of gr. mm .01 1.0 100	Lith. Char.	Lith. Class	Description/Comments
				Angle	Desc.	S	HL	HL	H	Min	Habit					
52					very Friable							2.54 4/0 dark gray	fine shaly		CLs	
54					r2/6. competent							2.54 2/0 black		S3 Lignite 5%		
55																END OF BORING AT 55'

E, Inc. BORE E-348 WELL(S) \_\_\_\_\_



Frontier Logging

Lakewood, Colorado

Date FEB. 18, 1987

Company	ESE		Driller	55 1/2 FT	
Bar #	E-34		Depth	3 3/8"	
Map Sheet	RMA		Sturdy	0725	
County	ADAMS COUNTY		Time	0740	
Section	TERRING		Light No.	110	
	SOUTH		Operator	Wm. Linton	
	ELEVATION		Location	Lakewood	
	LOG MEASURED FROM				
	GROUND LEVEL				

EQUIPMENT DATA		Scale		Scale		Scale		Scale	
T.D. Logged	55 1/2 FT	TC	CPSh	TC	CPSh	TC	CPSh	TC	CPSh
Natural Gamma	200 Scale = 20	From	To	From	To	From	To	From	To
Time Constant	2	Sec	Sec	Sec	Sec	Sec	Sec	Sec	Sec
Count Source	10	CPM	CPM	CPM	CPM	CPM	CPM	CPM	CPM
Probe Diameter	1 5/8"								
Probe Type	x Tal 3/4 x 1"								
Count Rate	2.36 x 10 <sup>-5</sup>								
Count Rate	7								
Count Rate	3 3/8"								

Gamma (Analog)	TC	CPSh	TC	CPSh	TC	CPSh	TC	CPSh
Gamma (Digital)	From	To	From	To	From	To	From	To
Caliper	2	Sec	2	Sec	2	Sec	2	Sec
Temperature	40 ohms/5"							
Closure	20 MV/Inch							
Azimuth								
True Vertical								

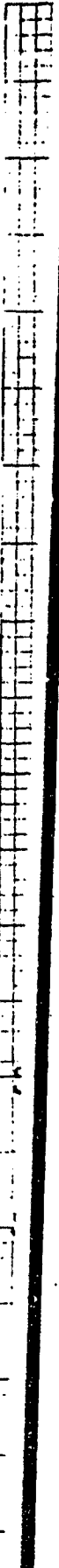
NATURAL GAMMA

RESISTANCE

S.P. 20 ohms

S.P. 20 MV

40 OHMS 5 inches

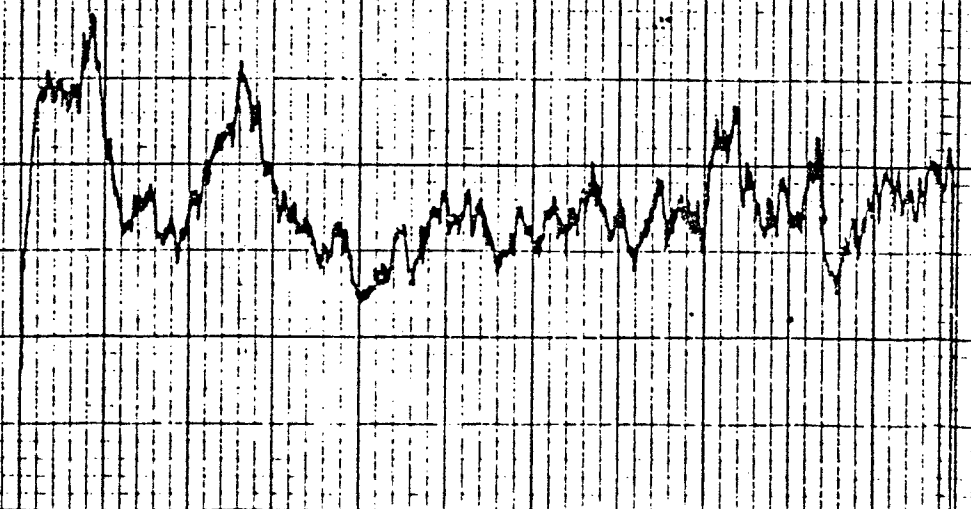


NATURAL GAMMA

20 cps

Initial Log

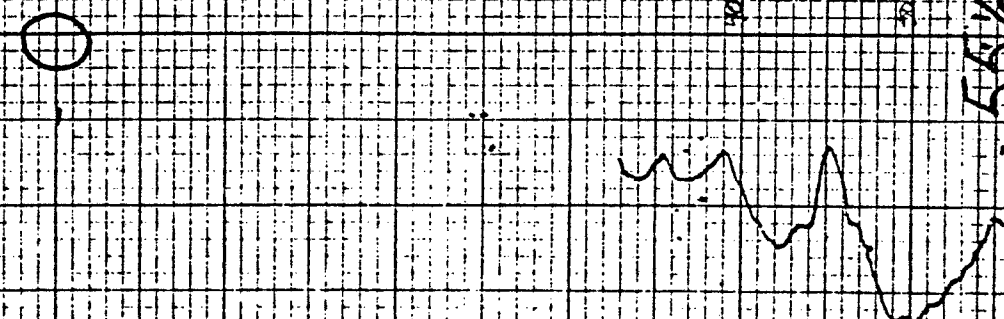
0 20 40  
COUNTS PER SECOND



S.P.

20 MV

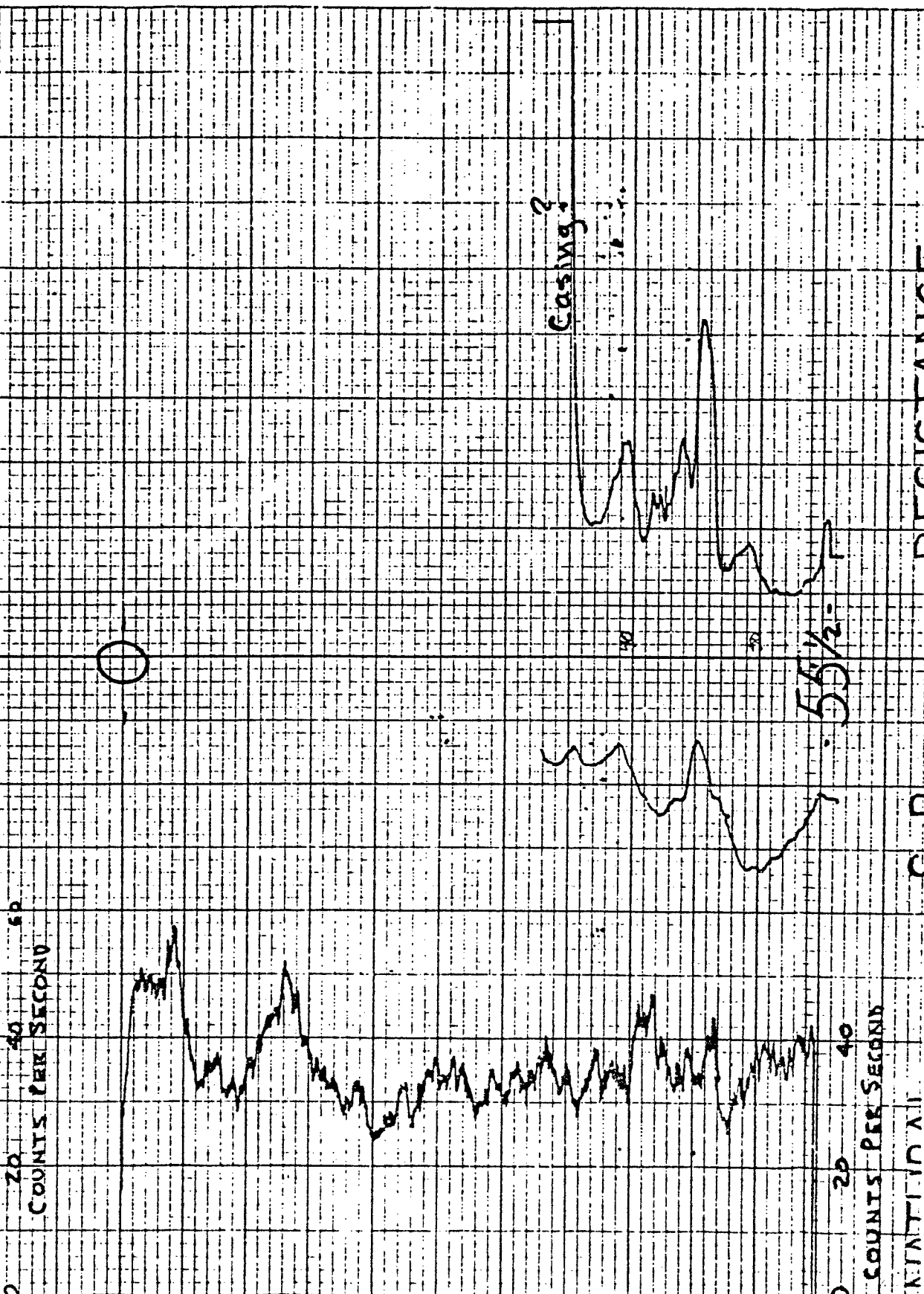
0 20 40  
COUNTS PER SECOND



RESISTANCE

40

OHMS/5 INCHES



Casing?

55 1/2'

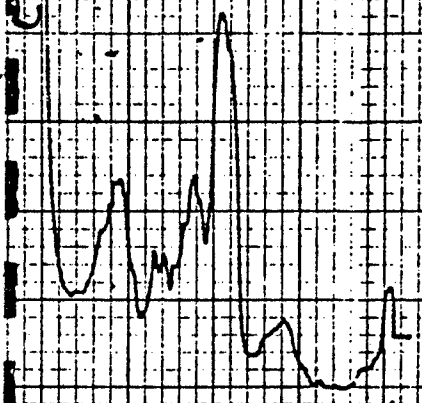
0 20 40  
COUNTS PER SECOND

INITIAL

C D

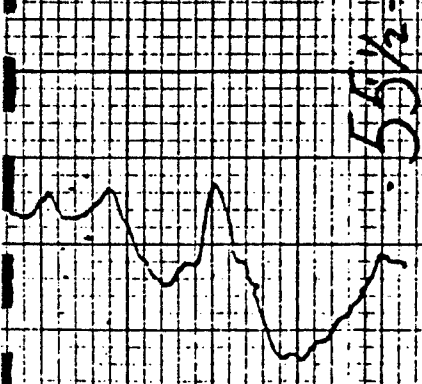
RESISTANCE

CASING



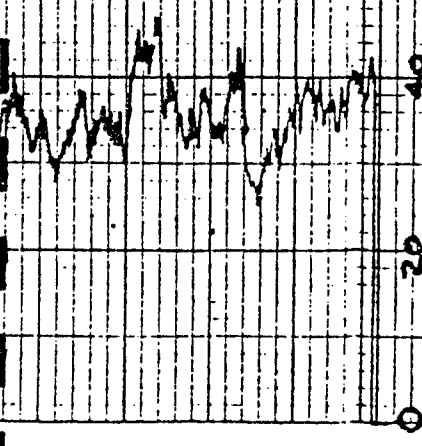
RESISTANCE

40 OHMS/5 INCHES



S.P.

20 MV/INCH



NATURAL  
GAMMA

COUNTS PER SECOND

E-34

Borehole: E-38A

Well: JR E-38A 3737A

Depth-Feet	Soil/Reel Type	Well Completion	Description
2			
4			
6			-4.8 Top of Bentonite
8			-7.7 Top of Sand -8.7 Top of Screen
10			-10' Water Level
12			
14			
16			
18			
20			
22			
24			-24.9 Bottom of Screen
26			-25.8 Bottom of Hole

Drill Site Geologist: Greg Litus  
 Reviewed By: Joseph Litus

Date: 3/2/87  
 Date: 9/20/87

WELL CONSTRUCTION SUMMARY

Borehole E-38A Well E-38A 3737A  
 Project Name and Location Open-Drilling North NE of 9th St. with 2 Project Number 17011-03910  
 Drilling Company Boyles Bros Driller Jarvis Rig Number \_\_\_\_\_  
 Drilling Method(s) Auger

Borehole Diameter 12 1/4 in. \_\_\_\_\_ cm. 0 ft. \_\_\_\_\_ cm. to 2 1/2 ft. \_\_\_\_\_ cm.  
 \_\_\_\_\_ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) \_\_\_\_\_

Sampling Method(s) Split-Spoon Continuous

Size and Type PVC 4"

Date/Time Start Drilling 1045

Total Borehole Depth 26.5' ft. \_\_\_\_\_ cm.

Date/Time Finish Drilling 1320

Depth to Bedrock 26' ft. \_\_\_\_\_ cm.

Date/Time Start Completion 1445

Depth to Water 10' ft. \_\_\_\_\_ cm.

Date/Time Cement Protective Casing 1620

Water Level Determined By Samples

Materials Used 7-4' TUBES 2 BOXES

Length Plain PVC (total) 16.23 ft. \_\_\_\_\_ cm.

Plain PVC 1-10' 1-5' FOR 11.37

Length of Screen 16.23 ft. \_\_\_\_\_ cm.

Slotted PVC 1-10' 1-5' FOR 16.23

Total Length of Well Casing 27.6 ft. \_\_\_\_\_ cm.

Bentonite Pellets 3 1/2 Buckets

PVC Stick Up 2.7' ft. \_\_\_\_\_ cm.

Bentonite Granular 0

Depth to Bottom of Screen 27.9 ft. \_\_\_\_\_ cm.

Cement 2 BAGS

Depth to Top of Screen 2.7 ft. \_\_\_\_\_ cm.

Sand 1 1/2 BAGS

Depth to Top of Sand 7.8 ft. \_\_\_\_\_ cm.

Water added during completion 0 (3 Gals. r. small amount)

Depth to Top of Bentonite 4.8 ft. \_\_\_\_\_ cm.

Water added during drilling 0

Total Gallons of water added 0 5 JK

Drill Site Geologist Bob Griggs, Greg Lewis

Date 3/2/87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 04/08/87 1320 JJB

Date/Time/Personnel Casing Painted JJP BAB 4/15/87 0915

Date/Time/Personnel Numbers Painted JJP BAB 4/15/87 0915

Materials Used 14 BGS Quick-Crete 1/2 Bg Cement 1/2 Bg Sand 1 Roll Edging

Top of Protective Casing to Top of PVC 2.3 ft. \_\_\_\_\_ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 2.5 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Internal Mortar 2.3 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Top of Cement Pad 2.9 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Ground Level 3.0 ft. \_\_\_\_\_ cm.

Reviewed By Joseph L. Reed Date 4/20/87

Drill Site Geologist Greg Lewis Date 3/2/87

WELL CONSTRUCTION SUMMARY

Borehole E-38 01 Well JR E-38 01 37379  
 Project Name and Location MW Installation Project Number 1705307410  
 Drilling Company Boyles Driller Rach Rig Number \_\_\_\_\_  
 Drilling Method(s) continuous, rotary drilling

Borehole Diameter 2 1/4 in. \_\_\_\_\_ cm. 30 ft. \_\_\_\_\_ cm. to 30 ft. \_\_\_\_\_ cm.  
2 7/8 in. \_\_\_\_\_ cm. 30 ft. \_\_\_\_\_ cm. to 56.5 ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) 12 1/4" blade bit

Sampling Method(s) no sampling

Size and Type PVC 4" schedule 40

Date/Time Start Drilling 3-13-87 10837

Total Borehole Depth 56.5 ft. \_\_\_\_\_ cm.

Date/Time Finish Drilling 3-13-87 1056

Depth to Bedrock 27 ft. \_\_\_\_\_ cm.

Date/Time Start Completion 3-13-87 1100

Depth to Water unknown ft. \_\_\_\_\_ cm.

Date/Time Cement Protective Casing 3-13-87 140

Water Level Determined By \_\_\_\_\_

Materials Used \_\_\_\_\_

Length Plain PVC (total) 41.96 ft. \_\_\_\_\_ cm.

Plain PVC 1 x 5' 4 x 10'

Length of Screen 11.24 ft. \_\_\_\_\_ cm.

Slotted PVC 1 x 10' 1 x 5'

Total Length of Well Casing 53.2 ft. \_\_\_\_\_ cm.

Bentonite Pellets 1 1/2 buckets

PVC Stick U<sub>p</sub> 2.7 ft. \_\_\_\_\_ cm.

Bentonite Granular 1 bag

Depth to Bottom of Screen 55.5 ft. \_\_\_\_\_ cm.

Cement 7 bags

Depth to Top of Screen 39.24 ft. \_\_\_\_\_ cm.

Sand 2 1/2 bags

Depth to Top of Sand 37.8 ft. \_\_\_\_\_ cm.

Water added during completion 500 gal. cement

Depth to Top of Bentonite 33.4 ft. \_\_\_\_\_ cm.

Water added during drilling 450 gal

Total Gallons of water added 950 gal

This water was all pumped back out

Drill Site Geologist J. Boyles

Date 3-16-87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 04/08/87 11:00 PGR

Date/Time/Personnel Casing Painted J.F. BAB 4/15/87 0907

Date/Time/Personnel Numbers Painted J.F. BAB 4/15/87 0907

Materials Used 14 Bys Quick-crete 1 Bg Cement 1 Bg sand 1 Roll paper

Top of Protective Casing to Top of PVC .1 ft. \_\_\_\_\_ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 1.40 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Internal Mortar 1.43 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Top of Cement Pad 1.74 ft. \_\_\_\_\_ cm.

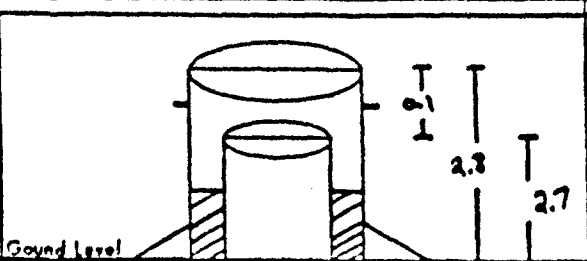
Top of Protective Casing to Ground Level 2.8 ft. \_\_\_\_\_ cm.

Reviewed By Joseph L. Ruell Date 4/20/87

Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

Borehole: E-37D1

Well: ~~E-38~~ 37379

Depth-Feet	Soil/Rock Type	Well Completion	Description
			
5			
10		9.07' 砾石	
15			GRout
20		19.05' 砾石	
25			
30		29.19' 砾石	
35			TOP OF BENTONITE SEAL 33.4'
40			TOP OF SANDPACK 37.8'
45			TOP OF SCREEN 39.24'
50			
55			Bottom of Screen 55.5'
60			Total depth 56.5'

Drill Site Geologist: C. Benson  
 Reviewed By: Joseph Lind

Date: 3.11.87  
 Date: 4/20/87

**WELL CONSTRUCTION SUMMARY**

Borehole E-3802 Well 37380  
 Project Name and Location  Hwy. 2 MW Installation Project Number 1705307410  
 Drilling Company Bayles Driller B. Koach Rig Number Falling 25  
 Drilling Method(s) Rotary - drilled with water

Borehole Diameter 17 1/2 in. cm. 0 ft. cm. to 30 ft. cm.  
11 3/4 in. cm. 30 ft. cm. to 55 ft. cm.  
4 3/10 " 55 ft. to 75 ft.

Size(s) and types of Bit(s) 17 1/2" tri-cone, Sampling Method(s) NA  
11 3/4" blade bit, 9 5/8" blade

Size and Type PVC 4" schedule 40 Date/Time Start Drilling 3.23.87 1006

Total Borehole Depth 75 ft. cm. Date/Time Finish Drilling 3.23.87 1115

Depth to Bedrock 27 ft. cm. Date/Time Start Completion 3.23.87 1130

Depth to Water NA ft. cm. Date/Time Cement Protective Casing 3.23.87 1540

Water Level Determined By NA Materials Used \_\_\_\_\_

Length Plain PVC (total) 66.2 ft. cm. Plain PVC 7 x 10"

Length of Screen 10.71 ft. cm. Slotted PVC 1 x 10"

Total Length of Well Casing 76.7 ft. cm. Bentonite Pellets 1 bucket

PVC Stick Up 8.7 ft. cm. Bentonite Granular 43 bag

Depth to Bottom of Screen 75 ft. cm. Cement 8 bags

Depth to Top of Screen 64.29 ft. cm. Sand 4 bags

Depth to Top of Sand 59 ft. cm. Water added during completion 5 cod

Depth to Top of Bentonite 54 ft. cm. Water added during drilling 1200

Drill Site Geologist C. Benson Total Gallons of water added 1700 0  
 Date 3.23.87 Water pumped back out into 28 barrels

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 9/2/87 / J. Packer M. Westcott  
 Date/Time/Personnel Casing Painted 4/8/87 / 1900 / K. Packer M. Westcott

Date/Time/Personnel Numbers Painted 4/15/87 0925 FWF B49  
 Materials Used 8 bags quickcrete, 1/2 bag portland cement, 1 1/2 bag silica sand

Top of Protective Casing to Top of PVC 0.2 ft. cm. COMMENT/NOTES \_\_\_\_\_

Top of Protective Casing to Weep Hole 1.1 ft. cm. \_\_\_\_\_

Top of Protective Casing to Internal Mortar 1.67 ft. cm. \_\_\_\_\_

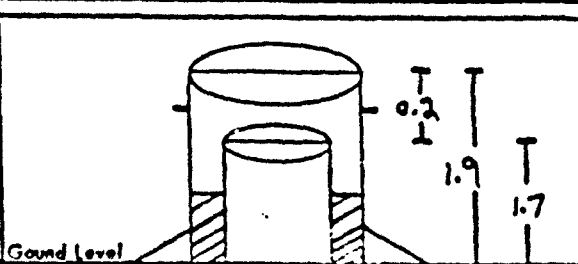
Top of Protective Casing to Top of Cement Pad 1.4 ft. cm. \_\_\_\_\_

Top of Protective Casing to Ground Level 1.9 ft. cm. \_\_\_\_\_

Reviewed By Joseph Reed Date 4/20/87  
 Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

Borehole: E38D2

Well: 37380

Depth-Feet	Soil/Rock Type	Well Completion	Description
		 <p>Ground Level</p>	
5		3.8 joint	
10			
15		13.86 joint	
20			GROUT
25		23.81 joint	
30			12" casing to 30" Centralizer 30"
35		33.96 joint	
40			
45		44.07 joint	
50			Centralizer 52" TOP OF BENJONITE SEAL 54" 8" casing to 55"
55		54.79 joint	
60			TOP OF SANDPALK 59"
65			TOP OF SCREEN 64.29"
70			
75			Total depth 75"

Drill Site Geologist: [Signature]  
 Reviewed By: [Signature]

Date: 3/23/87  
 Date: 3/20/87

Borehole: E-38A

Well Number: 37374

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
0.0						MUNSELL COLORS
0-1'	0-1'	1'	NA	0-1'	ML	<p><u>ML</u> Sandy-silt, 10% v.f.g. sand, 10YR, 3/2-3 v. dk. graysh. brn., non-plas., loose, moist, alluvium</p> <p>At 1.6', color changes to 10YR, 5/2-3, graysh brn., moisture decreases to slightly moist.</p> <p>At 2.0' color changes to 10YR, 5/4-6, graysh brn., percentage of v.f.g. sand increases to ~25%.</p> <p>At 5.0', percent v.f.g. sand increases to ~40-45%, color changes to 10YR, 5/3, brn., moisture increases to moist.</p> <p><u>SM</u> silty-sand, 25% silt, 10YR, 5/3, brn., non-plas., loose, wet, alluvium.</p> <p>Moisture change to saturated, H.T. @ 10.0'</p>
1.0	1-2'	1'		1-2'		
1.6	2-3'	1'		2-3'		
2.0	3-4'	1'		3-4'		
3.0	4-6'	2'		4-6'		
4.0	6-8'	1.25'		6-8'		
5.0	8-10'	1.5'		8-10'		
6.0	10-12'	1'		10-12'		
7.0						
8.0						
9.0						
10.0						
11.0						

Drill Site Geologist: A.E. Odell

Date: 3/3/87

Reviewed By: Joseph L. Reed

Date: 9/16/87

Borehole: E-38A

Well Number: 37374

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						Munsell Colors
11.0	10-12'	1'	NA	10-12'	SM	At 12.0, percent silt increases to ~40%.
13.0	12-14'	2'		12-14'		
14.0	14-16'	2'		14-16'	ML	ML <u>sandy-silt</u> , 10-15% f. of gr. sand, 10 YR, 6/3-4, pale br., non-pls, med. dense, wet, alluvium
16.5	16-18'	1.75'		16-18'	SM	SM <u>silty</u> <u>fine sand</u> , 15-20% <u>gr. sand</u> to 20% silt, 10 YR, 5/4-6, <u>gray br.</u> , non-pls, loose, wet, alluvium
19.0	18-20'	2'		18-20'		
21.5	20-22.5'	2'		20-22.5'		
21.5-23	21.5-23	1.75'		21.5-23		

Drill Site Geologist: S.E. Dettl

Date: 3/3/87

Reviewed By: Joseph L. Reed

Date: 4/16/87

Borehole: E-38A

Well Number: 37374

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
22.0	21.5 - 23'	1.75'	NA	21.5 - 23'	PM	
23.0				23 - 25'		
24.0	23 - 25'	2'				
25.0	25 - 26.5'	1.5'				
26.5					CL	silty-clay, 30% silt, 10% 6/6-8 ben-yellow, slightly plus, soft, moist, broken.
27.0						
END OF BORING LOG						

Drill Site Geologist: A.R. Juth  
 Reviewed By: Joseph Reed

Date: 3/3/87  
 Date: 3<sup>RD</sup> 9/16/87

**BOREHOLE SUMMARY LOG**

Borehole E-38 Well NA  
Project Name and Location MW Installation Project Number 17053 074 10  
Drilling Company Boyle Driller Jarvis Rig Number Forking 25 Aug  
Drilling Method(s) auger to 30', rotary to 130' Forking 25

Size(s) and type(s) of bit(s) 1 7/8", 7/8" rock bit  
Borehole Diameter 1 7/8 in. \_\_\_\_\_ cm. \_\_\_\_\_ 0 ft. \_\_\_\_\_ cm. to 30 ft. \_\_\_\_\_ cm.  
7/8 in. \_\_\_\_\_ cm. \_\_\_\_\_ 30 ft. \_\_\_\_\_ cm. to 130 ft. \_\_\_\_\_ cm.

Sampling Methods Continuous core

Total Number Soil Sampling Tubes \_\_\_\_\_

Total Number Core Boxes 14

Number of Gallons Lost Drilling Fluid 0

Date/Time Started Drilling 3-6-87 0738

Date/Time Completed Drilling 3-10-87 1418

Total Borehole Depth 130 ft. \_\_\_\_\_ cm.

Depth to Bedrock 25.8 ft. \_\_\_\_\_ cm.

Depth to Water ~ 10 ft. \_\_\_\_\_ cm.

Water Level Determined By? DR760A water level indicator

Borehole Completed as Monitoring Well? NO

Date/Time Grouting Completed 3-10-87 1700

Depth of Tremmie Pipe 130'

Gallons of Grout 90

Materials Used 9 bags cement, 1 bag bentonite, 90 gals. water

Comments: grouted to surface

Wellsite Geologist C Benson Date 3-23-87

Checked for Grout Settlement on \_\_\_\_\_ by \_\_\_\_\_

Amount of Grout Added \_\_\_\_\_

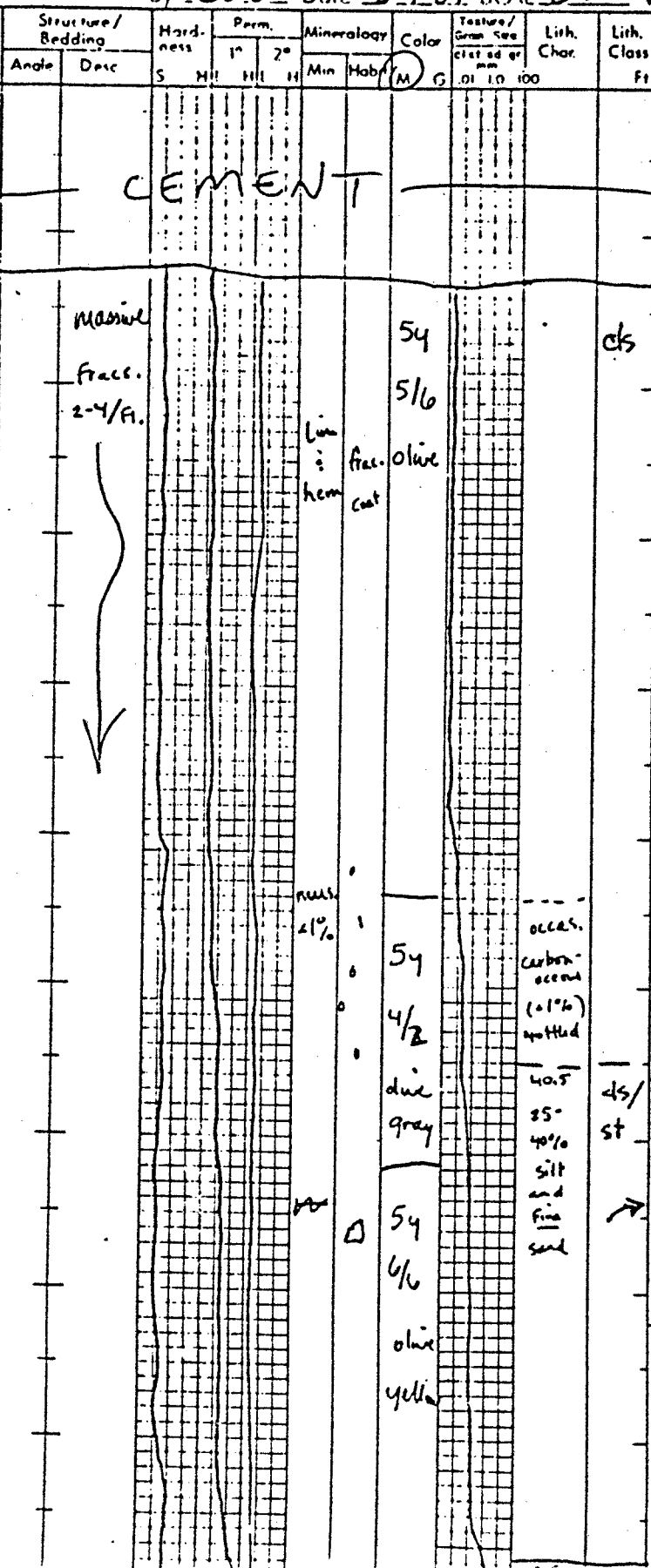
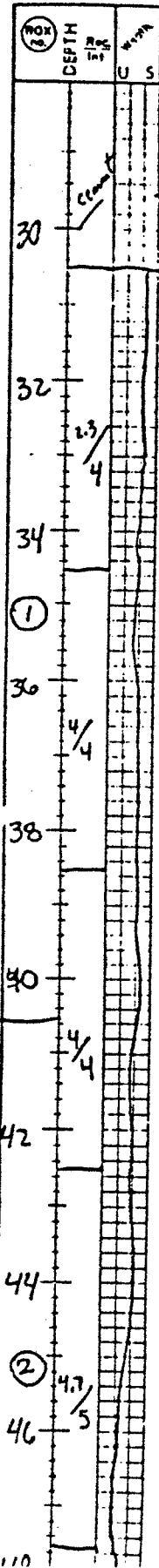
All Measurements from Ground Level

Reviewed by Joseph L. Reed Date 4/13/87

Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

MAX DEPTH Feet	Roc Int	U S	Structure/Bedding		Hardness	Perm.		Mineralogy		Color	Texture/Grain Size clst sd gr mm	Lith. Char.	Lith. Class	Description/Comments
			Anote	Disc		1"	2"	Min	Major					
30														Cement - alluvium logged on soils Log
32														cleopstone
34														lim:hem concentrated as fracture coatings
36														
38														
40														silt to 15%
42														
44														
46														43" 1/2" rounded pebble of calcite/dolomite visible in core
110														rock type change is transitional

ESE, Inc. BORE E-38 WELL(S)



**CEMENT**

Cement - alluvium logged on soils Log

cleopstone

lim:hem concentrated as fracture coatings

silt to 15%

43" 1/2" rounded pebble of calcite/dolomite visible in core

rock type change is transitional

BOX #	DEPTH Feet	U	S	Structure/ Bedding		Hard- ness		Perm.		Mineralogy		Color (M)	Tosses/ Gmm See class of gr mm	Lith. Char	Lith. Class	Description/Comments
				Angle	Desc	S	M	1"	2"	H	M					
	50				Maximal well indicated							54 6/4			SS	SS med.-grained, sub angular to subrounded - qtz. dominant
	52				Fracs. 1 per inch							olive yellow				was not visibly different but cement is calcareous
	54				massive & well indicated							alterat bands 3" to 1"				transition zone of oxidized and unoxidized rock 52' to 59'
	56											thick of 54 6/6 fine yellow				2' of core recovered was the 2' lost from above
	58											2.54 N5/5				
	60				Fracs. 2-4/ft.							gray				oxidized rock begins
	62				massive							very dark				
	64											gray				1.5' of core recovered was lost from previous sample
	66															

ESE, Inc. BORE E-38 WELL(S)

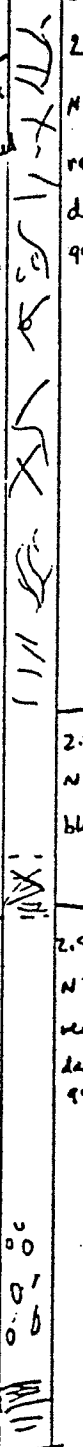
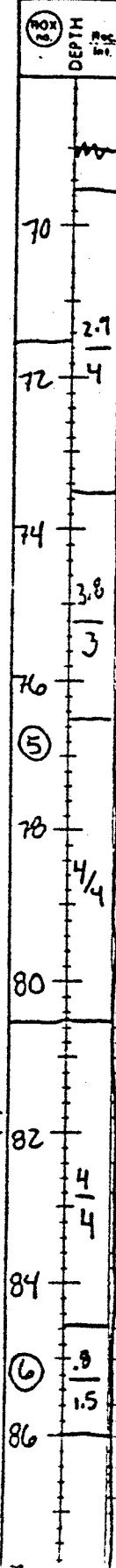
DEPTH Feet	U	S	Structure / Bedding		Hardness		Dorm.		Mineralogy		Color		Testes / Grain Size clst ad gr mm G1 10 100	Lith. Char.	Lith. Class	Description / Comments
			Angle	Desc.	S	HI	1°	2°	Min	Major	M	G				
70									cbn bands mottled		2.54 N3/3 very dark gray		fine grained silty (5%)	SS		
72									mus 4%							
74																
76																
78									cbn		2.74 N2/6 black		73 silt to 10%	cls	.8' recovered was from previous sample	
80											2.54 N3/3 very dark gray		76.5 Lignite			
82									mus 4%				78.4 cls		carbon mottled throughout	
84									cbn bands				79 fine grained, sub angular	SS		
86													80.5 cls			
													82" occal. sandy/silty interbeds			
													84" 1/4" to 1/2" thick carbonaceous	cls		

E, Inc. BORE E-38 WELL(S) \_\_\_\_\_

fracture  
fracture  
fracture

massive

massive



.8' recovered was from previous sample

carbon mottled throughout

DEPTH Feet Int.	Width U S	Structure/ Bedding		Hard- ness	Perm.		Mineralogy		Color M G	Texture/ Grain Size clast sd gr mm 01 10 100	Lith. Char.	Lith. Class	Description/Comments
		Angle	Disc		10	20	Mm	Mobil					
88	2		Massive						2.5y N2/0 black			ck	} 1' recovered was from previous sample
90	2		Fracture to mainly fractured										
92			Massive						2.5y N3/3 very dark gray				} 3' recovered was from previous sample
94													
96	1.5												
98	5												
100	5												
102									2.5y N2/0 black				
104	5		medium but less indurated (only slightly less)						2.5y N5/0 gray				
106													
108	2												

SE, Inc. BORE E-38 WELL(S)

COR DEPTH Feet	U S	Structure/ Bedding		Hard ness		Perm.		Mineralogy		Color (M) G	Texture/ Grain Size percent of gr mm	Lith. Char.	Lith. Class	Description/Comments Ft CM (Scale 1" = 2 (1))
		Angle	Desc	S	M	HL	H	Min	Major					
110	2.5		Massive							25% N5/0 grey		sand to 30%	st	
112	4													
114	5.15												ss	
116													ss	
118	5												cls	
120														
122	2.10													
124	3.7												ss	
126	1.8		bedding											

E, Inc. BORE E-38 WELL(S)

4" sand/clay

123.5  
silty  
sandy

.7' recovered was from previous sample

carbon following bedding planes and mottled throughout (1-4%)

DEPTH FEET	Dip		Structural/ Bedding		Hard- ness		Form.			Mineralogy		Color	Texture/ Grain Size Fines % or 0 10 100	Lith. Char	Lith. Class	Description/Comments FI CM (Scale 1" = 2' 1")
	U	S	Angle	Desc	S	H	1"	2"	Min	Hard						
10 18 2 130				Massive								grey MS/0		sil 2% fine sand	SS	very carbon rich
																130' END OF HOLE

SE, Inc. BORE E-38 WELL(S) \_\_\_\_\_

**FL**  
**Frontier Logging**  
 Lakewood, Colorado

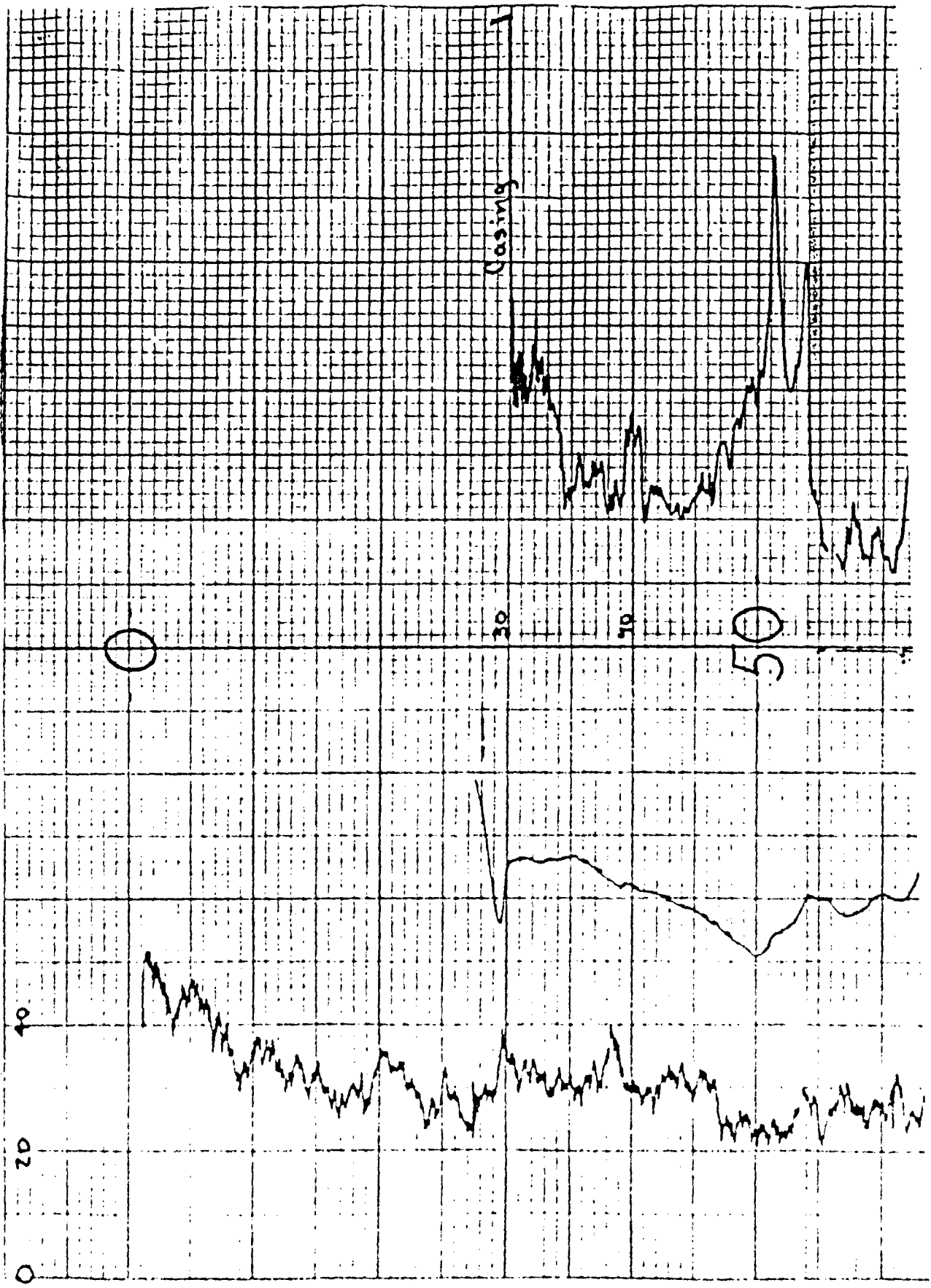
Date **Max. 10, 1987**  
 Driller **130 FT**  
 Depth **3 7/8"**  
 Core Length **30 feet**  
 Unit No. **1445**  
 Operator **W2 Linton**  
 Location **Lakewood**

**ESE**  
**E-38**  
**BMA**  
 Adams County  
 Colorado  
 Ground Level

Equipment Data		Scale		Scale		Scale	
TC	Logging Speed	TC	Logging Speed	TC	Logging Speed	TC	Logging Speed
129 Feet							
300 scales 20							
2							

Gamma (Analog)		Gamma (Digital)		Caliper		Temperature		Closure		Azimuth		True Vertical	
TC	Logging Speed	TC	Logging Speed	TC	Logging Speed	TC	Logging Speed	TC	Logging Speed	TC	Logging Speed	TC	Logging Speed
103-1041		xtcl 3/4 x 1 3/4"		1.60 x 10 <sup>-5</sup>		7		3 7/8"		50 ohms/5"		15 MV/Inch	

RESISTANCE **150** OHMS/5 INCHES  
 S.P. **15 MV**  
 NATURAL GAMMA **20**

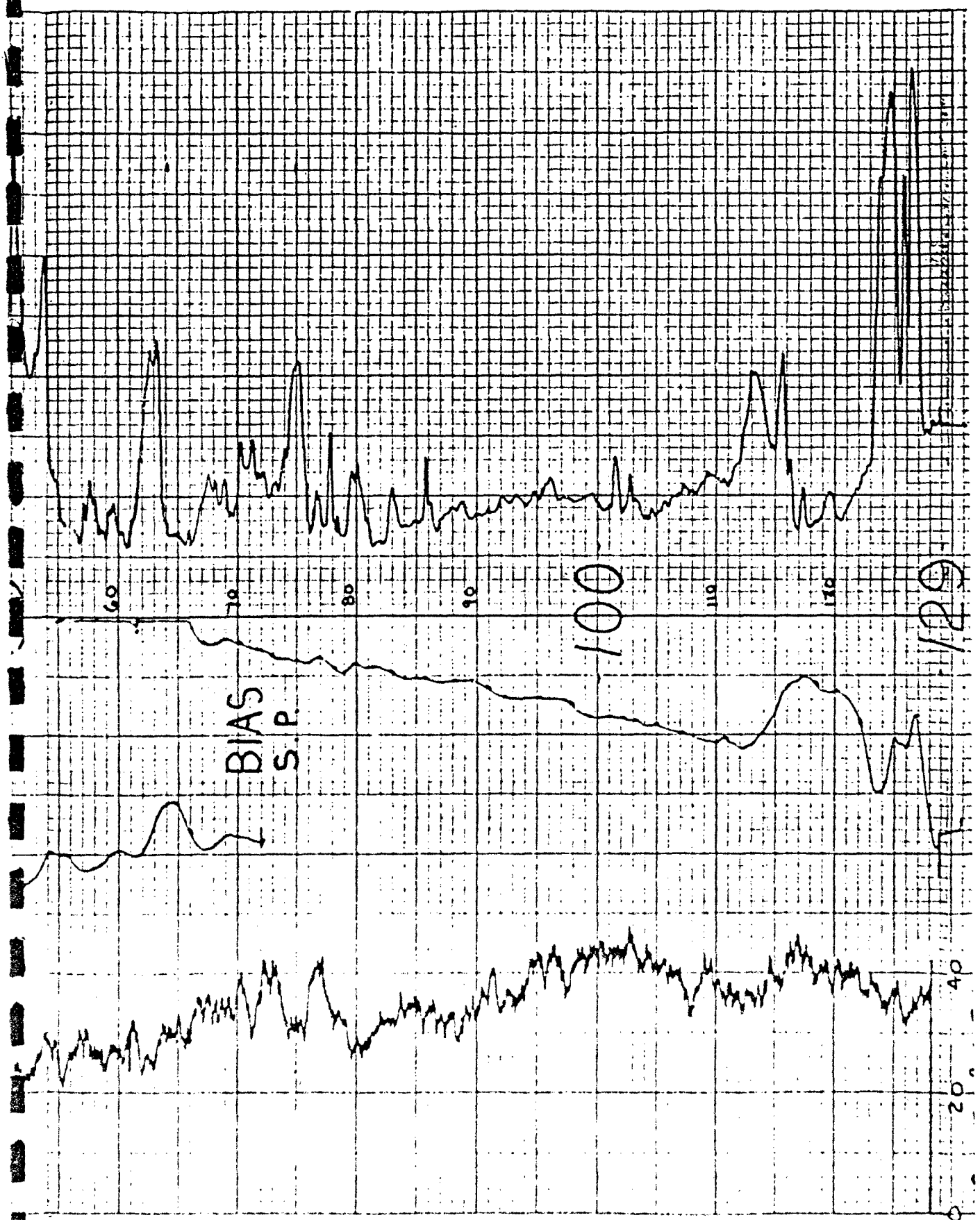


RESISTANCE  
50 OHMS 5 inches

S.P.  
15 MV

20

FRONTIER LOGGING CORPORATION



NO. C0134

DATE

129

20  
40  
COUNTS PER SECOND

NATURAL  
GAMMA

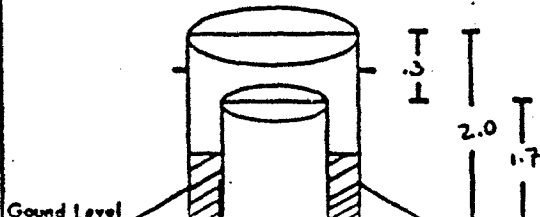
S.P.  
15 MV/INCH

RESISTANCE  
50 OHMS/5 INCHES

HOLE E-38

Borehole: E-3901

Well: 37387

Depth-Feet	Soil/Rock Type	Well Completion	Description
		 <p>The diagram shows a well completion with an 8-inch casing. Key features include a bentonite seal at 21 feet, a sand pack at 26 feet, and a screen section from 28 feet to 42.66 feet. A ground level is indicated at the top. Vertical dimensions on the right side of the diagram are 1.3, 2.0, and 1.7 feet.</p>	
<p>5 10 15 20 25 30 35 40 45</p>		<p>6.55' جنز 16.61' جنز 26.66' جنز 28' 32.4' 36.78' جنز 42.66'</p>	<p>8" casing TOP OF BENTONITE SEAL TOP OF SAND PACK TOP OF SCREEN BOTTOM OF HOLE, SCREEN</p>

Drill Site Geologist: C. Deuser  
 Reviewed By: Joseph L. Reed

Date: 4.9.07  
 Date: 5/20/07

WELL CONSTRUCTION SUMMARY

Borehole E-3901 Well 37387  
 Project Name and Location MW Installation Project Number 1705307410  
 Drilling Company Boyles Driller B. Roach Rig Number Failing 25  
 Drilling Method(s) Rotary with mud (bentonite and water)

Borehole Diameter 12 1/4 in. \_\_\_\_\_ cm. \_\_\_\_\_ 0 ft. \_\_\_\_\_ cm. to \_\_\_\_\_ 21 ft. \_\_\_\_\_ cm.  
7/4 in. \_\_\_\_\_ cm. \_\_\_\_\_ 21 ft. \_\_\_\_\_ cm. to \_\_\_\_\_ 42.66 ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) 12 1/4" blade  
bit, 7/4" blade bit

Sampling Method(s) not sampled  
 Date/Time Start Drilling 4-8-87 0942

Size and Type PVC Schedule 40, 4"

Date/Time Finish Drilling 4-8-87 0936

Total Borehole Depth 42.66 ft. \_\_\_\_\_ cm.

Date/Time Start Completion 4-8-87 0936

Depth to Bedrock 17 ft. \_\_\_\_\_ cm.

Date/Time Cement Protective Casing 4-8-87 1151

Depth to Water N.A. ft. \_\_\_\_\_ cm.

Materials Used \_\_\_\_\_

Water Level Determined By not determined

Plain PVC 4x10"

Length Plain PVC (total) 35.70 ft. \_\_\_\_\_ cm.

Slotted PVC 1x5"

Length of Screen 5.88 ft. \_\_\_\_\_ cm.

Bentonite Pellets 1.5 buckets

Total Length of Well Casing 44.36 ft. \_\_\_\_\_ cm.

Bentonite Granular none <sup>503</sup> 1/2 bag

PVC Stick Up 1.7 ft. \_\_\_\_\_ cm.

Cement 5 bags cement

Depth to Bottom of Screen 42.66 ft. \_\_\_\_\_ cm.

Sand 2 bags

Depth to Top of Screen 36.78 ft. \_\_\_\_\_ cm.

Water added during completion \_\_\_\_\_

Depth to Top of Sand 32.4 ft. \_\_\_\_\_ cm.

Water added during drilling \_\_\_\_\_

Depth to Top of Bentonite 78 ft. \_\_\_\_\_ cm.

Total Gallons of water added \_\_\_\_\_

Drill Site Geologist C. Benson Date 4-9-87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 05/08/87 1250 <sup>SMH</sup> PJB

Date/Time/Personnel Casing Painted 05-12-87 0800 SMH PJB

Date/Time/Personnel Numbers Painted 05-12-87 1255 SMH PJB

Materials Used 10 Bags Quickcrete 1 Roll Lumber Edging

		COMMENT/NOTES
Top of Protective Casing to Top of PVC	<u>0.25</u> ft. _____ cm.	
Top of Protective Casing to Weep Hole	<u>0.51</u> ft. _____ cm.	
Top of Protective Casing to Internal Mortar	<u>0.52</u> ft. _____ cm.	
Top of Protective Casing to Top of Cement Pad	<u>1.95</u> ft. _____ cm.	
Top of Protective Casing to Ground Level	<u>1.95</u> ft. _____ cm.	

Reviewed By Joseph L. Reed Date 6/19/87  
 Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

Borehole: E39D2

Well: 37388

Depth-Feet	Soil/Rock Type	Well Completion	Description
5			
10			
15			
20			20' 12" steel casing
25			
30			
35			
40			45' 8" steel casing
45			
50			
55			
60			TOP OF BENTONITE SEAL 57.6
65			TOP OF SAND PACK 64.2
70			TOP OF SCREEN 69.78'
75			
80			
85			
90			Total Depth 86'

Drill Site Geologist: C. Bensen  
 Reviewed By: Joseph K. Reed

Date: 4/11/87  
 Date: 5/20/87

WELL CONSTRUCTION SUMMARY

Borehole E39DZ Well 37388  
 Project Name and Location MW Installation Project Number 1705207410  
 Drilling Company Boyles Driller B. Roach Rig Number Falling 25  
 Drilling Method(s) Rotary sampling with bentonite mud

Borehole Diameter 11 1/2 in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.  
7 7/8 in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.  
45 to 86"

Size(s) and types of Bit(s) 11 1/2" blade, 11 1/2" blade and 7 7/8" blade bit

Sampling Method(s) not sampled

Date/Time Start Drilling 4-10-87 0737

Size and Type PVC 4" schedule 40

Date/Time Finish Drilling 4-10-87 0910

Total Borehole Depth 86 ft. \_\_\_\_\_ cm.

Date/Time Start Completion 4-10-87 0910

Depth to Bedrock 17 ft. \_\_\_\_\_ cm.

Date/Time Cement Protective Casing 4-10-87 1212

Depth to Water \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Materials Used \_\_\_\_\_

Water Level Determined By \_\_\_\_\_

Plain PVC 7 x 10 5 x 1

Length Plain PVC (total) 71.48 ft. \_\_\_\_\_ cm.

Slotted PVC 1 x 10 1 x 5

Length of Screen 16.22 ft. \_\_\_\_\_ cm.

Bentonite Pellets 2 buckets

Total Length of Well Casing 87.7 ft. \_\_\_\_\_ cm.

Bentonite <sup>powder</sup> Granular 1 bag

PVC Stick Up 1.7 ft. \_\_\_\_\_ cm.

Cement 13 bags

Depth to Bottom of Screen 86 ft. \_\_\_\_\_ cm.

Sand 2 1/2 bags

Depth to Top of Screen 69.78 ft. \_\_\_\_\_ cm.

Water added during completion -

Depth to Top of Sand 64.2 ft. \_\_\_\_\_ cm.

Water added during drilling -

Depth to Top of Bentonite 57.8 ft. \_\_\_\_\_ cm.

Total Gallons of water added -

Drill Site Geologist C Pearson

Date 4-10-87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 05/08/87 1330 PJB

Date/Time/Personnel Casing Painted 05-12-87 0800 PJB/SMH

Date/Time/Personnel Numbers Painted 05-12-87 14:00 PJB/SMH

Materials Used \_\_\_\_\_

	ft.	cm.	COMMENT/NOTES
Top of Protective Casing to Top of PVC	<u>2.26</u>	_____	_____
Top of Protective Casing to Weep Hole	<u>1.46</u>	_____	_____
Top of Protective Casing to Internal Mortar	<u>1.46</u>	_____	_____
Top of Protective Casing to Top of Cement Pad	<u>1.85</u>	_____	_____
Top of Protective Casing to Ground Level	<u>1.96</u>	_____	_____

Reviewed By Joseph L. Reed Date 6/4/87

Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

BOREHOLE SUMMARY LOG

Borehole E 39A Well \_\_\_\_\_  
Project Name and Location T-36 1/4 MILE N OF 96<sup>TH</sup> ST ALONG R. SECTION <sup>FARMER/IANE</sup> Project Number \_\_\_\_\_  
Drilling Company Boyles Bros Driller Dave Jarvis Rig Number 5451  
Drilling Method(s) Augur

Size(s) and type(s) of bit(s) \_\_\_\_\_  
Borehole Diameter 8 in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.  
\_\_\_\_\_ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Sampling Methods CONTINUOUS Split Spoon

Total Number Soil Sampling Tubes 10 - 2 FT

Total Number Core Boxes 2

Number of Gallons Lost Drilling Fluid 0

Date/Time Started Drilling 3/25/07 — 0815

Date/Time Completed Drilling 3/25/07 — 0915

Total Borehole Depth 20' ft. \_\_\_\_\_ cm.

Depth to Bedrock 17' ft. \_\_\_\_\_ cm.

Depth to Water 19' ft. \_\_\_\_\_ cm.

Water Level Determined By? Samples

Borehole Completed as Monitoring Well? No

Date/Time Grouting Completed 3/25/07 1035

Depth of Tremmie Pipe 50'

Gallons of Grout 50

Materials Used 3 BAGS OF CEMENT / 16 LBS ARMYTANITE

Comments 20' OF 4" PVC GROUTED IN PLACE TO BE USED AS SUCKER CASING FOR EXPLORATORY BORING E-39

Wellsite Geologist GARY LITUS Date 3/25/07

Checked for Grout Settlement on 4/28/87 by JLR

Amount of Grout Added \_\_\_\_\_

All Measurements from Ground Level \_\_\_\_\_

Reviewed by Joseph Reed Date 4/28/87

Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

Borehole: E 39 A Well Number: Dry Hole

SOILS LOG					
Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification
					MUNSELL Colors
1.5	7-0	2'	NA	7-2	ML ML <u>sandy-silt</u> , ~20-30% s.f. gr. sand, 10YR, 4/3-4. dk. yash. brn., non-plas., loose, moist, alluvium
	7-1	1.2'		7-1	
	7-6	2'		7-6	SM SM <u>silty-sand</u> , ~30-40% silt, 10YR 5/4-6, yash. brn., non-plas., loose, moist alluvium
6.5	6-7	0.9'		6-7	
7.0	6-9	1.25'		6-9	At 6.5' present silt decreases to ~20%, color changes to 10YR, 6/6-6, brnch. yellow.
	9-11	1.25'		9-11	

Drill Site Geologist: A.S. Patten Date: 3/27/87  
 Reviewed By: Joseph L. Reed Date: 4/16/87

Borehole: E 39.A Well Number: Dry Hole

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						Munsell Colors
	11-13'	1.7'	NA	11-13'	ML	ML sandy-silt, ~ 30% v. f. or sand, 10YR 5/6-8, gray-bm; non-plas., loose, moist alluvium.
	13-15'	1.2'		13-15'	SC	SC clayey-sand, ~ 20-30% clay, 10YR 5/3-4, brown, slight plas., v. soft, moist, alluvium. At 14.0', percent clay increases to ~ 40%, color changes to 10YR 6/3-4, pale br.
	15-17'	2'		15-17'		At 16.0' color changes to 10YR 5/2-3, gray br.
	17-19'	2'		17-19'	CL	CL sandy-clay, ~ 5-10% v. f. or calc. sand, 10YR 5/1-2 gray br, low plas., soft, moist bedrock.
	19-25'	1'		19-25'	WT	At 19.0' moisture increases to saturated.
						END OF BORING LOG -
						AKO

Drill Site Geologist: [Signature] Date: 3/27/87  
 Reviewed By: [Signature] Date: 4/16/87

**BOREHOLE SUMMARY LOG**

Borehole E-39 Well -  
Project Name and Location MW Installation Project Number 17052 07410  
Drilling Company Bayus Driller B Roach Rig Number Failing 25  
Drilling Method(s) Rotary - drill mud used  
Size(s) and type(s) of bit(s) 3 7/8" tricone bit  
Borehole Diameter 3 7/8 in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to 130 ft. \_\_\_\_\_ cm.  
\_\_\_\_\_ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.  
Sampling Methods continuous core  
Total Number Soil Sampling Tubes -  
Total Number Core Boxes 14  
Number of Gallons Lost Drilling Fluid ~ 1400 gals. - water lost 50'  
Date/Time Started Drilling 4-2-87 1109  
Date/Time Completed Drilling 4-3-87 1640  
Total Borehole Depth 130 ft. \_\_\_\_\_ cm.  
Depth to Bedrock 17 ft. \_\_\_\_\_ cm.  
Depth to Water unknown ft. \_\_\_\_\_ cm.  
Water Level Determined By? A.A.  
Borehole Completed as Monitoring Well? NO  
Date/Time Grouting Completed 4-6-87 1330  
Depth of Tremmie Pipe 125'  
Gallons of Grout 95  
Materials Used 9 1/2 bags cement, 9/10 bag bentonite, 95 gals water  
Comments hdc grouted to surface

Wellsite Geologist C Benson Date 4-6-87  
Checked for Grout Settlement on 6/11/87 by JRL  
Amount of Grout Added 0  
All Measurements from Ground Level  
Reviewed by Joseph L. Reed Date 6/11/87  
Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

Core No.	Depth (ft)	Structural/Bedding		Hardness	Fracture	Mineralogy		Color	Grain Size (mm)	Lith Char	Lith Class	Description/Comments
		Angle	Dip			Min	Major					
												C-20' Logged on soil Log Form
	20										CL	Claystone
	22	4.7						2.5y	0.4			light yellowish brown
	24											
	26	2.8										20' st sandy - sand 10%
	28											
	30	5.2										
	32											
	34	2.5										
	36											No Recovery
	38											
	40											
	42											
	44											
	46											
	48											
	50											

E, Inc. CORE E-39 WELL(S)

Massive  
↓

concretion  
frag  
↓

No Recovery

Depth (ft)	Core No.	Structure/Bedding	Mineralogy	Color	Lith. Class	Description/Comments
38	217	Massive	mus. 1%	gray	SS	SANDSTONE lentic staining pervasive
40			lim. 2%	6/6 brownish yellow		
42	515	Massive	FeO stain	2.5g	CL	CLAYSTONE
44	518		FeO carb frag	5/6 light olive brown		
46						
48	313	Fault gouge ↓ siderite visible	occ. carb		CL	Clay with calcareous pebbles  Gcc grains of water lost during drilling of this interval and following this interval  "imbricated/prophyritic" texture - clay with pebb. cobbles (primary calc.)
50						
52	519	Massive			CL	CLAYSTONE
54						
56	515		occ. FeO on frnt	2.5g N3/0 very dk gray	CL	Lignite Lignite Lignite
			mus. 1%		CL	CLAYSTONE

E, Inc. BORE WELL(S)

Elev ft	Depth ft	Structure/ Building Angle Date	Remarks	Mineralogy Min. Abund.	Color No.	Lith. Char.	Lith. Class	Description/Comments CM (Scale 1" = 2 ft)
SE				26% 4%	7.5y N40	carbon- rich	CL	Claystone
60	3.8 4		fault zone	calc. pyroxene	7.5y N40			} gouge - clay with calcareous pyroxene - some calc. cement
62			massive	2% 2%	7.5y N30 very dark gray	66 carbon- rich (19%) silt 5%	SS	
64				1%	7.5y N20 black	63 clay to 10%	L4	Lignite shaly clayey
66	5 5							
68	2.4 2			2.5y N30 dark gray		67	CL	Claystone
70								oxidation boundary (?) may be a little higher - due to to siliceous matrix due to intense pressure carbonaceous matter.
72	4 4							
74			bedded prop. to long axis of core			75 abs. fallow bedding carbon- rich frags	SS	SANDSTONE coarse grained to med fine to med grained
76	5 5							

ESE, Inc. BORE WELL(S)

Depth (ft)	Interval	Structure / Bedding	Mineralogy	Color	Lith. Char.	Lith. Class.	Description / Comments
78	F13	Medium ↓	Cm 12-15%	2.5y 8 3/0 very dark	7"	SS	Claystone interbed
80	F14					SS	
82	F15	↓	Cm 12-15%	4.5y	8"	SS	SANDSTONE silt, siltstone near siltstone and claystone interbeds 2-4" thick
84	F16					SS	
86	F17	↓	Cm 12-15%	4.5y	8"	SS	SANDSTONE silt, siltstone near siltstone and claystone interbeds 2-4" thick
88	F18					SS	
90	F19	↓	Cm 12-15%	4.5y	8"	SS	SANDSTONE silt, siltstone near siltstone and claystone interbeds 2-4" thick
92	F20					SS	
94	F21	↓	Cm 12-15%	4.5y	8"	SS	SANDSTONE silt, siltstone near siltstone and claystone interbeds 2-4" thick
96	F22					SS	

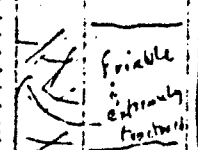
ESE, Inc. CORE LOG No. CPG Date 4-7-27. POPE E-39 Well(s) \_\_\_\_\_ Page 4 of 6

Depth (ft)	Interval	Structural Building Angle Pace	Diagram	Mineralogy		Color	Festness / Grain Size			Lith Class	Description / Comments
				Min	Block		10-20	20-40	40-100		
98	5 2			Ch	5%	2.5y W/S very dark grey			CL	CLAYSTONE silty with clayey areas mottled throughout	
100											
102	5 5			Col.		col. calc valley brails & Ocean Xtals					
104											
106	5 12										
108											
110	5 4										
112									SS	SILTSTONE, SANDSTONE interbedded	
114	5 13										
116											
									CL	CLAYSTONE	

E, Inc BORE WELLS(S)

(9)

(10)



Alpsian

friable

massive

friable

Ch  
to  
5%

Col.  
calc  
valley  
brails  
&  
Ocean  
Xtals

mass  
fine  
grained

Silt  
19%

Ch  
to  
7%

Ch

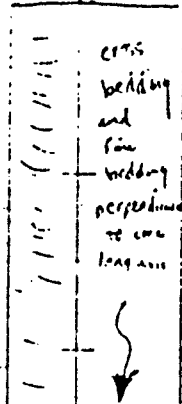
98  
will  
10%

Silt  
20-40%  
(very)  
sands  
to  
50%

silt  
5%

CM (Scale 1" = 2 ft)

Depth (ft)	Dip (°)	Bedding Angle (°)	Mineralogy	Color	Lith. Char.	Lith. Class	Description/Comments
118				2.54	shaly	CL	CLAYSTONE
120			thin to 2 1/2"	M3/O	shaly	CL	
122			thin to 3 1/2"	very dark gray	120' silt 10-10 1/2%	SS	SANDSTONE with siltstone & occasional claystone interbeds
124			thin to 4"				carbon mottled through core and following bedding planes
126							
128							
130							



WELLS 229 BORE (WELLS)

END OF CORING AT 130'



Frontier Logging

LAKEWOOD, COLORADO

ESE

E-39

RMA

ADAMS COUNTY

COLO

Ground level

Ground level

Date APRIL 6, 1987

Driller Depth 130 FT.

3 7/8"

Unit No 110

Operator W. Hinton

Location Lakewood

EQUIPMENT DATA

128 FT

Natural Gamma 200 Scale = 20

2

15

103-104H

xtel 3/4 x 1/4

7

160 x 10<sup>-5</sup>

40 + 50 ohms

20 MV/INCH

6 trips into hole  
sluggish/sloppy boots in hole

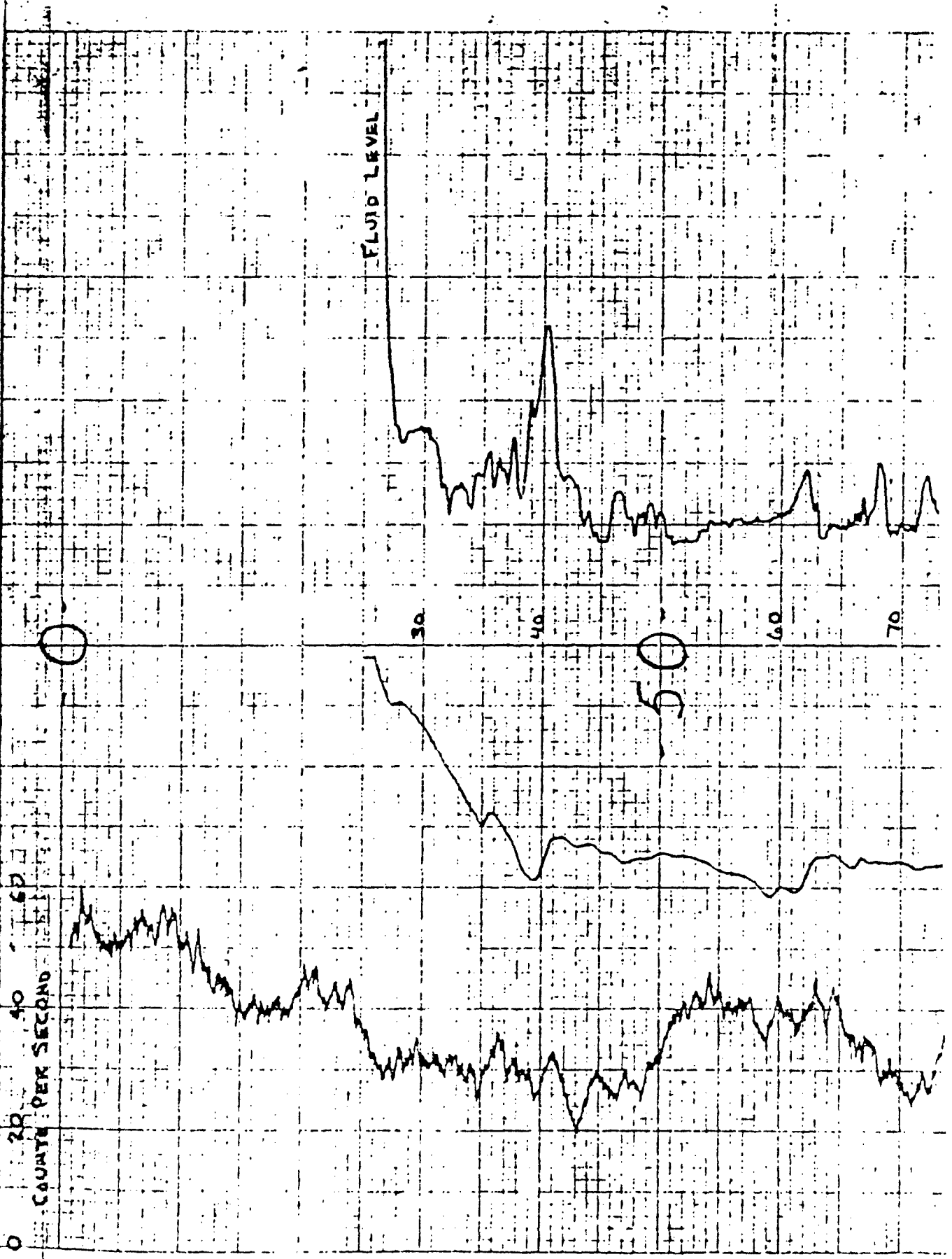
NATURAL GAMMA

S.P.

RESISTANCE

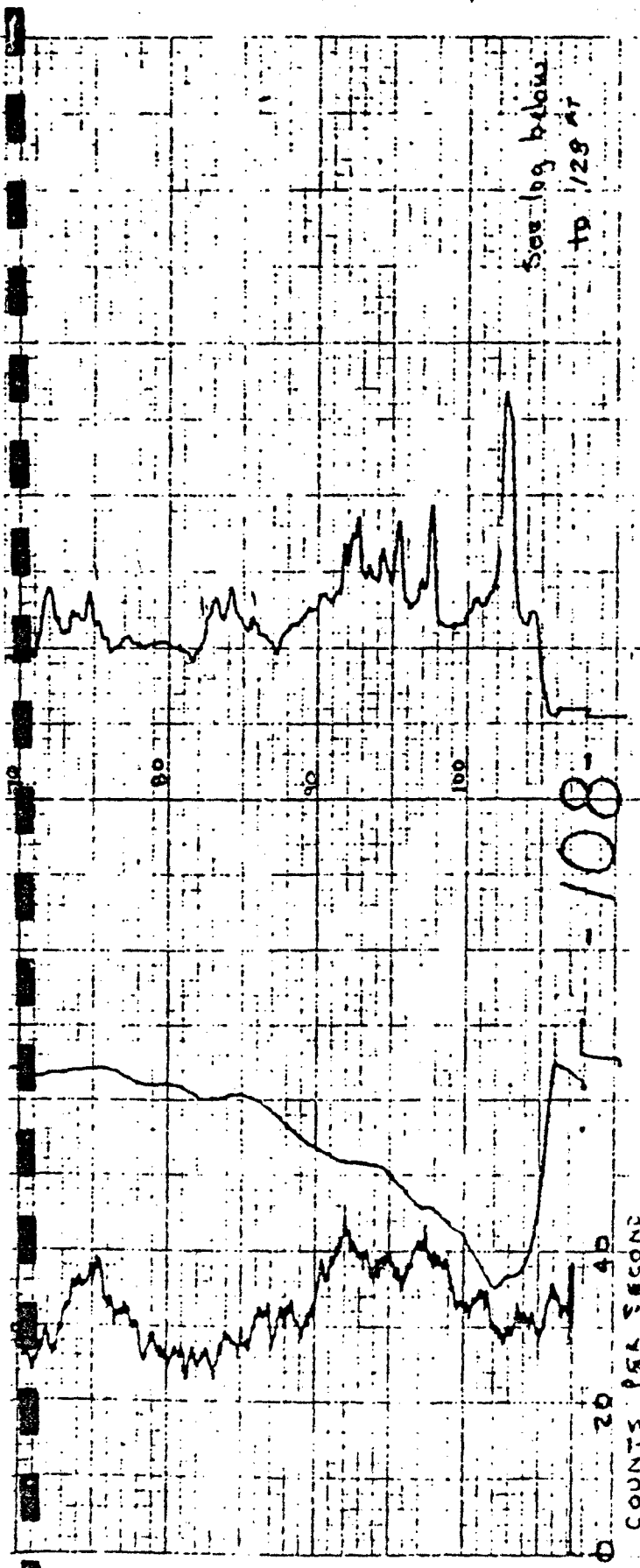
UNIVERSITY MICROFILMS

ORIGIN



No. 0017102

PRINTED IN U.S.A.



See log below  
to 128 at

108

20  
COUNTS PER SECOND

NATURAL S.P. GAMMA 20 MV/INCH

RESISTANCE 50 OHMS/5 INCHES

F-39

0

50



DRILL PIPE TO SCRAP

INSIDE OPEN HOLE

20  
COUNTS PER SECOND

NATURAL  
GAMMA

5 P  
20 MV/INCH

RESISTANCE

40 OHMS/5 INCHES

DRILL PIPE

100

128

HOLE # 39

WELL CONSTRUCTION SUMMARY

Borehole E40A Well 37370  
 Project Name and Location RMA offsite Project Number \_\_\_\_\_  
 Drilling Company Boyer Bros. Driller D. Jarvie Rig Number B57  
 Drilling Method(s) continuous core

Borehole Diameter 12 1/4 in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to 25.8 ft. \_\_\_\_\_ cm.  
~~10~~ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) 3/4" hollow stem auger Sampling Method(s) continuous core  
 Date/Time Start Drilling 1-21-87 0919

Size and Type PVC 4" schedule 80 Date/Time Finish Drilling 1-21-87 1101

Total Borehole Depth 27 ft. \_\_\_\_\_ cm. Date/Time Start Completion 1-21-87 1152

Depth to Bedrock 25.8 ~~ft.~~ <sup>ft.</sup> \_\_\_\_\_ cm. Date/Time Cement Protective Casing 1-21-87 1435

Depth to Water 9 ft. \_\_\_\_\_ cm. Materials Used 7-4" tubes 1-10" piece cas

Water Level Determined By field observation Plain PVC 2 10" piece

Length Plain PVC (total) 7.1 ft. \_\_\_\_\_ cm. Slotted PVC 2 10" piece

Length of Screen 21.41 ft. \_\_\_\_\_ cm. Bentonite Pellets 50 gal.

Total Length of Well Casing 28.5 ft. \_\_\_\_\_ cm. Bentonite Granular 10 lb.

PVC Stick Up 2.7 ft. \_\_\_\_\_ cm. Cement 1 bag

Depth to Bottom of Screen 25.8 ft. \_\_\_\_\_ cm. Sand 13 1/2 bags

Depth to Top of Screen 4.4 ft. \_\_\_\_\_ cm. Water added during completion 30 gal.

Depth to Top of Sand 3 ft. \_\_\_\_\_ cm. Water added during drilling 0

Depth to Top of Bentonite 2 ft. \_\_\_\_\_ cm. Total Gallons of water added 30 gal.

Drill Site Geologist C.D. Benson Date 1-21-87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 2/10/87 10106 JWF KWP

Date/Time/Personnel Casing Painted 2/10/87 1315 KWP

Date/Time/Personnel Numbers Painted 4/15/87 1115 JWF BAL

Materials Used 10 bags Quikrete

Top of Protective Casing to Top of PVC 0.6 ft. \_\_\_\_\_ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 2.34 ft. \_\_\_\_\_ cm. \_\_\_\_\_

Top of Protective Casing to Internal Mortar 2.4 ft. \_\_\_\_\_ cm. \_\_\_\_\_

Top of Protective Casing to Top of Cement Pad 3.05 ft. 3.30 cm. \_\_\_\_\_

Top of Protective Casing to Ground Level 3.05 ft. \_\_\_\_\_ cm. \_\_\_\_\_

Reviewed By Joseph L. Reed Date 6/11/87

Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

Borehole: E40A

Well: 37370

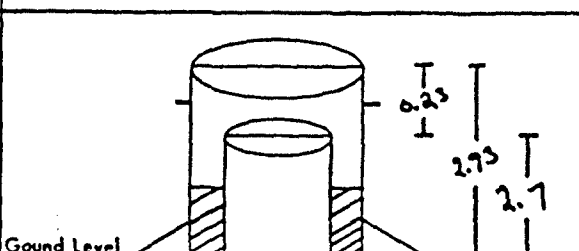
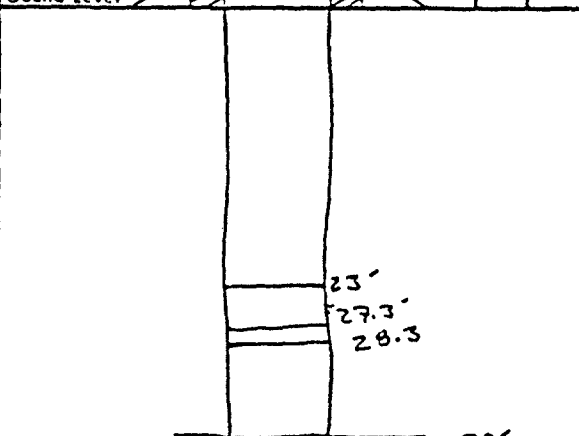
Depth-Feet	Soil/Rock Type	Well Completion	Description
<p>2</p> <p>4</p> <p>6</p> <p>8</p> <p>10</p> <p>12</p> <p>14</p> <p>16</p> <p>18</p> <p>20</p> <p>22</p> <p>24</p> <p>26</p> <p>28</p>			<p>TOP OF BENTONITE 2'</p> <p>TOP OF SAND 3'</p> <p>TOP OF SCREEN 4.4' / Joint</p> <p>Water Level 9'</p> <p>Joint at 14.91'</p> <p>Bottom of Screen 25.8'</p>

Drill Site Geologist: C.D. Benson  
 Reviewed By: Joseph L. Reed

Date: 1.21.87  
 Date: 6/11/87

Borehole: 340 Piezometer

Well: 37371

Depth-feet	Soil/rock Type	Well Completion	Description
			
5 10 15 20 25 30 35			TOP OF BENTONITE SEAL SAND TOP OF BENTONITE COB TOP OF SCREEN  Total Depth

Drill Site Geologist: C. D. Benson  
 Reviewed By: Joseph L. Reed

Date: 7-6-87  
 Date: 7/9/87

WELL CONSTRUCTION SUMMARY

Borehole E40 Piezometer Well 37371  
 Project Name and Location offpost monitor well Project Number \_\_\_\_\_  
 Drilling Company Boyles Driller B. Roach Rig Number 760  
 Drilling Method(s) continuous core

Borehole Diameter 7 7/8 in. \_\_\_\_\_ cm. 0 ft. \_\_\_\_\_ cm. to 39 ft. \_\_\_\_\_ cm.  
 \_\_\_\_\_ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) 7 7/8 Sampling Method(s) NA

Size and Type PVC 2" Schedule 40 Date/Time Start Drilling 2-5-87 1023

Total Borehole Depth 39 ft. \_\_\_\_\_ cm. Date/Time Finish Drilling 2-5-87 1512

Depth to Bedrock 27 ft. \_\_\_\_\_ cm. Date/Time Start Completion 2-5-87 1536

Depth to Water 7 ft. \_\_\_\_\_ cm. Date/Time Cement Protective Casing 2-6-87 1105

Water Level Determined By visual Materials Used \_\_\_\_\_

Length Plain PVC (total) 34.36 ft. \_\_\_\_\_ cm. Plain PVC 3x10" 1x5"

Length of Screen 10.63 ft. \_\_\_\_\_ cm. Slotted PVC 1x10"

Total Length of Well Casing 44.99 ft. \_\_\_\_\_ cm. Bentonite Pellets 1 bucket

PVC Stick Up 2.7 ft. \_\_\_\_\_ cm. Bentonite Granular 1 bag

Depth to Bottom of Screen 39 ft. \_\_\_\_\_ cm. Cement 7 bags

Depth to Top of Screen 28.3 ft. \_\_\_\_\_ cm. Sand 3 bags

Depth to Top of Sand 27.3 ft. \_\_\_\_\_ cm. Water added during completion none

Depth to Top of Bentonite 23 ft. \_\_\_\_\_ cm. Water added during drilling none

Drill Site Geologist C.D. Bussell Date 2-6-87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 2/10/87 JWF

Date/Time/Personnel Casing Painted JWF BAG 4/15/87 1049

Date/Time/Personnel Numbers Painted JWF BAG 4/15/87 1049

Materials Used 13 Bags Quikrete

Top of Protective Casing to Top of PVC 0.23 ft. \_\_\_\_\_ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 2.13 ft. \_\_\_\_\_ cm. \_\_\_\_\_

Top of Protective Casing to Internal Mortar 2.19 ft. \_\_\_\_\_ cm. \_\_\_\_\_

Top of Protective Casing to Top of Cement Pad 2.57 ft. \_\_\_\_\_ cm. \_\_\_\_\_

Top of Protective Casing to Ground Level 2.93 ft. \_\_\_\_\_ cm. \_\_\_\_\_

Reviewed By Joseph L. Reed Date 7/9/87

Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

WELL CONSTRUCTION SUMMARY

Borehole E40 DE Well JR 373 37372  
 Project Name and Location MW Installation - off post 96th Ave. Project Number \_\_\_\_\_  
 Drilling Company Baylen Driller B. Roach Rig Number TH-60  
 Drilling Method(s) Continuous wire

Borehole Diameter 7 7/8 in. \_\_\_\_\_ cm. 0 ft. \_\_\_\_\_ cm. to 96.3 ft. \_\_\_\_\_ cm.  
 \_\_\_\_\_ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) 7 7/8" OD

Sampling Method(s) Continuous core

Size and Type PVC 4" schedule 40

Date/Time Start Drilling 1-23-87 1051

Total Borehole Depth 43.5 ft. 96.3 cm.

Date/Time Finish Drilling 1-29-87 1404

Depth to Bedrock 26 ft. \_\_\_\_\_ cm.

Date/Time Start Completion 1-3-87 0736

Depth to Water 9 ft. \_\_\_\_\_ cm.

Date/Time Cement Protective Casing 2-5-87 1300

Water Level Determined By visual

Materials Used 10 CORE BOXES

Length Plain PVC (total) 33.32 ft. 73.04 cm.

Plain PVC 20.32 (7:10')

Length of Screen 26.94 ft. cm.

Slotted PVC 26.96 (12:10', 1:5')

Total Length of Well Casing 27.28 ft. 99.11 cm.

Bentonite Pellets 4 buckets

PVC Stick Up 2.2 ft. \_\_\_\_\_ cm.

Bentonite Granular 4 buckets

Depth to Bottom of Screen 38.5 ft. \_\_\_\_\_ cm.

Cement 26 bags

Depth to Top of Screen 66.5 ft. \_\_\_\_\_ cm.

Sand 7 bags

Depth to Top of Sand 60.5 ft. \_\_\_\_\_ cm.

Water added during completion \_\_\_\_\_

Depth to Top of Bentonite 56 ft. \_\_\_\_\_ cm.

Water added during drilling \_\_\_\_\_

Total Gallons of water added \_\_\_\_\_

Drill Site Geologist C.D. Jensen

Date 2-5-87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 2/10/87 0930 Jwf KWP

Date/Time/Personnel Casing Painted 2/10/87 1400 KWP

Date/Time/Personnel Numbers Painted 4/5/87 1100 Jwf BAB

Materials Used 10 BAGS QUICKCRETE

Top of Protective Casing to Top of PVC 0.43 ft. \_\_\_\_\_ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 1.91 ft. \_\_\_\_\_ cm. \_\_\_\_\_

Top of Protective Casing to Internal Mortar 3.15 ft. \_\_\_\_\_ cm. \_\_\_\_\_

Top of Protective Casing to Top of Cement Pad 2.35 ft. \_\_\_\_\_ cm. \_\_\_\_\_

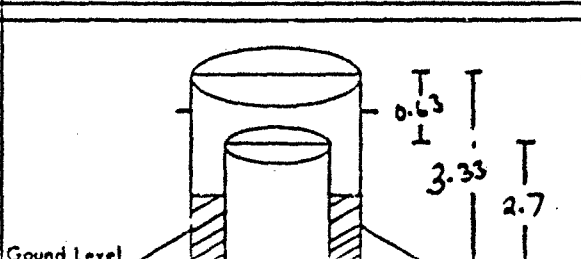
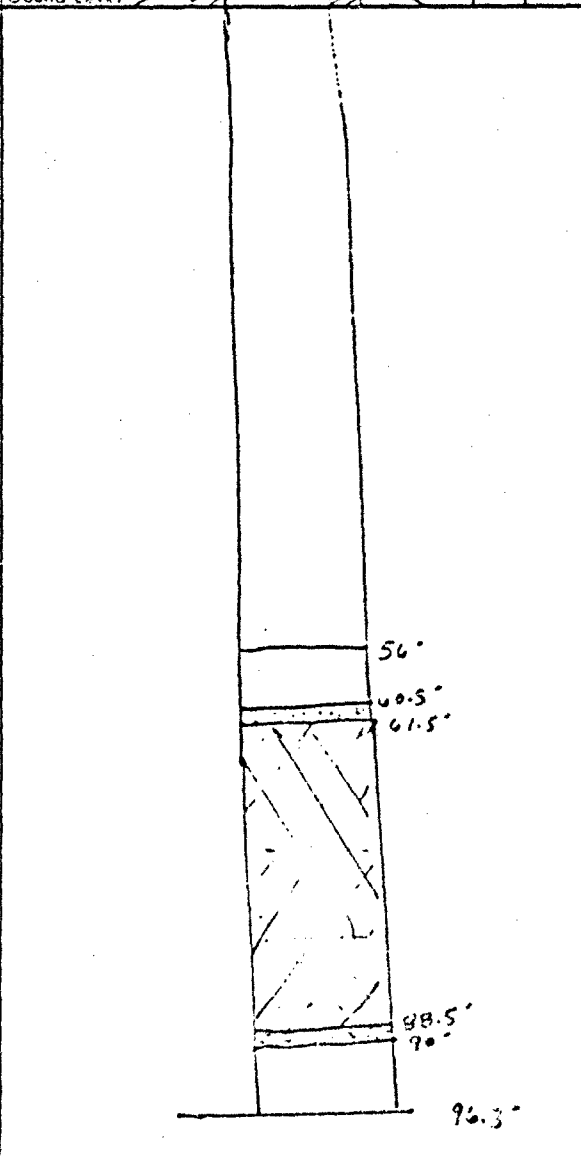
Top of Protective Casing to Ground Level 3.35 ft. \_\_\_\_\_ cm. \_\_\_\_\_

Reviewed By Joseph L. Reed Date 6/11/87

Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

Borehole: ≡40D

Well: 37372

Depth-Feet	Soil/Rock Type	Well Completion	Description
			
5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95			TOP OF BENTONITE TOP OF SAND TOP OF SCREEN  TOP OF SAND TOP OF BENTONITE MUD  Bottom of Hole

Drill Site Geologist: CD Benson  
 Reviewed By: Joseph L Reed

Date: 2.5.87  
 Date: 7/9/87

Borehole: E40A

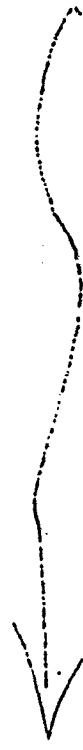

Well Number: E40A 37370

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
0.0	0 - 2'	2'	NA	0 - 2'	SM	<u>SM</u> - Silty sand, sl. clay, 10 yr 3/3, dk. brown, med. dense, nonplast, sl. moist alluvium
2.0	2 - 4'	1.8'		2 - 6'	SC	<u>SC</u> clayey sand, 25% clay, 10 yr 3/1, very dk. gray, med stiff, med plast, sl. moist alluvium
4.0	4 - 6'	2'				
6.0	6 - 8'	1.2'			SM	<u>SM</u> Silty sand, = 20% coarse sand, 10 yr 3/1 med dense, nonplast, moist
8.0	8 - 10'	2'				- moisture change to saturated at 9' (w.T)
10.0	10 - 12'	2'				coarse sand increase to 25%
11.0	10 - 12'	2'	10 - 12	10 - 12	SW	<u>SW</u> coarse sand, 10 yr 4/3, brown, med dk nonplast, saturated

Drill Site Geologist: C. D. Beckman


Date: 1-22-87

Borehole: E401 Well Number: 37370

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description	
11.0	10-12	2'	NA	10-12	SW	<p>SW - well-graded sands, gravelly sands                      - 5% gravel, 10% 1/3, brown/dk. brown, med                      dense, non plast, saturated</p> 	
12.0	12-14	2'		12-14			
13.0	14-16	1.8'		14-16			
14.0	16-18	1.6'		16-18			
15.0	18-20	1.8'		18-20			
16.0	20-22	1.7'		20-22			
17.0							<p>20% increase in % gravel to 30%                      Gravelly sands</p> 
18.0							
19.0							
20.0							
21.0							
22.0							

Borehole: E40.A

Well Number: 37370

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
22.0	22'					
23.0	24'	1' (aka stuff)	NA		SW	<p><u>SW</u> gravelly sands 30-40% gravel,            10yr 4/2 dk. grayish brown, med dense            even plast, saturated</p> 
24.0	24'	1'				
25.0	26'	1' (aka stuff)				
26.0	26'					<p>BEDROCK - weathered claystone            10yr 4/3 dk. brown</p>
27.0	27'	1'				<p>END OF BORING - REAMED TO 26'            27'</p>

Drill Site Geologist: L.D. Engstrom

Date: 1-27-87

BOR No.	DEPTH	Rec Int.	Structure/Bedding		Hardness		Perm.		Mineralogy		Color	Texture/Grain Size	Lith. Char.	Lith. Class	Description/Comments
			Angle	Desc.	S	H	1"	2"	Min.	Mobility					
	20		U	S											
	22														
	24														
	26														
Start Logging Alluvium logged on another sheet (All. Log)															
	28	10/20													
	30	10/1-3													
	32	40/40													
	34														
	36	50/50													
	38	M6													

BORE F40D WELL(S)  
 Inc. BORE F40D  
 (2)

Start Logging Alluvium logged on another sheet (All. Log)

Strongly  
fossiliferous  
carbonate  
10-20% ss

sandy  
clay  
rich

Silt  
stone

interbedded sandstone  
stone and fine sandy ls. ss

30.3'

ylt.  
perm.

25Y  
4/4

SS

Sandstone becomes coarser  
if rounded than depth to 40.'

clay  
balls

con  
frag

30Y  
2.5Y  
4/0

10Y  
2.5Y  
4/0

2.5Y  
4/0

2.5Y  
4/0

2.5Y  
4/0

30° x 100g

5° 10-20% ss

BOX NO	DEPTH FEET	INCH	Structure/Bedding		Hardness		Perm.		Mineralogy	Color	Texture/ Grain Size class of gr mm or 10 100	Lith. Choc	Lith. Class	Description/Comments
			U S	Angle	Desc.	S	HL	1°						
	40												SS	40.3
	42	5.0 5.0								2.5 N3/0		cbn		
										dk. gray			clay stone sh	
	44									2.5 N1/0		silty		
	46	0.9 1.4D								11. gray				43
(NR)	48									?		?	? N.R.	No recovery
	50	1.0 2.0								2.5 N4/4				
										dk gray			clay stone shale	
	52													
	54	1.1 3.6												
	56	1.9 2.7												
	58	1.7 1.7												
(4)		1.4											loose	57.9 noncem. loose sand, possibly sand slough from up hole? 58.6

INC. BORE E40D WELL(S)

BOX #	DEPTH FEET	Roc INT.	Swath		Structure/ Bedding		Hard- ness		Perm.		Mineralogy		Color		Texture/ Grain Size clay sd gr mm .01 10 100	Lith. Char.	Lith. Class	Description/Comments	
			U	S	Angle	Desc.	S	HL	HL	H	Min	Major	M	G					Ft
	60																		
	62					brkn							2.5Y M6/0 gray		lam. sst clay rich	st			
	64																		
	66																		
	68					Eng. cement br? cement?													
	70																		
	72																		
	74					brkn							gray brn 2.5Y 5/2		inter- bedded clay & silt	st			
	76												2.5Y N4/0 red gray		silty	ss			
	78																		

Inc. BORE E40D WELL(S)  
 ⑤  
 ⑥

50  
50  
1.2  
1.2  
4.8  
4.8  
2.7  
2.7

65.2

dense, m.g. ss

sh ss

71.5'

73.8

75.0

76.5

77.0

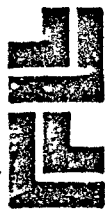
79.0

DEPTH FEET	U S	Structure/ Bedding		Hard- ness		Perm.		Mineralogy		Color M. G	Texture/ Gran. Size			Lith. Char.	Lith. Class	Description/Comments	
		Angle	Desc.	S	H	1"	2"	Min	Habit		clst. ad. gr.	0.01	LO				100
80														cbn- silty	sh	81.0	
82			Calc. Lent.											silty clayey	ss	82	
84																84.2	
86										dk 5.0				sandy clayey	st	predom. silty lime w/ some sandy component and thin 1-2" clay seams	86
88														silty	ss	87.5 88.2	88
90														shaly	st		90
92														sh		91.0	92
94										2.5' NSO 9.0'				silty			94
96																	96
EOH																	EOH = 96.3 ft.
98																	98

Inc. BORE E40D WELL(S)

5.0  
5.0  
1.7  
1.7  
5.0  
5.0  
4.6  
4.6  
2.3  
2.3

⑦



Frontier Logging  
Lakewood, Colorado

Date JAN. 28, 1987

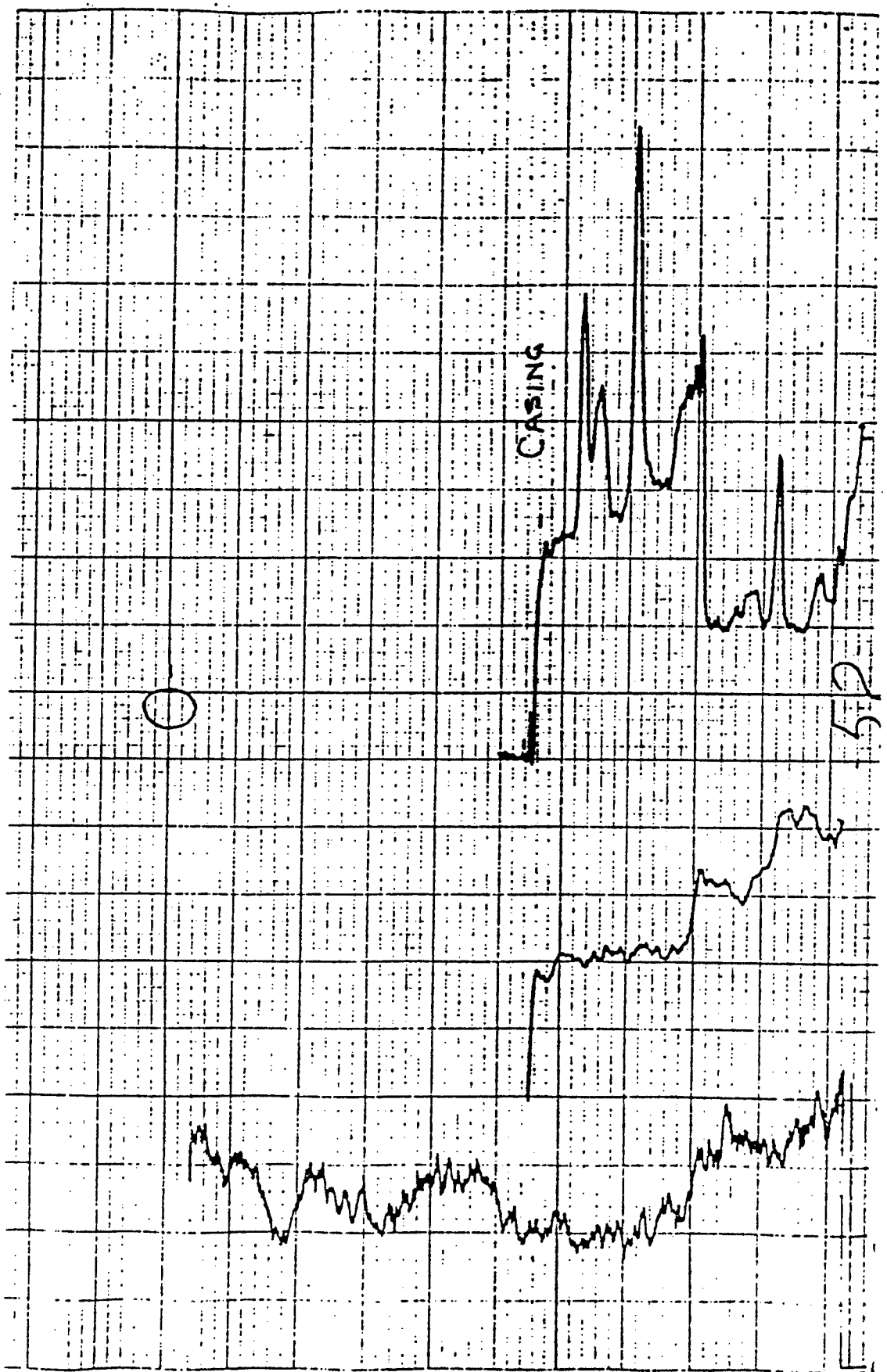
Company	ESE	Driller Depth	55 Ft	Max Hour Trip	40
Site Name	E 40 DENVER	Bit	3 Inch	Start	
Address		Chang Date	28 Feet	Time	1220
County	ADAMS COUNTY	Fluid in Hole	Water	Unit No.	110
Section		Density		Operator	Wm. Linton
		Viscosity		Location	Lakewood, CO
		Log Measured From	Ground Level		

EQUIPMENT DATA		NATURAL GAMMA RADIUMS (ANALOG)		NATURAL GAMMA RADIUMS (DIGITAL)	
TO LOGGED	Scale	Scale	Scale	Scale	Scale
52 Feet	TC	TC	TC	TC	TC
200 Scale = 20	Logging Speed	Logging Speed	Logging Speed	Logging Speed	Logging Speed
Time Constant 2	Sec	Sec	Sec	Sec	Sec
Count Source 15	From	From	From	From	From
	Total	Total	Total	Total	Total

Probe No	103-	Probe Diameter	1 5/8"	Density Source No	
Probe Type	x Tal	Probe Length	3/4 x 1"	Type	
Probe Factor	2.35 x 10 <sup>-5</sup>	Count Rate	7	CPStech	
Count Rate	1.07	Probe Size	3 Inch	Temperature	
RESISTANCE	75 ohms/5"	Dens per 5 inches		Neutron Source No	
S.P.	20 MV / Inch	SV per inch		Type	Strength
				CPStech	
				True Vertical	Survey Depth

True Vertical	ft	Survey Depth	ft

NATURAL GAMMA — 20 cps  
 S.P. — 20 MV  
 RESISTANCE — 75 OHMS/5 INCHES



52

0 20 40  
COUNTS PER SECOND

NATURAL

GAMMA

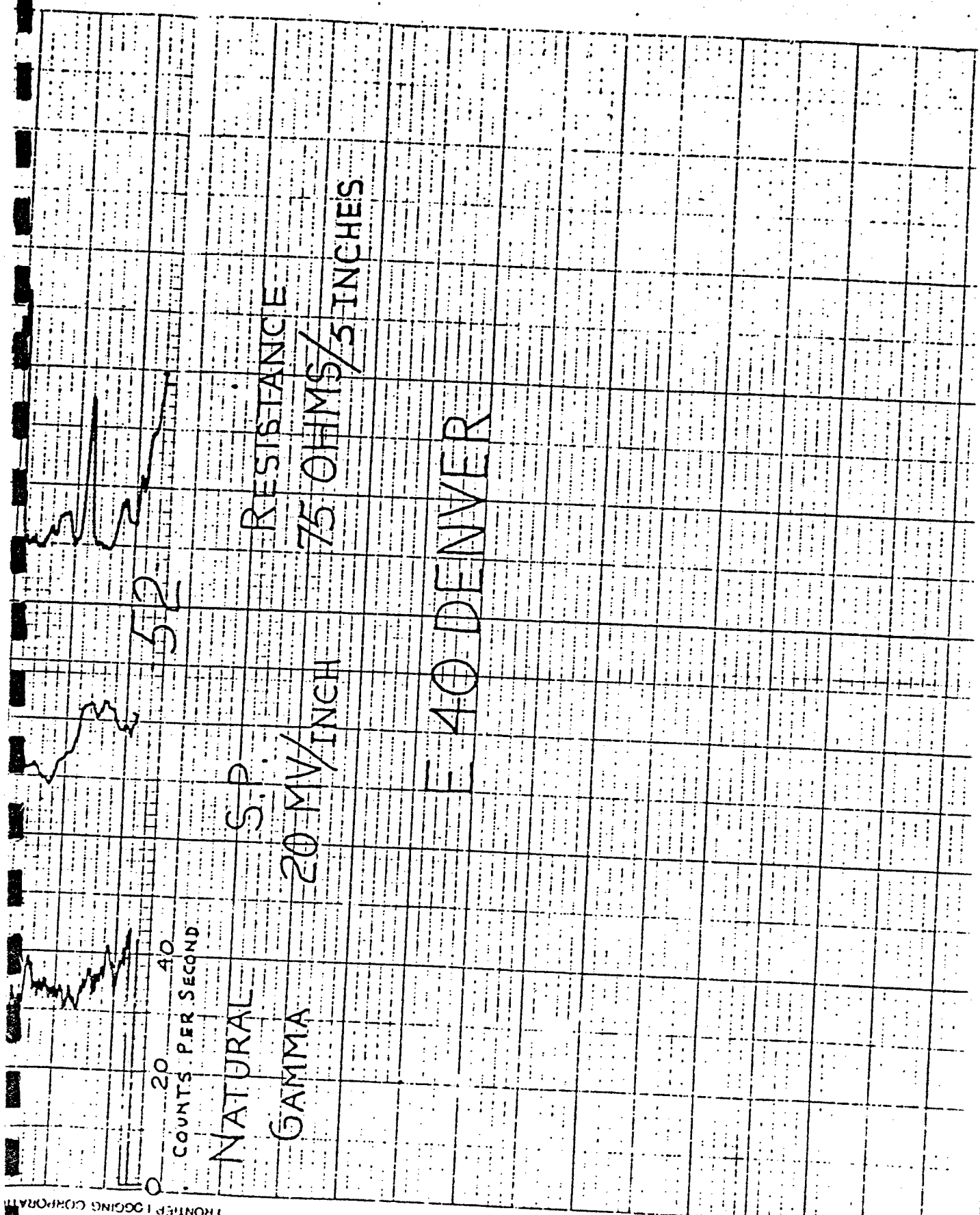
S.P.

20 MV/INCH

RESISTANCE

75 OHMS/5 INCHES

E 40 DENVER



WELL CONSTRUCTION SUMMARY

Borehole E42A Well 37369  
 Project Name and Location RMA Offsite Well Installation Project Number 1705804510  
 Drilling Company Boyles Bros Driller D. Jarvis Rig Number B57  
 Drilling Method(s) Continuous core

Borehole Diameter 2 1/4 in. \_\_\_\_\_ cm. 0.0 ft. \_\_\_\_\_ cm. to 25.26 ft. \_\_\_\_\_ cm.  
 \_\_\_\_\_ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) 3/4" hollow stem auger Sampling Method(s) Continuous core

Size and Type PVC	<u>4" Schedule 40</u>	Date/Time Start Drilling	<u>1/19/87 1115</u>
Total Borehole Depth	<u>25.26</u> ft. _____ cm.	Date/Time Finish Drilling	<u>1/19/87 1239</u>
Depth to Bedrock	<u>25.0</u> ft. _____ cm.	Date/Time Start Completion	<u>1/19/87 1402</u>
Depth to Water	<u>5.0</u> ft. _____ cm.	Date/Time Cement Protective Casing	<u>1/19/87 1545</u>
Water Level Determined By	<u>Field Observu</u>	Materials Used	_____
Length Plain PVC (total)	<u>6.68</u> ft. _____ cm.	Plain PVC	<u>1-10'</u>
Length of Screen	<u>21.21</u> ft. _____ cm.	Slotted PVC	<u>2-10'</u>
Total Length of Well Casing	<u>27.89</u> ft. _____ cm.	Bentonite Pellets	<u>1 bucket</u>
PVC Stick Up	<u>2.7</u> ft. _____ cm.	Bentonite Granular	<u>5#</u>
Depth to Bottom of Screen	<u>25.26</u> ft. _____ cm.	Cement	<u>1 bag</u>
Depth to Top of Screen	<u>4.05</u> ft. _____ cm.	Sand	<u>13 1/2 bags</u>
Depth to Top of Sand	<u>3.0</u> ft. _____ cm.	Water added during completion	<u>0</u>
Depth to Top of Bentonite	<u>2.0</u> ft. _____ cm.	Water added during drilling	<u>0</u>
		Total Gallons of water added	<u>0</u>

Drill Site Geologist D.A. Morgan Date 1/19/87

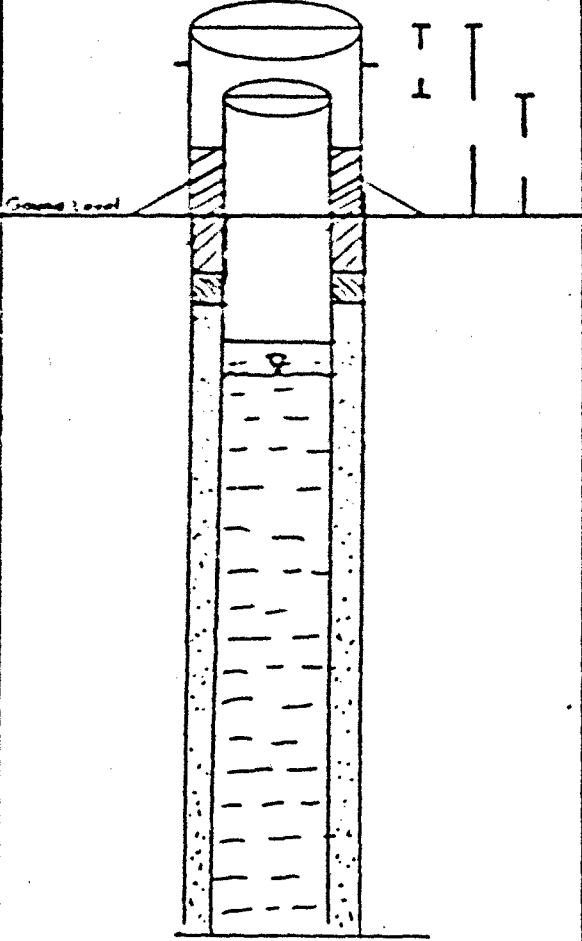
Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed \_\_\_\_\_  
 Date/Time/Personnel Casing Painted \_\_\_\_\_  
 Date/Time/Personnel Numbers Painted \_\_\_\_\_

Materials Used \_\_\_\_\_  
 Top of Protective Casing to Top of PVC \_\_\_\_\_ ft. \_\_\_\_\_ cm. COMMENT/NOTES  
 Top of Protective Casing to Weep Hole \_\_\_\_\_ ft. \_\_\_\_\_ cm. \_\_\_\_\_  
 Top of Protective Casing to Internal Mortar \_\_\_\_\_ ft. \_\_\_\_\_ cm. \_\_\_\_\_  
 Top of Protective Casing to Top of Cement Pad \_\_\_\_\_ ft. \_\_\_\_\_ cm. \_\_\_\_\_  
 Top of Protective Casing to Ground Level \_\_\_\_\_ ft. \_\_\_\_\_ cm. \_\_\_\_\_

Reviewed By \_\_\_\_\_ Date \_\_\_\_\_  
 Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

Borehole: 942A

Well: 37369

Depth-Feet	Soil/Rock Type	Well Completion	Description
0			
2			Top of Bentonite (2.0)
3			Top of Sand (3.0)
4			Top of Screen (4.05) / Joint
6			Water Level (5.0)
8			
10			
12			
14			
16			
18			
20			
22			
24			
25.26			Bottom of Screen (25.26)

Drill Site Geologist: D.A. Moran  
 Reviewed By: \_\_\_\_\_

Date: 1/19/87  
 Date: \_\_\_\_\_

Borehole: E 42 A Well Number: E 42 A 37369

0.0  
1.0  
2.0  
3.0  
4.0  
5.0  
6.0  
7.0  
8.0  
9.0  
10.0

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
0.0 - 2.0	1, 0-0	2'	N4	0-2'	SC	<u>SC</u> , clayey sand, 20% clay, 10gr 3/1 v. dk gray, med-stiff, med plast, moist alluvium (roots present 0-.4')
2.0 - 4.0	1, 0-6	2'			SM	<u>SM</u> , silty sand, 30% silt, 10gr 3/4, dk gray sh. br. med. dense, non-plast moist alluvium ↓ moisture increase to wet
4.0 - 5.0	1, 6-4	2'			SM	↓ moisture change to sat at 5.0' (w.t.)
5.0 - 7.0	1, 4-8	2'				
7.0 - 9.0	1, 8-9	2'				
9.0 - 10.0	1, 9-8	1.0'				
10.0 - 11.0	1, 8-5	.5'				

Drill Site Geologist: J.A. MEEHAN Date: 1/19/87  
 Reviewed By: W. [Signature] Date: 1/20/87

Borehole: E42A Well Number: E42A 37369

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
11.0	11-12	1.0'		11-12	SM	<u>SIL</u> silty sand, 40% silt, vfg sand, 10 gr 5/4 ywh brn, med-dense, non-plast, saturated Alluvium
12.0	12-14	2.0'				
14.0	14-16	2.0'				m-c. g sand 1.5115E
16.0	16-18	1.5'				
18.0	18-20	1.5' 1.5hrF				
20.0	20-22	1.5hrF 1.5hrF				
22.0						

Drill Site Geologist: D. J. McElroy Date: 11/19/87

Borehole: E42A

Well Number: E42A 37369

**SOILS LOG**  
Description

22

24

25

26

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	Description
	SE-CC	20'			SM	SM, silty sand, 40% silt 10gr s/s, dk grey brn, loose, non-plast, saturated alluvium
	SE-CC	1.0'				claystone (?) BEDROCK AT 25'
		1.0' sluff				1' sluff END OF BORING
<p>WELL KEENEED to 25' FOR WELL DEPTH          W/ 10" I.D. A.S. AUGER          8 1/4" ID Auger JLR</p> <p>WDA</p>						

WELL CONSTRUCTION SUMMARY

Borehole E44A Well 37373  
 Project Name and Location KMA Offsite - (102 Project Number 1705304510  
 Drilling Company Boyles Bros Driller V. Jarvis Rig Number 857  
 Drilling Method(s) intermittent core

Borehole Diameter 12 1/4 in. 0 ft. 26 cm. to 26 ft. 0 cm.  
0 in. 0 cm. 0 ft. 0 cm. to 0 ft. 0 cm.

Size(s) and types of Bit(s) 3/4" + 1 1/2" hollow stem auger Sampling Method(s) Continuous Core  
 Date/Time Start Drilling 1/20/87 1038

Size and Type PVC 1" schedule 80 Date/Time Finish Drilling 1/20/87 1228

Total Borehole Depth 25.7 ft. 0 cm. Date/Time Start Completion 1/20/87 1348

Depth to Bedrock 25 ft. 0 cm. Date/Time Cement Protective Casing 1/20/87 1521

Depth to Water 3 ft. 0 cm. Materials Used 7-4' TUBES 3 BOXES

Water Level Determined By Field observation Plain PVC 1-10'

Length Plain PVC (total) 16.96 ft. 0 cm. Slotted PVC 2-10'

Length of Screen 21.40 ft. 0 cm. Bentonite Pellets 1 1/2 buckets

Total Length of Well Casing 28.36 ft. 0 cm. Bentonite Granular 10#

PVC Stick Up 2.7 ft. 0 cm. Cement 1 bag

Depth to Bottom of Screen 25.7 ft. 0 cm. Sand 13 1/2 bags

Depth to Top of Screen 4.3 ft. 0 cm. Water added during completion 3 gal

Depth to Top of Sand 3.3 ft. 0 cm. Water added during drilling 0

Depth to Top of Bentonite 2.0 ft. 0 cm. Total Gallons of water added 3 gal

Drill Site Geologist D.A. Morgan Date 1/20/87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 4/14/87 JWF

Date/Time/Personnel Casing Painted JWF BAG 4/15/87 1009

Date/Time/Personnel Numbers Painted JWF BAG 4/15/87 1009

Materials Used \_\_\_\_\_

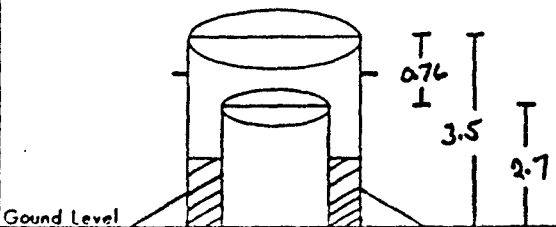

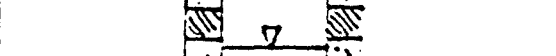
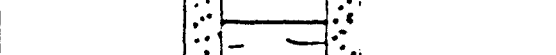
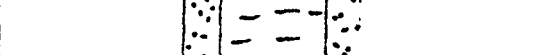
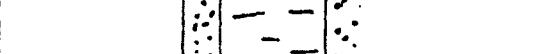

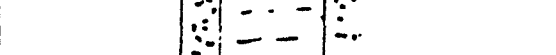
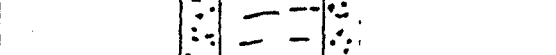
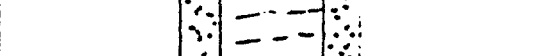
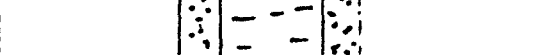
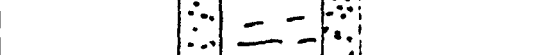
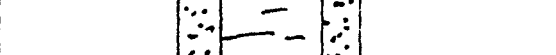
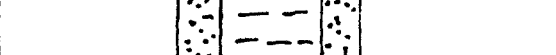
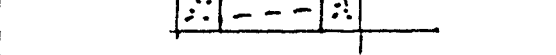
		COMMENT/NOTES
Top of Protective Casing to Top of PVC	<u>.76</u> ft. <u>0</u> cm.	
Top of Protective Casing to Weep Hole	<u>2.4</u> ft. <u>0</u> cm.	
Top of Protective Casing to Internal Mortar	<u>2.4</u> ft. <u>0</u> cm.	
Top of Protective Casing to Top of Cement Pad	<u>2.8</u> ft. <u>0</u> cm.	
Top of Protective Casing to Ground Level	<u>3.5</u> ft. <u>0</u> cm.	

Reviewed By Joseph L. Reed Date 4/20/87

Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

Borehole: 4A

Well: 37373

Depth-Feet	Soil/Rock Type	Well Completion	Description
0		 <p>Ground Level</p>	
2			Top of bentonite (2.0)
4			Top of sand (3.3)
6			Water level (3.5)
8			Top of screen (4.3) / Joint
10			
12			
14			
16			
18			
20			
22			
24			
25.7			Bottom of screen (25.7)
26			

Drill Site Geologist: P. Linda Manna Date: 4/20/87  
 Reviewed By: Joseph L. Reed Date: 4/20/87

Borehole: S44A Well Number: S44A 3737B

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
1	0-2	2'	NA	0-2	SC	clayey sand, 20% clay, 10% IR 3/1-2, v.lk grey to v.lk grey-blue, med stiff, sh plus, moist, alluvium, roots present in top 0.5'
2	2-4	1'	NA	2-4	SM	silty sand, 40% silt, 10% IR 4/4-6, dk wash bin, med dense, non plus, moist, alluvium At 3.0' sample is wet At 4.0' sample is sat, water level approximated @ 3.5' ↓
3	4-6	2'		4-6		
4	6-8	2'		6-8		
5			NA		SC	clayey sand, 30% clay, 10% IR 4/4-6, dk wash bin, med stiff, plus, sat, alluvium
6	8-10	2'	NA	8-10	SM	SM, silty sand, 30% silt, 10% IR 4/4-6, dk wash bin, med dense, non plus, sat, alluvium
7	10-12	1/2'	NA	10-12	SW	coarse sand, few fines, 10% IR 5/4-6, wash bin, loose, non plus, sat, alluvium

Drill Site Geologist: D.A. McManis Date: 1/27/57  
D.A. McManis DD 11/10/57 sh/bt

Borehole: E44A

Well Number: E44A 37373

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
11			NA		sw	sw as above
12	12-A	1'		12-A		<p style="text-align: center;">↓</p> <p>At 16' sand is coarse w/ occ gravel</p> <p style="text-align: center;">↓</p>
13						
14	14-B	1'		14-B		
15						
16	16-B	1/2'		16-B		
17						
18	18-20	0		18-20		
19						
20	20-22	1'		20-22		
21						
22						

Drill Site Geologist: D.A. Ussman

Date: 1/21/87

Reviewed By: D.A. Ussman David L. Reed

Date: 1/22/87 1/14/87

Borehole: EL 44A

Well Number: EL 44A 37373

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
22	22-24	1'	NA	22-24	SW	SW as above
23						
24	24-26	2	NA	24-26	CS	CS, bedrock, claystone, weathered, 104R 5/6-8, gush bin
25						
26						End of boring log

Drill Site Geologist: D.A. McManis

Date: 1/21/87

Reviewed By: D.A. McManis (Drill Pad)

Date: 1/22/87 9/16/87

WELL CONSTRUCTION SUMMARY

Borehole F-44-081 Well 37398  
 Project Name and Location RMA Mountain Well Instal. Project Number T39  
 Drilling Company Boyle Bros Driller Tom High Rig Number Mobile B-61  
 Drilling Method(s) 3 1/2" ID 6 1/2" OD Hollowstem Auger with Moss sampler,  
then reamed with 12 1/4" OD Hollowstem Auger with center bit  
 Borehole Diameter 6 1/2 in. cm. 0 ft. cm. to 24.0 ft. cm.  
Reamed 12 1/4 in. cm. 0 ft. cm. to 25.0 ft. cm.

Size(s) and types of Bit(s) 3 1/2" OD + 12 1/4" OD  
Auger bits

Size and Type PVC 2" sch 40 1020 slot  
 Total Borehole Depth 25.0 ft. cm.  
 Depth to Bedrock 23.7 ft. cm.  
 Depth to Water 2.2 ft. cm.  
 Water Level Determined By measuring surface  
 Length Plain PVC (total) 6.11 ft. cm.  
 Length of Screen 20.29 ft. cm.  
 Total Length of Well Casing 26.40 ft. cm.  
 PVC Stick Up 2.70 ft. cm.  
 Depth to Bottom of Screen 23.70 ft. cm.  
 Depth to Top of Screen 3.71 ft. cm.  
 Depth to Top of Sand 2.50 ft. cm.  
 Depth to Top of Bentonite 1.50 ft. cm.

Sampling Method(s) Continuous - Moss System  
 Date/Time Start Drilling 3/22/88 1042  
 Date/Time Finish Drilling 3/23/88 1048  
 Date/Time Start Completion 3/23/88 1123  
 Date/Time Cement Protective Casing 3/23/88 1440  
 Materials Used 3/23/88 1048 SP  
 Plain PVC 1-10' sect. (wt)  
 Slotted PVC 2-10' sections lend cap, 1 top cap  
 Bentonite Pellets 1 bucket  
 Bentonite Granular 1/5 bag  
 Cement 2 bags  
 Sand 14 bags  
 Water added during completion 0  
 Water added during drilling 50 gal  
 Total Gallons of water added 50 gal

Drill Site Geologist Steve Davis

Date 4/1/88

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 3/25/88 1330 BWJRR  
 Date/Time/Personnel Casing Painted 3/25/88 1450 BWJRR  
 Date/Time/Personnel Numbers Painted 3/25/88 1530 BWJRR

Materials Used 12 bags of Sublets

Top of Protective Casing to Top of PVC	<u>0.38</u> ft. cm.	COMMENT/NOTES
Top of Protective Casing to Weep Hole	<u>2.38</u> ft. cm.	
Top of Protective Casing to Internal Mortar	<u>2.40</u> ft. cm.	
Top of Protective Casing to Top of Cement Pad	<u>2.5</u> ft. cm.	
Top of Protective Casing to Ground Level	<u>2.7</u> ft. cm.	

Reviewed By [Signature] Date 4-5-88  
 Drill Site Geologist Steve Davis Date 4-8-88

Borehole: EPD E-44-081

Well: 37398

Depth-Feet	Soil/Rock Type	Well Completion	Description
		<p>Ground Level</p> <p>PVC Joints</p> <p>3.41'</p> <p>13.52'</p> <p>12" borehole</p>	<p>Gravel from 0-1.5'</p> <p>1.5' TOP of bentonite</p> <p>2.51' TOP of SAND</p> <p>3.41' TOP OF SCREEN</p> <p>23.7' Bottom of Screen TOP of Bedrock</p> <p>25.0' TOTAL DEPTH</p>
5			
10			
15			
20			
25			

Drill Site Geologist: [Signature]  
 Reviewed By: [Signature]

Date: 4.1.78  
 Date: 4.8.88

Borehole: E-44 OB-1

Well Number: OB-1 37398

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
1	0 2	4/2 <del>2.8</del>	1	0 ↓ 2	SC	Clayey sand, 35% clay 10VR 3/2 Very dark grayish brn, fine to medium sand moist, low plastic, med stiff
2	2 1 4	1.9 <del>2.0</del> <del>1.7</del>		2 ↓ 4	SM	SM/silty sand fine to medium, 20% silt 10VR 3/3 dark brown, low plastic, soft, Very moist b-
4	4 ↓ 6	1.7 ↓ 2		4 ↓ 6		Saturated at 4' Same as above
6	6 <del>2</del> 2	2/2		6 ↓ 8	SC	Sandy clayey sand, fine to coarse, 30% clay 2.5Y/5/2.4 light olive grayish brn, med plastic soft
9	9 ↓ 10	2/2		9 ↓ 10		From 9.5 to 10 interbedded with thin lenses of fine to medium sands

Drill Site Geologist: [Signature]

Date: 4-15-98

Reviewed By: [Signature]

Date: 4/20/98

Borehole: E-414 OB-1

Well Number: GB-1 37398

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
10	10		10	10	SP	Sand fine to medium, 4% silt, 10% R 6/8 brownish yellow, saturated, loose, non-plast.
11	↓	1.5/2	↓	↓		
12	12		12	12		
13	↓	1/2	↓	↓		
14	14		14	14		
15	↓	0/2	6	16		
16	16		16	↓		
17	↓	0/2	18	↓		
18	18		18	↓		
19	↓	1.5/2	↓	↓		
20	20		20	20	SP	Sand-fine to medium 2.5% 5/4 light olive brown, saturated, loose

NO Recovery 14 feet to 19.4 feet  
Flowing sands

Drill Site Geologist: [Signature]

Date: 4-15-88

Reviewed By: [Signature]

Date: 4/20/88

Borehole: E-44 08-1 Well Number: 37398

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
20	20			20	SP	↓ Same as above
21	↓ 21	2/4				
22	22 24					
23	↓ 23					
23.7	24			24		23.6 Bedrock = Claystone Weathered 2.54 G/G silice yellow

Drill Site Geologist: [Signature] Date: 4.15.98  
 Reviewed By: [Signature] Date: 4/20/98

WELL CONSTRUCTION SUMMARY

Borehole E-44 OB-2 Well 37399  
 Project Name and Location RMA OFFSET SECT. 14 Project Number TASK 39  
 Drilling Company BOTTLES BROS. Driller TOM HIGHT Rig Number B-61 Auger rig  
 Drilling Method(s) Auger w/ Moss System in 6 1/2" OD. Hollow Stem Augers, then  
ream hole w/ 12" OD. auger.  
 Borehole Diameter 12 in. 0 cm. 0 ft. 24 cm. to 24 ft. 0 cm.  
0 in. 0 cm. 0 ft. 0 cm. to 0 ft. 0 cm.

Size(s) and types of Bit(s) 6 1/2" OD. hollow stem  
auger, 12" OD. auger.  
 Size and Type PVC 2" Sch. 40  
 Total Borehole Depth 24 ft. 0 cm.  
 Depth to Bedrock 22.8 ft. 0 cm.  
 Depth to Water 2.4 ft. 0 cm.  
 Water Level Determined By Solinst water level meter.  
 Length Plain PVC (total) 6.42 ft. 0 cm.  
 Length of Screen 20.28 ft. 0 cm.  
 Total Length of Well Casing 26.70 ft. 0 cm.  
 PVC Stick Up 2.65 ft. 0 cm.  
 Depth to Bottom of Screen 24.05 ft. 0 cm.  
 Depth to Top of Screen 3.77 ft. 0 cm.  
 Depth to Top of Sand 2.1 ft. 0 cm.  
 Depth to Top of Bentonite 0.5 ft. 0 cm.

Sampling Method(s) Moss System w/ hollow stem A  
 Date/Time Start Drilling 3-24-88 / 0940  
 Date/Time Finish Drilling 3-24-88 / 1324  
 Date/Time Start Completion 3-24-88 / 1403  
 Date/Time Cement Protective Casing 3-24-88 / 1500  
 Materials Used 8" surface casing.  
 Plain PVC (1) 10 ft. section  
 Slotted PVC (2) 10 ft. sections  
 Bentonite Pellets 1/2 bucket  
 Bentonite Granular N/A  
 Cement 2 bags.  
 Sand 12 bags  
 Water added during completion 0  
 Water added during drilling 50 gal  
 Total Gallons of water added 50 gal

Drill Site Geologist [Signature]

Date 3/25/88

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 3/25/88 1430 BW & RR  
 Date/Time/Personnel Casing Painted 3/25/88 1500 BW & RR  
 Date/Time/Personnel Numbers Painted 3/25/88 1530 BW & RR  
 Materials Used 12 bags sacrete

Top of Protective Casing to Top of PVC	<u>0.53</u> ft. <u>0</u> cm.	COMMENT/NOTES
Top of Protective Casing to Weep Hole	<u>2.29</u> ft. <u>0</u> cm.	
Top of Protective Casing to Internal Mortar	<u>2.38</u> ft. <u>0</u> cm.	
Top of Protective Casing to Top of Cement Pad	<u>2.67</u> ft. <u>0</u> cm.	
Top of Protective Casing to Ground Level	<u>3.18</u> ft. <u>0</u> cm.	

Reviewed By [Signature] Date 3/27/88  
 Drill Site Geologist [Signature] Date 3/25/88

Borehole: E-44 06-2

Well: 37397

Depth-Feet	Soil/Rock Type	Well Completion	Description
2	PVC joints		8" surface casing set to 1.52'
4	3.77 JT →		bentonite seal (top of bentonite @ 0.5')
6			Top of Sand = 2.1'
8			Top of Screen = 3.77'
10			Sandpack (10-20 sand)
12			2" Sch. 40 PVC screen
14	13.77 JT →		12" borehole
16			
18			
20			
22			Bedrock @ 22.8'
24	24.05		Borehole depth = 24.05' = Bottom of Screen
26			Claystone Bedrock
			Endcap = 0.35'

Drill Site Geologist: [Signature]  
 Reviewed By: [Signature]

Date: 3/25/88  
 Date: 3/22/88

Borehole: E-44082

Well Number: 37399

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
		1.5 2.0			SC	CLAY SAND, 30% clay, fine to medium grained sand, 10YR 3/3, dark brown, moist, low plastic, med stiff
2		1.6 2.0			SM	Silty SAND, 30% silt, fine to medium <sup>grained</sup> sand, 10YR 3/3 dark brown, saturated, non plastic
4		1.0 2.0			SC	CLAYY SAND, 25% clay, fine to medium grained sand, 10YR 3/3 dark brown, saturated, low plastic
6		2.0 2.0			SC	CLAYY SAND, 35% clay, fine to coarse grained sand, 10YR 4/3 brown, moist, stiff, medium plastic
8						No Recovery 8' to 18' SP 20'
10						

Drill Site Geologist: [Signature]

Date: 3/25/88

Reviewed By: [Signature]

Date: 3/27/88

Borehole: E44082

Well Number: 37399

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
10						No Recovery 8 to 20'
12						
14						
16						
18						
20						

Drill Site Geologist: [Signature]

Date: 3/25/98

Reviewed By: [Signature]

Date: 3/27/98

Borehole: E-44081

Well Number: 37399

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
20					SP	SAND, 3% silt, medium to very coarse grained 10YR 6/4 brownish yellow, saturated, loose
22					22.8'	sandstone bedrock, fine grained, silty, 2.5Y 5/4, light olive brown, weathered.
24						TOTAL DEPTH 24.0'

Drill Site Geologist: [Signature]

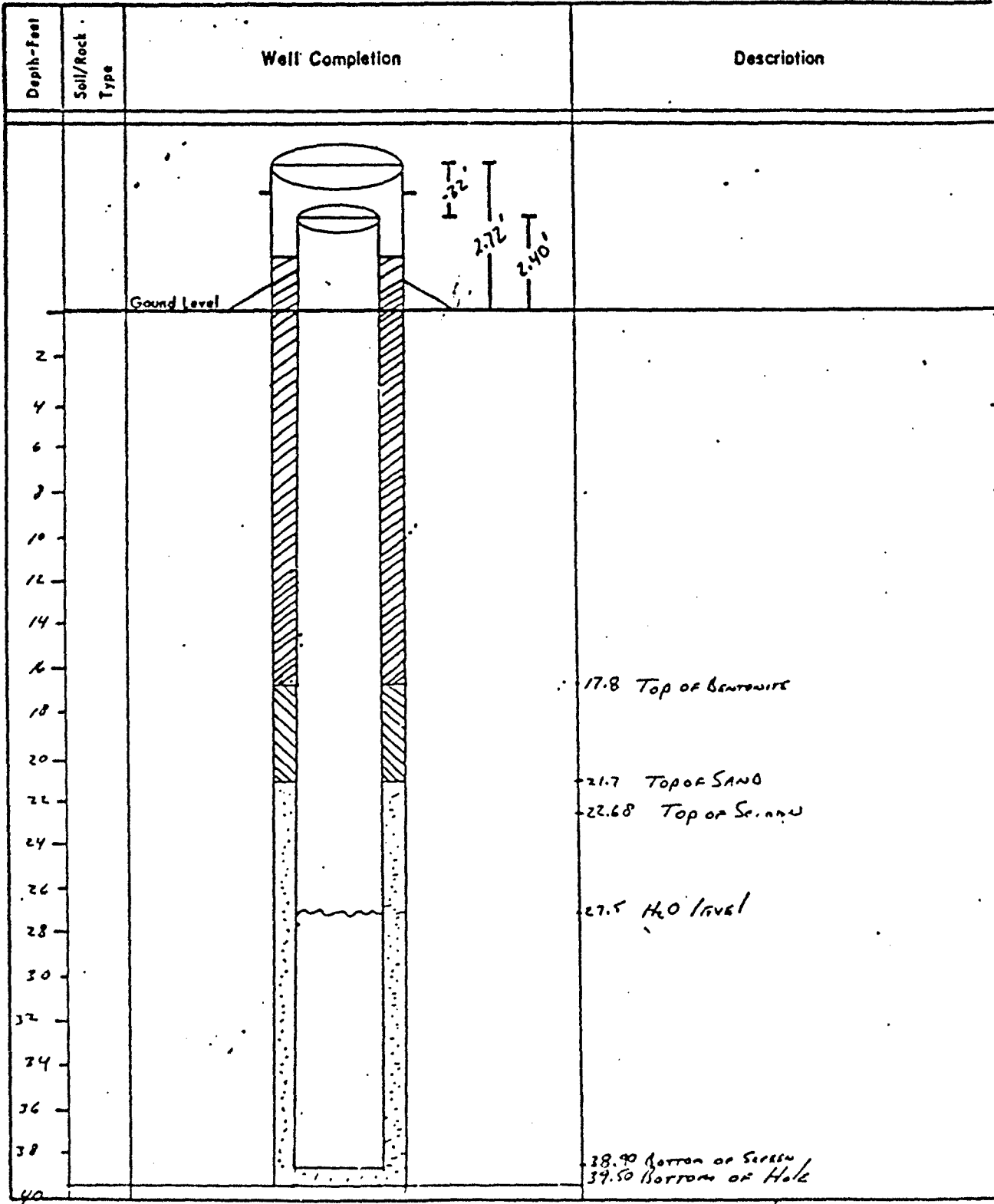
Date: 3/25/88

Reviewed By: [Signature]

Date: 3/27/88

Borehole: E-46A

Well: E-46A-1 57577



Drill Site Geologist: Cory LH  
 Reviewed By: Joseph R. Reed

Date: 3/2/87  
 Date: 7/23/87

**WELL CONSTRUCTION SUMMARY**

Borehole E-46A Well E-46A 37377  
 Project Name and Location Task 26 Yampa N. 1/2 mile E of Proctor Project Number 17053.074.10  
 Drilling Company Boyer Bros Driller DAVE JERRY Rig Number \_\_\_\_\_  
 Drilling Method(s) Auger

Borehole Diameter 12 1/4 in. \_\_\_\_\_ cm. 0 ft. \_\_\_\_\_ cm. to 39.5 ft. \_\_\_\_\_ cm.  
 \_\_\_\_\_ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) \_\_\_\_\_

Sampling Method(s) no sampling

Size and Type PVC 4" Screen .020

Date/Time Start Drilling 3/21/87 11:30

Date/Time Finish Drilling 3/21/87 1400

Total Borehole Depth 39.5 ft. \_\_\_\_\_ cm.

Date/Time Start Completion 3/21/87 1400

Depth to Bedrock 39.5 ft. \_\_\_\_\_ cm.

Date/Time Cement Protective Casing 3/20/87 10:00

Depth to Water 27.5 ft. \_\_\_\_\_ cm.

Materials Used \_\_\_\_\_

Water Level Determined By Previous Boring

Plain PVC 3 - 10' sections

Length Plain PVC (total) 25.4 ft. \_\_\_\_\_ cm.

Slotted PVC 1 - 10' 1-5'

Length of Screen 16.23 ft. \_\_\_\_\_ cm.

Bentonite Pellets 4 Buckets

Total Length of Well Casing 41.63 ft. \_\_\_\_\_ cm.

Bentonite Granular 0

PVC Stick Up 2.7 ft. \_\_\_\_\_ cm.

Cement 10 Bags ARANSOMA 100/20 50

Depth to Bottom of Screen 38.90 ft. \_\_\_\_\_ cm.

Sand 8 BAGS

Depth to Top of Screen 22.68 ft. \_\_\_\_\_ cm.

Water added during completion 5 Gals to Small

Depth to Top of Sand 21.7 ft. \_\_\_\_\_ cm.

Water added during drilling 0

Depth to Top of Bentonite 17.8 ft. \_\_\_\_\_ cm.

Total Gallons of water added 5.0

Drill Site Geologist Greg Lusk

Date 3/21/87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole installed 4/18/87/1030 K. Pacheco, M. Westcott

Date/Time/Personnel Casing Painted 4/9/87/11000 K. Pacheco, M. Westcott

Date/Time/Personnel Numbers Painted 4/15/87 1031 JWF BAJ

Materials Used 12 bags quickcrete cement, 1/4 portland cement, 1/2 bag silica sand water

Top of Protective Casing to Top of PVC 232 ft. \_\_\_\_\_ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 15 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Internal Mortar 119 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Top of Cement Pad 272 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Ground Level 272 ft. \_\_\_\_\_ cm.

Reviewed By Joseph L. Reed Date 4/23/87

Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

Borehole: E-46A

Well Number: 37377

SOILS LOG					
Description					
Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification
<i>MUSKELL COLORS</i>					
0.0			NA		ML
1.0	0-2'	1'		0-2'	<p><u>ML</u> Sandy-silt, 30-35% f. gr. sand, 10 YR 5/2-3, greyish brn., non-plin. loose, dry, alluvium.</p> <p>At 2.6' color changes to 10 YR 5/3-4, brn., moisture increases to slightly moist.</p> <p>At 5.0' color changes to 10 YR 5/4-6, yellowish brn., natural density increases to med. dense.</p> <p>At 6.5' percent f. calc. sand increases to ~15%, color changes to 10 YR, 6/4-6, light yellowish brn.</p>
2.0					
2.6	2-4'	1.6'		2-4'	
3.0					
4.0					
4.5	4-5.5'	1.5'		4-5.5'	
5.0					
5.5	5.5-6.5'	1'		<del>5.5-6.5'</del>	
6.0					
6.5					
7.0	6.5-8.5'	2'		6.5-8.5'	
8.0					
8.5					
9.0					
10.0	8.5-12.5'	4'		8.5-13.5'	
11.0					

Drill Site Geologist: A.E. Ostelby  
 Reviewed By: Joseph L. Reed

Date: 3/12/87  
 Date: 4/16/87

Borehole: E-46A

Well Number: 37377

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						<i>Mussie Cores</i>
11.0	8.5-12.5'	4'	NA	8.5-13.5'	ML	At 11.0', percent f.g. calc. sand decreases to <del>3%</del> to ~5%.
12.5	12.5-13.5'	1'		13.5-18'	SM	SM silty-sand, ~30% silt, 10% R 4/4-6, dk. grayish brn., non-plas, loose, moist alluvium.
13.5	13.5-17.5'	3'		18-22'	ML	
17.0	17-18'	1'				ML sandy-silt, ~15-20% f.g. sand, 10% R, 5/3-4, brn., non-plas, loose, moist, alluvium.
18.0	18-21'	2.2'				
19.0	21-22'	1'				
20.0						
21.0						
22.0						

Drill Site Geologist: [Signature]  
 Reviewed By: Joseph L. Reed

Date: 3/12/87  
 Date: 4/16/87

Borehole: E-46A

Well Number: 37377

SOILS LOG						
Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	Description
<i>MUNSELL Colors</i>						
22.0	22 - 23.5'	1.5'	NA	22 - 23.5'	ML	
23.0				23.5	23.5 - 28.5'	
24.0	23.5 - 27.5'	2.3'		23.5 - 28.5'		
25.0				26.0		
27.0	27.5 - 28.5'	1'		27.5 - 28.5'	SM	<p><i>SM silty sand, ~15-20% silt, 10% 6/3-4, light                  yellow brown, non plus, loose, wet, alluvium. MPE 27.5                  At 27.8, percent silt decreases to 2-3%, 95% coarse                  gr. sand, moisture increases &amp; (saturated)</i></p>
27.5				28.0		
28.0	28.5 - 32.5'	1'		28.5 - 32.5'		<p><i>SP                  or SW?</i></p>
28.5				29.0		
30.0	32.5 - 34'	0.5'		32.5 - 34'		<p><i>At 32.0 color changes to white, 6/20, light brown                  54% to</i></p>
31.0				32.0		
32.0						
32.5						
33.0						

Drill Site Geologist: [Signature]  
 Reviewed By: Joseph L. Reed

Date: 3/12/87  
 Date: 4/16/87

Borehole: E46A Well Number: \_\_\_\_\_

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						MUNSELL COLORS
33.0	32.5 - 34	0.5'	NA	32.5 - 34	SM	
34.0						At 34.0', color changes to 10YR, 6/2, light brown. gy.
35.0	34 - 37	1'		34 - 39		
36.0						
37.0	37 - 39	0.6'		37 - 39		At 37.0', color changes to 10YR, 5/3-4, brn.
38.0						
39.0						
40.0	39 - 42	0'		39 - 42		NO RECOVERY AUGER LOSS
41.0						
42.0	42 - 42.8	0.8'		42 - 42.8		At 42.5' natural density changes to v. dense, fine to med. gr. sandstone / bedrock.
42.5						
42.8						
43.0						END OF BORING LOG
44.0						tes

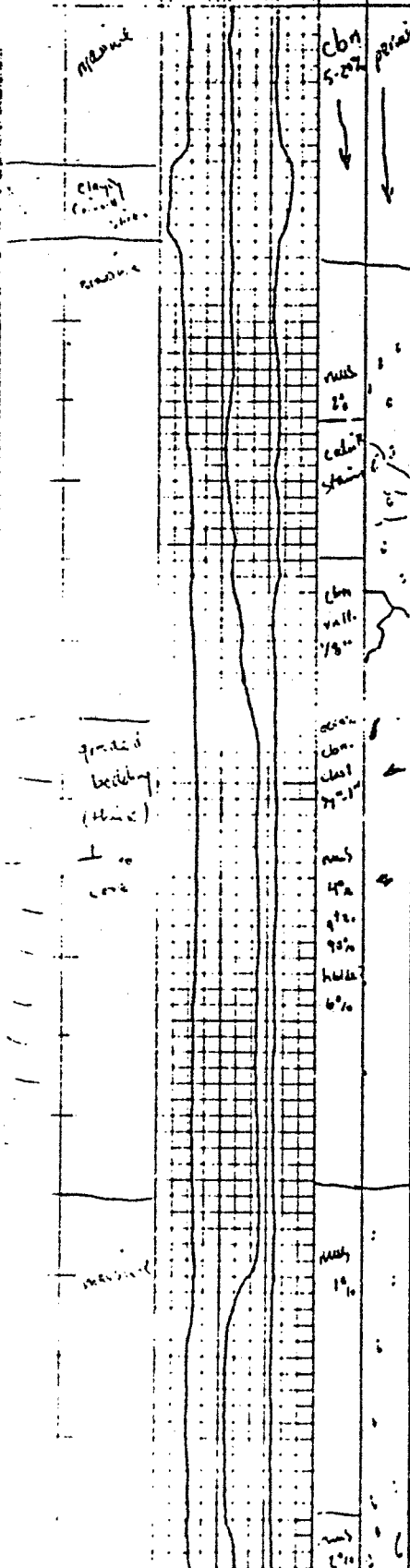
Drill Site Geologist: Bob Osteltz Date: 3/12/87  
 Reviewed By: Joseph L. Reed Date: 4/16/87

BORE NO. DEPTH	Rec Int	Structure / Bedding		Hardness	Perm.		Mineralogy		Color		Texture / Grain Size dist of gr mm 0.1 1.0 100	Lith. Chor.	Lith. Class	Description / Comments
		Angle	Desc.		1"	2"	Min	Habit	M	G				
40														BELOW SAMPLES AT 41" - SEE SHEET LOG FOR 0-41" Geology
42													CL	CLAYSTONE
44	5/4		shaly						104r 7/1 C gray					
46									104r 5/1 gray					- 45" Approx. oxidation boundary
48	5/2		fracs. abundant											
50	5/3													
52	5/3		shaly											
54	5/3												ST	SILTSTONE 2' of recovery from uphole
56	5/3													
58	5/2												CL	CLAYSTONE

E, Inc. BORE E-46 WELL(S)

Depth (ft)	Lith. Class	Description/Comments	Mineralogy		Color	Texture / Grain Size (clst ad gr mm)	Lith. Char	Lith. Class
			Mm	Mic				
60	CL	CLAYSTONE						
62					104r 3/1 very dark grey			
64					104r 5/1 grey		silt 5%, sand 15%	Becoming siltier & sandier -
66								clay % decreasing
68	SS	SANDSTONE						
70		SANDSTONE - "clean" - med to coarse grained - calc indurated, 1% cement						
72								
74	CL	CLAYSTONE						
76		med silty claystone						
78	ST	SANDY SILTSTONE						

ESE, Inc. BORE E-46 WELL(S)



E, Inc. BORE E-46 WELLS)

BOX #	DEPTH Feet Int	Structural Holdings	Mineralogy	Color	Texture/ Grain Size Clst or gr mm or 1/16 100	Lith. Char	Lith. Class	Description/Comments
	80	massive	shaly 10gr 6/8	gray		sand 30%	ST	<del>SILTY SANDSTONE</del> <del>SAND SILTSTONE</del>
	82						SS	SILTY SANDSTONE
	84					clay 20%		CLAY INTERBED
	86	bedded (med to thin)	cln 10%	gray				CLAY INTERBED
	88	cross bedding	cln 5%	dk gray				Coarser sandstone than previously (med. grain) - well indurated
	90	graded bedding	cln 5%	gray				med. (fine rounded) sand with lots of med. grain appearance but some ss
	92	massive	cln 3%				CL	CLAYSTONE INTERBED
	94		cln 3%			sand 10%	ST	SILTSTONE "fluff-looking"
	96		cln 3%			clay 20%		
	98		cln 3%			clay 10%		small white siltstone - larger voids - not "fluff-looking" as above

APRIL 17, 1987

ADAMS COUNTY, Colorado

ESE

E-46

RMA

ADAMS COUNTY

COLORADO

Ground Level

NATURAL GAMMA MEASUREMENT (HALL) (G)

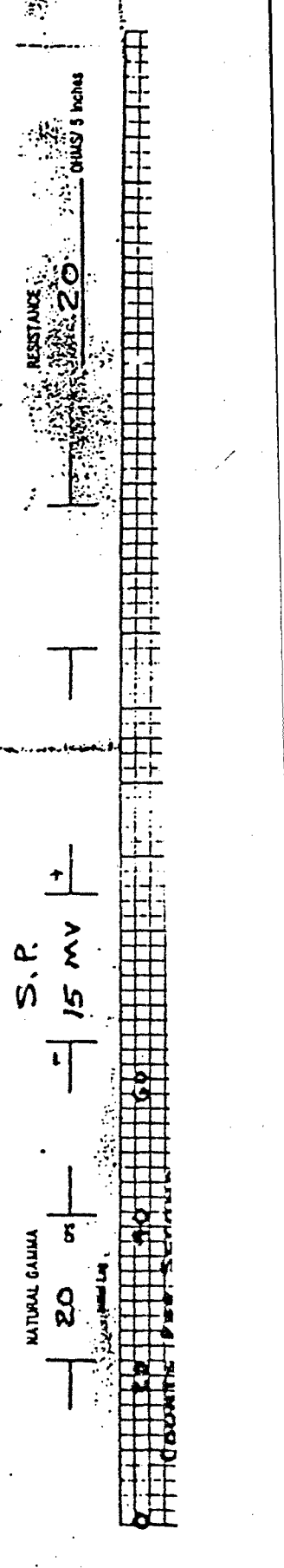
Driller	116 Ft
Depth	3 3/8"
Core	PVC to 4 1/2 Ft
Time	0750
Unit No.	110
Operator	Wm. Linton
Location	Lakewood

Scale	Scale	Scale
Logging Speed	Logging Speed	Logging Speed
From	From	From
To	To	To
Total	Total	Total

T.D. Logged	114 Ft
Major Gamma	20 cps/inch
Scale	2
Logging Speed	15
From	
To	
Total	

Gamma (Analog)	
Gamma (Digital)	
Caliper	
Temperature	
Closure	
Altimeter	

Resistance	20 ohms/5"
S.P.	15 MV/Inch
Density Source No	
Neutron Source No	
Survey Depth	
True Vertical	



NATURAL GAMMA

20

05

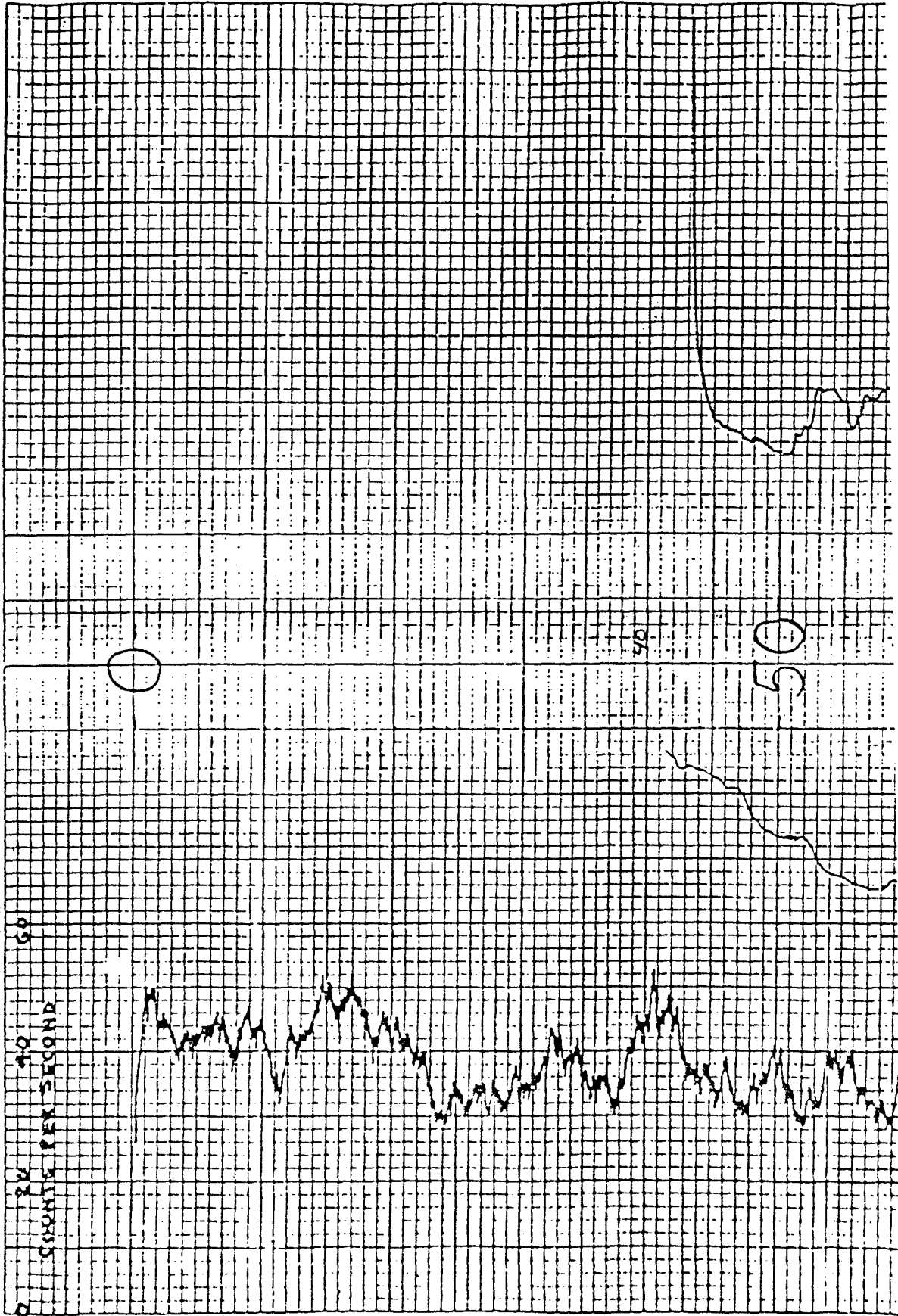
S.P.

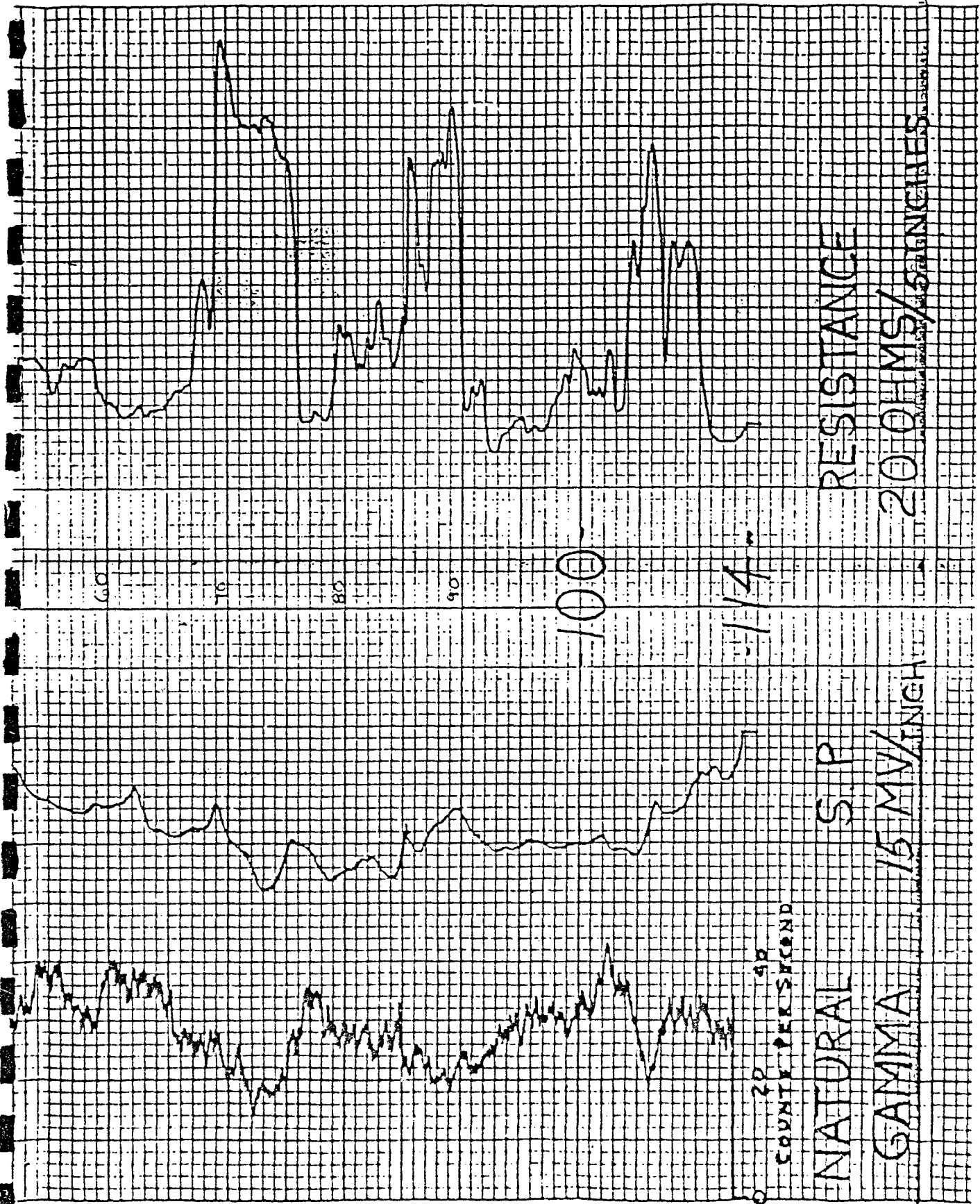
15 MV

RESISTANCE

20

OHMS 5 INCHES





RESISTANCE

20 OHMS/GINCHES

S.P

15 MV/INCH

NATURAL

GAMMA

20 40  
COUNT PER SECOND

100

1/4

60

70

80

90

20

40

20  
COUNTS PER SECOND

NATURAL

S.P

GAMMA

15 MVA INCH

1/4

RESISTANCE

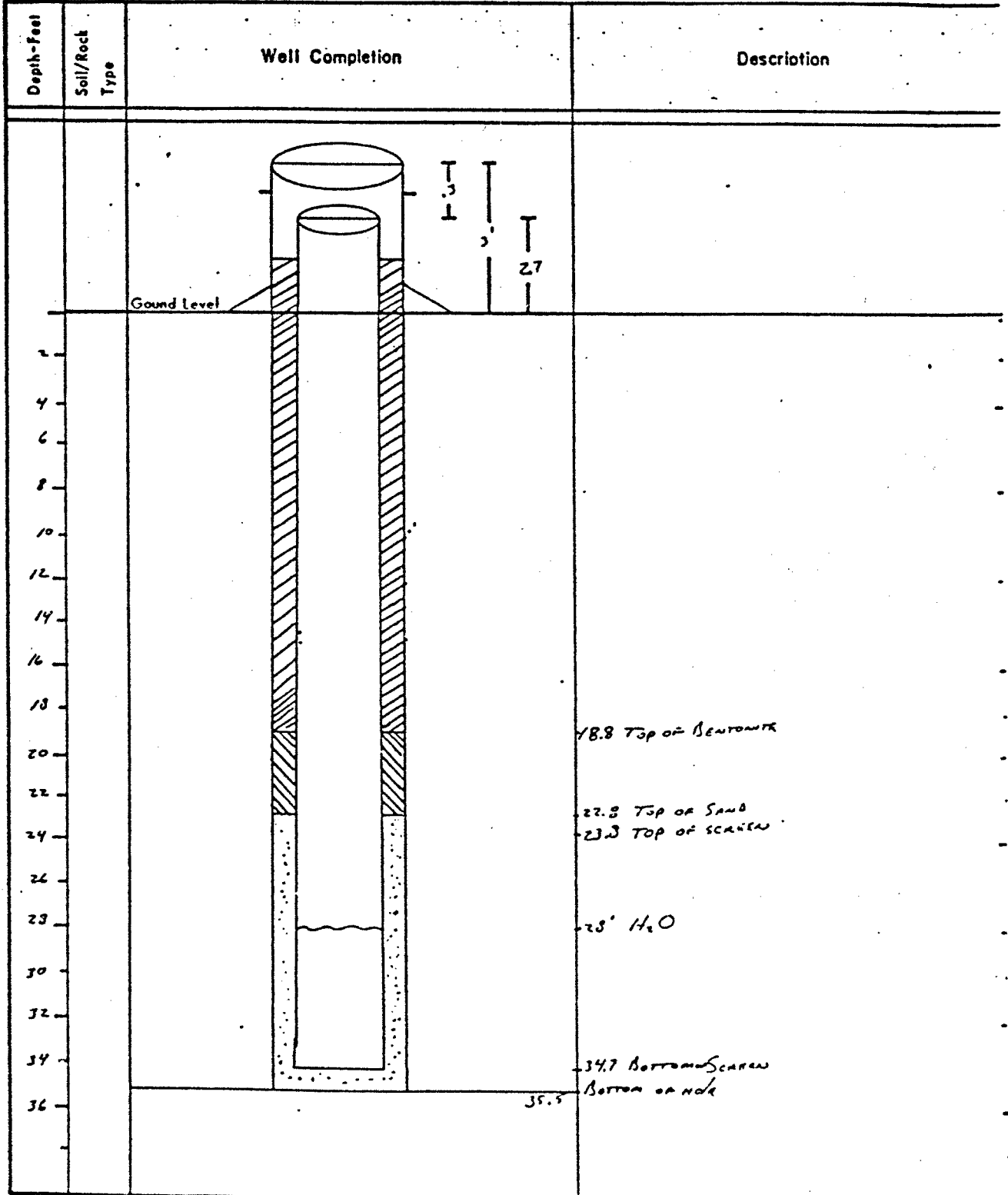
20 OHMS / INCHES

46

LD  
LD  
LD

Borehole: E-47A

Well: E-47A 37378  
 SR



Drill Site Geologist: Cory A. [Signature]  
 Reviewed By: Joseph L. Reed

Date: 3/5/87  
 Date: 7/20/87

**WELL CONSTRUCTION SUMMARY**

Borehole E-47A Well E-47A 37378  
 Project Name and Location 1/2 mile N, 1/2 mile E of Praha & 95<sup>th</sup> St Project Number 17051014.10  
 Drilling Company Boyle Bros Driller DAVA JAVUS Rig Number \_\_\_\_\_  
 Drilling Method(s) Auger

Borehole Diameter 12 1/4 in. \_\_\_\_\_ cm. 0 ft. \_\_\_\_\_ cm. to 35.5 ft. \_\_\_\_\_ cm.  
 \_\_\_\_\_ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) \_\_\_\_\_

Sampling Method(s) CONTINUOUS Split Spoon

Size and Type PVC 4" Screen .020

Date/Time Start Drilling 3/5/07 0830

Date/Time Finish Drilling 3/5/07 1400

Total Borehole Depth 35.5 ft. \_\_\_\_\_ cm.

Date/Time Start Completion 3/6/07 1400

Depth to Bedrock 35.0 ft. \_\_\_\_\_ cm.

Date/Time Cement Protective Casing 3/5/07 1600

Depth to Water 22.0 ft. \_\_\_\_\_ cm.

Materials Used 9-4' TUBES 4 BOXES

Water Level Determined By Samples

Plain PVC 7-10' SECTIONS

Length Plain PVC (total) 26.5 ft. \_\_\_\_\_ cm.

Slotted PVC 1-10' SECTION

Length of Screen 10.9 ft. \_\_\_\_\_ cm.

Bentonite Pellets 4 SUCKETS

Total Length of Well Casing 37.4 ft. \_\_\_\_\_ cm.

Bentonite Granular 0

PVC Stick Up 2.7 ft. \_\_\_\_\_ cm.

Cement 10 BAGS

Depth to Bottom of Screen 34.7 ft. \_\_\_\_\_ cm.

Sand 25 BAGS

Depth to Top of Screen 23.8 ft. \_\_\_\_\_ cm.

Water added during completion 5 GALS TO

Depth to Top of Sand 22.8 ft. \_\_\_\_\_ cm.

Water added during drilling SUBH BENTONITE

Depth to Top of Bentonite 18.8 ft. \_\_\_\_\_ cm.

Total Gallons of water added 5

Drill Site Geologist Greg L. Reed

Date 3/5/07

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 4/8/07/1000/K. Pacheco, M. Westcott/H. 11:35 PJL

Date/Time/Personnel Casing Painted 4/9/07/1100/K. Pacheco, M. Westcott/H.

Date/Time/Personnel Numbers Painted 4/15/07 0945 JLF BAE

Materials Used 9 bags quickcrete, 1/4 bag portland, 1/2 bag silica sand, mortar

Top of Protective Casing to Top of PVC 2.35 ft. \_\_\_\_\_ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 2.1 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Internal Mortar 2.13 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Top of Cement Pad 2.6 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Ground Level 3.0 ft. \_\_\_\_\_ cm.

Reviewed By Joseph L. Reed Date 4/20/07

Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

Borehole: E-47A

Well Number: 37378

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						Munsell Colors
0.0			NA		ML	
1.0	0-2	2'		0-2		<u>ML</u> sandy-silt, 15-20% v.f. gr. sand, 10YR, 4/1-6, dk. ywash. brn., non-plas., loose, slightly moist alluvium.
2.0						At 2.0' color changes to 10YR, 6/2-3, pale brn., moisture decreases to dry.
3.0	2-4	1.6'		2-4		
4.0						At 4.0' color changes to 10YR, 5/6-8, ywash brn., moisture increases to moist, percent sand increases to ~40% v.f. gr. sand.
5.0	4-5.5	1.2'		4-5.5		
6.0						
7.0	5.5-7.5	1.6'		5.5-7.5		
8.0						At 8.0' color is mottled w/ 10YR, 7/2-3, v. pale brn., ~30% calc. sand.
9.0	7.5-9.5	2'		7.5-9.5		
10.0						At 10.0', percent of calc sand decreases to 5%.
11.0	9.5-11.5	2'		9.5-11.5		

Drill Site Geologist: A.E. Dittler  
 Reviewed By: David L. Reed

Date: 3/13/87  
4/17/87

Borehole: E-47A

Well Number: 37378

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
						MUNSELL Colors
11.0	9.5-11.5	2'	NA	9.5-11.5	ML	
11.5	11.5-13.5	1.6'		11.5-13.5	SM	<u>SM</u> silty-sand, ~ 30% silt, 10 YR, 5/6-8, yellow-brown, non-plastic, loose, moist, alluvium.
12.0	13.5-15.5			13.5-15.5		
13.0						
13.5						
14.0	13.5-15.5	1'		13.5-15.5		At 14.0', percent of silt decreases to ~ 15%.
15.0						
15.5	15.5-17.5	1.35'		15.5-17.5		At 17.0', percent of silt decreases to ~ 5-10%.
16.0	17.5-19.5			17.5-19.5		
17.0						
17.5						
18.0	17.5-19.5	1.2'		17.5-19.5	SP	<u>SP</u> Gravelly-sand, 20% quartzite gravel, 60% coarse gr. sand, 20% silt, 10 YR, 5/3-4, brown, non-plastic, loose, moist, alluvium.
19.0	19.5-21.5			19.5-21.5		
19.5						
20.0	19.5-21.5	1.5'		19.5-21.5	SM	<u>SM</u> silty-sand, ~ 5% silt, 10 YR, 6/3-4, <del>tan to pale brown</del> , non-plastic, loose, moist, alluvium.
21.0	21.5-23.5			21.5-23.5		
21.5						
22.0		1'				

Drill Site Geologist: Paul D. [Signature]  
 Reviewed By: Paul L. Reed

Date: 3/13/87  
4/11/87

Borehole: E-47A

Well Number: 37378

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
22.0			NA		SM	Munsell Colors
23.0	21.5 - 23.5	1'		21.5 - 23.5	SM	
23.5	23.5 - 24	0.5'		23.5 - 24	SM	At 23.5' color changes to 10YR, 6/6-8 brownish yellow.
24.0	24 - 25.5	1.1'		24 - 25.5	SM	
25.0	25.5 - 27.5	2'		25.5 - 27.5	SC	SC Clayey-sand, ~30-40% clay, 10YR, 7/2-3, v. pale brn., slightly pls., soft, moist, alluvium
26.0	27.5 - 29.5	1.2'		27.5 - 29.5	SM	SM silty-sand, ~20% silt, 10YR, 5/4-6, ywash. brn., non-pls., loose, saturated alluvium
27.5	29.5 - 30.5	1'		29.5 - 30.5	SM	
28.0	30.5 - 32.5	1.3'		30.5 - 32.5	SM	At 31.0', percent silt decreases to 5-10%.
29.0	32.5 - 34	0'		32.5 - 34		No RECOVERY - Area Loss

Drill Site Geologist: [Signature]

Date: 3/13/87

Reviewed By: Joseph L. Reed

Date: 4/16/87

Borehole: E-47A Well Number: 37379

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						MUNSELL COLORS
33.0	32.5-34	0'		32.5-34		NO RECOVERY - AUGER LOSS
34.0						
34.5	34-36	2'		34-36	SM ↓ CL	
35.0						CL silty-clay, 20-30% silt, <del>to</del> 5/2, 5-6/1, gray w/ 5YR, 5/6 yellow red weathering, slightly plus, med. clay wet, bedrock.
36.0						END OF BORING LOG
37.0						
38.0						
39.0						
40.0						
41.0						
42.0						
43.0						
44.0						

Drill Site Geologist: Joseph L. Reed Date: 3/13/87  
 Reviewed By: Joseph L. Reed Date: 9/16/87

WELL CONSTRUCTION SUMMARY

Borehole E-50 A Well 37396

Project Name and Location RMA T39, ~1/2 mi. S. Hwy 2 of 101<sup>st</sup> Project Number 17053.075.10

Drilling Company Bovles Brothers Driller D. ERKID Rig Number E.R. TH-60

Drilling Method(s) Sample w/ 3 1/4" E.D. H.S. auger, 2' split sample barrel, 0.18' sample shoe, & "Moss" system. Ream w/ 8" E.D. H.S. auger w/ center bit.

Borehole Diameter 12 1/2 in. 0 ft. 28.5 ft.  
\_\_\_\_\_ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) H.S. center bit, continuous flight auger

Sampling Method(s) 3 1/2" E.D. H.S. auger o/a

Size and Type PVC 1" E.D. sch. 40

Date/Time Start Drilling 12/18/87 0952

Date/Time Finish Drilling 12/22/87 0935

Total Borehole Depth 28.50 ft. \_\_\_\_\_ cm.

Date/Time Start Completion 12/22/87 0940

Depth to Bedrock 28.50 ft. \_\_\_\_\_ cm.

Date/Time Cement Protective Casing 12/22/87 1140

Depth to Water 8.30 ft. \_\_\_\_\_ cm.

Materials Used 9.09 94P locking caps 559

Water Level Determined By measurement steel

Plain PVC 9.09' sch. 40

Length Plain PVC (total) 9.09 ft. \_\_\_\_\_ cm.

Slotted PVC 21.11' 20 Johnson Enviro. screen

Length of Screen 21.11 ft. \_\_\_\_\_ cm.

Bentonite Pellets 2 buckets (57<sup>th</sup> bucket) 3/8" slope and 1/4"

Total Length of Well Casing 30.20 ft. \_\_\_\_\_ cm.

Bentonite Granular none

PVC Stick Up 1.70 ft. \_\_\_\_\_ cm.

Cement 1 bag (94<sup>th</sup> bag) Type # Mountain

Depth to Bottom of Screen 28.50 ft. \_\_\_\_\_ cm.

Sand 15 1/2 bags CSSI 10-20

Depth to Top of Screen 7.39 ft. \_\_\_\_\_ cm.

Water added during completion 25 gal

Depth to Top of Sand 3.40 ft. \_\_\_\_\_ cm.

Water added during drilling 0

Depth to Top of Bentonite 1.50 ft. \_\_\_\_\_ cm.

Total Gallons of water added 25 gal

Drill Site Geologist Jamen F. France

Date 1/6/88

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 3-14-88 / 1335 / Dww & BW  
3/10/88 1420 JB/RP

Date/Time/Personnel Casing Painted 3-10-88 RP/JG

Date/Time/Personnel Numbers Painted 3-14-88 / 1335 / Dww & BW

Materials Used 10 bag substrate

	ft.	cm.	COMMENT/NOTES
Top of Protective Casing to Top of PVC	<u>0.30</u>	_____	
Top of Protective Casing to Weep Hole	<u>0.62 + 1.08<sup>2nd</sup></u>	_____	
Top of Protective Casing to Internal Mortar	<u>0.70</u>	_____	
Top of Protective Casing to Top of Cement Pad	<u>1.68</u>	_____	
Top of Protective Casing to Ground Level	<u>1.70</u>	_____	

Reviewed By John France Date 3/15/88  
 Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

Borehole: E-50

Well: 37396

Depth-Feet	Soil/Rock Type	Well Completion	Description
			<p>Set 8" I.D. protective CSG to 1.5'</p> <p>4" I.D. PVC to plain PVC from ~1.7' above ground to 7.39' below ground.</p> <p>4" I.D. 20 Johnson Environ. screen from 7.39' below ground to @ 28.5'</p>
5	silty sand		<p>Top of bentonite: 1.40'</p> <p>Bottom 8" I.D. steel CSG: 1.50'</p> <p>Top of sand: 3.40'</p> <p>Top of screen: 7.39'</p>
10	silty clay	Jt. 7.39	
15	clay sand		
15	silty clay		
15	silty clayey sand		
20	silty sand	Jt. 17.87	
20	sand		
25	C. sand		
30	weathered sandy clay B.R.		<p>Bottom of screen: 28.5'</p> <p>T.D. @ 28.5'</p> <p>Bedrock: 28.5'</p>
			<p><u>Materials</u></p> <p>Plain PVC: 2.09' Std 40</p> <p>Slotted PVC: 21.11' 20 Johnson Environ. Screen</p> <p>Bent. Pkts: 2 buckets, 3/8" Slope Indicator</p> <p>Cement: 1 bag Type II Mtn.</p> <p>Sand: 15 1/2 bags CSSZ #20</p> <p>Protect CSG: 5' x 8" I.D. red w/ locking cap.</p>

Drill Site Geologist: J.F. Powell  
 Reviewed By: [Signature]

Date: 11/6/88  
 Date: 11/7/88

Borehole: E-50

Well Number: 3739b

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						<i>Munsell Colors.</i>
0					SM	<p><i>Silly sand, 10-30% silt, predom. f-vf grained sand, trace clay, 10YR 3/2 v dk grayish brn, rounded-subrounded, pred Qtz, abundant root fragments &amp; organic debris, loose, non-plas, moist alluvium.</i></p>
1	0-2	2'		0-2		
2						<p style="text-align: center;">↓</p>
3	2-4	2'		2-4		
						<p><i>At 3.0'; root frags absent.</i></p>
4					CL	<p><i>At 3.8'; clay, silty clay, 10-30% silt, 10YR 4/2 dk grayish brn, slightly plas, soft, moist alluvium.</i></p>
5	4-6	2'		4-6		
6						↓

Drill Site Geologist: [Signature] Date: 1/6/88  
 Reviewed By: [Signature] Date: 1/7/88

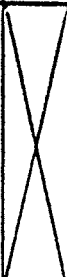
Borehole: E-50 Well Number: 3739b

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						Munsell Colors
0		X				No Recovery
7	8-9	1.5		8-9		At 6.5'; <u>saturated.</u>
8		X				No Recovery
9	8-10	2		8-10	SC	At 8.7'; <u>clayey sand</u> , 70-40% clay, pred f. of grained sand, occ med grind, 10YR 4/2 dk gray br x sl. plas, soft, saturated, alluvium,
10		X				
10					CL	At 9.5'; <u>silty clay</u> , 10-30% silt, 10YR 4/1 dk gray, sl plas, soft-med stiff, moist alluvium.
11	10-12	2		10-12		
12						

Drill Site Geologist: G.F. Pearce Date: 1/6/88  
 Reviewed By: [Signature] Date: 1/8/88

Borehole: E-50

Well Number: 37396

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
12						Munsell Colors
13	12-14			12-14		No Recovery
14		0.5'			SC	At 13.5'; <u>clayey sand</u> , 20-30% clay, pred f-vf grained sand, 10YR 9/1 dk gray, sl plas, saturated alluvium.
15	14-16	2'		14-16	SM	At 19.0'; color changes to 40YR 5/3 w/ brn some Fe stain 10YR 6/8 brn yell.,
16					SM	At 15.0'; <u>silty sand</u> , 10-30% silt, pred. f grained sand, 10-20% clay, 10YR 5/3 brn, w/ mottled and occ layered Fe stain 10YR 5/8 yell brn, pred qtz, sme ferromags, sl. plas, saturated, alluvium.
17	16-18	2'		16-18	SC	At 15.8'; <u>clayey sand</u> , 25-30% clay, pred f-vf w/ occ med grained sand, 10-20% silt, 10YR 5/4 yell brn, w/ mottled Fe stain as above, sl plas, soft, saturated, alluvium.
18					CL	At 17.2, <u>silty clay</u> , 20-30% silt, some v-f sand, 10YR 5/3 brn, Fe stain absent, sl-low plas, soft-med stiff, saturated, alluvium.

Drill Site Geologist: C. J. Pearce

Date: 1/6/88

Reviewed By: [Signature]

Date: 1/8/88

Borehole: E-50

Well Number: 3796

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						Munsell Colors
19	18-20	X		18-20		No Recovery
19		1'			SM	At 19.0'; <u>silty sand</u> 30-40% silt, pred f grained sand, 10YR 5/4 yell brn, loose, non-pls, saturated alluvium
20	20-22	2'		20-22	SP	At 19.9'; <u>poorly graded sand</u> , 20% med, 60% fine, remainder vt w/ tr coarse, 10YR 4/4 dk yell brn, pred qtz w/ 10-20% feldspar; minor ferromags, loose, non-pls saturated alluvium. At 20.6'; 20% vt, 20% f, 20% coarse 40% med grained, color changes to 10YR 4/2 dk grayish brn.
21						At 21.7'; coarse increases to 30%
22	22-24	X		22-24		No Recovery
23		1'				At 23.0'; pred f grained w/ 20% med, 10% coarse, occ. pebble
24						At 23.8'; pred coarse w/ abund. v. coarse

Drill Site Geologist: J. F. Pearce

Date: 1/6/88

Reviewed By: [Signature]

Date: 1/8/88

Borehole: E-50 Well Number: 37396

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
24						Munsell Colors.
25	24-26	2		24-26		
26						
27	26-28	2		26-28		At 27.0; pred v. coarse
28						
28.5						At 28.5; gravel - pebble At 28.5; weathered clay, sandy.
29	28-30	2		28-30		CL At 29.0; clay, 10YR 4/1 dk gray, stiff, mod plas, moist, bedrock.
30						

END OF BORING LOG

Drill Site Geologist: J. Pearce Date: 1/6/88  
 Reviewed By: AKS Date: 1/8/88

WELL CONSTRUCTION SUMMARY

Borehole C-52 Well 37397

Project Name and Location RMH T32, 1/8 mi N. of 101st on Peoria Project Number 17053.075-10

Drilling Company Boyles Brothers Driller D. Ervin Rig Number ER TH-60

Drilling Method(s) Sample w/ 3 1/4" I.D. H.S. auger, 2' split sample barrel, w/ 0.18" sample shoe, and "Moss" system. Recm w/ 8" I.D. H.S. auger w/ center bit

Borehole Diameter 12 1/2 in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to 34.80 ft. \_\_\_\_\_ cm.  
 \_\_\_\_\_ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) H.S. auger center bit, continuous flight auger.

Sampling Method(s) 3 1/4" I.D. H.S. as above.

Size and Type PVC 4" I.D. sch. 40

Date/Time Start Drilling 1/4/88 1420

Total Borehole Depth 34.80 ft. \_\_\_\_\_ cm.

Date/Time Finish Drilling 1/5/88 1230

Depth to Bedrock 31.90 ft. \_\_\_\_\_ cm.

Date/Time Start Completion 1/5/88 1230

Depth to Water 25.00 ft. \_\_\_\_\_ cm.

Date/Time Cement Protective Casing 1/5/88 1410

Water Level Determined By meas. w/ steel tape

Materials Used Protective casing w/ locking cap.

Length Plain PVC (total) 20.29 ft. \_\_\_\_\_ cm.

Plain PVC 20.29' 4" ID sch 40

Length of Screen 16.17 ft. \_\_\_\_\_ cm.

Slotted PVC 16.17' 4" I.D. 20-Johnson Ervin

Total Length of Well Casing 36.46 ft. \_\_\_\_\_ cm.

Bentonite Pellets 5 buckets (55#/buck) 3/8" slope into

PVC Stick Up 1.70 ft. \_\_\_\_\_ cm.

Bentonite Granular none

Depth to Bottom of Screen 34.80 ft. \_\_\_\_\_ cm.

Cement 5 bags Type II Mountain

Depth to Top of Screen 18.63 ft. \_\_\_\_\_ cm.

Sand 12 bags CSSI 10-20

Depth to Top of Sand 14.20 ft. \_\_\_\_\_ cm.

Water added during completion 5 gal

Depth to Top of Bentonite 9.00 ft. \_\_\_\_\_ cm.

Water added during drilling 0

Total Gallons of water added 5 gal.

Drill Site Geologist James F. Pearce

Date 1/6/88

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 3-10-88/1100/RP & FB

Weep hole: 374-88/1400/DW & BW

Date/Time/Personnel Casing Painted 3-10-88/1030/RP & FB

Date/Time/Personnel Numbers Painted 3-14-88/1400/DW & BW

Materials Used 12 bags concrete

Top of Protective Casing to Top of PVC 0.27 ft. \_\_\_\_\_ cm.

COMMENT/NOTES

Top of Protective Casing to Weep Hole 1.57 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Internal Mortar 1.60 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Top of Cement Pad 1.87 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Ground Level 1.87 ft. \_\_\_\_\_ cm.

Reviewed By Steve Paul

Date 3/15/88

Drill Site Geologist \_\_\_\_\_

Date \_\_\_\_\_

Borehole: E-52

Well: 37397

Depth-feet	Soil/Rock Type	Well Completion	Description
			Set 8" E.D. protect. cs9 to 3.00' 4" E.D. scd. 40 PVC from 1.7' above ground to 18.63 below ground 4" E.D. 20-Johnson EVID screen from 18.63 to 34.80' at 34.80'.
5	Silty sand		Bottom of 8" E.D. steel cs9: 3.00'
10	Sand f.g.	Jt. B-59	Top of Bentonite: 9.00'
15	sandy silt		Top of sand: 14.20
20	sand f-m gr.	Jt. 18.63	Top of screen: 18.63
25	clayey sand	Jt. 24.13	
30	silty sand		Bedrock: 31.90'
35	Sand f-m		Bottom of screen: 34.80'
			<b>Materials</b> Plain PVC: 20.29, 4" E.D. scd 40 Slot PVC: 16.17 " " 20-Johnson Rust. Pellets: 5 buckets 3/8" Slope Indicator Cement: 5 bags Type II Mtn. Sand: 13 bags CSSI 10-20. Protect cs9: 5' x 8" E.D. red iron w/ locking cap.

Drill Site Geologist: Danny F. Lister Date: 1/6/88  
 Reviewed By: [Signature] Date: 3/15/88

Borehole: E-52 Well Number: 37397

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
<i>Munsell Colors</i>						
0					SM	<u>Silty sand</u> , 10-20% silt, pred f grain w/ 20-30% v.f. grnd sand, subrded to rounded qtz., 10YR 3/2 v. dk grayish brn, loose, non plas., moist alluvium.
1	2-0	2'	2-0	2-0		↓ At 1.8'; color changes to 10YR 5/4 yell. brn.
2						At 2.0'; silt increases to 20-30%, sand grain sizes change to pred rf w/ 10-20% f, occ. med-coarse grnd sand. 10YR 4/4 dk. yell brn
3	4-2	2'	4-2	4-2		At 2.6'; no Hled 10YR 6/4 lt. yell. brn. At 3.2'; no Hled 10YR 6/4, absent.
4						
5	9-4	2'	9-4	9-4		
6					SP	At 5.8'; <u>poorly graded sand</u> , 20% rt., 20% red

Drill Site Geologist: James F. Pearce Date: 1/6/88  
 Reviewed By: Steve Date: 1/7/88

Borehole: E-52

Well Number: 37397

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						Munsell Colors
7	8-9	2'	8-9	8-9		60% f grained sand, 10YR 6/6 brnsh yell. subrded to rndd, qtz., 10%e, non-plas moist alluvium. At 6.5; pred med grained sand.
8					SM	At 7.3; <u>Silly sand</u> , 10-30% silt, 20% med, 20% v.f., 20% f grned sand, 10YR 4/6 dk yell brn, subrd - rnd, qtz, loose, non-plas, moist alluvium.
9	8-10	2'	8-10	8-10		At 8.5; mottled CaCO <sub>3</sub> , 10YR 6/3, pale brn At 9.2; 0.1' thick layer w/ 40-50% silt and moderate clay. At 9.5; silt decreases to 20-30%, clay absent. 20% vt grned, 40% fine grned sand.
10						
11	10-12	2'	10-12	10-12	ML	At 10.6; <u>Sandy silt</u> , 20-30% sand, pred v.f. f grained, occ coarse & pebble grains, 10YR 5/4, yell brn, loose, non plas, moist alluvium. At 11.5; sand decreases to 10-20%
12						

Drill Site Geologist: O.F. Pearce Date: 1/6/88  
 Reviewed By: John Paves Date: 1/7/88

Borehole: E-52

Well Number: 37397

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						<i>Munsell Colors</i>
12						At 12.0'; sand pred, coarse grained, occ granite pebbles.
13	12-14	2	12-14	12-14		At 13.0'; color changes to 10YR 6/4, 11 yell f. brn.
14						At 14.0'; mottled colors 10YR 7/2 11 gray sand pred f-vt grained w/ occ coarse
15	14-16	2	14-16	14-16		
16					SM	At 15.8'; silty sand, 20-30% silt, 20% vf, 20% f grained, 30% med grained,
17	16-18	2	16-18	16-18		At 16.6'; silt decreases to 10-20%, sand pred med grad. At 17.0'; silt increases to 20-30%.
18						At 17.7'; silt decreases to 10-20%, sand pred med grained w/ 10-20% coarse grained.

Drill Site Geologist: J. A. Pearce

Date: 1/6/88

Reviewed By: Steve Pans

Date: 1/7/88

Borehole: E-52

Well Number: 37397

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
18		X				No Recovery
19	02 - 01	1.5'	02 - 01	02 - 01	SP	At 18.5'; <u>poorly graded sand</u> , 10-20% v-f, 30% f, 30% med grained, 10YR 5/4 yell brn, subnd - rnd, qtz w/ minor feldspar, loose, non plas, moist alluvium. At 19.5'; pred coarse grained.
20					CL	At 19.7'; <u>silty clay</u> , 10-30% silt, 10YR 5/6, yell brn, sl plas, red stiff, moist, alluvium.
21	20 - 22	2'	20 - 22	20 - 22	SP	At 20.2'; <u>poorly graded sand</u> , pred coarse-med grained, 20-30% v-f grained, 10YR 6/4 lt yell brn, pred. rnded, qtz, loose, non-plas, moist, alluvium.
22		X			CL	At 21.8'; <u>clay</u> , trace silt, 10YR 5/2 grayish brn, low plas, stiff, moist, alluvium.
23	22 - 24	1'	22 - 24	22 - 24	SC	At 23.3'; <u>clay + sand</u> , 10-40% clay, pred med-f grained sand, 10YR 5/3, brn, w/ abundant Fe staining 5YR 4/4 red brn, subnd - rounded, qtz - feldspar, loose, non-plas, moist alluvium.

Drill Site Geologist: J. J. Ponce

Date: 1/6/88

Reviewed By: [Signature]

Date: 1/7/88

Borehole: E-52

Well Number: 37397

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						Munsell Colors
24						↓
25	24-26	2'	24-26	24-26		At 24.8'; o/c mottled CaCO <sub>3</sub> 10YR 7/2 lt gray
						↓
26						At 25.7'; 0.15" thick clay lens.
						At 26.0'; pred v.f. graind, 20% med graind. <u>saturated at 26.0'</u>
						At 26.4'; Fe stain & CaCO <sub>3</sub> absent
27	26-28	2'	26-28	26-28	SM	At 26.5'; <u>silty sand</u> ; 10-30% silt, pred. f. v.f. graind sand, 10YR 5/4 yell. brn., loose, non-plas, saturated alluvium.
28						
29	28-30	<del>2'</del> NO Sample	<del>28-30</del>	28-30		No Recovery
30						

Drill Site Geologist: G.F. Pearce

Date: 1/6/88

Reviewed By: [Signature]

Date: 1/7/88

Borehole: E-52

Well Number: 37397

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						Munsell colors
30		X				No Recover - 1
31	30-32		30-32	30-32	SM	<del>Silt</del> At 31.2'; silty sand as above.
32		1'				
					SP	At 31.9'; <u>poorly graded sand</u> , 20% vf, 30-50% f. med, trace coarse, some silty, 10YR 4/6, dk yell. brn, med qtz, w/ abundant, Fe staining, 10YR 6/8 brn yell, pred qtz, <sup>thinly bedded</sup> compacted & indurated, hard, moist bedrock.
33	32-34		32-31	32-34		
		2'				
34						End of Boring Log.

Drill Site Geologist: J.F. Pearce

Date: 1/6/88

Reviewed By: Alan Pa

Date: 1/7/88

WELL CONSTRUCTION SUMMARY

Borehole E-53A Well 37367  
 Project Name and Location RMA off Post task 39 Project Number 86-942-0210  
 Drilling Company Boyles Bros. Driller Dave Jarvie Rig Number 5951  
 Drilling Method(s) Hollow stem auger 3 1/2" ID 6 1/4" O.D. Continuous Sampling  
Reamed with 8 1/2" ID 12 1/2" O.D. Hollow stem Auger  
 Borehole Diameter 12 1/4 in. \_\_\_\_\_ cm. 0 ft. \_\_\_\_\_ cm. to 39.5 ft. \_\_\_\_\_ cm.  
 \_\_\_\_\_ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) Hollow stem Auger 12 1/4" Sampling Method(s) Continuous Hollow Stem Auger  
 Date/Time Start Drilling 12/17/86 1900  
 Date/Time Finish Drilling 12/18/86 1500  
 Date/Time Start Completion 12/19/86 0800  
 Date/Time Cement Protective Casing 1000  
 Materials Used \_\_\_\_\_  
 Size and Type PVC 4" sch 40 0.20" slot Plain PVC 2-10'  
 Slotted PVC 2-10' 1-5'  
 Total Borehole Depth 39.5 ft. \_\_\_\_\_ cm. Bentonite Pellets 5 Buckets (50 lbs)  
 Depth to Bedrock 39.5 ft. \_\_\_\_\_ cm. Bentonite Granular 10 lbs  
 Depth to Water 87 ft. \_\_\_\_\_ cm. Cement 2 Bags  
 Water Level Determined By Measurement 6 1/2" Auger After 24 hrs Sand 17 Bags  
 Length Plain PVC (total) 13.16 ft. \_\_\_\_\_ cm. Water added during completion 10 gal  
 Length of Screen 26.91 ft. \_\_\_\_\_ cm. Water added during drilling 0  
 Total Length of Well Casing 40.07 ft. \_\_\_\_\_ cm. Total Gallons of water added 10 gal  
 PVC Stick Up 1.70 ft. \_\_\_\_\_ cm.  
 Depth to Bottom of Screen 38.37 ft. \_\_\_\_\_ cm.  
 Depth to Top of Screen 11.46 ft. \_\_\_\_\_ cm.  
 Depth to Top of Sand 7.70 ft. \_\_\_\_\_ cm.  
 Depth to Top of Bentonite 3.70 ft. \_\_\_\_\_ cm.

Drill Site Geologist Joe Reed Date 12/19/86

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed \_\_\_\_\_  
 Date/Time/Personnel Casing Painted \_\_\_\_\_  
 Date/Time/Personnel Numbers Painted \_\_\_\_\_

Materials Used \_\_\_\_\_

Top of Protective Casing to Top of PVC	<u>0.35</u> ft. _____ cm.	COMMENT/NOTES
Top of Protective Casing to Weep Hole	<u>1.0</u> ft. _____ cm.	_____
Top of Protective Casing to Internal Mortar	<u>1.33</u> ft. _____ cm.	_____
Top of Protective Casing to Top of Cement Pad	<u>1.95</u> ft. _____ cm.	_____
Top of Protective Casing to Ground Level	<u>2.05</u> ft. _____ cm.	_____

Reviewed By \_\_\_\_\_ Date \_\_\_\_\_  
 Drill Site Geologist Joseph L. Reed Date 12/19/86

Borehole: E-53A

Well: 37367

Depth-feet	Soil/Rock Type	Well Completion	Description
<p>5</p> <p>10</p> <p>20</p> <p>30</p> <p>40</p>			<p>1.91 Joint</p> <p>3.7 Top of Bentonite</p> <p>7.70 Top of sand</p> <p>11.46 Top of Screen</p> <p>18.7 water level</p> <p>21.98 Joint</p> <p>32.5 joint</p> <p>38.37 Bottom of screen</p> <p>39.5 Borehole T.D. Bedrock</p>

Drill Site Geologist: Joseph J. Bieri  
 Reviewed By: \_\_\_\_\_

Date: 12/19/86  
 Date: \_\_\_\_\_

Borehole: E-53A

Well Number: 37367

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
0						
0 - 26.0		NO RECOVERY				NO RECOVERY
26.0 - 22.0		82%	E53-A	26-27'	ML	ML, sandy silt, 30% m-g sand, 10% R 4/4-6 dk. gray dk. non-plast, med. stiff, saturated alluvium
22.0 - 24.0		78%	E53-A	22-24'		
24.0 - 25.0			E53A	24-25'		
25.0 - 35.0						

Drill Site Geologist: W. C. [Signature] Date: 12/22/86

Reviewed By: \_\_\_\_\_ Date: \_\_\_\_\_

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SHEET 2 OF 4

Borehole: E53A Well Number: 37367

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
25.0		100%	E53A	25.0 - 26.5	SM	<p>SM, silty sand, 28% silt, 11-c. grain sand, 104K 514                      gush ben, non-plast, loose, saturated alluvium.</p> <p>DECREASE SAND SIZE, T. GR.</p>
26.0						
26.5		100%	E53A	26.5 - 28.0		
27.0						
28.0		100%	E53A	28.0 - 29.5		
29.0						
29.5		100%	E53A	29.5 - 31.5		
30.0						
31.0						

Borehole: ES3A Well Number: 37367

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
31.0		100%	ES3A	31.0 - 32.5	SM	INCREASE grain size to COARSE Increase grain size to coarse
31.5		100%	ES3A			
32.0						
32.5		100%	ES3A	32.5 - 33.5		DECREASE grain size to fine-med grain, color change to 10YR 9/4-6 DRK gray BRN.
33.0						
33.5		80% 1.5'	ES3A	33.5 - 35.0		
34.0						
35.0		1.5	ES3A	35.0 - 36.5		INCREASE grain size to coarse grain
36.0						
36.5		1.5	ES3A	36.5 - 38.0		COARSE sand w/ 10% gravel SP PRG 8/28
37.0						

Drill Site Geologist: W. G. [Signature] Date: 12/22/86

Borehole: E53A Well Number: 37367

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
37.0					SM	SOILS LOG Description
38.0	1.5		E53A	38 - 39.5		
39.0						
39.5						END OF BORING

Drill Site Geologist: W. Gustaf Date: 12/22/86  
 Reviewed By: \_\_\_\_\_ Date: \_\_\_\_\_

WELL CONSTRUCTION SUMMARY

Borehole E-5308-1 Well 37400  
 Project Name and Location RMA off post box 12 Project Number 739  
 Drilling Company Bowle Bros Driller Tom High Rig Number Mobile  
 Drilling Method(s) 3 1/4" ID hollow stem auger Moss system sampling then sealed with 1 1/4" OD hollow stem auger  
 Borehole Diameter 1 1/4 in. 0 ft. 42.0' ft. 0 cm. to 0 cm. to 0 ft. 0 cm.

Size(s) and types of Bit(s) Auger  
 Size and Type PVC 2" o.d. 40' 0.20 slot  
 Total Borehole Depth 42.0' ft. 0 cm.  
 Depth to Bedrock 38.5' ft. 0 cm.  
 Depth to Water 20.0' ft. 0 cm.  
 Water Level Determined By sample  
 Length Plain PVC (total) 18.29' ft. 0 cm.  
 Length of Screen 15.41' ft. 0 cm.  
 Total Length of Well Casing 43.7' ft. 0 cm.  
 PVC Stick Up 2.0' ft. 0 cm.  
 Depth to Bottom of Screen 41.7' ft. 0 cm.  
 Depth to Top of Screen 16.29' ft. 0 cm.  
 Depth to Top of Sand 11.90' ft. 0 cm.  
 Depth to Top of Bentonite 7.50' ft. 0 cm.

Sampling Method(s) continuous (Moss)  
 Date/Time Start Drilling 3/30/88 0903  
 Date/Time Finish Drilling 4/4/88 0958  
 Date/Time Start Completion 4/4/88 1028  
 Date/Time Cement Protective Casing 4/4/88 1210  
 Materials Used protective casing 1 cap, 1 bucket  
 Plain PVC 1-10' 1-cut section  
 Slotted PVC 2-10' 1-5' section  
 Bentonite Pellets 4 buckets (50# bucket)  
 Bentonite Granular 3/10 bags (50#)  
 Cement 3 bags  
 Sand 22 bags  
 Water added during completion 100 gal  
 Water added during drilling 0  
 Total Gallons of water added 100 gal

Drill Site Geologist Steve Jones

Date 4/14/88

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 4/7/88 SMP & SCS 1000  
 Date/Time/Personnel Casing Painted 4/7/88 SMP & SCS 1200  
 Date/Time/Personnel Numbers Painted 4/8/88 SMP & KR 1000

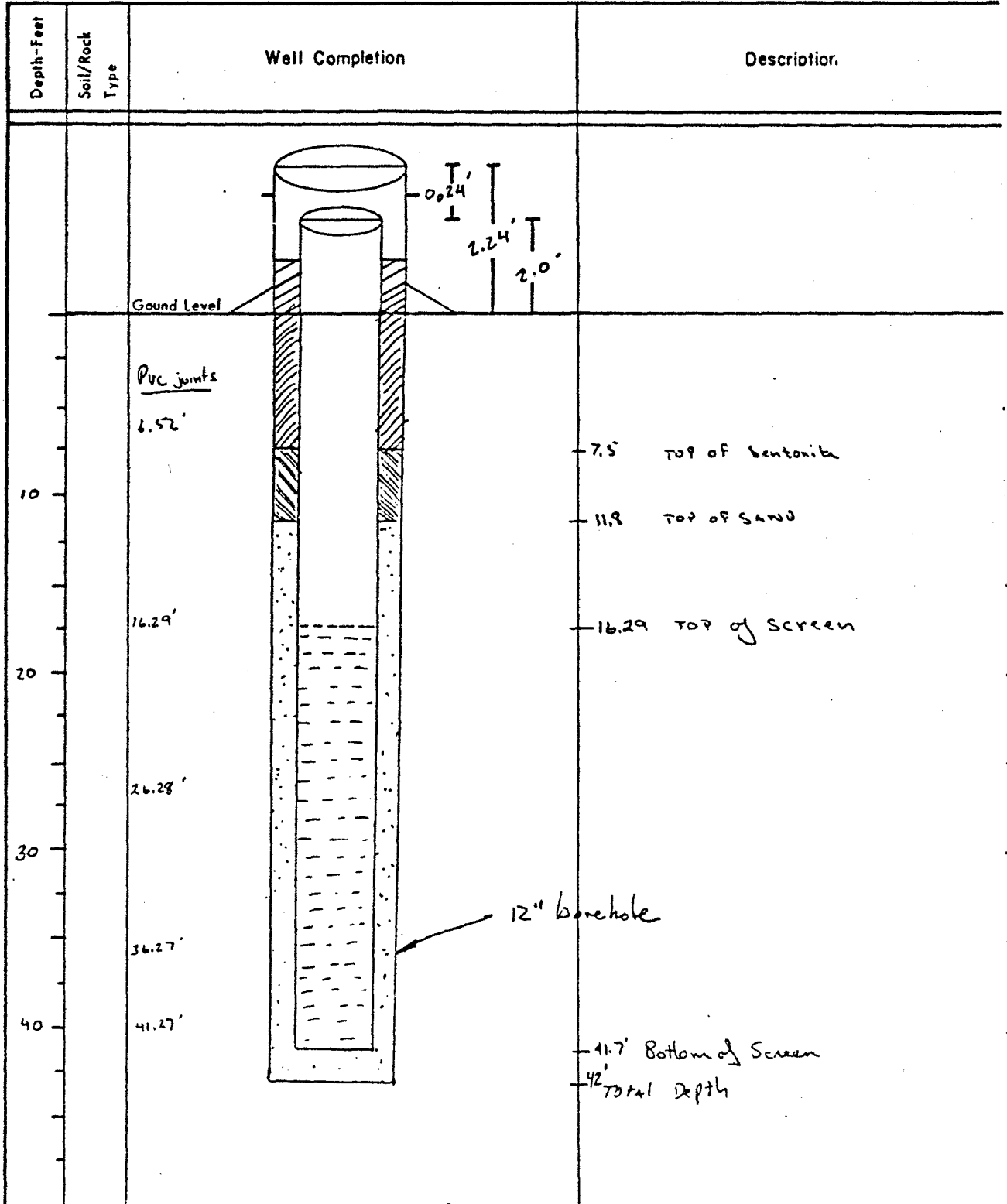
Materials Used 10 bags of pellets

Top of Protective Casing to Top of PVC	<u>0.24</u> ft. <u>0</u> cm.	COMMENT/NOTES
Top of Protective Casing to Weep Hole	<u>1.44</u> ft. <u>0</u> cm.	
Top of Protective Casing to Internal Mortar	<u>1.44</u> ft. <u>0</u> cm.	
Top of Protective Casing to Top of Cement Pad	<u>1.90</u> ft. <u>0</u> cm.	
Top of Protective Casing to Ground Level	<u>2.24</u> ft. <u>0</u> cm.	

Reviewed By Steve Jones Date 4-20-88  
 Drill Site Geologist Steve Jones Date 4-20-88

Borehole: E-5308-R1

Well: 37400



Drill Site Geologist: A. P. [Signature]  
 Reviewed By: [Signature]

Date: 4/8/88  
 Date: 4-20-88

Borehole: F-53

Well Number: OB-1

37406

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
0	2	2/2	1	0	SM	Silty sand, fine grained, 45% silt, 15 YR 4/4 dark yellow brown, dry, low plastic med stiff
2	2			2		
2	2	2/2	2	2	SC	Clayey sand fine to medium 25% clay 10 YR 4/4 dark yellowish brown, med stiff moist med plas
4	4			4		
4	4	2/2	3	4	SM	Silty sand, fine to medium grained, 30% silt 10 YR 5/3 brown, non cohesive, dry
6	6			6		
6	6	2/2	4	6	SC	Clayey sand, fine to medium grain, 30% clay 10 YR 6/9 light yellowish brown, med stiff moist med plastic
8	8			8		
9	9	2/1		9		at 9' changes to fine to coarse
9	6	2	5	6		
10	10			10		at 10' very calcareous

*Drill bit installed*

Drill Site Geologist: Steve L. Brown / (Lead) Date: 4-13-88

Reviewed By: A. Rand Date: 4/20/88

Borehole: E-53

Well Number: OB-1 37400

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
10	10	.7/2	6	10	SC	Same as above
11	12			12	SM	Silty sand fine to medium, 15% silt 10YR 5/6 yellowish brown, slightly moist low plastic med stite
12	12		7	12		
13	14	2/2		14	SC	Clayey sand, fine to medium 25% clay 10YR 5/6 yellowish brown, slightly moist med stite, low plastic, calc nod's
14	14		8	14		
15	16	2/2		16		
16	16			16		at 16' clay content increases to 35% grain size increases to fine to coarse
17	18	2/2	9	18		
18	18			18		
19	20	2/2	10	20		at 18' clay increases to 45%
20	20			20		

Dave West - Installer

Drill Site Geologist: [Signature] Date: 4/15/89

Reviewed By: [Signature] Date: 4/20/88

Borehole: E-53

Well Number: OB-1 37406

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
20	20	.5		26	SC	Same as above, saturated at 20'
21	21	1/2	11	21		
22	22			22		No recovery from 22 to 25-5
23	23	0/2	11/7	24		
24	24		12	24		
25	25	.5/2		26	SM	Silty sand, fine to very coarse, 5% gravel approx 20% silt, 10% R6/4 light yellow brown, saturated, non plastic, med dense
26	26		13	26		
27	27			28		
28	28			29		
29	29	1/1	14	29		
30	30			30		

Drill Site Geologist: [Signature]

Date: 4/13/88

Reviewed By: [Signature]

Date: 4/20/89

Borehole: E-53 Well Number: OB-1 37400

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
30	30	.5 / 2	16	30	SM	same as above
	↓			↓		
	32			32		
32	32	.5 / 2	17	32		
	↓			↓		
	34			34		
34	34	.5 / 2	19	34		
	↓			↓		
	36			36		gravel increases to 10% at 36'
	↓			↓		
	38	0 / 2	11/2	38		no recovery 36' → 38'
	↓			↓		
	38				GP	Poorly graded gravel small to large (2.5") 30% sand fine to very coarse 10YR 5/4 yellowish brown saturated Claystone bedrock mottled, very weathered, Silt claystone clasts in silt clay matrix Olive with blue-gray clasts
	↓					
	40					

Drill Site Geologist: [Signature] Date: 4-15-88  
 Reviewed By: [Signature] Date: 4/20/88

**WELL CONSTRUCTION SUMMARY**

Borehole E-53 032 Well 37401  
 Project Name and Location RMA OFF-ROAD SECT. 12 Project Number TASK 39  
 Drilling Company RYLES BROS. Driller TOM BIGHT Rig Number B-61 Auger Rig  
 Drilling Method(s) AUGER w/ MOSS SYSTEM (6 1/2" AUGERS) THEN RETURN  
HOLE TO T.D. w/ 12" AUGERS.

Borehole Diameter 12 in. \_\_\_\_\_ cm. 0 ft. \_\_\_\_\_ cm. to 42 ft. \_\_\_\_\_ cm.  
 \_\_\_\_\_ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) 6 1/2" hollow stem auger  
12" (OD) auger.

Size and Type PVC 2" sch. 40

Total Borehole Depth 42 ft. \_\_\_\_\_ cm.

Depth to Bedrock 41 ft. \_\_\_\_\_ cm.

Depth to Water 18.75 ft. \_\_\_\_\_ cm.

Water Level Determined By Solinst

Length Plain PVC (total) 18.44 ft. \_\_\_\_\_ cm.

Length of Screen + Endcap 25.24 ft. \_\_\_\_\_ cm.

Total Length of Well Casing 43.68 ft. \_\_\_\_\_ cm.

PVC Stick Up 1.63 ft. \_\_\_\_\_ cm.

Depth to Bottom of Screen 42.05 ft. \_\_\_\_\_ cm.

Depth to Top of Screen 16.81 ft. \_\_\_\_\_ cm.

Depth to Top of Sand 9.0 ft. \_\_\_\_\_ cm.

Depth to Top of Bentonite 3.0 ft. \_\_\_\_\_ cm.

Drill Site Geologist [Signature]

Sampling Method(s) MOSS SYSTEM w/ Hollow Stem Auger

Date/Time Start Drilling 3/25/88 1026

Date/Time Finish Drilling 3/29/88 0913

Date/Time Start Completion 3/29/88 0950

Date/Time Cement Protective Casing 3/29/88 1500

Materials Used 10 ft. sect. surface casing.

Plain PVC (2) 10ft sections

Slotted PVC (2) 10ft sections (1) 5ft. section.

Bentonite Pellets 2 buckets

Bentonite Granular N/A

Cement 3 bags

Sand 21 bags

Water added during completion ~ 110 gal.

Water added during drilling ~ 50 gal

Total Gallons of water added ~ 160 gal

Date 4/6/88

Weep hole & internal mortar: 4/6/88 SWP & RR

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed Cement pad: 4/1/88 SWP & SCS

Date/Time/Personnel Casing Painted 4/1/88 SWP & SCS

Date/Time/Personnel Numbers Painted 4/6/88 SWP & BW 1300

Materials Used 10" & bags sacrete

Top of Protective Casing to Top of PVC 0.34 ft. \_\_\_\_\_ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 1.49 ft. \_\_\_\_\_ cm. \_\_\_\_\_

Top of Protective Casing to Internal Mortar 1.51 ft. \_\_\_\_\_ cm. \_\_\_\_\_

Top of Protective Casing to Top of Cement Pad 1.79 ft. \_\_\_\_\_ cm. \_\_\_\_\_

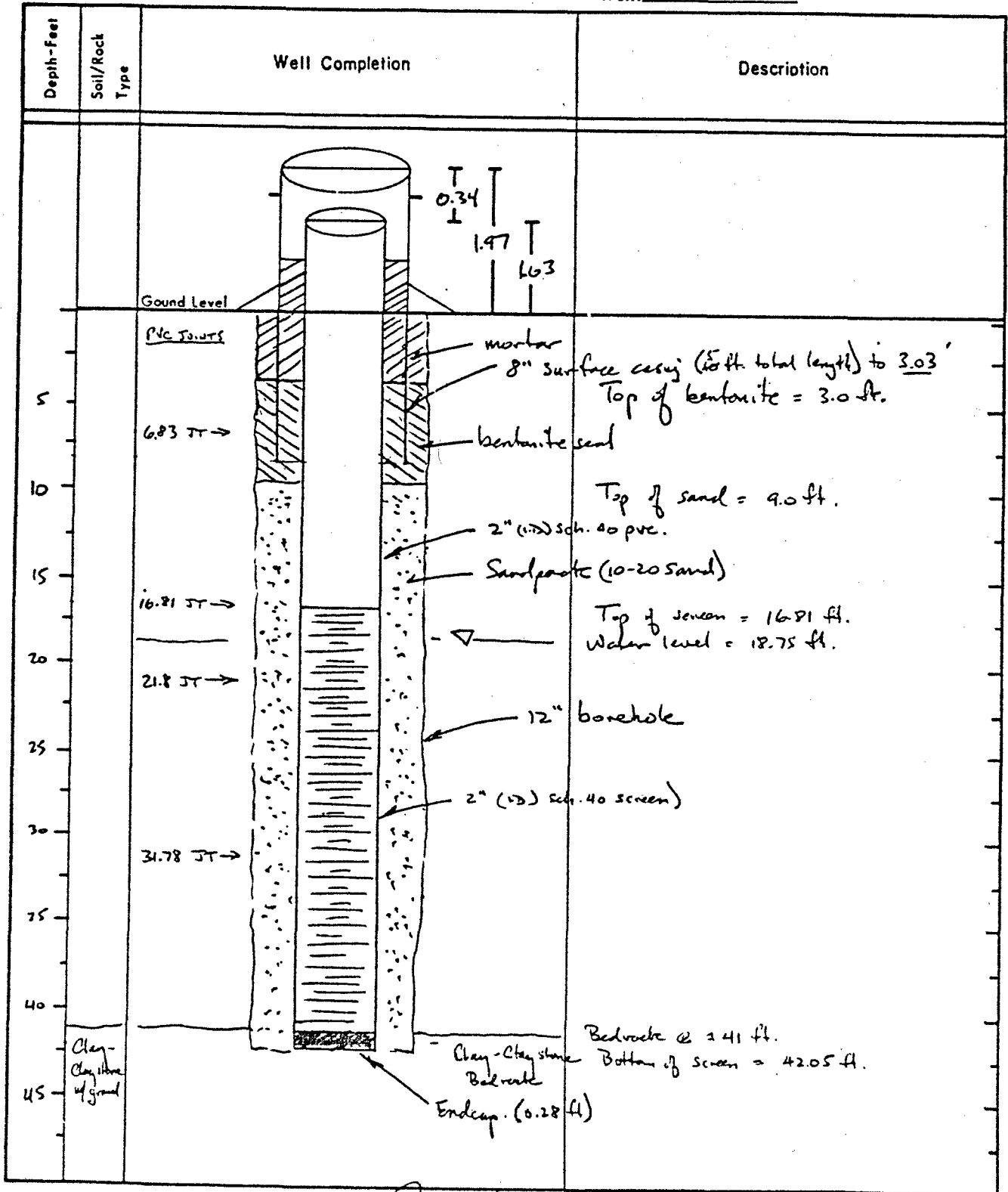
Top of Protective Casing to Ground Level 1.97 ft. \_\_\_\_\_ cm. \_\_\_\_\_

Reviewed By [Signature] Date 4/25/88

Drill Site Geologist [Signature] Date 4/6/88

Borehole: E-53 002

Well: 37401



Drill Site Geologist: [Signature]  
 Reviewed By: [Signature]

Date: 4/6/88  
 Date: 4/25/88

Borehole: E-53-4400-2

Well Number: 37401

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
0					SC	SAND, 40% clay, fine to medium grained sand, 10 YR 4/4, dark yellowish brown, moist, low plastic, med stiff.
1	① 0 - 2.0'	2.0 2.0	1	0 - 2.0		
2						
3	② 2.0 - 4.0	1.1 2.0	2		SM	
4						
5		0 2.0				
6						SAND, 20% clay, fine to medium grained sand 10 YR 5/4 yellowish brown, stiff, moist, medium plastic
7	③ 4.0 - 8.0	0.5 2.0	3			
8						
9	④ 8.0 - 12.0	2.0 2.0	4		SC	SAND, 20% clay, fine to medium grained sand 10 YR 5/4 yellowish brown, stiff, moist, medium plastic
10	SR					

Same as tube interval

Drill Site Geologist: Dave West logged by Harlan Date: 4/15/88  
 Reviewed By: [Signature] Date: 4.20.88

Borehole: E-5308-2

Well Number: 37401

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
11	8.0' to 12.0'	2.0			SC	Sand, 20% clay, fine to medium grained, 10YR 5/4 yellowish brown, stiff, moist, medium plastic
12						No Recovery 12-15'
13		2.0				
14						
15	12.0' - 16.0'	2.0			SC	Sand, 40% clay, fine to coarse grained sand, 10YR 7/3 very pale brown, stiff, moist, medium plastic, calc.
16						
17		2.0				at 16.5' Sand, 25% clay, fine to coarse grained sand, 10YR 5/4 yellowish brown, stiff, moist, medium plastic, calc.
18						
19	16.0' - 20.0'	2.0				
20						

same as sample #5  
 same as sample interval

Drill Site Geologist: Dave West Logged by Steve Paul Date: 4/15/88

Reviewed By: [Signature]

Date: 4-20-88

Borehole: F-53-087 Well Number: 37401

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
20						No Recovery 20-21
21	24.0' - 24.0'	1/2%			SP	SAND, 3% silt, fine to coarse grained, 10YR 5/4 yellowish brown, loose, saturated, non plastic
22						
23	20.0' - 20.0'	2/0%			SM	SAND, 10% silt, fine to medium grained sand 10YR 5/4 yellowish brown, loose, saturated, non plastic
24					SC	SAND, 20% clay, fine to v. coarse sand, occ. small gravel, 10YR 6/4 light yellowish brown, med dense, v. moist, low plastic
25						No Recovery 24-26'
26						
27	24.0' - 28.0'	2/0%			SP	SAND, 3% silt, fine to very coarse grained, 5% small gravels, 10YR 6/4, light yellowish brown, med dense, saturated, non plastic
28						No Recovery 28-33.5'
29						
30	28.0' - 32.0'	2/0%				

same as tube interval SP Number  
 same as tube interval

Drill Site Geologist: Dave West Signed by Steve Paul Date: 4/15/88  
 Reviewed By: [Signature] Date: 4/26/88

Borehole: E-53-08-2

Well Number: 37401

Depth-feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
30						No Recovery 28-33.5'
31						
32						
33	31.0' - 34.0'	0.4 2.0				
34	32.0' - 34.0'				BC	Gravel, 5% clay, small to medium (1") gravel, 10% 5/3, brown dense, saturated
35	34.0' - 36.0'	1.2 2.0			SP	SAND, 5% silt; fine to very coarse grained sand, 5% gravel, small to medium gravel (2"), 10% 5/3, brown dense, saturated
36						
37						
38						
39						
40	36.0' - 40.0'	0 4.0				
41						
42	40.0' - 42.0'	1.1 2.0				Claystone bedrock, 5% 5/3 olive, weathered Fe stains
TOTAL DEPTH 42'						

Same as tube # 35  
 Same as tube # 35

Drill Site Geologist: Dave Wist Logged by Steve Paul Date: 4/15/88  
 Reviewed By: [Signature] Notes: 4. 21.0.

WELL CONSTRUCTION SUMMARY

Borehole E-55A JR Well E55A #37382  
 Project Name and Location T-36 1/4 MILE E OF YARDING ON 92<sup>ND</sup> Project Number 17063-074-10  
 Drilling Company Boylas Bros Driller DAVE JARVIS Rig Number 545195452  
 Drilling Method(s) Auger

Borehole Diameter 12 1/4 in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to 97.5 ft. \_\_\_\_\_ cm.  
 \_\_\_\_\_ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) \_\_\_\_\_

Sampling Method(s) CONTINUOUS FLUID SAMPLE

Size and Type PVC 4" .020 slot

Date/Time Start Drilling 3/27 0905

Date/Time Finish Drilling 3/31 1000 1200/0001 REMARK

Total Borehole Depth 50.495 ft. \_\_\_\_\_ cm.

Date/Time Start Completion 3/31 1000

Depth to Bedrock 49 ft. \_\_\_\_\_ cm.

Date/Time Cement Protective Casing 3/31 1245

Depth to Water 37 ft. \_\_\_\_\_ cm.

Materials Used 11 4' TUBES 5 BOXES

Water Level Determined By SAMPLES

Plain PVC 4-10' BUNDLES

Length Plain PVC (total) 35.25 ft. \_\_\_\_\_ cm.

Slotted PVC 1-10', 1-5'

Length of Screen 16.45 ft. \_\_\_\_\_ cm.

Bentonite Pellets 5 BUCKETS

Total Length of Well Casing 51.7 ft. \_\_\_\_\_ cm.

Bentonite Granular 50 / 63

PVC Stick Up 1.7 ft. \_\_\_\_\_ cm.

Cement 11 BAGS

Depth to Bottom of Screen 50 ft. \_\_\_\_\_ cm.

Sand 14 BAGS

Depth to Top of Screen 32.55 ft. \_\_\_\_\_ cm.

Water added during completion 25 20 GALS

Depth to Top of Sand 20.5 ft. \_\_\_\_\_ cm.

Water added during drilling 15 10 GALS 100/00

Depth to Top of Bentonite 230 ft. \_\_\_\_\_ cm.

Total Gallons of water added 40 GALS

Drill Site Geologist Greg L.H.

Date 3/31/87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 04/08/87 11:00 PJB

Date/Time/Personnel Casing Painted 04/08/87 14:00 PJB

Date/Time/Personnel Numbers Painted 04/17/87 0930 PJB

Materials Used 14 Bags Quick-Crete 1/2 Bag Cement 1/2 Bag SAND

Top of Protective Casing to Top of PVC 0.425 ft. \_\_\_\_\_ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 1.1 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Internal Mortar 1.2 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Top of Cement Pad 1.9 ft. \_\_\_\_\_ cm.

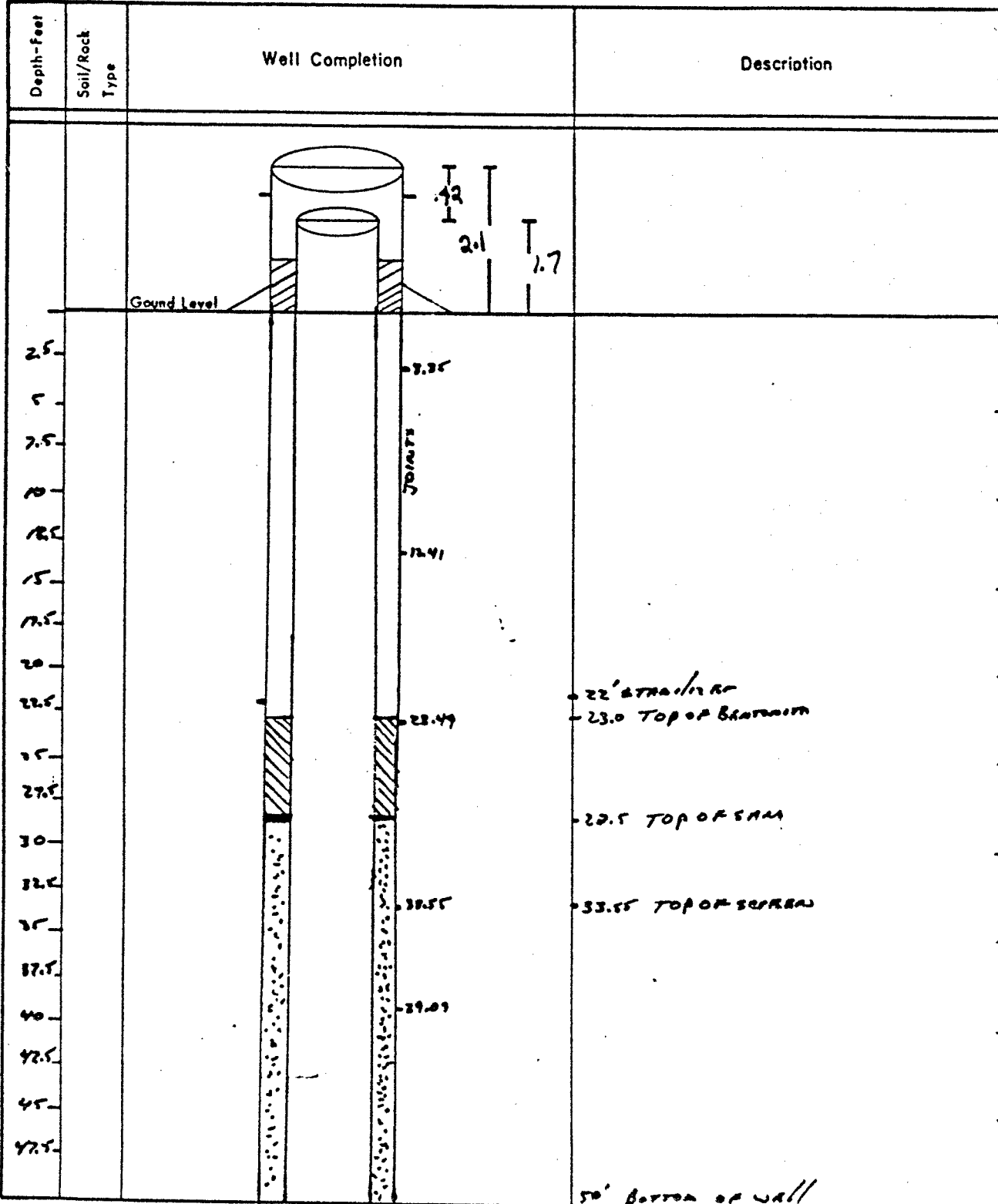
Top of Protective Casing to Ground Level 2.1 ft. \_\_\_\_\_ cm.

Reviewed By Joseph L. Rud Date 4/20/87

Drill Site Geologist \_\_\_\_\_

Borehole: E-55A

Well: ESSA 37382



Drill Site Geologist: [Signature]  
Reviewed By: [Signature]

Date: 3/31/09  
Date: 7/20/97

Borehole: E55A

Well Number: 37382

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
2	C. 2	100%		0- 2	ML	SILTS with 10% fine sand, 10% clay. roots occas. 2.5y 3/2 very dark grayish brown, <sup>sl. moist</sup> loose to dense, nonplastic moist sl. plastic (soft)
4	2- 4	100%		2- 4	SM	Silty sands - 10% silt, 3-5% clay, 2.5y 4/4 olive brown, loose to medium dense, nonplastic, dry occas. CaCO <sub>3</sub> -rich areas visible (pervasive white)
6	4- 6	80%		4- 6		
8	6- 8	100%		6- 8	SW	SANDS - 2% silt, 2.5y 5/6 light olive brown, loose, to med dense, nonplastic, sl. moist
10	8- 10	100%		8- 10		
12	10- 12	100%		10- 12	SM	Silty SANDS - 10% silt, 5% clay, 2.5y 5/6 light olive brown, medium dense, nonplastic, moist occas. CaCO <sub>3</sub> -rich areas
14	12- 14	100%		12- 14		
16	14- 16	100%		14- 16		
18	16- 18	100%		16- 18		
20	18- 20	100%		18- 20	SW	SANDS - 2.5y 5/6 light yellowish brown, loose, nonplastic moist
22	20- 22	100%		20- 22		

Drill Site Geologist: C. B. W. S. J.

Date: 3/31/87

Drill Site: 11/1/87

Borehole: E-55A

Well Number: 37382

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
22	22 24	100%		22- 24	SW	SANDS - 5% small gravel (peasize), 2.5y 6/4 light yellowish brown, loose, nonplastic, moist
24	24- 26	80%		24- 26		
26	26- 28	100%		26- 28	ML	25.5' SILT - 10% fine sand, 5% clay, 2.5y 1/4 olive brown, st (cohesive), nonplastic, moist
28	28- 30	100%		28- 30		
30	30- 32	100%		30- 32		} CaCO <sub>3</sub> - rich area - bleached white - = 30.6 - 31'
32	32- 34	100%		32- 34	SP	} 31.4 - 31.6 sandy/gravelly, some coal/nutshell in sample gravelly sands - small to 1/2" gravel ~20%, 10y 4/6 dark yellowish brown, loose, nonplastic, moist -> moisture increases at 34' most gravel well rounded, milky quartz
34	34- 36	50%		34- 36		
36	36- 38	50%		36- 38		gravel larger than previously (ca. 1/2" to 1") and 20-40% st
38	38- 40	0%		38- 40		} No sample - no recovery
40	40- 41.5	50%		40- 41.5		one cobble in sample - 2" across well rounded
42	41.5- 43.5	25%		41.5- 43.5		cobbles 1" to 2" about 15% of sample - most subrounded
44					SS	REDROCK ! TOP OF WATER TABLE

Drill Site Geologist: C. Bell

Date: 3-21-87

Borehole: \_\_\_\_\_

Well Number: 37382

Depth-Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
44	43.5 to 45.5	100%		43.5 to 45.5	SS	SANDSTONE BEDROCK 10yr 4/6 dark yellowish brown, moderately indurated (friable), massive, saturated  } sandstone very friable Rock now well indurated coarse sandstone (small lenses are common) FeOx staining common on some pebble-size clasts & cement
46	45.5 to 47.5	100%		45.5 to 47.5		
48	47.5 to 49.5	50%		47.5 to 49.5		
50					CS	49' - CLAYSTONE 10yr 3/3 dark brown, soft  END OF BORING AT 49.5'

Drill Site Geologist: C. Pearson

Date: 3-31-87

11/1/87

WELL CONSTRUCTION SUMMARY

Borehole E-58 Well 37368  
 Project Name and Location TASK 39: OFFPOST / PERUA 1/4 MI. W. OF 2 Project Number 86 946 0210  
 Drilling Company BOYLES BROS Driller DAVE JARVIS Rig Number B57 5451  
 Drilling Method(s) HOLLOW STEM ANGER

Borehole Diameter 12 1/4 in. \_\_\_\_\_ cm. 0.0 ft. \_\_\_\_\_ cm. to 33.7 ft. \_\_\_\_\_ cm.  
 \_\_\_\_\_ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) 8 1/4 I.D., 12 1/4 O.D.  
HOLLOW STEM ANGER

Sampling Method(s) CONTINUOUS AUGERING

Size and Type PVC 4" SCHEDULE 40

Date/Time Start Drilling 12-19-86 / 1300

Total Borehole Depth 34.833.7 ft. \_\_\_\_\_ cm.

Date/Time Finish Drilling 12-22-86 / 1000

Depth to Bedrock 34.0 ft. \_\_\_\_\_ cm.

Date/Time Start Completion 12-22-86 / 1000

Depth to Water 25.0 ft. \_\_\_\_\_ cm.

Date/Time Cement Protective Casing 12-22-86 / 1145

Water Level Determined By SAMPLE INSPECTION

Materials Used \_\_\_\_\_

Length Plain PVC (total) 19.78 ft. \_\_\_\_\_ cm.

Plain PVC 2 - 10' SECTIONS

Length of Screen 16.19 ft. \_\_\_\_\_ cm.

Slotted PVC 1 - 10' AND 1 - 5' SECTION

Total Length of Well Casing 35.97 ft. \_\_\_\_\_ cm.

Bentonite Pellets 4.25 BUCKETS

PVC Stick Up 1.7 ft. \_\_\_\_\_ cm.

Bentonite Granular 20 lb.

Depth to Bottom of Screen 34.27 ft. \_\_\_\_\_ cm.

Cement (4) 50 LB. BAGS

Depth to Top of Screen 18.06 ft. \_\_\_\_\_ cm.

Sand 13.25 BAGS

Depth to Top of Sand 12.8 ft. \_\_\_\_\_ cm.

Water added during completion 15 GAL.

Depth to Top of Bentonite 7.8 ft. \_\_\_\_\_ cm.

Water added during drilling 4.5 GAL

Total Gallons of water added 19.5 GAL

Drill Site Geologist M. Myall

Date 12-22-86

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed \_\_\_\_\_

Date/Time/Personnel Casing Painted \_\_\_\_\_

Date/Time/Personnel Numbers Painted \_\_\_\_\_

Materials Used \_\_\_\_\_

		COMMENT/NOTES
Top of Protective Casing to Top of PVC	<u>2.30</u> ft. _____ cm.	
Top of Protective Casing to Weep Hole	<u>1.29</u> ft. _____ cm.	
Top of Protective Casing to Internal Mortar	<u>1.25</u> ft. _____ cm.	
Top of Protective Casing to Top of Cement Pad	<u>1.95</u> ft. _____ cm.	
Top of Protective Casing to Ground Level	<u>2.00</u> ft. _____ cm.	

Reviewed By Joseph L. Reed Date \_\_\_\_\_  
 Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

Borehole: E-58

Well: \_\_\_\_\_

Depth-Feet	Soil/Rock Type	Well Completion	Description
<p>0</p> <p>5</p> <p>10</p> <p>20</p> <p>30</p> <p>40</p>			<p>GROUT FROM 7.8'</p> <p>TOP OF BANTONITE SEAL = 7.8'</p> <p>JOINT = 8.04'</p> <p>TOP OF SAND = 12.8'</p> <p>TOP OF SCREEN = 18.08' JOINT</p> <p>JOINT 23.5</p> <p>WATER LEVEL = 25.0'</p> <p>BEDROCK = 34.0'</p> <p>BOTTOM OF SCREEN 34.27</p> <p>T.D. = 34.3'</p>

Drill Site Geologist: \_\_\_\_\_

Date: \_\_\_\_\_

Reviewed By: \_\_\_\_\_

Date: \_\_\_\_\_

Borehole: E58

Well Number: 37368

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
0		1.0'	E58 ↓ All sample numbers below	0-3'	CL	<u>CL</u> , Sandy clay, 15% vfg sand, 10yr 3/3 BRK ben, med plast, med stiff, moist Alluvium
1.0						
2.0		1.5'		2-4'	ML	<u>ML</u> , sandy silt, 10% vfg sand, non-plast, med-stiff 10yr 3/4 BRK wash ben, non-plast, med-stiff moist Alluvium
3.0						
4.0		1.2'		4-5'		
5.0		1.3'		5-6'		color change 10yr 5/4 wash ben
6.0						

Drill Site Geologist: W. Prustel

Date: 12/22/86

Reviewed By: \_\_\_\_\_

Date: \_\_\_\_\_

Borehole: E 58 Well Number: 37368

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
6.0		.15'		6-7.0'	CL	<u>CL</u> , sandy clay, 30% vty sand, 10yr 4/4 dk ywash ben, med plast, med-stiff moist Alluvium
7.0		.05'		7-7.5		color change to 10yr 5/4 ywash ben silty clay
8.0						
9.0		.45'		9-10.0		Sandy clay, 20% vty sand
10.0		.70'		10-11.0'	SC	<u>SC</u> , clayey sand, 40% clay, 10yr 4/4 dk ywash ben, low plast, med stiff moist Alluvium
11.0		.65'		11-12.0'		
12.0						

Drill Site Geologist: N. Christensen Date: 12/22/86  
 Reviewed By: \_\_\_\_\_ Date: \_\_\_\_\_

Borehole: ESJ Well Number: \_\_\_\_\_

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
12.0		.6'		12- 13.0	SC	SC, clayey sand, 10% clay, VF-fg sand, 104R5/6 wash ben, non-plast, LOOSE, moist Alluvium
13.0		.45'		13- 14.0		
14.0		.8'			SM	SM, silty sand, 10% silt, f-g 104R5/4 wash ben, non-plast LOOSE, moist Alluvium
15.0		NO REC		15- 18.0		NO RECOVERY
16.0						
17.0						
18.0						

Drill Site Geologist: N. Armstrong Date: 12/22/76  
 Reviewed By: \_\_\_\_\_ Date: \_\_\_\_\_

Borehole: E-58

Well Number: 37368

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
18.0		.85'	18- 20'		SP	<u>SP</u> , poorly graded, r-ing sand, 104R 5/4 wash brn, non-plast, LOOSE moist Alluvium
19.0						
20.0		1.0'	20- 22'		SU	<u>SU</u> , well graded f-c.g., 104R 6/4 Lt. wash brn, non-plast, Loose, moist Alluvium
21.0						
22.0		.85'	22- 24'			moisture INCREASE to WET
23.0						
24.0						

Drill Site Geologist: W. G. Mitchell

Date: 12/22/86

Reviewed By: \_\_\_\_\_

Date: \_\_\_\_\_

Borehole: E58 Well Number: 37368

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
24.0		1.1'		24.26'	SW	SW - color change 10yr 4/4 BRK gwash brn
24.5						↓ moisture increase to saturated WATER TABLE AT 24.5
25.0						
26.0		1.5'		26 → 27.5'		SP, poor graded, m-c grained 10yr 4/4 gwash brn non-plast LOOSE SATURATED ALLUVIUM
27.0						
28.0		1.6'		27.5 - 28.5	SP	SP, poorly graded sand, m-c grained, 10yr 4/4 gwash brn, non-plast, LOOSE, SATURATED ALLUVIUM (0.6' slough)
29.0		1.6'		28.5 - 30.0		
30.0		1.5'		30 - 31.5'		
31.0						
32.0		0.0		31.5 → 32.0		NO RECOVERY
33.0		3.0		32 - 34.0	SP	SP, poorly graded sand, c-g, 10yr 4/4 gwash brn, non-plast LOOSE SATURATED ALLUVIUM
34.0						
35.0						CLAYSTONE BEDROCK AT 33.8'
36.0						END OF BORING LOG
						WJA

Drill Site Geologist: W. Armstrong Date: 12/22/86  
 Reviewed By: \_\_\_\_\_ Date: \_\_\_\_\_

WELL CONSTRUCTION SUMMARY

Borehole E-59 Well 37395  
 Project Name and Location RMA T39, offpost alluvial Project Number 17053.015.10  
 Drilling Company Boyle Brothers Driller D. Ercin Rig Number FR TH-60  
 Drilling Method(s) 12 1/2" O.D. H.S. Auger with 2x2" split screen sample barrel

Borehole Diameter 12 1/2 in. \_\_\_\_\_ cm. 0 ft. \_\_\_\_\_ cm. to 44.96' ft. \_\_\_\_\_ cm.  
 \_\_\_\_\_ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) 8" O.D. center bit

Size and Type PVC 1" E.D. sch. 40

Total Borehole Depth 44.96 ft. \_\_\_\_\_ cm.

Depth to Bedrock 44.50 ft. \_\_\_\_\_ cm.

Depth to Water 25.80 ft. \_\_\_\_\_ cm.

Water Level Determined By sample saturation

Length Plain PVC (total) 18.29 ft. JEP cm.

Length of Screen 26.67 ft. \_\_\_\_\_ cm.

Total Length of Well Casing 46.56 ft. \_\_\_\_\_ cm.

PVC Stick U<sub>1</sub> 1.60 ft. \_\_\_\_\_ cm.

Depth to Bottom of Screen 44.96 ft. \_\_\_\_\_ cm.

Depth to Top of Screen 18.29 ft. \_\_\_\_\_ cm.

Depth to Top of Sand 12.85 ft. \_\_\_\_\_ cm.

Depth to Top of Bentonite 6.00 ft. \_\_\_\_\_ cm.

Sampling Method(s) Push sample w/ 2' barrel

Date/Time Start Drilling 12/14/87 1425

Date/Time Finish Drilling 12/15/87 1526

Date/Time Start Completion 12/16/87 0902

Date/Time Cement Protective Casing 12/17/87 0845

Materials Used 5' 8" ID steel csg. protective

Plain PVC 19.89'

Slotted PVC 26.67'

Bentonite Pellets 30 gal 3/8" slope indicator

Bentonite Granular 1/3 bag (50" bag)

Cement 3 bags (100%) Type II Mountain

Sand 20 1/4 bags (100%) 10-20 CSSF

Water added during completion ~75 gal

Water added during drilling ~25 gal

Total Gallons of water added 100 gal

Drill Site Geologist Gary F. Pearce

Date 12-17-87

Weep hole: 3-14-83/1425/dw & BW

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 3/11/88 1100 FS/RP

Date/Time/Personnel Casing Painted 3/11/88 1100 FS/RP

Date/Time/Personnel Numbers Painted 3/11/86 1105 FS/RP 3-14-83/1425/dw } DW

Materials Used 8 bags of sand

Top of Protective Casing to Top of PVC 0.28 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Weep Hole 1.48 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Internal Mortar 1.51 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Top of Cement Pad 1.72 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Ground Level 1.75 ft. \_\_\_\_\_ cm.

COMMENT/NOTES

Reviewed By Alan Paus Date 3/16/88

Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

**ESE** ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.  
 7332 SOUTH ALTON WAY • SUITE M-1  
 ENGLEWOOD, COLORADO 80112-303/741-0639

Borehole: E-59

Well: 37395

Depth-Feet	Soil/Rock Type	Well Completion	Description
			Set 5' length 8" I.D. steel csg. to 3'. 4" I.D. sec. 40 PVC from 1.6' above ground to 18.29' below ground. 4" I.D. Johnson Environ. Screen from 18.29' below ground to T.D.
	Ground Level		
	Silty-sands		Bottom 8" protective csg: 3.00'
			Top of bentonite: 6.00'
10	Sand clayey silt	Jt. 8.27	Top of sand: 12.85'
20	Silty-clay Sand's partly sorted	Jt. 18.29	Top of screen: 18.29'
30	Silty-clay Silt Sand Silty-sand Silt Silty-sand Silt Silty-sand Silt Silty-sand Silt Silty-sand Silt	Jt. 23.76	
40	Silty-sands	Jt. 34.28	
44.5	no recovery		Bedrock: 44.50'
44.5	Sandy clay w/ Fe stain.	Bedrock	T.D. (4" ID PVC): 44.96'
50			

Borehole: F-57 w/ post RPAH 739 Well Number: 37395

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
0			NA		SM	<i>Munsell Colors</i> Silty sands, 20-40% silt, vf-f grained sands, 10YR 5/3 dark brn, root frags to 1.0', loose, non-plas, moist alluvium.
1	2-0	1.8		2-0		At 1.0'; silty sands, 10-30% silt, vf-f sands, color changes to 10YR 4/4,3 brn to dark yellowish brn, occ root frags, loose non-plas, moist alluvium.
2						
3	4-2	1.7		4-2		
4						
5	9-8	2.0		9-8		

Drill Site Geologist: [Signature]  
Reviewed By: [Signature]

Date: 12-17-87  
Date: 1/4/88

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 ENGLEWOOD, COLORADO 80112 • 303/741-0639

SHEET 2 OF 6

Borehole: E-59 Offset

Well Number: 37395

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
7	8-9	1.8	NA	8-9		
8						
9	01-8	1.8		01-8	SP	At 8.6'; SP poorly graded sands, 10-20% med-coarse grained sand, 10YR 9/3; brn-dk brn, loose, non-plas, moist alluvium.
10					ML	At 8.8'; clayey silts, 10-20% clay, trace v.f. sand, 10YR 5/3 brn, mottled w/ CaCO <sub>3</sub> 10YR 7/3, v. pale brn, loose, v. sl. plas, moist alluvium.
11	21-21	1.7		21-21		At 11.0'; CaCO <sub>3</sub> absent
12						

Drill Site Geologist: P. J. Ponce

Date: 12-17-87

Drill Site: AL-10

Date: 1/9/82

Borehole: E-59 PIMA T-9 Well Number: 37395

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
12			NA			At 12.0'; clayey silts, clay increases to 20-30%, 10YR 5/4, yellowish brn, soft, sl plas, moist alluvium.
13	7/ - 2/	2.0'		7/ - 2/		
14						
15	9/ - 4/	2.0'		9/ - 4/		
16					CL	At 15.2'; silty clay, 20-30% silt, to vf-f grained sand, 10YR 5/4, yellowish brn, sl stiff, sl plas, moist alluvium.
17	3/ - 2/	2.0'		3/ - 2/	SP	At 16.2'; poorly graded sand, 10-20% of 10-20% med grained, 60-80% fine grained 10YR 6/4 light yellowish brn, loose non-plas, moist alluvium.

Drill Site Geologist: J.F. Pounce

Date: 12-17-87

Date: 1/9/88

Borehole: E-59 RMA 739 Well Number: 37395

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
18			NA			No Recovery
19.4						
20	19.4 - 21	1.8		19.4 - 21	SP	At 20.0'; pred. med sand, 20-30% coarse grained, some rf & v. coarse grains, subrounded, 10YR 6/4, lt. yell. brn, loose, non-plas, moist alluvium.
21						At 21.2', pred. coarse grained, sm v.c. sands.
22	21 - 23	2.0		21 - 23	CL	At 22.2'; inorganic <sup>silt</sup> clay, 10-20% silt, 10YR 5/3 brown, soft, st-med plas, moist alluvium.
23						
24	23 - 25	1.8		23 - 25	ML	At 23.5', clayey st silts, 10-30% clay, 10YR 5/4, yell. brn, loose, st plas moist alluvium.

Drill Site Geologist: [Signature] Date: 12-17-87  
 Reviewed By: [Signature] Date: 1/9/87 E4

Borehole: E-59 RMA T39 Well Number: 37395

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
24	23-25	1.8		23-25	SM	At 24.0'; silty sand, 30-40% silt, 10YR 5/4 yell. brn, loose, non plas, moist alluvium.
25						No Recovery
26	25.5-27	1.5		25.5-27	SP	At 25.5'; poorly graded sands, pred med, 10-20% coarse, 10-20% v.f., some v. coarse, 10YR 5/4 yell. brn, loose, wet, alluvium, saturated at 25.8. <u>Water Table @ 25.8'</u>
27						No Recovery
28	27.5-29	1.5		27.5-29	ML	At 26.9'; clayey silts, 20-40% clay, 10YR 5/3 brn, soft, sl. plas, saturated alluvium.
29						
	29-31	2.0		29-31	CL	At 28.0'; sandy clay, 10-20% sand (pred f-v), 10YR 5/3 brn, sl stiff, sl plas, saturated alluvium. <del>At 28.5';</del> At 28.8'; occ. mottled CaCO <sub>3</sub> , 10YR 7/3 v. pale brn.
					SP	At 29.2'; poorly graded, sub rounded, fine to coarse sands, 10YR 5/4 yell. brn, pred med graded, loose, non-plas, saturated alluvium. At 29.8'; predom. coarse sands

Drill Site Geologist: [Signature] Date: 12-17-87  
 Reviewed By: [Signature] Date: 1/4/88

Borehole: E-59

Well Number: 37395

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
30			NA 1			At 30.0'; predom. v.c. sands.
					CL	At 30.2'; silty clay, 10-50% silty, 10YR 5/4 brn, sl stiff, sl pls, saturated alluvium.
31	31-32	1.0		31-32	SM	At 31.0'; Silty sands, 20-40% silt, poorly graded w/ predom f-m. grained sand, some coarse to v.c. sands, 10YR 5/3 brn, loose. non pls, saturated alluvium.
32						No Recovery 32.0 - 44.5'
44						No Recovery 32.0 - 44.5'
44.5	44.5 - 45.5	1.0		44.5 - 45.5	CL	At 44.5'; sandy clay, 10-20% v.f. grained sand, 10YR 5/3.4 brn-dk brn, stiff, sl pls, abund Fe staining 10YR 6/8 brn yell. occ carbonaceous flakes,
45						
45.5						END OF BORING LOG

Drill Site Geologist: J. F. Pearce

Date: 12-17-87

Reviewed By: [Signature]

Date: 1/9/88

WELL CONSTRUCTION SUMMARY

Borehole E-63A Well 37589  
 Project Name and Location TASK 39 Project Number \_\_\_\_\_  
 Drilling Company Boyles Bros Driller Dave Jarvis Rig Number 5451  
 Drilling Method(s) Auger

Borehole Diameter 7 1/4 in. \_\_\_\_\_ cm. 0 ft. \_\_\_\_\_ cm. to 36.0' ft. \_\_\_\_\_ cm.  
reamed to 12 1/4 in. \_\_\_\_\_ cm. 0 ft. \_\_\_\_\_ cm. to 36.0 ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) _____	Sampling Method(s) <u>2 ft wire-line runs</u>
Size and Type PVC <u>4" Sch. 40</u>	Date/Time Start Drilling <u>4/22 1212</u>
Total Borehole Depth <u>36.0</u> ft. _____ cm.	Date/Time Finish Drilling <u>4/22 1402</u>
Depth to Bedrock <u>~34.0m</u> _____ cm.	Date/Time Start Completion <u>4/23 1140</u>
Depth to Water <u>~9</u> ft. _____ cm.	Date/Time Cement Protective Casing <u>4/23 1405</u>
Water Level Determined By <u>Sample saturation</u>	Materials Used _____
Length Plain PVC (total) <u>10.1</u> ft. _____ cm.	Plain PVC <u>1 X 10'</u>
Length of Screen <u>26.8</u> ft. _____ cm.	Slotted PVC <u>1 X 5', 2 X 10'</u>
Total Length of Well Casing <u>36.9</u> ft. _____ cm.	Bentonite Pellets <u>1 1/2 buckets</u>
PVC Stick Up <u>1.7</u> ft. _____ cm.	Bentonite Granular <u>2 bags X 50"</u>
Depth to Bottom of Screen <u>35.2</u> ft. _____ cm.	Cement <u>15 1/2 bags X 94" (2 bags X 94"</u>
Depth to Top of Screen <u>8.4</u> ft. _____ cm.	Sand <u>15 1/2 bags X 94" (7 more before redrill)</u>
Depth to Top of Sand <u>7.1</u> ft. _____ cm.	Water added during completion <u>0</u>
Depth to Top of Bentonite <u>3.0</u> ft. _____ cm.	Water added during drilling <u>20 gallons + 0% returned</u>
	Total Gallons of water added <u>0</u>

Drill Site Geologist K.J. Matthews Date 4/2

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 8AG 5/19/87  
 Date/Time/Personnel Casing Painted 06 03 87 1315 POB WTV  
 Date/Time/Personnel Numbers Painted 06 16 87 930 POB DLW  
 Materials Used 12 Bags Quikrete 11 Bag Sand 1 Bag Cement

Top of Protective Casing to Top of PVC	<u>.25</u> ft. _____ cm.	COMMENT/NOTES
Top of Protective Casing to Weep Hole	<u>1.12</u> ft. _____ cm.	
Top of Protective Casing to Internal Mortar	<u>1.15</u> ft. _____ cm.	
Top of Protective Casing to Top of Cement Pad	<u>1.54</u> ft. _____ cm.	
Top of Protective Casing to Ground Level	<u>1.95</u> ft. _____ cm.	

Reviewed By Joseph L. Reed Date 7/8/87  
 Drill Site Geologist K.J. Matthews Date 7/8/87

Borehole: E-63A

Well: 37389

Depth-Feet	Soil/Rock Type	Well Completion	Description
		<p>Ground Level</p> <p>20'</p> <p>1.7'</p>	
2			
4			
6			
8			Bottom of gravel 7.1'
10			Top of sand pack 7.1'
12			Top of sand pack on screen 37'
14			
16			
18			
20			
22			
24			
26			
28			
30			
32			
34			
36			Bottom of screen 35.2'
			Bottom of hole 36.0'

Drill Site Geologist: K. J. McFarlane  
 Reviewed By: Joseph Leland

Date: 7/8/87  
 Date: 7/9/87

*no record of well*  
**WELL CONSTRUCTION SUMMARY**

Borehole E-03D1 Well 37390  
 Project Name and Location MW Installation Project Number T36 17053074  
 Drilling Company Bayles Driller B. Roach Rig Number Fading 25  
 Drilling Method(s) rotary - bentonite mud

Borehole Diameter 7 7/8 in. \_\_\_\_\_ cm. 0 ft. \_\_\_\_\_ cm. to 26 ft. \_\_\_\_\_ cm.  
3 7/8 in. \_\_\_\_\_ cm. 26 ft. \_\_\_\_\_ cm. to 46 ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) 7 7/8" - blade Sampling Method(s) not sampled

Size and Type PVC 4" sched. 40 Date/Time Start Drilling 4-23-87 0815

Total Borehole Depth 346 ft. \_\_\_\_\_ cm. Date/Time Finish Drilling 4-23-87 0901

Depth to Bedrock 25 ft. \_\_\_\_\_ cm. Date/Time Start Completion 4-23-87 0926

Depth to Water 3 ft. \_\_\_\_\_ cm. Date/Time Cement Protective Casing 4-23-87

Water Level Determined By tape measure Materials Used \_\_\_\_\_

Length Plain PVC (total) 41.32 ft. \_\_\_\_\_ cm. Plain PVC 4x10' 1x3.5' (cut off and piece)

Length of Screen 5.88 ft. \_\_\_\_\_ cm. Slotted PVC 1x5'

Total Length of Well Casing 47.7 ft. \_\_\_\_\_ cm. Bentonite Pellets 1 1/2 buckets

PVC Stick Up 1.7 ft. \_\_\_\_\_ cm. Bentonite Granular 34 bags

Depth to Bottom of Screen 354.6 ft. \_\_\_\_\_ cm. Cement 7 1/2 bags

Depth to Top of Screen 40.17 ft. \_\_\_\_\_ cm. Sand 1 1/2 bags

Depth to Top of Sand 39 ft. \_\_\_\_\_ cm. Water added during completion 0

Depth to Top of Bentonite 34 ft. \_\_\_\_\_ cm. Water added during drilling 0

Drill Site Geologist C Benson Date 4-23-87

⊗ sand pack usually 3-5 ft. but this smaller sand pack was done specifically at the request of ESE staff.

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 5/19/87 RAG

Date/Time/Personnel Casing Painted 06-03-87 WTV PJB 1315

Date/Time/Personnel Numbers Painted 06-22-87 DLW PJB 13:50

Materials Used \_\_\_\_\_

Top of Protective Casing to Top of PVC 0.36 ft. \_\_\_\_\_ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 1.0 ft. \_\_\_\_\_ cm. \_\_\_\_\_

Top of Protective Casing to Internal Mortar 1.27 ft. \_\_\_\_\_ cm. \_\_\_\_\_

Top of Protective Casing to Top of Cement Pad 1.86 ft. \_\_\_\_\_ cm. \_\_\_\_\_

Top of Protective Casing to Ground Level 2.07 ft. \_\_\_\_\_ cm. \_\_\_\_\_

Reviewed By Joseph L. Reid Date 6/23/87

Drill Site Geologist \_\_\_\_\_

Borehole: E-63D1

Well: 3739D

Depth-Feet	Soil/Rock Type	Well Completion	Description
5 10 15 20 25 30 35 40 45		<p>Ground Level</p> <p>9.95 Joint</p> <p>20.01 Joint</p> <p>30.07 Joint</p> <p>40.12 Joint</p> <p>26" - Bottom of 8" steel casing</p> <p>34" - TOP OF BENTONITE SEAL</p> <p>39" - TOP OF SANDPACK</p> <p>40.12" - TOP OF SCREEN</p> <p>Total Depth 40'</p>	

Drill Site Geologist: C. Benson  
 Reviewed By: Joseph. Reed

Date: 4.23.87  
 Date: 7/8/87

BOREHOLE SUMMARY LOG

Borehole E-63 Well \_\_\_\_\_  
Project Name and Location MW Installation - Task 36 Project Number 170520-410  
Drilling Company Boyles Driller B. Roach Rig Number Falling 25  
Drilling Method(s) continuous core - rotary with bentonitic  
drill mud  
Size(s) and type(s) of bit(s) 7 7/8"  
Borehole Diameter 7 7/8 in. \_\_\_\_\_ cm. 0 ft. \_\_\_\_\_ cm. to 26 ft. \_\_\_\_\_ cm.  
3 7/8 in. \_\_\_\_\_ cm. 26 ft. \_\_\_\_\_ cm. to 63 ft. \_\_\_\_\_ cm.  
Sampling Methods core  
Total Number Soil Sampling Tubes \_\_\_\_\_  
Total Number Core Boxes 3  
Number of Gallons Lost Drilling Fluid 0  
Date/Time Started Drilling 4-17-87 1700  
Date/Time Completed Drilling 4-17-87 1400  
Total Borehole Depth 63 ft. \_\_\_\_\_ cm.  
Depth to Bedrock 21 ft. \_\_\_\_\_ cm.  
Depth to Water 10 ft. \_\_\_\_\_ cm.  
Water Level Determined By? tape  
Borehole Completed as Monitoring Well? NO  
Date/Time Grouting Completed 4-17-87 1600  
Depth of Tremmie Pipe 60 feet  
Gallons of Grout 50  
Materials Used 50 gals. water, 5 bags cement, 1/2 bag bentonite  
Comments \_\_\_\_\_

Wellsite Geologist C. Benson Date 4-17-87  
Checked for Grout Settlement on 12/1/87 by Steve Paul  
Amount of Grout Added none needed  
All Measurements from Ground Level  
Reviewed by Steve Paul Date 12/1/87  
Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

Borehole: E-63A

Well Number: 37389

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
0	0-2'	2.0'	N/A	0-1'	ML	ML - clayey silt. ~20% clay. 10YR 3/3 dk brown. Loose. Slightly plastic. Moist. Alluvium. Occasional white inclusions.
3	2-4'	1.5'		2-3'	SM	SM - silty sand. ~30% silt in f.g. sand. 10YR 4/4 dk yellowish brown. Loose. Non-plas. Wet. Alluvium.
5	4-6'	2.0'		4-6'	ML	ML - sandy clayey silt. ~10% f.g. sand; ~20% clay. 10YR 6/3 pale brown. Loose. Slightly plastic. Wet. Alluvium. Grades into sand below.
7	6-8'	1.3'		6-8'		~8' Water table noted in field.
9	8-10'	1.5'		8-10'	SM	SM - silty sand. ~15% silt in f.g. sand. 10YR 6/4 light yellowish brown. Loose. Non-plas. Wet. Alluvium.
10	10-12'	2.0'		10-12'		

L48  
 Drill Site Geologist: K.J. Matthews

Date: 4/29/87

Reviewed By: Joseph L. Reed

Date: 7/9/87

Borehole: E-63A Well Number: 37389

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
11	10'-12'	0.0'	N/A	10'-12'	sm	<p>From 12'-23.5' <sup>FLKIM</sup> 23.5'</p> <p>sands become fine to medium grained.</p>
12	12'-14'	1.4'		12'-14'		
13	14'-16'	0.0'		14'-16'		
14	16'-18'	1.1'		16'-18'		
15	18'-20'	2.0'		18'-20'		
16	20'-22'	2.0'		20'-22'		
17						
18						
19						
20						
21						
22						

LAB  
 Drill Site Geologist: R.J. Matthews Date: 4/29/87  
 Reviewed By: Joseph L. Reed Date: 7/9/87

Borehole: E-63 A

Well Number: 37389

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
22	22'-24'	1.4'	N/A	22'-24'		
23						Bedrock = 23.5' <sup>PRG</sup>
23.5					ML	
24						ML - clayey silt. ~ 40% clay. Trace f.g. sand. 10YR 4/1 dk. yellowish brown. Loose. Slightly pls. incl. Alluvium.
25	24'-26'	2.0'		24'-26'		At 25' Fine grain sand increases to ~ 10% of gtz, mica.
26						
27	26'-28'	2.0'		26'-28'		
28						At 25' Fine grained sand increases to ~ 15%. Includes gtz, mica. Color has tint of orange; black deposits. Non-plastic.
29	28'-30'	1.5'		28'-30'		
30						
31	30'-32'	1.4'		30'-32'		
32	32'-34'	2.0'		32'-34'		

LAB  
 Drill Site Geologist: R.J. Millman

Date: 4/29/89

Reviewed By: Donald L. Reed

Date: 7/9/87

Borehole: E-63A Well Number: 37389

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
33	32'-34'	2.0'	N/A	32'-34'	ML	ML - sandy silt. ~ 40% f. gr. sand. Trace clay. 2.5% R5/2 grayish brown. Loose. Non-plastic. Moist. Alluvium. Interbeds with clay below.
34	34'-36'	2.0'		34'-36'	CL	CL - silty clay. ~ 40% silt. 10% R 3/1 v. dk. gray. Med. dense. friable. Dry. Bedrock.
35						
36						End of Boring

Drill Site Geologist: K.J. Matthews Date: 4/29/87  
 Reviewed By: Joseph L. Reed Date: 7/9/87

BOX NO.	DEPTH	Rec. Int.	Weather		Structure / Bedding		Hardness	Perm.				Mineralogy		Color		Texture / Grain Size			Lith. Char.	Lith. Class	Description / Comments	
			U	S	Angle	Desc		S	HL	HL	H	Min	Habit	M	G	clst	sd	gr				mm
	20																					
	22																					21" BEDROCK BEGINS
	24																					See Alluvium log for geology CRACKING SET TO 26"
	26																					CEMENT TO 26"
	28					thin bedded, fine frags: 7-10/11																SILTY SANDSTONE
	30																					claystone interbed
	32																					silty sandstone
	34																					
	36																					oxidation boundary at 36"
	38																					claystone
																						silty sandstone

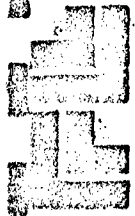
Inc. BORE E-63 WELL(S)

DEPTH IN FT	MWD		Structure/ Bedding		Hard- ness		Perm		Mineralogy		Color (A) G	Texture/ Grain Size Clas. ad gr mm 01 10 100	Lith. Char	Lith Class	Description/Comments Fr CM (Scale 1" = <u>2</u> ft)
	U	S	Angle	Desc	S	H	L	H	Min	Habit					
40				massive					mm's	2%	7.5		40	SS	SANDSTONE - well indurated (st. friable) silt. cement
41				fracture					dn	1%	N6/O				
42				massive					qtz	8%	gray				
43				L to coarse (fine) bedding					hilt	10%					
44															→ 43' 1" to 2" beds of fine sandstone alternating with conglomeratic beds 1/4 - 1/2" pebbles 44' = end of alternating beds
45													45'	CL	CLAYSTONE AT 45'
46				massive					clon	4%					
47									fd	1%					
48															
49															
50															
51															
52				heavily fractured											
53				massive											
54															
55															
56															
57															
58															
59															
60															

ESE, Inc. BORE E-63 WELL(S) \_\_\_\_\_

BOX #	DEPTH Rec int.	Swath		Structure/ Bedding		Hard- ness		Perm.		Mineralogy		Color		Texture/ Grain Size		Lith. Char.	Lith. Class	Description/Comments
		U	S	Angle	Desc.	S	H	1°	2°	Min	Major	M	G	clst	sd			
						S	H	L	H	L	H			mm of 10 100		Ft	CM (Scale 1" = <u>2</u> ft)	
	60				Massive ↓								75% N6/0 gray			CL		CLAYSTONE
	62																	
	63																	63' Total Depth

Inc. BORE E-63 WELL(S) \_\_\_\_\_



Frontier Logging  
Lakewood, Colorado

Date APRIL 17, 1987

County: **ESE**  
 Range: **E 63**  
 Township: **R 63**  
 Section: **1435**  
 Unit No.: **110**  
 Operator: **W. Van Linston**  
 Location: **Lakewood**

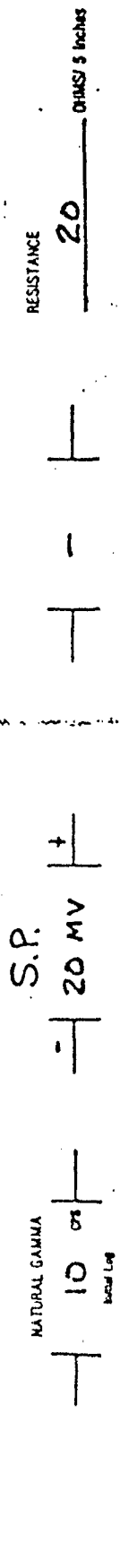
State: **COLORADO**  
 Log Measured From: **Ground Level**  
 Density: **water + native mud**  
 Density Viscosity: **0**  
 Drilling Measured From: **Ground Level**

**MEASUREMENT DATA**

TO LOGGED	Scale	DPS/m		Scale	
		TC	Logging Speed	TC	Logging Speed
Natural Gamma	6 1/2 Ft	20 CPS per inch			
Time Correction	2				
Calor Source	15				

Probe No: **103-1041**  
 Probe Diameter: **5/8"**  
 Stem Length: **3/4 x 1 1/4"**  
 Stem Factor: **7**  
 Calor Factor: **3 7/8"**  
 Density Source No: **20**  
 Density Source Type: **Gamma (Analog)**  
 Density Source Type: **Gamma (Digital)**  
 Caliper: **1.60 x 10<sup>-5</sup>**  
 Temperature: **7**

Resistance: **20** Ohms per 5 inches  
 S.P.: **20** MV per inch  
 Neutron Source No: **20**  
 Neutron Source Type: **Gamma**  
 Closure: **20**  
 Azimuth: **20**  
 True Vertical: **20**  
 Survey Depth: **20**



NATURAL GAMMA

10 cps

Vertical Log

S.P.

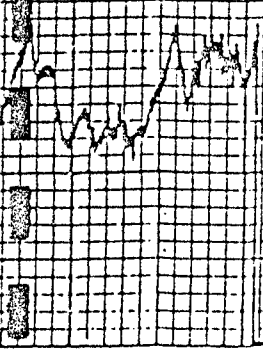
20 MV

RESISTANCE

20

OHMS/5 Inches

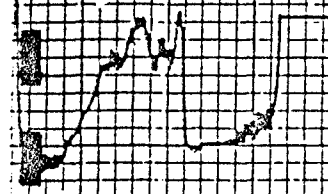




NATURAL  
GAMMA



S.P.  
20 MV/INCH



RESISTANCE  
20 OHMS/5 INCHES

63

0 20 40

COUNTS PER SECOND

6 1/2

50

BOREHOLE SUMMARY LOG

Borehole E-64 Well Dry  
Project Name and Location T-36 1/2 mile N of 95th on Provia Project Number 17063-074.10  
Drilling Company Boyles Bros Driller DAVE JAMES Rig Number 5451  
Drilling Method(s) Auger

Size(s) and type(s) of bit(s) \_\_\_\_\_  
Borehole Diameter 8 in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to 20.5 ft. \_\_\_\_\_ cm.  
\_\_\_\_\_ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Sampling Methods CONTINUOUS Split Spoon  
Total Number Soil Sampling Tubes 3.25 - 4' TUBES

Total Number Core Boxes 2  
Number of Gallons Lost Drilling Fluid 0

Date/Time Started Drilling 0850 3/4/87  
Date/Time Completed Drilling 3/4/87 1001

Total Borehole Depth 20.5 ft. \_\_\_\_\_ cm.  
Depth to Bedrock 20.5 ft. \_\_\_\_\_ cm.  
Depth to Water 0 Dry ft. \_\_\_\_\_ cm.

Water Level Determined By? SAMPLES  
Borehole Completed as Monitoring Well? NO

Date/Time Grouting Completed 3.4.87 1025  
Depth of Tremmie Pipe IN AUGER

Gallons of Grout 60  
Materials Used 4 BAGS OF CEMENT 20 lbs of BRANTONITE

Comments IN REVIEW WE MAY HAVE HIT A ROULDER TO GET AUGER REFUSED

Wellsite Geologist Gray LA Date 6/11/87

Checked for Grout Settlement on 6/11/87 by JLR  
Amount of Grout Added 0

All Measurements from Ground Level  
Reviewed by Joseph L. Reed Date 6/11/87  
Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

Borehole: E-64A

Well Number: ~~3775~~ (Dev)

Depth-feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
0.0						MUNSELL COLORS
0.0 - 1.0	0-2	1.2'	NA	0-2	SM	SM silty-sand, ~ 30-40% silt, 10 YR, 5/4-6, ywsh. brn., non-plas., loose, slightly moist alluvium.
1.0 - 2.0						
2.0 - 3.0	2-4	0'		2-4		No RECOVERY - AUGER LOSS
3.0 - 4.0						
4.0 - 5.0	4-6	1.4'		4-6	SM	At 4.0', percent silt decreases to ~ 10-20%, color changes to 10 YR, 4/4-6, dk. ywsh. brn.,
5.0 - 6.0						
6.0 - 7.0	6-8	1.5'		6-8		At 7.0' color changes to 10 YR, 6/6-8, brnsh. yellow,
7.0 - 8.0						
8.0 - 9.0	8-10	1.4'		8-10		
9.0 - 10.0					ML	ML sandy-silt, 30-40% f. gr sand, 10 YR, 5/6-8, ywsh brn., non-plas., loose, moist, alluvium.
10.0 - 11.0	10-12	1.4'		10-12		

Drill Site Geologist: A.E. Smith

Date: 3/12/87

Reviewed By: Joseph L. Reed

Date: 4/11/87

Drillhole: E-64A

Well Number: 3205 Dry

TRC

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
11.0	70-12	1.4	NA	10-12	SC	<u>SC</u> Clayey - sand, ~30-40% clay, 10 YR, 7/3-4, v. pale brn., slightly pls., med. stiff, moist, alluvium.
12.0	12-14	1.5'		12-14		
13.0						
14.0	14-16	1.5'		14-16	SM	<u>SM</u> silty - sand, ~5-10% silt, 90-95% coarse sand, 10 YR, 5/2-3 gray. brn., non-pls, loose slightly moist alluvium
15.0						
16.0						
17.0	<del>16-18</del>			16-18		No RECOVERY
18.0	16-20	0'		18-20		AUGER LOSS
19.0						
20.0		0.5'			ML	<u>ML</u> sandy silt, 10-15% v.f. sand, 10 YR, 7/3-4, v. pale brn., med. stiff, dry alluvium.
20.5						END OF BORING LOG
21.0						
22.0						As

Drill Site Geologist: [Signature]

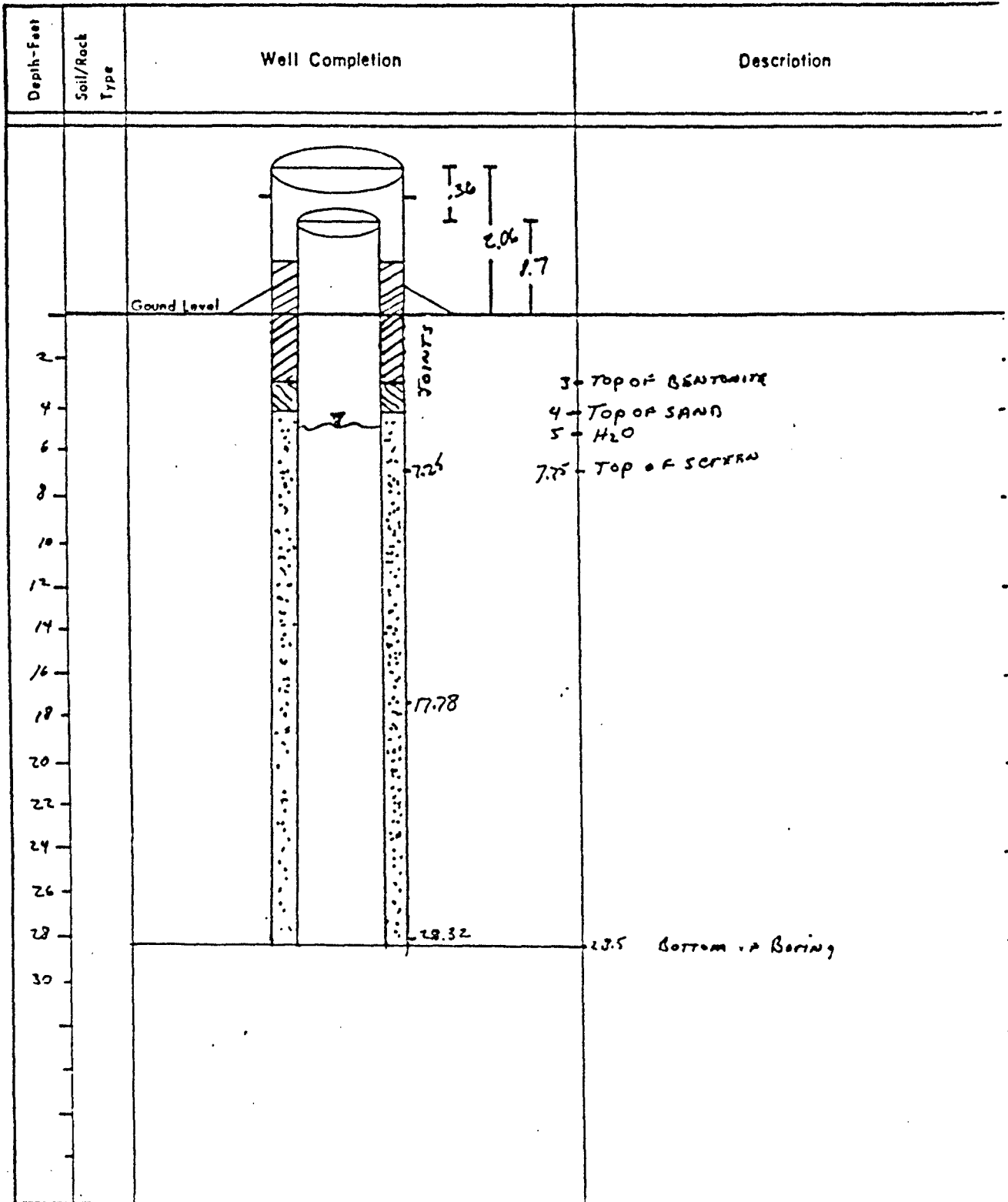
Date: 3/13/87

Reviewed By: [Signature]

Date: 4/16/87

Borehole: E-65A

Well: JR 37381  
655-A



Drill Site Geologist: Greg Litus  
 Reviewed By: Joseph Reed

Date: 3/26/87  
 Date: 6/11/87

WELL CONSTRUCTION SUMMARY

Borehole E-65A Well JR E-65A 37381  
 Project Name and Location T-36 1/2 mile N of 94th & 1/2 mile W of P Project Number 17053 074.10  
 Drilling Company Boyles Bros Driller Dave Jarvis Rig Number 5451  
 Drilling Method(s) Auger

Borehole Diameter 12 in. 28.5 ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.  
 \_\_\_\_\_ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) \_\_\_\_\_

Sampling Method(s) Continuous Split Spoon

Size and Type PVC 4" 1020

Date/Time Start Drilling 3/26/07 0845

Date/Time Finish Drilling 3/26/07 1010<sup>SWC</sup> 1120

Total Borehole Depth 28.5 ft. \_\_\_\_\_ cm.

Date/Time Start Completion 3/26/07 1120

Depth to Bedrock 28 ft. \_\_\_\_\_ cm.

Date/Time Cement Protective Casing 3/26/07 1415

Depth to Water 5 ft. \_\_\_\_\_ cm.

Materials Used \_\_\_\_\_

Water Level Determined By SAMPLES

Plain PVC 1-10' LENGTH

Length Plain PVC (total) 8.95 ft. \_\_\_\_\_ cm.

Slotted PVC 2-10' LENGTHS

Length of Screen 21.25 ft. \_\_\_\_\_ cm.

Bentonite Pellets 1 BUCKET

Total Length of Well Casing 30.2 ft. \_\_\_\_\_ cm.

Bentonite Granular 10 lbs

PVC Stick Up 1.7 ft. \_\_\_\_\_ cm.

Cement 17 BAGS

Depth to Bottom of Screen 28.5 ft. \_\_\_\_\_ cm.

Sand 18 BAGS

Depth to Top of Screen 7.25 ft. \_\_\_\_\_ cm.

Water added during completion 90

Depth to Top of Sand 4 ft. \_\_\_\_\_ cm.

Water added during drilling 0

Depth to Top of Bentonite 3 ft. \_\_\_\_\_ cm.

Total Gallons of water added 90

Drill Site Geologist Greg Livi

Date 3/26/07

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed RAG 5/19/87

Date/Time/Personnel Casing Painted 06-03-87 0800 PJB/WTV

Date/Time/Personnel Numbers Painted 06-03-87 1500 PJB/WTV

Materials Used 13 bags Bentonite 1 bag sand 1 bag cement

Top of Protective Casing to Top of PVC 0.36 ft. \_\_\_\_\_ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 1.42 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Internal Mortar 1.43 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Top of Cement Pad 1.62 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Ground Level 2.06 ft. \_\_\_\_\_ cm.

Reviewed By Joseph L. Reed Date 6/11/87

Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

Borehole: E-65A

Well Number: \_\_\_\_\_

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
	C- 2	100%		0- 2	ML	Silts with ~ 30% clays - roots and twigs to 10% of sample S <sub>u</sub> 3/2, dark olive gray, loose, nonplastic, moist
2	2- 4	100%		2- 4	ML	Silts with 20% clays, now 5-10% sands (incl. to coarse 2.5 <sub>u</sub> 3/2, very dark grayish brown, loose, nonplastic, moist
4	4- 6	100%		4- 6	SM	saturated SANDS with 25% silt - Fine - 2.5 <sub>u</sub> 5/4, light olive brown, loose, nonplastic, saturated also ~ 5% clay
6	6- 8	100%		6- 8		
8	8- 10	100%		8- 10	SM	- H <sub>2</sub> O increases in hole/sample SANDS - 15% silt, 1% clay, 2.5 <sub>u</sub> 5/6 light olive brown, loose, nonplastic, saturated
10	10- 12	100%		10- 12		
12	12- 14	100%		12- 14	SM	SANDS - 15% silt, 1% clay - sand coarser than previously - 10 <sub>u</sub> 5/6, somewhat yellow, loose, nonplastic, sat.
14	14- 16	100%		14- 16		
16	16- 18	25% <del>100%</del>		16- 18	SM	SANDS - 15% silt, 1% clay - 2.5 <sub>u</sub> 5/6 light olive brown, loose, nonplastic, saturated
18	18- 20	25% <del>100%</del>		18- 20		
20	20- 22	100%		20- 22	SP	SANDS - 5% silt - sand is medium grained - 10 <sub>u</sub> 4/6, brown, yellow, loose, nonplastic, saturated

Drill Site Geologist: C. Lewis

Date: 2.21.87

Borehole: E-69A Well Number: \_\_\_\_\_

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
22	22- 23.5	100%		22- 23.5	SP	<p>SANDS - 5% silt - sand fine to medium grain size - 10 yr 6/6,            brownish yellow, loose, nonplastic, saturated</p> <p>NOTE: 1' sample intervals contain 2' of sample due to            influx of sands in the augers</p> <p>28' BEDROCK - sandstone - slightly more indurated -            occas. carbon fragments in bedrock.</p> <p>END OF BORING AT 29'</p>
24	23.5 -25	100%		23.5 25		
26	25- 26	100%		25- 26		
	26- 27	100%		26- 27		
28	27- 29	100%		27- 29	SS	
30						

Drill Site Geologist: C. F. ... Date: 3-31-87

WELL CONSTRUCTION SUMMARY

Borehole E-66A Well JE 566A 37386  
 Project Name and Location MW installation Project Number 7-25  
 Drilling Company Boyles Bros Driller Dave Jarvie Rig Number 5451  
 Drilling Method(s) Auger

Borehole Diameter 12 1/4 in.        cm. 00 ft.        cm. to 50.6 ft.        cm.  
       in.        cm.        ft.        cm. to        ft.        cm.

Size(s) and types of Bit(s)        Sampling Method(s) Auger  
 Date/Time Start Drilling       

Size and Type PVC 4" ID Date/Time Finish Drilling 4/10/87 0802

Total Borehole Depth 50.6 ft.        cm. Date/Time Start Completion 4/10/87 0823

Depth to Bedrock 50.0 ft.        cm. Date/Time Cement Protective Casing 4/10/87 1130

Depth to Water 46.5 ft.        cm. Materials Used 25 2" liners

Water Level Determined By sample Plain PVC       

Length Plain PVC (total) 41.23 ft.        cm. Slotted PVC       

Length of Screen 10.89 ft.        cm. Bentonite Pellets 4 1/2 buckets

Total Length of Well Casing 52.12 ft.        cm. Bentonite Granular 1/2 bucket + 1/4 bucket

PVC Stick Up 1.7 ft.        cm. Cement 18 bags

Depth to Bottom of Screen 50.4 ft.        cm. Sand 9 bags

Depth to Top of Screen 39.51 ft.        cm. Water added during completion 5 gallons

Depth to Top of Sand 34.7 ft.        cm. Water added during drilling 20 gal x 50% = 10 gal

Depth to Top of Bentonite 29.7 ft.        cm. Total Gallons of water added 10 gallons 15 gal

Drill Site Geologist K. J. Matthews Date 4-10-87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 5/19/87 / 0900 / RAG + WJW

Date/Time/Personnel Casing Painted 06-03-87 1930 PJB WTK

Date/Time/Personnel Numbers Painted 06-16-87 0800 PJB DLW

Materials Used 15 Bags Quickcrete 1 bag sand, 1 Bag cement

Top of Protective Casing to Top of PVC 0.32 ft.        cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 1.32 ft.        cm.

Top of Protective Casing to Internal Mortar 1.35 ft.        cm.

Top of Protective Casing to Top of Cement Pad 1.72 ft.        cm.

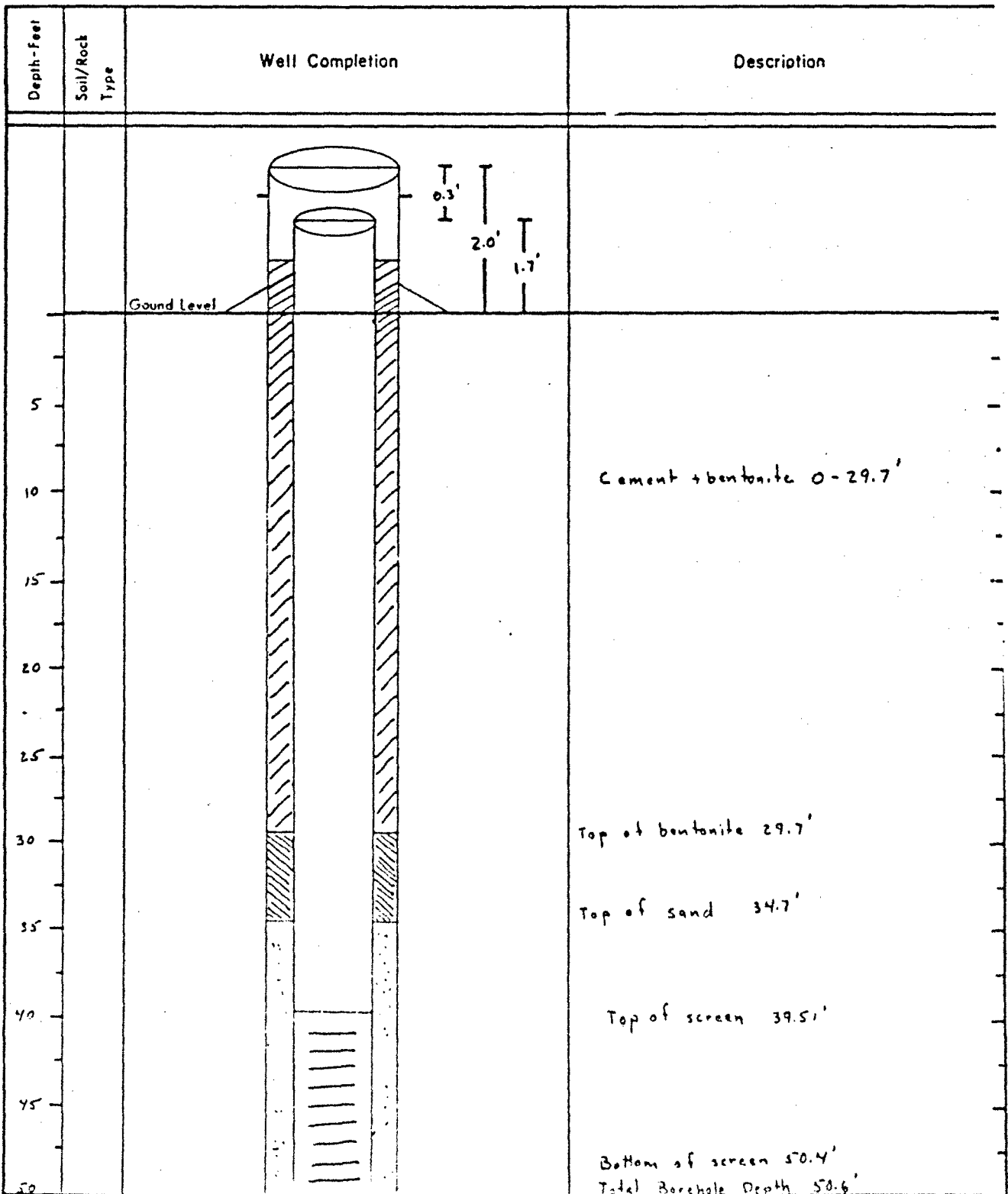
Top of Protective Casing to Ground Level 8.02 ft.        cm.

Reviewed By Joseph Reed Date 6/19/87

Drill Site Geologist        Date

Borehole: E 66 A

Well: 37386



Drill Site Geologist: Kevin Matthews

Date: 9/26/83

Reviewed By: [Signature]

Date: 12/1/87

Borehole: E-65A F-66A

Well Number: 37389<sup>JR</sup> 37386

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
						<u>Munsell Colors</u>
0.0			NA		ML	<u>ML</u> sandy-silt, 10-20% v.f. gr. sand, 10 YR, 4/3-4, dk. br., non-pls., loose, moist, alluvium.
1.0	0-2'	2'		0-2'		
1.5						At 1.8', sandy-silt, 10-20% v.f. gr. sand, 10 YR, 7/2-3, v. pale br., non-pls., loose, dry, alluvium.
2.0						
3.0	2-4'	2'		2-4'		
4.0						
5.0	4-6'	2'		4-6'		At 5.0', sandy-silt, 40-45% v.f. gr. sand, 10 YR, 5/6-8, ywash. br., non-pls., loose, slightly moist alluvium.
6.0						
7.0	6-8'	2'		6-8'		
8.0						
9.0	8-10'	2'		8-10'		
10.0						At 10.0', sandy-silt, 10-20% v.f. gr. sand, 10 YR, 5/6-8, ywash. br., non-pls., loose, slightly moist alluvium.
11.0	10-12'	2'		10-12'		

Lab  
 Date Site Geologist: AE Dettl

Date: 4/9/87  
4/16/87

Borehole: E-66A

Well Number: ~~37389~~<sup>JE</sup> 37386

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
11.0	10-12'	2'	NA	10-12'	ML	<p style="text-align: center;"><i>Munsell Colors</i></p> <p>At 13.0, sandy-silt, ~ 10-20% v.f.gr. sand, 10 YR, 5/6-8, mottled w/ 5-10% calc. sand v.f.gr. sand, 10 YR, 8/1, white, non-pls., med. dense, slightly moist, alluvium.</p> <p>At 20.0, sand-silt, ~ 40% v.f.gr. sand, 10 YR, 5/6-8, ywash. brn., non-pls., loose, slightly moist, alluvium.</p>
12.0	12-14'	2'		12-14'		
13.0	14-16'	2'		14-16'		
14.0	16-18'	2'		16-18'		
15.0	18-20'	2'		18-20'		
16.0	20-22'	2'		20-22'		
17.0						
18.0						
19.0						
20.0						
21.0						
22.0						

Drill Site Geologist: A.R. Ostberg

Date: 4/9/87  
4/11/87

Borehole: E-66A

Well Number: 37389 <sup>JE</sup> 37386

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
<i>Munsell Cores</i>						
22.0	22-24'	2'	NA	22-24'	ML	<i>ML clayey-silt, ~10-20% clay, 10 YR, 6/6-8, brownish yellow, slightly plus, soft, moist, alluvium.</i>
23.0						
24.0	24-26'	0'		24-26'		— NO RECOVERY —
26.0	26-28'	2'		26-28'	ML	<i>At 27.0', clayey-silt, ~20-30% clay, 10 YR, 5/4-6, ywsh. brn., <del>low plus</del> mottled w/ f. gr. calc. sand, 10 YR, 8/1, white, low-med, plus., soft, moist, alluvium.</i>
27.0						
28.0	28-30'	2'		28-30'		
30.0	30-32'	2'		30-32'		<i>At 32.0', clayey-silt, ~5-10% clay, 10 YR 5/4-6 ywsh. brn., slightly plus, soft, moist, alluvium.</i>
31.0						
32.0	32-34'	2'		32-34'		
33.0						

Drill Site Geologist: S.R. [Signature]  
 Reviewed By: Michael L. Reed

Date: 4/9/87  
 Date: 4/16/87

Borehole: E-66A

Well Number: 37389<sup>3e</sup> 37386

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
<i>Munsell Colors</i>						
33.0	32-34'	2'	NA	32-34'	ML	<p>At 35.0'; clayey-silt, 30-40% clay, 10 YR, 4/4-6, dk. ywash. brn., low-med. plas., med. stiff, moist, alluvium.</p>
34.0	34-36'			34-36'		
35.0	36-38'	2'		36-38'		
36.0	38-40'			38-40'		
37.0	40-42'	2'		40-42'	CL	
40.0	42-44'	1.6'		42-44'		<p>CL silty-clay, ~30% silt, 10 YR, 4/3-4, dk. ywash. brn., med. plas., med. stiff, moist, alluvium.</p>
42.0						<p>At 42.0'; silty-clay, ~10% silt, 10 YR, 4/3-4, dk. ywash. brn., med. plas., med. stiff, moist, alluvium.</p>
43.0	42-44'	1.0'		42-44'		
44.0						

Log  
 Drill Site Geologist: A.S. Dutek  
 Reviewed By: Orson L. Reed

Date: 4/9/87  
 Date: 4/16/87

Borehole: E-66A

Well Number: 37389<sup>SR</sup> 37386

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						Munsell Colors
44.0	44-45	1'	NA	44-45	SP	SP gravelly-sand, 20-30% gtz. gravel, 10% R, 5/6-8, yash. br., non-pls., loose, moist, alluvial.
45.0	45-46	1'		45-46		
46.0	46-47	0.5'		46-47		At. 46.5 gravelly-sand, 20-30% gtz. gravel, 10% R, 5/6-8, yash. br., non-pls., loose, <u>unsaturated</u> , alluvial.
47.0	47-48	0'		47-48		No Recovery - AUCRA Loss
49.0	49-50	0'		49-50		No Recovery - AUCRA Loss
50.0	50-51	0'		50-51		No Recovery - AUCRA Loss
51.0	51-52	0'		51-52		No Recovery - AUCRA Loss
52.0	52-53	0'		52-53		No Recovery - AUCRA Loss
53.0	53-54	0'		53-54		No Recovery - AUCRA Loss
54.0	54-55	0'		54-55		No Recovery - AUCRA Loss
55.0						

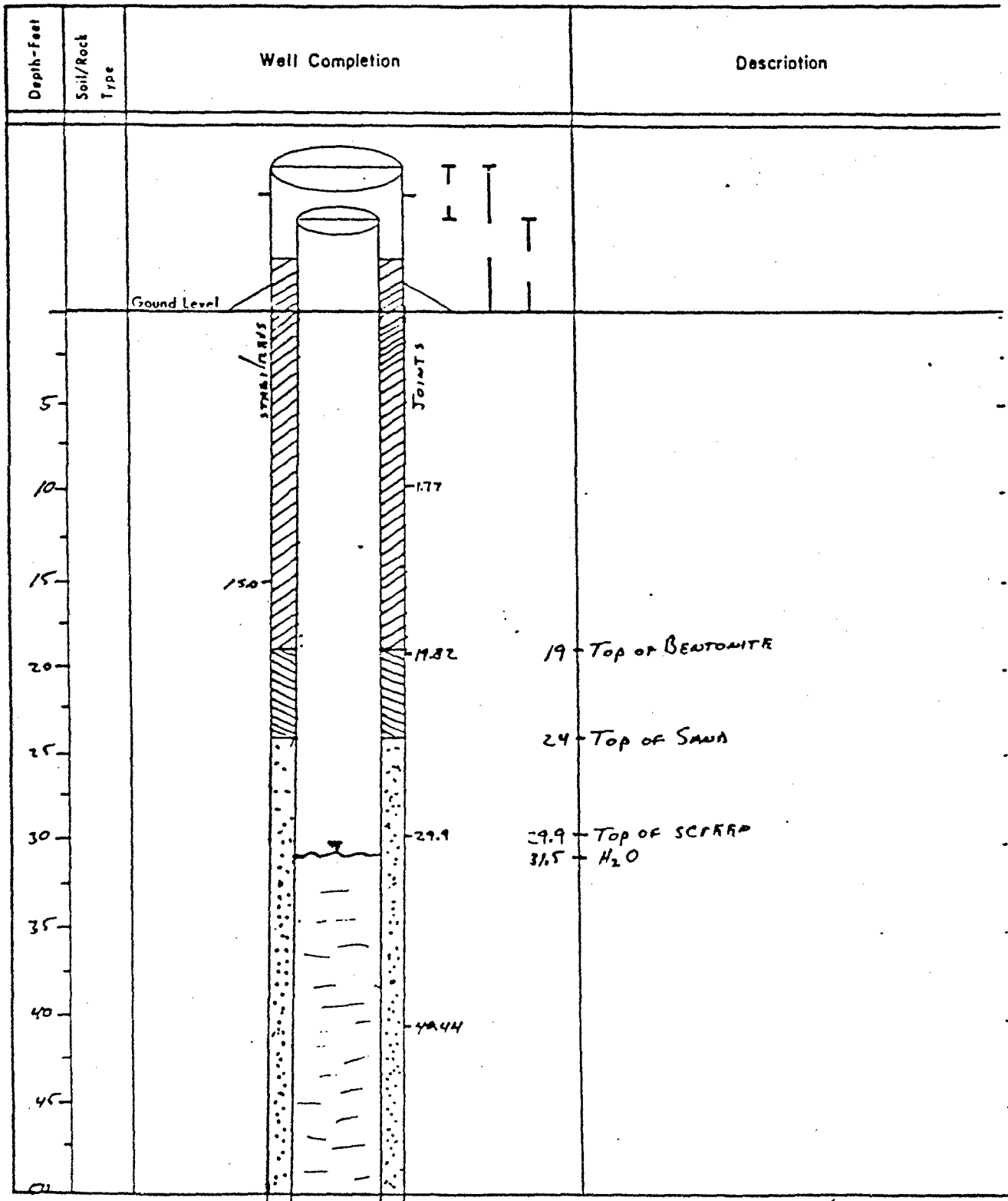
END OF BORING LOG

Drill Site Geologist: A.E. Daulton  
 Reviewed By: Donald L. Reed

Date: 4/9/87  
 Date: 4/16/87

Borehole: E-67A

Well: JR 37385  
~~E67A~~



Drill Site Geologist: G. J. GA Date: 4/7/07  
 Reviewed By: \_\_\_\_\_ Date: \_\_\_\_\_

WELL CONSTRUCTION SUMMARY

Borehole GW E-67A Well JR E-67A 37385  
 Project Name and Location F-25 YOSEMITE @ 92ND Project Number \_\_\_\_\_  
 Drilling Company Buyless Bros Driller DAVE JARVIS Rig Number 5451  
 Drilling Method(s) AUGER

Borehole Diameter 1 1/4 in. \_\_\_\_\_ cm. 0 ft. \_\_\_\_\_ cm. to 51.39 ft. \_\_\_\_\_ cm.  
 \_\_\_\_\_ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) \_\_\_\_\_

Sampling Method(s) CONTINUOUS Split Spoon

Size and Type PVC 4" .020 slot

Date/Time Start Drilling 4/3/87 1330

Total Borehole Depth 51.39 ft. \_\_\_\_\_ cm.

Date/Time Finish Drilling 4/3/87 1626 <sup>DOES NOT INCLUDE REAM</sup>

Depth to Bedrock 51 ft. \_\_\_\_\_ cm.

Date/Time Start Completion 4/7/87 0830

Depth to Water 31.5 ft. \_\_\_\_\_ cm.

Date/Time Cement Protective Casing 4/7/87 1120

Water Level Determined By SAMPLES

Materials Used 22- 2' TUBES 46 CAPS

Length Plain PVC (total) 31.6 ft. \_\_\_\_\_ cm.

Plain PVC 3-10' SECTIONS + 1 CUT PIECE

Length of Screen 21.49 ft. \_\_\_\_\_ cm.

Slotted PVC 2-10' SECTIONS

Total Length of Well Casing 53.09 ft. \_\_\_\_\_ cm.

Bentonite Pellets 4.5 BUCKETS

PVC Stick Up 1.7 ft. \_\_\_\_\_ cm.

Bentonite Granular 40/65

Depth to Bottom of Screen 51.39 ft. \_\_\_\_\_ cm.

Cement 3 Bags

Depth to Top of Screen 29.90 ft. \_\_\_\_\_ cm.

Sand 16 Bags

Depth to Top of Sand 24.0 ft. \_\_\_\_\_ cm.

Water added during completion 35

Depth to Top of Bentonite 19.0 ft. \_\_\_\_\_ cm.

Water added during drilling 15- all WATER WAS BROUGHT UP WITH CUTTING

Total Gallons of water added 50

Drill Site Geologist Greg [Signature]

Date 4/7/87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 5/19/87 RAG

Date/Time/Personnel Casing Painted 06-03-87 13:00 PJB-WTV

Date/Time/Personnel Numbers Painted \_\_\_\_\_

Materials Used 12 Bags Quikrete 1 Bag sand 1 cement

Top of Protective Casing to Top of PVC 0.25 ft. \_\_\_\_\_ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 1.57 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Internal Mortar 1.54 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Top of Cement Pad 1.77 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Ground Level 1.95 ft. \_\_\_\_\_ cm.

Reviewed By Joseph L. Reed Date 6/11/87

Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

Borehole: E-67-1

Well Number: 37385

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
<i>MUNSELL COLORS</i>						
0.0	0-2'	2'	NA	0-2'	ML	ML clayey-silt, ~30-40% clay, 10 YR, 5/2-3, greyish brn., non-pls slightly, v. soft, moist alluvium.
1.0						
1.7	2-4'	2'		2-4'		At 1.7', sandy-silt, ~20-30% v.f. gr. sand, 10 YR, 4/3-4, dk. greyish brn., non-pls., loose, moist alluvium.
2.0						
3.0	4-6'	2'		4-6'		At 3.6', sandy-silt, ~30% v.f. gr. sand, 10 YR, 6/4-6, light. greyish brn., non-pls., loose, slightly moist alluvium.
3.6						
4.0	6-8'	2'		6-8'		At 5.5', sand-silt, ~40-45% v.f. gr. sand, 10 YR, 6/6, brack. yellow, non-pls, loose, dry, alluvium.
5.0						
5.5	8-10'	2'		8-10'	SM	SM silty-sand, ~30% silt, 10 YR, 6/6-8, brack. yellow non-pls, loose, moist, alluvium.
6.0						
7.0	10-12'	2'		10-12'	ML	ML clayey-silt, ~20% clay, 10 YR, 5/4-6, greyish brn., non-pls slightly, med. stiff, slightly moist, alluv.
8.0						
9.0						
10.0						
11.2						

Drill Site Geologist: A.E. Dettl

Date: 4/9/87

Borehole: E-67A

Well Number: 37385

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
<i>MUSEUM COLORS</i>						
11.0	10-12'	2'	NA	10-12'	ML	At 11.0', clayey-silt, ~ 30-40% clay, 10 YR, 5/6-8, ywash. brn., low pls., soft, moist, alluvium.
12.0	12-14'	2'		12-14'		
13.0	14-16'	2'		14-16'		At 13.0', clay-silt ~ 30-40% clay, 10 YR, 5/6-8, mottled w/ 5-10% calc. sand 10 YR, 8/1-2, white, low pls., soft, moist, alluvium.
14.0	16-18'	2'		16-18'		
15.0	18-20'	2'		18-20'	SM	SM silty-sand, ~ 20% silt, 10 YR, 7/4-6, v. pale brn non-pls., loose, slightly moist, alluvium.
16.0	20-22'	2'		20-22'	ML	ML clayey-silt, ~ 10-20% clay, 20% v. f. gr. sand, 10 YR, 5/6-8, ywash. brn., slightly pls., soft, moist, alluvium.
17.0						
17.7						
18.0						
19.0						
20.0						
21.0						At 21.0', clayey-silt ~ 30-40% clay, 10 YR, 5/6-8, ywash brn., low med. pls, soft, moist, alluvium
22.0						

Drill Site Geologist: A.E. D'Amico

Date: 4/9/87  
4/11/87

Borehole: E-67A

Well Number: 37385

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
22.0						MONSIEUR Colors  
23.0	22-24'	2'	NA	22-24'	ML	
24.0						
25.0	24-26'	2'		24-26'	CL	
26.0						
27.0	26-28'	2'		26-28'		
27.5						
28.0	28-30'	2'		28-30'		
29.0						
30.0	30-32'	2'		30-32'	SM	
31.0						
31.5	32-34'	2'		32-34'		
32.0						

CL silty-clay, ~ 30% silt, 10 YR, 7/2-3, v. pale br low plas., soft, moist, alluvium.

At 27.5', silty-clay, ~ 5-10% silt, 10 YR, 7/1-2, light gray, low plas., soft, moist, alluvium.

SM silty-sand, 10% silt, 10 YR, 5/4-6, good brn., non-plas., loose, saturated, alluvium.

142  
 Drill Site Geologist: A.E. Daulton  
 Reviewed By: Joseph L. Reed

Date: 4/9/87  
 Date: 9/16/87

Borehole: E-67A Well Number: 37385

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
33.0	32-34'	2'	NA	32-34'	SP	<i>Munsell Brown</i> <u>SP</u> gravelly-sand, 20-30% gta. gravel, 10% silt, 5/4- wash. br., non-pla., loose, saturated, alluvial
34.0	34-35'	1'		34-35'		
35.0	35-37'	0'		35-37'		
36.0						No RECOVERY — AUGER LOSS
37.0	37-39'	0.3'		37-39'	SM	<u>SM</u> silty-sand, 10-15% silt, 10% gravel, 5/4-6, wash. br., non-pla., loose, saturated, alluvial
38.0	39-41'	0'		39-41'		
39.0	41-43'	0.3'		41-43'		
40.0						No RECOVERY — AUGER LOSS
41.0	43-45'	0'		43-45'	SM	No RECOVERY — AUGER LOSS
42.0						
43.0						

Geologist: A.R. [Signature] Date: 4/9/87  
 Reviewed By: [Signature] Date: 4/16/87

Borehole: E-67A Well Number: 37385

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						MUNSELL COLORS
44.0		0'	NA			NO RECOVERY - SUGAR LOSS
45.0					SM	
46.0						
47.0						
48.0						
49.0						
50.0					CL	CL sandy-clay, 20% med.-course gr. sand, 10YR 4/2 dk gray brn., low plas., soft, wet, bedrock.
51.0						At 51.0 silty-clayst., 30% silt, 10YR, 3/1, v. dk gray slightly plas., hard, wet, bedrock.
52.0						END OF BORING LOG
53.0						
54.0						Geo
55.0						

Geologist: L.S. Intally Date: 4/9/87  
 Reviewed By: Joseph L. Reed Date: 4/16/87

BOREHOLE SUMMARY LOG

Borehole E-69 Well \_\_\_\_\_  
Project Name and Location MW Installation Project Number 17053 07411  
Drilling Company Boyle Driller Roach Rig Number Fairing 25  
Drilling Method(s) Rotary - with water

Size(s) and type(s) of bit(s) 12 1/4 rock, 7 7/8 tricone  
Borehole Diameter 12 1/4 in. \_\_\_\_\_ cm. 0 ft. \_\_\_\_\_ cm. to 30 ft. \_\_\_\_\_ cm.  
7 7/8 in. \_\_\_\_\_ cm. 30 ft. \_\_\_\_\_ cm. to 121 ft. \_\_\_\_\_ cm.

Sampling Methods Continuous Core

Total Number Soil Sampling Tubes -

Total Number Core Boxes 13

Number of Gallons Lost Drilling Fluid 0

Date/Time Started Drilling 2:11:87 1027

Date/Time Completed Drilling 2:12:87 1305

Total Borehole Depth 121 ft. \_\_\_\_\_ cm.

Depth to Bedrock 27 ft. \_\_\_\_\_ cm.

Depth to Water \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Water Level Determined By? NOT Determined - drilled with water

Borehole Completed as Monitoring Well? No

Date/Time Grouting Completed 2:12:87 1506

Depth of Tremmie Pipe 120'

Gallons of Grout 80

Materials Used 3 bags cement, 30 gals water

Comments hole grouted to 10' of surface as requested by landowner,  
Casing cemented

Wellsite Geologist C Benson Date 3.23.87

Checked for Grout Settlement on 5.19.87 by CDE

Amount of Grout Added none

All Measurements from Ground Level

Reviewed by Joseph L. Reed Date 6/11/87

Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

DEPTH Feet	REG Int.	Structure/ Bedding		Marl- ness		Perm.		Mineralogy		Color (M) G	Texture/ Grain Size clst ad gr mm			Lith. Char	Lith. Class	Description/Comments
		Angle	Desc.	S	HL	HL	H	Min	Habit		01	10	100			
26																BORING AUGERED and Cased to 30' - NO LOG -
28																
30										2.5y				5/6		silty 15% SS SS
32	667.									Li. olive brown						
34	4 5															33' 33'
36	107. 21 3															
38																FeOx/lim on fracture faces ↓
40																
42																OXIDATION BOUNDARY
44										2.5y 2.5/10 Haux						

SE, Inc. BORE E-69 WELLS

33  
4/ft.

platy  
thick

BORING AUGERED and  
Cased to 30' -  
NO LOG -

FeOx/lim on fracture faces  
↓

OXIDATION BOUNDARY

COR No	DEPTH	Reef Int	Width		Structure/Bedding		Hardness		Form.		Mineralogy		Color		Texture/Grain Size			Lith. Char.	Lith. Class	Description/Comments		
			U	S	Angle	Desc.	S	HL	1"	2"	Min	Habit	M	G	Cl	10	100					
	46		S	S									2.5y									
(2)	48					severely broken platy thick							2.5y S/G									
	50		S	S									2.5y H2/O black									
	52					highly fractured							2.5y H2/O black									
(3)	54		4	4		jts. 4-8 per foot							2.5y H5/O gray									
	56																					
	58		4	4																		
	60					jts. 10-12 per foot																
(4)	62		4	4		jts. 4-6 per foot																

ESE, Inc. BORE E-69 WELL(S) \_\_\_\_\_

cln  
6%

clay  
4-7%

Lq  
Frag.

Δ

Δ

Δ

Δ

Δ

Δ

Lq  
Frag.

Δ

Δ

PROX. DEPTH IN FEET	CORRECTION		Structure/ Bedding		Hard- ness			Perm.		Mineralogy		Color		Texture/ Grain Size			Lith. Char.	Lith. Class	Description/Comments	
	U	S	Angle	Desc.	S	HL	H	1"	2"	Min	Major	M	G	clst	sd	gr				mm
66		3		js. 12/Ft.														B	st	
68		3.2		js. 3/Ft.														B		
70		4											2.5g					B		
72		2		js. 10-12/Ft.									N50					B		
74		4		js. 3-5/Ft.									gray					B		
76																		B		
78		2.4																B		
80		5																B		
82		4		js. 9-12/Ft.														B		

E. Inc. BORE E-69 WELL(S)

BOX #	DEPTH Feet	U	S	Structure/ Bedding		Hard- ness		Perm.		Mineralogy		Color		Texture/ Grain Size Clay % of gr			Lith. Char.	Lith. Class	Description/Comments
				Angle	Desc.	S	H	1"	2"	Mic	Habit	M	G	01	10	100			
	86				0-1/ft					10% cbn		2.5y N5/C				silty 57%	SS		
	88				highly fractured to friable					bt 24%		gray				bt 27%		Carbon/liquite seam = 2"	
	90				jts 0-1/ft														
	92				highly fractured to friable					mul						91 very friable	Lg		
	94															93	cls		
	96				jts 0-4/ft (compacted vick)					8						95 med to coars	SS		
	98									cbn 10%						96	cls		
	100																		
	102											2.5y 4/2 gray brown						no carbon to 107"	

ESE, Inc. BORE E-69 WELL(S)

DEPTH Feet	Roc Int.	North U S	Structure/ Bedding		Hard- ness		Perm.				Mineralogy		Color M G	Texture/ Grain Size clst or gr mm of 10 100	Lith. Char.	Lith. Class Ft	Description/Comments CM (Scale 1" = <u>2</u> ft)
			Angle	Desc.	S	HL	HL	H	Min	Habit							
106	4 4			fts. 24/Gr. (competent rock)									2.5y 3/0 very dk grn			cls	
108													2.5y 5/0				
110	4 4												gray			SS	light seam 2"
112																SS	
114	26 4															SS	
116																SS	
118	5 5															SS	
120																SS	
121																	END OF HOLE 121'

E, Inc. BORE E-69 WELL(S)

Drilling Date: **12/10** Sturdy  
 In Size: **3 3/4"**  
 Core Depth: **28 Ft** Unit No.: **1320** Form No.: **1345**  
 State: **COLORADO** Version: **Water / Native Mud** Operator: **Wm. Linton**  
 Log Measured From: **Ground Level** Log Measured To: **Ground level** Location: **Wakenwood**

EQUIPMENT DATA

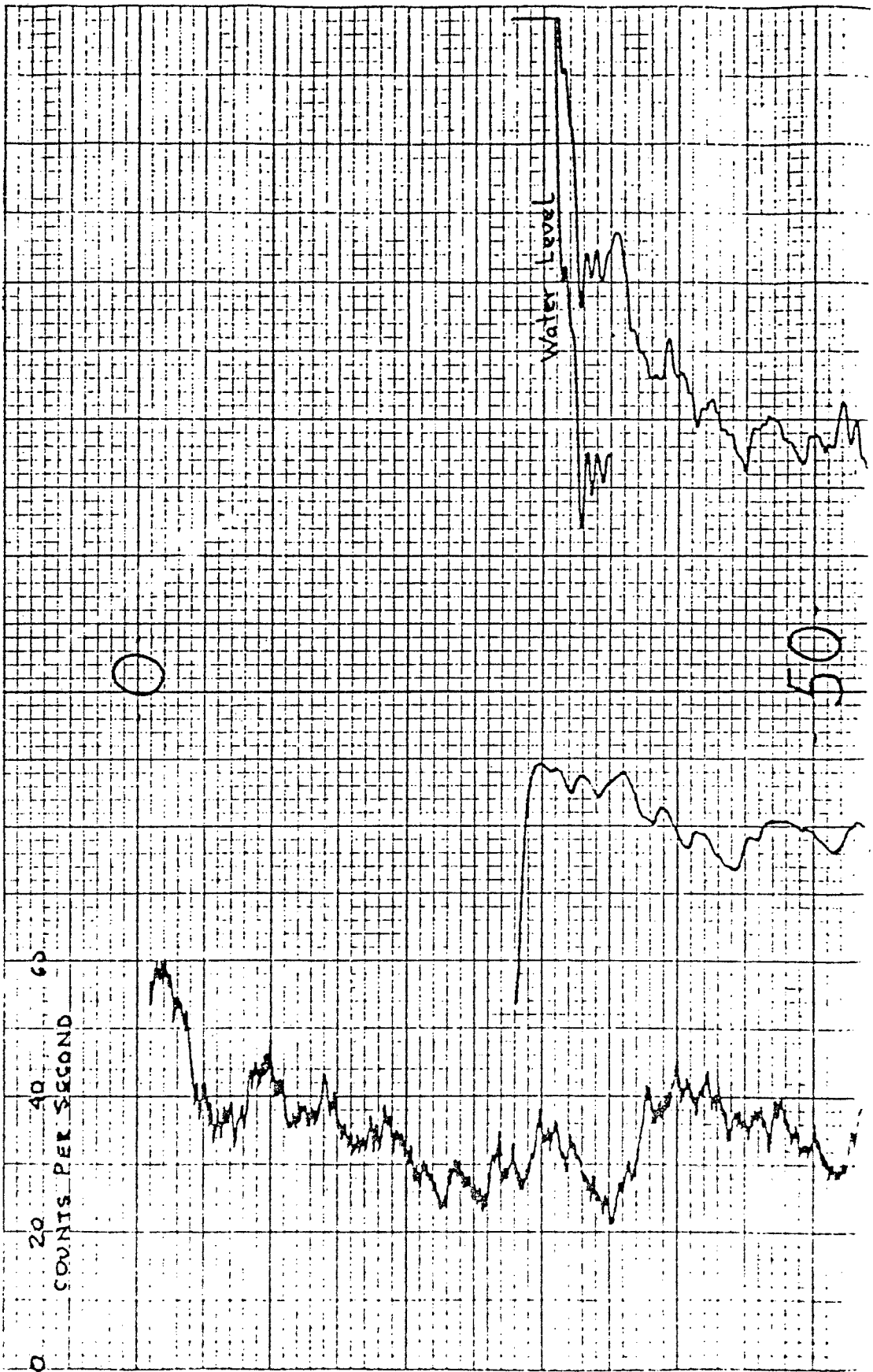
TO Logged: **118 Feet** Scale: **TC** CPS/in: **TC** Logging Speed: **TC** From: **TC** To: **TC** Total: **TC**  
 Natural Gamma Scale: **20 Scale = 20** CPS per inch  
 Log Scale: **2** Logging Speed: **15** From: **TC** To: **TC** Total: **TC**  
 Cable Source Measured: **103-124** From: **TC** To: **TC** Total: **TC**  
 Probe Diameter: **1 5/8"** CPS/in: **TC** Logging Speed: **TC** From: **TC** To: **TC** Total: **TC**  
 Cable Type: **Xtal 3/4 x 1"** CPS/in: **TC** Logging Speed: **TC** From: **TC** To: **TC** Total: **TC**  
 Cable Length: **2.35 x 10<sup>5</sup>** From: **TC** To: **TC** Total: **TC**

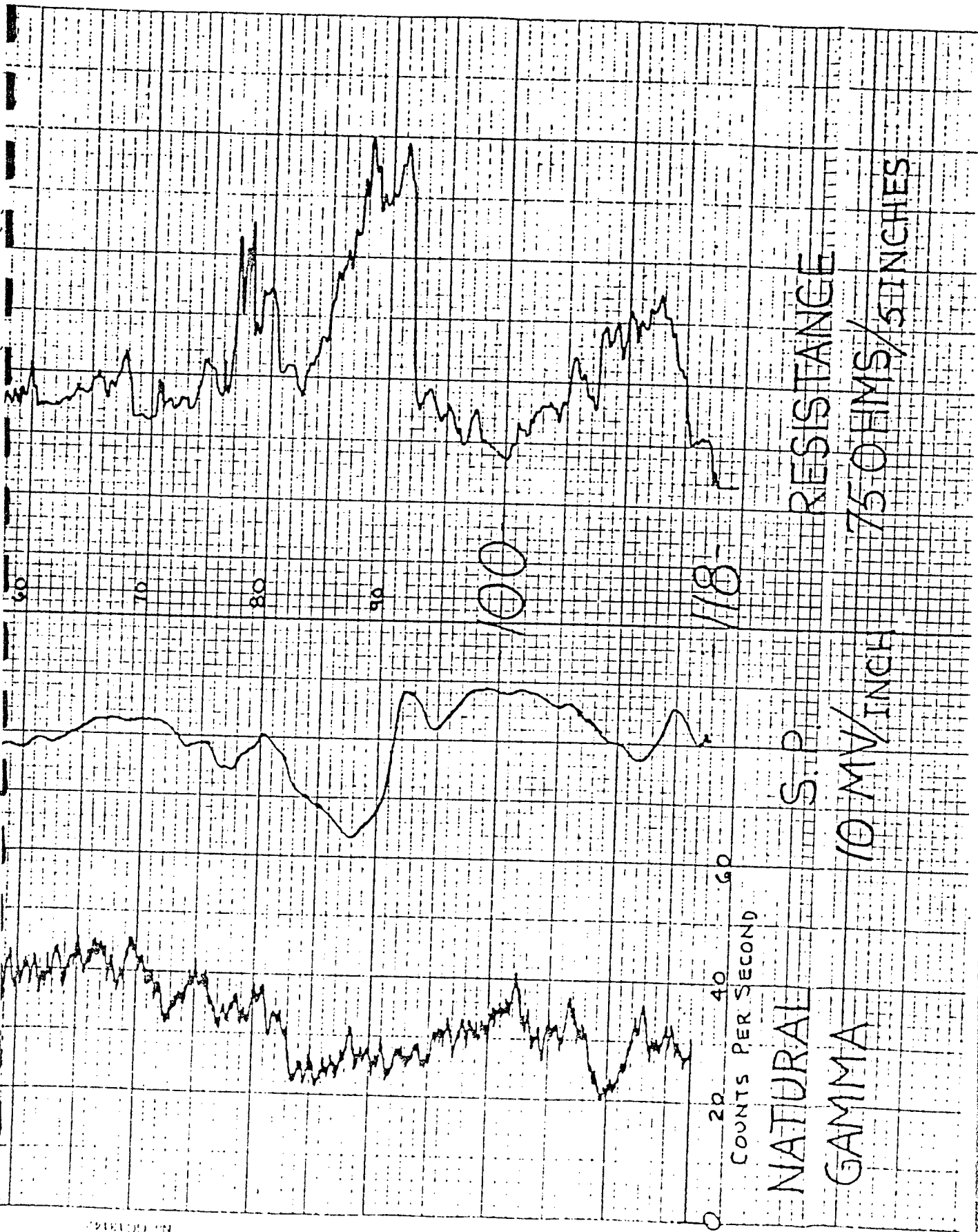
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 Caliper: **TC** Type: **TC** Logging Speed: **TC** From: **TC** To: **TC** Total: **TC**  
 Temperature: **TC** Type: **TC** Logging Speed: **TC** From: **TC** To: **TC** Total: **TC**  
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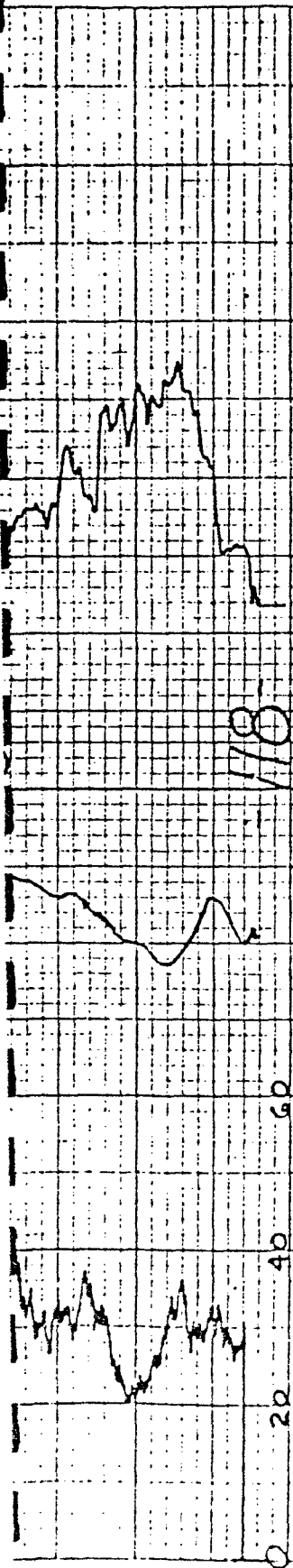
RESISTANCE: **20** ohms/5" **S.P.** **10 MV** **75** OHMS 5 inches  
 NATURAL GAMMA: **20** CPS **40** CPS PER SECOND  
 S.P. **10 MV / Inch**

0	20	40	60	80	100
COUNTS PER SECOND					

NATURAL GAMMA S.P. RESISTANCE  
 20 cps = 10 MV 75  
Initial Log - OHMS/ 5 inches







NATURAL

S.P.

RESISTANCE

GAMMA

10 MV/INCH

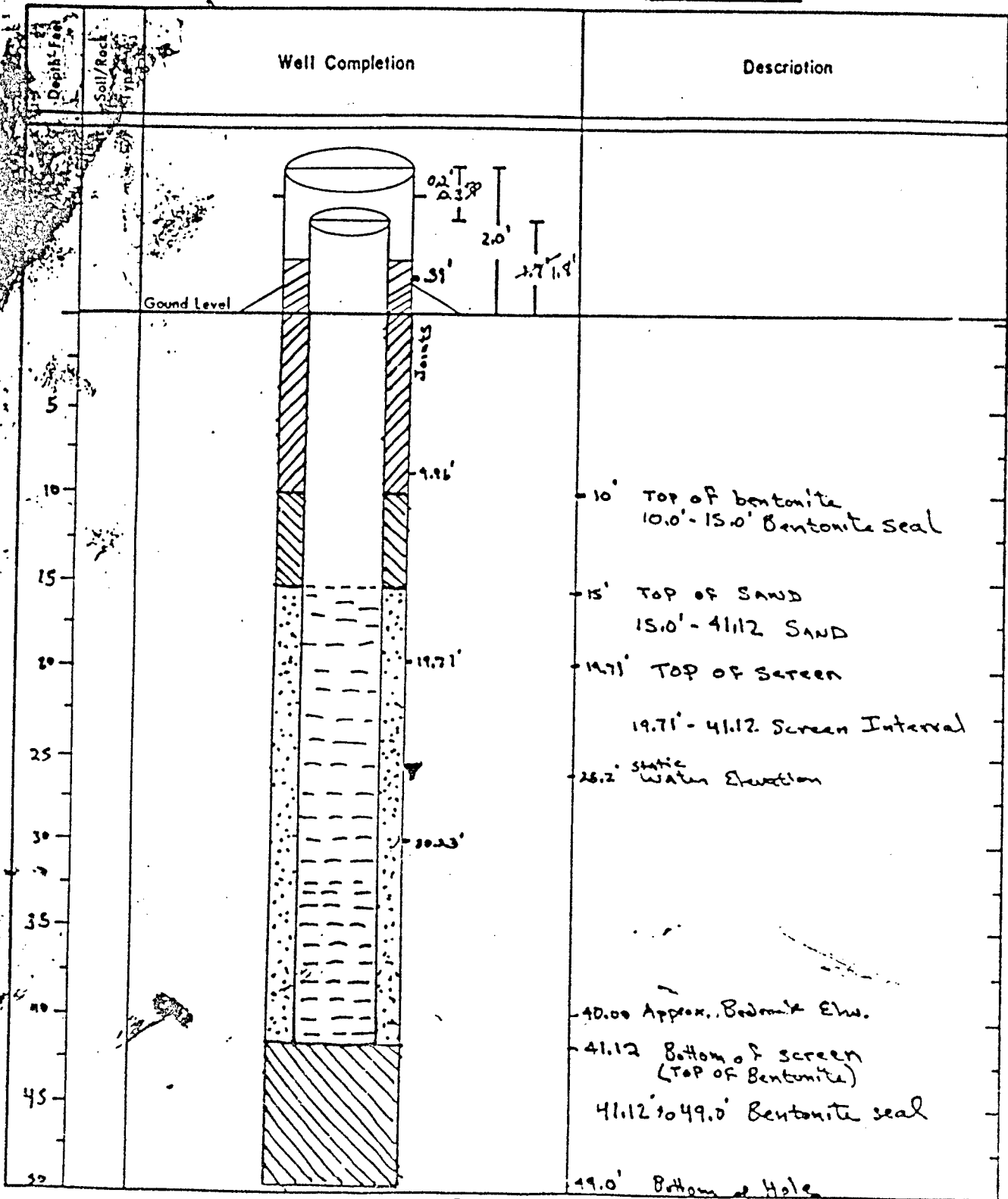
75 OHMS/5 INCHES

HOLE

F 69

Borehole: E-73A

Well: 37391



Drill Site Geologist: Steve Parris  
 Reviewed By: Joseph [Signature]

Date: 7/6/87  
 Date: 11/5/87

WELL CONSTRUCTION SUMMARY

Borehole E-73A Well 37391

Project Name and Location TASK 39 off post Project Number \_\_\_\_\_

Drilling Company Boyle Bros. Driller Don Irvine Rig Number TR

Drilling Method(s) Auger

Borehole Diameter 12 1/4 in. \_\_\_\_\_ cm. 0.0' ft. \_\_\_\_\_ cm. to 49.0' ft. \_\_\_\_\_ cm.  
 \_\_\_\_\_ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) Hollow Stem Auger

Sampling Method(s) Continuous Split Spoon

Size and Type PVC 4" .020 slot

Date/Time Start Drilling 6/29/87 1341

Total Borehole Depth 49.00 ft. \_\_\_\_\_ cm.

Date/Time Finish Drilling 6/29/87 1031

Depth to Bedrock 40.00 ft. \_\_\_\_\_ cm.

Date/Time Start Completion 6/29/87 1047

Depth to Water 25.20 ft. \_\_\_\_\_ cm.

Date/Time Cement Protective Casing 6/30/87 0930

Water Level Determined By Sounding + samples

Materials Used 15-2" TUBES 30 caps

Length Plain PVC (total) 21.41 ft. \_\_\_\_\_ cm.

Plain PVC 2-10' section + 1 cut piece

Length of Screen 21.41 ft. \_\_\_\_\_ cm.

Slotted PVC 2-10' section

Total Length of Well Casing 42.82 ft. \_\_\_\_\_ cm.

Bentonite Pellets 13.5 buckets

PVC Stick Up 1.70 ft. \_\_\_\_\_ cm.

Bentonite Granular 30 5/8 bag

Depth to Bottom of Screen 41.12 ft. \_\_\_\_\_ cm.

Cement 5 bags

Depth to Top of Screen 19.71 ft. \_\_\_\_\_ cm.

Sand 18 bags

Depth to Top of Sand 15.0 ft. \_\_\_\_\_ cm.

Water added during completion 30 gal.

Depth to Top of Bentonite 10.0 ft. \_\_\_\_\_ cm.

Water added during drilling NA

Total Gallons of water added 30 gal

Drill Site Geologist STEVE PARIS

Date 7/2/87

Date/Time/Personnel Internal Mortar, Cement Pad and Weep Hole Installed 07/13/87 / 0900 / am

Date/Time/Personnel Casing Painted (white) 07/13/87 / 0930 / am

Date/Time/Personnel Numbers Painted 7/13/87 JLR

Materials Used 10 bags Sakrete

		COMMENT/NOTES
Top of Protective Casing to Top of PVC	<u>.20</u> ft. _____ cm.	
Top of Protective Casing to Weep Hole	<u>1.95</u> ft. _____ cm.	
Top of Protective Casing to Internal Mortar	<u>1.95</u> ft. _____ cm.	
Top of Protective Casing to Top of Cement Pad	<u>1.94</u> ft. _____ cm.	
Top of Protective Casing to Ground Level	<u>2.0</u> ft. _____ cm.	

Reviewed By \_\_\_\_\_ Date \_\_\_\_\_

Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

## BOREHOLE SUMMARY LOG

Borehole E-73 Well 37391  
 Project Name and Location M/W Installation - Offpost Project Number Task 39  
 Drilling Company Boyles Driller B. Roach Rig Number Fairing 1500  
 Drilling Method(s) Rotary

Size(s) and type(s) of bit(s) 11"  $\alpha$  auger, 5 7/8" Tricone bit  
 Borehole Diameter 11 1/2 in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to 39 ft. \_\_\_\_\_ cm.  
5 7/8 in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to 111 ft. \_\_\_\_\_ cm.

Sampling Methods Continuous core

Total Number Soil Sampling Tubes \_\_\_\_\_

Total Number Core Boxes 7

Number of Gallons Lost Drilling Fluid \_\_\_\_\_

Date/Time Started Drilling 7-9-87 0918

Date/Time Completed Drilling 7-9-87 0837

Total Borehole Depth 111 ft. \_\_\_\_\_ cm.

Depth to Bedrock 36 ft. \_\_\_\_\_ cm.

Depth to Water \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Water Level Determined By? \_\_\_\_\_

Borehole Completed as Monitoring Well? NO

Date/Time Grouting Completed 7-9-87 1030

Depth of Tremmie Pipe 100

Gallons of Grout 80 gals.

Materials Used 80 gals. water, 8 bags cement, 1 bag barite

Comments hole grouted to surface

Wellsite Geologist C. D. Benson Date 7-9-87

Checked for Grout Settlement on after pour by 11/19/87

Amount of Grout Added 0

All Measurements from Ground Level

Reviewed by Joseph L. Reed Date 11/19/87

Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

Borehole: E-73A

Well Number: 37391

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
1'					SM	Silty Sand, 30% silt, 2.5Y 6/2, light brownish grey, very loose, non plastic, moist
2'						
3'						
4'						
5'					CL	CLAY, 35% sand, fine to coarse grained, 2.5Y 7/4, pale yellow, very old, moist, calcareous low plastic
6'						
7'					SC	gradual change to SC Clayey Sand, 25% clay, fine to coarse grained, mo de 2.5Y 6/6 olive yellow, moist, calcareous
8'					CL	CLAY, 30% Sand, fine to coarse grained, 2.5Y 4/4 olive brown, very stiff, moist, calcareous low plastic
9'						
10'						

Drill Site Geologist: Steve Paine Date: 1/12/87  
 Reviewed By: Joseph L. Reed Date: 9/27/87

Borehole: E-73A

Well Number: 37391

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
11	6 10.0' - 12.0'				CL	CLAY, 30% Sand, fine to coarse grained, 2.5Y 4/4 olive brown, very stiff, moist, very calcareous, low plastic  gradual change to SC
12					SC	Clayey Sand, 20% clay, fine to coarse grained 2.5Y 4/4, olive brown, med dense, moist
13	7 12.0' - 14.0'					
14						color change from 14.0' to 15.0'
15	8 14.0' - 16.0'					10YR 3/3 dark brown
16					Sm	Silty Sand, 15% silt, fine to medium grained 2.5Y 5/4, light olive brown, med dense moist
17	9 16.0' - 18.0'					
18					SP	Poorly graded sands, 3% silt, fine to coarse grained, 2.5Y 6/4, light yellowish brown med dense, moist
19	10 18.0' - 20.0'					
20						

Drill Site Geologist: Steve Pans

Date: 6/29/87

Reviewed By: Joseph L. Reed

Date: 9/29/87

Borehole: E-73A

Well Number: 37391

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
21	11 20.0' - 22.0'	147' / 2.0'			SP	SANDS <sup>SP</sup> Poorly graded SANDS, 3% silt, fine to coarse grained, 2.5Y 5/4, light olive brown, med dense, moist
23	12 32.0' - 34.0'	110' / 2.0'				Sand grain size increase to: fine to very coarse grained including some small gravels (15%)
24						SANDS saturated 24'-25'
25	13 34.0' - 36.0'	152' / 2.0'			SC	CLAYEY SANDS, 15% clay, fine to very coarse grained, 10YR 5/4, yellowish brown, med. dense, moist
26						sharp contact with gravels below
27	14 46.0' - 48.0'	144' / 2.0'			GM GP SP	<del>Poorly graded gravel</del> Silty gravel, 15% silt, 30% sand, fine to coarse grained and small lamed gravels, 10YR 5/4, yellowish brown, med. dense, saturated
28					SP	Poorly graded sands, 10% silty, fine to very coarse grained 10YR 6/4, light yellowish brown, med dense, saturated
29	15 58.0' - 60.0'	No Recovery				No recovery after 28.0'. Suspect poorly graded sands and silty gravels flowing out of sampler while sampler was being removed from hole.
30						

Drill Site Geologist: Steve Paris

Date: 6/29/87

Reviewed By: Joseph L. Reed

Date: 9/29/87

Borehole: E-73A Well Number: 37391

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						<p>Continuous sampling method utilized to 49'.            No recovery after 28.0', suspect unconsolidated            sands and gravel flowing out of auger or            plugged auger resulted in no recovery from 28.0'-49.0'</p> <p>Estimate 4.0' of weathered bedrock from            36.0'-40.0'. Determined by increase torque            on drill rig to auger through this depth</p> <p>Estimate bedrock at 40.0' by increase in torque            from 40.0'-49.0'.</p>

Drill Site Geologist: Steve Paul Date: 7/6/87  
 Reviewed By: Joseph L. Reed Date: 9/29/87

DEPTH Feet	U	S	Structure/ Bedding		Hard- ness		Perm.			Mineralogy		Color		Testes/ Gran. Sae clst sd gr mm 01 to 100	Lith Char	Lith Class	Description/Comments CM (Scale 1" = 2 ft)
			Angle	Desc	S	H	1"	2"	Min	Habit	M	G					
																	Casing set to 39', bedrock at 36', core begins at 39'
40				fractures 2-3 ft. ± to core									2.5y N6/2 lt. brown gray			CL	CLAYSTONE
42																	
44																	
46																	oxidation boundary
48													2.5y N4/0 dk. gray				47' sand 15%
50																	48.5' sand 35%
52																	50' SS sandstone
54																	52' CL sandy, carbonaceous claystone
56																	54' sand 5%

E, Inc. BORE E.73 WELL(S)

①

②

fractures  
2-3  
ft.  
± to  
core

calc.  
wilt.  
1/2" wide 5'

cbn  
fract  
10%  
4"

muscl  
2%  
pyrite  
1%

cbn  
20%  
cbn  
5%

muscl  
1%

oxidation boundary

sandy, carbonaceous claystone

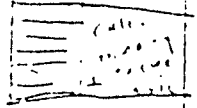
sandy, carbonaceous  
claystone

sandy claystone

BOX NO.	DEPTH FEET	Struct. / Bedding		Hard- ness	Perm.		Mineralogy		Color	Texture / Grain Size	Lith. Char.	Lith. Class.	Description / Comments
		Angle	Desc.		1°	2°	Min	Habi					
	60	U	S					cln 2%	2.5y		Sand 10%	CL	CLAYSTONE
	61							↓	NS/0		545 Silt 15%	SS	silty sandstone
	62							max 1%	gray				
	63												coarse sandstone
	64												
	65												
	66												
	67												
	68												
	69												
	70							cln 5%	2.0				medium sandstone
	71							max 2% (1% grain 1/4")	↓				
	72												
	73												
	74												
	75												
	76							cln	2.5y				finely bedded sandstone med calc (1% max) best very regular (consistent)
	77							cln	NS/0				

E, Inc. BORE E-73 WELL(S)

Massive  
↓



finely bedded sandstone  
med calc (1% max)  
best very regular (consistent)  
COARSE SANDSTONE

DEPTH Feet	Inch	Structure/Bedding		Hardness		Perm		Mineralogy		Color		Lith Char	Lith. Class	Description/Comments
		Angle	Desc.	S	H	L	H	Min	Habit	M	G			
80	5							cbn 5%	frag	2.5g	NS/0		SS	SANDSTONE med to coarse sandstone
	5							cbn 25%				80.5	CL	carbonaceous claystone
82								calc. v. alk.				81	CL	
								cbn 5-10%	small 2%			82	SS	SANDSTONE fine sandstone, occas. slightly silty
84	5		Fine bedding, occas. X bedding											
86	5							cbn. frag 5%					CL	CLAYSTONE sandy claystone
88	5													
90	5													
92								cbn frag 3%					SS	SANDSTONE coarse sandstone, more friable/less indurated/more heavily cemented than previous sandstones
94	4.2													
96	5													

E, Inc. BORE E-73 WELL(S)

vs. cbn. here. 2 v. 10.2

silty sandstone

PROX DEPTH	Roc Int	U S	Structure/ Bedding		Hard- ness		Perm.		Mineralogy		Color	Texture/ Gran Size clst ad gr mm 01 10 100	Lith Char	Lith Class	Description/Comments
			Angle	Desc	S	H	L	H	Min	Habit					
98									cbn 95%	2.5y NS/0 gray			78	ST	SILTSTONE carbonaceous
100	5/4.2								cbn 2%	2.5y NS/0 gray			99		
102													102	CL	CLAYSTONE
104	5/5								cbn 30%	2.5y NS/0 gray			104	SS	SANDSTONE
106									cbn frag 20%	2.5y NS/0 gray			106.5	CL	CLAYSTONE
108	4.2/5								cbn 10%	2.5y NS/0 gray					
110															
111															Total Depth 111'

ESE, Inc. BORE E-73 WELL(S)



Frontier Logging  
Lakewood, Colorado

Date **JULY 9, 1987**

Company	ESE		Driller	111 FT	Meters
Site No.	E-73		Depth	3 7/8"	ft
Address	RMA		Time	0900	Time Out
County	ADAMS COUNTY	State	water	Unit No.	110
Township		Elevation		Operator	Wm. Linton
Log Measured From	Ground Level	Log Measured From	Ground Level	Location	Lakewood

EQUIPMENT DATA		NATURAL GAMMA READINGS (ANALOG)		NATURAL GAMMA READINGS (ANALOG)	
TC	Scale	TC	Scale	TC	Scale
110 FT					
200 Scale = 20 CPS per inch					
2					
103-1041	1 5/8"				
xtel 3/4 x 1"					
1.60 x 10 <sup>-5</sup>	7				
1.10	3 7/8"				

Probe No.	103-1041	Probe Diameter	1 5/8"
Probe Type	xtel 3/4 x 1"	Density Source No.	
Count Rate	1.60 x 10 <sup>-5</sup>	Type	
Count Factor	1.10	Caliper	
Resistance	40 ohms / 5"	Temperature	
S.P.	20 MV / Inch	Directional Data	
		Closure	
		Azimuth	
		True Vertical	
		Survey Depth	

NATURAL GAMMA  
S.P. 20 CPS  
RESISTANCE 40 OHMS / 5 INCHES

S.P. 20 MV  
NATURAL GAMMA  
RESISTANCE 40 OHMS / 5 INCHES

NATURAL GAMMA

20 cps

Initial Log

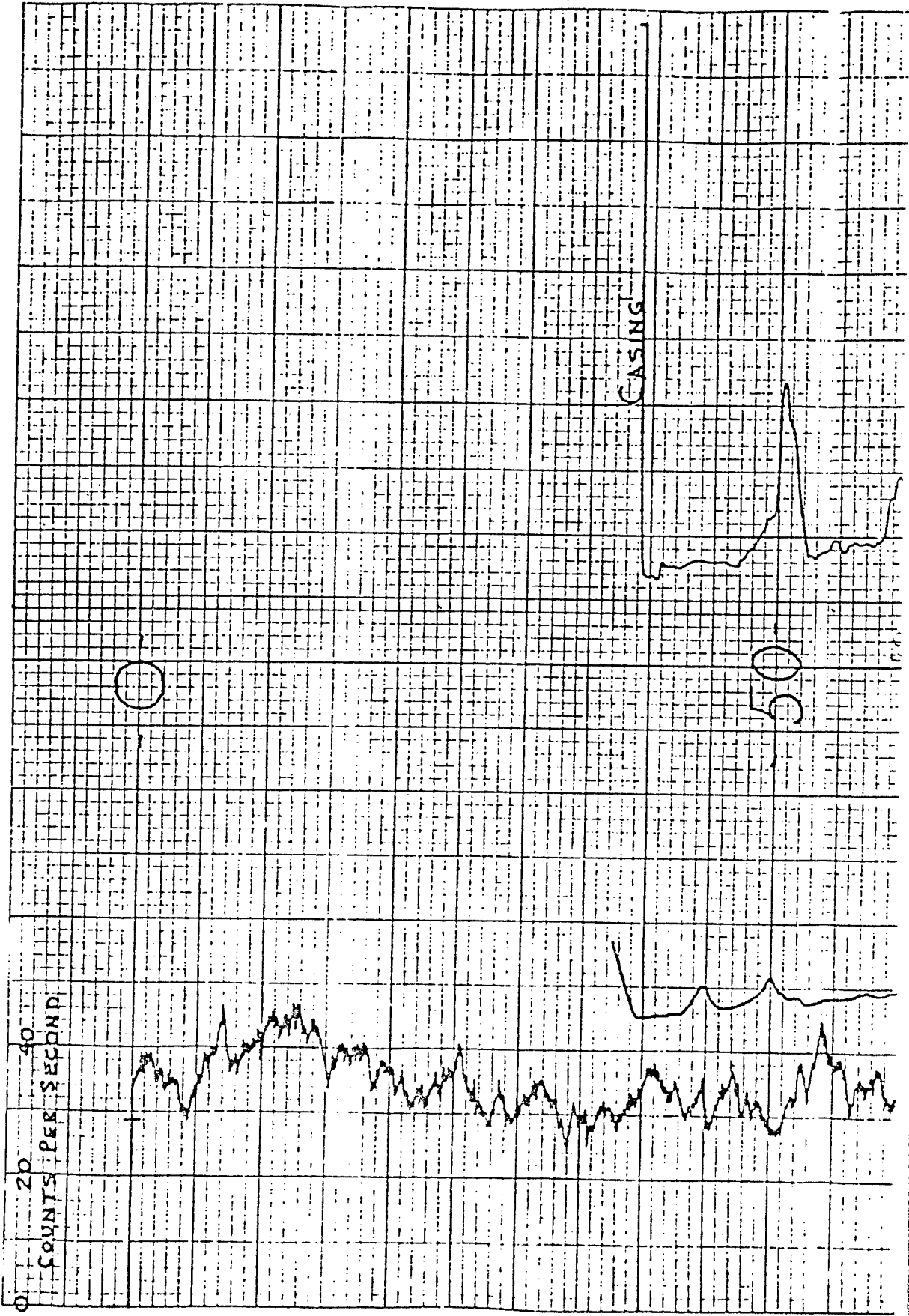
S.P.

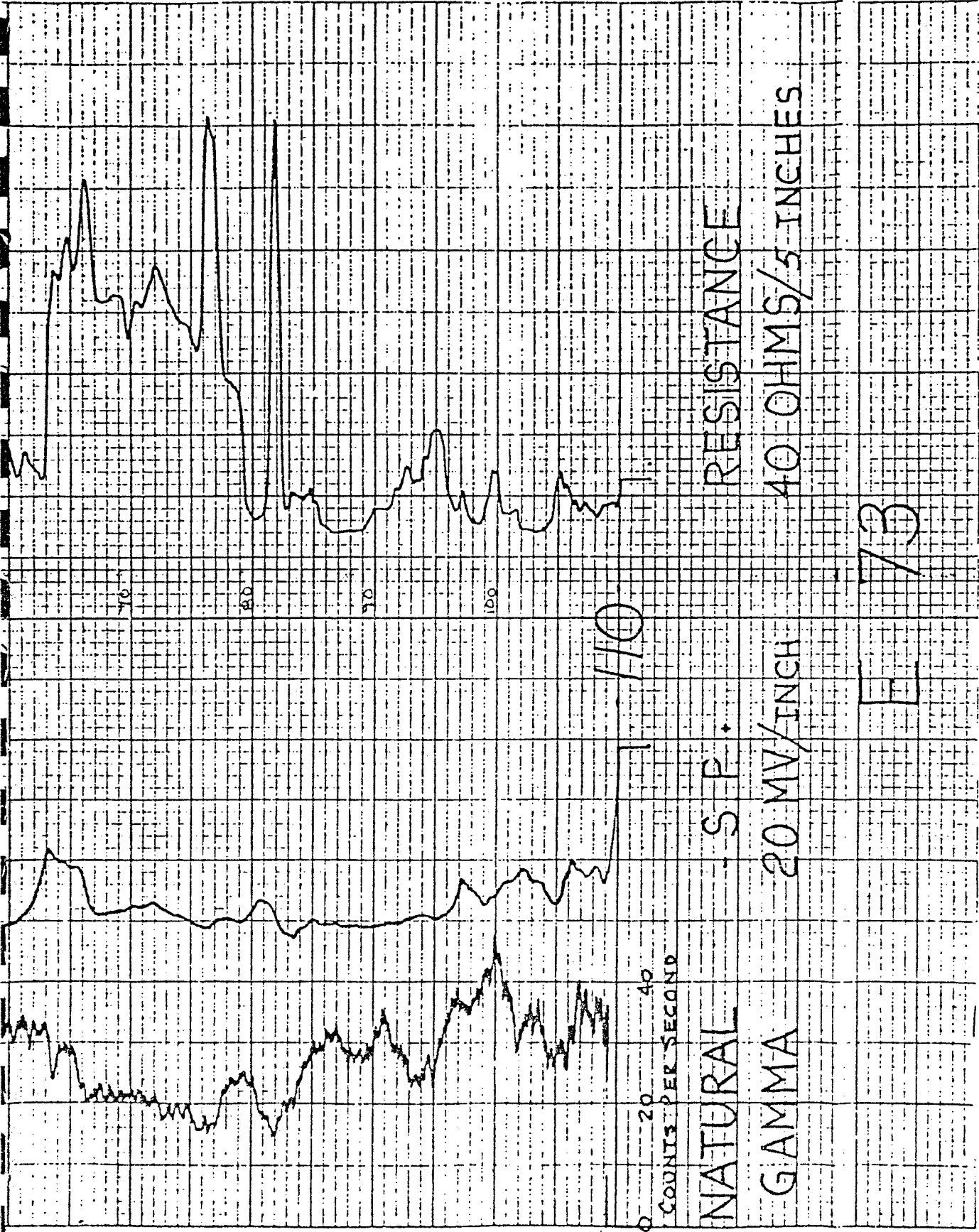
20 MV

RESISTANCE

40

OHMS/ 5 INCHES





WELL CONSTRUCTION SUMMARY

Borehole E-74A Well 37392  
 Project Name and Location \_\_\_\_\_ Project Number TASK 39  
 Drilling Company Boyle Bros Driller Don Tryine Rig Number IR  
 Drilling Method(s) Auger Hollow stem auger 3/4" ID 7/4" OD continuous  
Sample, reamed with 8 1/2" ID 12 3/4" OD Hollow Stem Auger  
 Borehole Diameter 12 1/4 in. \_\_\_\_\_ cm. 0.0 ft. \_\_\_\_\_ cm. to 30.2 ft. \_\_\_\_\_ cm.  
 \_\_\_\_\_ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) Hollow stem Auger 12 1/4 Sampling Method(s) continuous, split spoon  
 Date/Time Start Drilling 7/2/87 1048  
 Size and Type PVC 4" sch. 40 0.20' slot Date/Time Finish Drilling 7/6/87 1556  
 Total Borehole Depth 30.2 ft. \_\_\_\_\_ cm. Date/Time Start Completion 7/7/87 0910  
 Depth to Bedrock 28.1 ft. \_\_\_\_\_ cm. Date/Time Cement Protective Casing 7/7/87 0927  
 Depth to Water 18.5 ft. \_\_\_\_\_ cm. Materials Used \_\_\_\_\_  
 Water Level Determined By sample Plain PVC 1-10' section, 1-6' section  
 Length Plain PVC (total) 15.8 ft. \_\_\_\_\_ cm. Slotted PVC 1-10' section, 1-5' section  
 Length of Screen 16.22 ft. \_\_\_\_\_ cm. Bentonite Pellets 4 1/2 buckets  
 Total Length of Well Casing 31.13 ft. \_\_\_\_\_ cm. Bentonite Granular 3/8 bag  
 PVC Stick Up 1.70 ft. \_\_\_\_\_ cm. Cement 3 bags  
 Depth to Bottom of Screen 29.43 ft. \_\_\_\_\_ cm. Sand 11 1/2 bags  
 Depth to Top of Screen 13.21 ft. \_\_\_\_\_ cm. Water added during completion none  
 Depth to Top of Sand 8.5 ft. \_\_\_\_\_ cm. Water added during drilling none  
 Depth to Top of Bentonite 3.50 ft. \_\_\_\_\_ cm. Total Gallons of water added \_\_\_\_\_

Drill Site Geologist Steve Paul Date 7/9/87

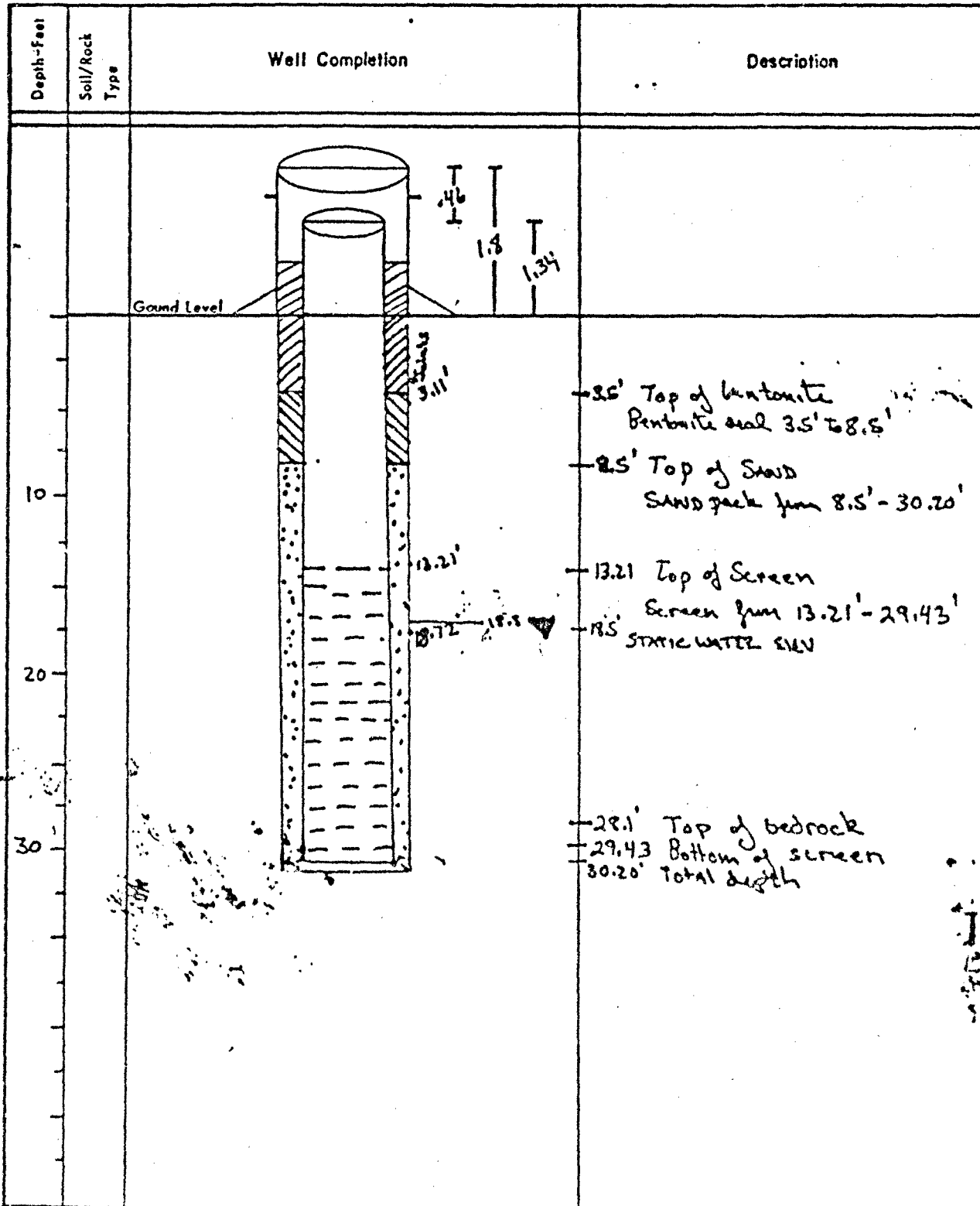
Date/Time/Personnel Internal Mortar Cement Pad and Weep Hole Installed 07/13/87 / 1000 / am  
 Date/Time/Personnel Casing Painted (white) 07/13/87 / 1030 / am  
 Date/Time/Personnel Numbers Painted 7/13/87 JRT/IR  
 Materials Used 9 bags Sakrete

Top of Protective Casing to Top of PVC	<u>.46</u> ft. _____ cm.	COMMENT/NOTES
Top of Protective Casing to Weep Hole	<u>1.2</u> ft. _____ cm.	_____
Top of Protective Casing to Internal Mortar	<u>1.2</u> ft. _____ cm.	_____
Top of Protective Casing to Top of Cement Pad	<u>1.6</u> ft. _____ cm.	_____
Top of Protective Casing to Ground Level	<u>1.80</u> ft. _____ cm.	_____

Reviewed By \_\_\_\_\_ Date \_\_\_\_\_  
 Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

Borehole: E-74A

Well: 37392



Drill Site Geologist: James P. [Signature]  
 Reviewed By: Joseph [Signature]

Date: 7/19/87  
 Date: 11/18/87

Borehole: E-74A

Well Number: 37392

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
1	1 0.0' - 2.0'	100%			SM	Silty SAND, 35% silt, fine to coarse grained sand, 10 YR 4/4, Dark yellowish brown, medium dense, moist, non plastic
2					CL	Clay, 20% SAND, fine to coarse sand, 10 YR 5/4, yellowish brown, stiff, moist, medium plastic, calcareous.  Sand increases to 35%, fine to coarse grained
3	2 2.0' - 4.0'					
4						
5	3 4.0' - 6.0'					
6						
7	4 6.0' - 7.0'				SM	Silty SAND, 15% silt, fine to coarse grained sand, 10 YR 6/4, light yellowish brown, med. dense, moist, non-plastic
8						
9	5 8.0' - 10.0'				SC	Clayey SAND, 20% clay, fine to very coarse grained SAND, 10 YR 5/6, yellowish brown medium dense, moist, plastic.
10						
6	6 10.0' - 12.0'				SM	Silty s.m., 15% silt, fine to coarse grained sand (from 10.5' to 10.7')

Drill Site Geologist: Steve Park  
 Reviewed By: Joseph L. Reed

Date: 7/9/87  
 Date: 9/29/87 215

Borehole: E-74A Well Number: 37392

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
11-6	10.0' - 12.0'	1.8' / 2.0'			SM	2.5Y 6/6, Olive yellow, medium dense, moist, non plastic
12					CL	CLAY, 30% SAND, fine to coarse grained sand, 2.5Y 5/4 - light olive brown, stiff, moist, medium plastic
13-7	12.0' - 14.0'	1.8' / 2.0'			SC	SANDY CLAY, 30% CLAY, 10YR 5/3, brown, medium dense, moist, brown, low plastic (fine to coarse grained sand)
14						
15-8	14.0' - 16.0'	100% 2.0' / 2.0'			SP	Poorly graded sands, fine to coarse grained sands, 5% small gravel, 2.5Y 6/4, light yellowish brown, loose, moist, non plastic
16						
17-9	16.0' - 18.0'	2.0' / 2.0'			GP	Poorly graded gravel, fine to medium, 10YR 6/4, light yellowish brown, loose, moist, non plastic
18					SP	Poorly graded sands, fine to very coarse grained, 10YR 7/2 light grey, loose, moist, non plastic
19-10	18.0' - 20.0'	2.0' / 2.0'				SANDS saturated at 19.0'
20	20.0' - 22.0'					

Drill Site Geologist: Steve Parsi Date: 7/19/87  
 Reviewed By: Joseph L. Reed Date: 7/29/87

Borehole: E-74A

Well Number: 37392

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
21	11 20.0' - 21.0'	0.0' / 2.0'			SP	Poorly graded sands, fine to very coarse grains 10YR 7/2, light grey, loose, <sup>saturated</sup> <del>loose</del> non plastic No recovery from 20.0' - 22.0' cuttings indicated poorly graded sands (SP)
22						
23	12 22.0' - 24.0'	3' / 2.0'			SP	No Recovery from <sup>24.0'</sup> 23.0' - 27.0' Auger cuttings indicate poorly graded sands (SP) with possible silty sand lenses (SM)
24						Poorly graded sands (SP) from 22.0' - 24.0', fine to medium grained 10YR 7/2, light grey, loose, saturated, non plastic.
25						
26						
27						
28	14 27.0' - 29.0'	100% 2.0' / 2.0'			SP	Poorly graded sands, fine to very coarse grained, 10% gravel, 10YR 7/2, light grey, loose, saturated, non-plastic
29						CLAYSTONE BEDROCK, Olive, Fe stains
						TD 29.0'

Drill Site Geologist: H. Jones  
 Reviewed By: Joseph Reed

Date: 7/13/87  
 Date: 9/29/87

## BOREHOLE SUMMARY LOG

Borehole E-74 Well 37392

Project Name and Location MW Installation - N of RMA Project Number Task 39

Drilling Company Boyles Driller B. Roach Rig Number Failing 1500

Drilling Method(s) Rotary

Size(s) and type(s) of bit(s) 7 7/8" , 3 3/4" bit

Borehole Diameter 7 7/8 in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to 36 ft. \_\_\_\_\_ cm.  
3 3/4 in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to 111 ft. \_\_\_\_\_ cm.

Sampling Methods Continuous core

Total Number Soil Sampling Tubes \_\_\_\_\_

Total Number Core Boxes \_\_\_\_\_

Number of Gallons Lost Drilling Fluid \_\_\_\_\_

Date/Time Started Drilling 7.2.87 0943

Date/Time Completed Drilling 7.7.87 0830

Total Borehole Depth 111 ft. \_\_\_\_\_ cm.

Depth to Bedrock 35 ft. \_\_\_\_\_ cm.

Depth to Water \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Water Level Determined By? \_\_\_\_\_

Borehole Completed as Monitoring Well? NO

Date/Time Grouting Completed 1410 7.7.87

Depth of Tremmie Pipe 110 ft. \_\_\_\_\_ cm.

Gallons of Grout 80 bags - 608

Materials Used 80 gals. water, 8 bags cement, 3/4 bag bentonite

Comments hole grouted to surface

Wellsite Geologist C D Benson Date 7.8.87

Checked for Grout Settlement on 11/18/87 by Steve

Amount of Grout Added none

All Measurements from Ground Level

Reviewed by Joseph L. Reed Date 11/17/87

Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

BOX No.	DEPTH	Rec Int.	Weather		Structure/Bedding		Hardness		Perm.		Mineralogy		Color	Texture/Grain Size	Lith. Char.	Lith. Class	Description/Comments
			U	S	Angle	Desc.	S	H/L	1°	2°	Min	Habit					
																	Bedrock at 35', casing set to 36', coring starts at 36'
	36																CLAYSTONE
	38	1.3 4				massive							2.54 N 3/4 very dark gray				End of predominant carbon
	40																40' claystone becomes very soft; incompetent to 42.5'
	42	3 3															
	44	4 4															Sandy claystone
	46																
	48	4.2 4.5															sandy, silty claystone
	50																carbonaceous claystone
	52	3.2 5															

ESE, Inc. BORE E-74 WELL(S)

massive

irregularly fine to 50'

carbon to 30% matrix

matrix 2%

carb frags 10%

matrix 3%

carbon to 35% matrix

carbonaceous

42.5 SANDY sand 25%

76.5 sand 5% silt 10%

49'

CLAYSTONE

Sandy claystone

sandy, silty claystone

carbonaceous claystone

End of predominant carbon

40' claystone becomes very soft; incompetent to 42.5'

BOX NO.	DEPTH FEET	CORRECTION INCH	Structure/ Bedding		Hard- ness	Perm.		Mineralogy		Color	Texture/ Grain Size clst ad gr mm .01 to 100	Lith. Char.	Lith. Class	Description/Comments
			Angle	Desc.		1°	2°	Min.	Habit					
	56			Massive				cbn 10%	frag. massive	2.5y 4/10 very dark gray		carbonaceous CL	CL	CLAYSTONE
	58	1.3												
	60													
	62	2.1								5y 5/1 gray		61"	CL	End of pervasive carbon Core recovery from uphole
	64	5												
	66	5						cbn 5%		5y 4/10 dark gray				
	68	5						Sand 70 15%		5y 6/10 gray		68" Sand zone/ areas discrete in claystone		
	70							cbn 10%						
	72	4.1						cbn 5%	frag.			71" silt 20%	SS	SANDSTONE - SILTY
	74	5												

SE, Inc. BORE E-74 WELL(S)

BOX NO.	DEPTH	Rec. Int.	Well(s)	Structure/Bedding		Hardness		Perm.		Mineralogy		Color		Texture/Grain Size	Lith. Char.	Lith. Class	Description/Comments	
				Angle	Desc.	S	H	1°	2°	Min.	Habit	M	G					mm
	70											5y			silt 5%	SS	Silty sandstone claystone interbed	
												6/1 gray			75% <sup>2</sup>	CL		
															silt 15%	SS		
	84															63'	CL	CLAYSTONE
	85															85'		sandy interbed
	88															88'		silty interbed
	92																	

ESE, Inc. BORE E-74 WELL(S)

No slide

2 2/3  
Mudstone  
(grains to 1/4")

DEPTH Feet	Recon. Int.	Weather		Structure/ Bedding		Hard- ness		Perm.		Mineralogy		Color M G	Texture/ Grain Size clst ad gr mm .01 10 100	Lith. Char.	Lith. Class	Description/Comments Ft CM (Scale 1" = 2 ft)
		U	S	Angle	Desc.	S	H	HL	H	Min.	Habit					
74												5y 6/1 gray			CL	CLAYSTONE
76																} silty interbed
80																
85																
90																
95																
100															SS	SANDSTONE
102																
104																
106																
106.5															CL	CLAYSTONE
108																
110																
111																
															Total Depth 111'	

Massive  
↓

X-bedding  
clay along  
bedding

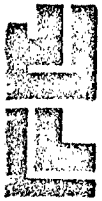
Massive  
↓

carbonaceous  
clay  
frag  
1%  
carbonaceous  
clay  
frag  
5%

pyritic  
1%  
medium  
pyritic

coarser and more frequent  
texture to 104'

Total Depth  
111'



Frontier Logging  
Lakewood, Colorado

Date JULY 7, 1987

Property	ESE		Driller	111 FT		Meters	Sunday	
Well No.	E-74		Drill Bit	3 7/8"		Time In	1145	
Well Name	BMA		Fluid	36 FT water		Time Out	1255	
County	ADAMS COUNTY		Density/Viscosity	water		Unit No.	110	
State	COLORADO		Operator	W. Hinton		Location	Lakeswood	
Log Measured From	Ground Level		Log Measured From	Ground Level				

D Logged	Scale		Scale		Scale		Scale	
	TC	CP/CM	TC	CP/CM	TC	CP/CM	TC	CP/CM
Natural Gamma	104 FT							
200 Scale	20 CPS per inch							
Log Constant	15							
Log Source Measured								

EQUIPMENT DATA		NATURAL GAMMA REFORMS (ANALOG)		DIRECTIONAL DATA	
Scale	TC	CP/CM	TC	CP/CM	Survey Depth
103-1041	1 5/8"				
XTal	3/4 x 1"				
1.60 x 10 <sup>-5</sup>	7				
110	3 7/8"				
25 dms/5"					
20 MU/Inch					

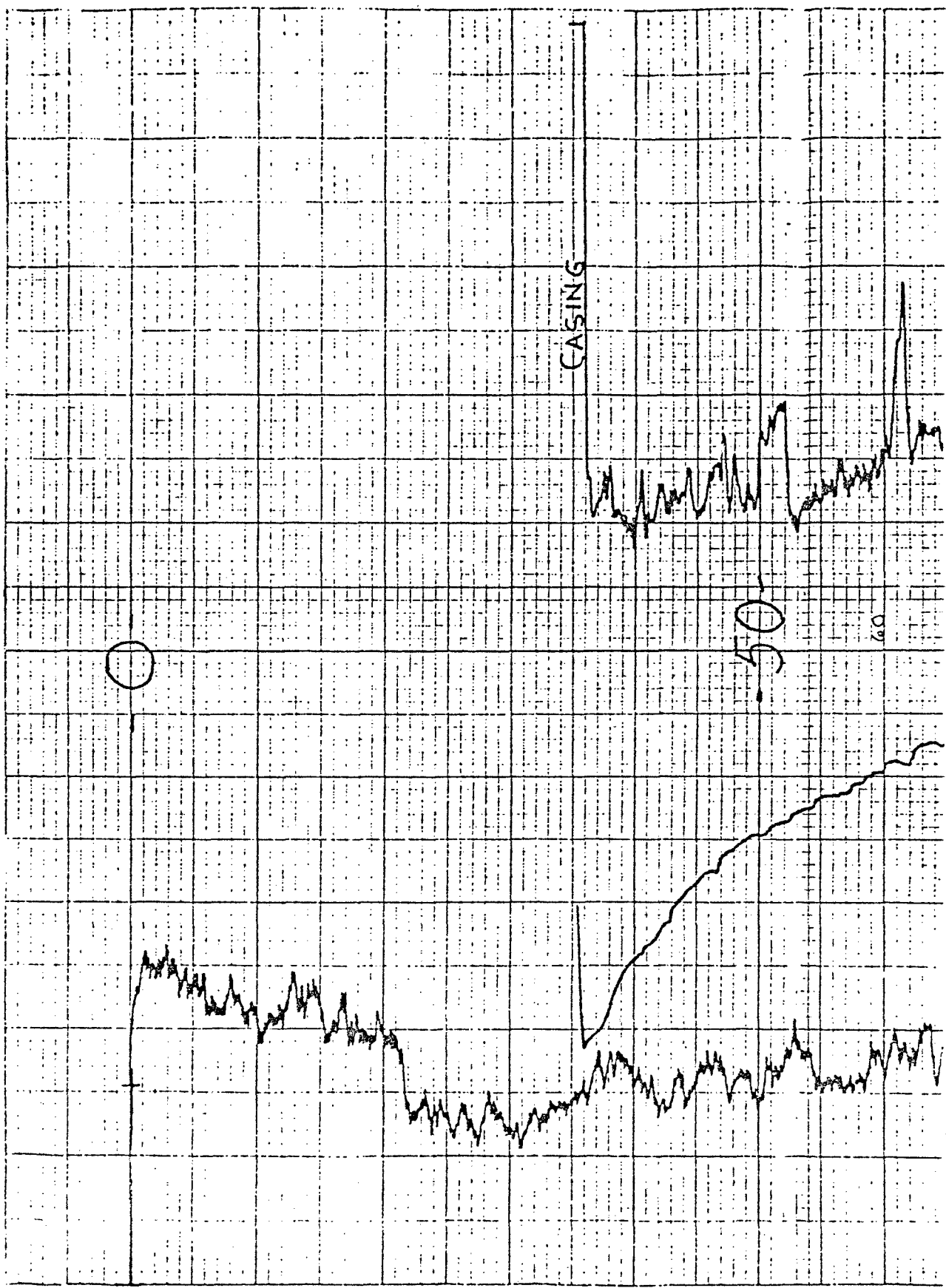
NATURAL GAMMA  
Initial Log

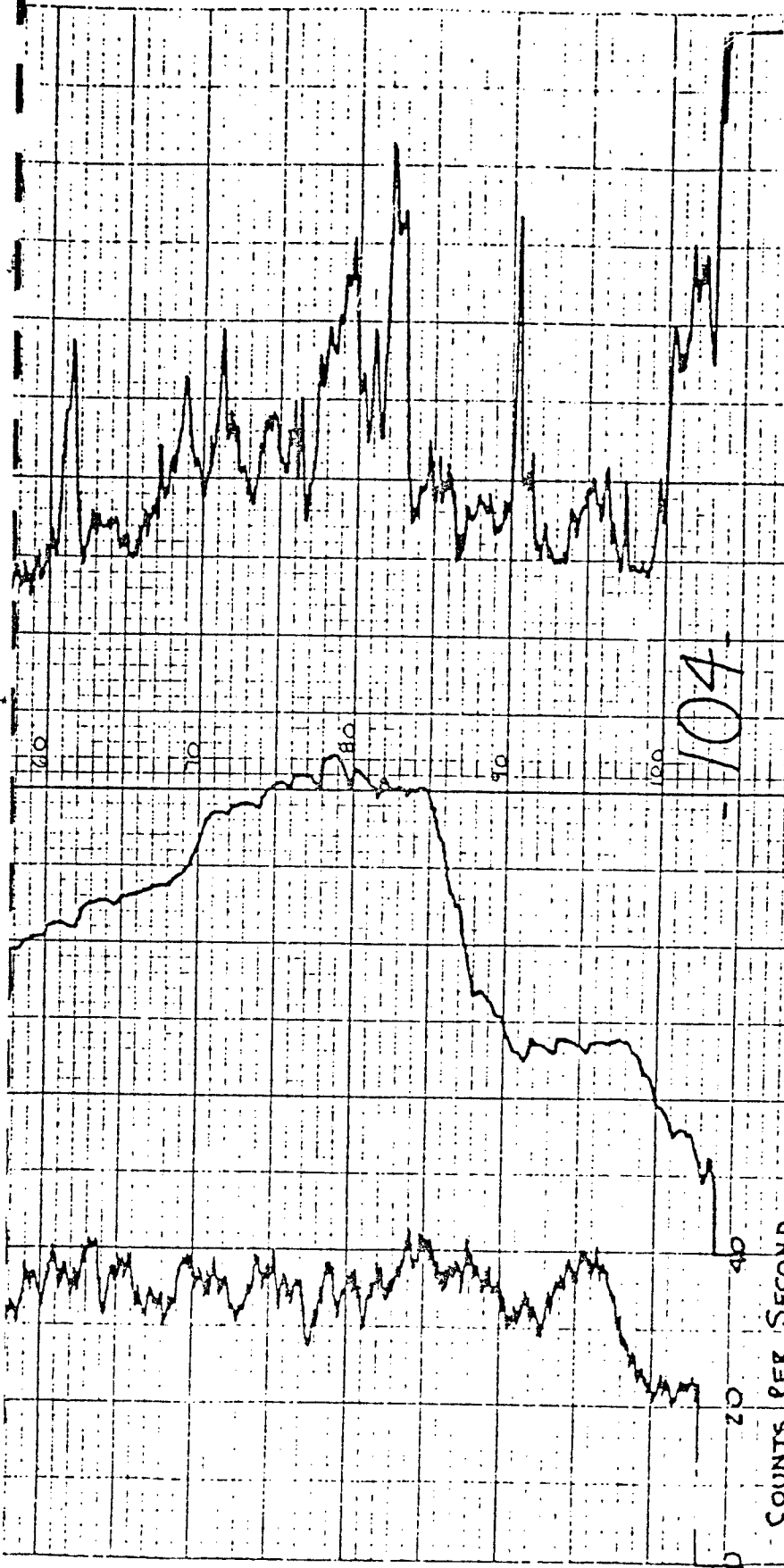
S.P. 20 CPS

20 MU

RESISTANCE 25 OHMS/5 inches

NATURAL GAMMA  
 20 cps  
 S.P.  
 20 MV  
 RESISTANCE  
 25  
 OHMS 5 inches





NATURAL  
GAMMA

COUNTS PER SECOND

S.P. +  
20 MV/INCH

RESISTANCE  
25 OHMS/5 INCHES

104

F 7/4

BOREHOLE SUMMARY LOG

JR  
Borehole E-75A Well Dry Hole  
Project Name and Location T-36 Yumbe East Hwy 2, on 104<sup>th</sup> St Project Number 0053074.10  
Drilling Company Boyer Bros Driller DAVE JACOB Rig Number 6452  
Drilling Method(s) Auger

Size(s) and type(s) of bit(s) \_\_\_\_\_  
Borehole Diameter 7 1/4 in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to 98' ft. \_\_\_\_\_ cm.  
\_\_\_\_\_ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Sampling Methods Continuous Salt Spoon

Total Number Soil Sampling Tubes 24

Total Number Core Boxes 5

Number of Gallons Lost Drilling Fluid 0

Date/Time Started Drilling 4/1/87 0830

Date/Time Completed Drilling 4/1/87 1018

Total Borehole Depth 98' ft. \_\_\_\_\_ cm.

Depth to Bedrock 46' ft. \_\_\_\_\_ cm.

Depth to Water Dry ft. \_\_\_\_\_ cm.

Water Level Determined By? Samples

Borehole Completed as Monitoring Well? NO

Date/Time Grouting Completed 4-1-87 12:30

Depth of Tremmie Pipe In Auger

Gallons of Grout ~135

Materials Used 9 BAGS CEMENT 1 BAG OF PORTLAND

Comments During auger removal the auger caught up and was associated with the soil. Through sample analysis and <sup>SALT</sup> the hole was determined dry. No well will be installed despite the heavy auger

Wellsite Geologist: Greg LA Date 4/1/87

Checked for Grout Settlement on 4/7/87 by JLR

Amount of Grout Added 0.0

All Measurements from Ground Level

Reviewed by Joseph L. Reed Date 6/7/87

Drill Site Geologist \_\_\_\_\_ Date \_\_\_\_\_

Borehole: E-75A Well Number: Dry Hole

B.T. = 13.0'  
 PRC - 7/15/87

**SOILS LOG**  
 Description

MUNSELL COLORS

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	Description
0.0			NA		ML	
1.0	0-2'	2'		0-2'		At 1.8', sandy-silt, ~ 10% v. f. gr. sand, 10YR, 4/2-3, dk. br., non-plas., loose, moist, alluvium.
2.0	2-4'	2'		2-4'		At 6.8', sandy-silt, ~ 10% v. f. gr. sand, 10YR to color change to 10YR, 7/3-4, v. pale br., non-plas., med. dense, dry, alluvium.
3.0						
4.0	4-6'	2'		4-6'		
5.0						
6.0	6-8'	2'		6-8'		At 6.0' sandy-silt, ~ 30-40% v. f. gr. sand, 10YR, 5/4-6, ywsh br., non-plas., loose, moist, alluvium.
7.0						
8.0	8-10'	2'		8-10'		
9.0						
10.0	10-12'	2'		10-12'		At 9.5', clayey-silt, ~ 20% clay, 10-15% v. f. gr. sand, 10YR, 5/3-4, br., slightly plas., moist, moist, alluvium.
11.0						

Drill Site Geologist: A.E. Dittler Date: 7/8/87  
 Reviewed By: Joseph L. Reed Date: 8/16/87

Borehole: E-75A

Well Number: Dry Hole

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
11.0	10-12'	2'	NA	10-12'	ML	MONTELL COLORS
12.0	12-14'	2'		12-14'	CL	
13.0	14-16'	2'		14-16'	ML	CL sandy-clay, 10-20% v.f. gr sand, 10% R, 6/2-3, light. brnch. grey, low plus., med. stiff, moist, alluvium. Bedrock PRC
14.0	16-18'	2'		16-18'	ML	At 15.0' silty-clay, 10-20% silt, 5-10% v.f. gr sand, 10% R, 6/1-2, grey, med. plus., med. stiff, moist, alluvium. Bedrock PRC
15.0	18-20'	2'		18-20'	ML	
16.0	20-22'	2'		20-22'	ML	ML sandy-siltst, 10-20% v.f. gr sand, 10% R, 5/6-8, grey. br., no plus., moist, med dark, alluvium. Bedrock PRC
17.0						
18.0						
19.0						
20.0						
21.0						
22.0						

Drill Site Geologist: Lee Estelle

Date: 4/9/87

Reviewed By: Joseph L. Reed

Date: 4/16/87

Borehole: E-75A

Well Number: Dry Hole

SOILS LOG					
Description					
Munsell Colors					
Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification
22.0			NA		ML
23.0	22-24'	2'		22-24'	
24.0					
25.0	24-26'	2'		24-26'	SM
26.0					
27.0	26-28'	2'		26-28'	
28.0					
29.0	28-30'	1.4"		28-30'	
30.0					
31.0	30-32'	2'		30-32'	
32.0					
33.0	32-34'	2'		32-34'	

At 31.0', silty-sand, ~ 10-15% silt, 2.5 Y, 5/4, light olive br., non-plas., med. dense, moist, alluvium.  
 Bedrock PRC

Geologist: A.E. Entell Date: 4/3/87  
 Reviewed By: Joseph L. Reed Date: 4/16/87

Borehole: E-75A

Well Number: Dry Hole

SOILS LOG					
Description					
Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification
<i>MUNSEL COALS</i>					
33.0	32-34'	2'	NA	32-34'	SM
34.0					
35.0	34-36'	2'		34-36'	
36.0					
37.0	36-38'	2'		36-38'	
38.0					
39.0	38-40'	2'		38-40'	ML <i>ML sandy-siltst., ~10-20% v. f. gr. sand, 2.5Y, 5/2, gray. br., non-plas, dense, moist, alluvium</i> Peaback PRL
40.0					
41.0	40'-4 1/2'	1.3'		40'-4 1/2'	At 400' sandy-siltst., ~10-20% v. f. gr. sand, 2.5Y, 6/1 light gray. br., non-plas., med. dense, slightly moist, alluvium Peaback PRL
42.0					
43.0	4 1/2-4 1/4'	2'		4 1/2-4 1/4'	SM <i>SM silty-sandst., ~20% silt, 2.5Y, 5/4-6, light olive br., non-plas., med. dense, slightly moist, alluvium</i> Peaback PRL
44.0					

Drill Site Geologist: L.S. [Signature]

Date: 4/8/87

Reviewed By: Joseph L. Reed

Date: 4/16/87

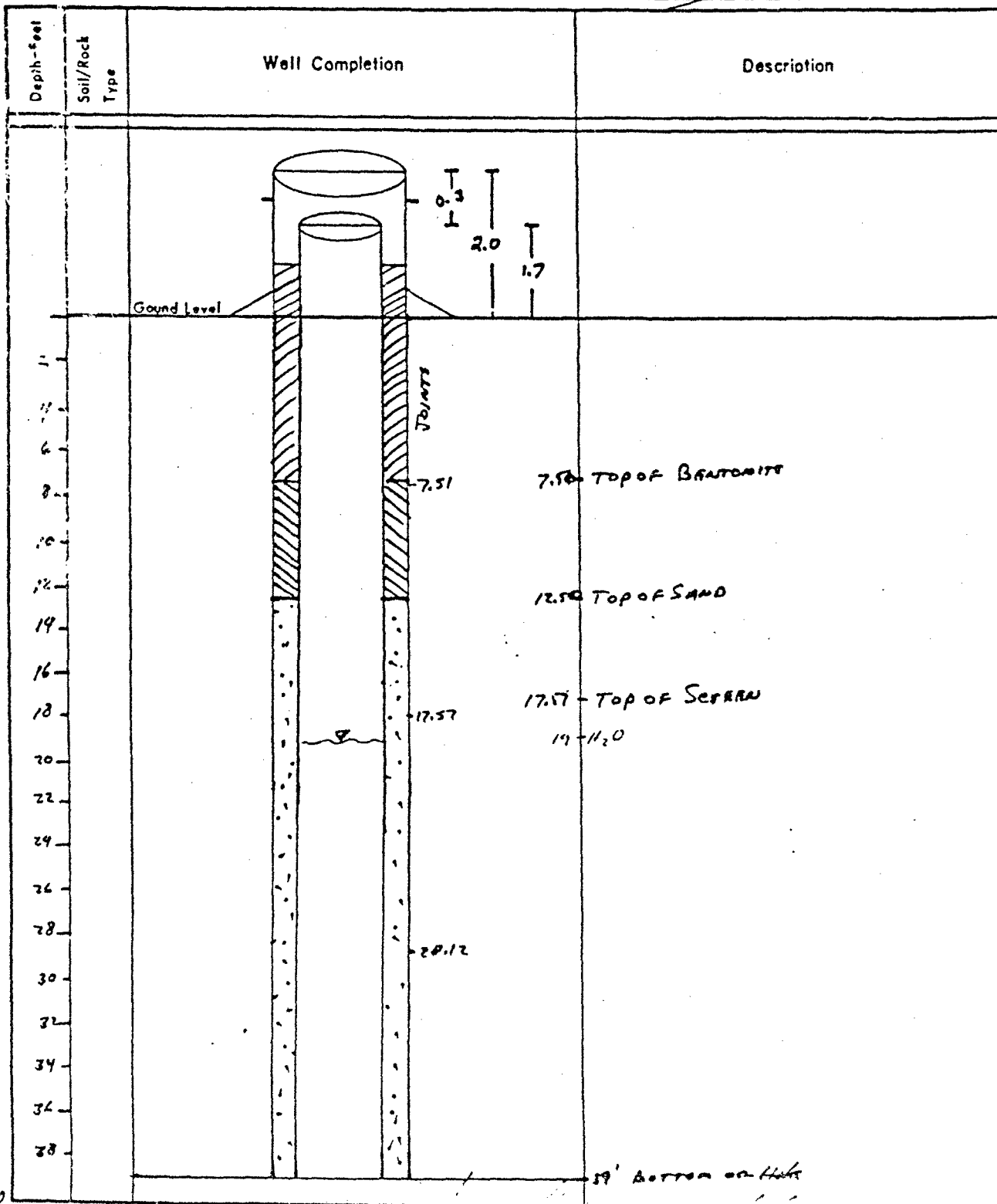
Borehole: E-75A Well Number: Dry Hole

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
44.0			NA		SM	Munsell Colors
45.0	977-977	2'		977-977		
45.5					CL	CL silty-clayst., 5-10% silt, 2.54, 4/1, dk gray brownish plus, stiff, slightly moist, bedrock.
46.0						
47.0	127-977	1.5'		187-977		
48.0						END of BORING LOG
49.0						AEO
50.0						
51.0						
52.0						
53.0						
54.0						
55.0						

Drill Site Geologist: A.E. Dittler Date: 4/8/87  
 Reviewed By: Joseph L. Reed Date: 4/16/87

Borehole: E-76A

Well: JR  
E76A 37383



Drill Site Geologist: [Signature]  
 Reviewed By: Joseph K. Reid

Date: 6/12/87  
 Date: 4/20/87

WELL CONSTRUCTION SUMMARY

Borehole E-76A Well JR E76A 37383  
 Project Name and Location Task 26 1/2 mile E of Hwy 2 on 104th Project Number 17053072.10  
 Drilling Company Boylis Bros Driller Dave Jarvis Rig Number 5952  
 Drilling Method(s) HUGER

Borehole Diameter 12 1/4 in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to 39 ft. \_\_\_\_\_ cm.  
 \_\_\_\_\_ in. \_\_\_\_\_ cm. \_\_\_\_\_ ft. \_\_\_\_\_ cm. to \_\_\_\_\_ ft. \_\_\_\_\_ cm.

Size(s) and types of Bit(s) \_\_\_\_\_

Sampling Method(s) CONTINUOUS Split spoon

Size and Type PVC 4"

Date/Time Start Drilling 4/2/87 10/56

Total Borehole Depth 37 ft. \_\_\_\_\_ cm.

Date/Time Finish Drilling 4/3/87 1030 INCLUDES

Depth to Bedrock ~38 ft. \_\_\_\_\_ cm.

Date/Time Start Completion 4/2/87 1030

Depth to Water 19 ft. \_\_\_\_\_ cm.

Date/Time Cement Protective Casing 4/2/87 1200

Water Level Determined By SAMPLES

Materials Used 21-2' TUBES

Length Plain PVC (total) 19.37 ft. \_\_\_\_\_ cm.

Plain PVC 2-10' SECTIONS

Length of Screen 31.43 ft. \_\_\_\_\_ cm.

Slotted PVC 2-10' SECTIONS

Total Length of Well Casing 40.7 ft. \_\_\_\_\_ cm.

Bentonite Pellets 5 BUCKETS

PVC Stick Up 1.7 ft. \_\_\_\_\_ cm.

Bentonite Granular \_\_\_\_\_

Depth to Bottom of Screen 59.0 ft. \_\_\_\_\_ cm.

Cement 3 BAGS

Depth to Top of Screen 17.57 ft. \_\_\_\_\_ cm.

Sand 16 BAGS

Depth to Top of Sand 12.5 ft. \_\_\_\_\_ cm.

Water added during completion 25

Depth to Top of Bentonite 7.5 ft. \_\_\_\_\_ cm.

Water added during drilling 5

Total Gallons of water added 30

Drill Site Geologist Greg Linton

Date 4/3/87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 4-9-87/900/12 P. H. W. M. A. S. T. L. T.

Date/Time/Personnel Casing Painted 1A 4/13/87 1100 PSR

Date/Time/Personnel Numbers Painted 4/17/87 1040 PJB

Materials Used 12 bags Quikrete 1/2 bag silica sand 1/4 bag portland cement

Top of Protective Casing to Top of PVC 0.3 ft. \_\_\_\_\_ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 0.9 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Internal Mortar 0.55 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Top of Cement Pad 0.53 ft. \_\_\_\_\_ cm.

Top of Protective Casing to Ground Level 2.0 ft. \_\_\_\_\_ cm.

Reviewed By Joseph L. Reed Date 4/20/87

Drill Site Geologist Greg Linton Date 6/10/87 226

Borehole: E-76A Well Number: 37383 5121.05

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						<u>MUSSELL COLORS</u>
0.0			NA		ML	<u>ML</u> sandy-silt, ~ 2.0% v.f. gr. sand, 10 YR, 4/3-4, dk br., non-pls., loose, moist, alluvium.
1.0	0-2'	2'		0-2'		
1.5						At 1.5', sandy-silt, ~ 2.0% v.f. gr. sand, color changes to 10 YR, 5/6-8, ywash. br., non-pls., loose, moist, alluvium.
2.0						
3.0	2-4'	2'		2-4'		
4.0						
5.0	4-6'	2'		4-6'		
6.0						
7.0	6-8'	2'		6-8'		At 7.0', sandy-silt, percent sand increases to 4.0% v.f. gr. sand, 10 YR, 5/6-8, ywash. br., non-pls., loose, moist, alluvium.
8.0						
9.0	8-10'	2'		8-10'	SM	<u>SM</u> silty-sand, ~ 4.0% silt 10 YR, 5/6-8, ywash br., non-pls., loose, moist, alluvium.
10.0						
10.2	10-12'	2'		10-12'		

Lab  
 Drill Site Geologist: A.E. Jantzen Date: 4/8/87  
 Reviewed By: Joseph L. Reed Date: 4/11/87

Borehole: E-76A

Well Number: 37383

SOILS LOG						
Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	Description
<i>Monsieu Cross</i>						
11.0	10-12'	2'	NA	10-12'	SM	At 11.0', <del>percent</del> silty-sand, percent of silt decrease to ~ 20% silt, 10 YR, 6/6, brownish yellow, non-plas., loose, moist, alluvium.
12.0	12-14'			12-14'		↓
13.0	14-16'	2'		14-16'		
14.0	16-18'			16-18'		↓
14.5	18-20'	2'		18-20'		
15.0	20-22'	2'		20-22'		At 14.5', silty-sand, percent silt decreases to 5-10% silt, 10 YR, 6/6, brown. yellow, non-plas., loose, moist, alluvium.
16.0						↓
17.0						
18.0						↓
19.0						
19.0						▽ W.T. @ 19.0'
19.0					SM	At 19.0', silty-sand, 10% silt, 70% med-coarse gr. sand., 10 YR, 5/6-8, yash. brn., non-plas., loose, saturated, alluvium.
20.0						↓
21.0						
22.0						

Drill Site Geologist: Lee D'Atello Date: 4/8/87  
 Reviewed By: Joseph L. Reed Date: 4/16/87

Borehole: E-76A

Well Number: 37383

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						<i>Munsell Colors</i>
22.0					SM	
23.0	22-24'	2'		22-24'		
24.0						
25.0	24-26'	1.5'		24-26'		
26.0						
27.0	26-28'	1.0'		26-28'		
28.0						
29.0	28-30'	2'		28-30'		
30.0						
31.0	30-32'	1.5'		30-32'	SP	SP gravelly-sand, 10-20% gtc. gravel, 10 yr. 5/6-8, yach. brn., non-plas, loose, saturated, alluvium.
32.0	32-35'	2'		32-35'		
33.0						

Drill Site Geologist: LAB A.E. [Signature]  
 Reviewed By: Joseph L. Reed

Date: 4/8/87  
 Date: 4/16/87

Borehole: E-76A

Well Number: 37383

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
33.0	33-35'	2'	NA	33-35'	SP	
34.0						
35.0	35-37'	0'		35-37'		No Recovery - SAMPLE LOST
36.0						
37.0	37-38'	1'		37-38'	SP	
38.0						
38.0	38-40'			38-40'	OL Ch	OL clayey siltst., 20-30% clay, 10-12, 4/4-6, dk. ywd br., low-pls., v. dense, wet, bedrock.
39.0						
40.0	40-41'			40-41'		
41.0						
42.0	END OF BORING LOG					
43.0	See					
44.0						

Drill Site Geologist: Joseph L. Reed

Date: 4/8/87

Reviewed By: Joseph L. Reed

Date: 4/16/87

APPENDIX C  
WELL LOCATIONS, COMPLETION DATA AND SITE CONDITIONS, AND SITING RATIONALE

C.1 ALLUVIAL WELLS

### Alluvial Wells

#### Site E-38, Well 37374

Location: Site E-38 is located approximately 800 ft north of the south section line and 900 ft east of the west section line of Section 14 (T2S, R67W).

Completion Data and Site Conditions: A borehole was drilled to a total depth of 26.5 ft where silty claystone bedrock was encountered at 26.0 ft. During drilling, the water table was estimated to be at 10 ft below ground surface. Well 37374 was screened across the entire saturated thickness in predominantly silty sand material.

Siting Rationale: This installation is a cluster site which is being utilized to examine the potential for flow between the alluvium and Denver Fm aquifers and water chemistry within both aquifers. The alluvial well was installed to assess water quality and water levels in the southwest corner of Section 14. In this area, the alluvial aquifer appears to be separated from the main alluvial pathway along First Creek by a zone of unsaturated alluvium. This well is downgradient of the western portion of the NBCS and is being used to depict the water chemistry and hydrogeology along this flow pathway.

#### Site E-39

Location: Site E-39 is located approximately 880 ft north of the south section line and 2630 ft east of the west section line of Section 14 (T2S, R67W).

Completion Data and Site Conditions: The borehole at this site was drilled to 20.0 ft and the bedrock contact was called at 18 ft. The alluvium, which consists mostly of silty sands and clayey sands was unsaturated at this site and therefore no alluvial well was completed. The water table was encountered in the sandy claystone bedrock and was estimated to be at 19 ft below ground surface.

Siting Rationale: This alluvial well was to be part of a cluster site. However, unsaturated alluvium was encountered. Therefore, geologic data was obtained from continuous logging and the hole was abandoned in accordance with Section 3.4 of the Task 36 Technical Plan. Data obtained from this site helps to delineate the bedrock surface and a zone of unsaturated alluvium in the southern portion of Section 14.

#### Site E-40, Well 37370

Location: Site E-40 is located approximately 1280 ft north of the south section line and 1875 ft west of the east section line of Section 14 (T2S, R67W).

6/14/88

Completion Data and Site Conditions: The borehole at this site encountered water at 9 ft and the bedrock contact was estimated at 26 ft. Well 37370 was screened across the water table to the bedrock contact. The bedrock encountered at the bottom of the boring is a dark brown weathered claystone.

Siting Rationale: The alluvial well at this site is part of a cluster installation being used to assess water chemistry and the potential for vertical flow between the alluvium and Denver Fm aquifers. The alluvial well at this site was installed to further define the hydrogeology and water chemistry along the First Creek paleochannel which has historically shown significant contaminant concentrations.

Site E-42, Well 37369

Location: Site E-42 is located approximately 750 ft north of the south section line and 440 ft west of the east section line of Section 14 (T2S, R67W).

Completion Data and Site Conditions: A borehole was drilled to an approximate depth of 26 ft where claystone bedrock was encountered. During drilling the water table was estimated to be 5 ft below ground surface. Well 37369 is screened across the water table to the bedrock contact in well graded gravelly sands.

Siting Rationale: This alluvial well was installed to fill a data gap in the monitoring network just downgradient of the NBCS. This site is fundamental to the monitoring program because it depicts the hydrogeology and water chemistry along the First Creek paleochannel just west of Peoria Street where there are currently no alluvial monitoring sites. This area is suspected of significant alluvial ground water contamination because of high concentrations upgradient along the paleochannel.

Site E-44, Well 37373, Well 37398, Well 37399

Location: Site E-44 is located approximately 1950 ft north of the south section line and 1780 ft west of the east section line of Section 14 (T2S, R67W).

Completion Data and Site Conditions: The borehole at the site of Well 37373 was drilled to a total depth of 26 ft. Weathered claystone bedrock was encountered at 25.0 ft. Depth to water was estimated to be at 3.5 ft below ground surface during drilling. Alluvial borings were also drilled for Wells 37398 and 37399. At Well 37398, the boring was drilled to a total depth of 25.0 ft and weathered claystone bedrock was encountered at 23.7 ft. Depth to water was estimated at 2.2 ft below ground surface during drilling. At Well 37399, the boring was drilled to a total depth of 24.0 ft and silty sandstone bedrock was encountered at 22.8 ft. Depth to water was estimated to be at 2.4 ft below ground surface during drilling. All three wells are screened across the

C.2 DENVER WELLS

Denver Wells

Site E-34 Pilot Corehole Well #37376 D1

Location: Site E-34 is located approximately 50 ft north of the south section line and 2575 ft east of the west section line of Section 13 (T2S R67W).

Completion Data and Site Conditions: Two Denver Fm sandstone units were encountered during drilling of the 55 ft pilot corehole. A 10 ft claystone aquitard separates the alluvium from the first sandstone unit. The two saturated sandstones are separated by only a 2-ft fractured lignitic claystone, therefore they are assumed to be hydrologically connected and Well 37376 is completed in both sandstones.

Siting Rationale: The pilot corehole at this site was drilled to provide geologic data for cross sections and a well completion. Well 37376 was installed to obtain hydrologic and water quality data in the first and second Denver Fm sandstone units downgradient of the NBCS. There are currently no first or second Denver sandstone water quality wells in service in this area. Water quality data is needed here to assess if these Denver Fm units are acting as contamination pathways beneath the NBCS.

Site E-38 Pilot Corehole Well 37379 D1 Well 37380 D2

Location: Site E-38 is located approximately 850 ft north of the south section line and 900 ft east of the west section line of Section 14 (T2S R67W).

Completion Data and Site Conditions: The 130 ft pilot corehole was drilled and four Denver Fm sandstone units were encountered. The alluvium is separated from the first sandstone by a 13.5-ft claystone aquitard and a 7-ft silty claystone interval. Upon review of the corehole data Well 37379 was completed in the first saturated sandstone and Well 37380 was completed in the second saturated sandstone. Wells may need to be completed in the deeper sandstones if the chemical analyses on Well 37380 show it to be contaminated.

Siting Rationale: The pilot corehole at this site was drilled to provide geologic data for cross sections and well completions. This corehole will also provide geologic data for any future interpretive work in the Denver Fm and/or any future well installations at this site. Wells 37379 and 37380 were installed to provide hydrologic and water quality data for the first and second Denver Fm sandstone units northwest of the NBCS. This well cluster will fill a large data gap that exists in the southwest corner of Section 14.

Site E-39, Pilot Corehole, Well 37387 D1, Well 37388 D2

Location: Site E-39 is located approximately 900 ft north of the south section line and 2620 ft west of the east section line of Section 14 (T2S R67W).

Completion Data and Site Conditions: The pilot corehole was drilled to a total depth of 130 ft and six Denver Fm sandstone units were encountered. The bedrock lithology is a claystone and this creates the 9-ft thick aquitard between the alluvium and the first Denver sandstone unit. Review of the pilot corehole data showed that this site is located on a bedrock high and the first sandstone unit is not correlated to sandstones in surrounding wells. Therefore, it is not likely that this hydrologic unit is contaminated and a well was not completed in this interval. Well 37387 was completed in the second saturated sandstone and Well 37388 was completed in the fourth saturated sandstone which correlated with the previously installed Denver wells.

Siting Rationale: The pilot corehole at this site was drilled to provide important geologic data for cross sections that will aid in the assessment of the lateral and northerly extent of the Denver Fm sandstone units and for the completion of Wells 37387 and 37388. This corehole will also provide geologic data for any future interpretive work in the Denver Fm and/or any future well installations at this site. There are presently no first or second Denver Fm sandstone wells in this area and monitoring wells in these sandstone units are required to assess the water quality of the Denver Fm sandstones downgradient of the barrier at this location.

Site E-40, Pilot Corehole, Well 37371 D1, Well 37372 D2

Location: Site E-40 is located approximately 1300 ft north of the south section line and 1880 ft west of the east section line of Section 14 (T2S R67W).

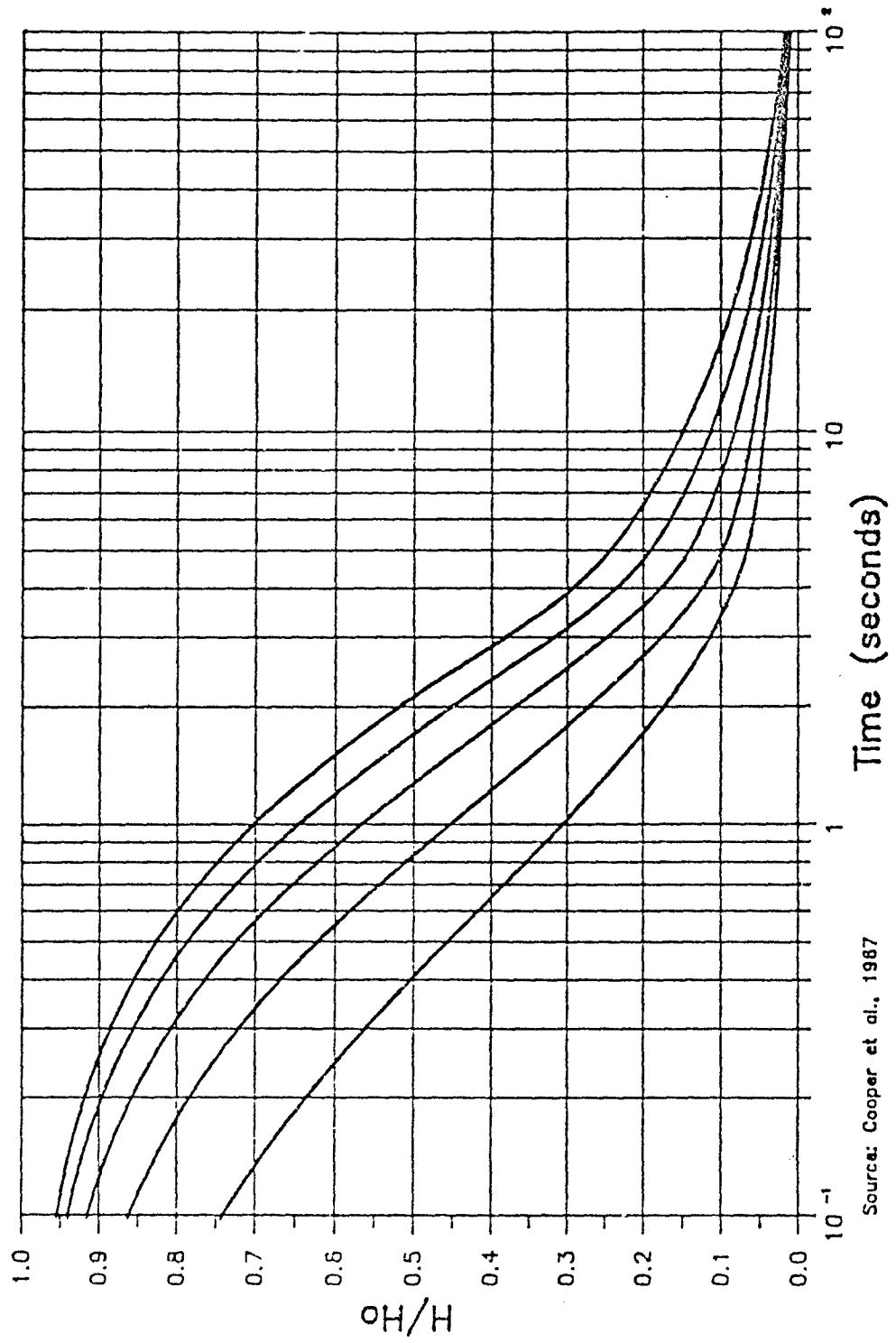
Completion Data and Site Conditions: The pilot corehole was drilled to an approximate total depth of 96.5 ft and three sandstones were encountered. A 4-ft clayey siltstone separates the alluvium from the first Denver sandstone and therefore it appears that this first sandstone is 2-ft hydrologically connected with the alluvium. Well 37371 is screened entirely within the first saturated sandstone. The lower sandstones are interbedded with siltstone and claystone and the pilot corehole log showed no substantial confining claystone layer between the sandstones. Therefore, the sandstones were assumed to be hydrologically connected and Well 37372 screens them as one unit.

Siting Rationale: The pilot corehole at this site was drilled to provide geologic data downgradient of the NBCS for cross sections and well completions. This corehole will also provide geologic data for any future interpretive work in the Denver Fm and/or any future well installations at this site. The Denver Fm wells are a part of a cluster site being used to assess the potential for vertical flow.

APPENDIX D  
SLUG TESTS: COOPER TYPE CURVES AND DATA CURVES,  
AND AQUIFER TEST ANALYSES

D.1 SLUG TESTS; COOPER TYPE CURVES AND DATA CURVES

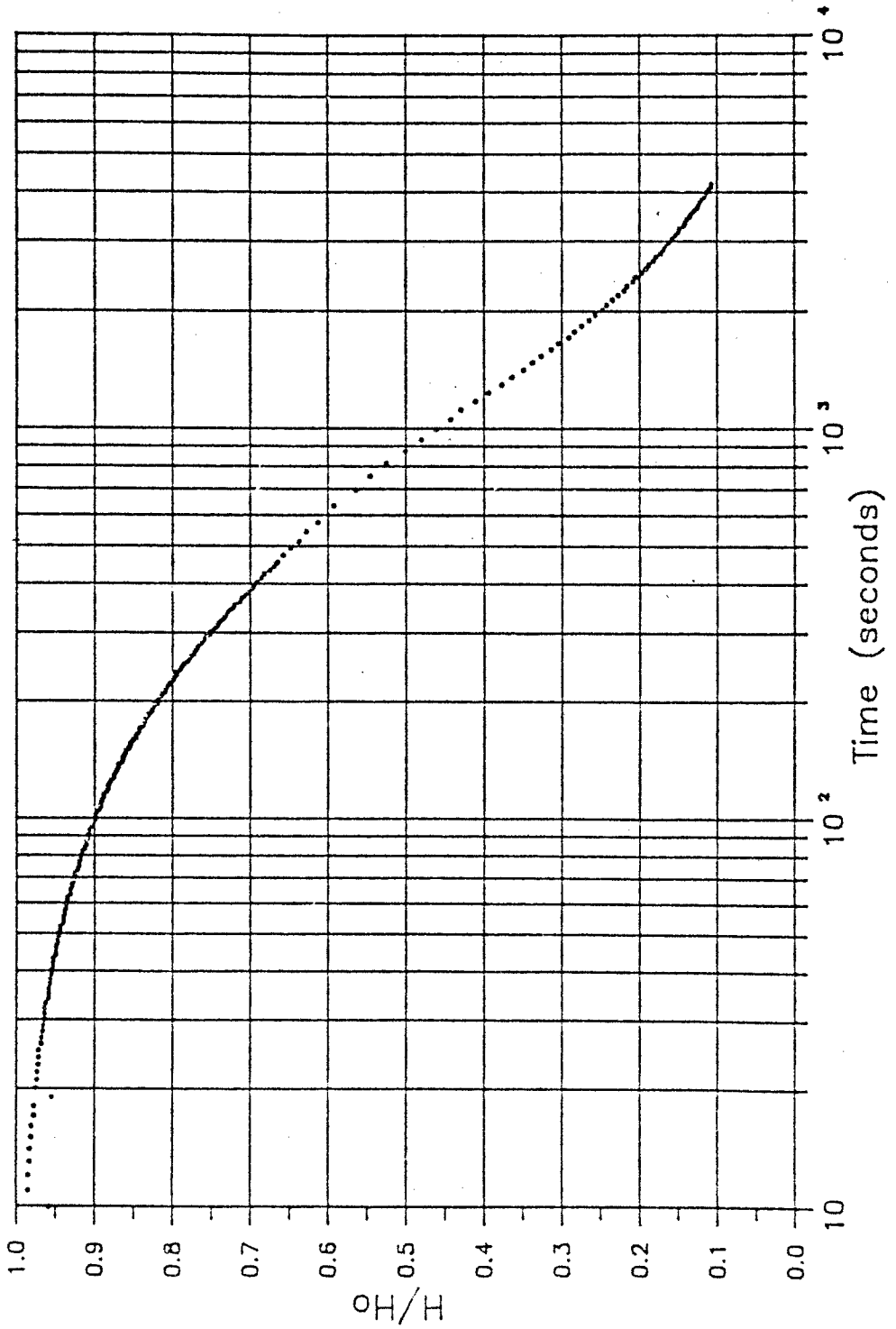
TYPE CURVES



Source: Cooper et al., 1987

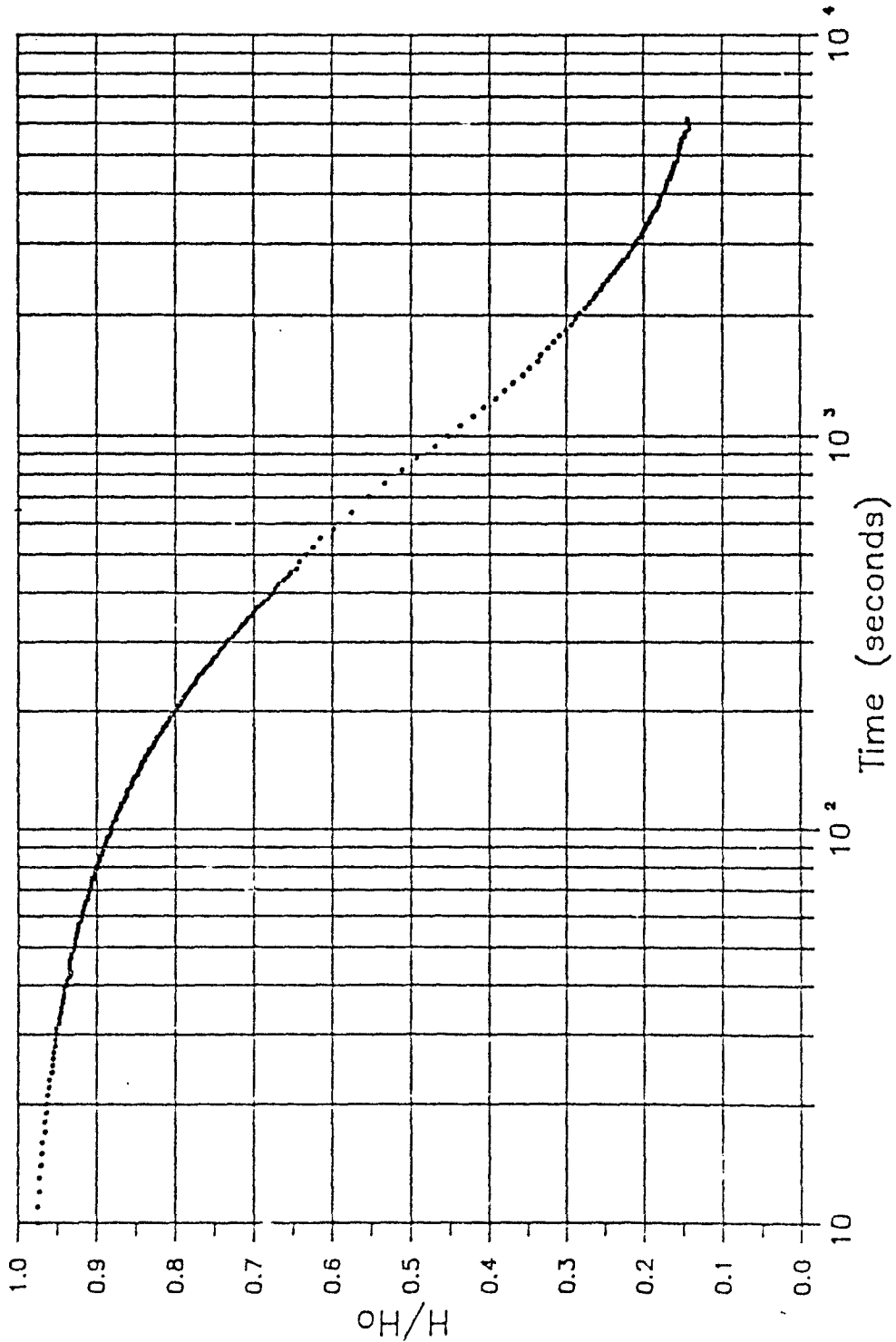
SLUG TEST: WELL #37376 (E-34)

Slug In



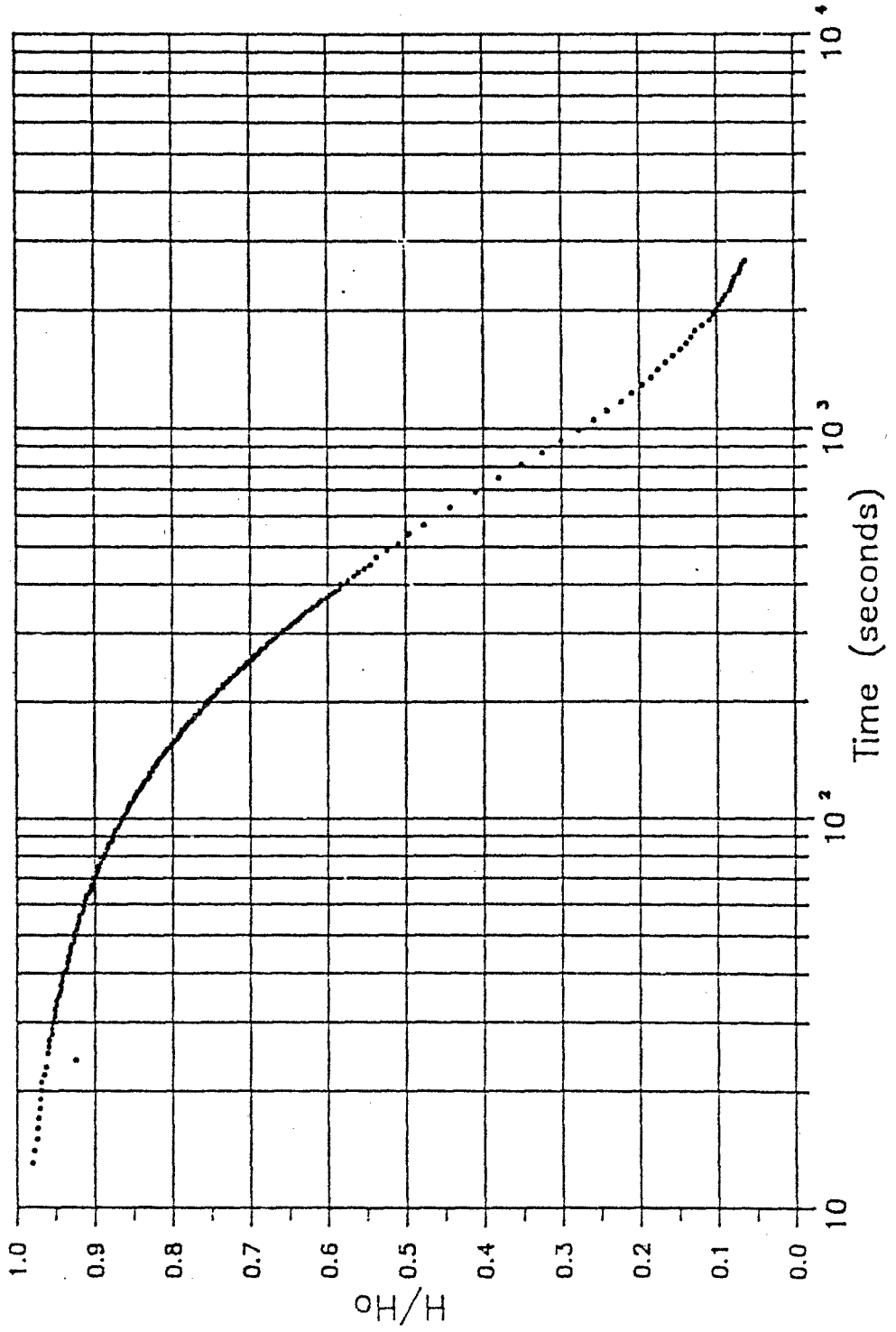
SLUG TEST: WELL #37376 (E-34)

Slug Out



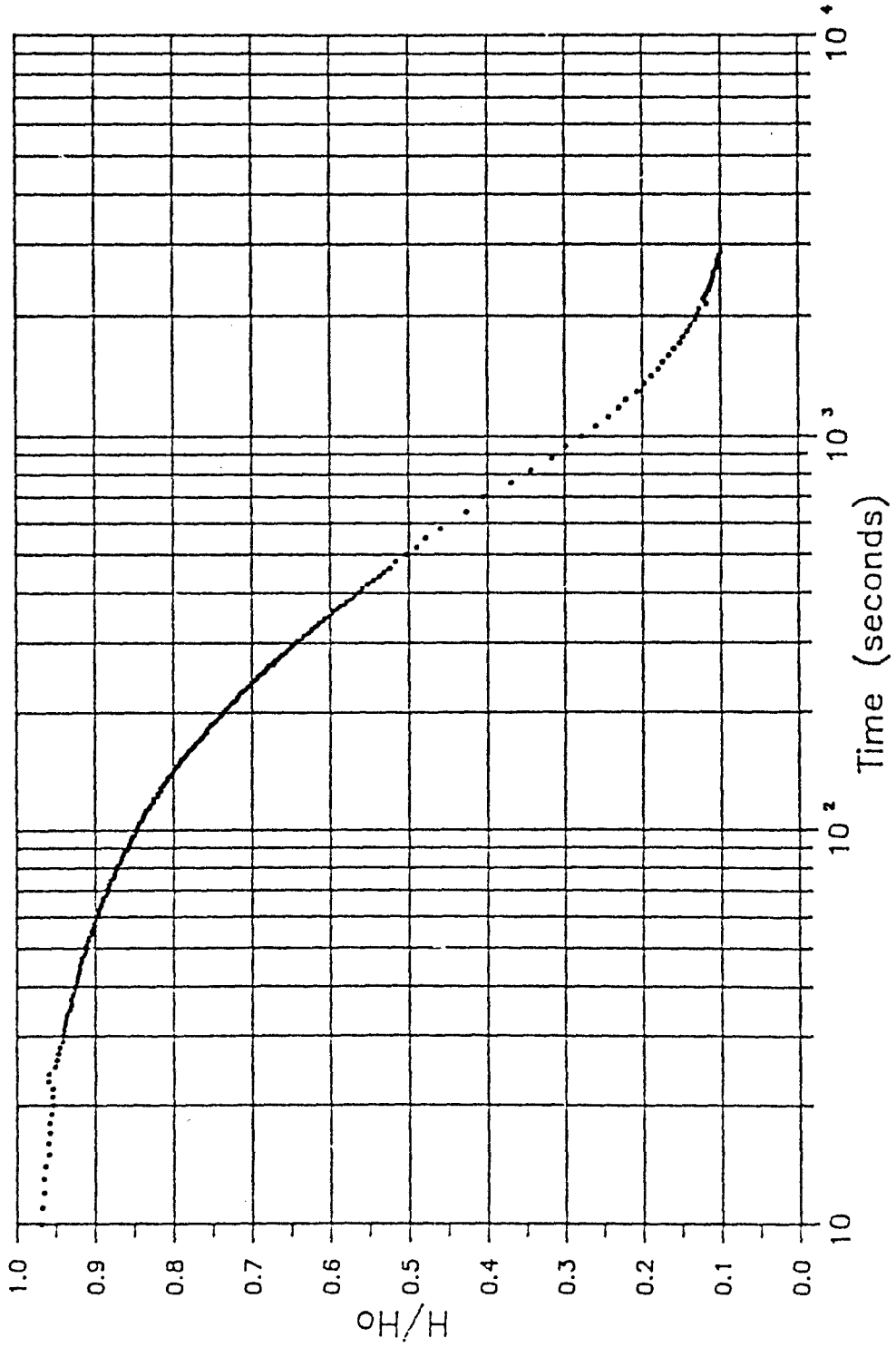
SLUG TEST: WELL #37379 (E-38)

Slug In



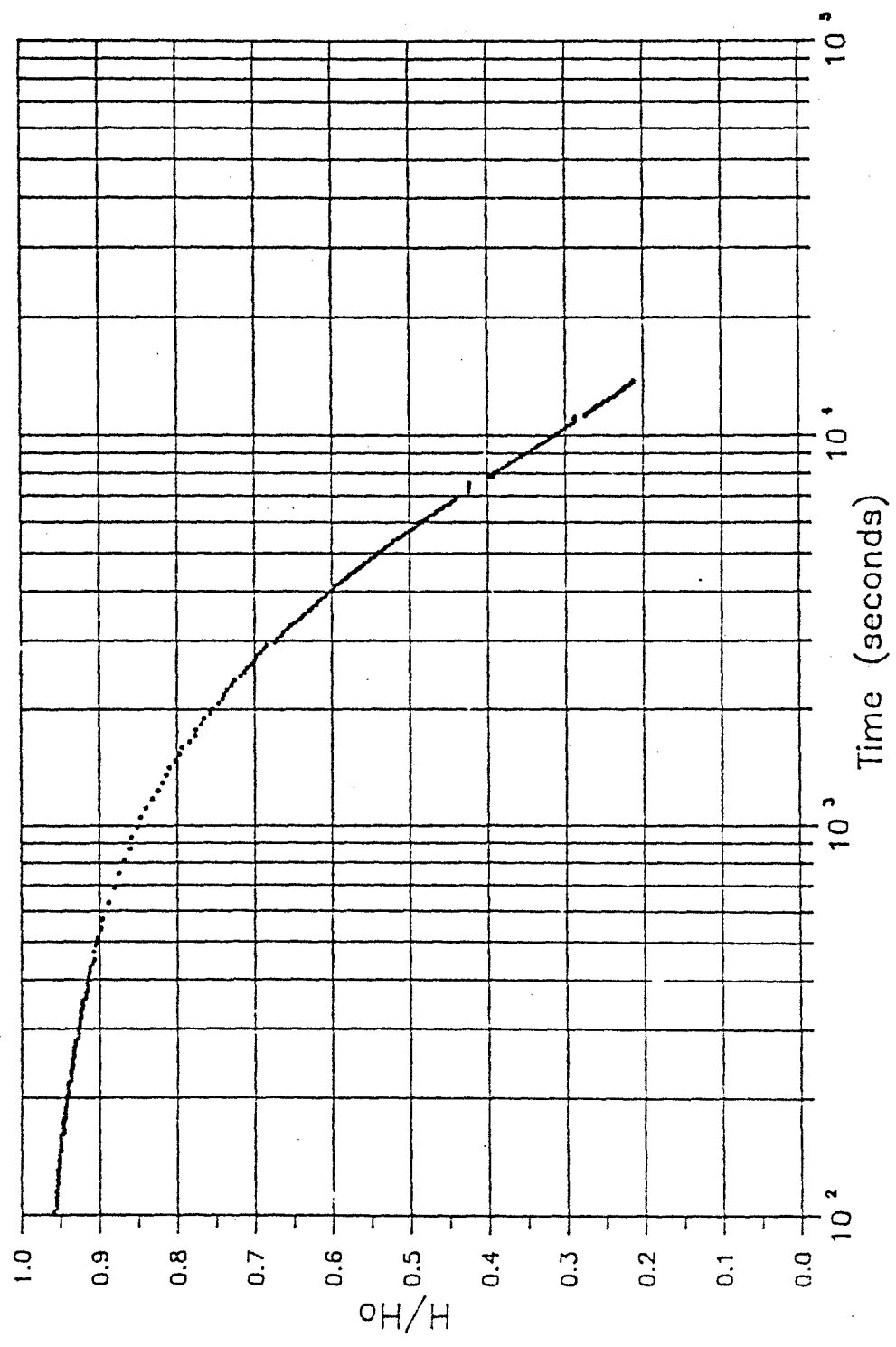
SLUG TEST: WELL #37379 (E-38)

Slug Out

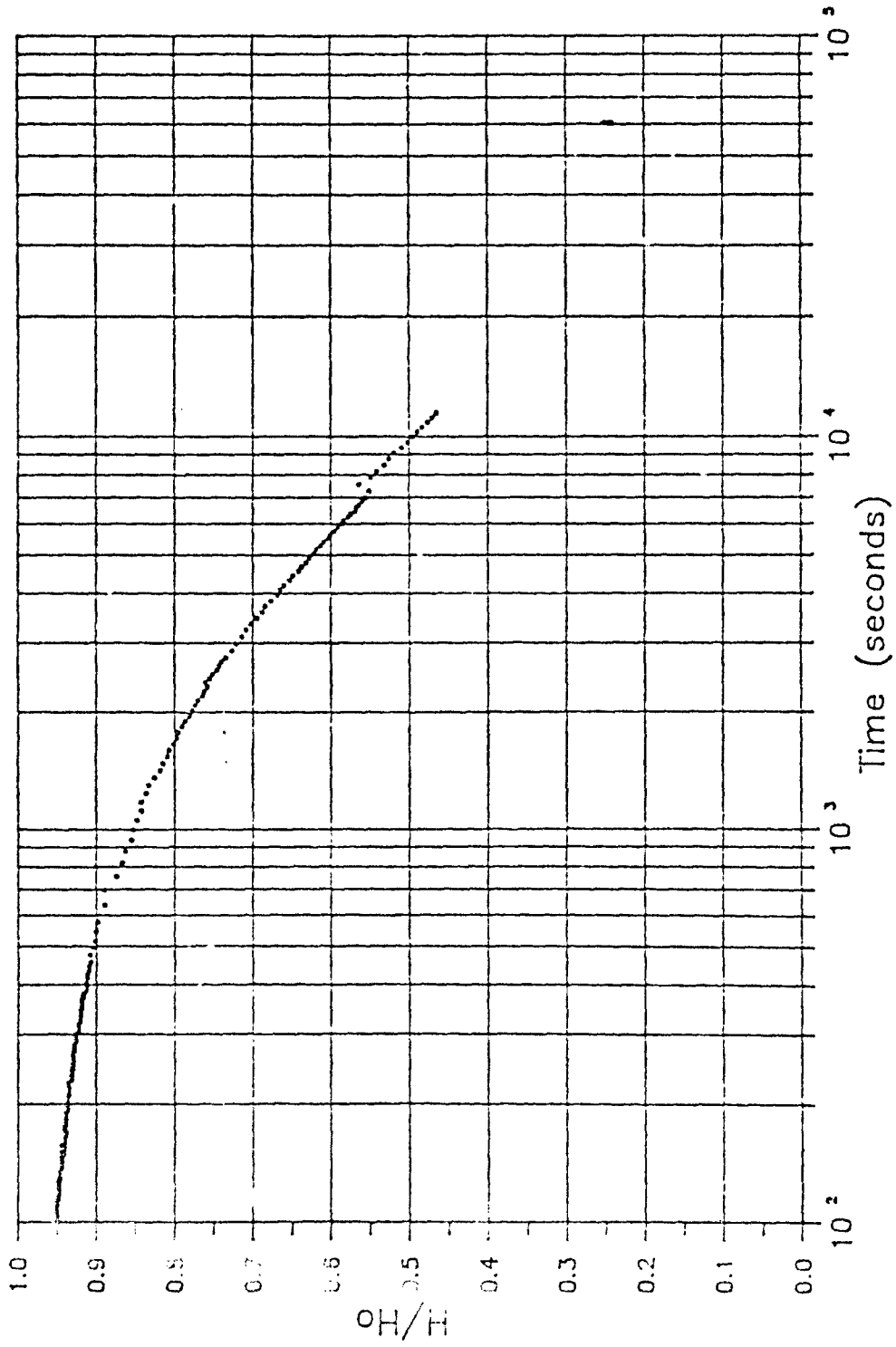


SLUG TEST: WELL #37380 (E-38)

Slug In

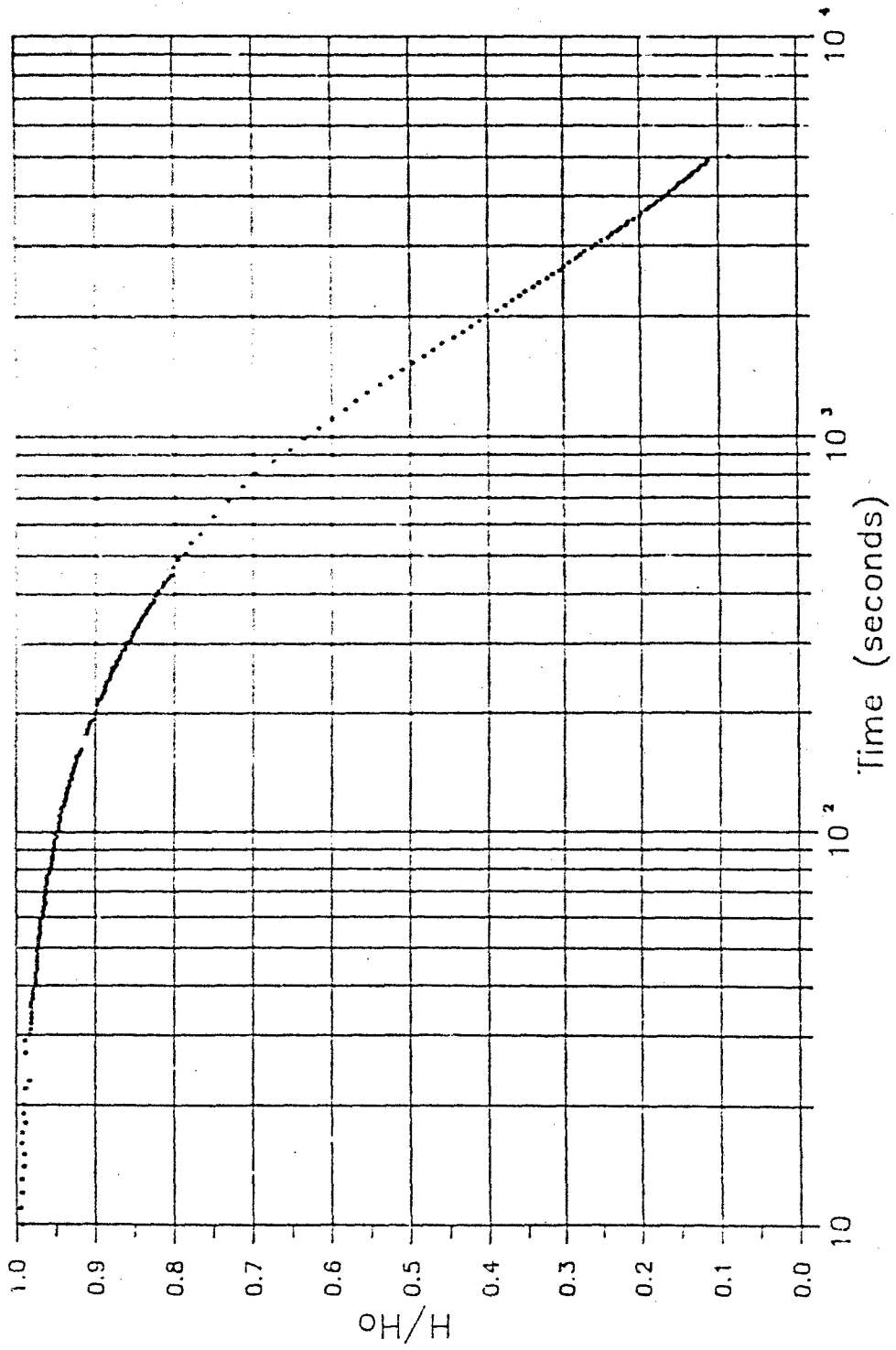


SLUG TEST: WELL #37380 (E-38)  
Slug Out



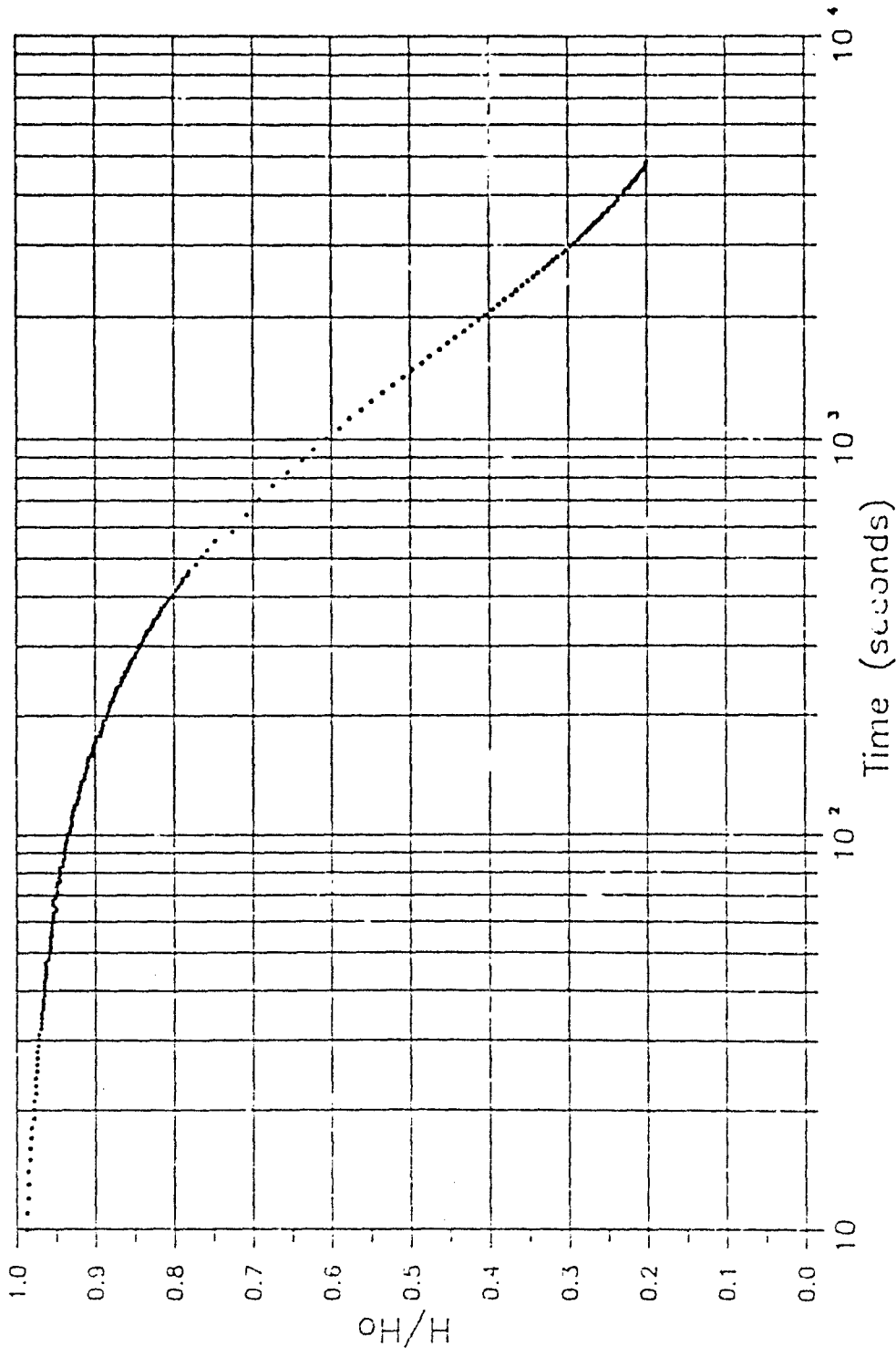
SLUG TEST: WELL #37387 (E-59)

Slug In



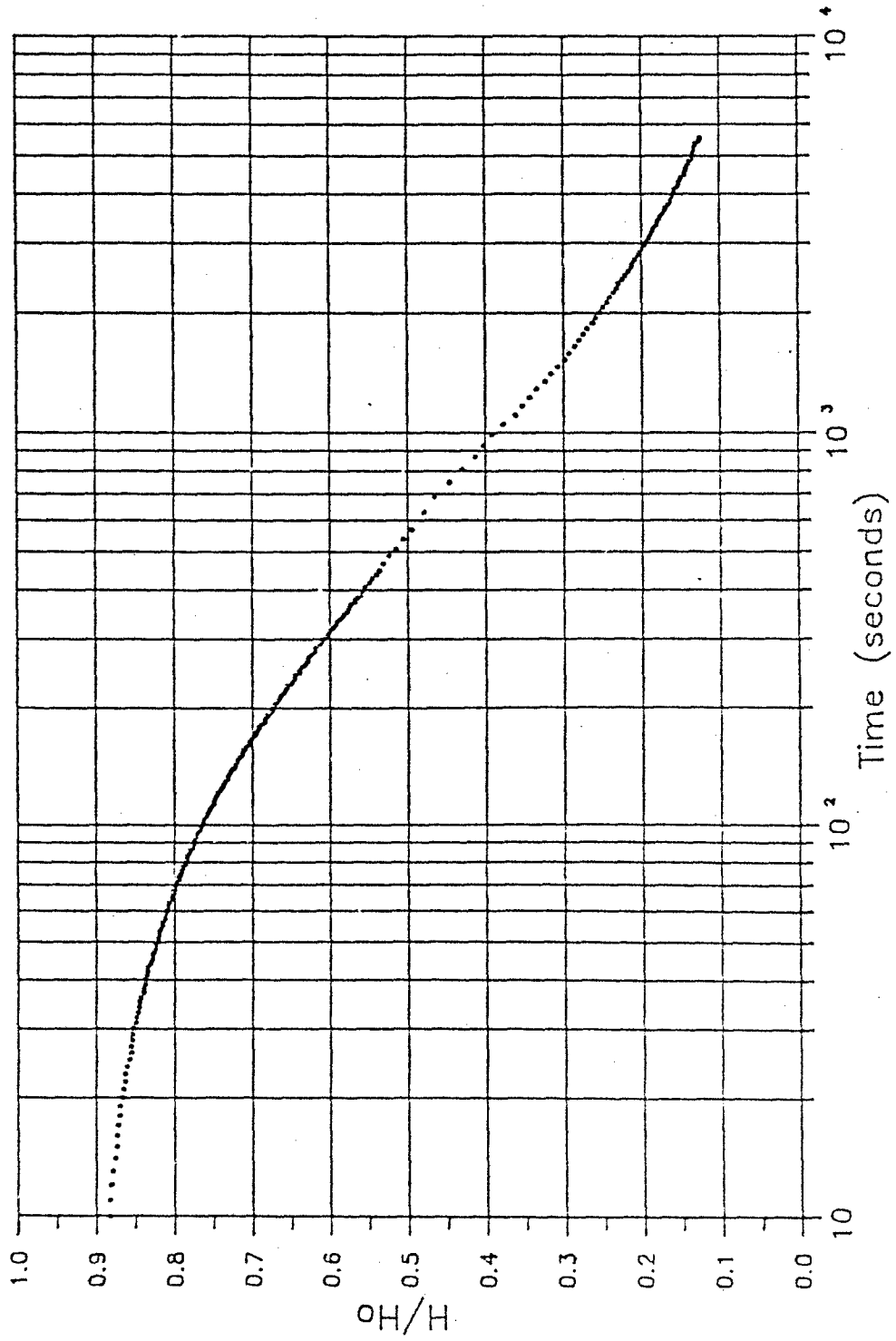
SLUG TEST: WELL #37387 (E-39)

Slug Out

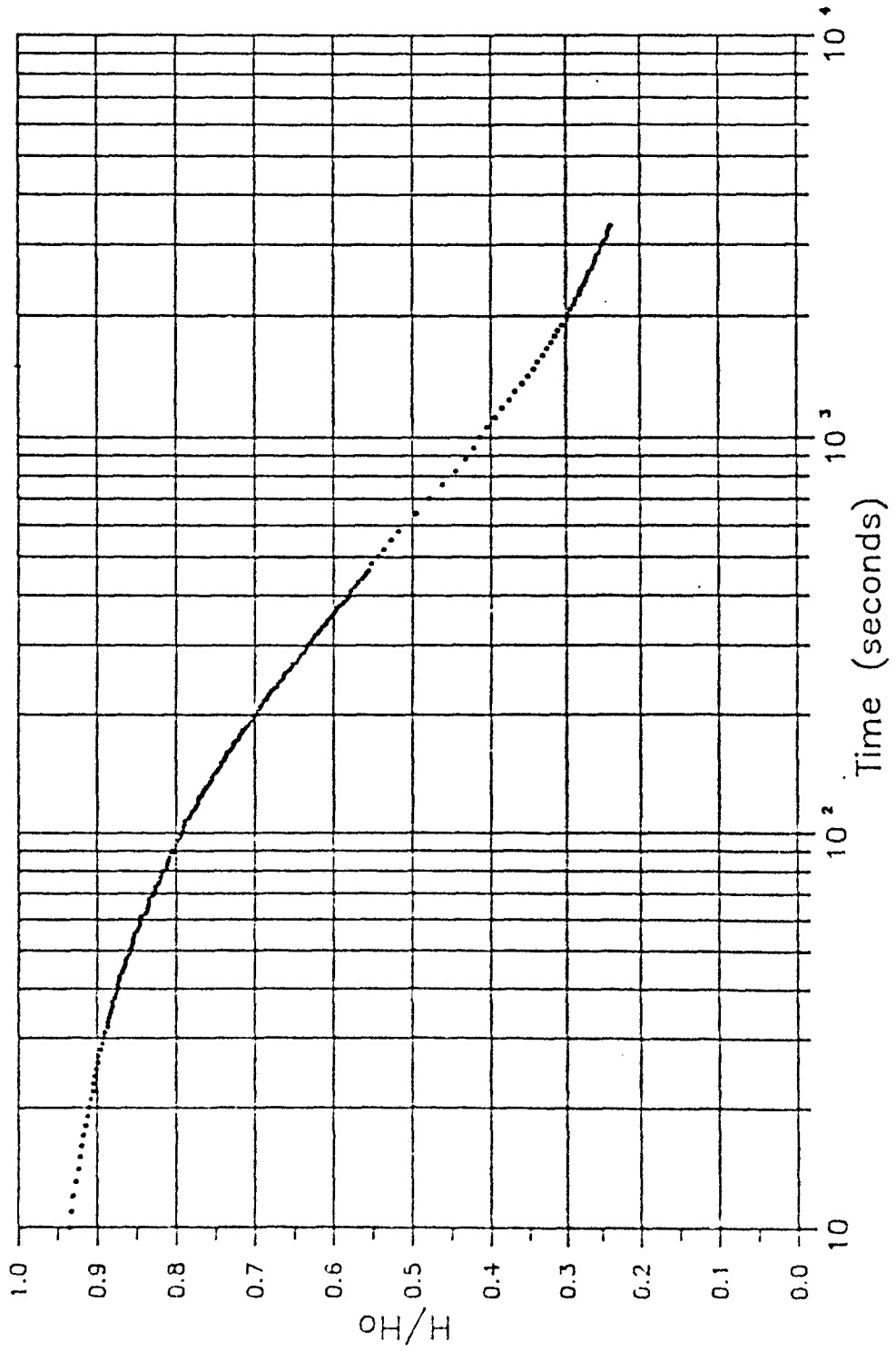


SLUG TEST: WELL #37388 (E-39)

Slug In

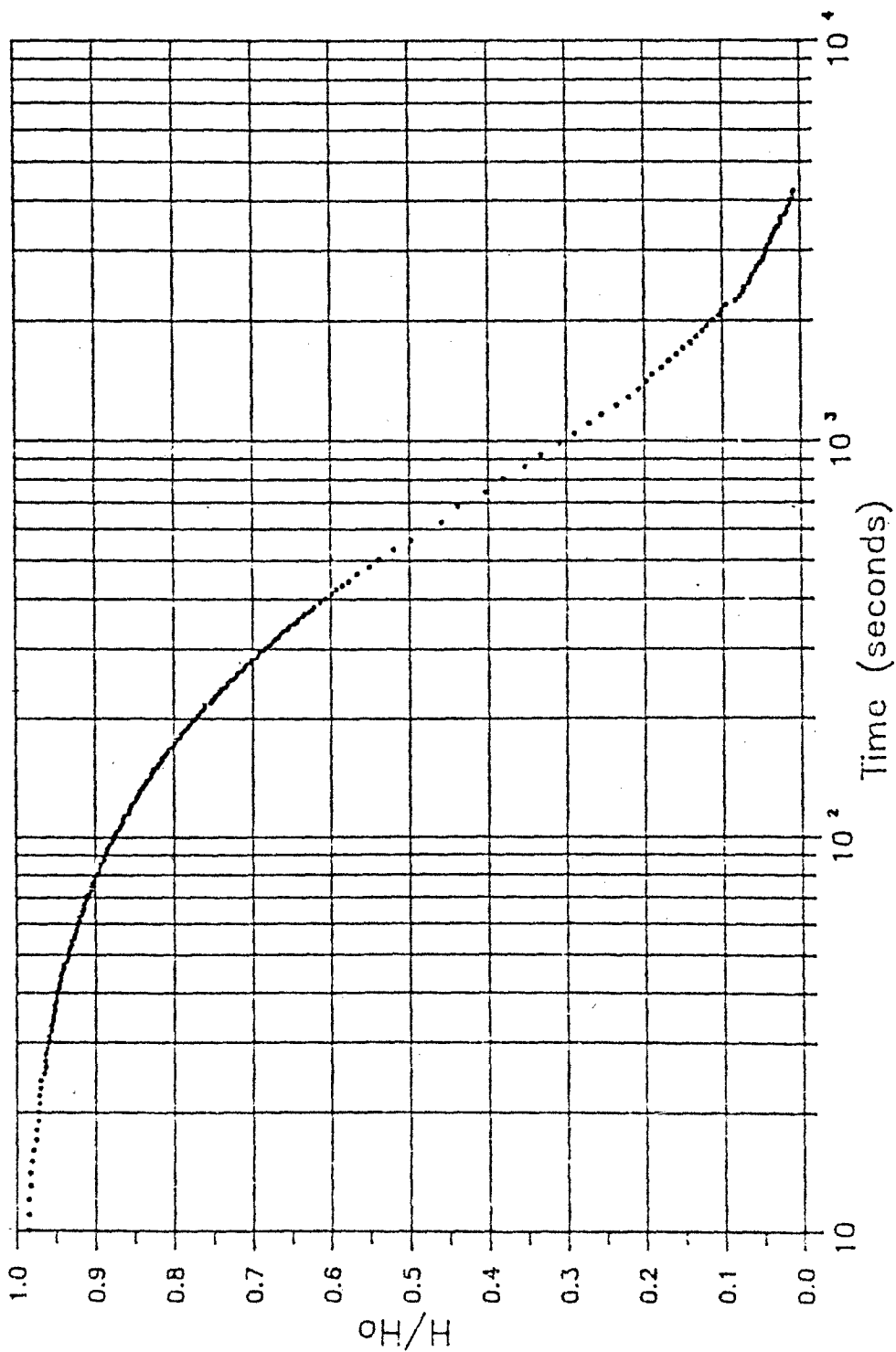


SLUG TEST: WELL #37388 (E-39)  
Slug Out

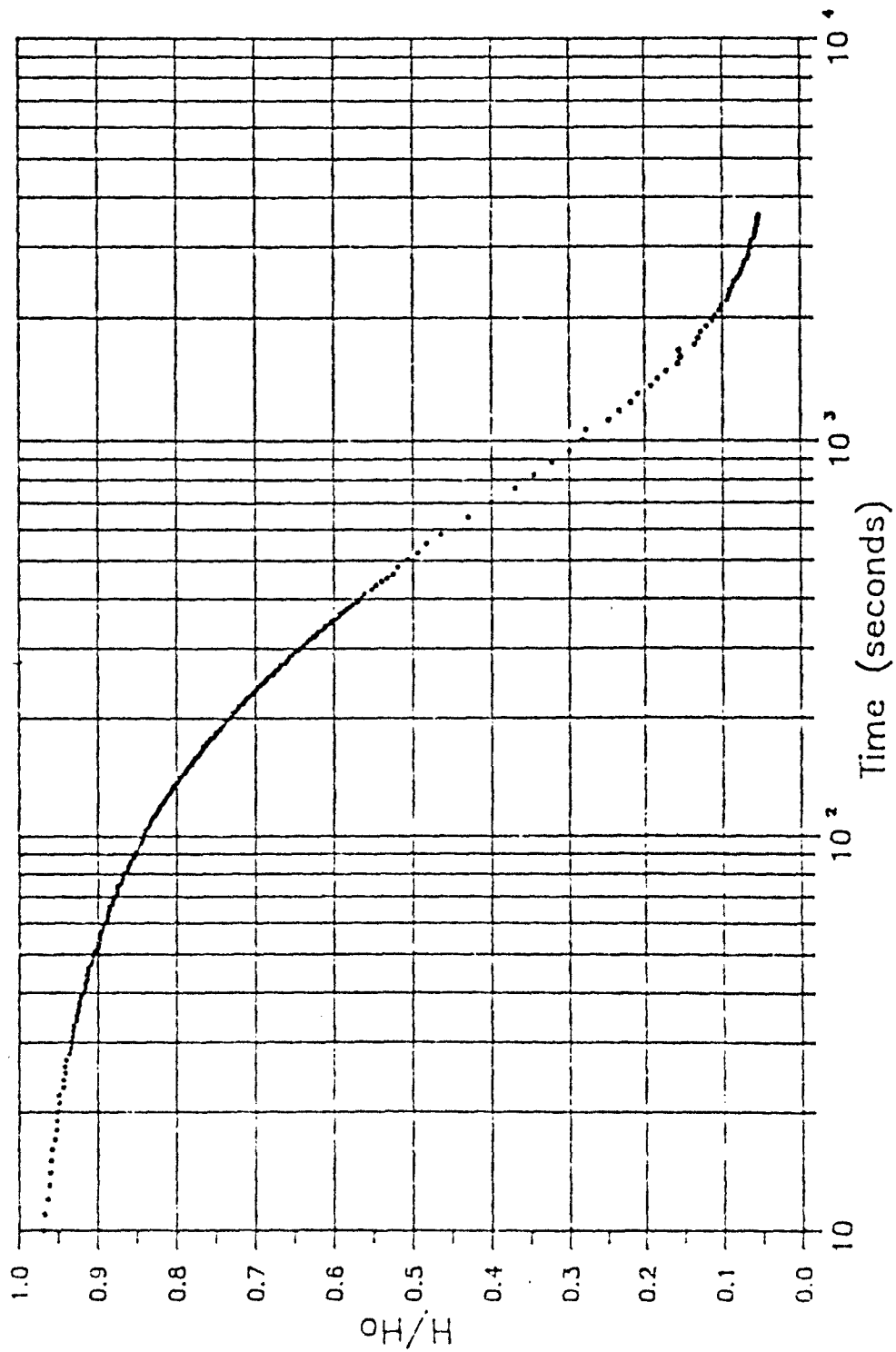


SLUG TEST: WELL #37372 (E-40)

Slug In

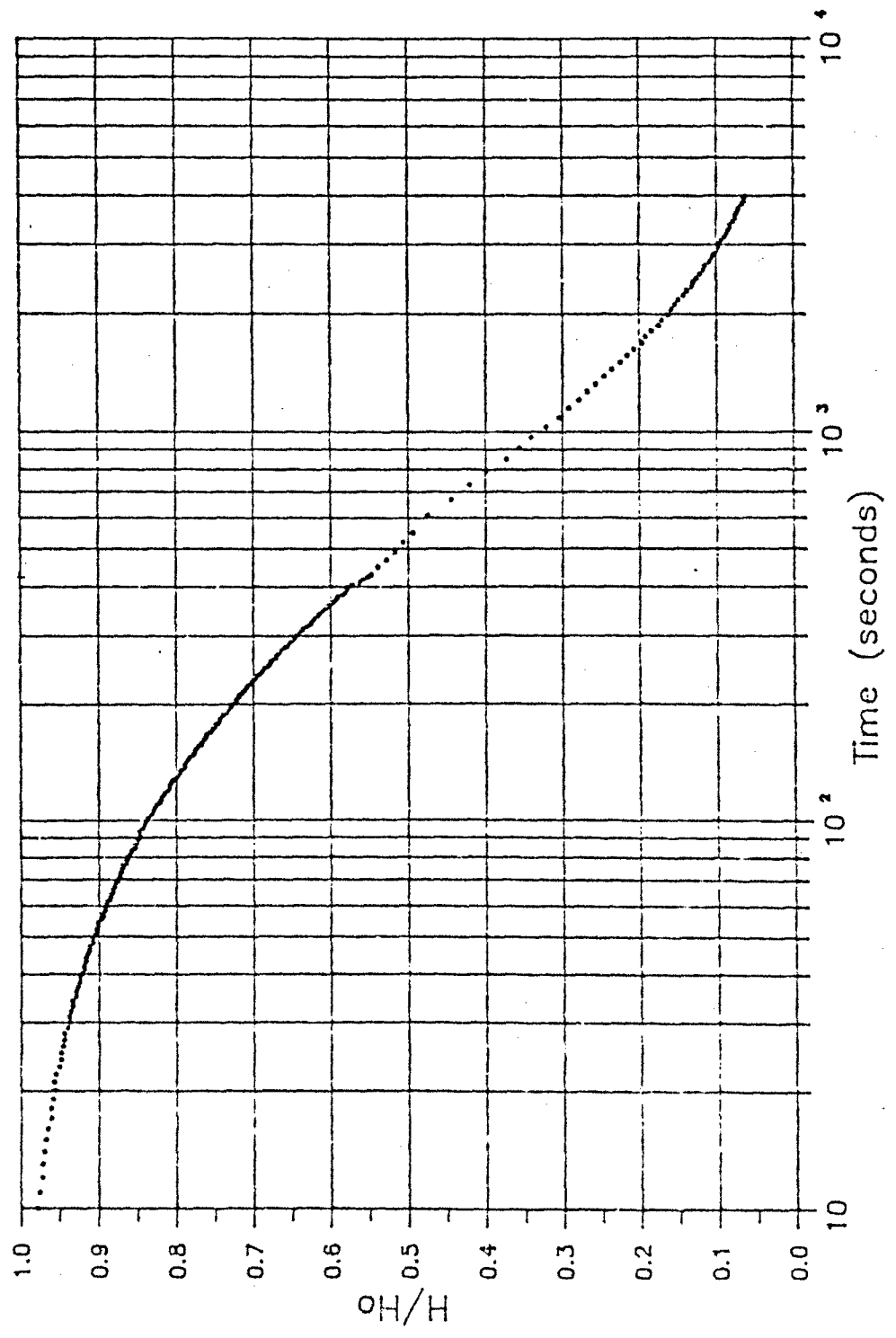


SLUG TEST: WELL #37372 (E-40)  
Slug Out

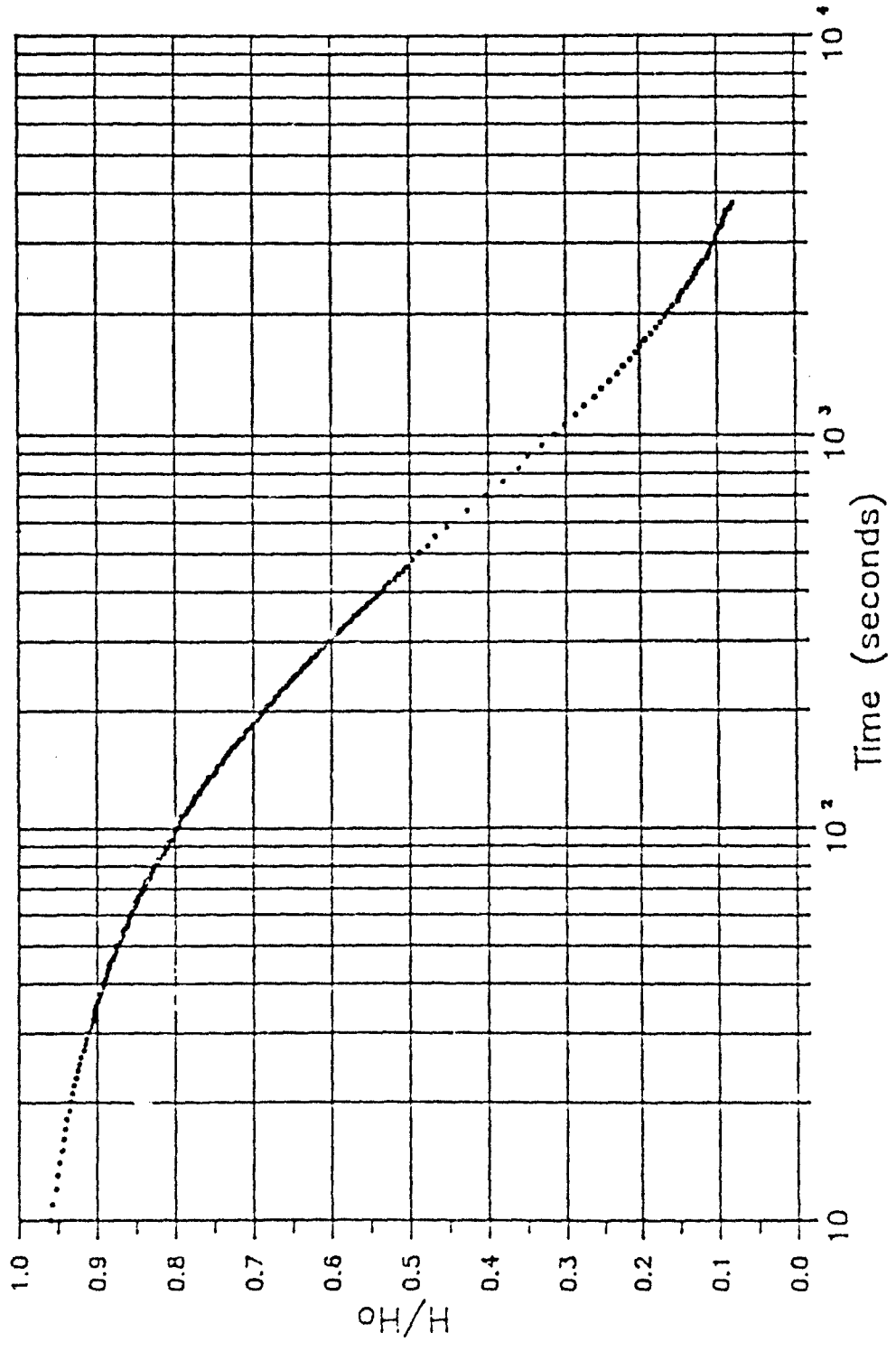


SLUG TEST: WELL #37390 (E-63)

Slug In



SLUG TEST: WELL #37390 (E-63)  
Slug Out



D.2 WELL 37367 AQUIFER TEST ANALYSES

Harding Lawson Associates

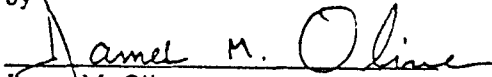
A Report Prepared for


Environmental Science and Engineering, Inc.  
7332 S. Alton Way, Suite H  
Englewood, Colorado 80112

WELL 37367 AQUIFER TEST  
ROCKY MOUNTAIN ARSENAL  
ADAMS COUNTY, COLORADO

HLA Job No. 17053,103.10

by

  
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June 20, 1988

TABLE OF CONTENTS

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LIST OF TABLES.....iii

LIST OF ILLUSTRATIONS.....iv

LIST OF CALCULATION SHEETS .....v

    I    INTRODUCTION.....1

    II   AQUIFER TEST METHODOLOGY.....2

        A.   Discharge Rate and Measurement.....3

    III  AQUIFER TEST RESULTS.....4

        A.   Step-Drawdown Test.....4

        B.   Constant-Rate Discharge Test.....5

    IV   REFERENCES.....7

TABLES

ILLUSTRATIONS

CALCULATION SHEETS

Appendix A - GEOLOGIC BORING LOGS

DISTRIBUTION

## LIST OF TABLES

---

Table 1	Step-Drawdown Test Discharge Rate Measurement
Table 2	Constant-Rate Discharge Rate Measurements
Table 3	Summary of Well 37367 Aquifer Test
Table 4	Drawdown Data for Step-Drawdown Test - Well 37367
Table 5	Drawdown Data for Constant-Rate Test - Well 37367
Table 6	Drawdown Data for Constant-Rate Test - Well 37400
Table 7	Drawdown Data for Constant-Rate Test - Well 37401
Table 8	Residual Drawdown Data for Recovery Test - Well 37367
Table 9	Residual Drawdown Data for Recovery Test - Well 37400
Table 10	Residual Drawdown Data for Recovery Test - Well 37401

## LIST OF ILLUSTRATIONS

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- |          |  |
|----------|--|
| Plate 1  | Well Location Map  |
| Plate 2  | Change in Water Level versus Time for Well 37367               |
| Plate 3  | Drawdown versus Time for Well 37367 - Step-Drawdown Test       |
| Plate 4  | Drawdown versus Log Time for Well 37367                        |
| Plate 5  | Residual Drawdown versus Log Dimensionless Time for Well 37367 |
| Plate 6  | Log Drawdown versus Log Time for Well 37400                    |
| Plate 7  | Drawdown versus Log Time for Well 37400                        |
| Plate 8  | Residual Drawdown versus Log Dimensionless Time for Well 37400 |
| Plate 9  | Log Drawdown versus Log Time for Well 37401                    |
| Plate 10 | Drawdown versus Log Time for Well 37401                        |
| Plate 11 | Residual Drawdown versus Log Dimensionless Time for Well 37401 |

## LIST OF CALCULATION SHEETS

---

Sheet 1	Modified Non-Equilibrium Method for Well 37367
Sheet 2	Residual Drawdown Method for Well 37367
Sheet 3	Unconfined Aquifer Type Curve Method for Well 37400
Sheet 4	Modified Non-Equilibrium Method for Well 37400
Sheet 5	Residual Drawdown Method for Well 37400
Sheet 6	Unconfined Aquifer Type Curve Method for Well 37401
Sheet 7	Modified Non-Equilibrium Method for Well 37401
Sheet 8	Residual Drawdown Method for Well 37401

## I. INTRODUCTION

Harding Lawson Associates (HLA) performed a series of aquifer tests for Environmental Science and Engineering, Inc. (ESE) as part of the Rocky Mountain Arsenal Task 39 Offpost RI/FS program. Step-drawdown, constant-rate discharge, and recovery tests were performed in Well 37367 (Boring E-53), located approximately 1 mile north of the Rocky Mountain Arsenal boundary in Adams County, Colorado (Plate 1). The tests were conducted from April 11 to 14, 1988, to estimate aquifer parameters including transmissivity, hydraulic conductivity, and storativity in the offpost operable unit.

## II. AQUIFER TEST METHODOLOGY

Prior to the start of the aquifer tests, water levels were monitored in Well 37367 for 42.5 hours to measure any periodic or unusual water level fluctuations. Any water level trends should be identified before aquifer testing to avoid introducing error into aquifer parameter calculation by including water-level responses not attributable to pumping during the aquifer test.

The Well 37367 step-drawdown test was performed for a total of 4.2 hours on April 12, 1988. Water level changes were measured in Well 37367 using an In Situ SE1000B Hermit datalogger and pressure transducer.

The constant-rate discharge test in Well 37367 was performed April 13 through 14, 1988. Water-level changes were monitored in Wells 37367, 37400, and 37401 (Plate 1) with pressure transducers and the data stored on In Situ SE1000B Hermit dataloggers while Well 37367 was pumped for 24.0 hours. Water-level recovery was measured for 4.0 hours in all wells after the pump was shut off.

Discharge water from both the step-drawdown and constant-rate tests was pumped into three 20,000 gallon storage tankers. Disposal of this water was handled by ESE.

Well 37367 was selected as the pumping well by ESE because it is considered representative of the aquifer materials observed in the Northern Contaminant Pathway in the Offpost Operable Unit. Wells 37400 and 37401 were installed by ESE to be used as observation wells for the aquifer test. Well 37400 is 39.36 feet north of Well 37367, and Well 37401 is 81.33 feet north of Well 37367. Geologic boring logs for Wells 37367, 37400 and 37401 are in Appendix A. The geologic logs show the aquifer zone to be comprised primarily of silty and clayey fine- to coarse-grained sand, with some sandy silt.

### Discharge Rate and Measurement

A totalizing Rockwell International flowmeter was to have been used to monitor flow during the aquifer tests. However, on-site calibration of the flowmeter indicated that it

was inaccurate at the low pumping rates to be used during the aquifer tests. Because no other flowmeters were available for use during the tests, a calibrated 55-gallon drum (5-gallon bucket for low flow rates) was used to measure the pumping flow rate. Flow measurements were made by timing the filling of the calibrated drum (or bucket). Flow was measured at the end of the 100-foot discharge line, located approximately 13 feet above ground level at the top of the storage tank.

During the step-drawdown test, the discharge rate of the pump in Well 37367 was increased in four increments from an initial rate of 8.1 gallons per minute (gpm) to a final rate of 36.7 gpm. Discharge rate measurements taken during each step are given in Table 1.

During the constant-rate discharge test, the discharge rate of the submersible pump in Well 37367 was held reasonably constant at an average rate of 32.3 gpm. The pumping rate varied less than 3 percent from the average throughout the test. Flow measurements were taken frequently throughout the test to verify the constancy of the discharge rate. Table 2 presents the discharge rate data for the constant-rate discharge test.

### III. AQUIFER TEST RESULTS

Based upon the geologic boring log of Boring E53A (Well 37367) and water-level data, the aquifer zone tested was interpreted to be an unconfined aquifer, and appropriate analysis methods were chosen. The hydraulic properties of the aquifer were evaluated from the constant-rate and recovery test data using type curve and straight-line graphical methods (Theis, 1935; Jacob, 1950; and Prickett, 1965). Graphs of drawdown versus log time, log drawdown versus log time, and residual drawdown versus log dimensionless time were constructed for each well monitored (Plates 4 through 11). On all graphs, drawdown was corrected to account for changes in saturated thickness (Jacob, 1950). The graphs are used for solving equations which express the relationship between the hydraulic properties of an aquifer and hydraulic response of an aquifer to pumping.

Aquifer parameters calculated (Calculation Sheets 1 through 8) using water-level response data from the constant-rate discharge test are presented on Table 3. The arithmetic mean of values calculated from different analytical methods for each observation well describes the average value of transmissivity and hydraulic conductivity. Where transmissivity and hydraulic conductivity were determined at more than one observation well, the geometric mean of these values describes the average value of the parameter for the aquifer test. The arithmetic mean of all methods for all observation wells describes the average value of storativity. These methods were used to calculate mean values because transmissivity has been shown to be log normally distributed in space, and storativity to be normally distributed in space (Freeze, 1975).

#### A. Step-Drawdown Test

The step-drawdown test was performed in Well 37367 on April 12, 1988. A plot of water-level drawdown versus time for Well 37367 is shown on Plate 3. Drawdown data collected during the step-drawdown test are tabulated in Table 4. Flow rate measurements for each step are summarized in Table 1. The drawdown versus time plot shows a short

transitional period between changing discharge rates. Fluctuations observed in the drawdown data during later steps were caused by unstable flow rates due to a generator malfunction.

The main purpose of the step-drawdown test was to determine an optimal flow rate for the constant-rate discharge test. The optimal flow rate for the test is one that can be sustained for at least 24 hours without dewatering the well. From the step-drawdown test data, it was estimated that a flow rate of 30-35 gpm would be appropriate for the constant-rate discharge test. Under ideal circumstances, data from a step-drawdown test can be used to calculate well efficiency. However, this well parameter could not be estimated because of fluctuations in drawdown caused by the generator malfunction.

#### B. Constant-Rate Discharge Test

Prior to the aquifer testing, water levels were monitored in Well 37367 to assess the potential for outside influences on water levels. The results of this monitoring are shown on Plate 2. During the 42.5-hour period in which Well 37367 was monitored, water levels decreased approximately 0.2 feet. The decrease was fairly constant throughout the period, indicating that the source of the decrease was not a diurnal fluctuation. The fluctuations may possibly be attributed to seasonal variations or an unidentified pumping well.

The constant-rate discharge test was performed in Well 37367 on April 13-14, 1988. Table 3 summarizes the aquifer test results. Drawdown and recovery data collected during the constant-rate discharge test are tabulated on Tables 5 through 10. Calculations made in estimating the aquifer parameters shown in Table 3 are presented on Sheets 1-8. Graphs of the data are shown on Plates 4 through 11. Drawdown values have been corrected to account for decreasing saturated thicknesses.

Calculated transmissivity values ranged from 4,000 ft<sup>2</sup>/day to 8,800 ft<sup>2</sup>/day, with a geometric mean of 6,600 ft<sup>2</sup>/day. These values are typical for the well-graded sand and gravels comprising the aquifer zone. A value of 360 ft/day was estimated for hydraulic conductivity, using the screened intervals of the observation wells as the aquifer thickness.

Three segments are observed in the drawdown data from the observation wells, representing different aquifer response conditions. For the first segment, a value of  $1.9 \times 10^{-3}$  was estimated for aquifer storativity. This value is lower than the typical value range expected for an unconfined alluvial aquifer and is indicative of the early-time or artesian response of the aquifer (Neuman, 1972). The second segment of the drawdown curve is nearly flat and indicates delayed ground-water yield following dewatering of saturated material. During this time, vertical recharge to the saturated zone by delayed yield partially compensates for drawdown from pumping. An accurate estimate of transmissivity and storativity cannot be made during this period. The late-time (third segment) response is representative of the unconfined response of the aquifer and is controlled by the specific yield of materials at the water table. Delayed yield effects were observed in the 24-hour constant-rate discharge test, and the late-time or unconfined response was not fully developed before the test was terminated. To fully develop the late-time curve, the test would have had to run for several days; it is doubtful that the additional data so gained would have added significantly to the refinement of aquifer parameter estimates. Therefore, the storativity value of  $1.9 \times 10^{-3}$  representative of the early-time artesian is the only such value which is estimated from the aquifer test, and is not representative of the late-time specific yield of the aquifer.

Table 1

Step-Drawdown Test Discharge Rate Measurements

<u>Step 0</u>		<u>Step 1</u>	
Time	Flow Rate (gpm)	Time	Flow Rate (gpm)
9:11	Start of Test	10:17	Start of Test
9:18	7.4	10:18	18.7
9:20	8.5	10:19	14.3
9:30	8.7	10:20	13.6
10:00	5.5	10:21	13.0
10:05	5.5	10:22	14.3
10:10	8.6	10:33	15.0
10:13	8.5	10:39	13.6
		10:45	15.0
Time-weighted average flow rate	8.1 gpm	10:55	15.0
Length of step:	66 min	11:15	14.3
		Time-weighted average flow rate	14.9 gpm
		Length of step:	62 min
<u>Step 2</u>		<u>Step 3</u>	
Time	Flow Rate (gpm)	Time	Flow Rate (gpm)
11:21	Start of Test	12:24	Start of Test
11:21	25.0	12:25	42.8
11:22	25.6	12:26	40.0
11:23	26.7	12:27	39.1
11:24	28.1	12:28	39.3
11:25	30.0	12:35	36.0
11:26	30.0	12:38	36.4
11:27	28.6	12:41	36.1
11:28	28.6	13:14	35.8
11:29	28.6	13:23	35.6
11:50	28.6		
12:22	28.6	Time-weighted average flow rate	36.7 gpm
Time-weighted average flow rate	28.5 gpm	Length of step:	60 min
Length of step:	62 min		

**Table 2**  
**Constant-Rate Test Discharge Rate Measurements**

Date	Time	Flow Rate (gpm)
4/13/88	15:43	Start of Test
	15:47	32.6
	15:53	32.4
	15:56	32.6
	16:25	32.8
	16:44	32.3
	17:58	32.1
	19:00	31.9
	20:00	32.8
	21:00	32.2
	22:00	32.5
	23:00	32.7
	23:58	33.1
	4/14/88	01:04
01:59		32.1
03:00		32.0
04:04		32.6
05:02		32.2
06:04		32.4
07:05		32.5
09:02		31.9
11:05		32.3
13:05		32.3
15:30	31.9	
Time-weighted average flow rate		32.3 gpm

Table 3. Summary of Well 37367 Aquifer Test

Dates Tested: April 13-14, 1988  
 Pumped Well: 37367  
 Discharge Rate: 32.3 gpm  
 Pumping Duration: 24.0 hours  
 Recovery Duration: 4.0 hours

Observation Well	Distance to Pumped Well (ft)	Magnitude Water Level Response (ft)	Method of Analysis	Transmissivity (ft <sup>2</sup> /day)	Hydraulic Conductivity (ft/day)	Storativity (dimensionless)
37367	0	12.14	SL	4,000	210	-
			RD	7,600	400	-
37400	39.36	0.58	LL	7,200	380	1.9 x 10 <sup>-3</sup>
			SL	6,000	320	2.1 x 10 <sup>-3</sup>
			RD	7,100	370	-
37401	81.33	0.33	LL	6,300	350	1.9 x 10 <sup>-3</sup>
			SL	8,800	490	1.7 x 10 <sup>-3</sup>
			RD	7,100	390	-

T geometric = 6,600 ft<sup>2</sup>/day

K geometric = 3.50 ft/day

S arithmetic = 1.9 x 10<sup>-3</sup> (dimensionless)

LL = Unconfined Aquifer Type Curve Method (Prickett, 1965)

SL = Modified Non-Equilibrium Method (Jacob, 1950)

RD = Residual Drawdown Method (Theis, 1935)

Table 4.  
Drawdown Data for Step - Drawdown Test  
Well 37363

Pumping Well: 37367  
Observation Well: 37367  
Step - Drawdown Test  
04/12/88

Step# 0 04/12 09:11

Elapsed Time (min)	Drawdown Value (ft)
0.0000	0.01
0.0033	0.07
0.0066	1.12
0.0099	-0.35
0.0133	-0.34
0.0166	0.13
0.0200	0.18
0.0233	0.15
0.0266	0.12
0.0300	0.11
0.0333	0.12
0.0500	0.11
0.0666	0.11
0.0833	0.10
0.1000	0.13
0.1166	0.12
0.1333	0.11
0.1500	0.11
0.1666	0.11
0.1833	0.12
0.2000	0.12
0.2166	0.12
0.2333	0.13
0.2500	0.30
0.2666	0.48
0.2833	0.60
0.3000	0.89
0.3166	1.12
0.3333	1.37
0.4167	1.86
0.5000	1.12
0.5833	0.99
0.6667	0.97
0.7500	0.95
0.8333	0.93
0.9167	0.92
1.0000	0.91
1.0833	0.93
1.1667	0.96
1.2500	0.98
1.3333	1.01
1.4166	1.03
1.5000	1.04
1.5833	1.04
1.6667	1.05

Table 4. (continued)

1.7500	1.05
1.8333	1.04
1.9167	1.06
2.0000	1.06
2.5000	1.07
3.0000	1.08
3.5000	1.06
4.0000	1.08
4.5000	1.09
5.0000	1.08
5.5000	1.06
6.0000	1.07
6.5000	1.09
7.0000	1.18
7.5000	1.21
8.0000	1.22
8.5000	1.24
9.0000	1.26
9.5000	1.25
10.0000	1.27
12.0000	1.26
14.0000	1.28
16.0000	1.29
18.0000	1.25
20.0000	1.26
22.0000	1.29
24.0000	1.27
26.0000	1.24
28.0000	1.30
30.0000	1.27
32.0000	1.27
34.0000	1.29
36.0000	1.27
38.0000	1.26
40.0000	1.26
42.0000	1.28
44.0000	1.29
46.0000	1.29
48.0000	1.26
50.0000	1.27
52.0000	0.89
54.0000	0.87
56.0000	0.86
58.0000	0.15
60.0000	1.07
62.0000	1.15
64.0000	1.17
66.0000	1.14

Step# 1 04/12 10:17

Elapsed Time (min)	Drawdown Value (ft)
0.0000	1.17

Table 4. (continued)

0.0033	1.53
0.0066	1.34
0.0099	1.21
0.0133	1.47
0.0166	1.35
0.0200	1.27
0.0233	1.32
0.0266	1.35
0.0300	1.36
0.0333	1.39
0.0500	1.49
0.0666	1.56
0.0833	1.60
0.1000	1.62
0.1166	1.66
0.1333	1.68
0.1500	1.70
0.1666	1.72
0.1833	1.72
0.2000	1.75
0.2166	1.76
0.2333	1.77
0.2500	1.78
0.2666	1.81
0.2833	1.82
0.3000	1.85
0.3166	1.83
0.3333	1.86
0.4167	1.96
0.5000	2.06
0.5833	2.11
0.6667	2.15
0.7500	2.18
0.8333	2.21
0.9167	2.25
1.0000	2.23
1.0833	2.15
1.1667	2.17
1.2500	2.14
1.3333	2.16
1.4166	2.14
1.5000	2.15
1.5833	2.15
1.6667	2.15
1.7500	2.15
1.8333	2.14
1.9167	2.14
2.0000	2.15
2.5000	2.15
3.0000	2.15
3.5000	2.17
4.0000	2.19
4.5000	2.18
5.0000	2.23
5.5000	2.22
6.0000	2.20

Table 4. (continued)

6.5000	2.21
7.0000	2.22
7.5000	2.22
8.0000	2.23
8.5000	2.24
9.0000	2.26
9.5000	2.26
10.0000	2.22
12.0000	2.23
14.0000	2.25
16.0000	2.25
18.0000	2.22
20.0000	2.23
22.0000	2.26
24.0000	2.22
26.0000	2.29
28.0000	2.27
30.0000	2.29
32.0000	2.29
34.0000	2.29
36.0000	2.29
38.0000	2.30
40.0000	2.31
42.0000	2.29
44.0000	2.31
46.0000	2.31
48.0000	2.31
50.0000	2.31
52.0000	2.30
54.0000	2.33
56.0000	2.31
58.0000	2.32
60.0000	2.31
62.0000	2.31

Step# 2 04/12 11:20

Elapsed Time (min)	Drawdown Value (ft)
0.0000	2.32
0.0033	2.33
0.0066	2.46
0.0099	2.82
0.0133	2.53
0.0166	2.53
0.0200	2.65
0.0233	2.56
0.0266	2.67
0.0300	2.62
0.0333	2.72
0.0500	2.96
0.0666	3.13
0.0833	3.30
0.1000	3.47

Table 4. (continued)

0.1166	3.58
0.1333	3.66
0.1500	3.76
0.1666	3.85
0.1833	3.89
0.2000	3.98
0.2166	3.95
0.2333	4.05
0.2500	4.05
0.2666	4.15
0.2833	4.14
0.3000	4.18
0.3166	4.23
0.3333	4.27
0.4167	4.43
0.5000	4.56
0.5833	4.61
0.6667	4.71
0.7500	4.77
0.8333	4.83
0.9167	4.88
1.0000	4.95
1.0833	5.00
1.1667	5.02
1.2500	5.07
1.3333	5.07
1.4166	5.25
1.5000	5.23
1.5833	5.32
1.6667	5.38
1.7500	5.39
1.8333	5.43
1.9167	5.51
2.0000	5.48
2.5000	5.55
3.0000	6.14
3.5000	6.40
4.0000	6.45
4.5000	6.56
5.0000	6.53
5.5000	6.41
6.0000	6.34
6.5000	6.35
7.0000	6.36
7.5000	6.42
8.0000	6.44
8.5000	6.45
9.0000	6.46
9.5000	6.49
10.0000	6.48
12.0000	6.51
14.0000	6.58
16.0000	6.60
18.0000	6.62
20.0000	6.60
22.0000	6.62

Table 4. (continued)

24.0000	6.64
26.0000	6.04
28.0000	6.73
30.0000	6.74
32.0000	6.73
34.0000	6.77
36.0000	6.79
38.0000	6.75
40.0000	6.79
42.0000	6.77
44.0000	6.77
46.0000	6.82
48.0000	6.80
50.0000	6.83
52.0000	6.81
54.0000	6.84
56.0000	6.91
58.0000	6.86
60.0000	6.87
62.0000	6.85

Step# 3 04/12 12:24

Elapsed Time (min)	Drawdown Value (ft)
0.0000	6.80
0.0033	6.88
0.0066	6.88
0.0099	6.91
0.0133	6.89
0.0166	6.90
0.0200	6.98
0.0233	7.12
0.0266	7.04
0.0300	4.07
0.0333	7.14
0.0500	7.49
0.0666	7.78
0.0833	8.07
0.1000	8.38
0.1166	8.62
0.1333	8.91
0.1500	9.09
0.1666	9.29
0.1833	9.42
0.2000	9.58
0.2166	9.78
0.2333	9.88
0.2500	9.98
0.2666	10.11
0.2833	10.19
0.3000	10.22
0.3166	10.30
0.3333	10.34

Table 4. (continued)

0.4167	10.63
0.5000	10.83
0.5833	10.94
0.6667	11.18
0.7500	11.44
0.8333	11.59
0.9167	11.75
1.0000	11.48
1.0833	11.18
1.1667	10.96
1.2500	10.87
1.3333	10.82
1.4166	10.78
1.5000	10.75
1.5833	10.80
1.6667	10.77
1.7500	10.71
1.8333	10.75
1.9167	10.76
2.0000	10.73
2.5000	10.85
3.0000	10.89
3.5000	10.33
4.0000	10.39
4.5000	10.37
5.0000	10.15
5.5000	10.36
6.0000	10.58
6.5000	10.63
7.0000	10.65
7.5000	10.64
8.0000	10.85
8.5000	10.76
9.0000	10.84
9.5000	10.81
10.0000	11.03
12.0000	10.96
14.0000	11.20
16.0000	10.81
18.0000	11.34
20.0000	11.42
22.0000	11.53
24.0000	11.52
26.0000	11.56
28.0000	11.55
30.0000	11.68
32.0000	11.66
34.0000	11.67
36.0000	11.72
38.0000	11.76
40.0000	11.78
42.0000	11.77
44.0000	11.81
46.0000	11.84
48.0000	11.40
50.0000	11.86

Table 4. (continued)

52.0000	11.69
54.0000	11.87
56.0000	11.46
58.0000	11.97
60.0000	11.94

Table 5.  
 Drawdown Data for Constant-Rate Test  
 Well 37367

Pumping Well: 37367  
 Observation Well: 37367  
 Constant - Rate Discharge Test  
 04/13/88 15:43

Elapsed Time (min)	Drawdown Value (ft)
0.0000	0.01
0.0033	0.01
0.0066	1.49
0.0099	1.59
0.0133	0.55
0.0166	0.00
0.0200	0.64
0.0233	0.96
0.0266	0.96
0.0300	1.04
0.0333	1.16
0.0500	1.79
0.0666	2.28
0.0833	2.71
0.1000	3.12
0.1166	3.47
0.1333	3.85
0.1500	4.21
0.1666	4.44
0.1833	4.66
0.2000	4.88
0.2166	5.09
0.2333	5.30
0.2500	5.44
0.2666	5.57
0.2833	5.69
0.3000	5.85
0.3166	6.01
0.3333	6.14
0.4167	6.71
0.5000	7.12
0.5833	7.47
0.6667	7.70
0.7500	7.97
0.8333	8.16
0.9167	8.23
1.0000	8.38
1.0833	8.51
1.1667	8.60
1.2500	8.76
1.3333	8.91
1.4166	9.00
1.5000	9.11
1.5833	9.25
1.6667	9.35
1.7500	9.44
1.8333	9.50

Table 5. (continued)

1.9167	9.59
2.0000	9.65
2.5000	9.92
3.0000	10.07
3.5000	10.10
4.0000	10.17
4.5000	10.19
5.0000	10.22
5.5000	10.22
6.0000	10.25
6.5000	10.32
7.0000	10.32
7.5000	10.27
8.0000	10.35
8.5000	10.38
9.0000	10.41
9.5000	10.40
10.0000	10.43
12.0000	10.47
14.0000	10.54
16.0000	10.53
18.0000	10.54
20.0000	10.60
22.0000	10.71
24.0000	10.74
26.0000	10.77
28.0000	10.78
30.0000	10.83
32.0000	10.79
34.0000	10.90
36.0000	10.88
38.0000	10.93
40.0000	10.92
42.0000	10.96
44.0000	10.94
46.0000	10.98
48.0000	11.02
50.0000	10.97
52.0000	11.04
54.0000	11.07
56.0000	11.05
58.0000	11.12
60.0000	11.10
62.0000	11.11
64.0000	11.18
66.0000	11.10
68.0000	11.11
70.0000	11.11
72.0000	11.15
74.0000	11.13
76.0000	11.18
78.0000	11.04
80.0000	11.02
82.0000	11.02
84.0000	11.00
86.0000	11.07

Table 5. (continued)

88.0000	11.06
90.0000	11.08
92.0000	11.06
94.0000	11.08
96.0000	11.07
98.0000	11.13
100.0000	11.11
110.0000	11.14
120.0000	11.18
130.0000	11.19
140.0000	11.25
150.0000	11.31
160.0000	11.33
170.0000	11.32
180.0000	11.41
190.0000	11.42
200.0000	11.39
210.0000	11.44
220.0000	11.47
230.0000	11.49
240.0000	11.50
250.0000	11.49
260.0000	11.50
270.0000	11.51
280.0000	11.52
290.0000	11.53
300.0000	11.54
310.0000	11.56
320.0000	11.60
330.0000	11.60
340.0000	11.58
350.0000	11.60
360.0000	11.58
370.0000	11.60
380.0000	11.67
390.0000	11.64
400.0000	11.68
410.0000	11.71
420.0000	11.70
430.0000	11.70
440.0000	11.70
450.0000	11.69
460.0000	11.72
470.0000	11.77
480.0000	11.80
490.0000	11.81
500.0000	11.74
510.0000	11.80
520.0000	11.78
530.0000	11.82
540.0000	11.83
550.0000	11.83
560.0000	11.83
570.0000	11.81
580.0000	11.78
590.0000	11.90

Table 5. (continued)

600.0000	11.89
610.0000	11.88
620.0000	11.86
630.0000	11.87
640.0000	11.87
650.0000	11.88
660.0000	11.89
670.0000	11.91
680.0000	11.88
690.0000	11.87
700.0000	11.88
710.0000	11.94
720.0000	11.93
730.0000	11.91
740.0000	11.90
750.0000	11.85
760.0000	11.92
770.0000	11.95
780.0000	11.91
790.0000	11.97
800.0000	11.91
810.0000	11.94
820.0000	11.99
830.0000	11.94
840.0000	12.02
850.0000	12.00
860.0000	11.97
870.0000	11.92
880.0000	11.95
890.0000	11.96
900.0000	11.97
910.0000	11.99
920.0000	12.05
930.0000	12.05
940.0000	12.05
950.0000	12.00
960.0000	12.05
970.0000	12.07
980.0000	12.07
990.0000	12.14
1000.0000	12.12
1030.0000	12.13
1060.0000	12.06
1090.0000	12.01
1120.0000	12.04
1150.0000	12.05
1180.0000	12.11
1210.0000	12.05
1240.0000	12.14
1270.0000	12.04
1300.0000	12.07
1330.0000	12.08
1360.0000	12.12
1390.0000	12.06
1420.0000	12.08

Table 6.  
Drawdown Data for Constant-Rate Test  
Well 37400

Pumping Well: 37367  
Observation Well: 37400  
Constant Rate Discharge Test  
04/13/88 15:43

Elapsed Time (min)	Value (ft)
0.0000	0.02
0.0033	0.02
0.0066	0.02
0.0099	0.02
0.0133	0.03
0.0166	0.03
0.0200	0.02
0.0233	0.02
0.0266	0.02
0.0300	0.03
0.0333	0.03
0.0500	0.03
0.0666	0.03
0.0833	0.03
0.1000	0.03
0.1166	0.03
0.1333	0.04
0.1500	0.04
0.1666	0.05
0.1833	0.05
0.2000	0.05
0.2166	0.05
0.2333	0.05
0.2500	0.06
0.2666	0.06
0.2833	0.06
0.3000	0.06
0.3166	0.06
0.3333	0.06
0.4167	0.08
0.5000	0.09
0.5833	0.10
0.6667	0.11
0.7500	0.11
0.8333	0.11
0.9167	0.12
1.0000	0.12
1.0833	0.13
1.1667	0.13
1.2500	0.13
1.3333	0.13
1.4166	0.14
1.5000	0.15
1.5833	0.15
1.6667	0.15
1.7500	0.15
1.8333	0.16
1.9167	0.16

Table 6. (continued)

2.0000	0.16
2.5000	0.18
3.0000	0.19
3.5000	0.20
4.0000	0.21
4.5000	0.22
5.0000	0.22
5.5000	0.23
6.0000	0.24
6.5000	0.25
7.0000	0.25
7.5000	0.25
8.0000	0.26
8.5000	0.26
9.0000	0.26
9.5000	0.27
10.0000	0.27
12.0000	0.29
14.0000	0.30
16.0000	0.31
18.0000	0.33
20.0000	0.33
22.0000	0.34
24.0000	0.35
26.0000	0.36
28.0000	0.37
30.0000	0.38
32.0000	0.39
34.0000	0.39
36.0000	0.40
38.0000	0.40
40.0000	0.41
42.0000	0.42
44.0000	0.43
46.0000	0.42
48.0000	0.43
50.0000	0.43
52.0000	0.44
54.0000	0.44
56.0000	0.45
58.0000	0.46
60.0000	0.46
62.0000	0.46
64.0000	0.47
66.0000	0.47
68.0000	0.47
70.0000	0.47
72.0000	0.48
74.0000	0.48
76.0000	0.49
78.0000	0.49
80.0000	0.49
82.0000	0.49
84.0000	0.50
86.0000	0.50
88.0000	0.51

Table 6. (continued)

90.0000	0.51
92.0000	0.51
94.0000	0.51
96.0000	0.51
98.0000	0.52
100.0000	0.52
110.0000	0.53
120.0000	0.54
130.0000	0.54
140.0000	0.54
150.0000	0.55
160.0000	0.56
170.0000	0.56
180.0000	0.56
190.0000	0.56
200.0000	0.56
210.0000	0.56
220.0000	0.56
230.0000	0.56
240.0000	0.56
250.0000	0.56
260.0000	0.56
270.0000	0.56
280.0000	0.56
290.0000	0.56
300.0000	0.56
310.0000	0.56
320.0000	0.56
330.0000	0.56
340.0000	0.56
350.0000	0.56
360.0000	0.56
370.0000	0.56
380.0000	0.56
390.0000	0.56
400.0000	0.56
410.0000	0.56
420.0000	0.56
430.0000	0.56
440.0000	0.56
450.0000	0.56
460.0000	0.56
470.0000	0.56
480.0000	0.56
490.0000	0.56
500.0000	0.56
510.0000	0.56
520.0000	0.56
530.0000	0.56
540.0000	0.56
550.0000	0.56
560.0000	0.56
570.0000	0.56
580.0000	0.56
590.0000	0.56
600.0000	0.56

Table 6. (continued)

610.0000	0.56
620.0000	0.56
630.0000	0.56
640.0000	0.56
650.0000	0.56
660.0000	0.56
670.0000	0.56
680.0000	0.56
690.0000	0.56
700.0000	0.56
710.0000	0.56
720.0000	0.56
730.0000	0.56
740.0000	0.56
750.0000	0.56
760.0000	0.56
770.0000	0.56
780.0000	0.56
790.0000	0.56
800.0000	0.56
810.0000	0.57
820.0000	0.56
830.0000	0.57
840.0000	0.57
850.0000	0.57
860.0000	0.57
870.0000	0.57
880.0000	0.57
890.0000	0.57
900.0000	0.57
910.0000	0.57
920.0000	0.57
930.0000	0.57
940.0000	0.57
950.0000	0.57
960.0000	0.58
970.0000	0.58
980.0000	0.58
990.0000	0.58
1000.0000	0.58
1030.0000	0.58
1060.0000	0.58
1090.0000	0.57
1120.0000	0.57
1150.0000	0.57
1180.0000	0.57
1210.0000	0.57
1240.0000	0.56
1270.0000	0.56
1300.0000	0.57
1330.0000	0.56
1360.0000	0.57
1390.0000	0.57
1420.0000	0.57

Table 7.  
Drawdown Data for Constant-Rate Test  
Well 37401

Pumping Well: 37367  
Observation Well: 37401  
Constant Rate Discharge Test  
04/13/88 15:43

Elapsed Time (min)	Drawdown Value (ft)
0.0000	0.00
0.0033	0.00
0.0066	0.00
0.0099	0.00
0.0133	0.00
0.0166	0.01
0.0200	0.01
0.0233	0.01
0.0266	0.01
0.0300	0.01
0.0333	0.01
0.0500	0.01
0.0666	0.01
0.0833	0.01
0.1000	0.01
0.1166	0.01
0.1333	0.00
0.1500	0.01
0.1666	0.01
0.1833	0.01
0.2000	0.01
0.2166	0.01
0.2333	0.01
0.2500	0.01
0.2666	0.01
0.2833	0.01
0.3000	0.01
0.3166	0.01
0.3333	0.01
0.4167	0.01
0.5000	0.02
0.5833	0.02
0.6667	0.02
0.7500	0.02
0.8333	0.02
0.9167	0.03
1.0000	0.03
1.0833	0.03
1.1667	0.04
1.2500	0.04
1.3333	0.04
1.4167	0.04
1.5000	0.04
1.5833	0.05
1.6667	0.05
1.7500	0.05
1.8333	0.05

Table 7. (continued)

1.9167	0.05
2.0000	0.06
2.5000	0.07
3.0000	0.07
3.5000	0.08
4.0000	0.09
4.5000	0.09
5.0000	0.10
5.5000	0.10
6.0000	0.11
6.5000	0.12
7.0000	0.12
7.5000	0.13
8.0000	0.13
8.5000	0.13
9.0000	0.14
9.5000	0.14
10.0000	0.15
12.0000	0.16
14.0000	0.17
16.0000	0.18
18.0000	0.18
20.0000	0.18
22.0000	0.19
24.0000	0.21
26.0000	0.19
28.0000	0.20
30.0000	0.21
32.0000	0.21
34.0000	0.21
36.0000	0.22
38.0000	0.22
40.0000	0.23
42.0000	0.24
44.0000	0.24
46.0000	0.24
48.0000	0.24
50.0000	0.23
52.0000	0.24
54.0000	0.23
56.0000	0.24
58.0000	0.24
60.0000	0.24
62.0000	0.25
64.0000	0.25
66.0000	0.24
68.0000	0.24
70.0000	0.24
72.0000	0.25
74.0000	0.26
76.0000	0.25
78.0000	0.25
80.0000	0.25
82.0000	0.25
84.0000	0.25
86.0000	0.26

Table 7. (continued)

88.0000	0.26
90.0000	0.26
92.0000	0.26
94.0000	0.26
96.0000	0.26
98.0000	0.27
100.0000	0.27
110.0000	0.26
120.0000	0.26
130.0000	0.27
140.0000	0.28
150.0000	0.27
160.0000	0.27
170.0000	0.27
180.0000	0.27
190.0000	0.27
200.0000	0.26
210.0000	0.26
220.0000	0.26
230.0000	0.26
240.0000	0.26
250.0000	0.26
260.0000	0.26
270.0000	0.27
280.0000	0.26
290.0000	0.26
300.0000	0.26
310.0000	0.26
320.0000	0.27
330.0000	0.26
340.0000	0.26
350.0000	0.26
360.0000	0.26
370.0000	0.26
380.0000	0.27
390.0000	0.27
400.0000	0.26
410.0000	0.26
420.0000	0.26
430.0000	0.26
440.0000	0.27
450.0000	0.27
460.0000	0.26
470.0000	0.26
480.0000	0.26
490.0000	0.26
500.0000	0.27
510.0000	0.27
520.0000	0.27
530.0000	0.26
540.0000	0.27
550.0000	0.26
560.0000	0.27
570.0000	0.27
580.0000	0.27
590.0000	0.27

Table 7. (continued)

600.0000	0.27
610.0000	0.27
620.0000	0.28
630.0000	0.28
640.0000	0.27
650.0000	0.27
660.0000	0.27
670.0000	0.27
680.0000	0.28
690.0000	0.28
700.0000	0.28
710.0000	0.28
720.0000	0.27
730.0000	0.27
740.0000	0.28
750.0000	0.28
760.0000	0.28
770.0000	0.27
780.0000	0.27
790.0000	0.28
800.0000	0.29
810.0000	0.29
820.0000	0.28
830.0000	0.28
840.0000	0.29
850.0000	0.28
860.0000	0.29
870.0000	0.29
880.0000	0.29
890.0000	0.29
900.0000	0.28
910.0000	0.29
920.0000	0.30
930.0000	0.30
940.0000	0.30
950.0000	0.30
960.0000	0.30
970.0000	0.29
980.0000	0.30
990.0000	0.30
1000.0000	0.30
1030.0000	0.29
1060.0000	0.31
1090.0000	0.30
1120.0000	0.30
1150.0000	0.29
1180.0000	0.32
1210.0000	0.31
1240.0000	0.29
1270.0000	0.31
1300.0000	0.33
1330.0000	0.30
1360.0000	0.31
1390.0000	0.33
1420.0000	0.32

Table 8.

Residual Drawdown Data for Recovery Test  
Well 37367

Pumping Well: 37367  
Observation Well: 37367  
Recovery Test  
04/14/88 15:43

Elapsed Time (min)	Drawdown Value (ft)
0.0000	12.10
0.0033	12.12
0.0066	11.68
0.0099	11.66
0.0133	11.45
0.0166	11.21
0.0200	10.97
0.0233	10.76
0.0266	10.55
0.0300	10.35
0.0333	10.13
0.0500	9.12
0.0666	8.26
0.0833	7.58
0.1000	7.00
0.1166	6.45
0.1333	6.03
0.1500	5.63
0.1666	5.29
0.1833	5.00
0.2000	4.75
0.2166	4.51
0.2333	4.27
0.2500	4.05
0.2666	3.83
0.2833	3.60
0.3000	3.39
0.3166	3.20
0.3333	3.05
0.4167	2.47
0.5000	2.01
0.5833	1.70
0.6667	1.47
0.7500	1.31
0.8333	1.18
0.9167	1.08
1.0000	0.99
1.0833	0.92
1.1667	0.86
1.2500	0.80
1.3333	0.75
1.4166	0.72
1.5000	0.69
1.5833	0.66
1.6667	0.64
1.7500	0.62
1.8333	0.61

Table 8. (continued)

1.9167	0.59
2.0000	0.58
2.5000	0.54
3.0000	0.50
3.5000	0.48
4.0000	0.47
4.5000	0.45
5.0000	0.45
5.5000	0.43
6.0000	0.43
6.5000	0.42
7.0000	0.42
7.5000	0.41
8.0000	0.40
8.5000	0.39
9.0000	0.38
9.5000	0.38
10.0000	0.37
12.0000	0.35
14.0000	0.33
16.0000	0.32
18.0000	0.31
20.0000	0.30
22.0000	0.29
24.0000	0.28
26.0000	0.27
28.0000	0.27
30.0000	0.26
32.0000	0.25
34.0000	0.25
36.0000	0.24
38.0000	0.24
40.0000	0.23
42.0000	0.23
44.0000	0.23
46.0000	0.22
48.0000	0.22
50.0000	0.21
52.0000	0.21
54.0000	0.21
56.0000	0.20
58.0000	0.20
60.0000	0.20
62.0000	0.20
64.0000	0.20
66.0000	0.19
68.0000	0.19
70.0000	0.09
72.0000	0.18
74.0000	0.18
76.0000	0.18
78.0000	0.18
80.0000	0.18
82.0000	0.18
84.0000	0.17
86.0000	0.17

Table 8. (continued)

88.0000	0.17
90.0000	0.17
92.0000	0.16
94.0000	0.16
96.0000	0.16
98.0000	0.16
100.0000	0.16
110.0000	0.15
120.0000	0.14
130.0000	0.13
140.0000	0.13
150.0000	0.12
160.0000	0.12
170.0000	0.11
180.0000	0.10
190.0000	0.10
200.0000	0.09
210.0000	0.09
220.0000	0.09
230.0000	0.08

Table 9.  
Residual Drawdown Data for Recovery Test  
Well 37400

Pumping Well: 37367  
Observation Well: 37400  
Recovery Test  
04/14 15:36

Elapsed Time (min)	Drawdown Value (ft)
0.0000	0.58
0.0033	0.58
0.0066	0.58
0.0099	0.58
0.0133	0.58
0.0166	0.58
0.0200	0.58
0.0233	0.58
0.0266	0.58
0.0300	0.58
0.0333	0.58
0.0500	0.58
0.0666	0.58
0.0833	0.58
0.1000	0.57
0.1166	0.57
0.1333	0.57
0.1500	0.57
0.1666	0.56
0.1833	0.56
0.2000	0.56
0.2166	0.55
0.2333	0.55
0.2500	0.55
0.2666	0.55
0.2833	0.54
0.3000	0.54
0.3166	0.54
0.3333	0.54
0.4167	0.53
0.5000	0.52
0.5833	0.51
0.6667	0.50
0.7500	0.50
0.8333	0.49
0.9167	0.49
1.0000	0.49
1.0833	0.48
1.1667	0.47
1.2500	0.47
1.3333	0.47
1.4166	0.47
1.5000	0.46
1.5833	0.46
1.6667	0.46
1.7500	0.46
1.8333	0.45

Table 9. (continued)

1.9167	0.45
2.0000	0.45
2.5000	0.44
3.0000	0.42
3.5000	0.42
4.0000	0.41
4.5000	0.40
5.0000	0.40
5.5000	0.39
6.0000	0.39
6.5000	0.39
7.0000	0.38
7.5000	0.38
8.0000	0.37
8.5000	0.36
9.0000	0.36
9.5000	0.36
10.0000	0.35
12.0000	0.34
14.0000	0.32
16.0000	0.32
18.0000	0.31
20.0000	0.30
22.0000	0.30
24.0000	0.29
26.0000	0.28
28.0000	0.28
30.0000	0.28
32.0000	0.27
34.0000	0.27
36.0000	0.27
38.0000	0.27
40.0000	0.26
42.0000	0.26
44.0000	0.26
46.0000	0.26
48.0000	0.26
50.0000	0.26
52.0000	0.26
54.0000	0.25
56.0000	0.25
58.0000	0.25
60.0000	0.25
62.0000	0.25
64.0000	0.25
66.0000	0.24
68.0000	0.24
70.0000	0.24
72.0000	0.24
74.0000	0.24
76.0000	0.24
78.0000	0.24
80.0000	0.24
82.0000	0.23
84.0000	0.23
86.0000	0.23

Table 9. (continued)

88.0000	0.23
90.0000	0.23
92.0000	0.23
94.0000	0.23
96.0000	0.23
98.0000	0.22
100.0000	0.23
110.0000	0.22
120.0000	0.21
130.0000	0.20
140.0000	0.19
150.0000	0.19
160.0000	0.18
170.0000	0.17
180.0000	0.17
190.0000	0.16
200.0000	0.16
210.0000	0.15
220.0000	0.15
230.0000	0.14

Table 10.  
Residual Drawdown Data for Recovery Test  
Well 37401

Pumping Well: 37367  
Observation Well: 37401  
Recovery Test  
04/14/88 15:43

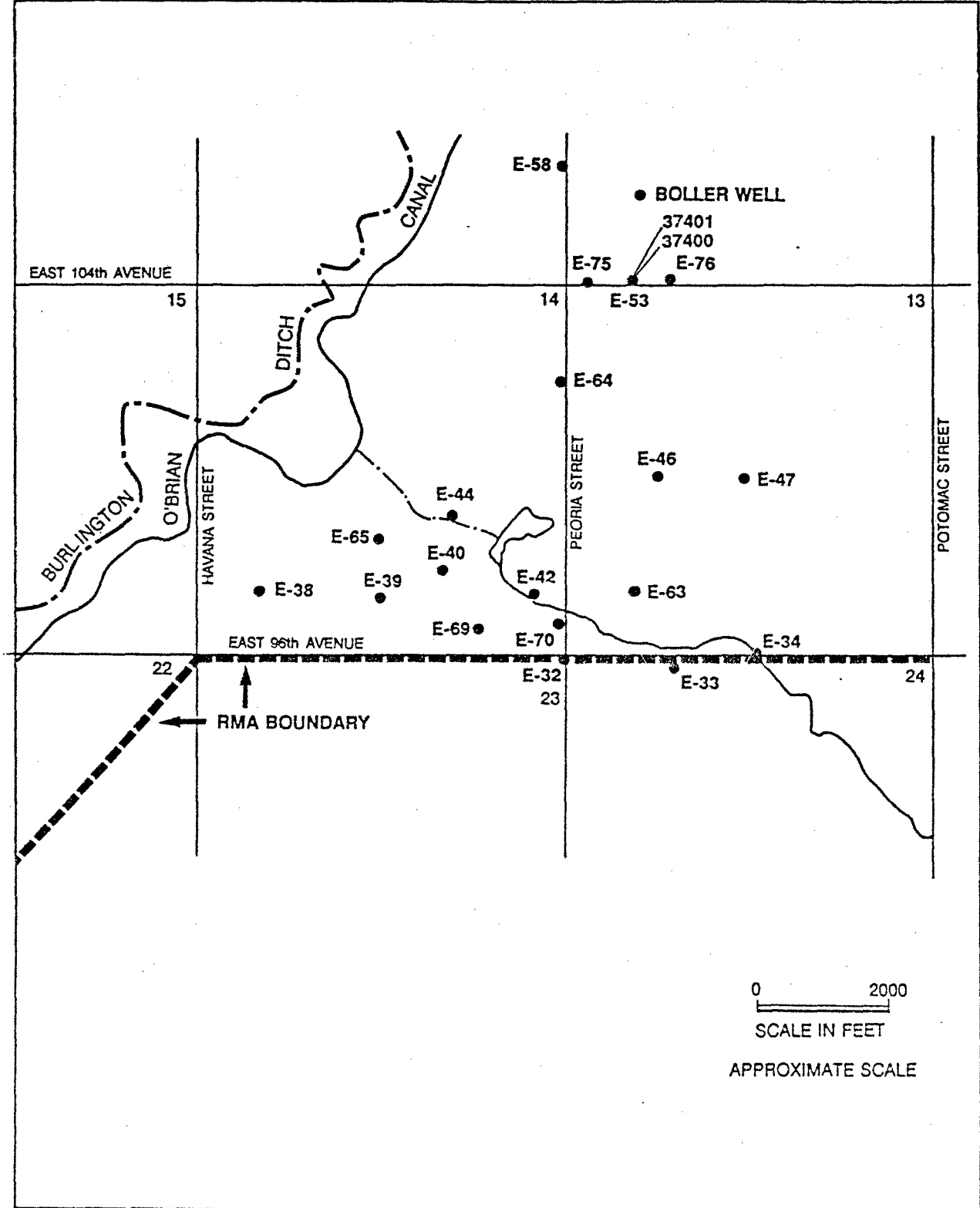
Elapsed Time (min)	Drawdown Value (ft)
0.0000	0.36
0.0033	0.36
0.0066	0.36
0.0099	0.36
0.0133	0.36
0.0166	0.36
0.0200	0.36
0.0233	0.36
0.0266	0.36
0.0300	0.36
0.0333	0.36
0.0500	0.36
0.0666	0.36
0.0833	0.36
0.1000	0.36
0.1166	0.36
0.1333	0.36
0.1500	0.36
0.1666	0.36
0.1833	0.36
0.2000	0.36
0.2166	0.36
0.2333	0.36
0.2500	0.36
0.2666	0.36
0.2833	0.36
0.3000	0.36
0.3166	0.36
0.3333	0.36
0.4167	0.36
0.5000	0.36
0.5833	0.36
0.6667	0.36
0.7500	0.36
0.8333	0.36
0.9167	0.36
1.0000	0.35
1.0833	0.35
1.1667	0.35
1.2500	0.35
1.3333	0.34
1.4166	0.34
1.5000	0.34
1.5833	0.33
1.6667	0.33
1.7500	0.33
1.8333	0.32

Table 10. (continued)

1.9167	0.32
2.0000	0.32
2.5000	0.32
3.0000	0.31
3.5000	0.30
4.0000	0.30
4.5000	0.30
5.0000	0.30
5.5000	0.30
6.0000	0.30
6.5000	0.30
7.0000	0.30
7.5000	0.30
8.0000	0.30
8.5000	0.29
9.0000	0.28
9.5000	0.28
10.0000	0.28
12.0000	0.26
14.0000	0.23
16.0000	0.22
18.0000	0.22
20.0000	0.22
22.0000	0.21
24.0000	0.21
26.0000	0.19
28.0000	0.19
30.0000	0.19
32.0000	0.19
34.0000	0.20
36.0000	0.19
38.0000	0.19
40.0000	0.19
42.0000	0.18
44.0000	0.18
46.0000	0.18
48.0000	0.18
50.0000	0.18
52.0000	0.18
54.0000	0.17
56.0000	0.17
58.0000	0.17
60.0000	0.17
62.0000	0.16
64.0000	0.16
66.0000	0.16
68.0000	0.15
70.0000	0.15
72.0000	0.15
74.0000	0.14
76.0000	0.14
78.0000	0.14
80.0000	0.14
82.0000	0.14
84.0000	0.13
86.0000	0.13

Table 10. (continued)

88.0000	0.13
90.0000	0.13
92.0000	0.13
94.0000	0.12
96.0000	0.12
98.0000	0.12
100.0000	0.12
110.0000	0.10
120.0000	0.09
130.0000	0.08
140.0000	0.07
150.0000	0.06
160.0000	0.06
170.0000	0.04
180.0000	0.03
190.0000	0.02
200.0000	0.02
210.0000	0.01
220.0000	0.02
230.0000	0.01



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**Well Location Map**  
Rocky Mountain Arsenal  
Adams County, Colorado

PLATE

**1**

DRAWN  
NJB

JOB NUMBER  
17053.103.10

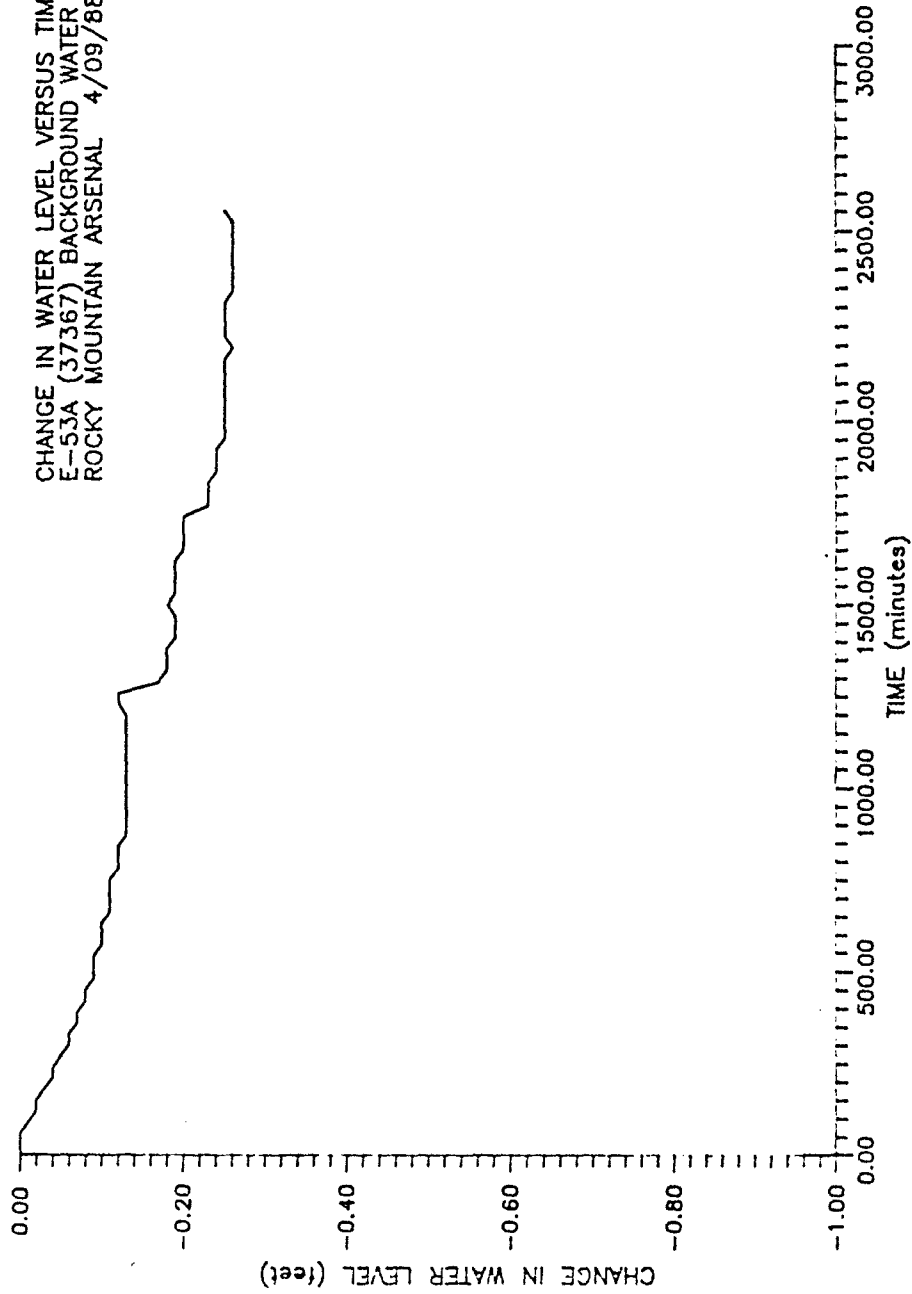
APPROVED  
*JMO*

DATE  
6/88

REVISED

DATE

CHANGE IN WATER LEVEL VERSUS TIME  
E-53A (37367) BACKGROUND WATER LEVELS  
ROCKY MOUNTAIN ARSENAL 4/09/88



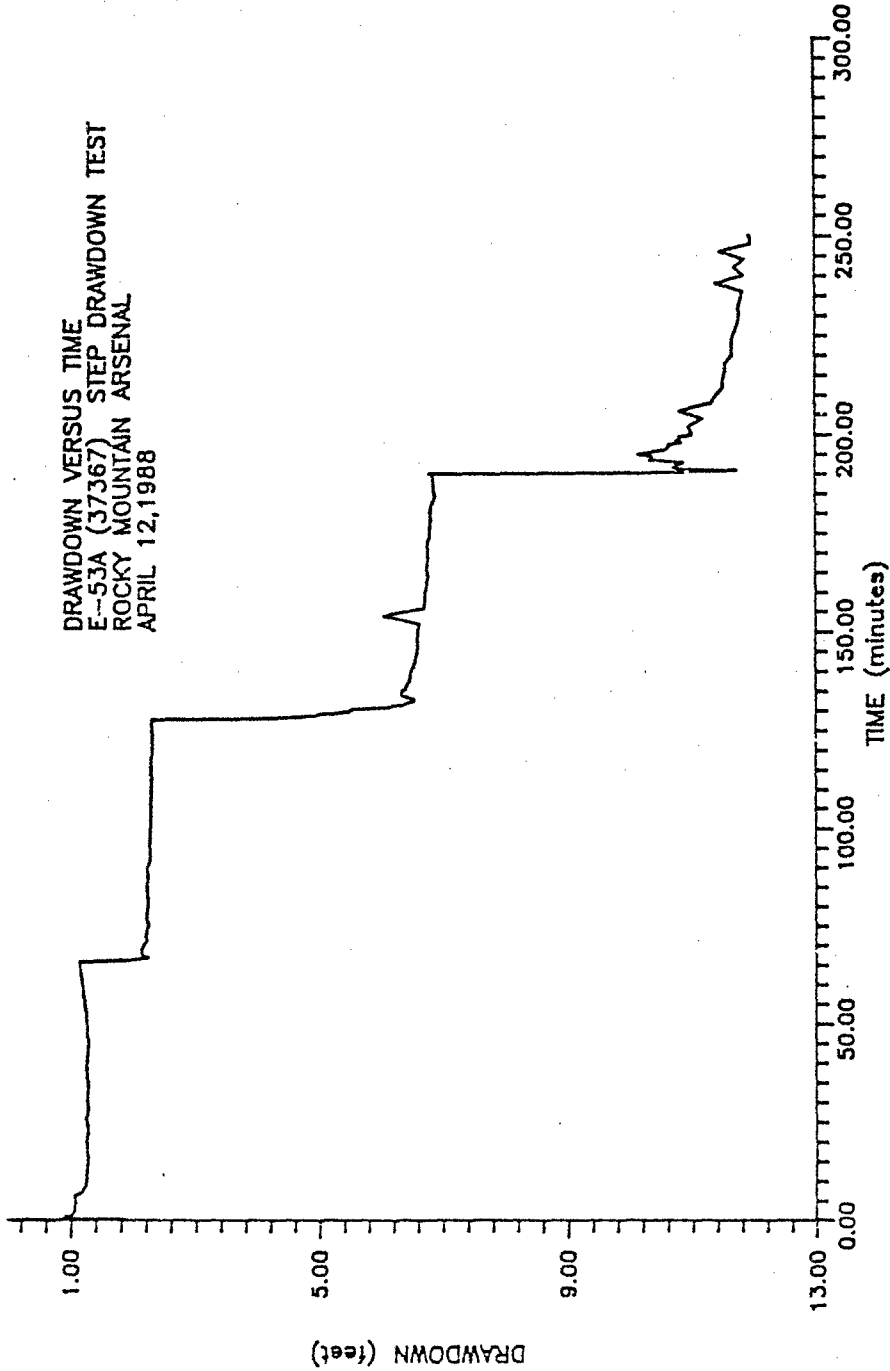
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Change in Water Level Versus Time for Well 37367  
Rocky Mountain Arsenal  
Adams County, Colorado

P. 476

2

DRAWDOWN VERSUS TIME  
E-53A (37367) STEP DRAWDOWN TEST  
ROCKY MOUNTAIN ARSENAL  
APRIL 12, 1988



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Drawdown Versus Time for Well 37367  
Step-Drawdown Test  
Rocky Mountain Arsenal  
Adams County, Colorado

PLATE

3

DRAWN  
MCI

LOG NUMBER  
17053.103.10

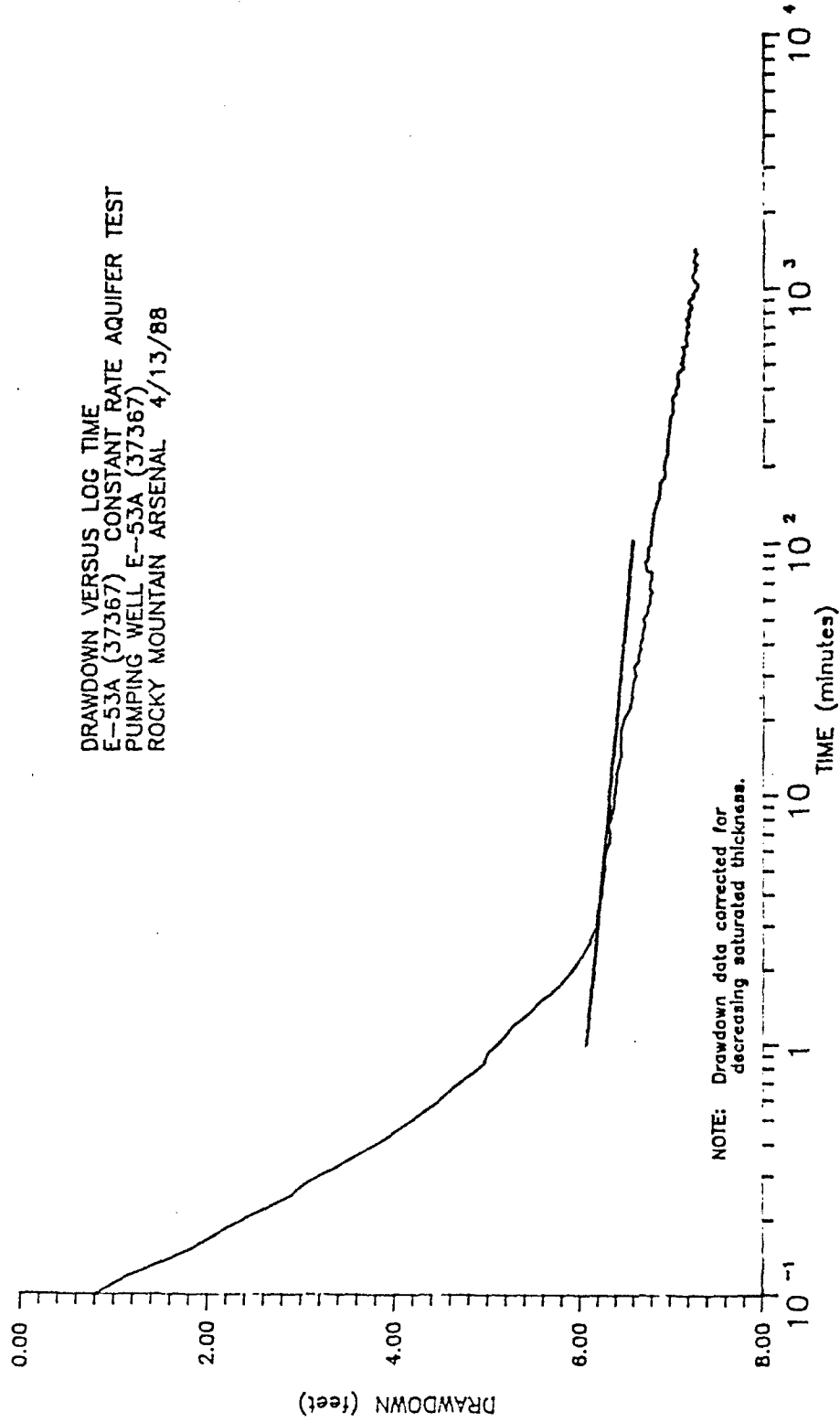
APPROVED  
*[Signature]*

DATE  
5/88

REVISED

DATE

DRAWDOWN VERSUS LOG TIME  
E-53A (37367) CONSTANT RATE AQUIFER TEST  
PUMPING WELL E-53A (37367)  
ROCKY MOUNTAIN ARSENAL 4/13/88



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Drawdown Versus Log Time for Well 37367  
Rocky Mountain Arsenal  
Adams County, Colorado

PLATE

4

DRAWN  
MOI

JOB NUMBER  
17053.103.10

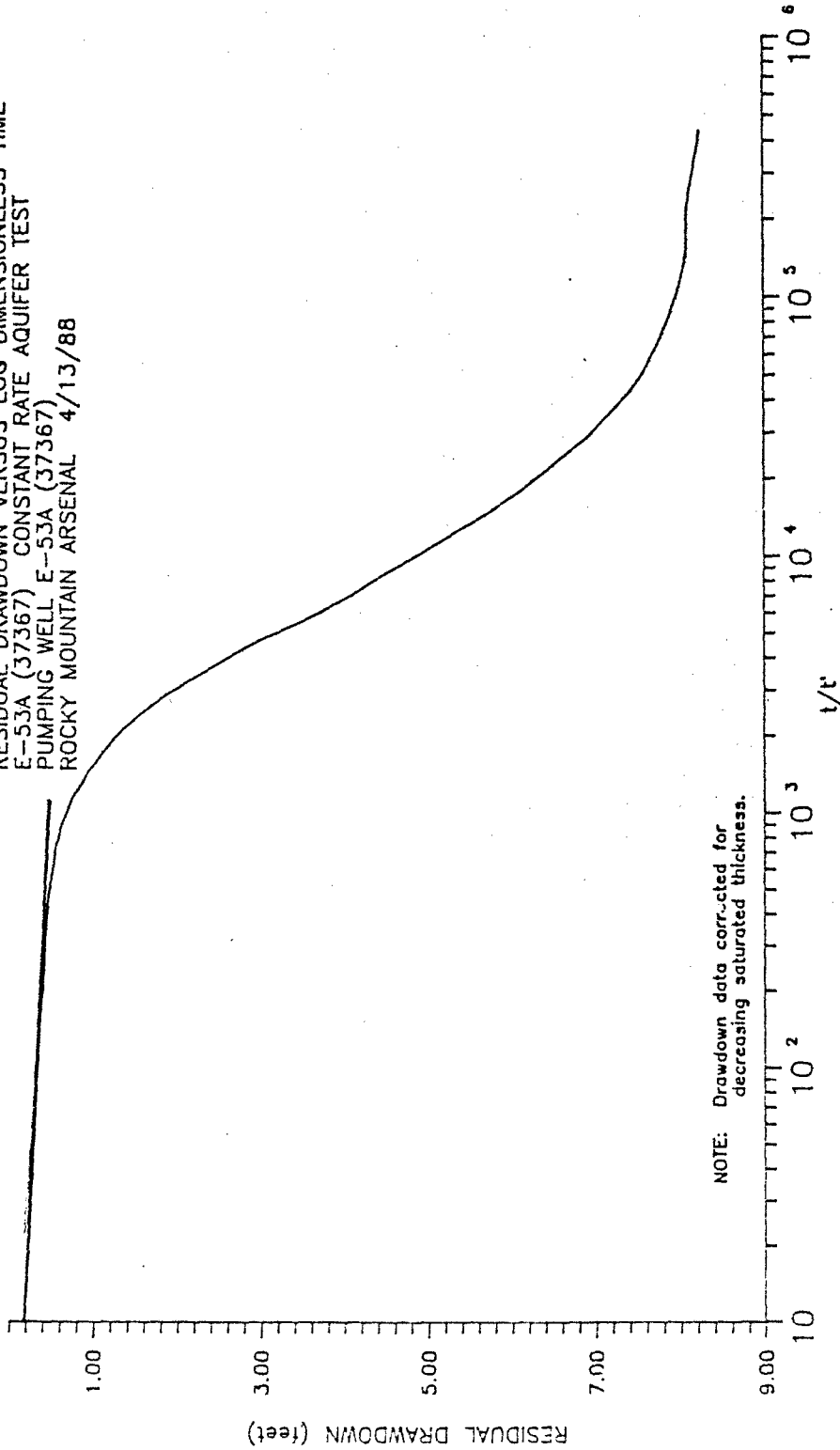
APPROVED  
*jm0*

DATE  
5/88

REVISED

DATE

RESIDUAL DRAWDOWN VERSUS LOG DIMENSIONLESS TIME  
E-53A (37367) CONSTANT RATE AQUIFER TEST  
PUMPING WELL E-53A (37367)  
ROCKY MOUNTAIN ARSENAL 4/13/88



NOTE: Drawdown data corrected for decreasing saturated thickness.



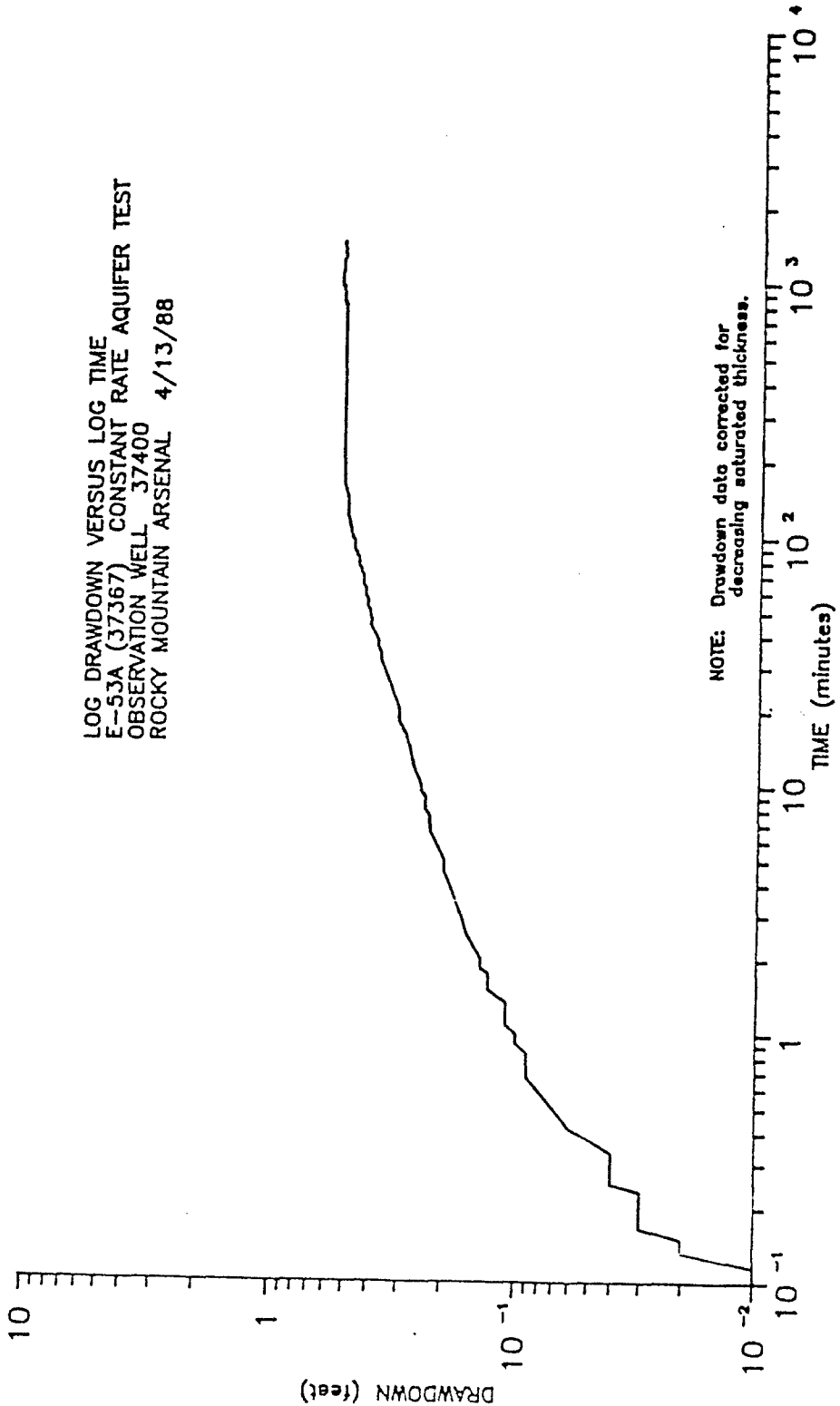
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Residual Drawdown Versus Log Dimensionless Time  
for Well 37367  
Rocky Mountain Arsenal  
Adams County, Colorado

PLATE

5

LOG DRAWDOWN VERSUS LOG TIME  
E-53A (37367) CONSTANT RATE AQUIFER TEST  
OBSERVATION WELL 37400  
ROCKY MOUNTAIN ARSENAL 4/13/88



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Log Drawdown Versus Log Time for Well 37400  
Rocky Mountain Arsenal  
Adams County, Colorado

PLATE

6

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MOI

DATE  
17053,103.10

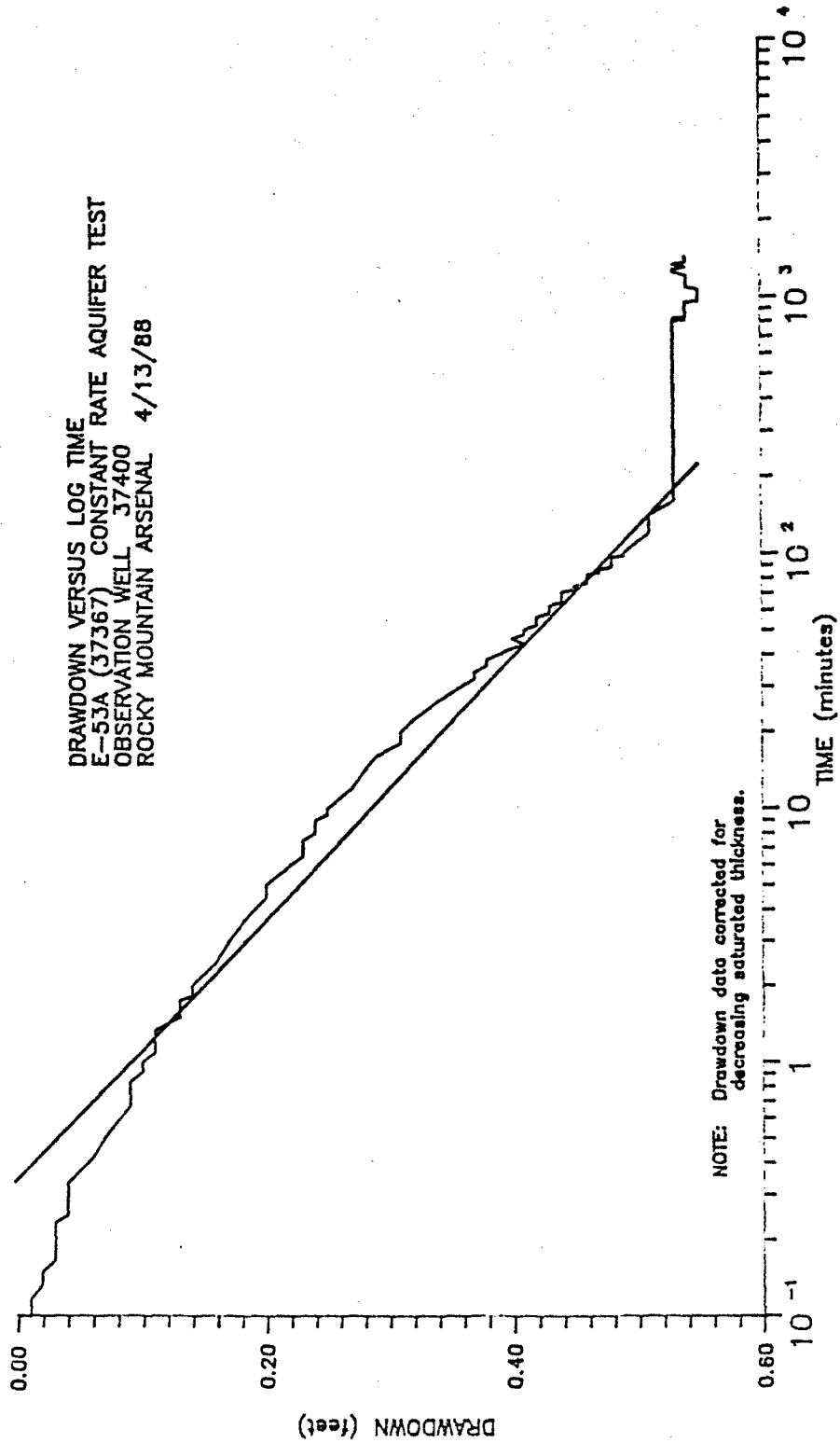
BY  
*mo*

DATE  
5/88

REVISED

DATE

DRAWDOWN VERSUS LOG TIME  
E-53A (37367) CONSTANT RATE AQUIFER TEST  
OBSERVATION WELL 37400  
ROCKY MOUNTAIN ARSENAL 4/13/88



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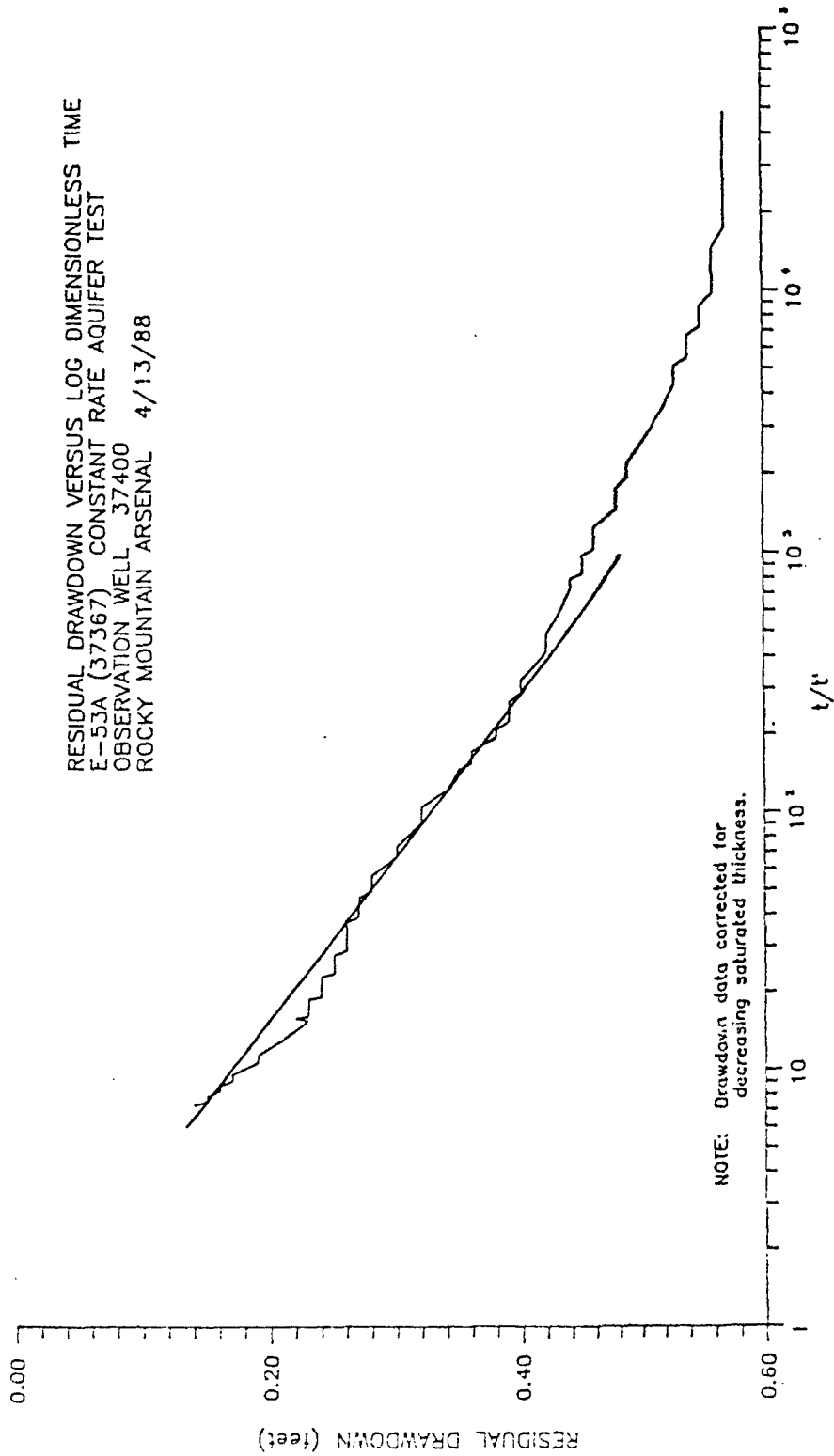
Drawdown Versus Log Time for Well 37400  
Rocky Mountain Arsenal  
Adams County, Colorado

PLATE

7

DRAWN MOI	JOB NUMBER 17053.103.10	APPROVED <i>[Signature]</i>	DATE 5/88	REVISED	DATE
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RESIDUAL DRAWDOWN VERSUS LOG DIMENSIONLESS TIME  
 E-53A (37367) CONSTANT RATE AQUIFER TEST  
 OBSERVATION WELL 37400  
 ROCKY MOUNTAIN ARSENAL 4/13/88



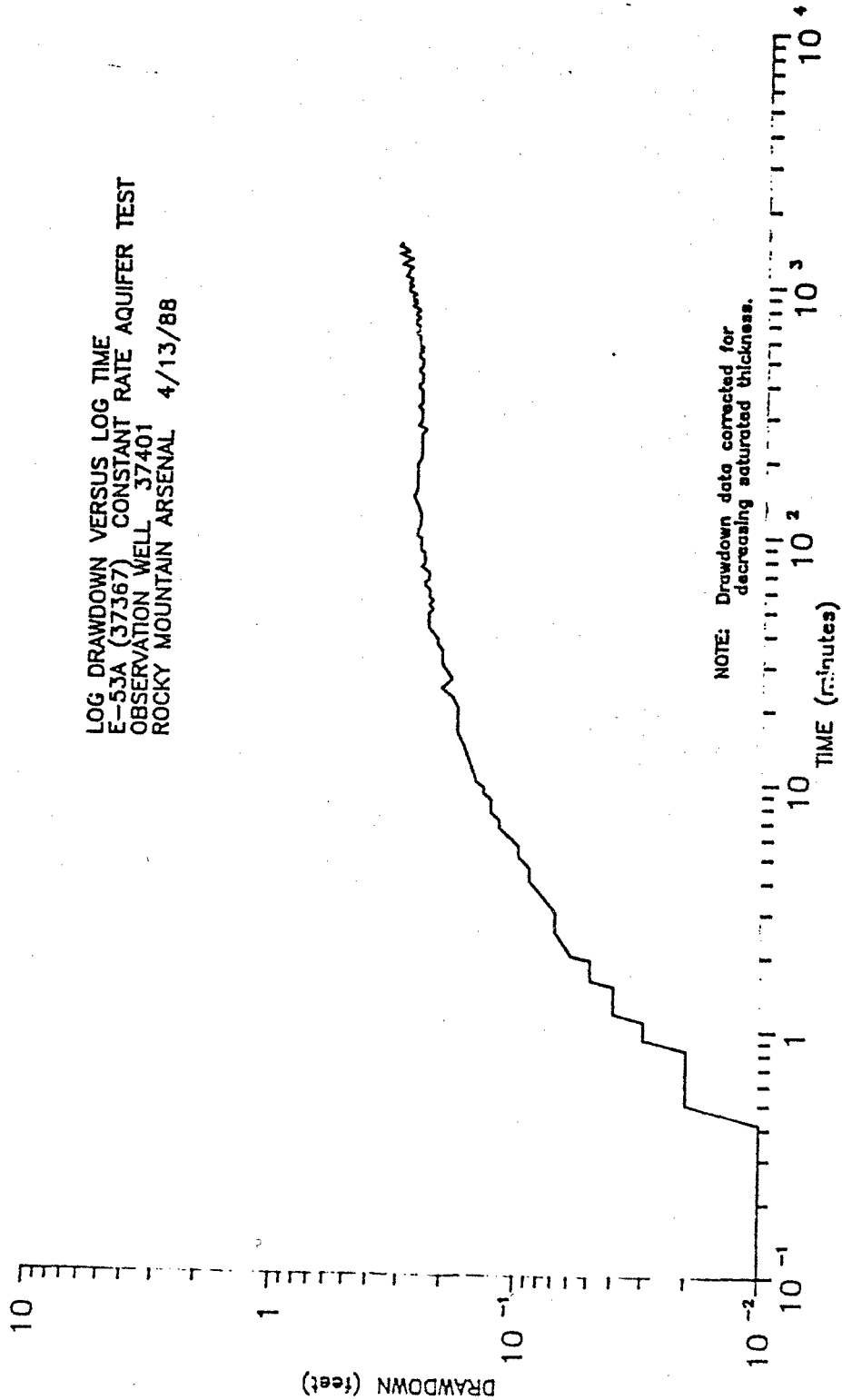
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Residual Drawdown Versus Log Dimensionless Time  
 for Well 37400  
 Rocky Mountain Arsenal  
 Adams County, Colorado

PLATE  
 8

DRAWN	BY NUMBER	APPROVED	DATE	REVISED	DATE
MOI	17053 103.10	<i>[Signature]</i>	5'83		

LOG DRAWDOWN VERSUS LOG TIME  
E-53A (37367) CONSTANT RATE AQUIFER TEST  
OBSERVATION WELL 37401  
ROCKY MOUNTAIN ARSENAL 4/13/88



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Log Drawdown Versus Log Time for Well 37401  
Rocky Mountain Arsenal  
Adams County, Colorado

PLATE

9

DRAWN  
MOI

JOB NUMBER  
17053.103.10

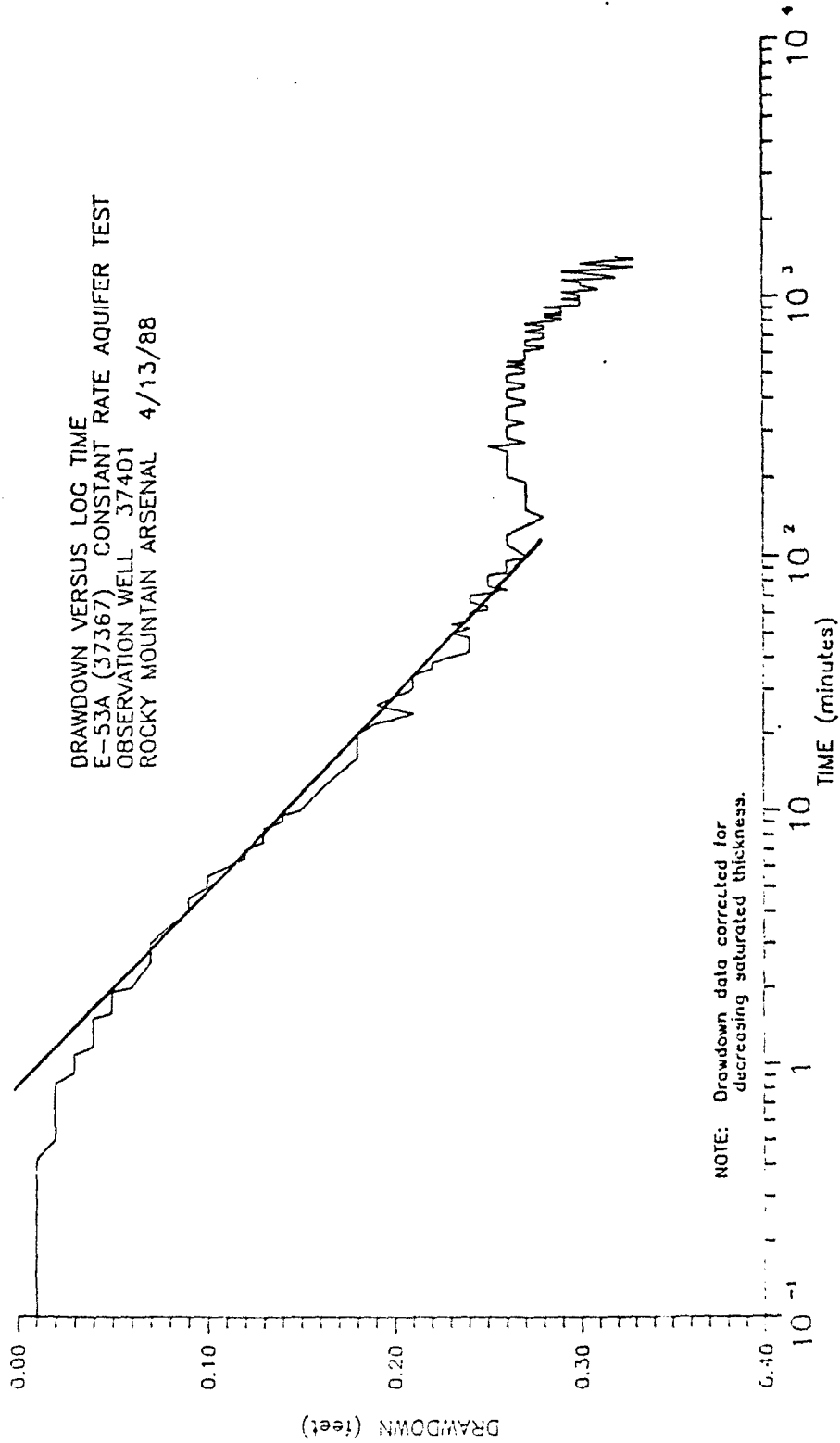
APPROVED  
*[Signature]*

DATE  
5/88

REVISED

DATE

DRAWDOWN VERSUS LOG TIME  
E-53A (37367) CONSTANT RATE AQUIFER TEST  
OBSERVATION WELL 37401  
ROCKY MOUNTAIN ARSENAL 4/13/88

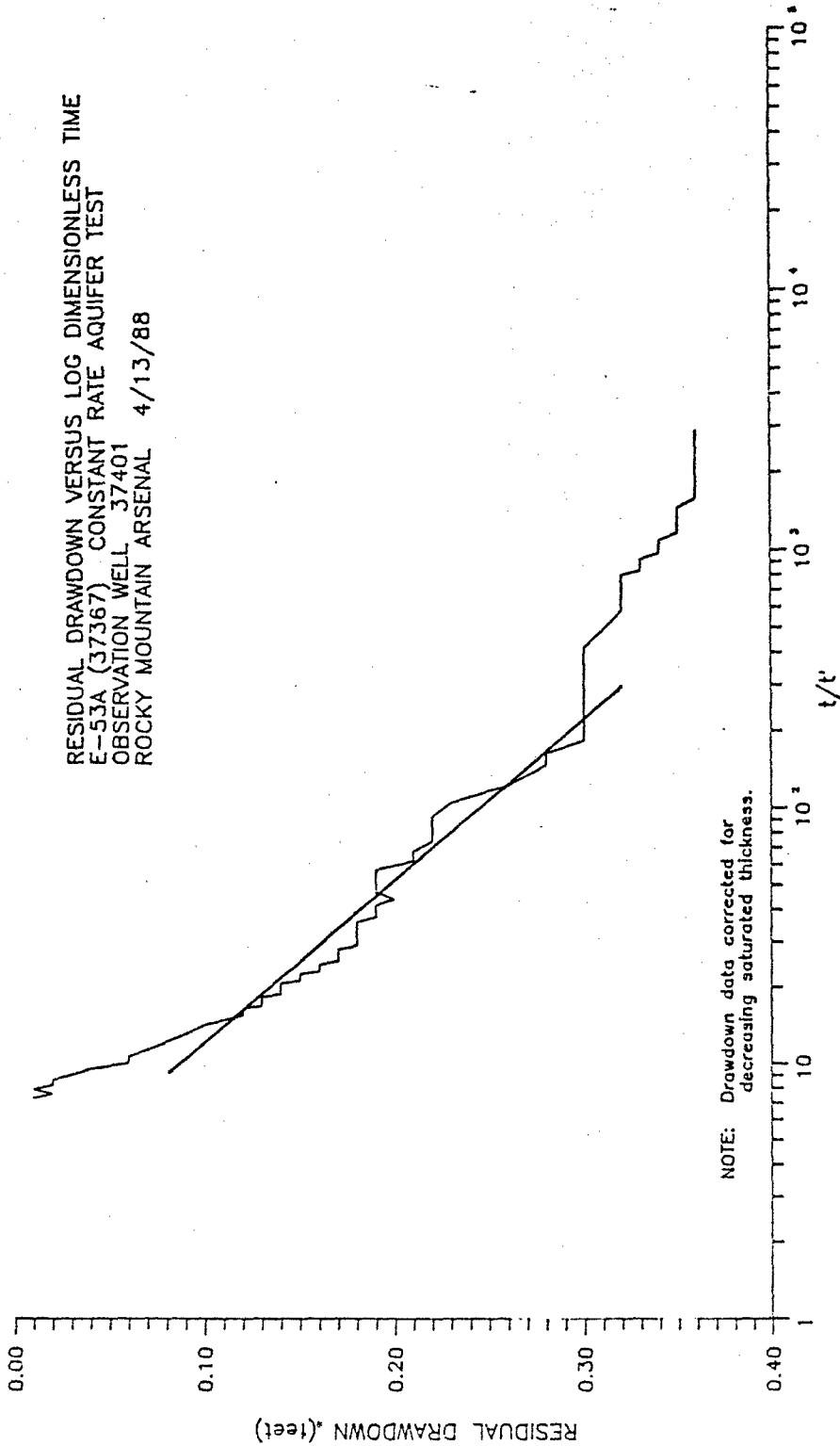


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Drawdown Versus Log Time for Well 37401  
Rocky Mountain Arsenal  
Adams County, Colorado

10

RESIDUAL DRAWDOWN VERSUS LOG DIMENSIONLESS TIME  
 E-53A (37367) CONSTANT RATE AQUIFER TEST  
 OBSERVATION WELL 37401  
 ROCKY MOUNTAIN ARSENAL 4/13/88



**Harding Lawson Associates**  
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**Residual Drawdown Versus Log Dimensionless Time**  
**for Well 337401**  
 Rocky Mountain Arsenal  
 Adams County, Colorado

PLATE

**11**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
MOI	17053.103.10	<i>[Signature]</i>	5/88		

Sheet 1. Modified Non-Equilibrium Method for Well 37367

Modified Non-Equilibrium Method (Jacob, 1950)

Pumping Well 37367  
Observation Well 37367  
Reference Plate 4

Q	Constant Pumping Rate	32.3	gpm
$\Delta s$	Change in Drawdown per One Log Cycle	0.28	feet
b	Saturated Aquifer Thickness	19	feet

TRANSMISSIVITY (T)

T	= (264 Q)/ $\Delta s$
T	= 30,000 gpd/ft
T	= 4,000 ft <sup>2</sup> / day
T	= 370 m <sup>2</sup> /day

HYDRAULIC CONDUCTIVITY (K)

K	= T/b
K	= 210 ft/day
K	= 0.074 cm/sec

Sheet 2. Residual Drawdown Method for Well 37367

Residual Drawdown Method (Theis, 1935)

Pumping Well 37367  
Observation Well 37367  
Reference Plate 5

Q	Constant Pumping Rate	32.3	gpm
$\Delta s$	Change in Drawdown per One Log Cycle	0.15	feet
b	Saturated Aquifer Thickness	19	feet

TRANSMISSIVITY (T)

T	= (264 Q)/ $\Delta s$
T	= 57,000 gpd/ft
T	= 7,600 ft <sup>2</sup> /day
T	= 710 m <sup>2</sup> /day

HYDRAULIC CONDUCTIVITY (K)

K	= T/b
K	= 400 ft/day
K	= 0.14 cm/sec

Sheet 3. Unconfined Aquifer Type Curve Method for Well 37400

Unconfined Aquifer Type Curve Method (Prickett, 1965)

Pumping Well 37367  
Observation Well 37400  
Reference Plate 6

Q	Constant Pumping Rate	32.3 gpm
b	Saturated Aquifer Thickness	19 feet
r	Distance to Pumping Well	39.36 feet

Early-time type curve match point:

$$1/u_A = 1.0 \quad u_A = 1.0 \quad W(u_A, r/D) = 1.0 \quad r/D = 0.0$$
$$s \text{ (drawdown)} = 0.068 \text{ ft} \quad t \text{ (time)} = 0.14 \text{ min.} = 1.0 \times 10^{-4} \text{ days}$$

TRANSMISSIVITY (T)

$$T = 114.6 Q W(u_A, r/D) / s$$
$$T = 54,000 \text{ gpd/ft}$$
$$T = 7,200 \text{ ft}^2/\text{day}$$
$$T = 670 \text{ m}^2/\text{day}$$

HYDRAULIC CONDUCTIVITY (K)

$$K = T/b$$
$$K = 380 \text{ ft/day}$$
$$K = 0.13 \text{ cm/sec}$$

STORATIVITY (S)

$$S = u_A Tt/1.87r^2$$
$$= 1.9 \times 10^{-3} \text{ dimensionless}$$

Sheet 4. Modified Non-Equilibrium Method for Well 37400

Modified Non-Equilibrium Method (Jacob, 1950)

Pumping Well 37367  
Observation Well 37400  
Reference Plate 7

Q	Constant Pumping Rate	32.3 gpm
$\Delta s$	Change in Drawdown per One Log Cycle	0.19 feet
b	Saturated Aquifer Thickness	19 feet
$t_0$	Time to Zero Drawdown Intercept	0.34 min. $1.2 \times 10^{-4}$ days
r	Distance to Pumping Well	39.36 feet

TRANSMISSIVITY (T)

$$T = (264 Q) / \Delta s$$
$$T = 45,000 \text{ gpd/ft}$$
$$T = 6,000 \text{ ft}^2/\text{day}$$
$$T = 560 \text{ m}^2/\text{day}$$

HYDRAULIC CONDUCTIVITY (K)

$$K = T/b$$
$$K = 320 \text{ ft/day}$$
$$K = 0.11 \text{ cm/sec}$$

STORATIVITY (S)

$$S = 0.3 T t_0 / r^2$$
$$S = 2.1 \times 10^{-3} \text{ dimensionless}$$

Time (t) after which  $u < 0.01$

$$t = 1.87 r^2 s / uT$$
$$t = 0.007 \text{ days}$$
$$t = 10 \text{ min}$$

Sheet 5. Residual Drawdown Method for Well 37400

Residual Drawdown Method (Theis, 1935)

Pumping Well 37367  
Observation Well 37400  
Reference Plate 8

Q	Constant Pumping Rate	32.3	gpm
$\Delta s$	Change in Drawdown per One Log Cycle	0.16	feet
b	Saturated Aquifer Thickness	19	feet

TRANSMISSIVITY (T)

$$T = (264 Q) / \Delta s$$
$$T = 53,000 \text{ gpd/ft}$$
$$T = 7,100 \text{ ft}^2/\text{day}$$
$$T = 660 \text{ m}^2/\text{day}$$

HYDRAULIC CONDUCTIVITY (K)

$$K = T/b$$
$$K = 370 \text{ ft/day}$$
$$K = 0.13 \text{ cm/sec}$$

Sheet 6. Unconfined Aquifer Type Curve Method for Well 37401

Unconfined Aquifer Type Curve Method (Prickett, 1965)

Pumping Well 37367  
Observation Well 37401  
Reference Plate 9

Q	Constant Pumping Rate	32.3 gpm
b	Saturated Aquifer Thickness	18 feet
r	Distance to Pumping Well	81.33 feet

Early-time type curve match point:

$$1/u_A = 1.0 \quad u_A = 1.0 \quad W(u_A, r/D) = 1.0 \quad r/D = 2.0$$
$$s \text{ (drawdown)} = 0.078 \text{ ft} \quad t \text{ (time)} = 0.7 \text{ min.} = 4.9 \times 10^{-4} \text{ days}$$
$$r/D = 0.2$$

TRANSMISSIVITY (T)

$$T = 114.6 Q W(u_A, r/D) / s$$
$$T = 47,000 \text{ gpd/ft}$$
$$T = 6,300 \text{ ft}^2/\text{day}$$
$$T = 590 \text{ m}^2/\text{day}$$

HYDRAULIC CONDUCTIVITY (K)

$$K = T/b$$
$$K = 350 \text{ ft/day}$$
$$K = 0.12 \text{ cm/sec}$$

STORATIVITY (S)

$$S = u_A Tt/1.87r^2$$
$$= 1.9 \times 10^{-3} \text{ dimensionless}$$

Sheet 7. Modified Non-Equilibrium Method for Well 37401

Modified Non-Equilibrium Method (Jacob, 1950)

Pumping Well 37367  
Observation Well 37401  
Reference Plate 10

Q	Constant Pumping Rate	32.3 gpm
$\Delta s$	Change in Drawdown per One Log Cycle	0.12 feet
b	Saturated Aquifer Thickness	18 feet
$t_0$	Time to Zero Drawdown Intercept	0.8 min. $5.6 \times 10^{-4}$ days
r	Distance to Pumping Well	81.33 feet

TRANSMISSIVITY (T)

$$T = (264 Q) / \Delta s$$
$$T = 66,000 \text{ gpd/ft}$$
$$T = 8,800 \text{ ft}^2/\text{day}$$
$$T = 820 \text{ m}^2/\text{day}$$

HYDRAULIC CONDUCTIVITY (K)

$$K = T/b$$
$$K = 490 \text{ ft/day}$$
$$K = 0.17 \text{ cm/sec}$$

STORATIVITY (S)

$$S = 0.3 T t_0 / r^2$$
$$S = 1.7 \times 10^{-3} \text{ dimensionless}$$

Time (t) after which  $u < 0.01$

$$t = 1.87 r^2 s / uT$$
$$t = 0.032 \text{ day}$$
$$t = 46.0 \text{ min}$$

Sheet 8. Residual Drawdown Method for Well 37401

Residual Drawdown Method (Theis, 1935)

Pumping Well 37367  
Observation Well 37401  
Reference Plate 11

Q	Constant Pumping Rate	32.3	gpm
$\Delta s$	Change in Drawdown per One Log Cycle	0.16	feet
b	Saturated Aquifer Thickness	18	feet

TRANSMISSIVITY (T)

T	= (264 Q)/ $\Delta s$
T	= 53,000 gpd/ft
T	= 7,100 ft <sup>2</sup> /day
T	= 660 m <sup>2</sup> /day

HYDRAULIC CONDUCTIVITY (K)

K	= T/b
K	= 390 ft/day
K	= 0.14 cm/sec

APPENDIX A  
GEOLOGIC BORING LOGS

G4355-R

Borehole: E-53A

Well Number: \_\_\_\_\_

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
0						NO RECOVERY
↓ 26.0						
		86%	53-A	26-27'	ML	med. sandy silt, 30% m-g sand, 10% R 4/4-6 blk ywash UEN non-plast, med-stiff, saturated alluvium
21.0						
22.0		94%	53-A	22-24'		
27.0						
29.0			E 57A	24-25.0'		
35.0						

Drill Site Geologist: W. Crutcher

Date: 12/22/86

Borehole: E53A

Well Number: \_\_\_\_\_

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
25.0		100%	E53A	25- 26.5	SM	<p>SM, silty sand, 20% silt, 11-c. grain sand, 104K 5/4            gush ben, non-plast, loose, saturated alluvium.</p> <p>DECREASE SAND SIZE, f. gr.</p>
26.0						
26.5		100%	E53A	26.5- 28.0		
27.0						
28.0		100%	E53A	28.0- 29.5		
29.0						
29.5		100%	E53A	29.5- 31.5		
30.0						
31.0						
31.5						

Drill Site Geologist: W. Amstad

Date: 10/22/76

Date: \_\_\_\_\_

Borehole: ES3A

Well Number: \_\_\_\_\_

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
31.6		100%	ES3A	31- 32.5	SM	INCREASE grain size to COARSE Increase grain size to coarse ↓ DECREASE grain size to fine-med grain, color change to 10YR 9/4-6 DRK ywsh brn. ↓ INCREASE grain size to coarse grain ↓ COARSE sand w/ 10% gravel SP PRG 8/28
31.5		100%				
32.0						
32.5		100%	ES3A	32.5- 33.5		
33.0						
33.6		80% 1.5'	ES3A	33.5- 35.0		
34.0						
35.1		1.5	ES3A	35.0- 36.5		
36.0						
36.5		1.5	ES3A	36.5- 38.0		
37.0						

Drill Site Geologist: W. Sprunt

Date: 12/20/86

Borehole: E53A Well Number: \_\_\_\_\_

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
37.0					SM	
38.0	1.5		E53A	38 - 39.5		
39.0						
39.5						

Drill Site Geologist: W. [Signature] Date: 12/22/86  
 Reviewed By: \_\_\_\_\_ Date: \_\_\_\_\_

Borehole: E-53 Well Number: OB-1 37406

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
1	0 ↓ 2	2/2	1	0 ↓ 2	SM	Silty sand fine grained, 45% silt, '5 YR 4/4 dark yellow brown, dry, low plastic med stiff
2	2 ↓ 4	2/2	2	2 ↓ 4	SC	Clayey sand fine to medium 25% clay 10 YR 4/4 dark yellowish brown, med stiff moist med plas
3	4 ↓ 6	2/2	3	4 ↓ 6	SM	Silty sand, fine to medium grained 30% silt 10 YR 5/3 brown, non cohesive, dry
4	6 ↓ 8	2/2	4	6 ↓ 8	SC	Clayey sand, fine to medium grain, 30% clay 10 YR 6/4 light yellowish brown, med stiff moist med plastic.
5	8					at 9' changes to fine to coarse
6	8 ↓ 10	2/2	5	8 ↓ 10		at 10' very calcareous

*Drill bit installed*

Drill Site Geologist: [Signature] (Logged) Date: 4-13-88

Reviewed By: [Signature] Date: 4/20/88

Borehole: E-53 Well Number: OB-1 37400

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description	
	10	7/2	6	10	SC	Same as above	10
11	12			12	SM	Silty sand fine to medium, 15% silt 10YR 5/6 yellowish brown, slightly moist low plastic med stite	11
12	12		7	12			12
13	14	2/2		14	SC	Clayey sand, fine to medium 25% clay 10YR 5/6 yellowish brown, slightly moist med stite, low plastic, calc nod's	13
14	14		8	14			14
15	16	2/2		16		at 16' clay content increases to 35%	15
16	16		9	16		grain size increases to fine to coarse	16
17	18	2/2		18		at 18' clay increases to 45%	17
18	18		10	18			18
19	20	2/2		20			19
20							20

Dave West - Installer

Drill Site Geologist: [Signature] Date: 4-15-88

Reviewed By: [Signature] Date: 4/20/88



Borehole: E-53

Well Number: OB-1 37400

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
20	20	.5		20	SC	Same as above, saturated at 20'
21	21	1/2	11	21		
22	22			22		No recovery from 22 to 25-5
23	23	0/2	11/7	23		
24	24		12	24		
25	25	.5/2		25		SM Silty sand fine to very coarse, 5% gravel 8% 20% silt, 10% R6/4 light yellow brown, saturated, non plastic, med dense
26	26		13	26		
27	27			27		
28	28			28		
29	29	1/1	14	29		
30	30	1/1	15	30		

Drill Site Geologist: [Signature]

Date: 4/13/88

Reviewed By: [Signature]

Date: 4/20/88

Borehole: E-53 Well Number: OB-1 37400

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
	30	.5 / 2	16	30	SM	same as above
	↓			↓		
	32			32		
	32	.5 / 2	17	32		
	↓			↓		
	34			34		
	34	.5 / 2	18	34		
	↓			↓		
	36			36		gravel increases to 10% at 36'
	36	0 / 2	19	36		
	↓			↓		
	38			38		no recovery 36' → 38'
	38				GP	Pearly granitic gravel small to large (2.5") 30% sand fine to very coarse 10GR <sup>5/4</sup> yellowish brown saturated Claystone bedrock mottled, very well indurated Silt claystone clasts in silt clay matrix Olive with blue-gray clasts

21  
52  
33  
34  
35  
36  
37  
38  
39.5

Drill Site Geologist: [Signature] Date: 4-15-05  
 Reviewed By: [Signature] Date: 4/20/08

Borehole: E-5400-2 Well Number: 37401

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
0					SC	SAND, 40% clay, fine to medium grained sand, 10 YR 4/4, dark yellowish brown, moist, low plastic, med stiff.
1	① 0 - 2.0'	2.0 2.0	1	0 - 2.0'		
2					SM	SAND, 25% silt, fine to medium grained sand, 10 YR 6/4, light yellowish brown, med stiff, light moist, v. low plastic
3	② 2.0' - 4.0'	1.0 2.0	2			
4						
5		9.0				
6						
7	③ 4.0' - 8.0'	4.0 2.0	3			
8						
9	④ 8.0' - 12.0'	4.0 2.0	4		SC	SAND, 20% clay, fine to medium grained sand 10 YR 5/4 yellowish brown, stiff, moist, medium plastic
10	SR					

Dinner as tube interval

Drill Site Geologist: Dave West Logged by: Hubert Date: 4/15/88  
 Reviewed By: [Signature] Date: 4.20.88

Borehole: E-5308-Z Well Number: 37401

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
11	⑤ 8.0' to 12.0'	2.0 1.4			SC	Sand, 20% clay, fine to medium grained, 10YR 5/4 yellowish brown, stiff, moist, medium plastic
12						No Recovery 12-15'
13		2.0				
14						
15	⑥ 12.0' - 16.0'	2.0 0.8			SC	Sand, 40% clay, fine to coarse grained sand, 10YR 7/3 very pale brown, stiff, moist, medium plastic, calc.
16						
17	⑦ 16.0' - 20.0'	2.0 2.0				at 16.5' Sand, 25% clay, fine to coarse grained sand, 10YR 5/4 yellowish brown, stiff moist, medium plastic, calc.
18						
19						
20						

same as sample #5  
 same as sample interval

Drill Site Geologist: Dave West Assisted by Steve Paul Date: 4/15/88  
 Reviewed By: [Signature] Date: 4/20/88

Borehole: F-53-082 Well Number: 37401

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
20						No Recovery 20-21
21	(9) 24.0' - 24.0'	2.0%			SP	SAND, 3% silt, fine to coarse grained, 10YR 5/4 yellowish brown, loose, saturated, non plastic
22					SM	SAND, 10% silt, fine to medium grained sand 10YR 5/4 yellowish brown, loose, saturated, non plastic
23	(10) 20.0' - 20.0'	2.0%			SC	SAND, 20% clay, fine to v. coarse sand, occ. small gravel, 10YR 6/4 light yellowish brown, med dense, v. moist, low plastic
24						No Recovery 24-26'
25		2.0%				
26					SP	SAND, 3% silt, fine to very coarse grained, 5% small gravels, 10YR 6/4, light yellowish brown, med dense, saturated, non plastic
27	(11) 24.0' - 24.0'	2.0%				
28						No Recovery 28-33.5'
29		5.0%				
30	28.0' - 32.0'					

same as tube interval SP Number

same as tube interval

Drill Site Geologist: Dave West Logged by Steve Gault Date: 1/15/88  
 Reviewed By: [Signature] Date: 4.20.88

Borehole: E-53-08-2

Well Number: 37401

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
0						No Recovery 28-33.5'
1						
2						
3	32.0' - 34.0'	0.4 / 2.0				GC Gravel, 5% Clay, small to medium (1") gravel, 10% S <sub>13</sub> , brown dense, saturated
34						
5	34.0' - 36.0'	1.1 / 2.0				SP SAND, 5% silt, fine to very coarse grained sand, 5% gravel, small to medium gravel (2"), 10% S <sub>13</sub> , brown dense, saturated
6						
7						
8						
9						
10	36.0' - 40.0'	1.1 / 2.0				Claystone bedrock, S <sub>13</sub> S <sub>13</sub> clay, weathered Fe stains
2	40.0' - 42.0'	1.1 / 2.0				TOTAL DEPTH 42'

Well Site Geologist: Dave West Logged by Steve Pate Date: 4/15/84

Reviewed By: [Signature] Date: 4-20-84